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高次モーメントを用いた年最大風速推定  
Prediction of maximum wind speed by using 4 moments

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## 1. はじめに

これまで建築物の風荷重評価においては、年最大風速のような極値は Gumbel 分布に従うこととして、議論がされてきた。Gumbel 分布は風速が独立で (Independent) 且つ同一の (identical) 母分布から発生するという i. i. d 仮定の上に成り立っている。しかしこの i. i. d 仮定は、実測結果を見ると現象を説明できていないことが分かっており、近年 i. i. d を前提としない風速の極値分布の研究が注目されている。また、しばしば年最大風速の極値評価において有効記録の短さが問題となる。推定したい再現期間が有効記録の長さをこえるため、有効記録に基づく外挿補間、すなわち有効記録の長さが比較的短いデータからの極値分布推定に頼った再現期待値の評価には、極値分布推定の精度の検証が必要である。本研究では、4 次のモーメントで決定される母分布の非定常性を条件として年最大風速の発生をある程度上手く説明できることを確認する。そして、非同一母分布に従う年最大風速のモデル構造を利用し、少数のデータから極値分布推定を行う新しい方法について検討する。

## 2. 確率分布における高次モーメントの評価

### 2. 1. 多項式分布

多項式分布とは、ある歪度 ( $\gamma_1$ )、尖度 ( $\gamma_2$ ) をもつ母分布を作り出すために利用する式で、次式を用いて、母分布を作ることができる。

正規分布累積関数  $\Phi(x_a)$  と非正規分布累積関数  $F(y_a)$  との関係式

$$F(y_a) = \Phi(x_a) \Leftrightarrow y_a = F^{-1} \circ \Phi(x_a) = g(x_a)$$

3 次多項式 (translation 関数)

$$g(x_a) = a + b x_a + c x_a^2 + d x_a^3$$

多項式のパラメータ 関係式

$$\mu = a + c = 0$$

$$\sigma^2 = b^2 + 6bd + 2c^2 + 15d^2 = 1$$

$$\gamma_1 = 2c(b^2 + 24bd + 105d^2 + 2)$$

$$\gamma_2 = 24\{db + c^2(1 + b^2 + 28bd) + d^2(12 + 48bd + 141c^2 + 225d^2)\}$$

上式で  $x_a$  は正規分布、 $g(x_a)$  は正規分布から変数変換した分布である。 $\sigma$  = 標準偏差、 $a, b, c, d$  はそれぞれ歪度、尖度から求められるパラメータであり、一つの歪度、尖度の組み合わせに、一つののパラメータの組み合わせを得る。

それに標準偏差をかけて、平均値を足したものが、与えられた 4 つのモーメントを持つ母分布である。

## 2. 2. 多項式を用いたシミュレーション

下図は、多項式分布を用いて、年最大風速値の推定をするときに得られる分布である。母分布は 30000 個で計算している。（この個数については、後ほど検討する。）

シミュレーションの流れは、まず、30000 個の正規分布（図 1 左図）を作り、実際のデータの  $\gamma_1, \gamma_2$  を用いて、変数変換し、図 1 中図の様な分布を作る。それに標準偏差をかけ、平均を足して、与えられた 4 つのモーメントをもつ母分布をつくる。そこから最大値だけを取り出す。

正規分布をランダムに発生させることを何度か（今回は 11 回で計算した）で、シミュレーションに幅を持たせ、最大値の中間値を取り出す。

これが一年分のシミュレーションである。

何年分も行い、グンベル基準化変数を用いて、プロットする。

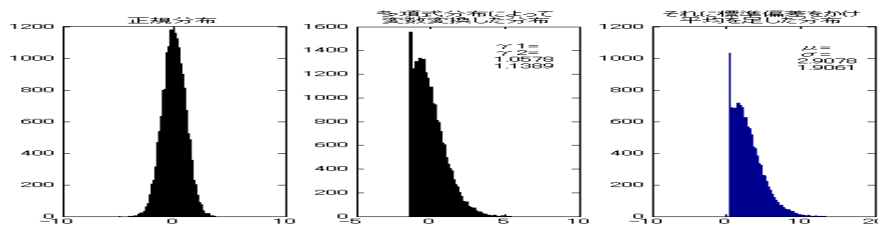


図 1 シミュレーションの際に発生する分布

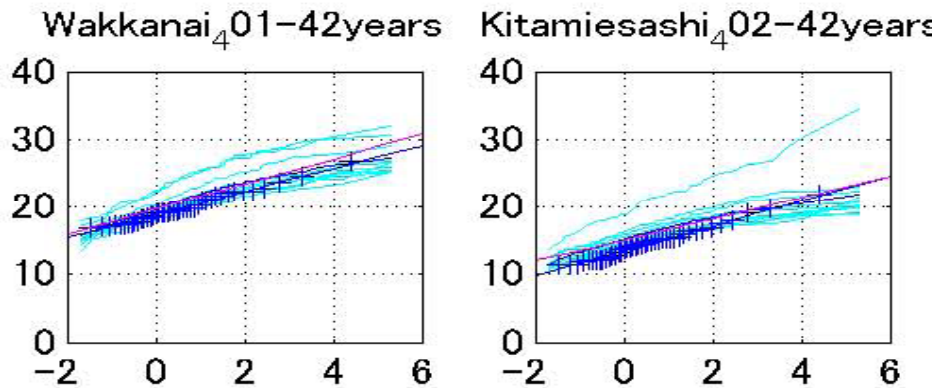


図 2 42年のモーメントを用いたシミュレーション結果と実測値の比較

図 2 は、稚内、北見江刺の 42 年分の 4 つのモーメントを用いたシミュレーション（水色の線）と、実際の 42 年間の年最大風速値 + をグンベル基準化変数を用いてプロットし、比較したものである。

シミュレーションは 100 年分の年最大風速を水色の線をつないでいるが、100 年間の母分布を作るには、与えられた 4 つのモーメントの平均、標準偏差（ばらつき具合）を用いて分布させている。

上の二つの地点では、42 年分の 4 つのモーメントの平均、標準偏差を用いて 4 つのモーメントを 100 個作って一つの水色の線を描くことを 11 回繰り返して中間値を青い線で結んでいる。シミュレーションと実測値がよく合っていて、上手くシミュレーションできていると言える。

### 2. 3. 用いたデータ

使用したデータは、1962年～2002年の全国154箇所の4つのモーメントのデータと年最大風速のデータである。

年最大風速のデータは、石原らによって整理された全国155カ所における1929～1999年の未補正年最大平均風速記録と、平均時間と観測装置の違いによる補正を施したものと、日本気象協会の地上気象観測時日編集データ(CSV版)から抜粋した2000～2002年の年最大平均風速を用いた。

一方、10分間平均風速の年間母分布特性の検討には1961～2002年まで42年間の日本気象協会の地上気象観測時日編集データ(CSV版)を用いたが、このデータ集は時期毎に記録の形式が異なる。即ち、1961～1990年までは3時間ごとの毎正時10分間平均風速が記録されており、その後は毎正時10分間の平均風速が記録されている。他方、10分間平均風速の年間分布特性を調べるためには毎10分間平均風速の連続記録が必要であるが、上記データ集は記録の欠落が多いため、母集団の基本統計量(平均 $\mu$ 、標準偏差 $\sigma$ 、歪み度 $\gamma_1$ 、尖度 $\gamma_2 = \beta_2 - 3$ )の推定結果の信頼性が問題になり得る。そこで、これらの断続的記録から推定した基本統計量の信頼性を調べるため、同じく日本気象協会の95型地上観測装置1分値データを用いた検討を行った。検討に用いられた記録は東京、名古屋での1996～2007年の6年間分である。尚、1分値データの記録開始時期は観測箇所によって異なるが、最も早いところで1997年3月からの記録が提供されている。

検討の方法は、1) 1分値データを用いて10分間平均風速の年間データ集を作成し、2) その中から毎正時の10分間平均風速のみを残した年間データ集と、3) 3時間ごとの毎正時10分間平均風速のみを残した年間データ集を作成し、年ごとの基本統計量の比較を行った。その結果を図3, 図4に示す。図から分かるように、記録形式の違いによる影響は尖度に見られるが、その度合いは大きくない。このことは各記録形式の年間データの個数(52560, 8760, 2920)からも容易に推察できることである。以上の検討結果を踏まえ、以下においては母集団の基本統計量としてCSV版データから求めたものを記録形式の区別なく用いることにし、「10分間平均風速」は単に「平均風速」と称する。

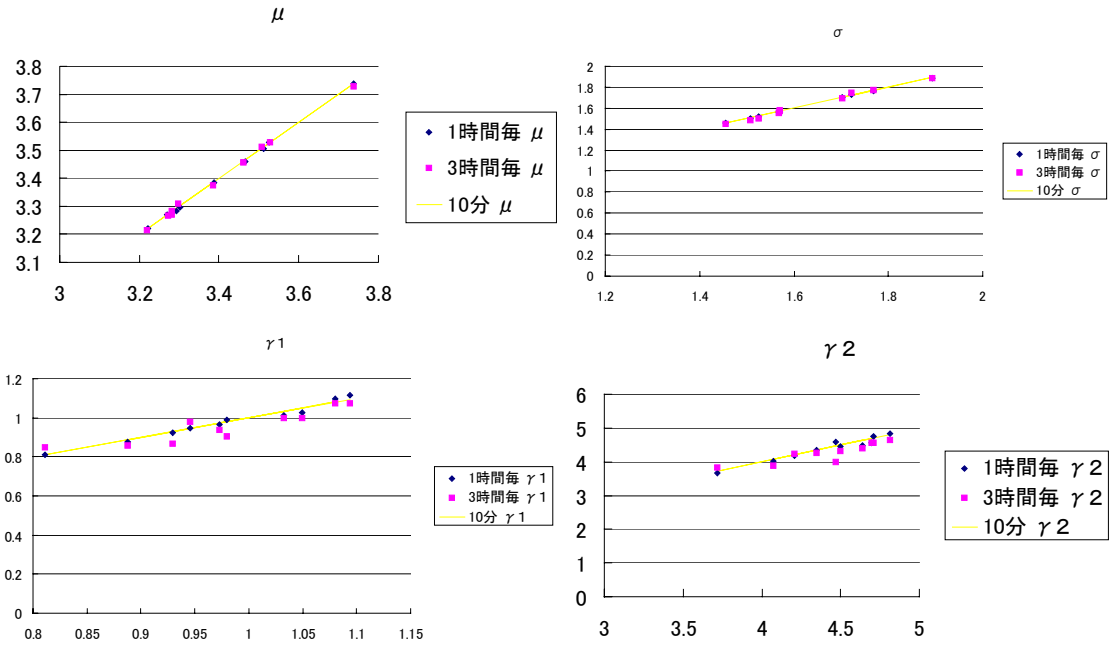


図 3 東京におけるデータ形式の異なる 10 分間平均風速のモーメントのの比較

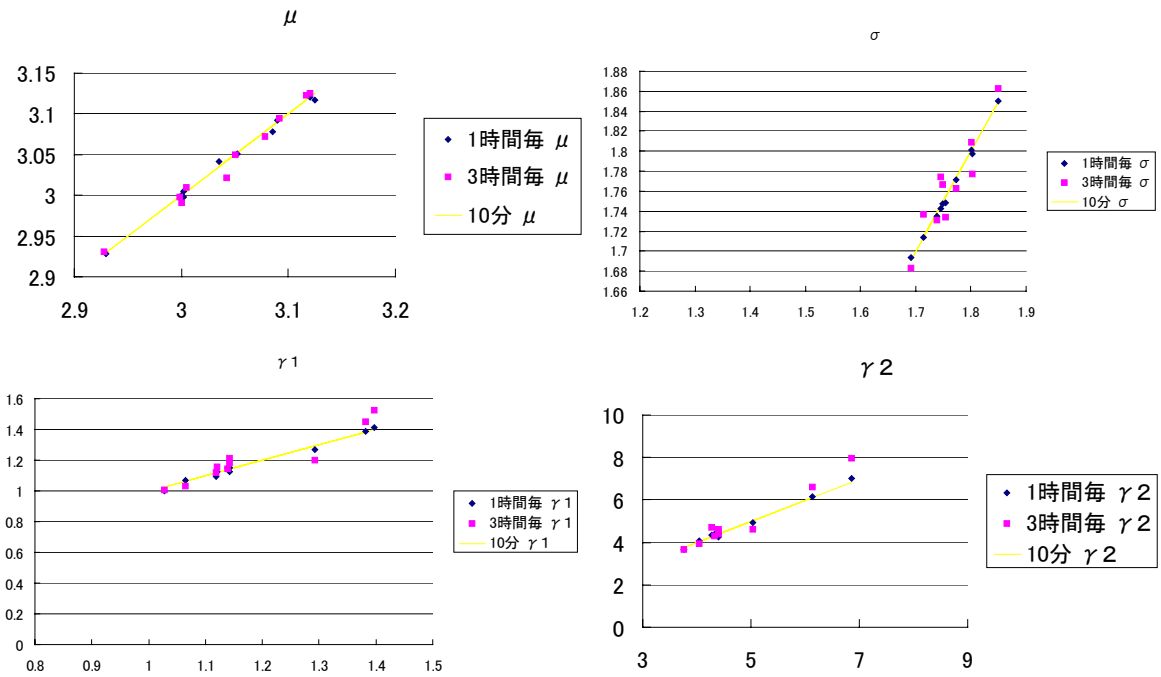


図 4 名古屋におけるデータ形式の異なる 10 分間平均風速のモーメントのの比較

### 3. わが国の風速4つのモーメントのデータと年最大風速

#### 3. 1. はじめに

シミュレーションを行うにあたって、下図プロットの全国 154 箇所における高次モーメントの分布をみる。



図 5 154 Points in Japan

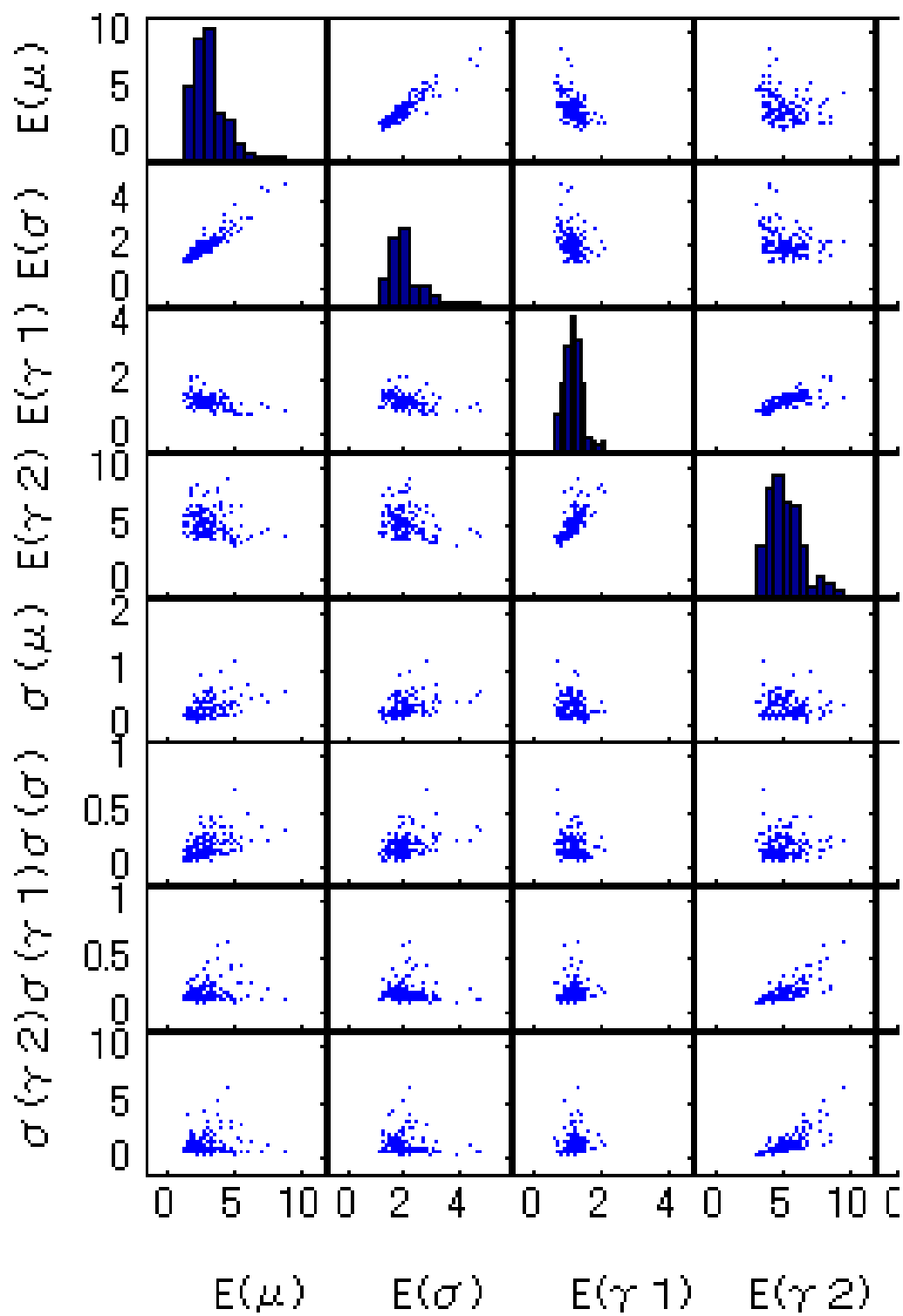


図 6 全国 154 箇所の 8 つのモーメントの相関



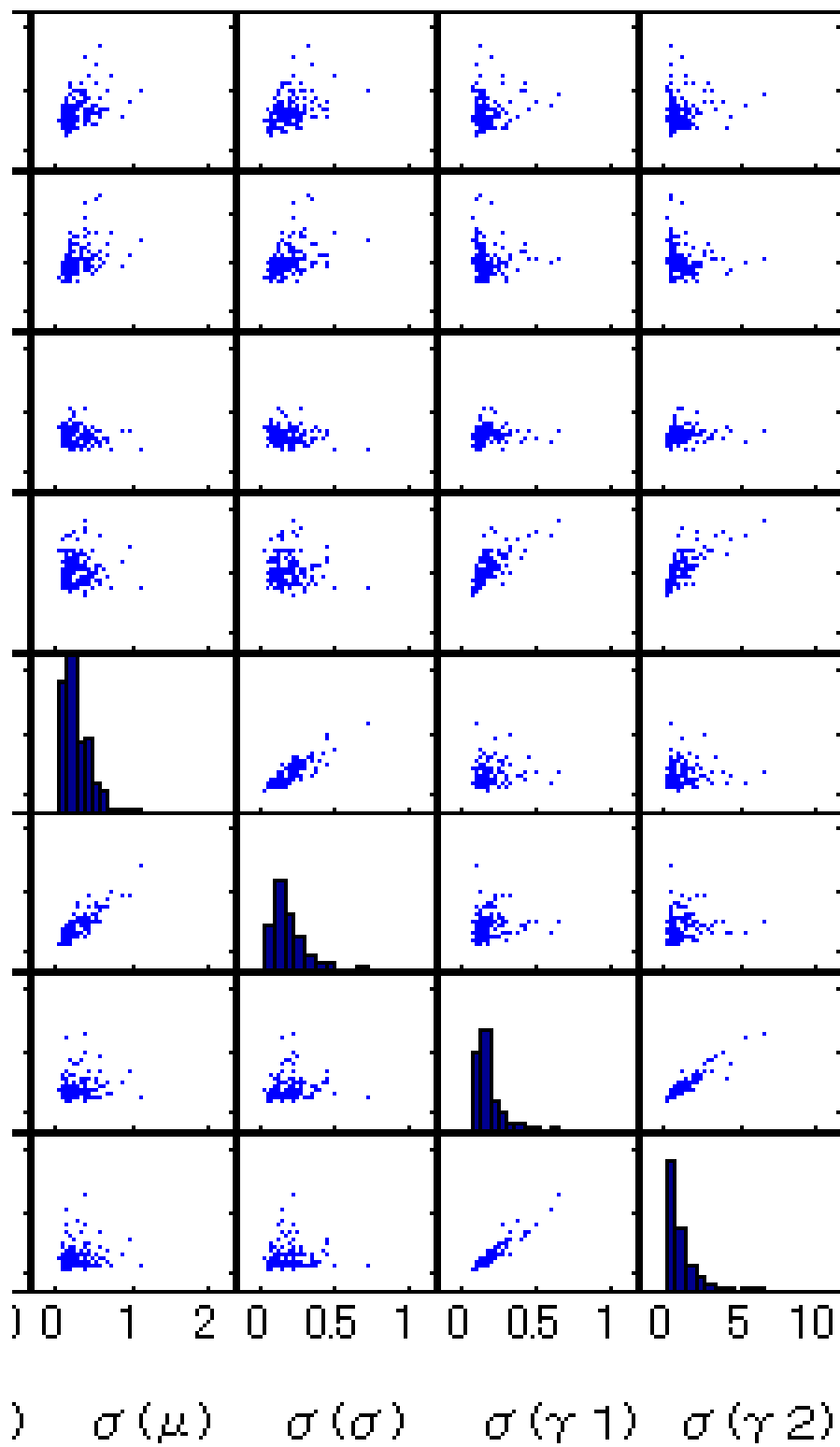


図6は、全国154箇所の1962年から2002年までの4つのモーメントの平均と、標準偏差の分布である。図7、図8で詳しく見てみると、 $\mu$ と $\sigma$ の平均と標準偏差、 $\gamma_1$ と $\gamma_2$ の平均と標準偏差の相関がそれぞれ高いことがわかる。また、 $\sigma$ と $\gamma_1$ の平均には、負の相関関係がある。

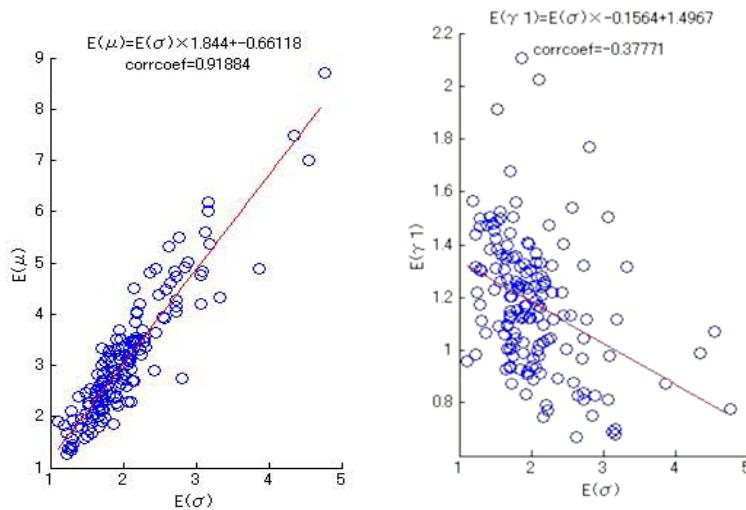


図7  $E(\sigma)$ と $E(\mu)$ 、 $E(\sigma)$ と $E(\gamma_1)$ の相関関係

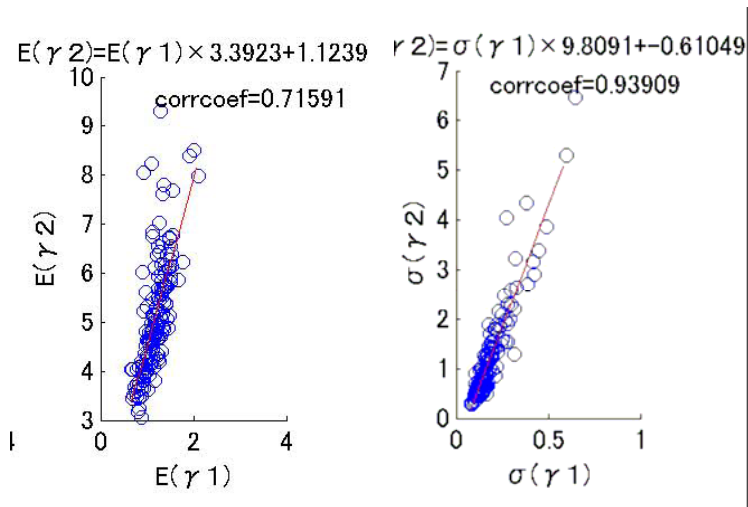


図8  $E(\gamma_1)$ と $E(\gamma_2)$ 、 $\sigma(\gamma_1)$ と $\sigma(\gamma_2)$ の相関関係

これを踏まえて、シミュレーションでは、平均と標準偏差、 $\gamma_1$ と $\gamma_2$ にそれぞれ相関を持たせて母分布の4つのモーメントを作ることにする。

具体的には、100年間分の標準偏差のモーメントをつくる際に、{(平均の正規分布)  $\times$  0.5 + (正規分布)  $\times$  0.8}  $\times$  標準偏差の標準偏差 + 標準偏差の平均 として、平均と相関を持った母分布を作った。また、 $\gamma_2$ に関しては、 $\gamma_1$ との相関がかなり高いので、 $\gamma_2$ のデータを用いずに、 $\gamma_1$ との相関関係を用いて、 $\gamma_2$ を導いた。

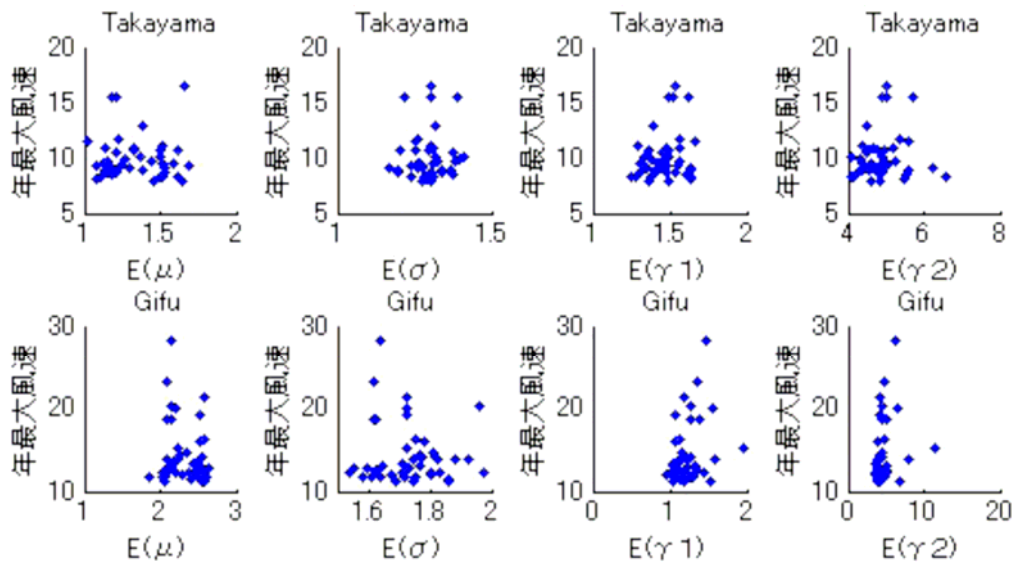
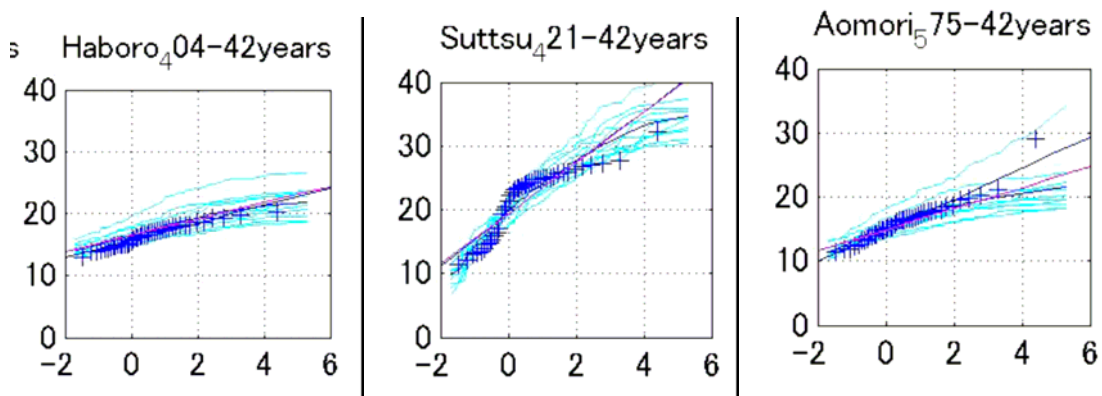


図 9 4つのモーメントと年最大風速の関係

最大風速と4つのモーメントの関係に関しては、特に大きな相関は見られないので、どのモーメントも最大風速に関与していると考えて、シミュレーションする。

### 3. 4. 多項式分布シミュレーションによる年最大風速分布

はじめに、多項式分布でシミュレーションができるか、確認するために、持っている最大限のモーメントデータ（1962年～2002年の42年分）を用いて、100年再現期待値のシミュレーションしてみる。（比較用の実データは42年分しかないので、実際は42年再現期待値で比較することになる。）長期間のデータを用いることは、4つのモーメントの各年毎のばらつき具合を、反映するので、短い期間のデータを用いるより、全体の傾向を上手くあらわすと予想できる。



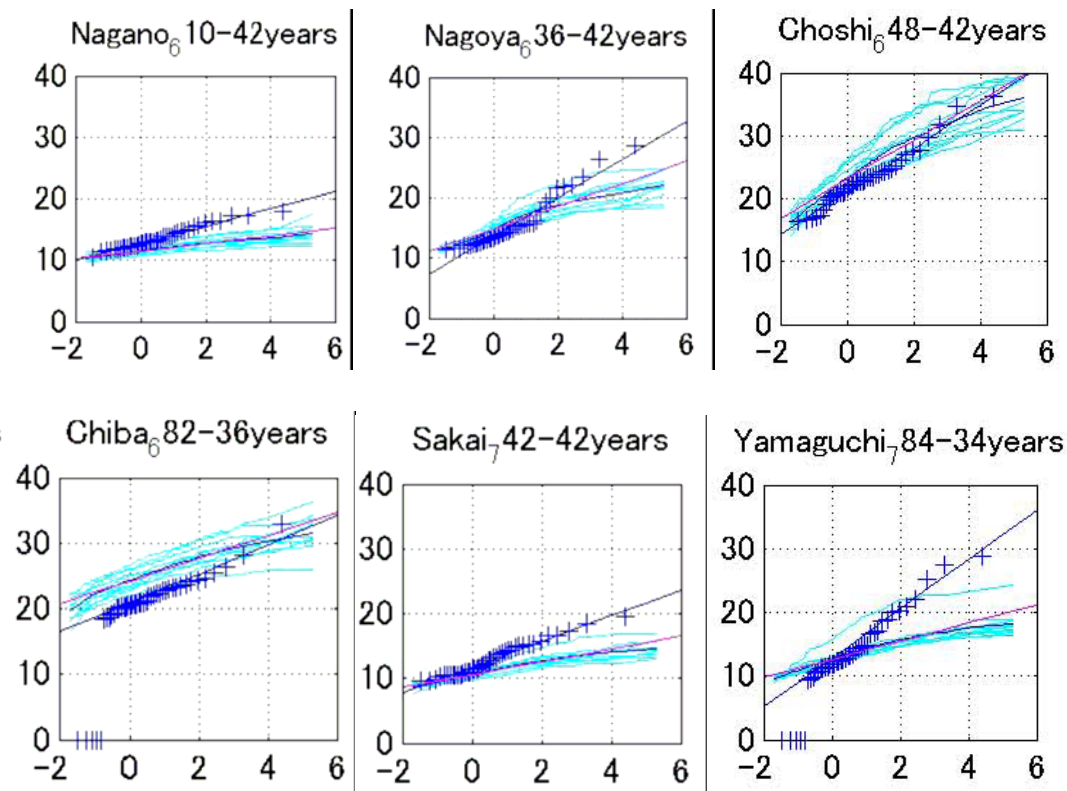


図 10 9つの地点における42年間のモーメントを用いたシミュレーション結果

図10に、全国154箇所のシミュレーションからピックアップし、のせた。図から、42年分のモーメントのデータを用いても、シミュレーションがあまり上手く合わないことがあることがわかる。巻末資料に154箇所のシミュレーション結果を示した。

### 3. 5. 短い期間のデータでのシミュレーション

次に、短い期間のデータを用いて、シミュレーションできるかを試した。

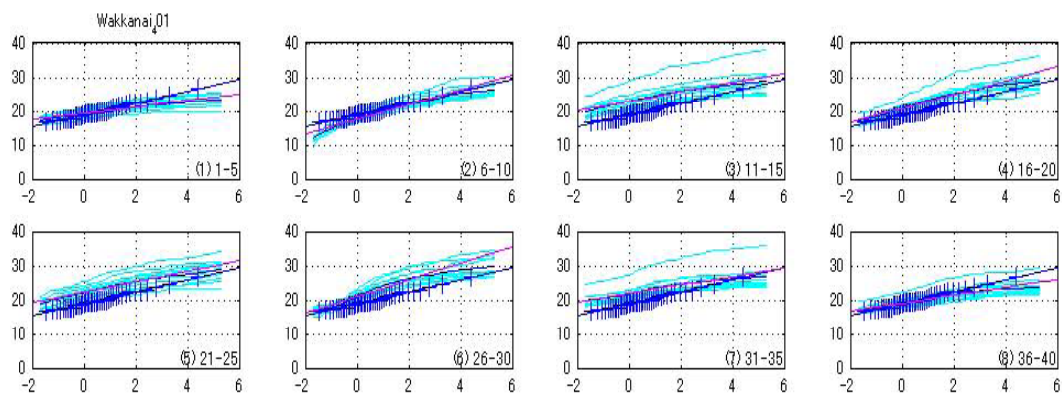


図 11 稚内における5年毎のデータを用いたシミュレーション

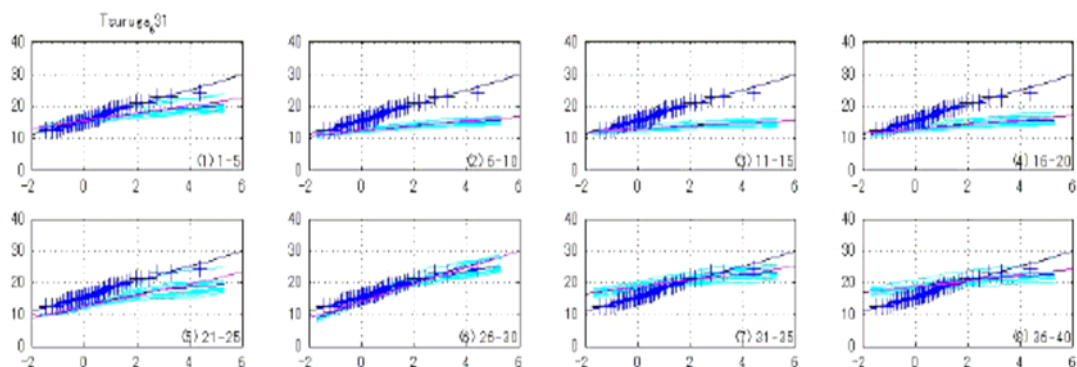


図 12 敦賀における 5 年毎のデータを用いたシミュレーション

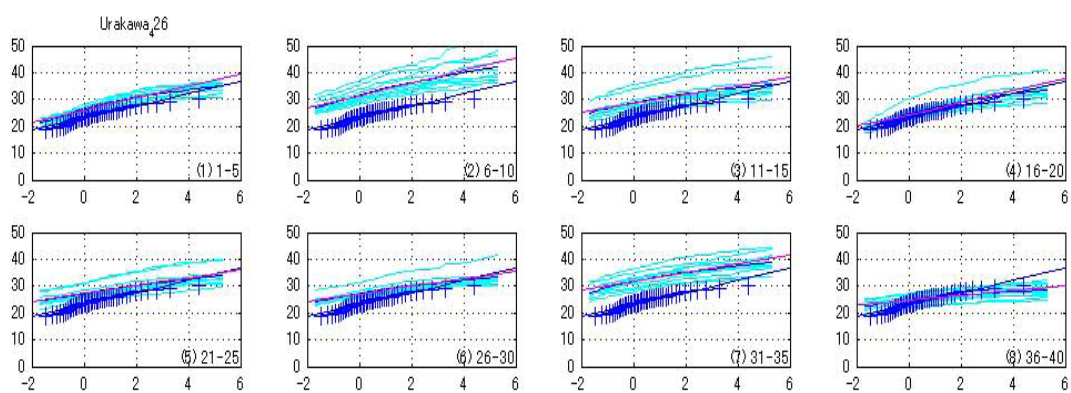


図 13 浦河における 5 年毎のデータを用いたシミュレーション

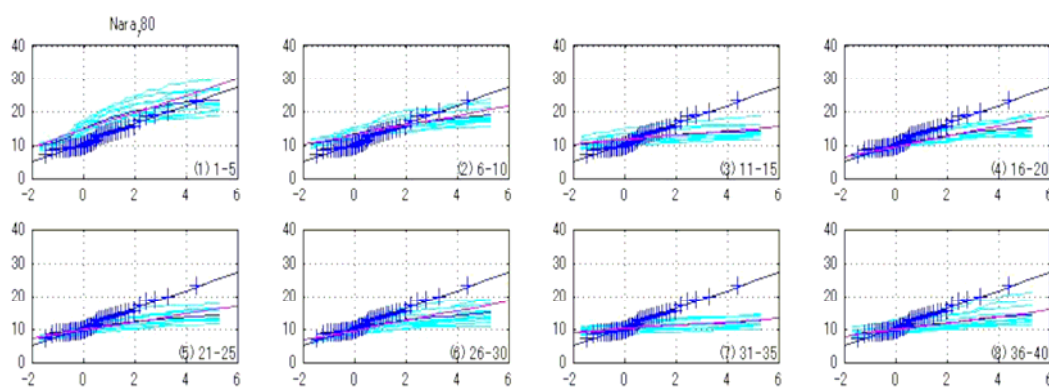


図 14 奈良における 5 年毎のデータを用いたシミュレーション

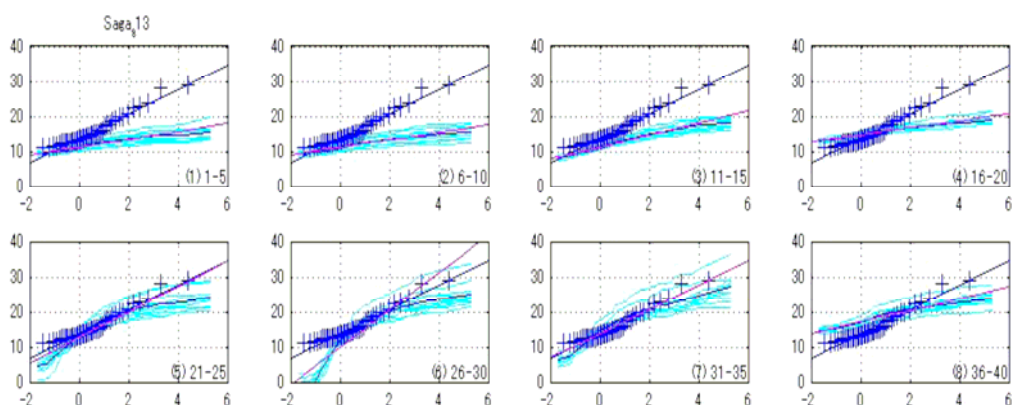


図 15 佐賀における 5 年毎のデータを用いたシミュレーション

図 1 1～図 16 に稚内、敦賀、浦河、奈良、佐賀の 5 つの地点での 5 年毎の 4 つのモーメントデータを用いたシミュレーション結果を示した。1962 年から 5 年毎にモーメントを取り出し、42 年間÷5 年=8 回のシミュレーションを行ったものである。

稚内においては、どの 5 年間をとっても概ね合っている。敦賀では、シミュレーションの傾きが実測値を大きく下回っているが、26～30 年のデータだけ、合っている。浦河では、シミュレーションが実測値と平行にずれている。奈良、佐賀においても敦賀と同じように、シミュレーションの傾きが実測値の傾きを大きく下回っている。

図からわかるように、どの 5 年のデータを用いるかによって、シミュレーションの精度が大きく違うことがわかる。

### 3. 6. まとめ

42 年分のデータを用いたものと、5 年分のデータを用いたもののシミュレーション結果から、シミュレーションがよく合うときと、合わないときがあることがわかった。なぜずれるか、どのモーメントがシミュレーションに影響しているのかを特定するために、次章では既存のデータを用いずに、パラメトリックにモーメントを変化させて、シミュレーションをしてみることにする。

## 4. パラメトリックシミュレーション

### 4. 1. モーメントを変化させたときの分布の変化

4つのモーメントの中で、平均、標準偏差が分布に及ぼす影響はイメージできるが、 $\gamma_1$ 、 $\gamma_2$ が及ぼす影響はどのようなになるか分からないので、 $\gamma_1$ 、 $\gamma_2$ をパラメトリックに変化させたときの分布形の変化を見てみる。

#### $\gamma_1$ を変化させたときの分布の変化

まず、 $\gamma_1$ を変化させる。モーメントは $\mu=0$ 、 $\sigma=1$ 、 $\gamma_1$ をパラメトリックに変化させる。そして $\gamma_2$ には0を入れて多項式分布の分布を作ってみた。すると、図9に示すように、 $\gamma_2$ は自然に $\gamma_1$ と相関するように変化することがわかった。平均、標準偏差は0、1を前後し、あまり大きな変化はない。図10に示すように、歪度が1を超えたあたりから、 $\gamma_2$ 、最大値とも比例して大きくなる。

表 a 分布計から計算したモーメント

	$\mu$	$\sigma$	$\gamma_1$	$\gamma_2$	m
1	-0.00541	0.990711	-0.00734	2.999529	3.759726
11	-0.00615	0.990196	0.236012	2.990567	4.159742
21	-0.00691	0.990394	0.476914	2.998757	4.284822
31	-0.00777	0.994326	0.690403	3.037031	4.106276
41	-0.00881	1.011071	0.838182	3.077643	5.68296
51	-0.01011	1.057833	0.947324	3.536012	11.69696
61	-0.01173	1.159315	1.214602	6.90953	19.7082
71	-0.01377	1.341933	1.865574	17.0267	30.02439
81	-0.0163	1.626043	2.828301	33.32721	42.9532
91	-0.01939	2.023452	3.81242	50.55201	58.80233

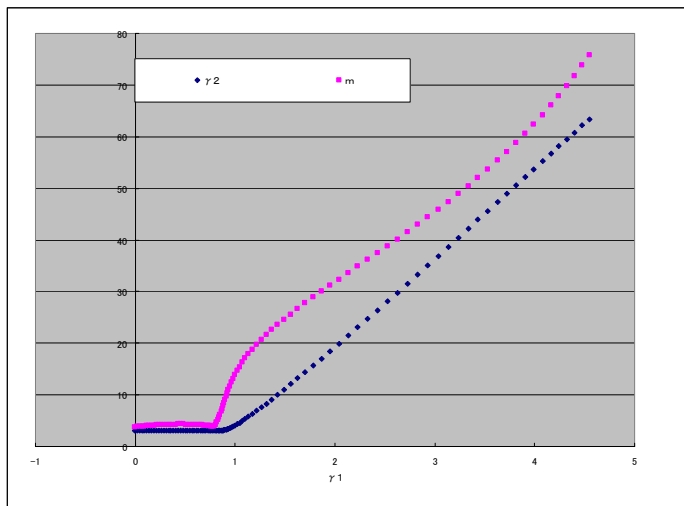


図 16  $\gamma_1$ を変化させたときの、 $\gamma_2$ 、最大値mの変化

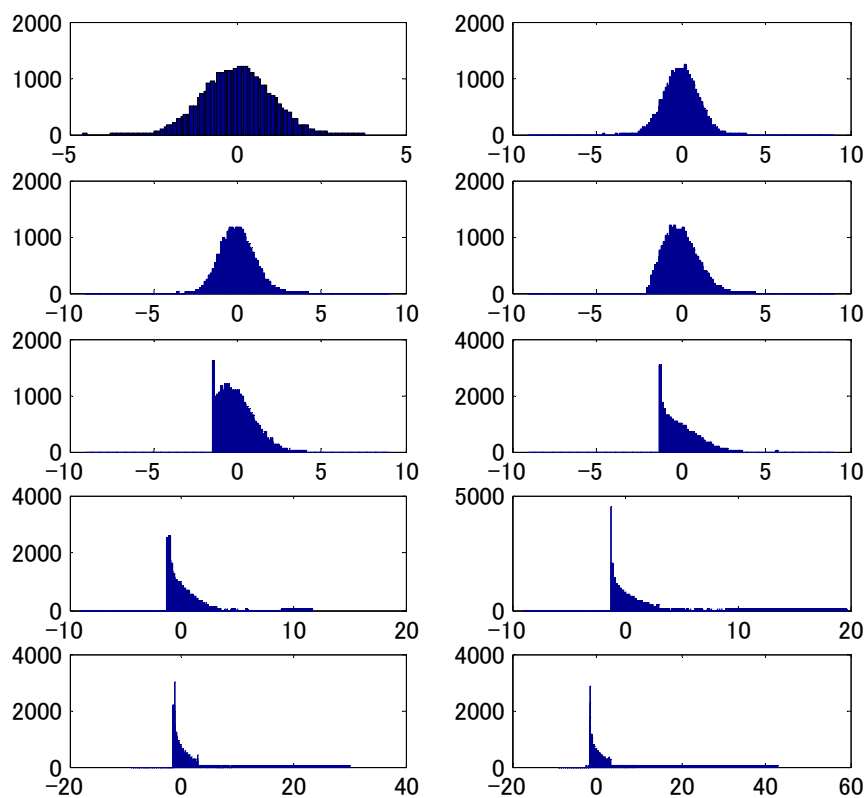


図 17  $\gamma 1$  を変化させたときの分布形の変化

図 1 6 から分かるように  $\gamma 1$  が 1 を超えるあたりから、右に大きく歪み出すことがわかる。

$\gamma 2$  を変化させたときの分布の変化

次に、 $\gamma 2$  を同じように変化させてみる。

表 b 図 1 4 の分布計に対応するモーメント

	$\mu$	$\sigma$	$\gamma 1$	$\gamma 2$	m
1	0.000396	1.009842	0.011188	3.005257	4.018226
11	0.000712	1.011627	0.030552	3.815336	5.454697
21	0.000932	1.013081	0.052632	4.599698	6.436313
31	0.001093	1.013763	0.07169	5.344103	7.169048
41	0.001236	1.014752	0.092787	6.110878	7.807118
51	0.001363	1.015761	0.114839	6.876994	8.361846
61	0.001474	1.016616	0.136893	7.627092	8.844559
71	0.001571	1.017232	0.158145	8.353794	9.26658
81	0.001657	1.017599	0.177935	9.057173	9.639235
91	0.001732	1.017766	0.195727	9.743882	9.973846



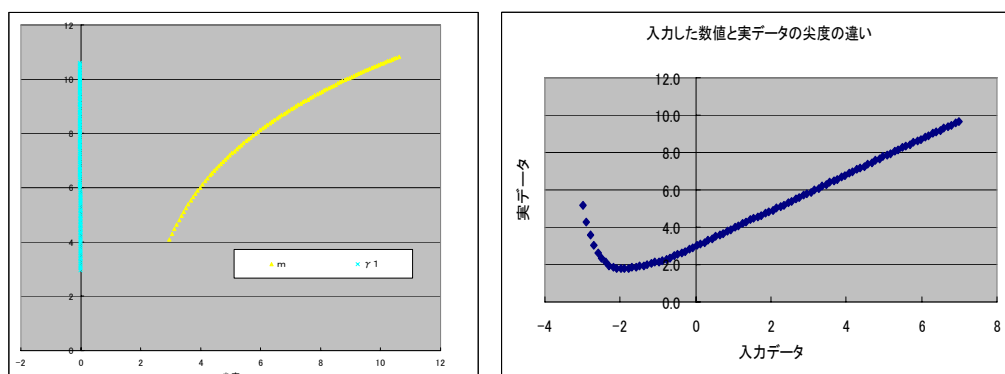


図 18  $\gamma 2$  を変化させたときの最大値  $m$ 、 $\gamma 1$  の変化

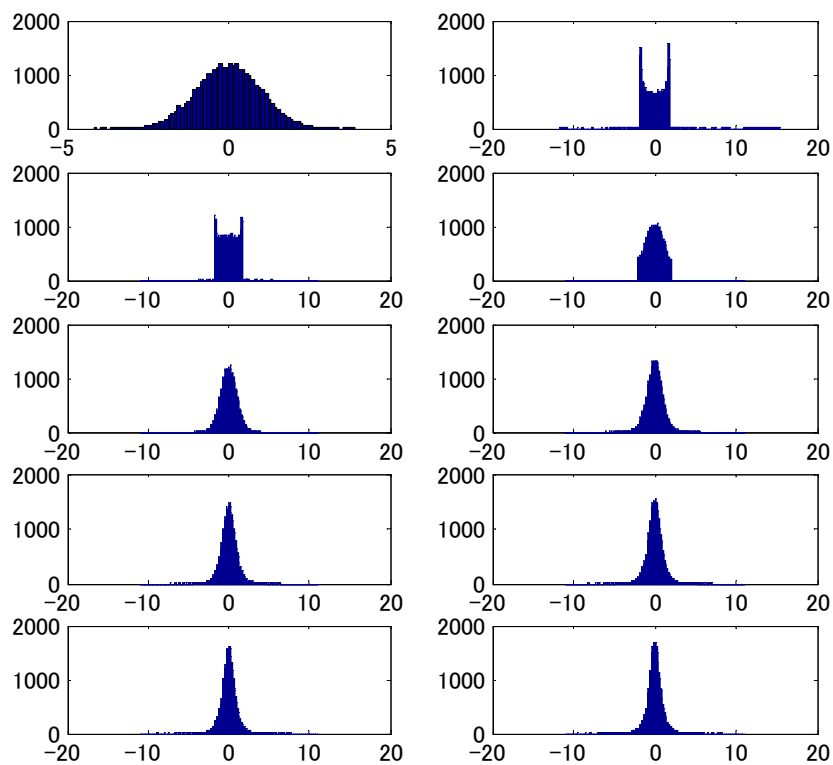


図 19  $\gamma 2$  を変化させたときの分布形の変化

図 18 から、 $\gamma 2$  を変化させると最大値は大きくなるが、その他のモーメント、 $\mu$ 、 $\sigma$ 、 $\gamma 1$  には影響がないことがわかる。また、正規分布では尖度 = 1 以下の数値を入力すると分布形の尖度が入力数値と違う値をとってしまうことがわかった。

### 4. 3. パラメトリックシミュレーション

以上の事を踏まえて、 $\gamma 1$  と  $\gamma 2$  の相関関係を保たせながら、各パラメータ、平均、標準偏差、歪度の平均と標準偏差  $E(\mu)$ 、 $E(\sigma)$ 、 $E(\gamma 1)$ 、 $\sigma(\mu)$ 、 $\sigma(\sigma)$ 、 $\sigma(\gamma 1)$  を変化させ、シミュレーションの変化を見てみる。

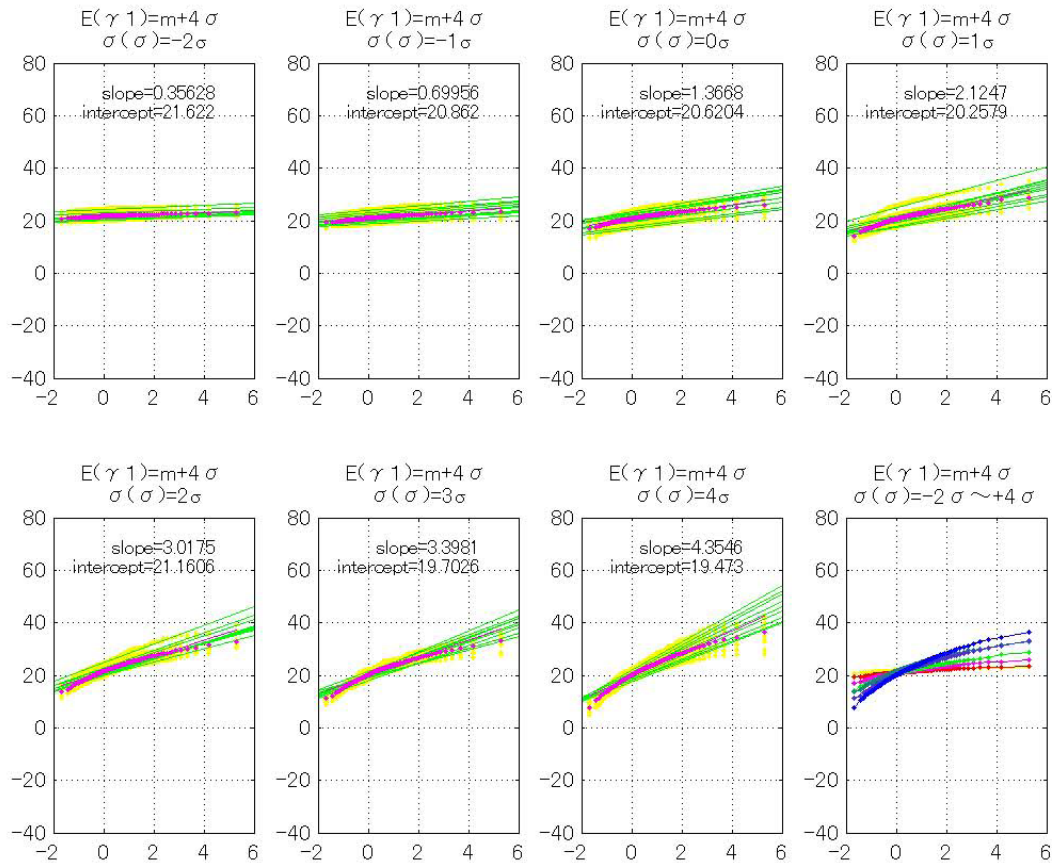


図 20  $E(\sigma)=$ 平均 $+4\times\sigma$ のときに $\sigma(\sigma)$ を $-2\sigma\sim+4\sigma$ まで変化させたときのシミュレーションの変化の様子

図 20 のように、8 つのパラメータのうち、2 つのパラメータを選び、そのパラメータの  $\sigma$  分ずつ変化させた。(実際には、 $\gamma 2$  は  $\gamma 1$  と相関を持たせているので、6 つのパラメータを変化させた。)

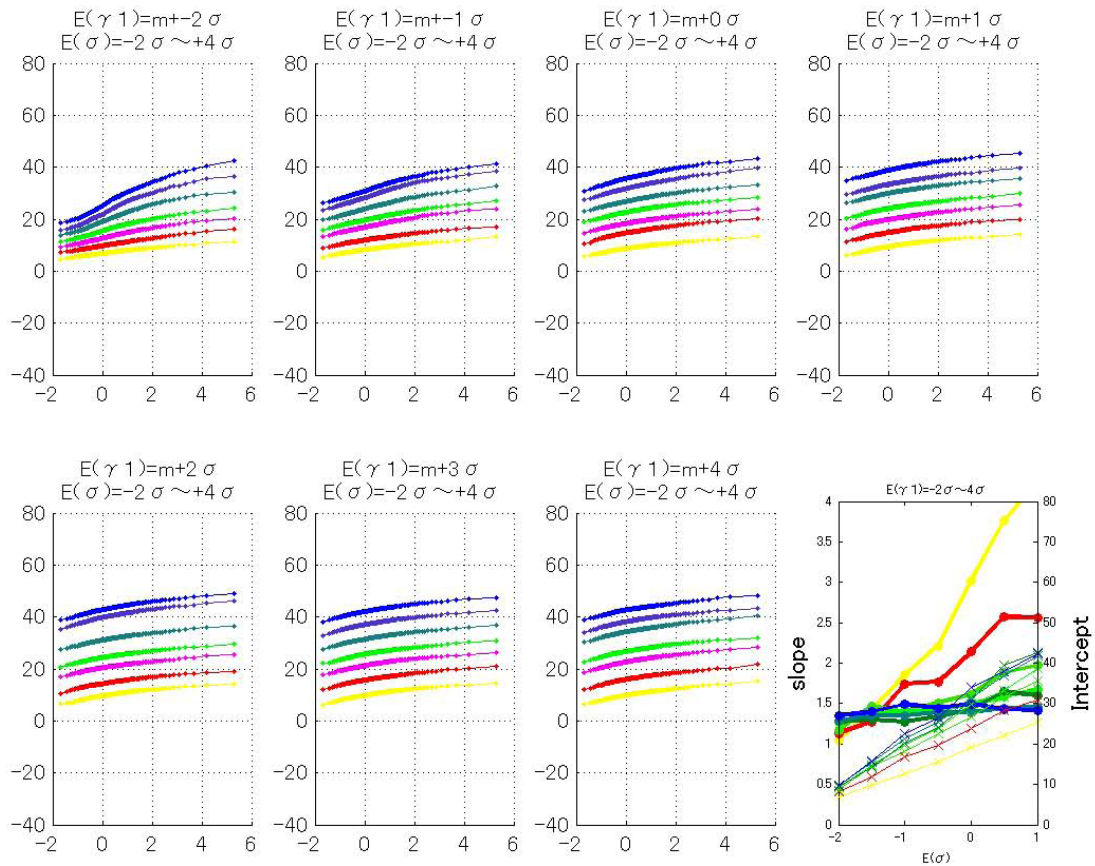


図 21  $E(\gamma 1)$ と  $E(\sigma)$  を変化させたとき

図 21 のようにそれぞれのシミュレーションの中間値だけを集めたデータをプロットした。図 21 から、 $E(\sigma)$  を変化させると、シミュレーションが平行に上にあがっていく様子が分かる。また、 $E(\gamma 1)$  が小さいときはシミュレーションの線がうねるようになっている。右下のグラフは、7 つのシミュレーション結果の傾きと切片だけを取り出したものである。7 つのグラフと色の意味は違う。つまり、右下のグラフの黄色は、 $E(\gamma 1)$  の大きさを、他は  $E(\sigma)$  の大きさを表している。また、太い線が傾きを表し、細い線が切片を表している。ここからもまた、 $E(\gamma 1)$  が小さいときに、傾きの変化が大きいことがわかる。

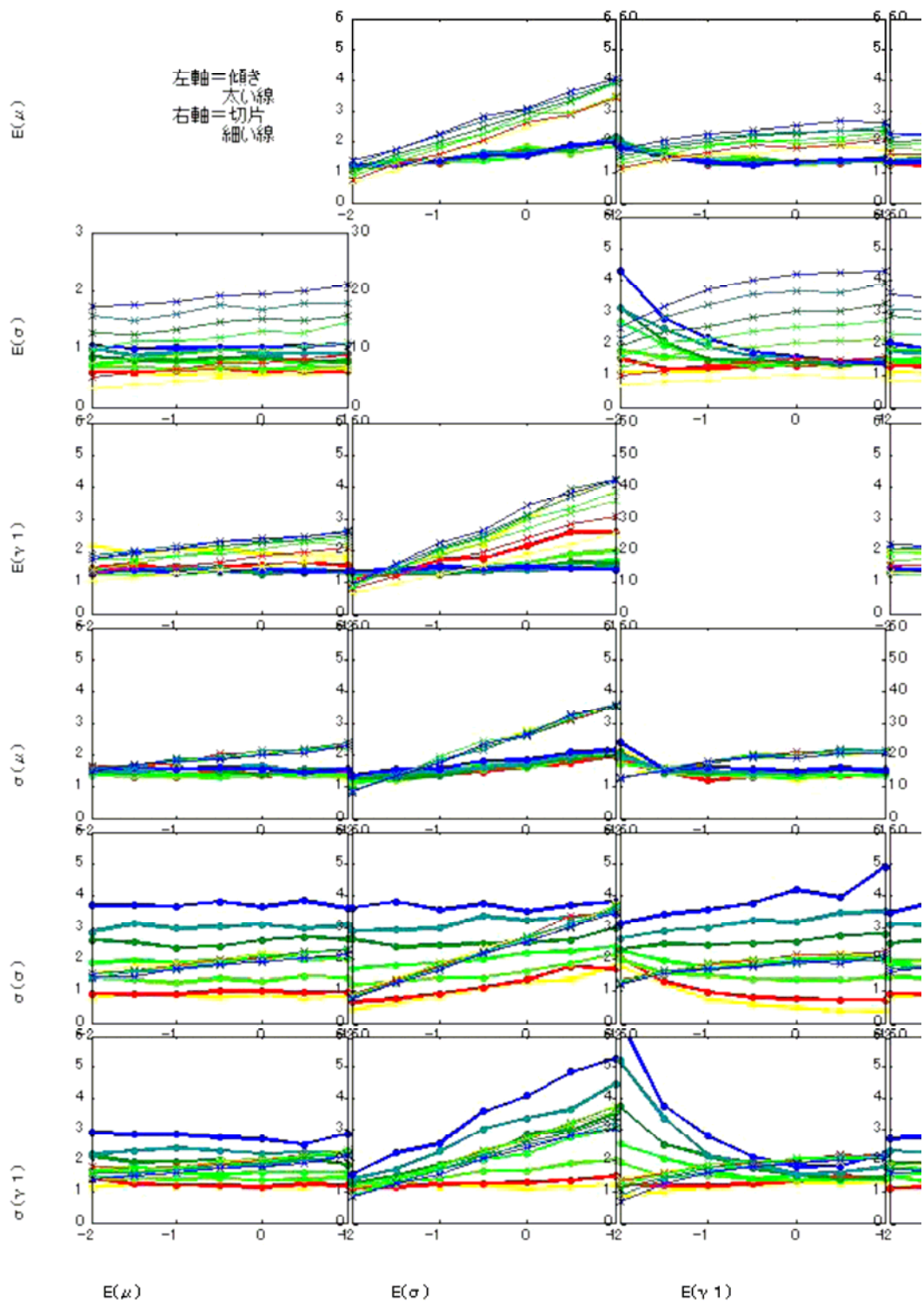


図 22 6つのパラメータを変化させたときの傾き、切片の変化の様子 (次ページに続く)

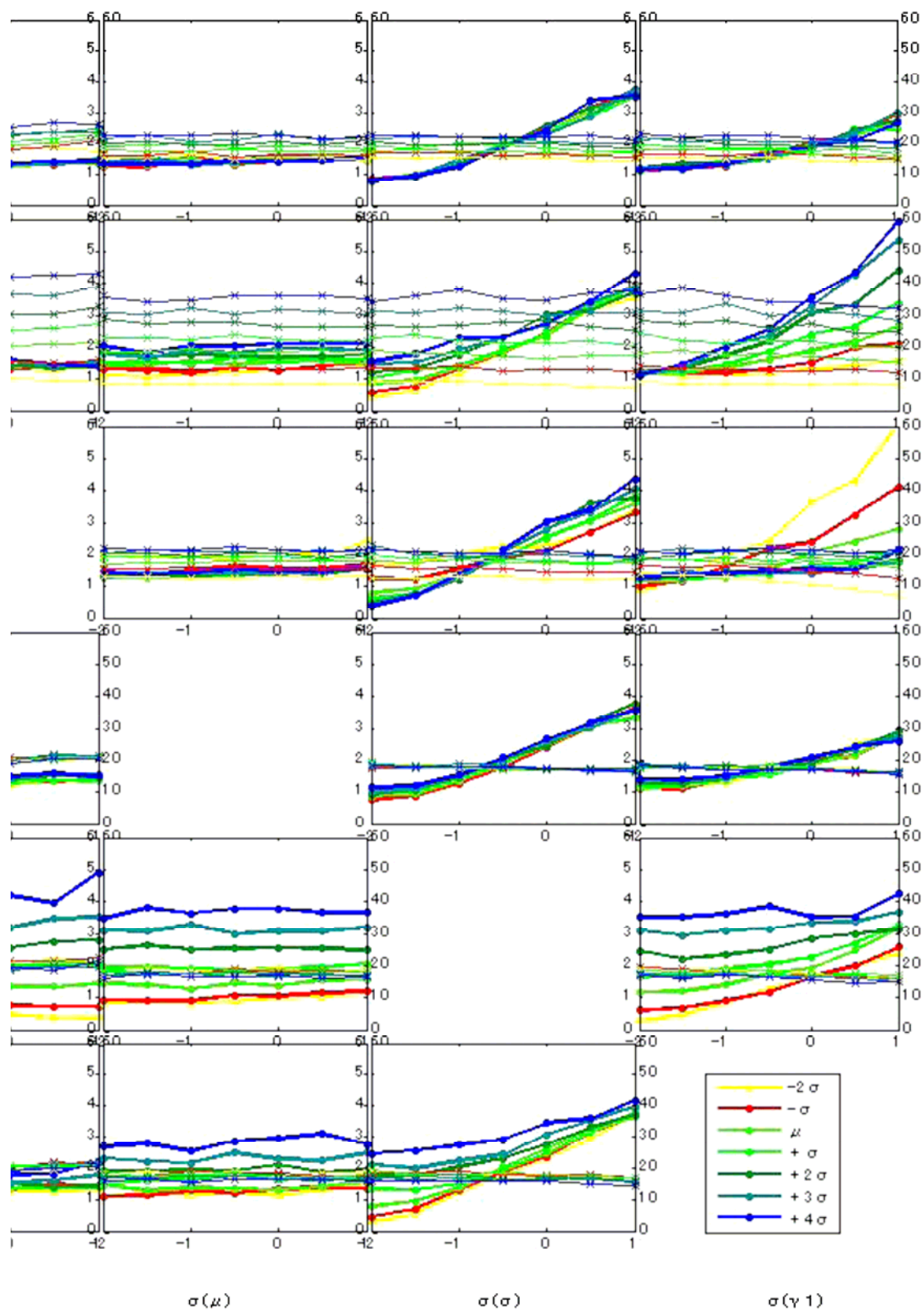
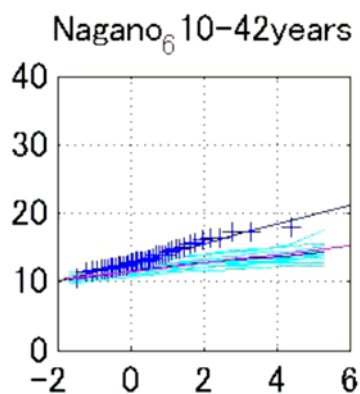


図 2 2 は、図 2 1 の右下のグラフをそれぞれのパラメータについて集めたものである。顕著なのは、 $E(\sigma)$  が大きくなるにつれ、切片が変化すること、 $E(\gamma 1)$  が小さいときに傾きが大きくなること、 $\sigma$  ( $\sigma$ ) と傾きの比例、 $\sigma$  ( $\gamma 1$ ) と傾きの比例関係である。つまり、シミュレーションの際には、 $\sigma$ 、 $\gamma 1$  に注意が必要であるということだ。

#### 4. 4. 4つのモーメントがシミュレーションに与える影響



以上をふまえて、前章で行ったシミュレーション結果を検証してみたい。

左図のようにシミュレーションがずれるのはなぜか。

まず、全国 154 箇所のシミュレーションのずれ具合を指標にしてみる。

指標として、シミュレーション中間値と実測値の距離の 2 乗和、シミュレーション中間値と実測値の距離の和、傾きの差  $\tan(\text{実測値}-\text{シミュレーション})$ 、切片の差、42 年間の最大値 (42 年再現期待値) の差の 5 つを見てみた。

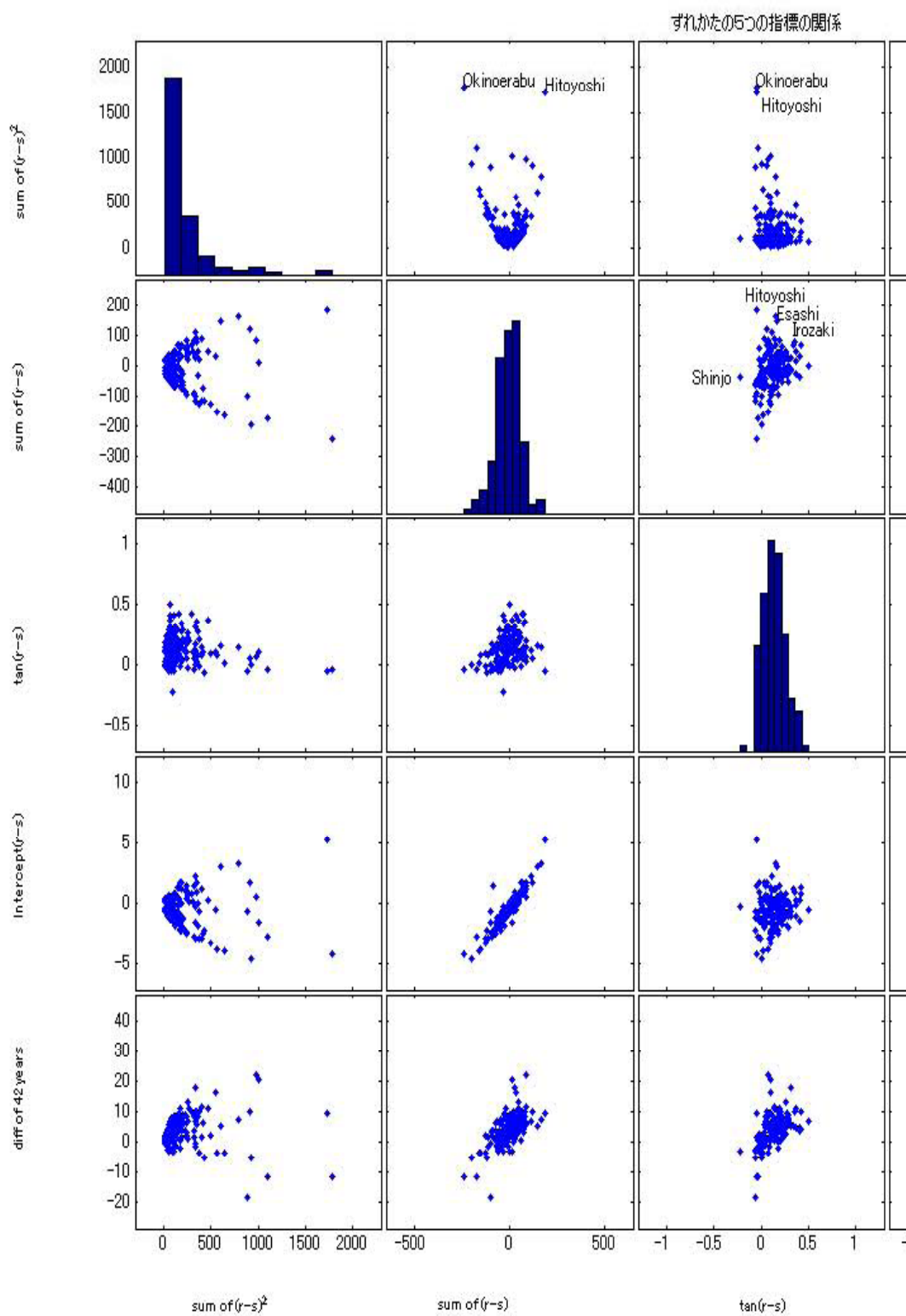


図 23 5つのずれ方指標の全国分布

長の関係

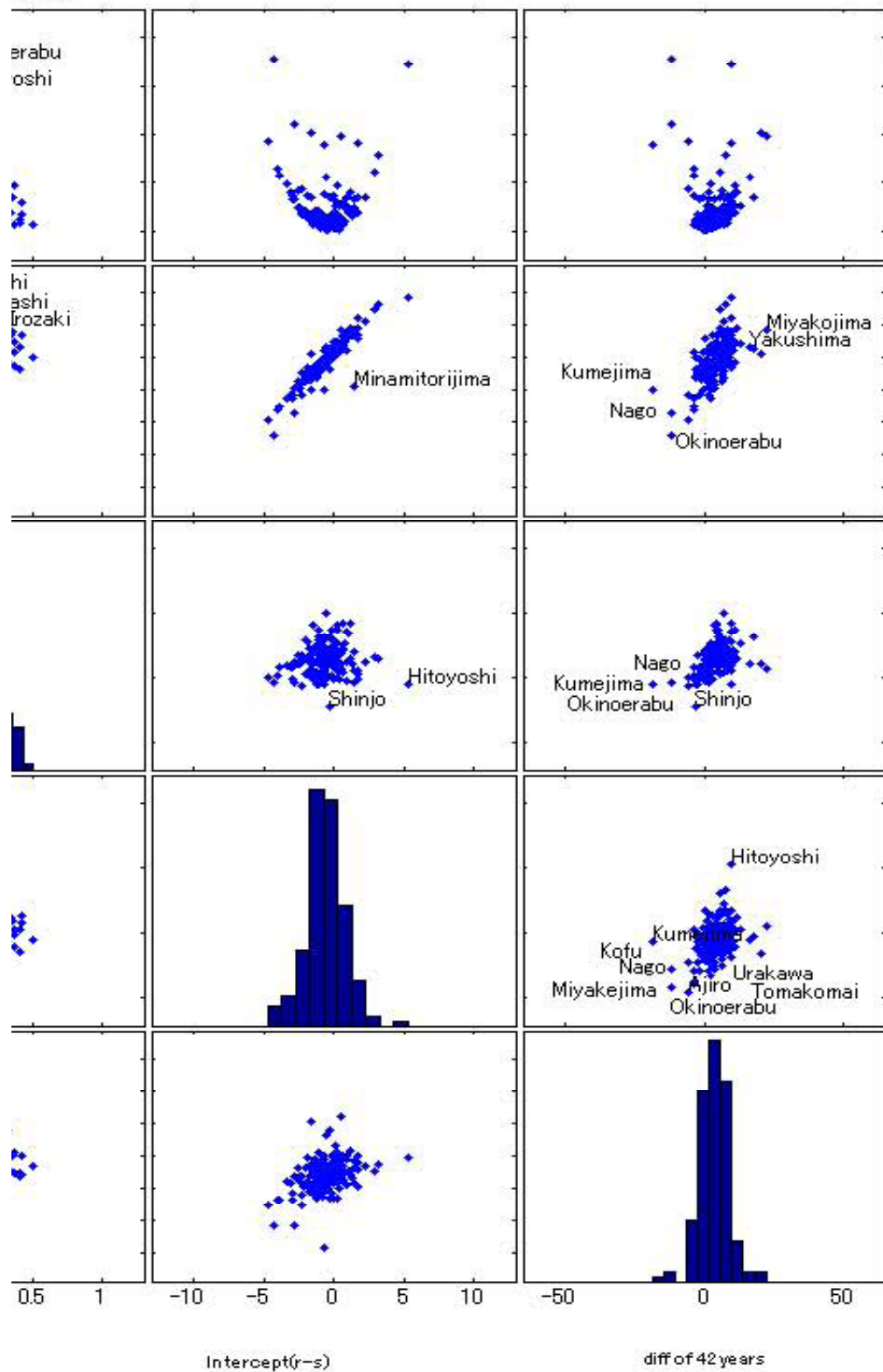




図 2 4 は、シミュレーション中間値と実測値の距離の 2 乗和、シミュレーション中間値と実測値の距離の和、傾きの差  $\tan$ (実測値—シミュレーション)、切片の差、42 年間の最大値 (42 年再現期待値) の差をマトリックス形式で散布させた図である。

図 2 4 を見てみると、2 乗和と和は 2 次曲線を描き、切片と距離の和は相関している。

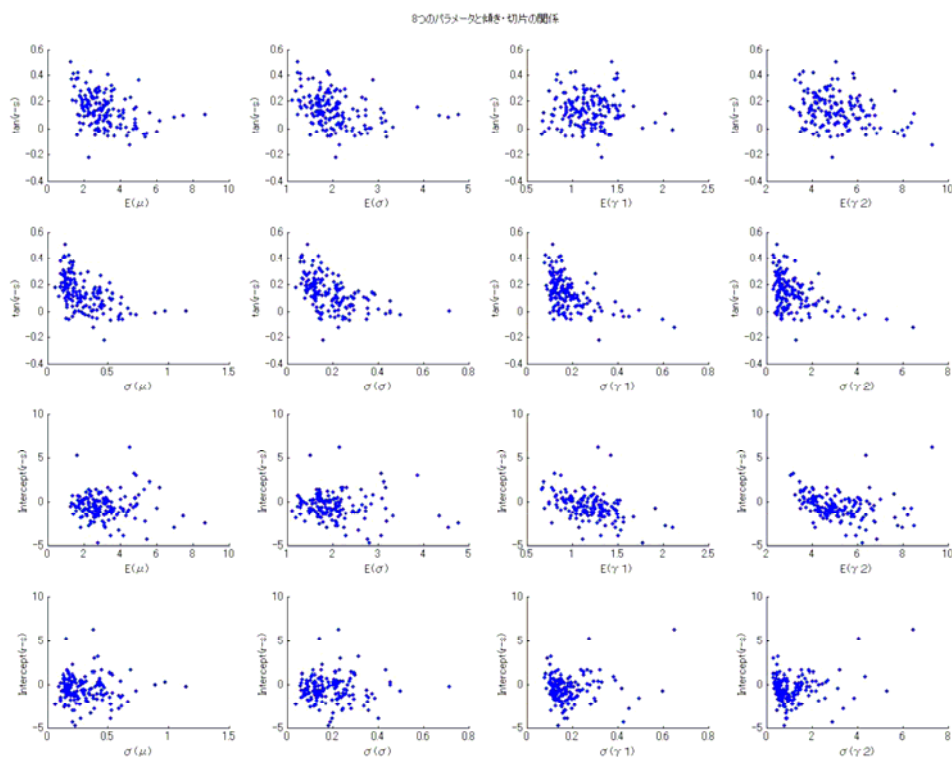


図 24 8つのパラメータと傾きの差・切片の差の関係

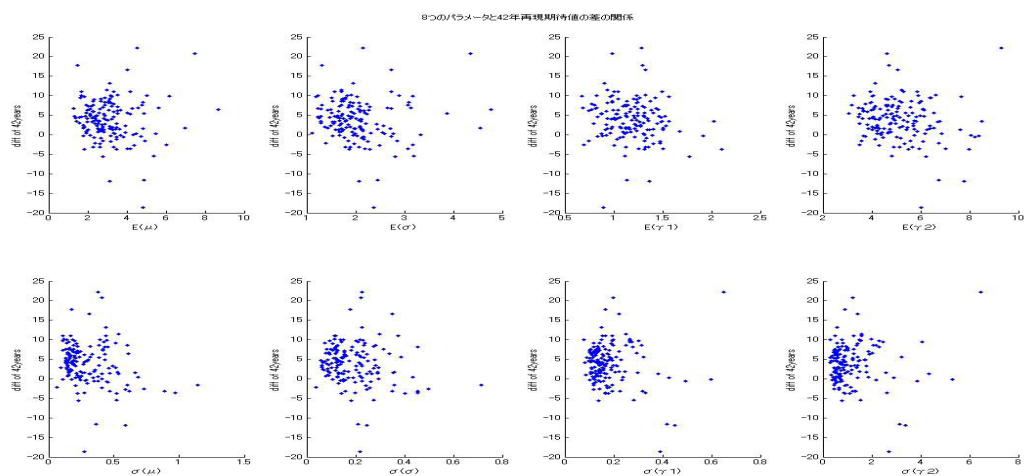


図 25 42 年再現期待値と 8 つのモーメントの関係

図 25 を見てみると、傾きの差と 4 つのモーメントの標準偏差が負の相関を示している。つまり、標準偏差が大きくなると、傾きの差が小さくなるということである。しかし、傾きの差が小さくなると 42 年再現期待値が小さくなるとは限らない。なぜなら、図 26 で、傾きの差と 42 年再現期待値の関係は、はっきりと相関しているとはいえないからだ。

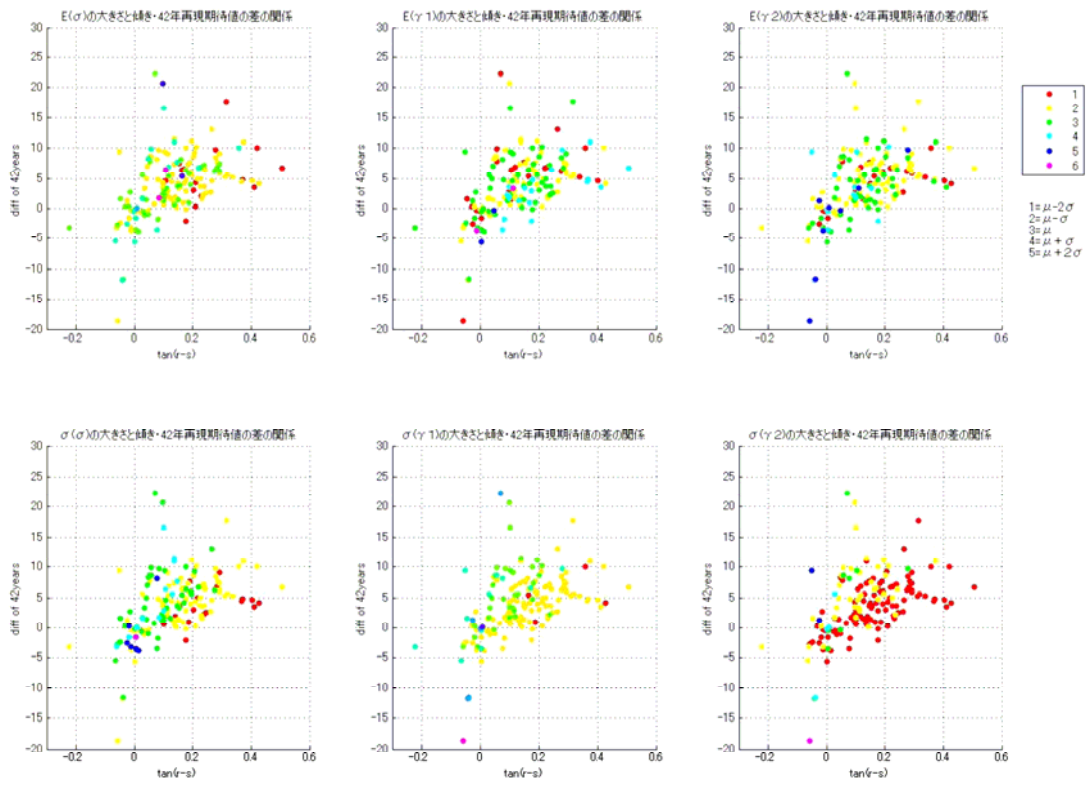


図 26 42 年再現期待値と傾きの差と、8 つのパラメータの関係

図 27 では、3 つのモーメント、 $\sigma$ 、 $\gamma 1$ 、 $\gamma 2$  で色の分布の差が表れている。つまり、値が小さいときに傾きの差が大きく、値が大きくなるにつれて傾きの差、42 年再現期待値の差が小さくなっている。

#### 4. 2. 5 年間シミュレーションの検証

つぎに、5 年間シミュレーションにおいて、5 年間の 8 つのパラメータとずれ方の関係を見してみる。

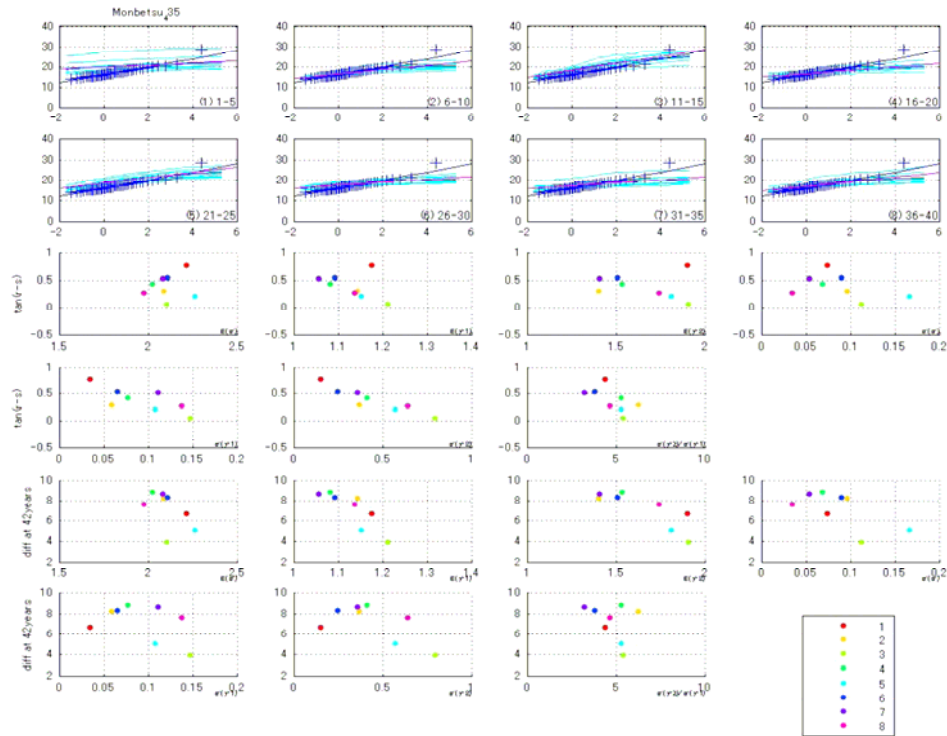


図 27 紋別における 5 年間シミュレーションと傾きの差、42 年再現期待値の差の関係

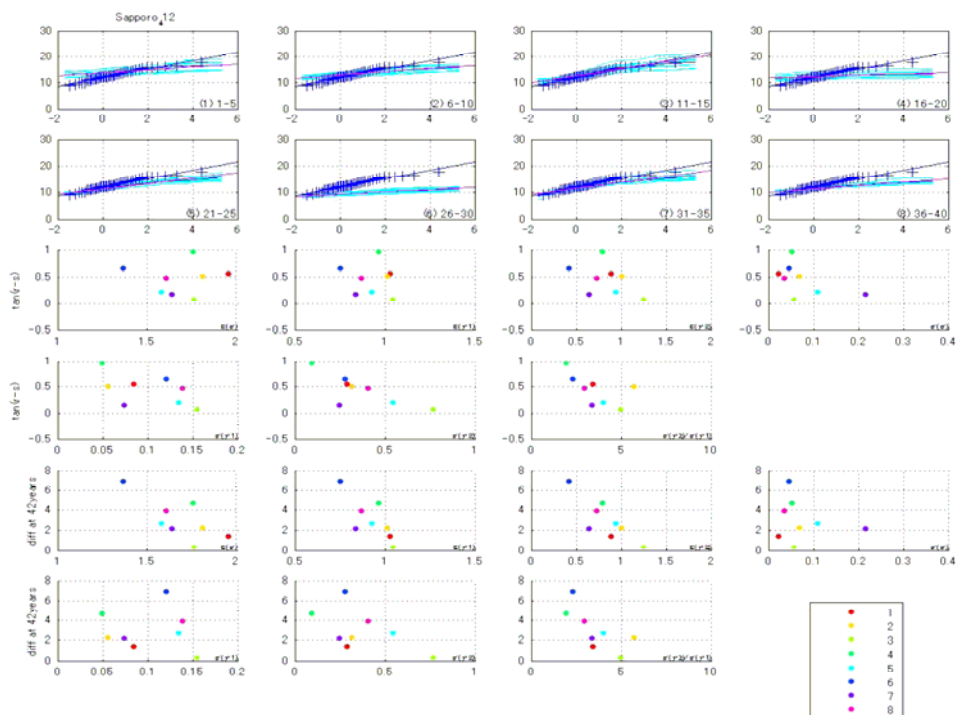


図 28 札幌における 5 年間シミュレーションと傾きの差、42 年再現期待値の差の関係

図 28 においては、 $\sigma$  ( $\gamma 2$ ) と傾きの関係にははっきりと負の相関が見られる。また、図 29 においては  $\sigma$  ( $\gamma 2$ ) が小さいときにシミュレーションがあっている点があるが、そのときに  $\sigma$  ( $\sigma$ ) が大きいことがわかる。どちらかが大きければ、シミュレーションがよく合うようになるということが推定できる。巻末資料に 154 箇所のシミュレーションについての結果をのせる。

図 30 に、全国についての、ずれ方とパラメータの関係についてのせた。これを見ても、やはり、 $\gamma 1$ 、 $\gamma 2$  と傾きの差の負の相関が見られる。

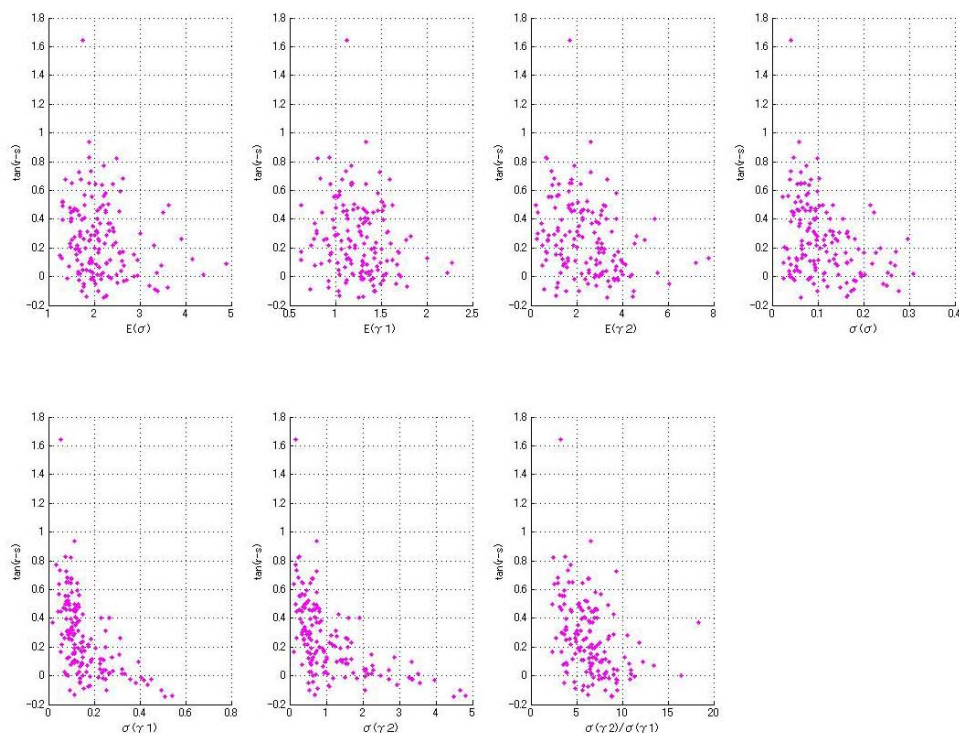


図 29 全国 154 箇所の傾きの差と各パラメータの相関関係

#### 4. 2. データ数（独立性）の評価

次に、一年間の風速をシミュレーションするために発生させるデータの個数について検証する。これまでのシミュレーションでは一年の 10 分間風速の和  $6 \times 24 \times 365$  日 = 52560 個のうち、相関する風速を考慮して独立だと考えられる、30000 個のデータを用いてきた。しかし、シミュレーションの結果を踏まえて、パラメータの小さいところ、大きいところで、個数を変えた方が良く合うのではないかと考えられる。よって、地点によって、どのくらいの個数のデータを用いればいいか、42 年再現期待値が最小になるような個数を算出した。20000 個から 5000 個ずつ足していき、42 年再現期待値が最小になる数値を求めた。

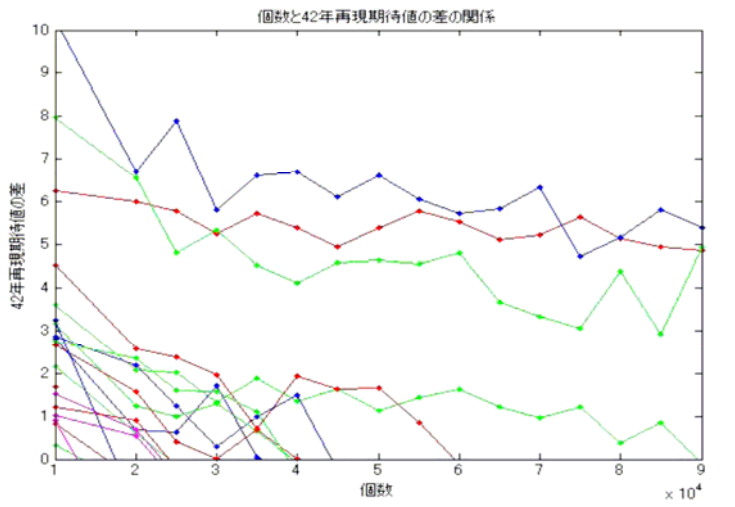


図 30 個数を大きくしていったときの、42年再現期待値の変化

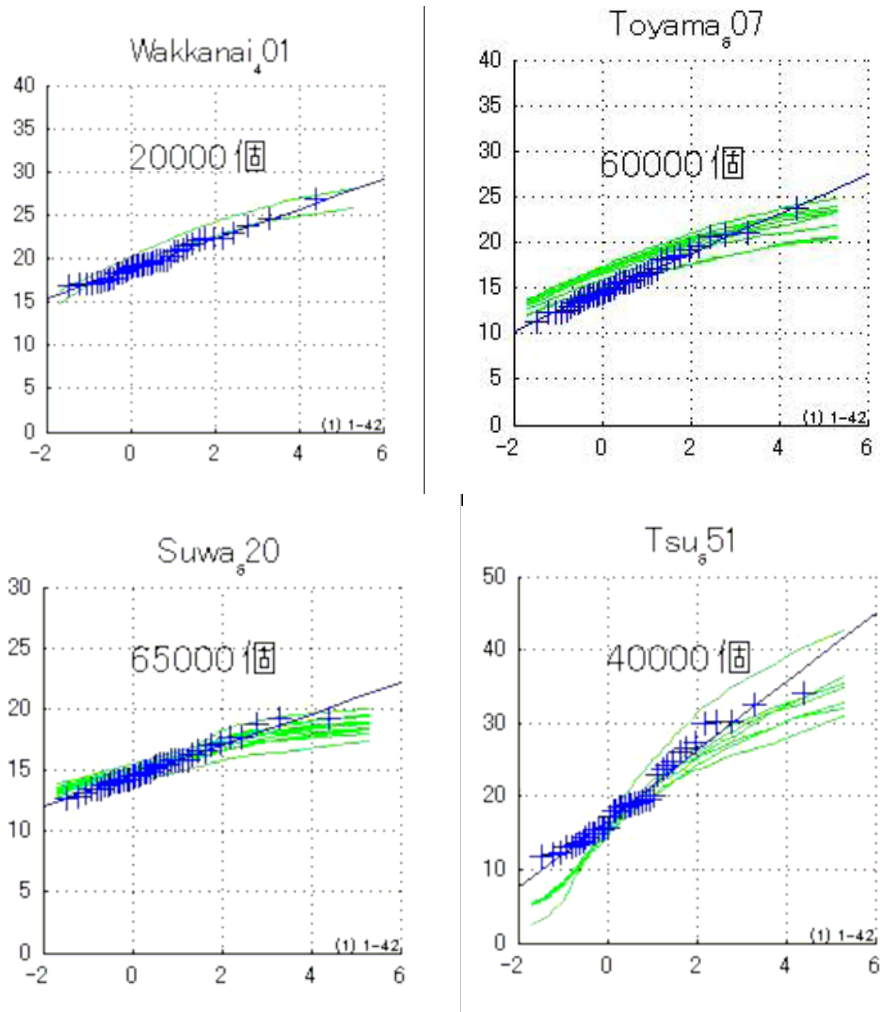


図 31 それぞれの地点における最適個数

巻末に全国 154 箇所の最適個数データをのせる。

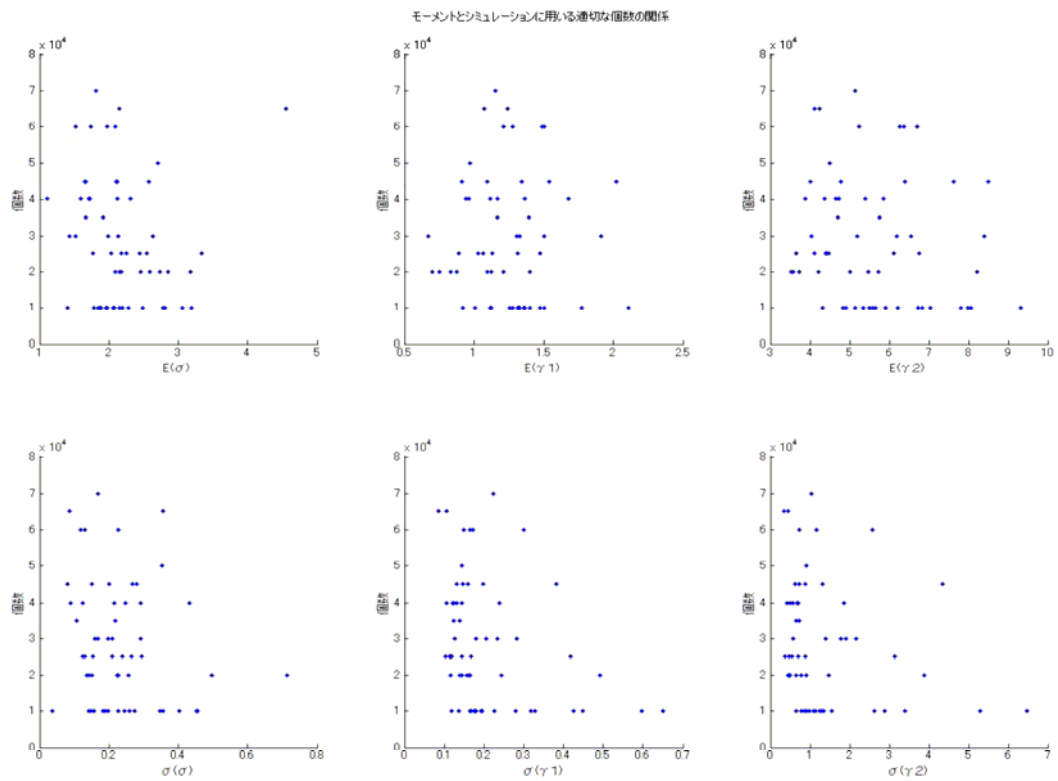


図 32 個数と各パラメータの関係

図 3 3 は、パラメータと最適個数の関係である。図から、 $\sigma(\gamma 1)$ 、 $\sigma(\gamma 2)$  が大きいときは個数を小さくしたほうが良いことがわかる。

#### 4. 3. 柏、本郷のデータによる年最大風速モデルの予測

これまで、柏と本郷キャンパスで観測してきた風速を利用して、シミュレーションを行ってみる。1998-2002 までの風速データの和を巻末資料にのせる。

図 3 4 は本郷で観測した 1998 年～2007 年までの 10 分間平均風速のモーメントと東京気象観測台のデータの比較である。左上から  $\mu$ 、 $\sigma$ 、 $\gamma 1$ 、 $\gamma 2$  のデータである。

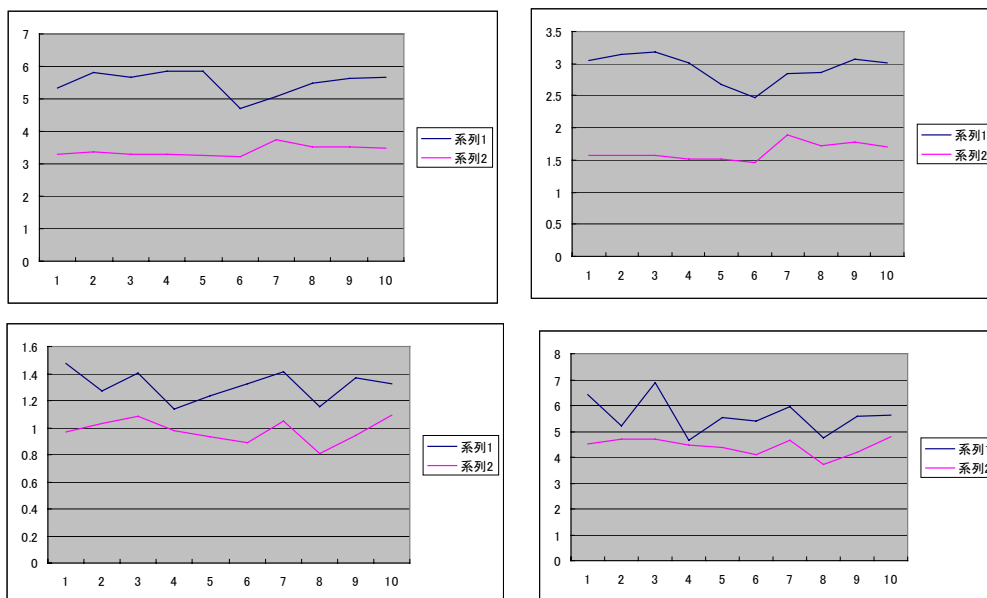
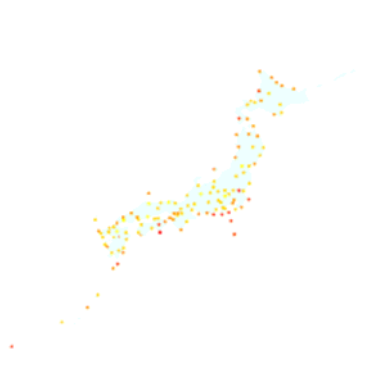


図 33 本郷と東京気象観測台データの違い

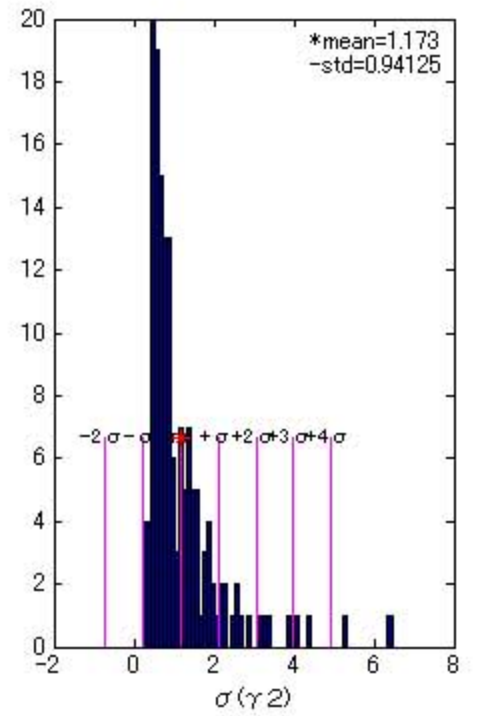
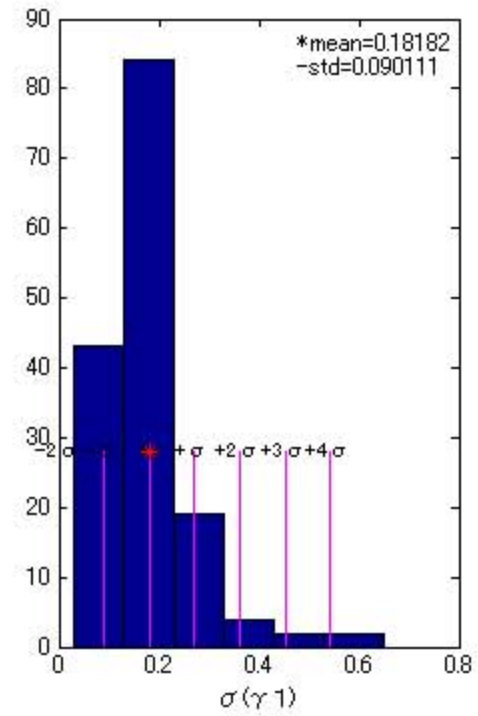
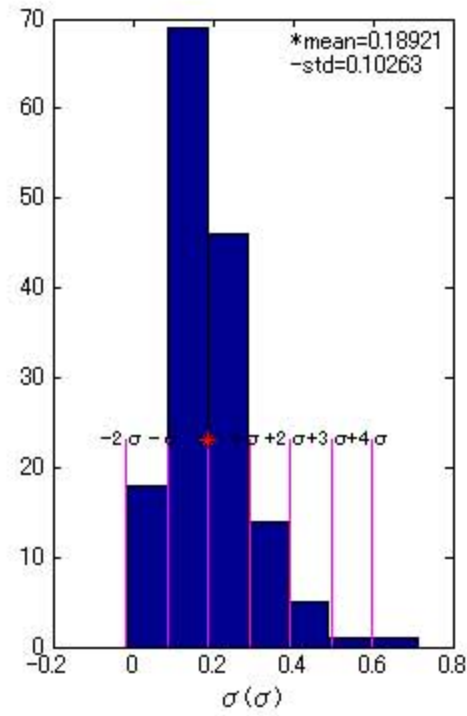
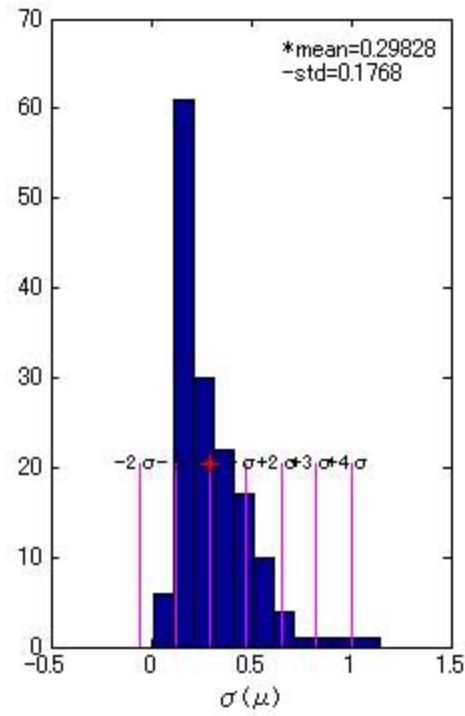
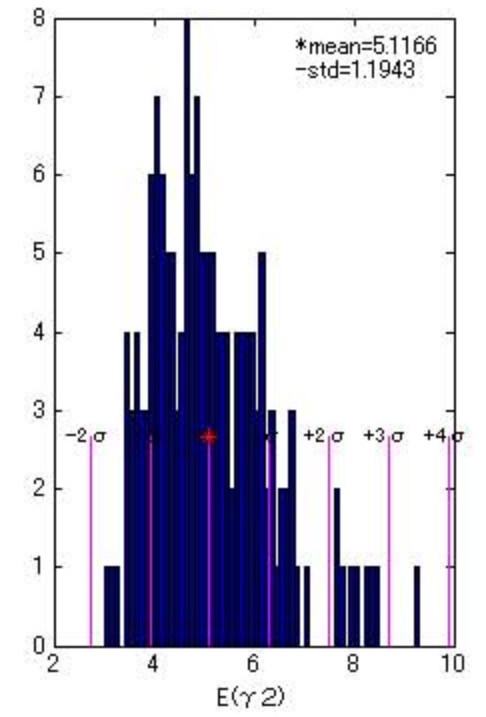
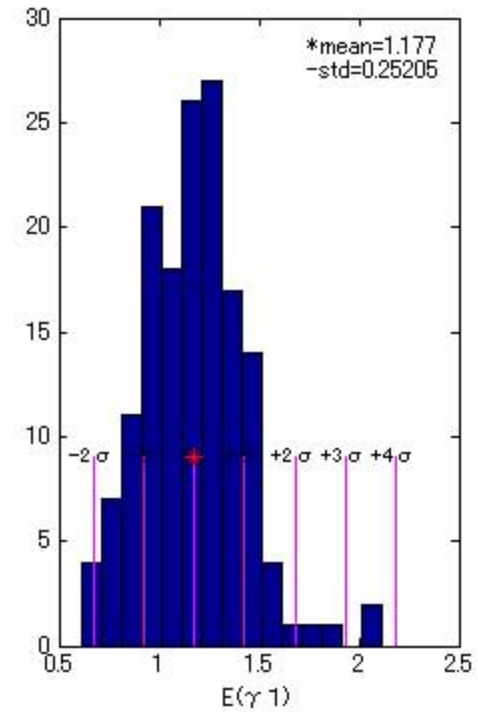
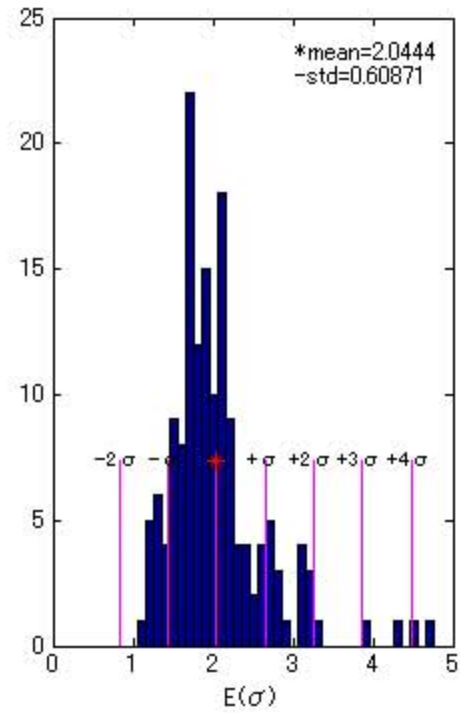
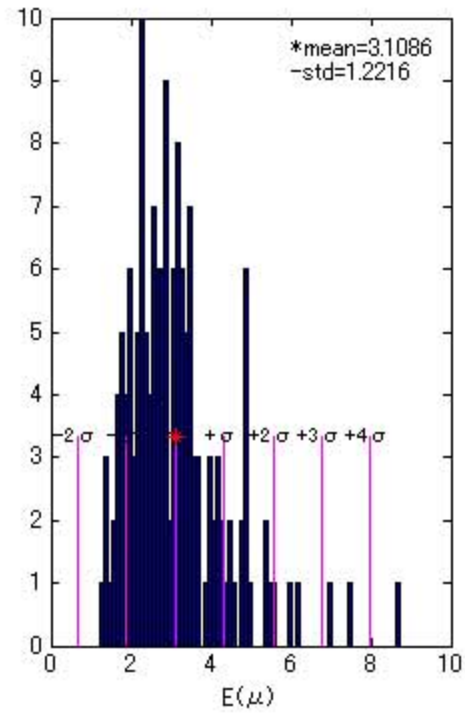
#### 4. 4. パラメータの全国分布

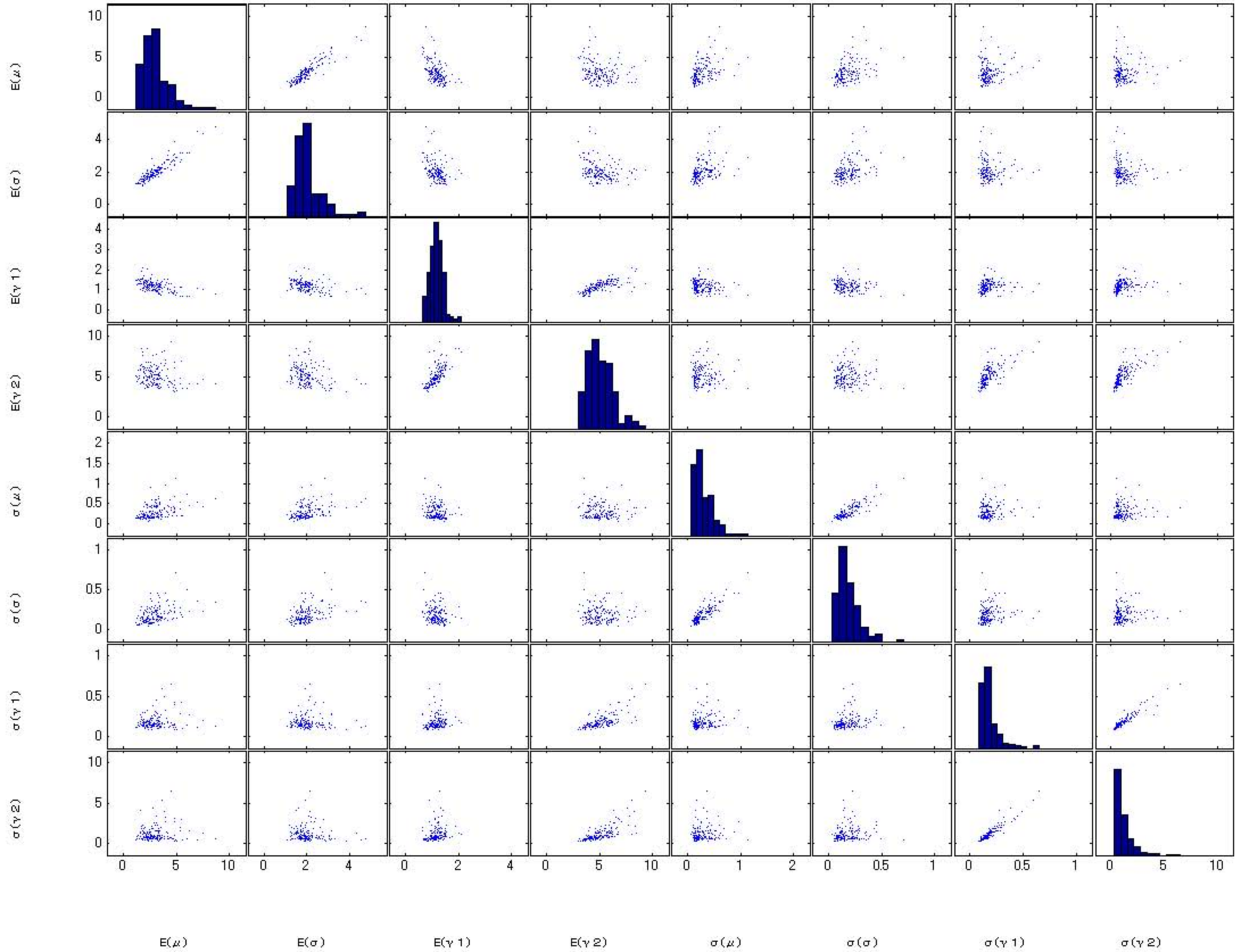


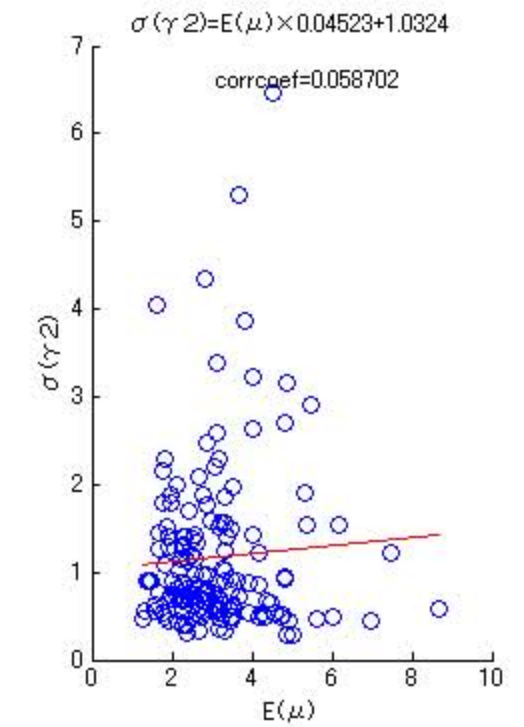
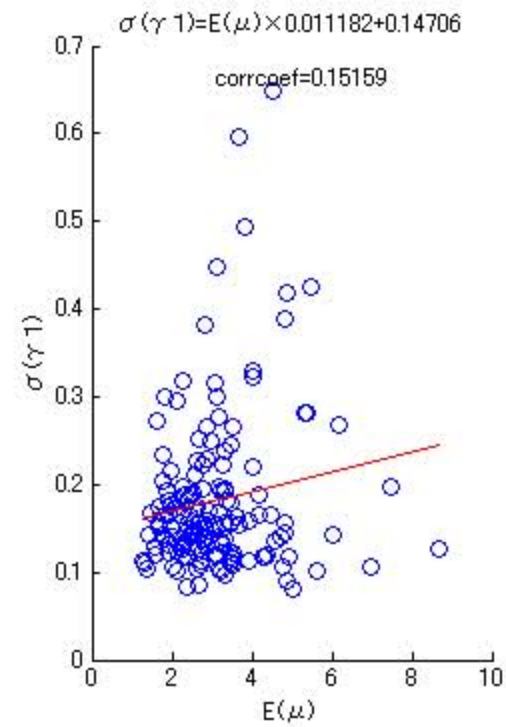
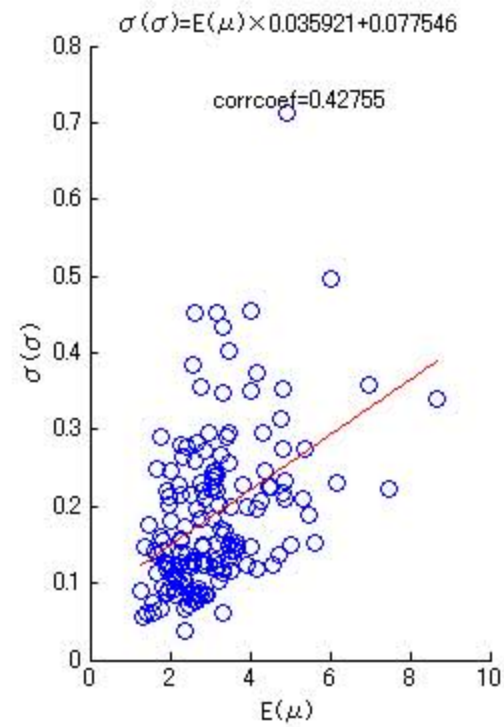
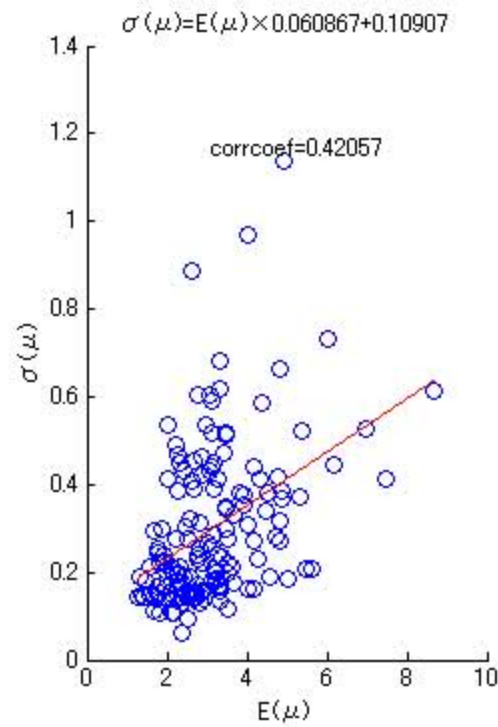
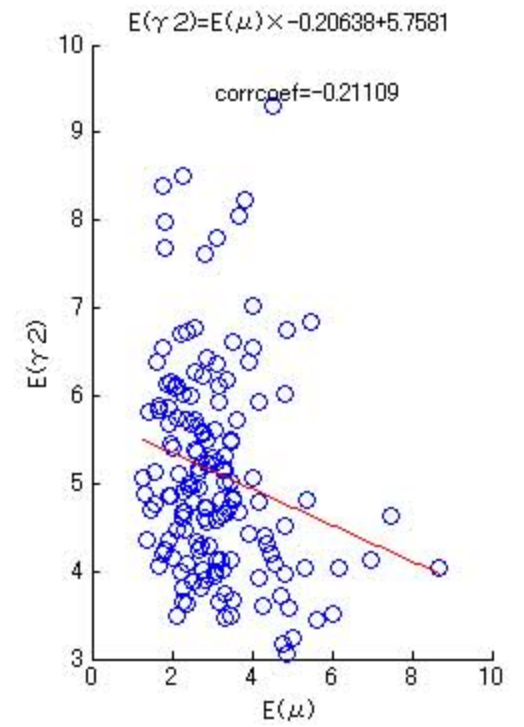
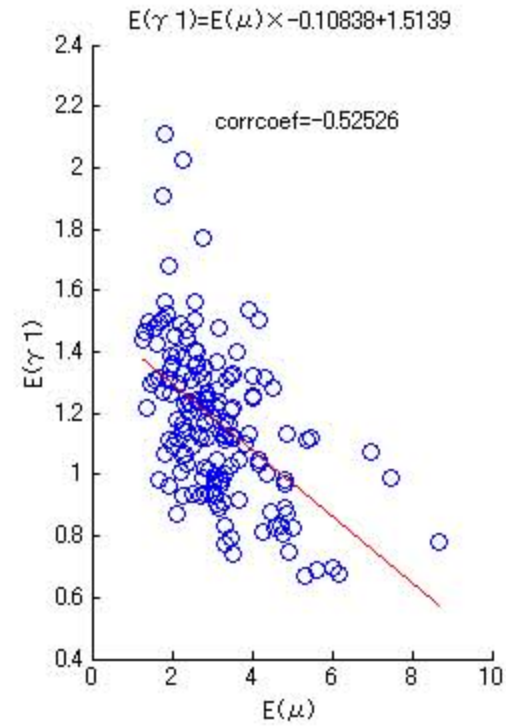
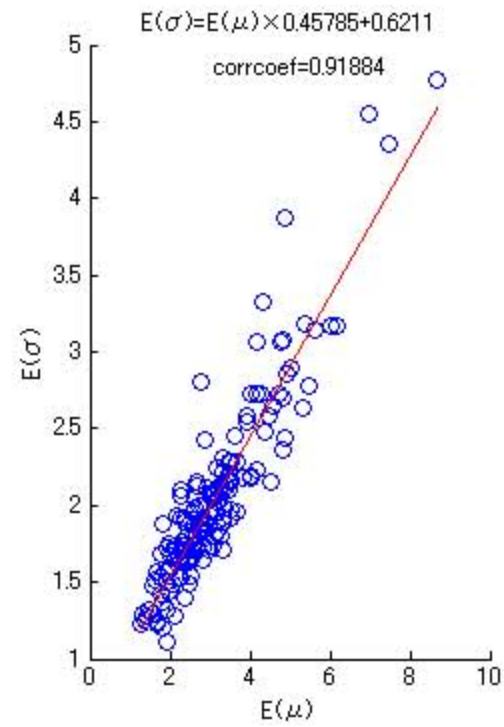
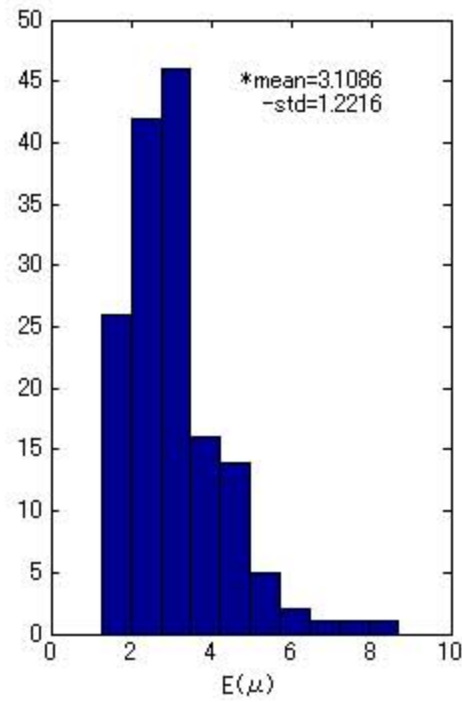
#### 5. 結論

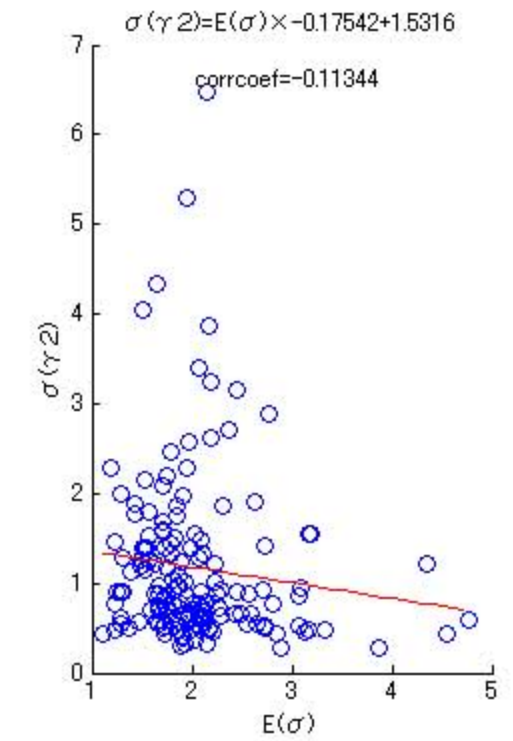
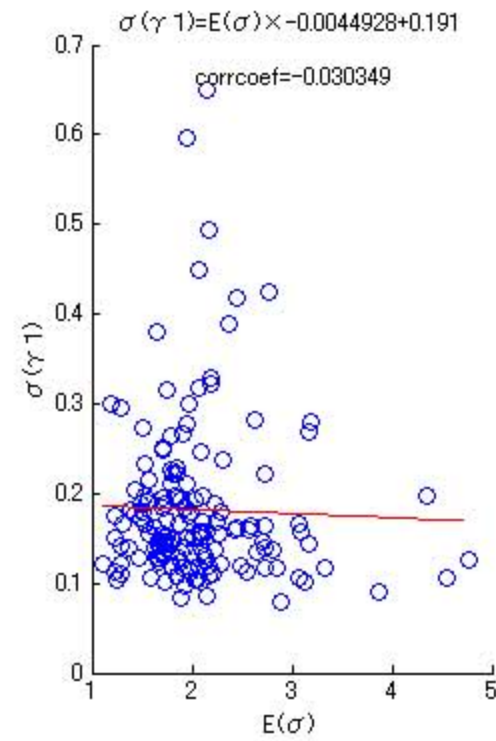
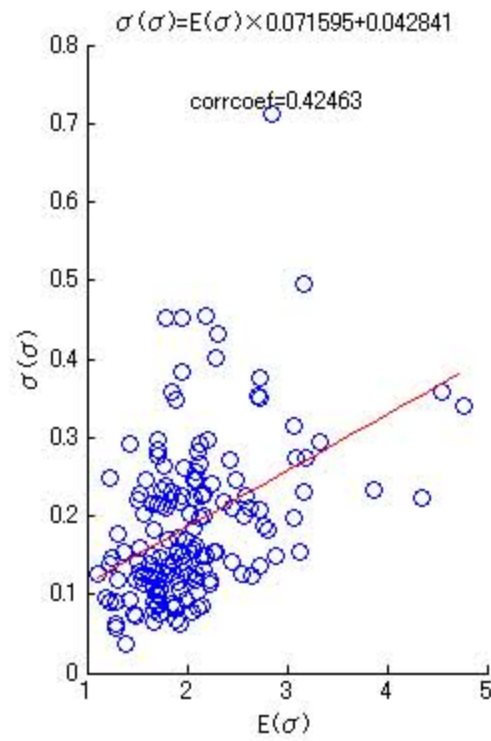
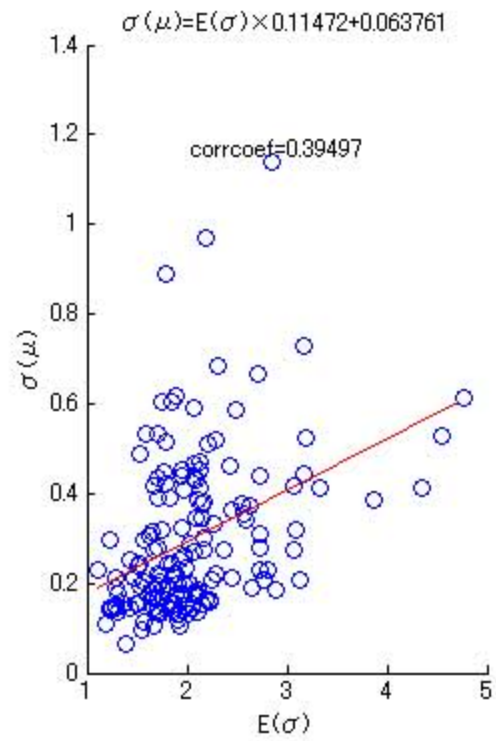
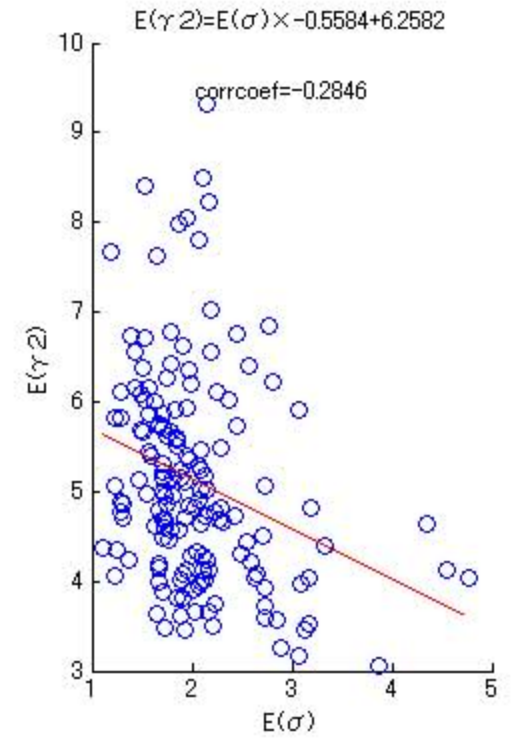
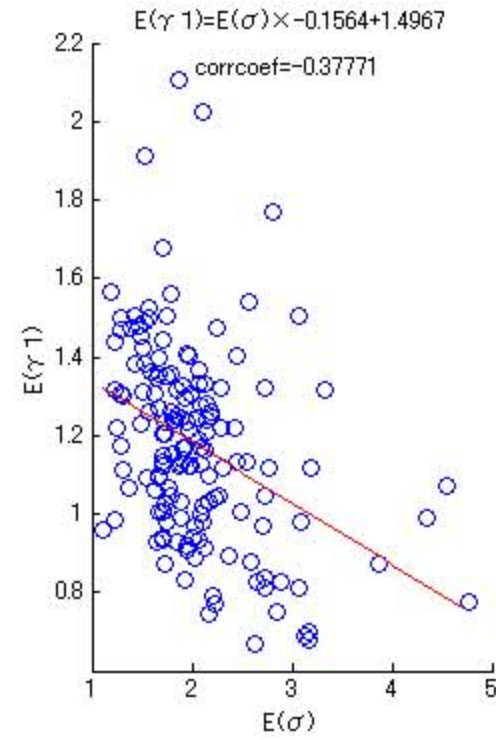
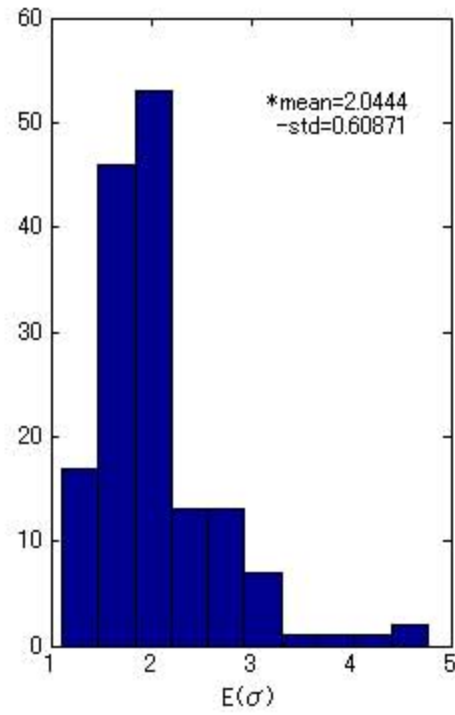
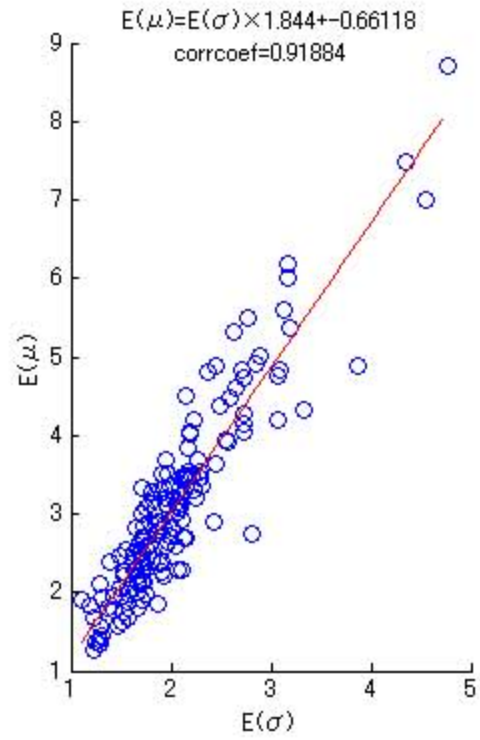
シミュレーションが合う合わないは、それぞれの地点のパラメータと大きな関係があることがわかった。特に、 $\sigma$  ( $\gamma^2$ ) が大きな相関をみせた。今後、それらのパラメータをうまくモデル化できれば、シミュレーションの精度が上がるだろう。

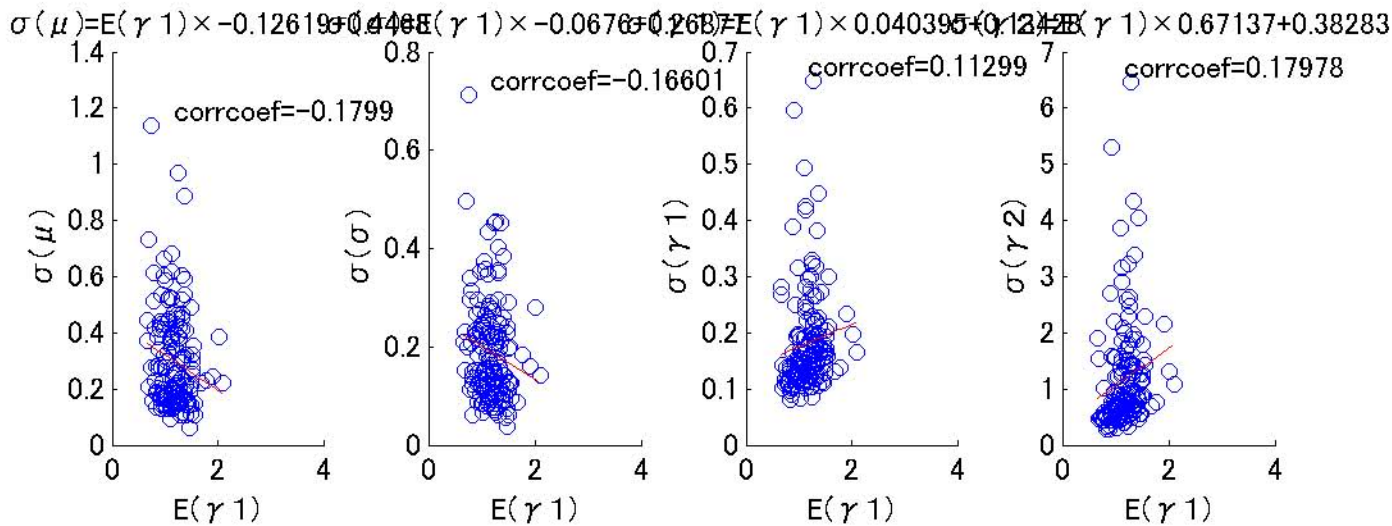
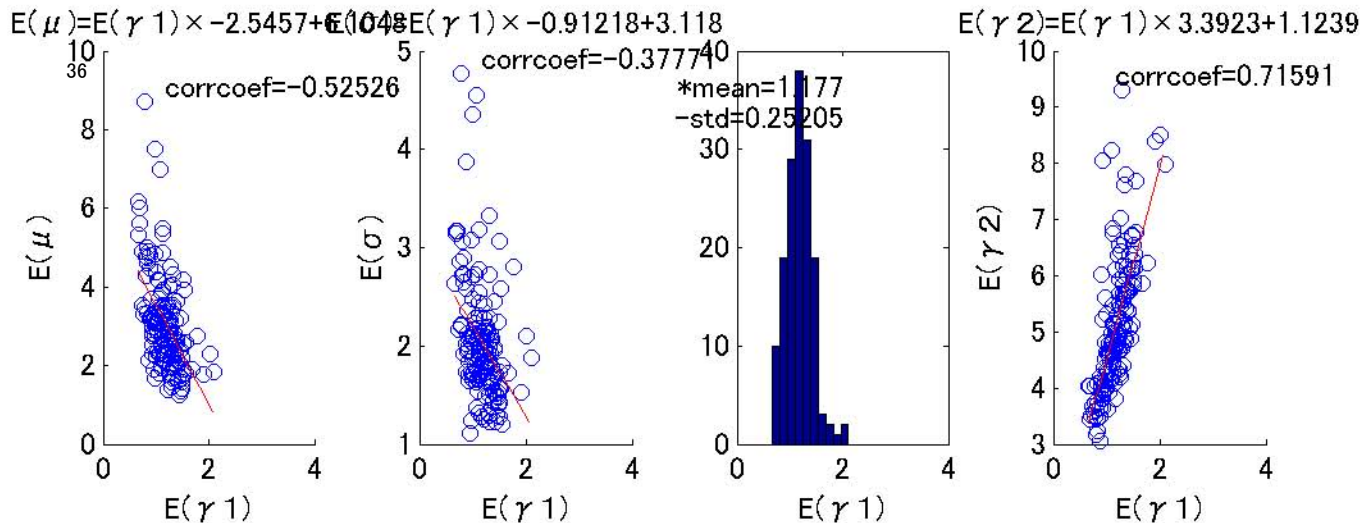


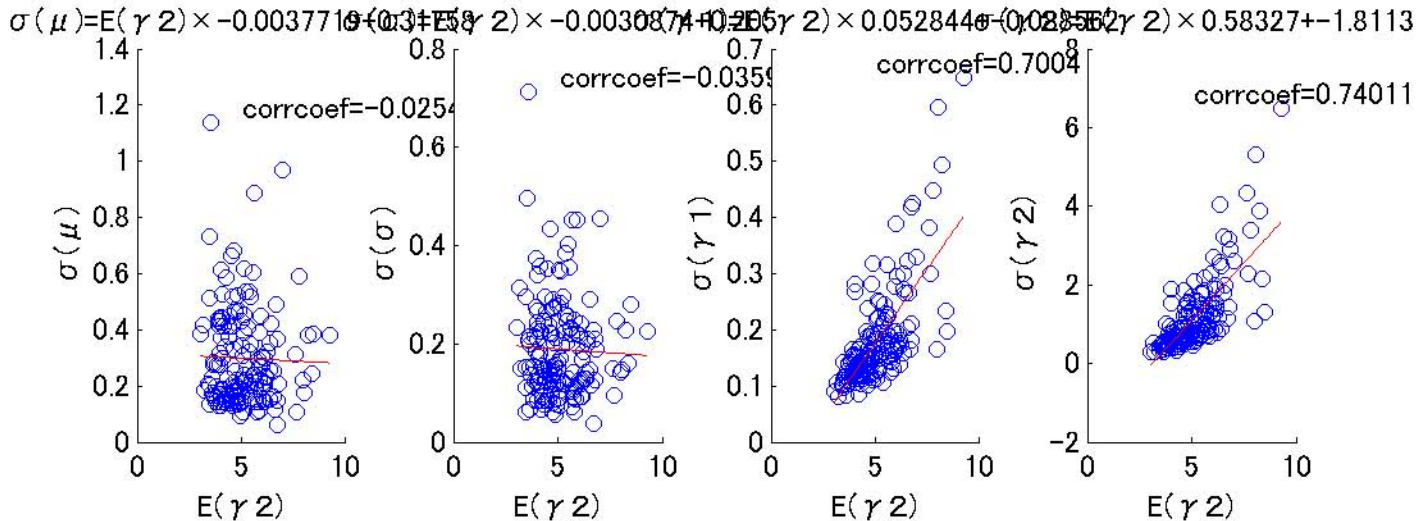
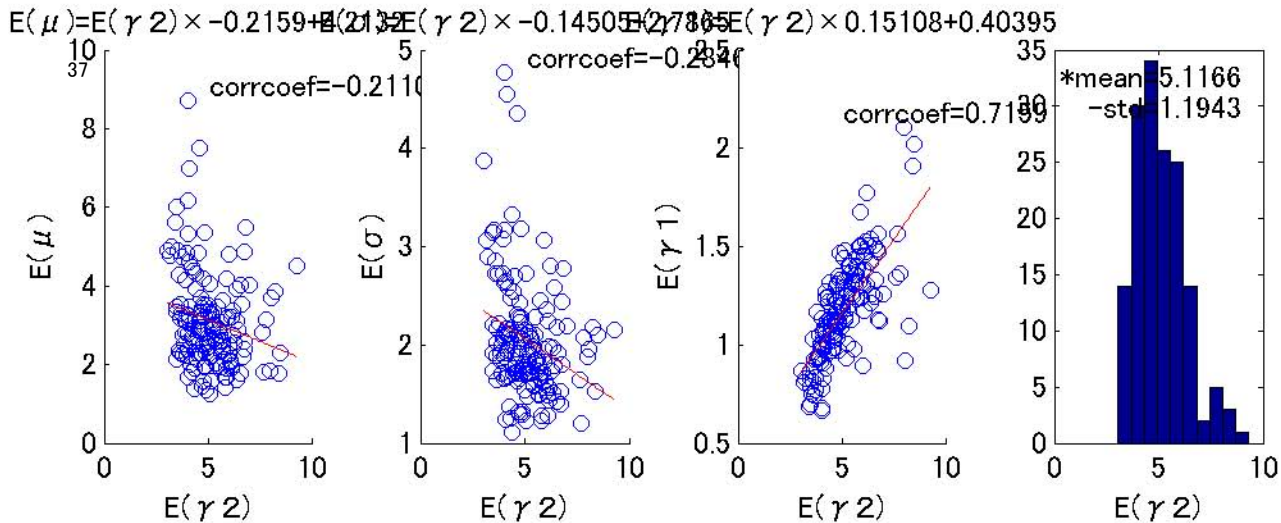




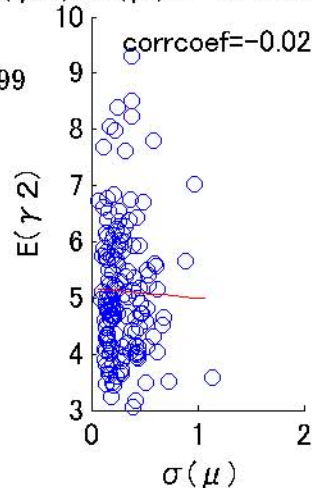
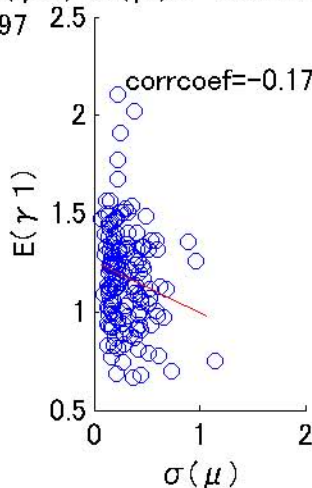
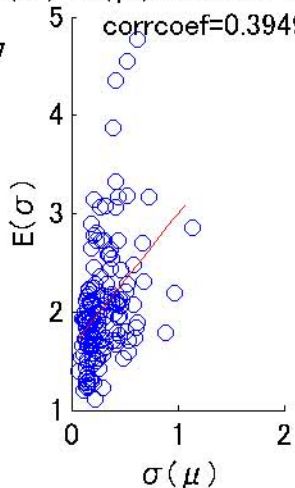
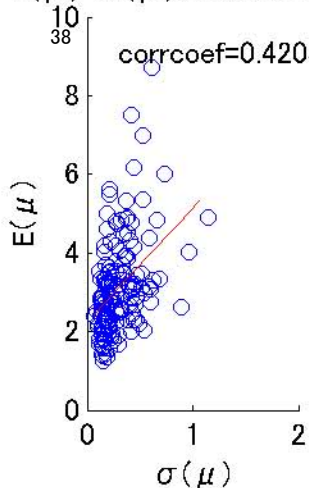




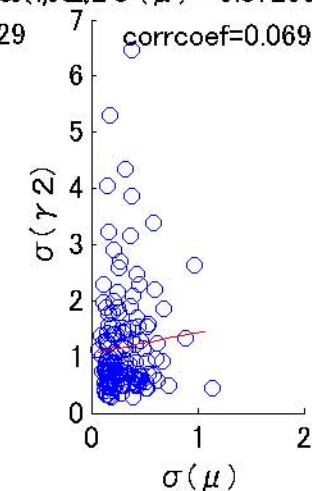
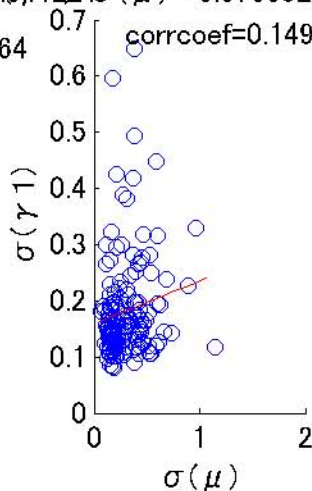
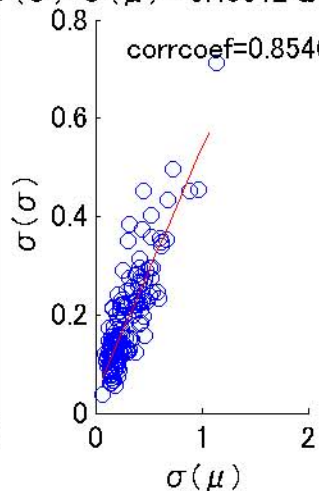
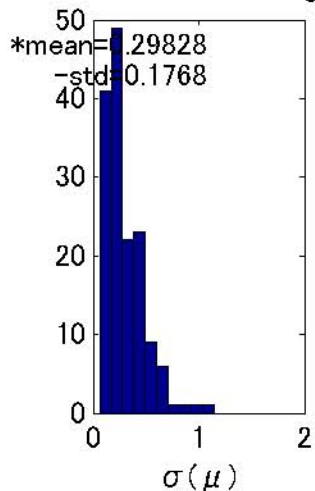




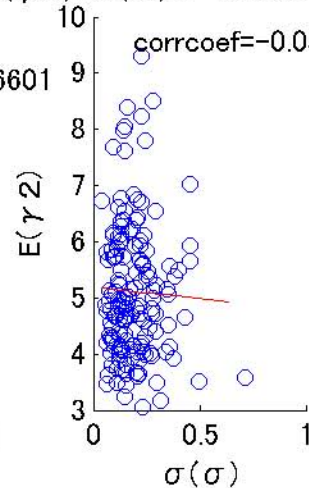
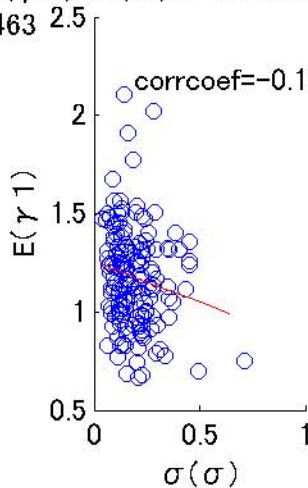
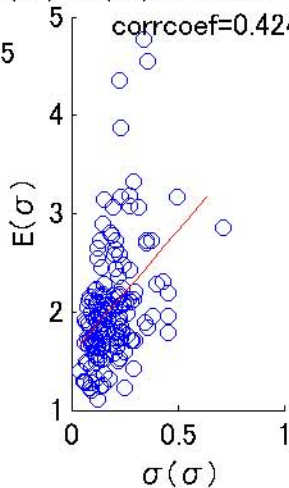
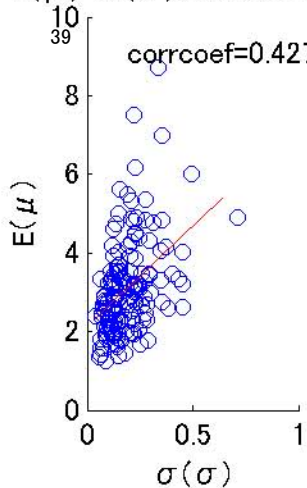
$$E(\mu) = \sigma(\mu) \times 2.906 + 2.21107 = \sigma(\mu) \times 1.3599 + E(6387) = \sigma(\mu) \times -0.2564 + E(12235) = \sigma(\mu) \times -0.17214 + 5.1679$$



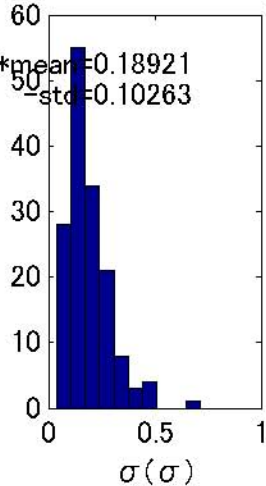
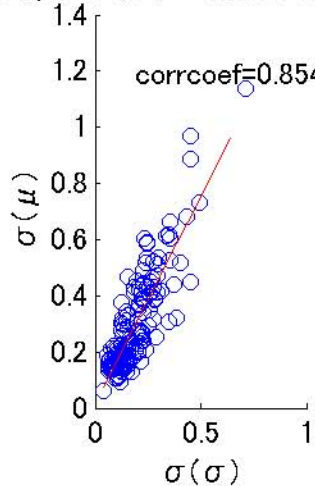
$$\sigma(\sigma) = \sigma(\mu) \times 0.49612 + 0.041221 = \sigma(\mu) \times 0.076092 + 0.15210 = \sigma(\mu) \times 0.37206 + 1.062$$



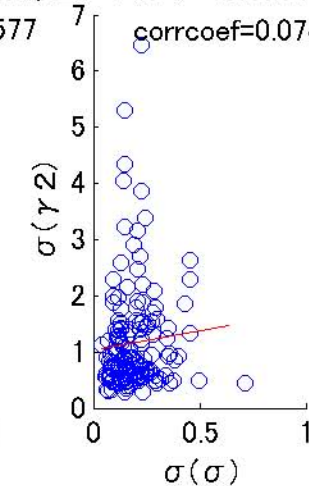
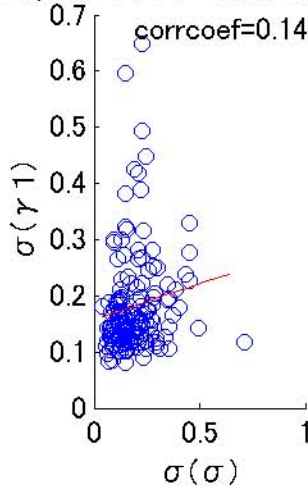
$$E(\mu) = \sigma(\sigma) \times 5.089 + 2.1457 = \sigma(\sigma) \times 2.5185 + 5.5878 = \sigma(\sigma) \times -0.4077 + 1.2241 = \sigma(\sigma) \times -0.41811 + 5.1957$$



$$\sigma(\mu) = \sigma(\sigma) \times 1.4722 + 0.019729$$

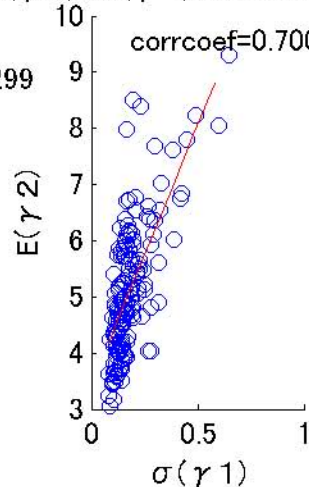
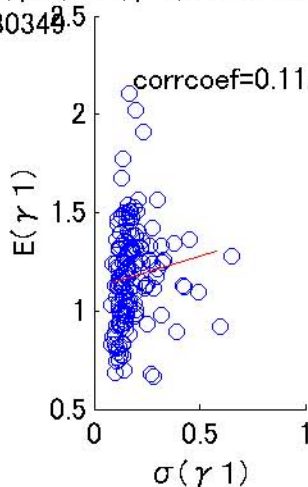
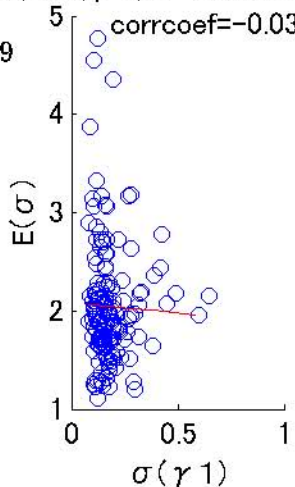
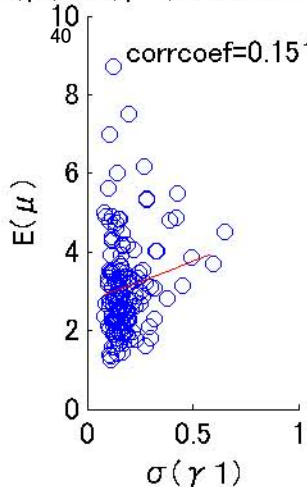


$$\sigma(\gamma 1) = \sigma(\sigma) \times 0.12799 + 0.1528 = \sigma(\sigma) \times 0.68488 + 1.0434$$

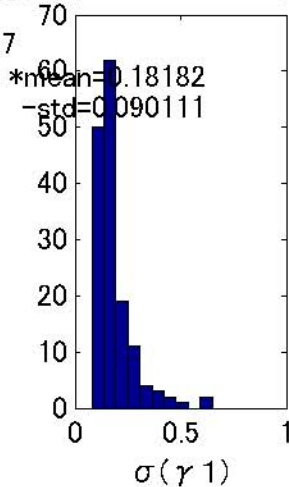
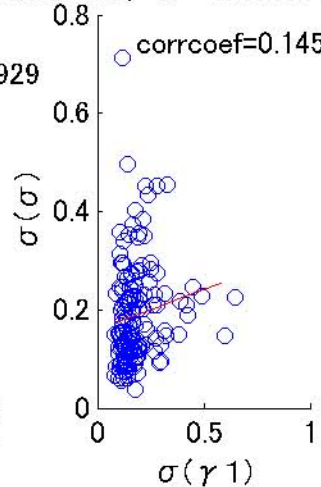
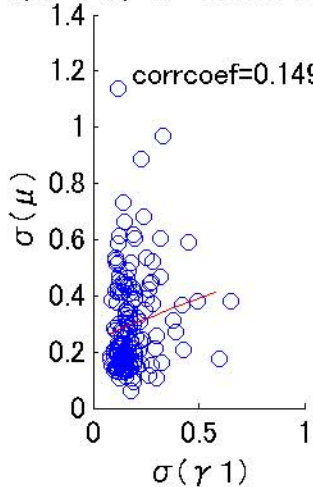




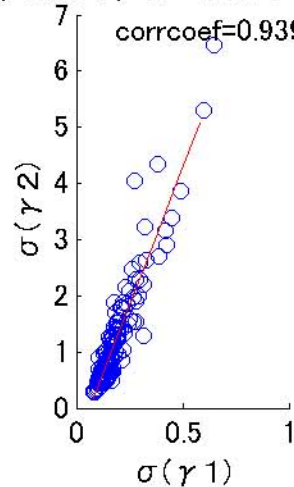
$$E(\mu) = \sigma(\gamma 1) \times 2.0551 + 2.7349 \quad E(\sigma) = \sigma(\gamma 1) \times -0.2050 + 2.0816 \quad E(\gamma 1) = \sigma(\gamma 1) \times 0.31604 + 1.1295 \quad E(\gamma 2) = \sigma(\gamma 1) \times 9.2833 + 3.4287$$



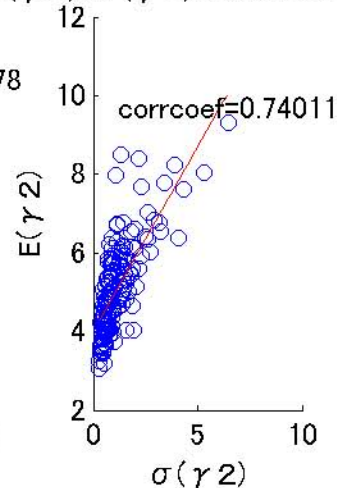
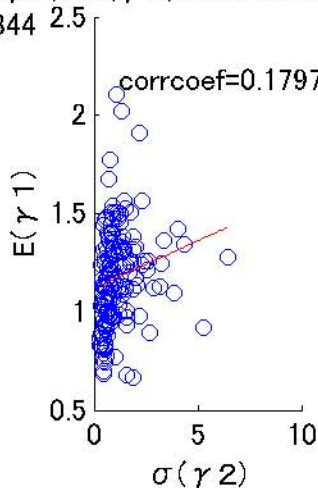
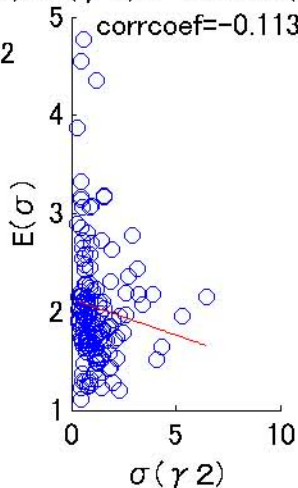
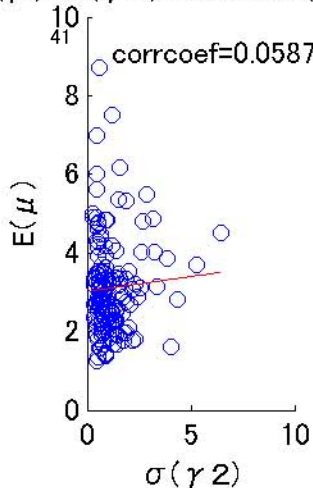
$$\sigma(\mu) = \sigma(\gamma 1) \times 0.29291 + 0.24503 \quad \sigma(\sigma) = \sigma(\gamma 1) \times 0.16603 + 0.15902$$



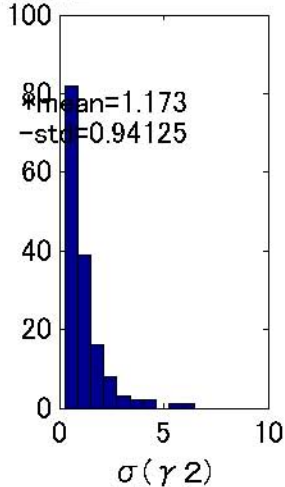
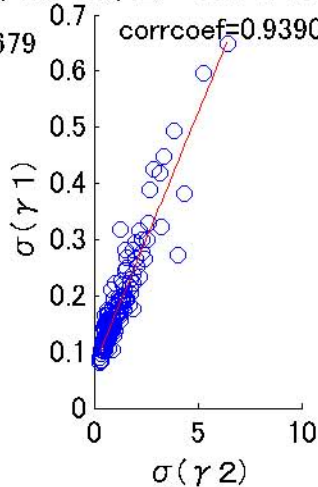
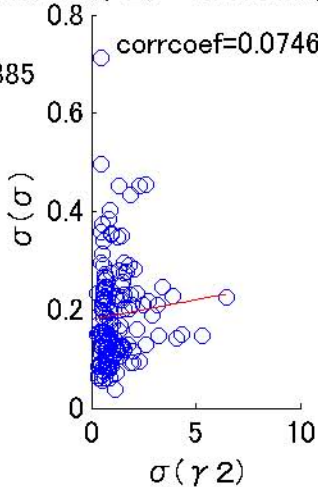
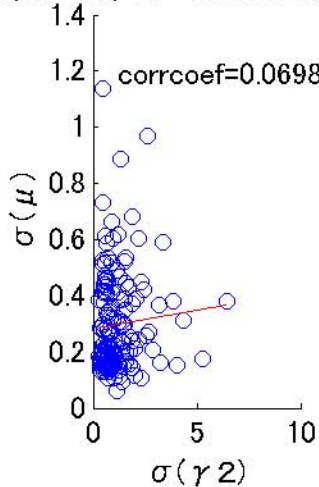
$$\sigma(\gamma 2) = \sigma(\gamma 1) \times 9.8091 + 0.61049$$



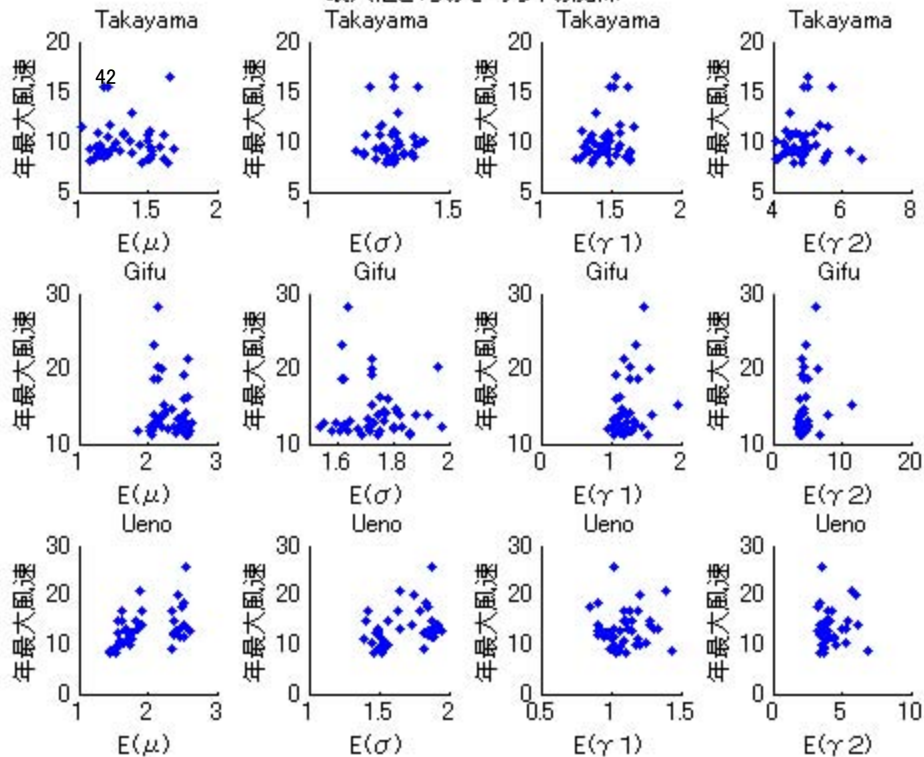
$$E(\mu) = \sigma(\gamma_2) \times 0.076186 + 3.04192 \quad E(\sigma) = \sigma(\gamma_2) \times -0.073365 + 2.11304 \quad E(\gamma_1) = \sigma(\gamma_2) \times 0.048142 + 1.2295 \quad E(\gamma_2) = \sigma(\gamma_2) \times 0.93912 + 4.015$$



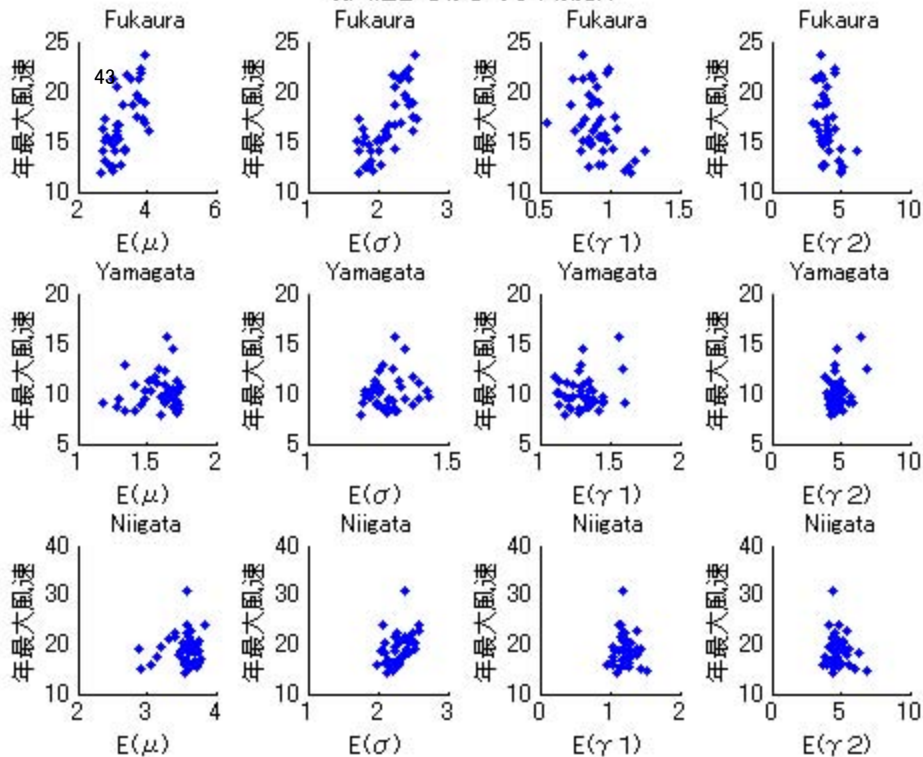
$$\sigma(\mu) = \sigma(\gamma_2) \times 0.013127 + 0.28289 \quad \sigma(\sigma) = \sigma(\gamma_2) \times 0.0081428 + 0.17966 \quad \sigma(\gamma_1) = \sigma(\gamma_2) \times 0.089904 + 0.076362$$



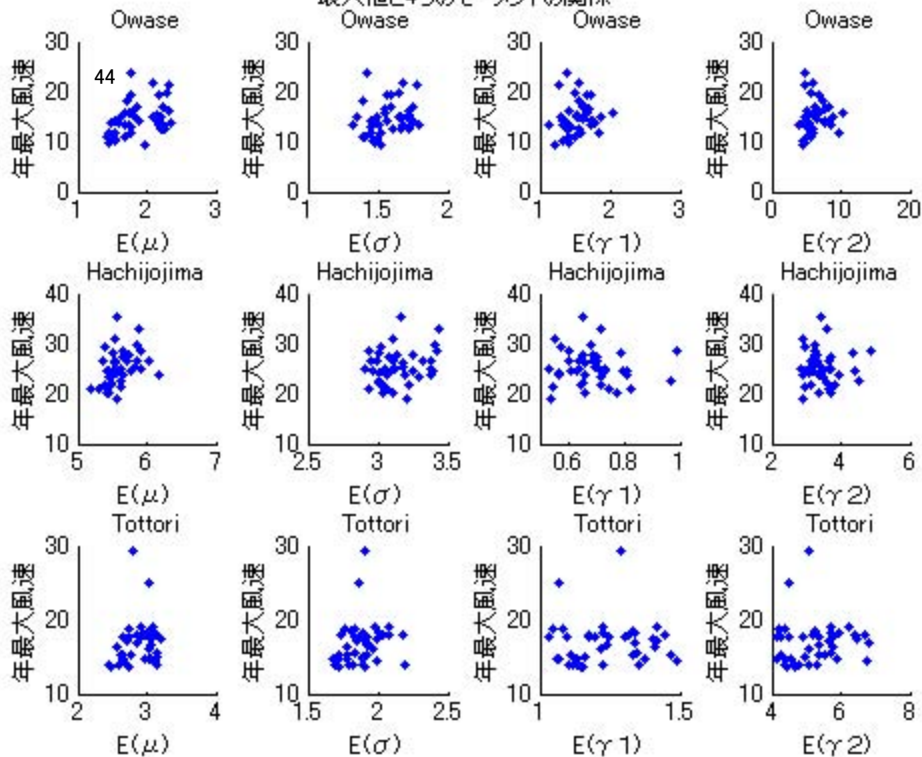
最大値と4つのモーメントの関係



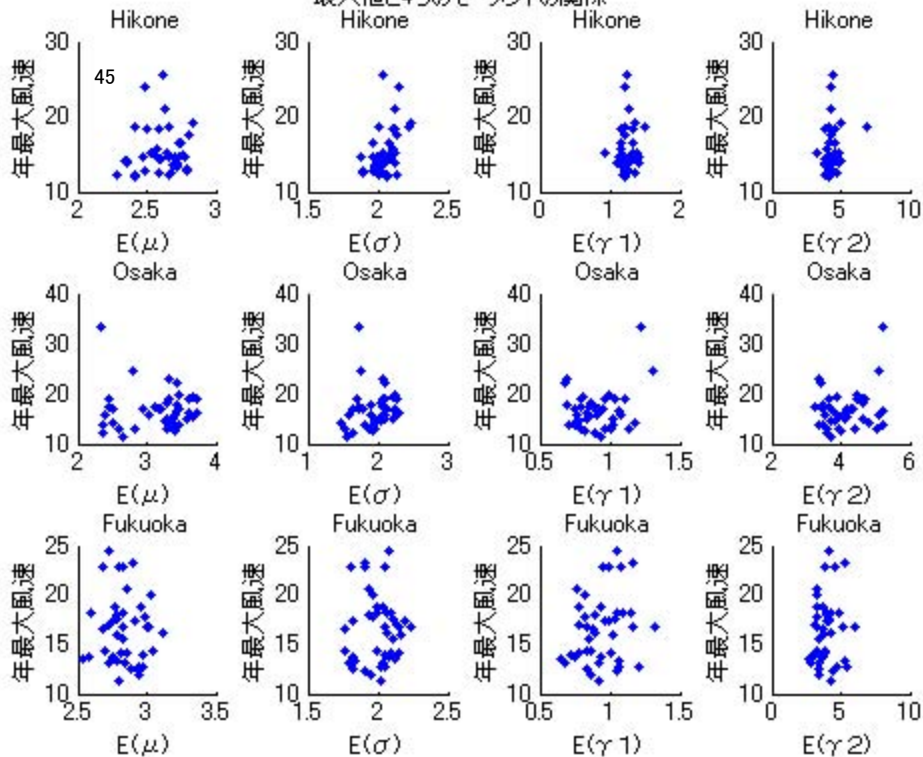
最大値と4つのモーメントの関係



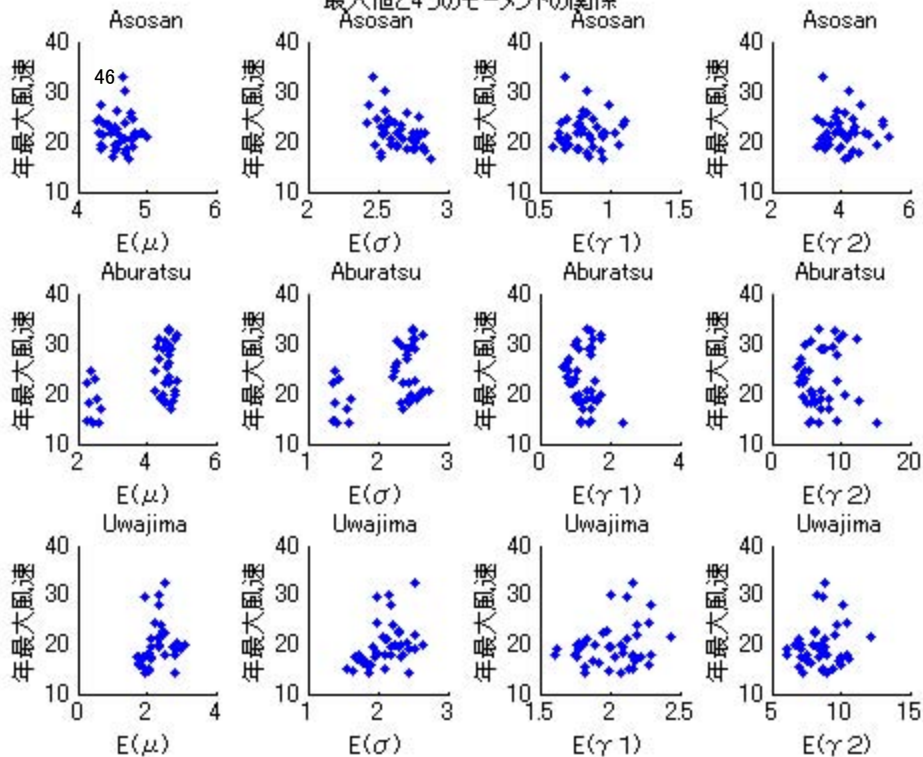
最大値と4つのモーメントの関係

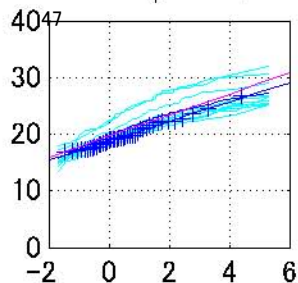
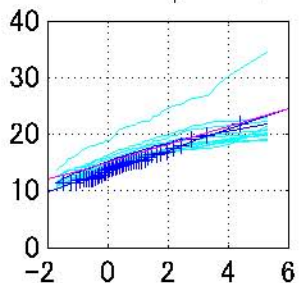
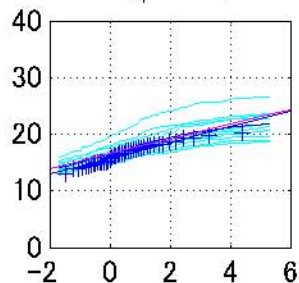
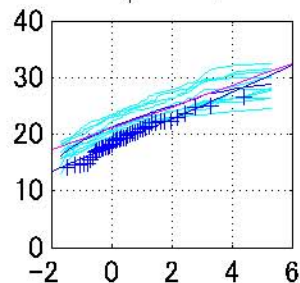
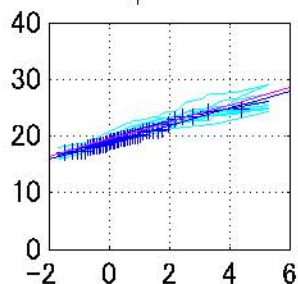
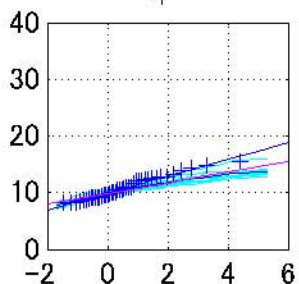
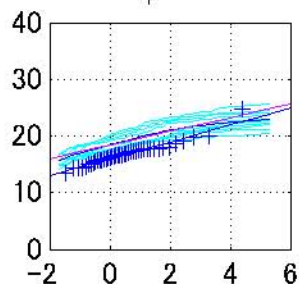
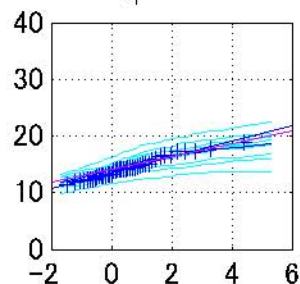
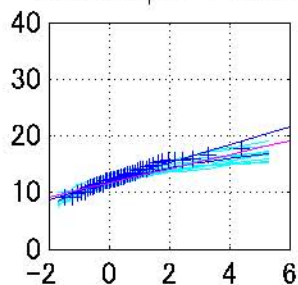
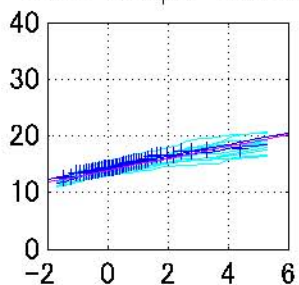
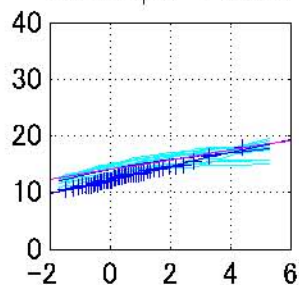
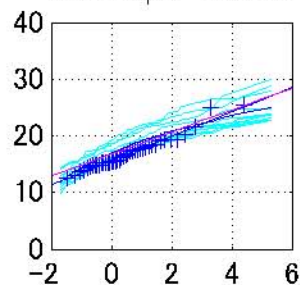


最大値と4つのモーメントの関係

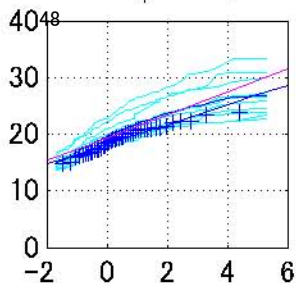
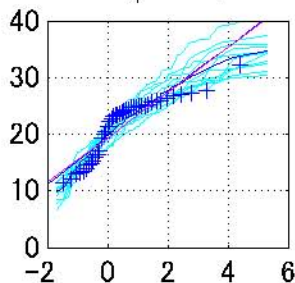
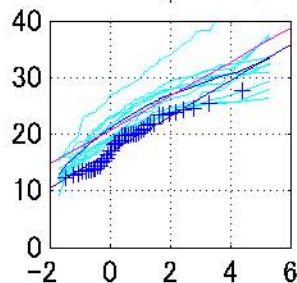
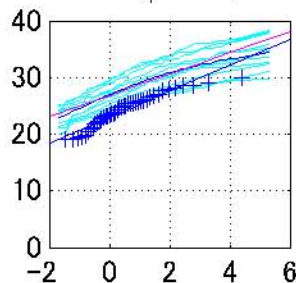
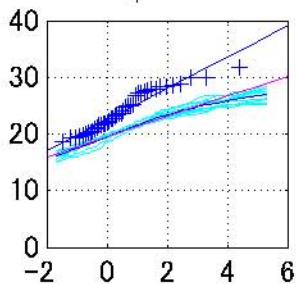
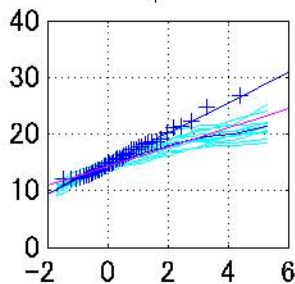
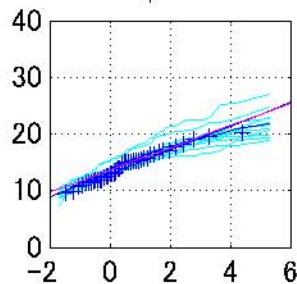
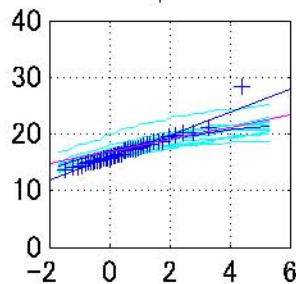
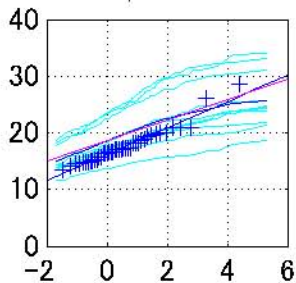
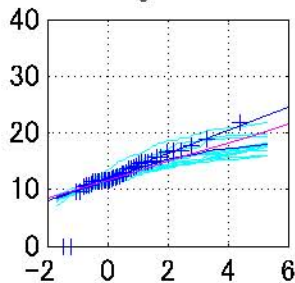
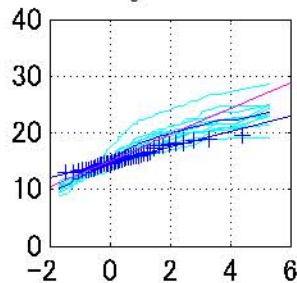
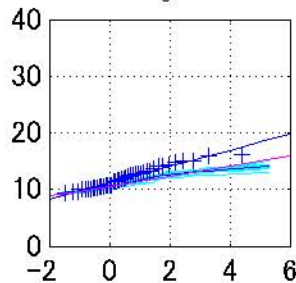


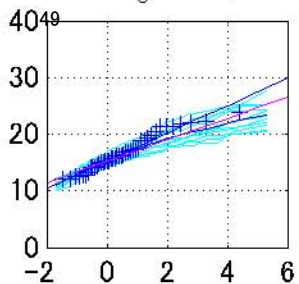
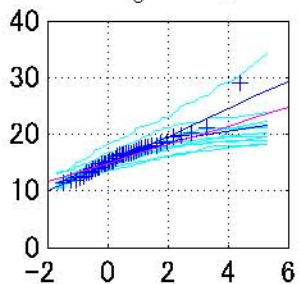
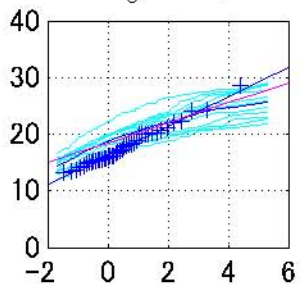
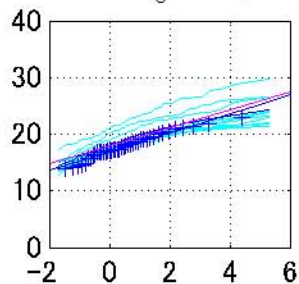
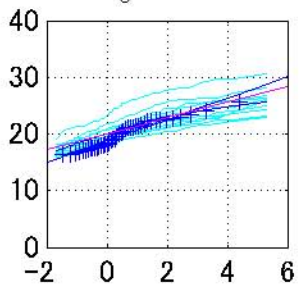
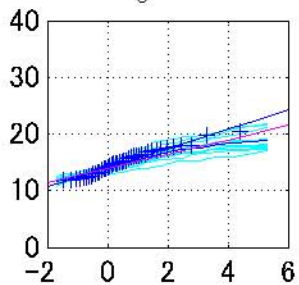
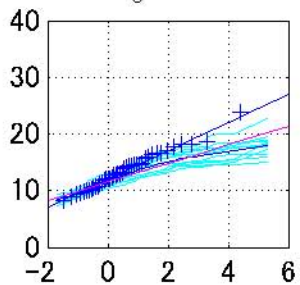
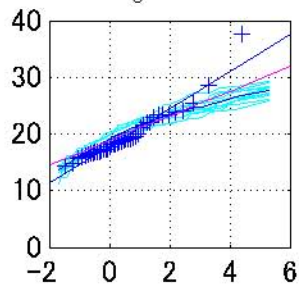
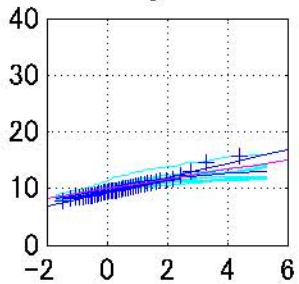
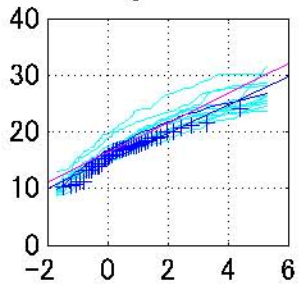
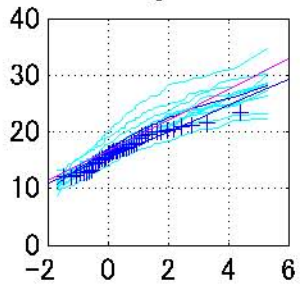
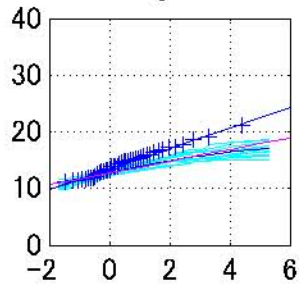
最大値と4つのモーメントの関係

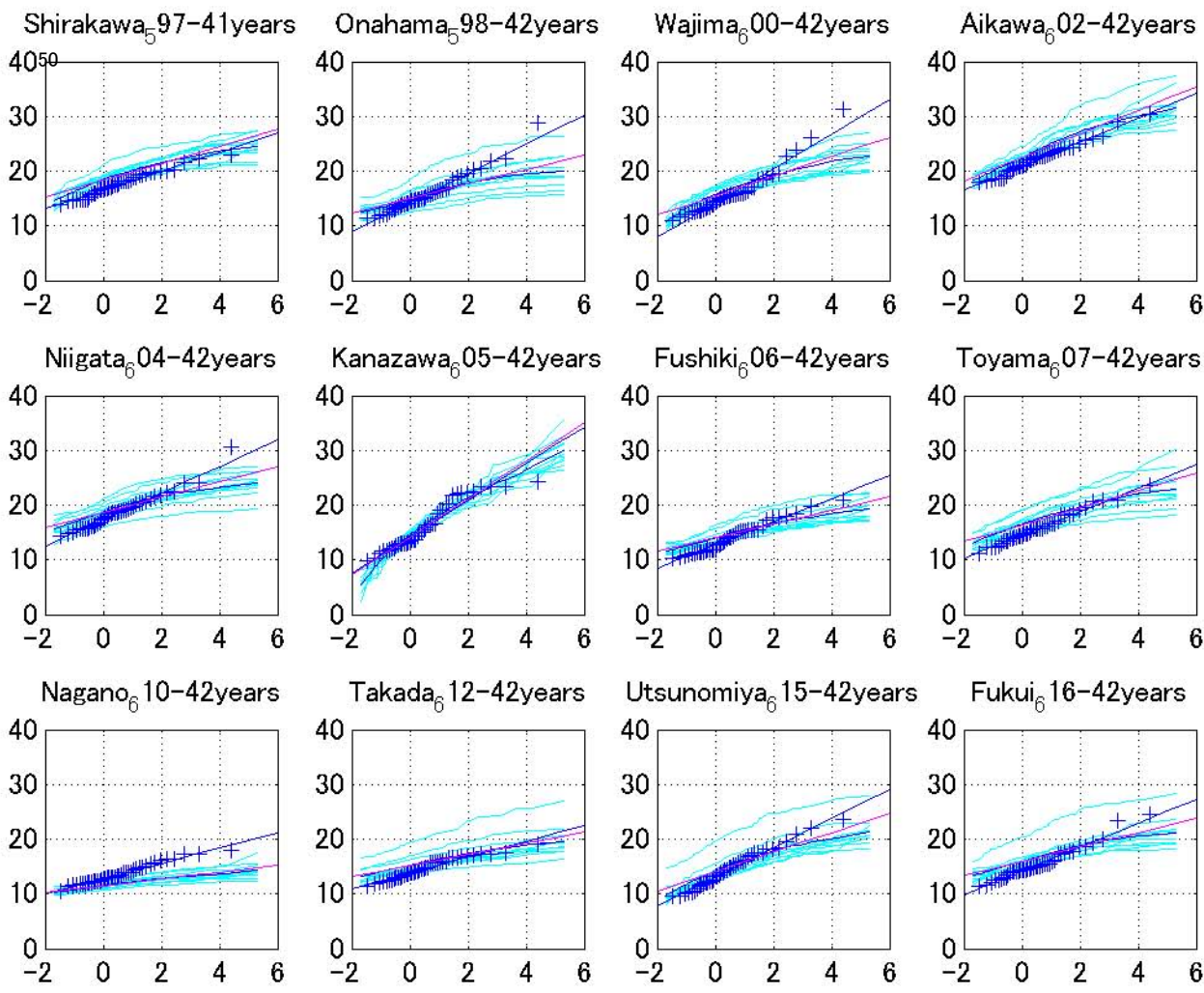


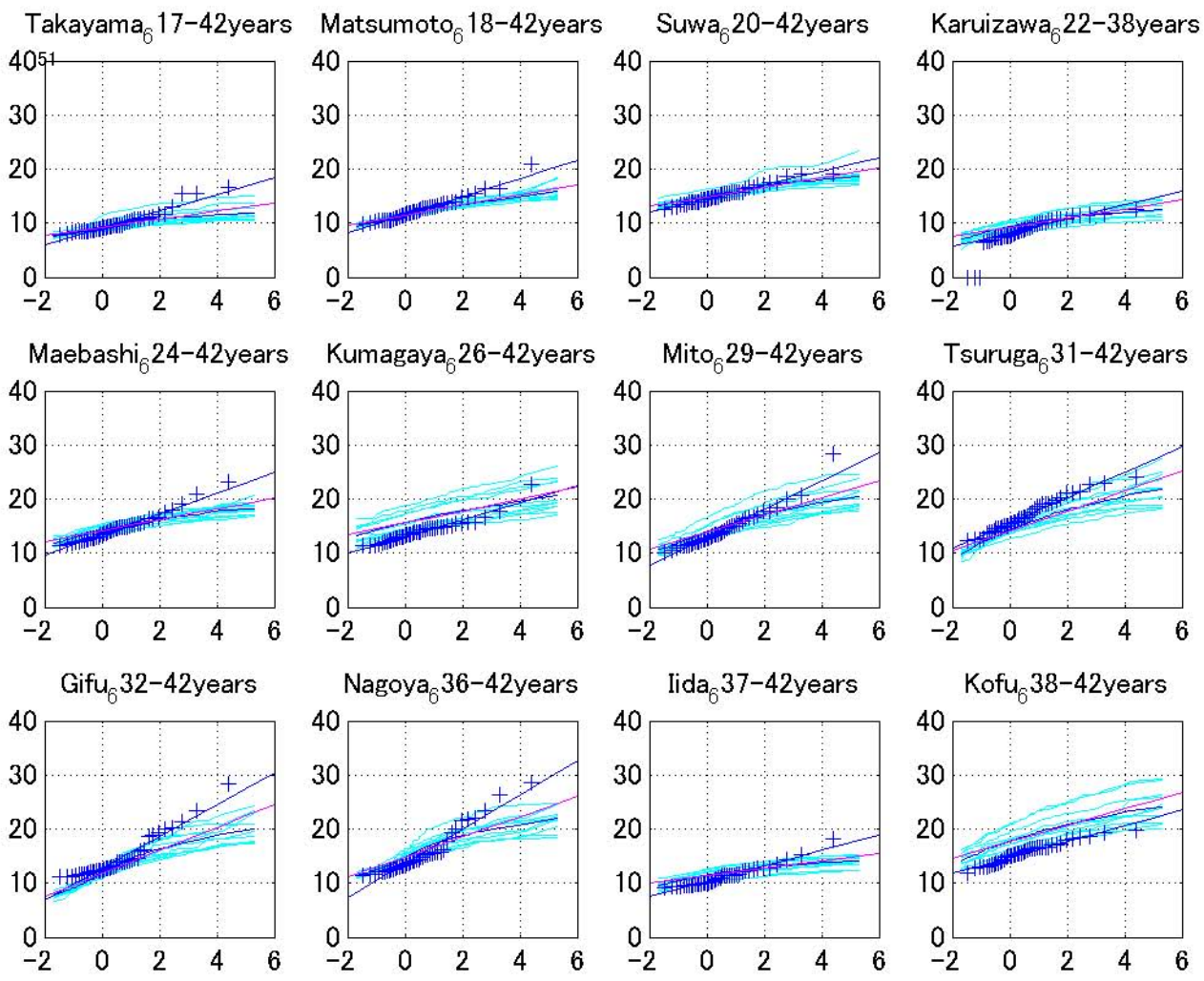
Wakkanai<sub>4</sub>01-42yearsKitamiesashi<sub>4</sub>02-42yearsHaboro<sub>4</sub>04-42yearsOmu<sub>4</sub>05-42yearsRumoi<sub>4</sub>06-42yearsAsahikawa<sub>4</sub>07-42yearsAbashiri<sub>4</sub>09-42yearsOtaru<sub>4</sub>11-42yearsSapporo<sub>4</sub>12-42yearsIwamizawa<sub>4</sub>13-42yearsObihiro<sub>4</sub>17-42yearsKushiro<sub>4</sub>18-42years

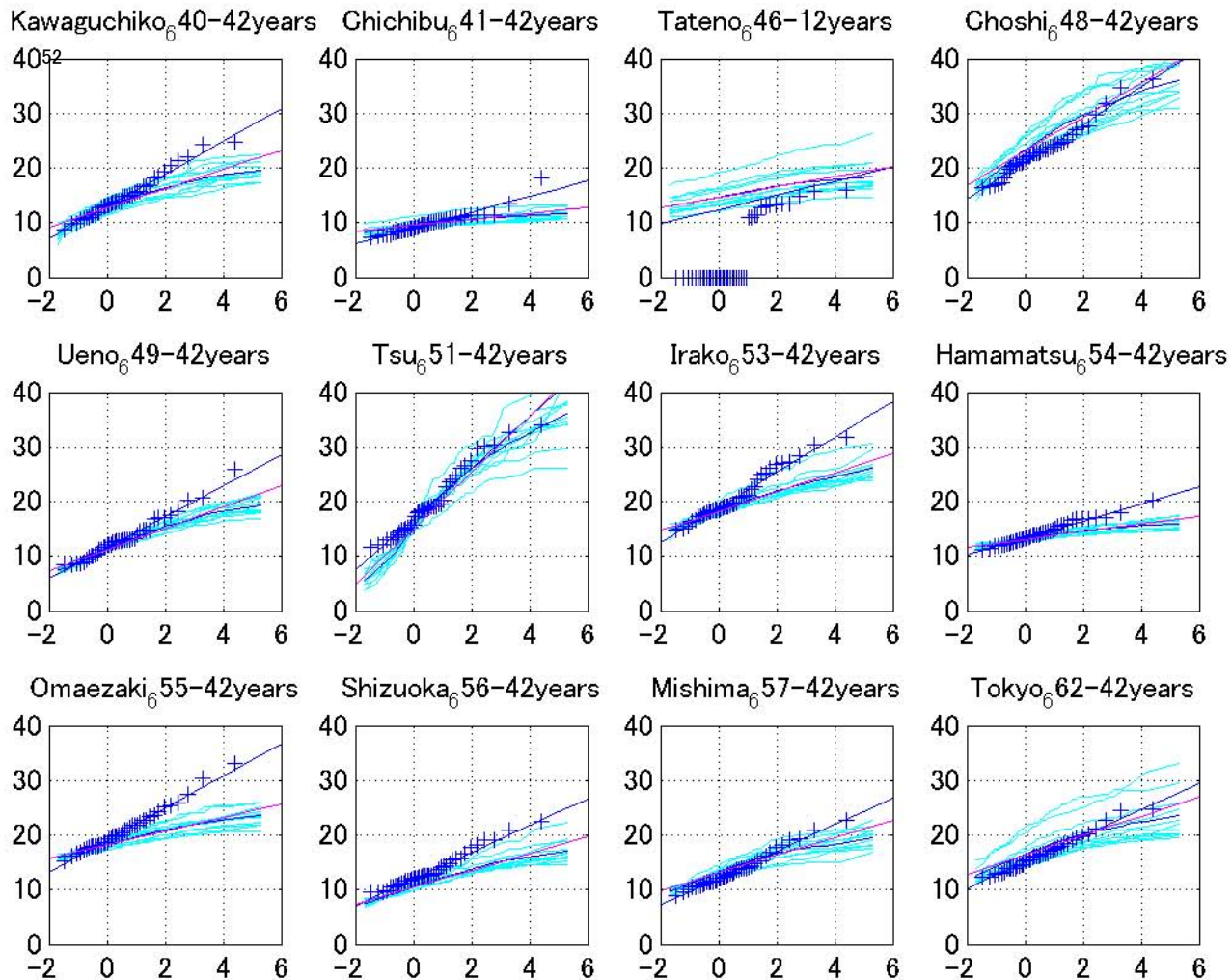


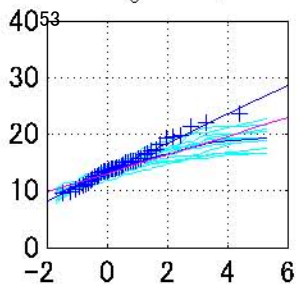
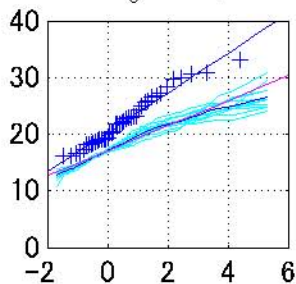
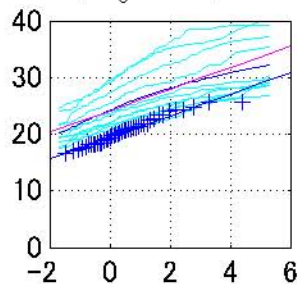
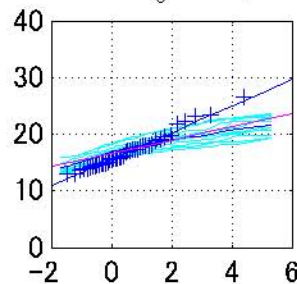
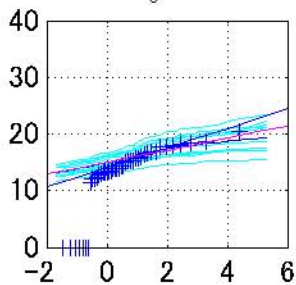
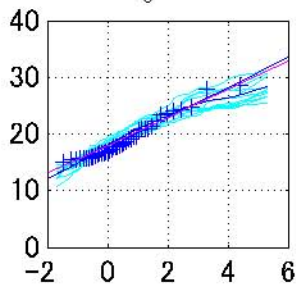
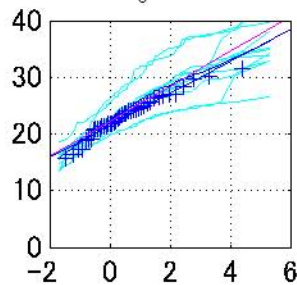
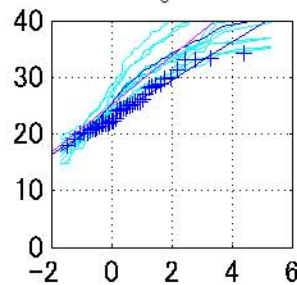
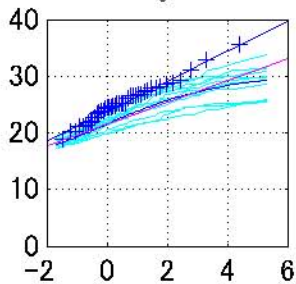
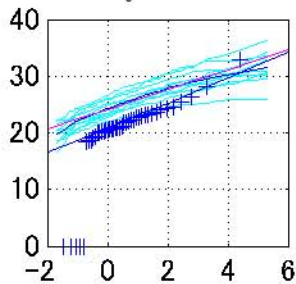
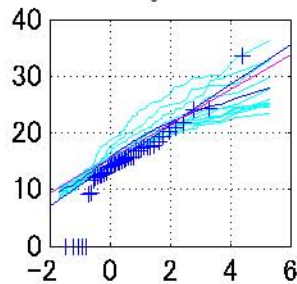
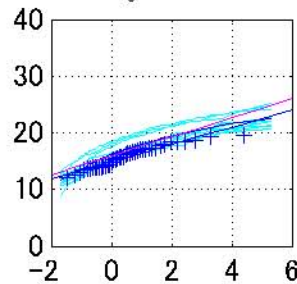
Nemuro<sub>4</sub>20-42yearsSuttsu<sub>4</sub>21-42yearsTomakomai<sub>4</sub>24-42yearsUrakawa<sub>4</sub>26-42yearsEsashi<sub>4</sub>28-42yearsHakodate<sub>4</sub>30-42yearsKutchan<sub>4</sub>33-41yearsMonbetsu<sub>4</sub>35-42yearsHiroo<sub>4</sub>40-42yearsOfunato<sub>5</sub>12-39yearsShinjo<sub>5</sub>20-42yearsWakamatsu<sub>5</sub>70-42years

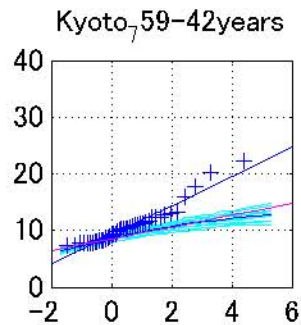
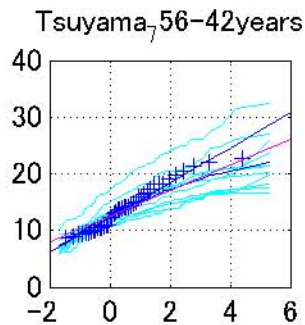
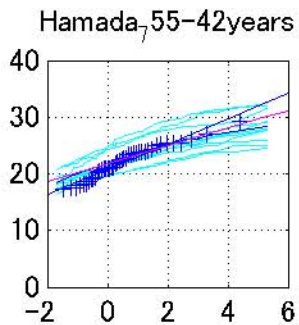
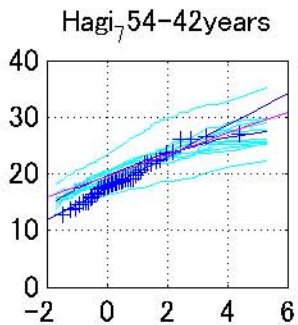
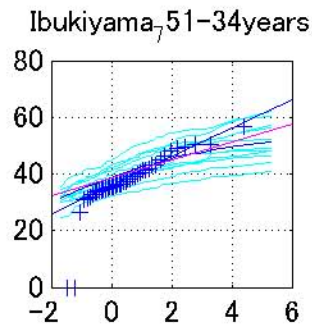
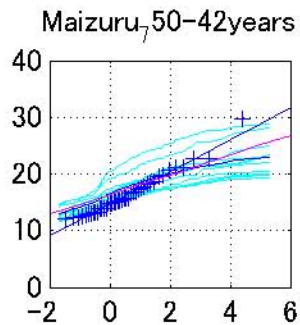
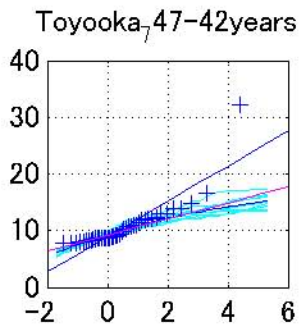
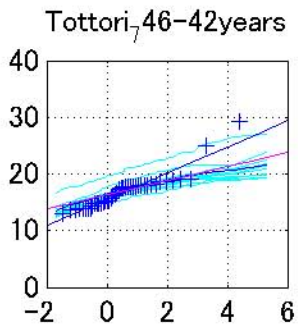
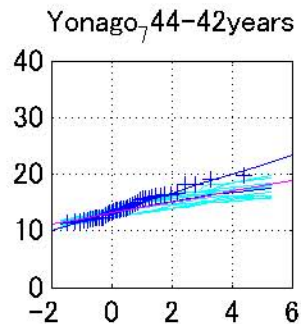
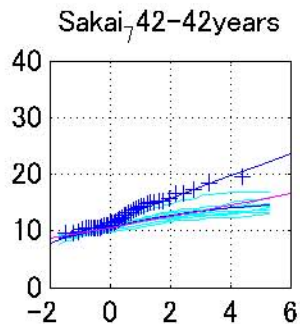
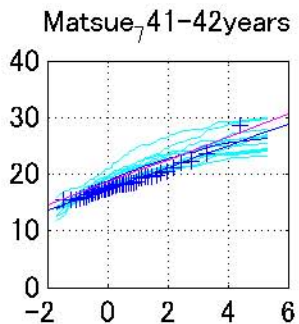
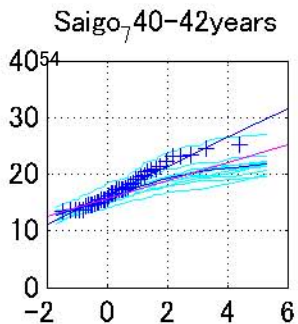
Fukaura<sub>5</sub>74-42yearsAomori<sub>5</sub>75-42yearsMutsu<sub>5</sub>76-42yearsHachinohe<sub>5</sub>81-42yearsAkita<sub>5</sub>82-42yearsMorioka<sub>5</sub>84-42yearsMiyako<sub>5</sub>85-42yearsSakata<sub>5</sub>87-42yearsYamagata<sub>5</sub>88-42yearsSendai<sub>5</sub>90-42yearsIshinomaki<sub>5</sub>92-42yearsFukushima<sub>5</sub>95-42years

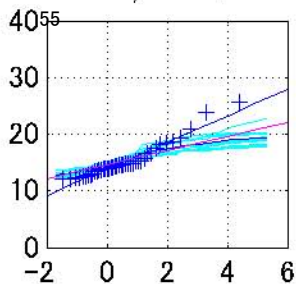
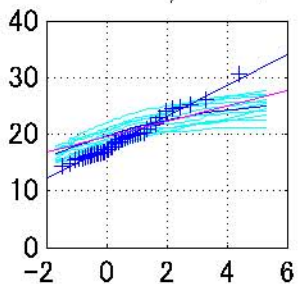
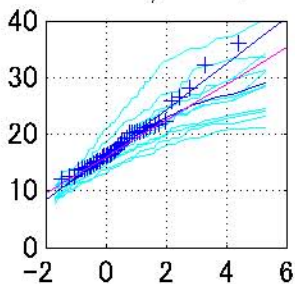
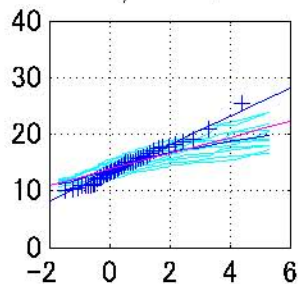
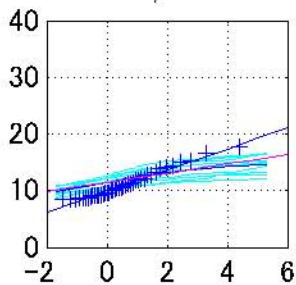
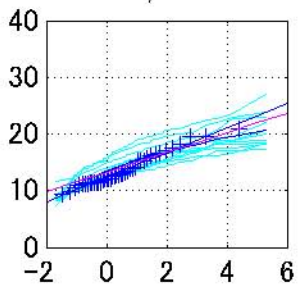
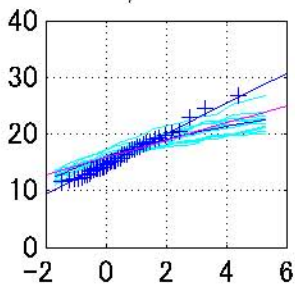
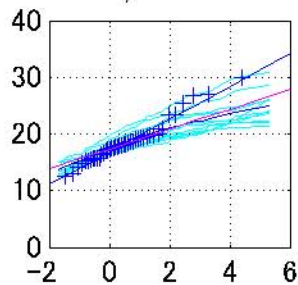
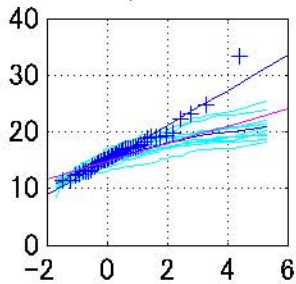
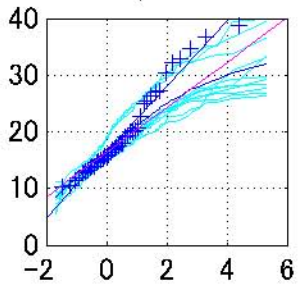
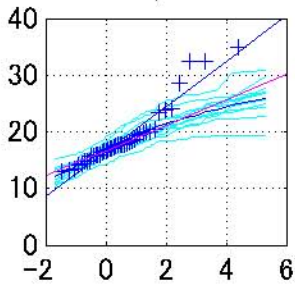
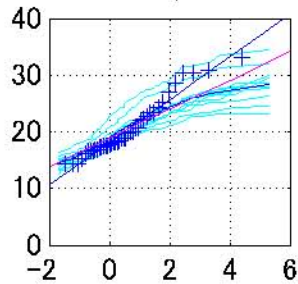




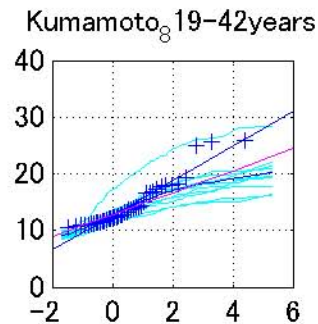
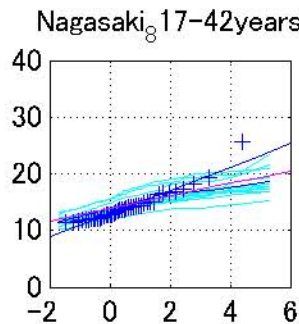
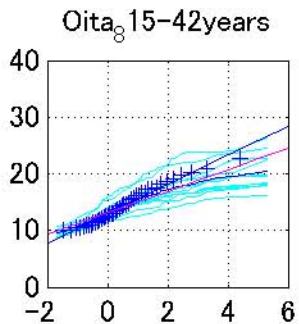
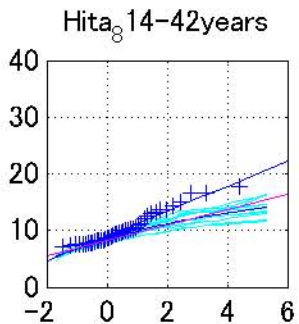
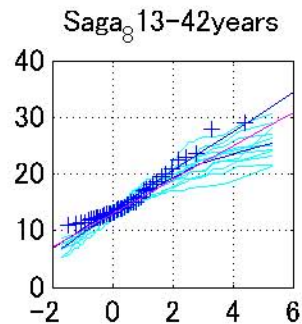
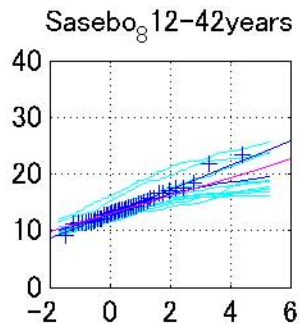
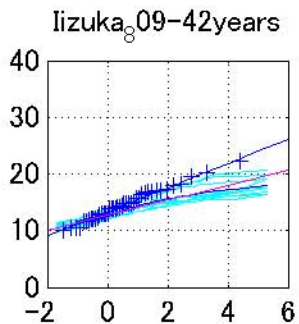
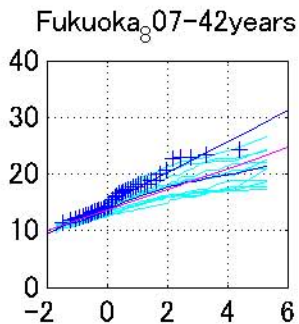
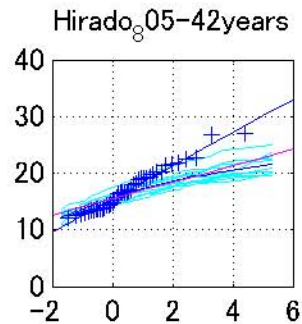
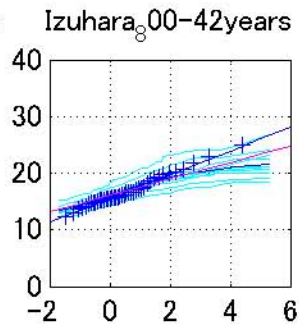
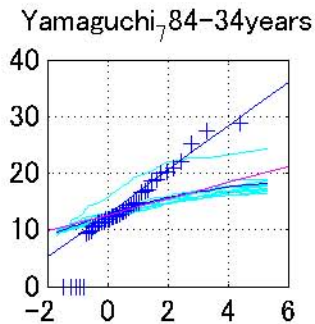
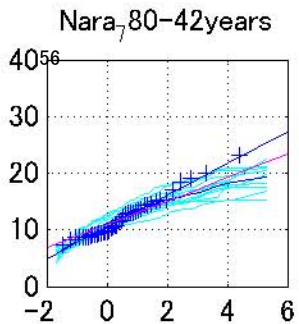


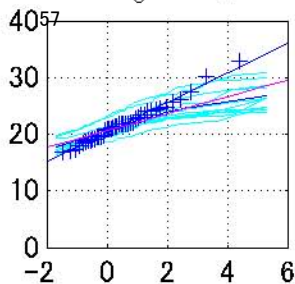
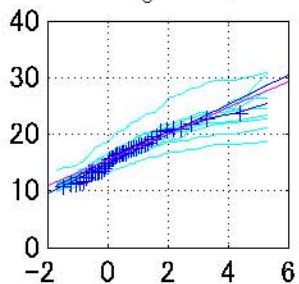
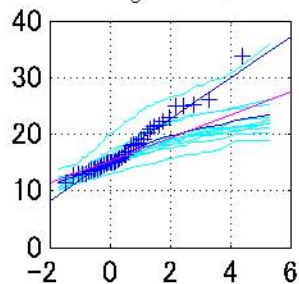
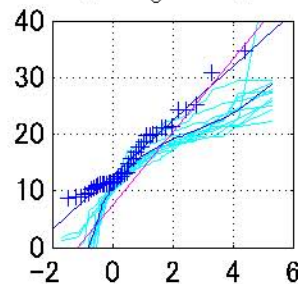
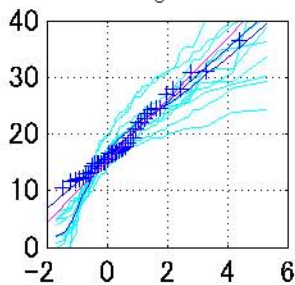
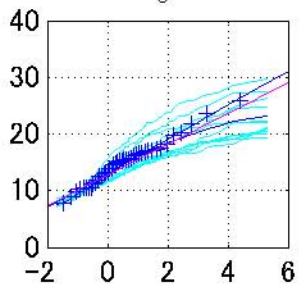
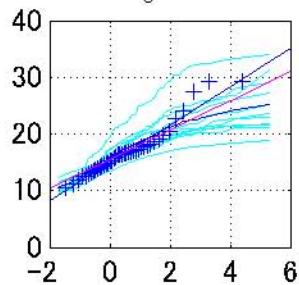
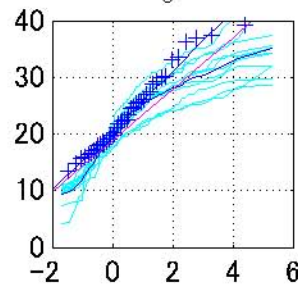
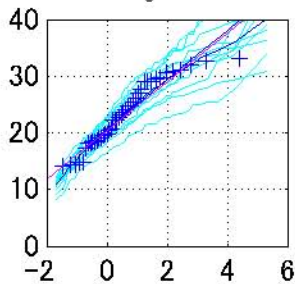
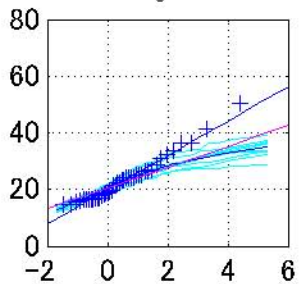
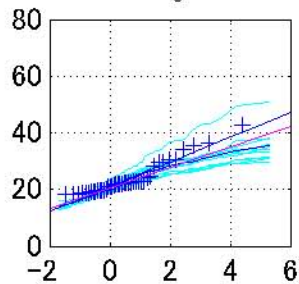
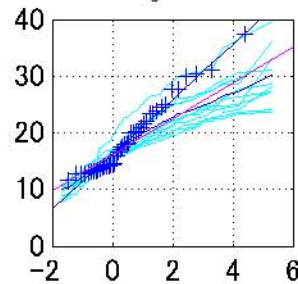
Owase<sub>6</sub> 63-42yearsIrozaki<sub>6</sub> 66-42yearsAjiro<sub>6</sub> 68-42yearsYokohama<sub>6</sub> 70-42yearsTateyama<sub>6</sub> 72-34yearsKatsuura<sub>6</sub> 74-42yearsOshima<sub>6</sub> 75-41yearsMiyakejima<sub>6</sub> 77-40yearsHachijojima<sub>6</sub> 78-42yearsChiba<sub>6</sub> 82-36yearsYokkaichi<sub>6</sub> 84-36yearsNikko<sub>6</sub> 90-42years

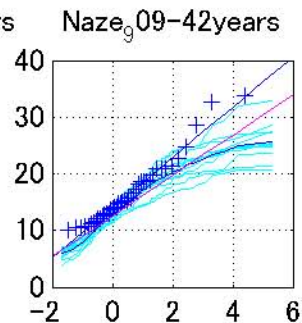
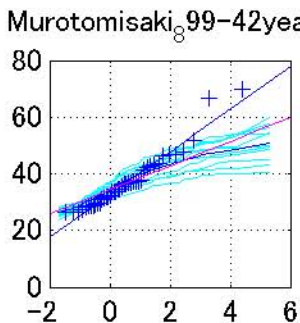
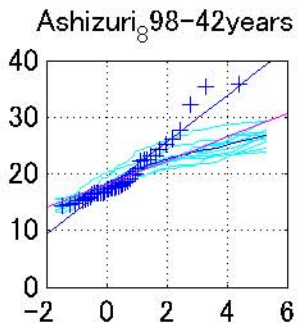
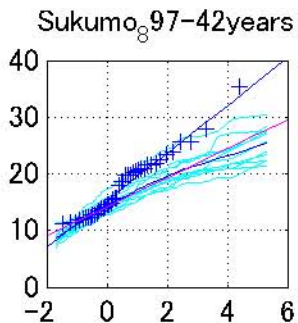
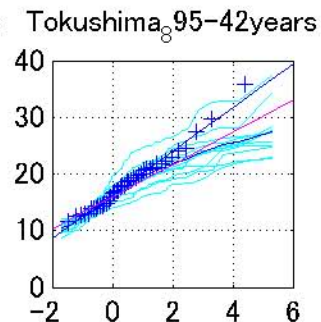
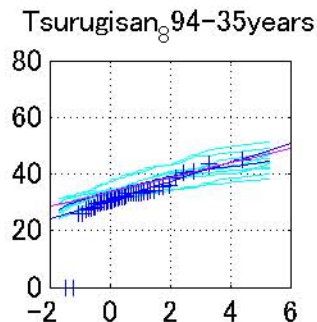
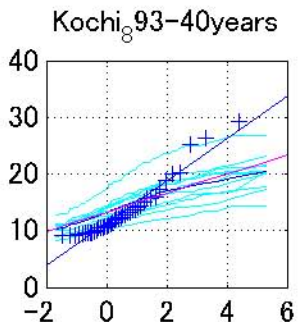
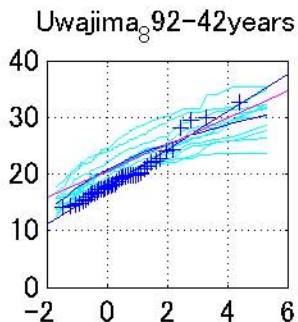
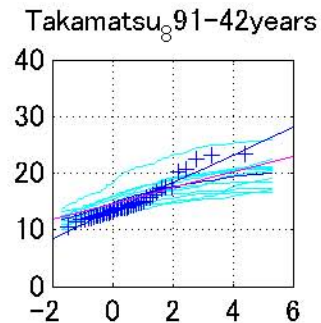
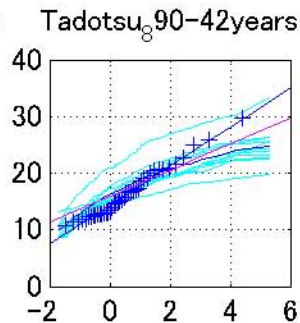
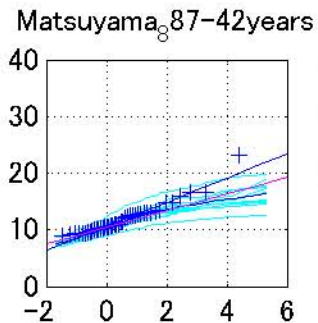
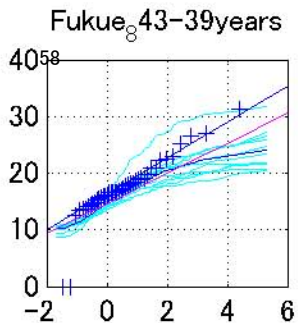


Hikone<sub>7</sub>61-42yearsShimonoseki<sub>7</sub>62-42yearsHiroshima<sub>7</sub>65-42yearsKure<sub>7</sub>66-42yearsFukuyama<sub>7</sub>67-41yearsOkayama<sub>7</sub>68-42yearsHimeji<sub>7</sub>69-42yearsKobe<sub>7</sub>70-42yearsOsaka<sub>7</sub>72-42yearsSumoto<sub>7</sub>76-42yearsWakayama<sub>7</sub>77-42yearsShionomisaki<sub>7</sub>78-42years

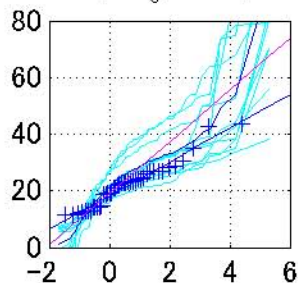
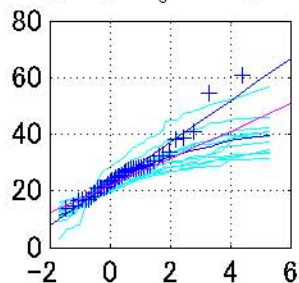
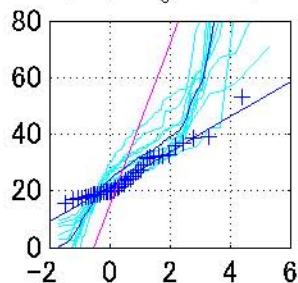
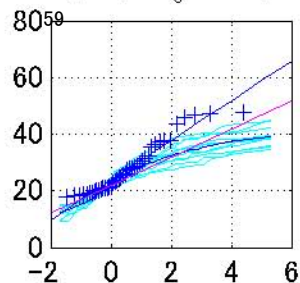




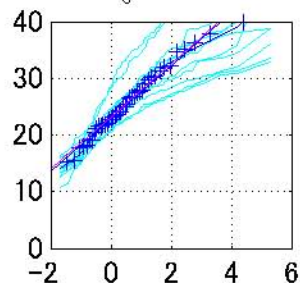
Asosan<sub>o</sub>21-42yearsNobeoka<sub>o</sub>22-41yearsAkune<sub>o</sub>23-42yearsHitoyoshi<sub>o</sub>24-42yearsKagoshima<sub>o</sub>27-42yearsMiyakonojo<sub>o</sub>29-42yearsMiyazaki<sub>o</sub>30-42yearsMakurazaki<sub>o</sub>31-42yearsAburatsu<sub>o</sub>35-42yearsYakushima<sub>o</sub>36-42yearsTanegashima<sub>o</sub>37-42yearsUshibuka<sub>o</sub>38-41years



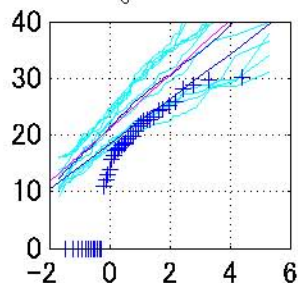
Yonagunijima<sub>9</sub> 12-39years Ishigakijima<sub>9</sub> 18-39years Miyakoijima<sub>9</sub> 27-37years Kumeijima<sub>9</sub> 29-33years



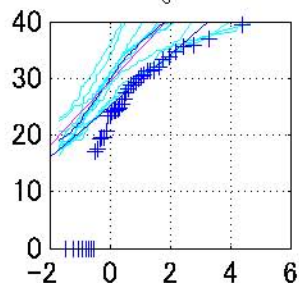
Naha<sub>9</sub> 36-39years



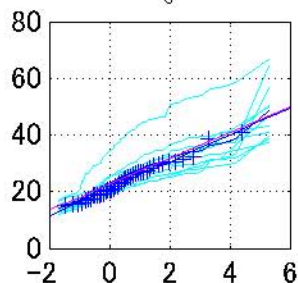
Nago<sub>9</sub> 40-29years



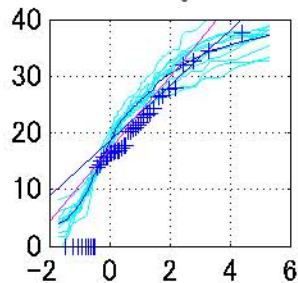
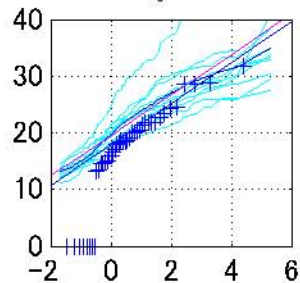
Okinoerabu<sub>9</sub> 42-33years



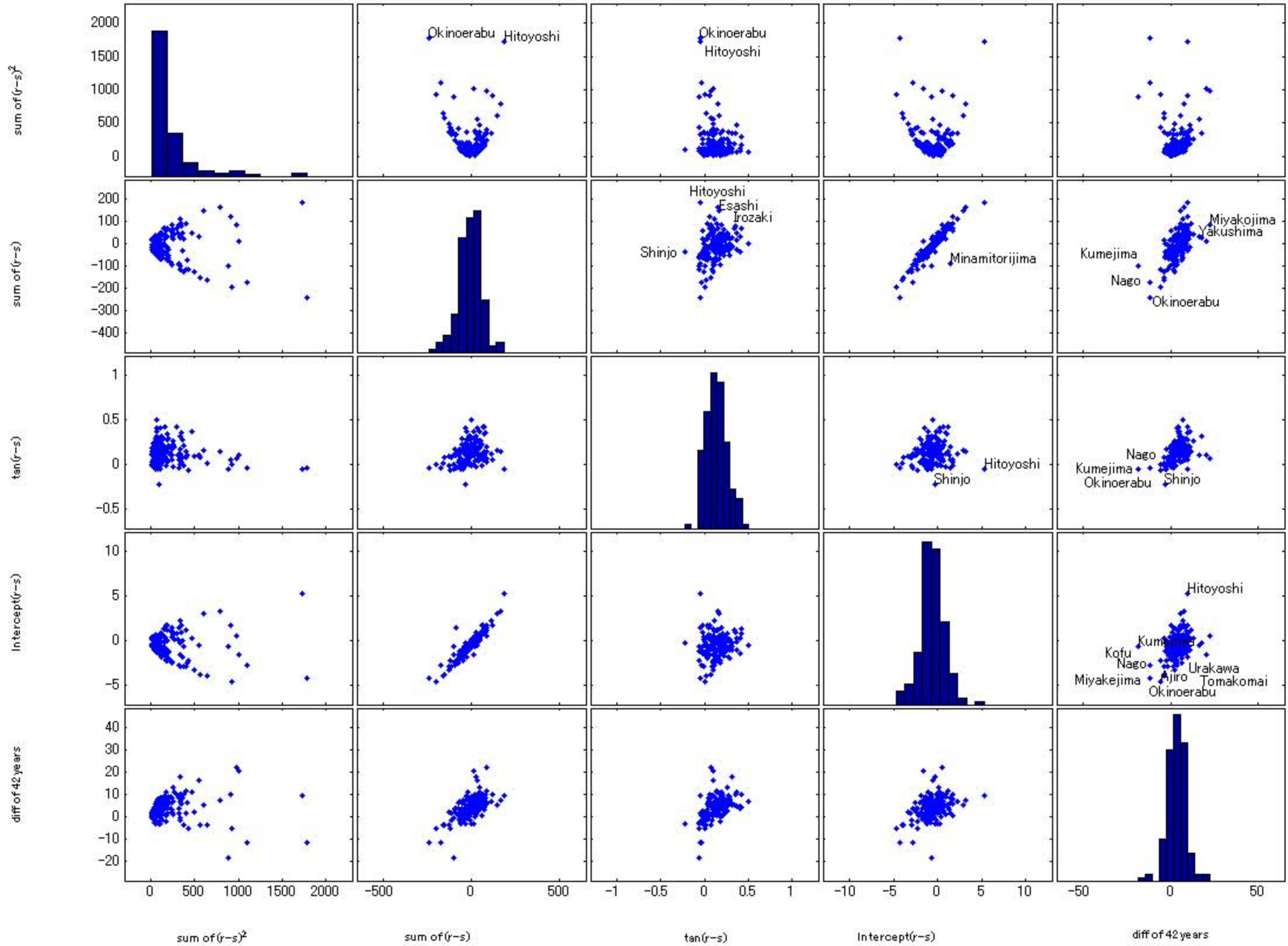
Minamidaito<sub>9</sub> 45-39years

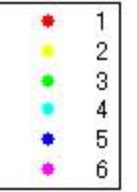
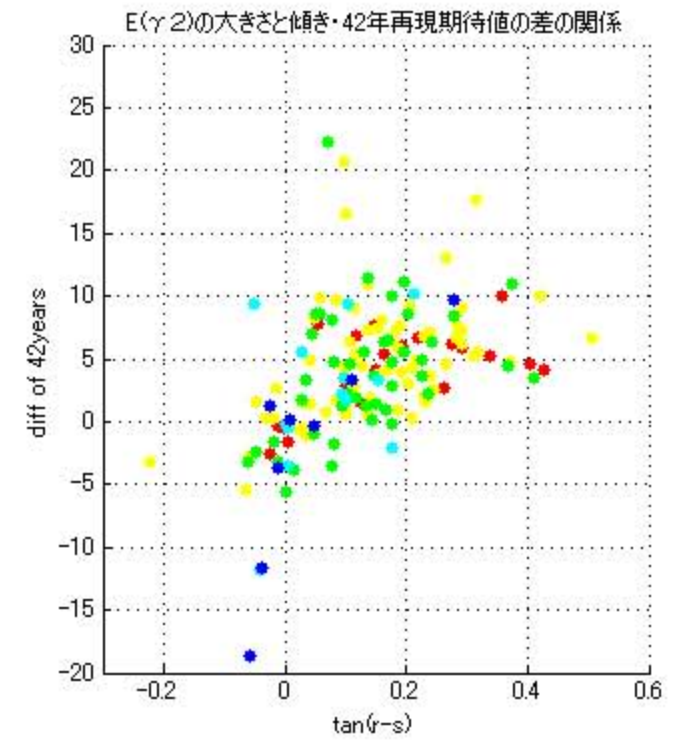
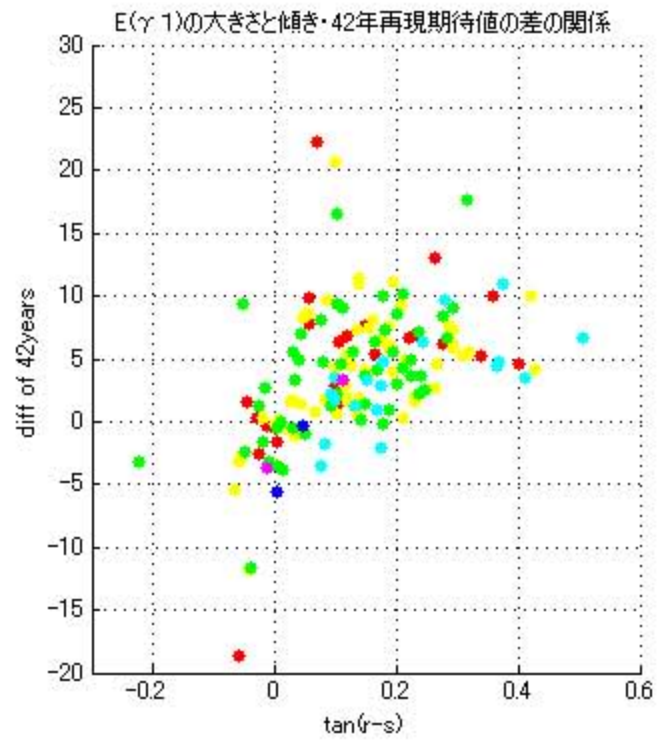
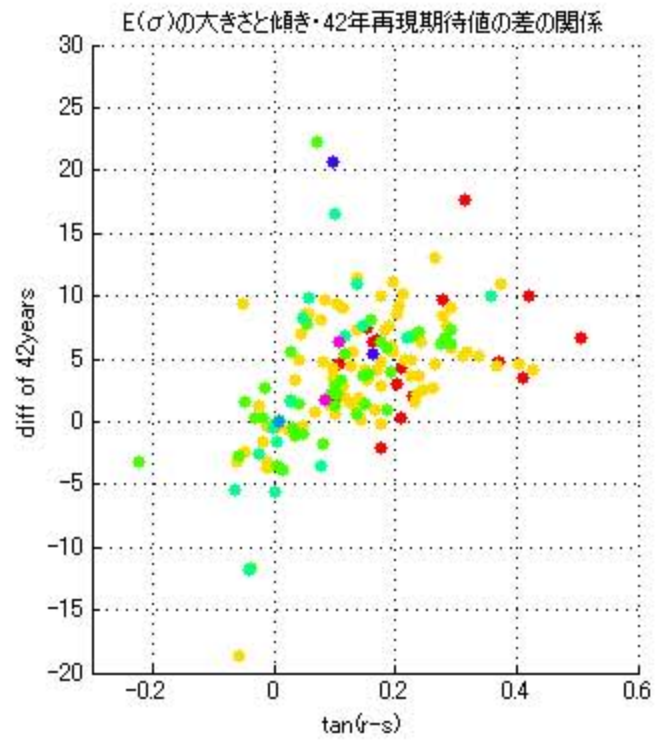


Chichijima<sub>9</sub> 71-34years Minamitorijima<sub>9</sub> 91-33years

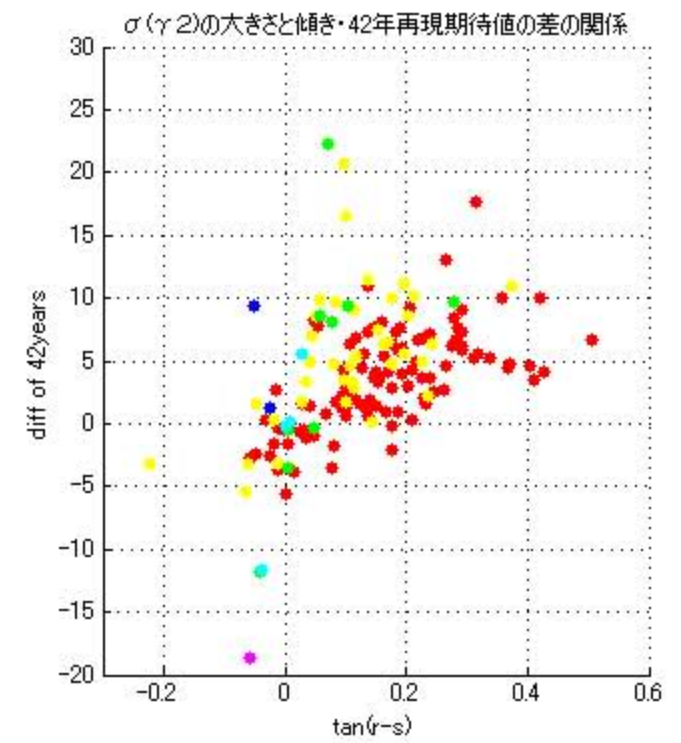
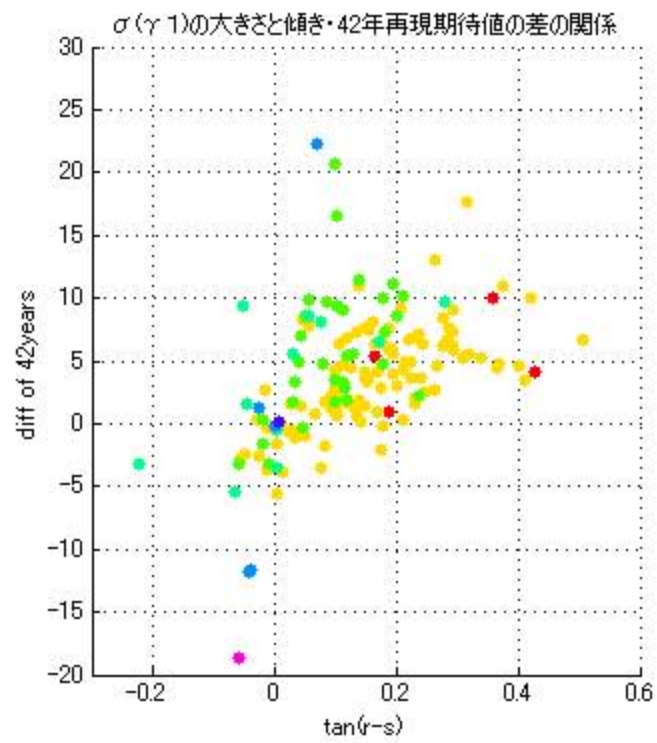
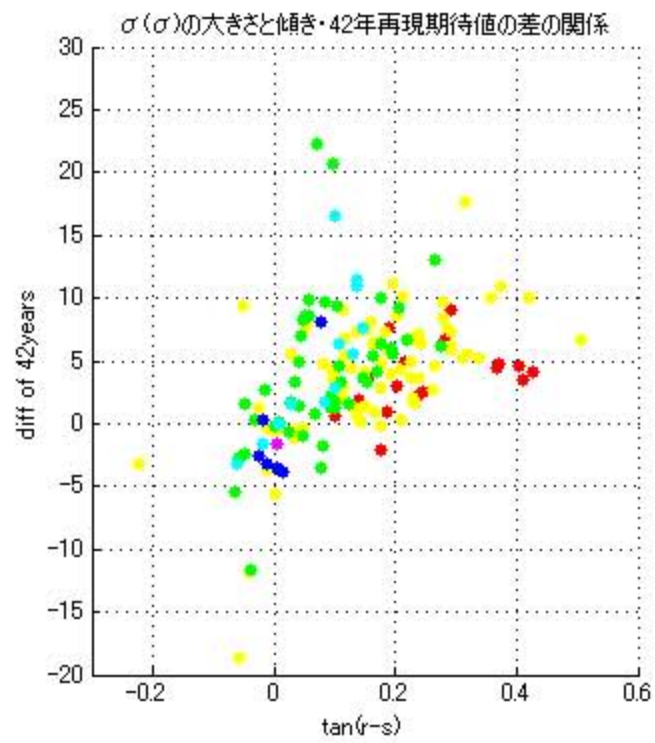


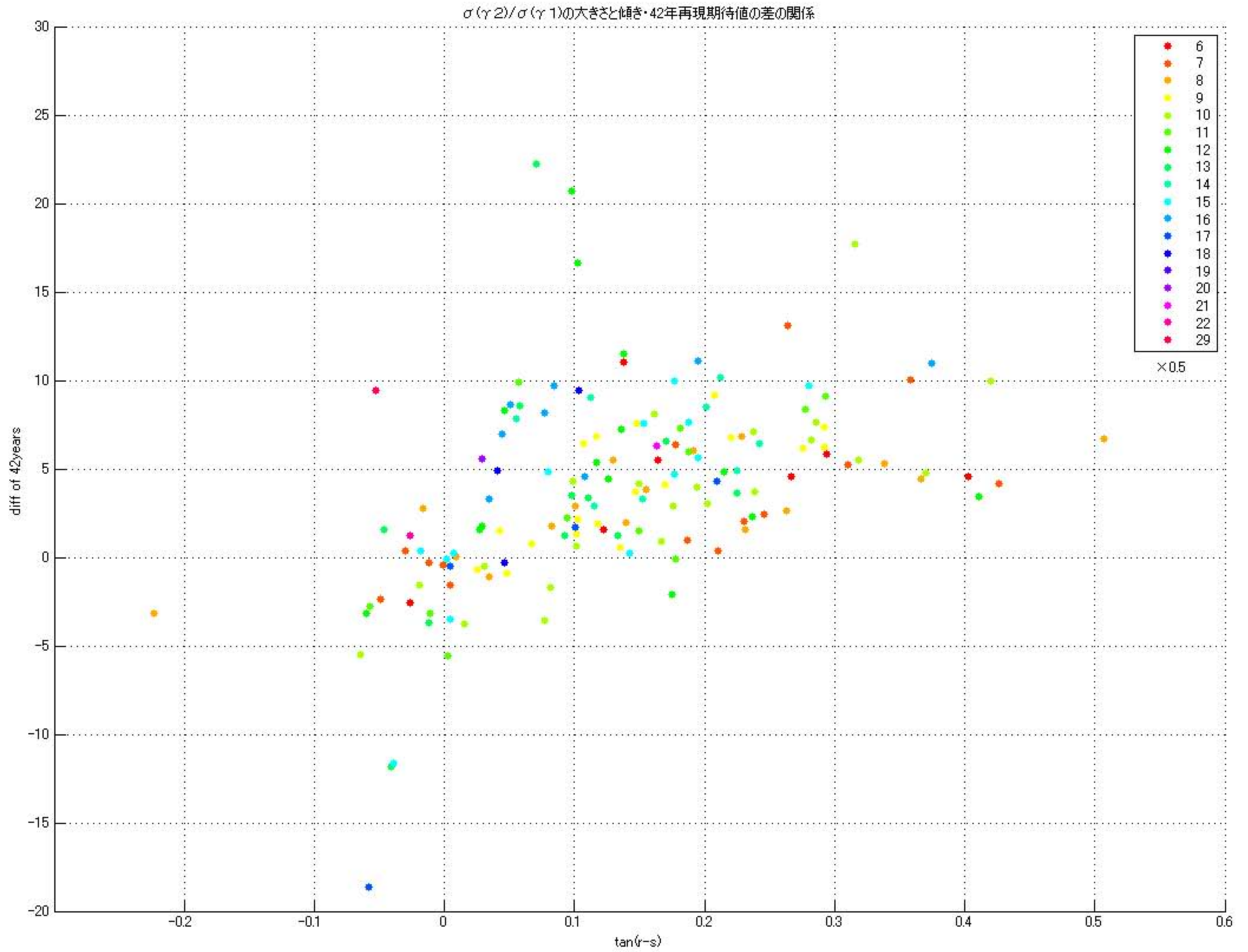
ずれかたの5つの指標の関係



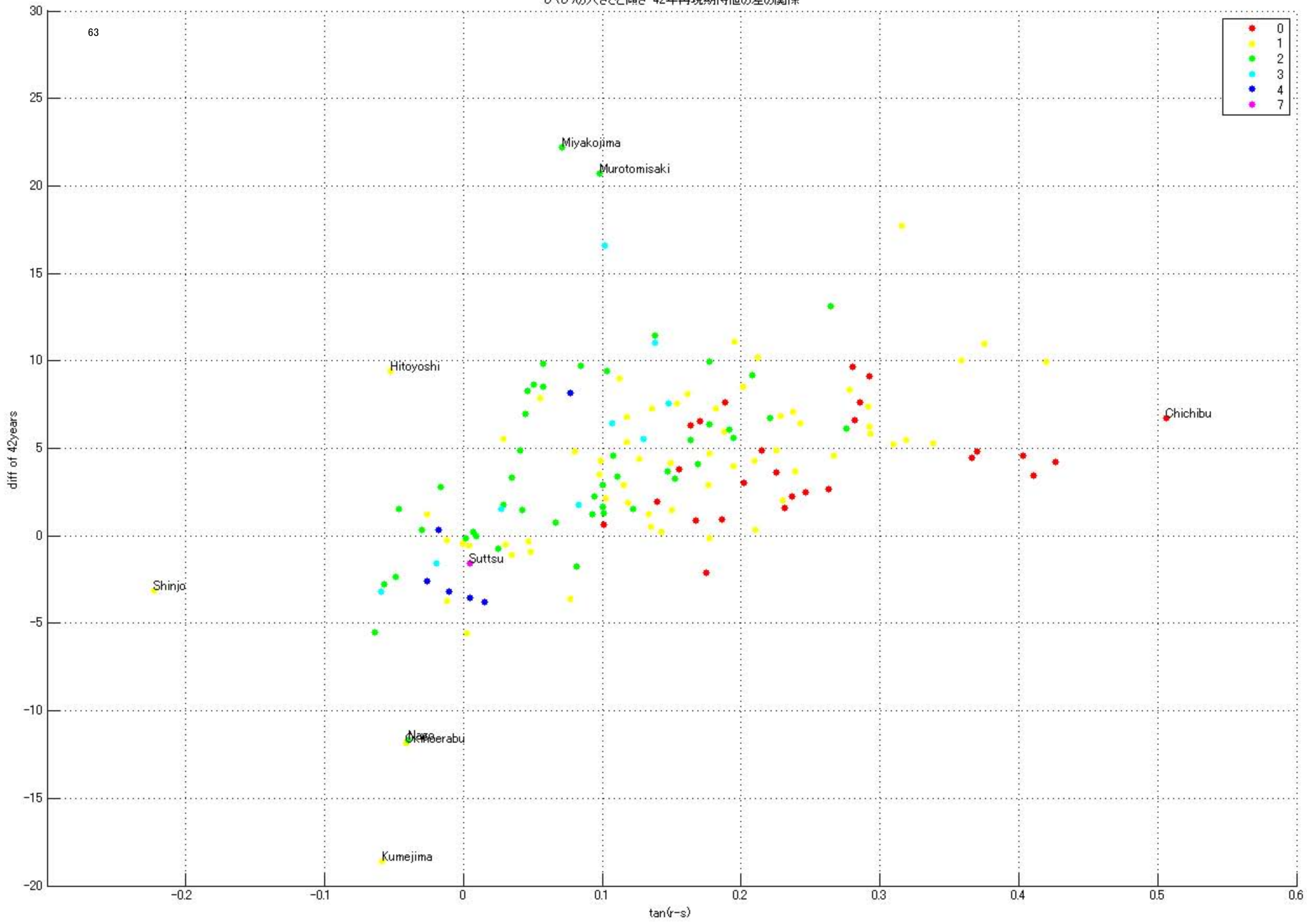


1 =  $\mu - 2\sigma$   
2 =  $\mu - \sigma$   
3 =  $\mu$   
4 =  $\mu + \sigma$   
5 =  $\mu + 2\sigma$

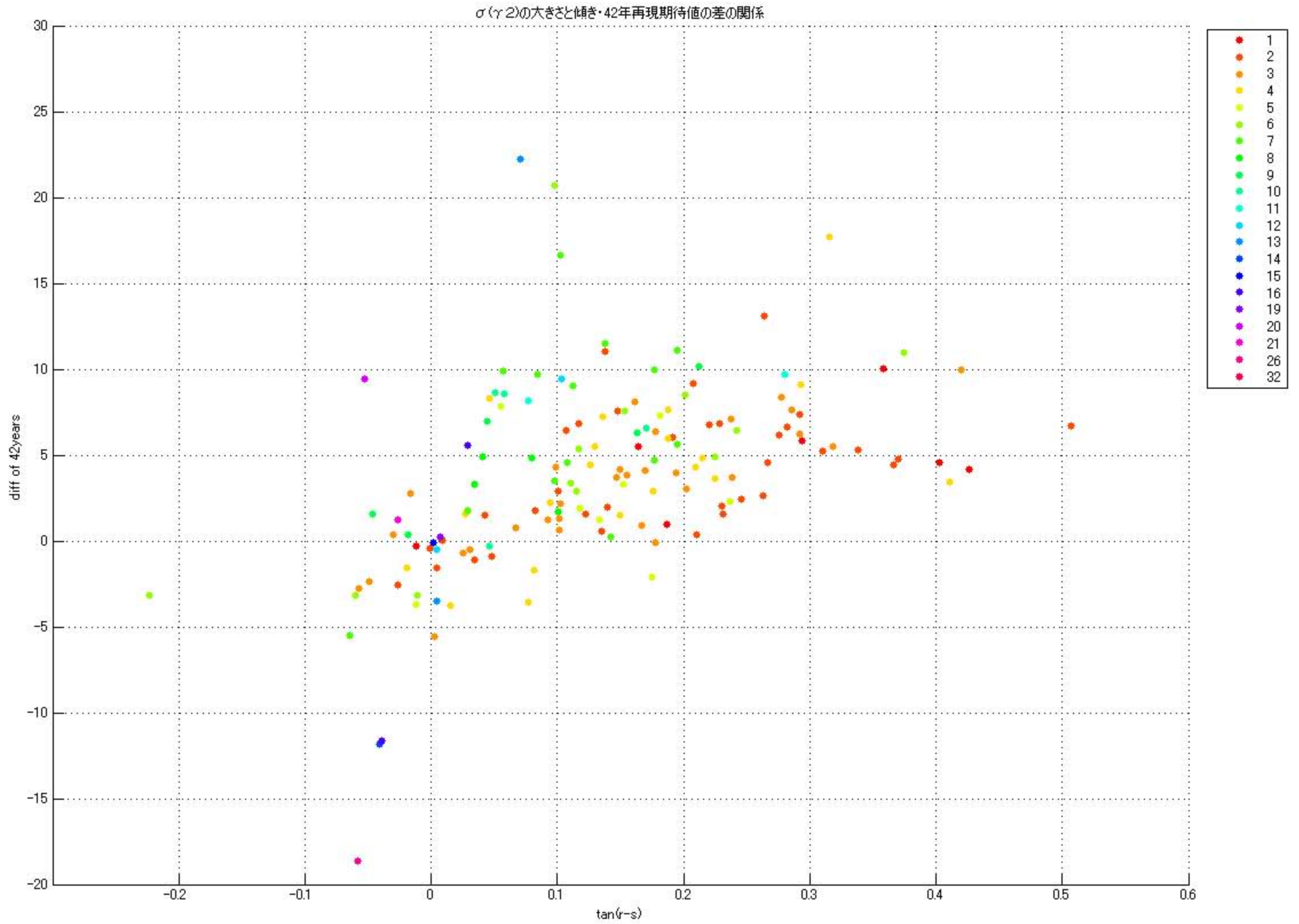


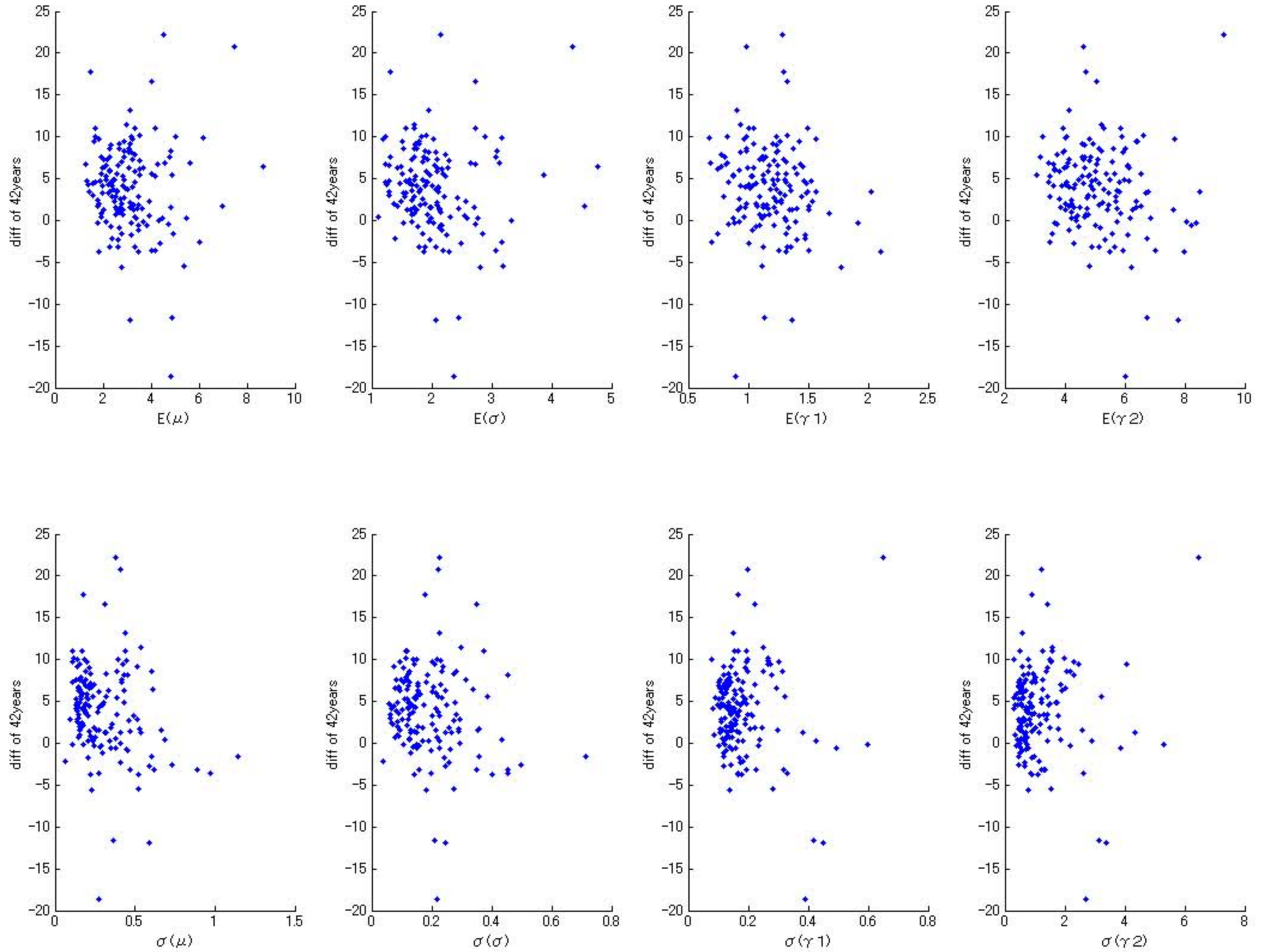


$\sigma(\sigma)$ の大きさと傾き・42年再現期待値の差の関係

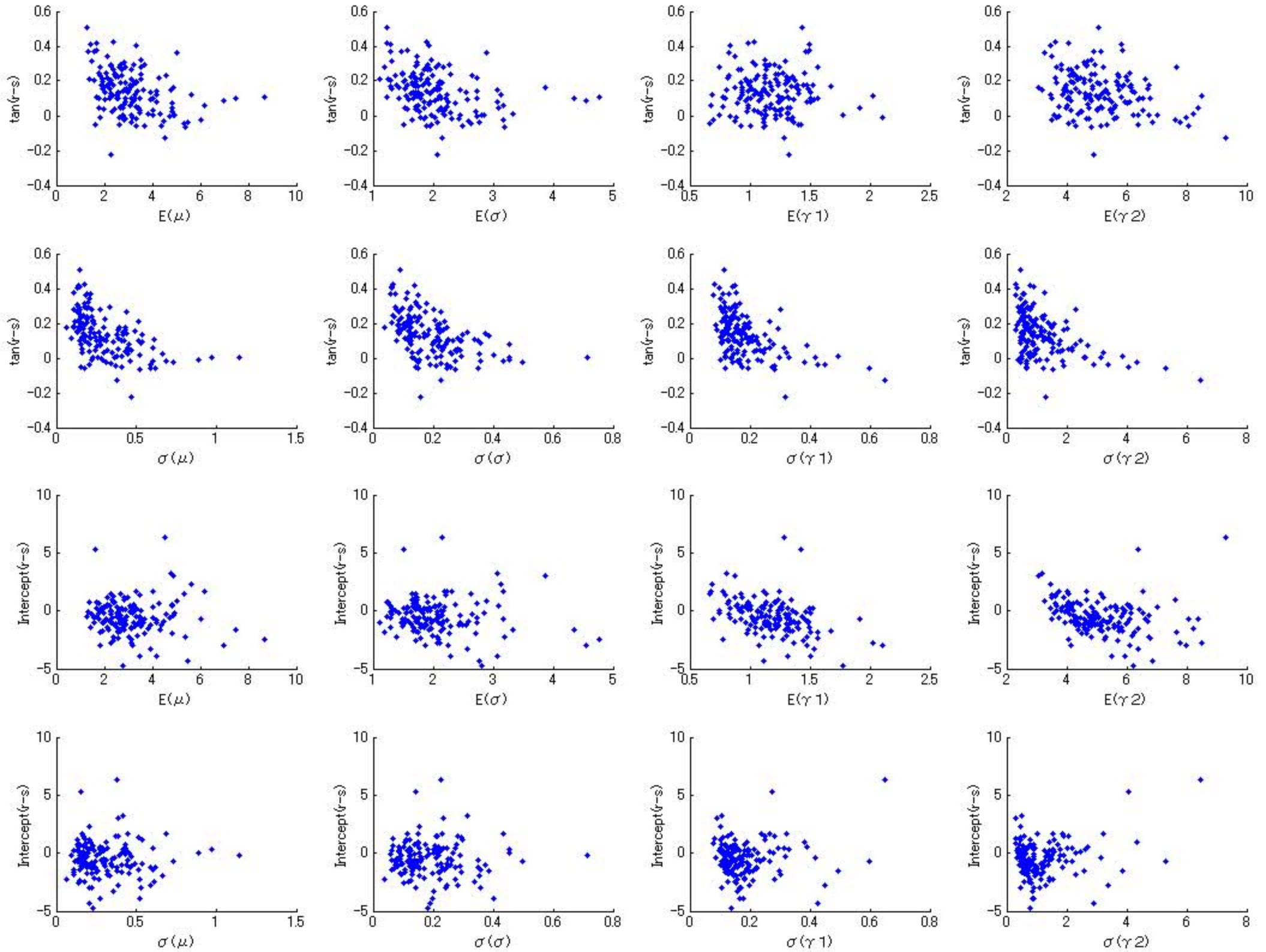


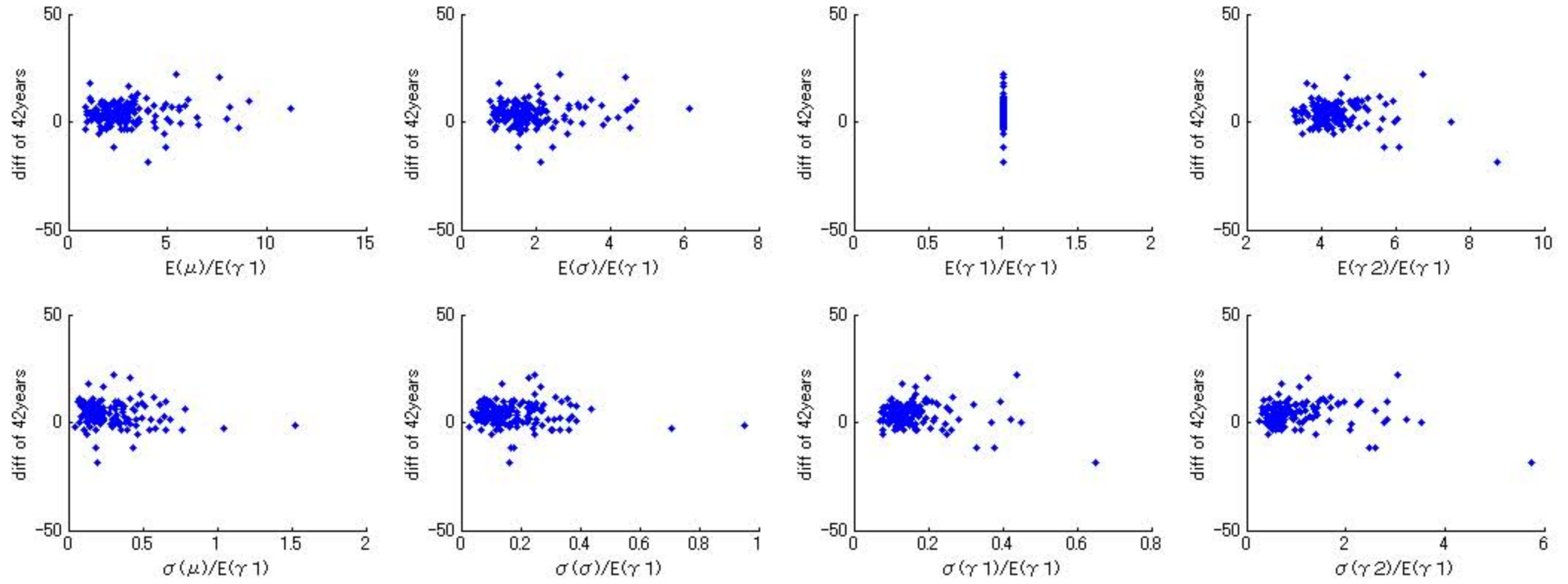


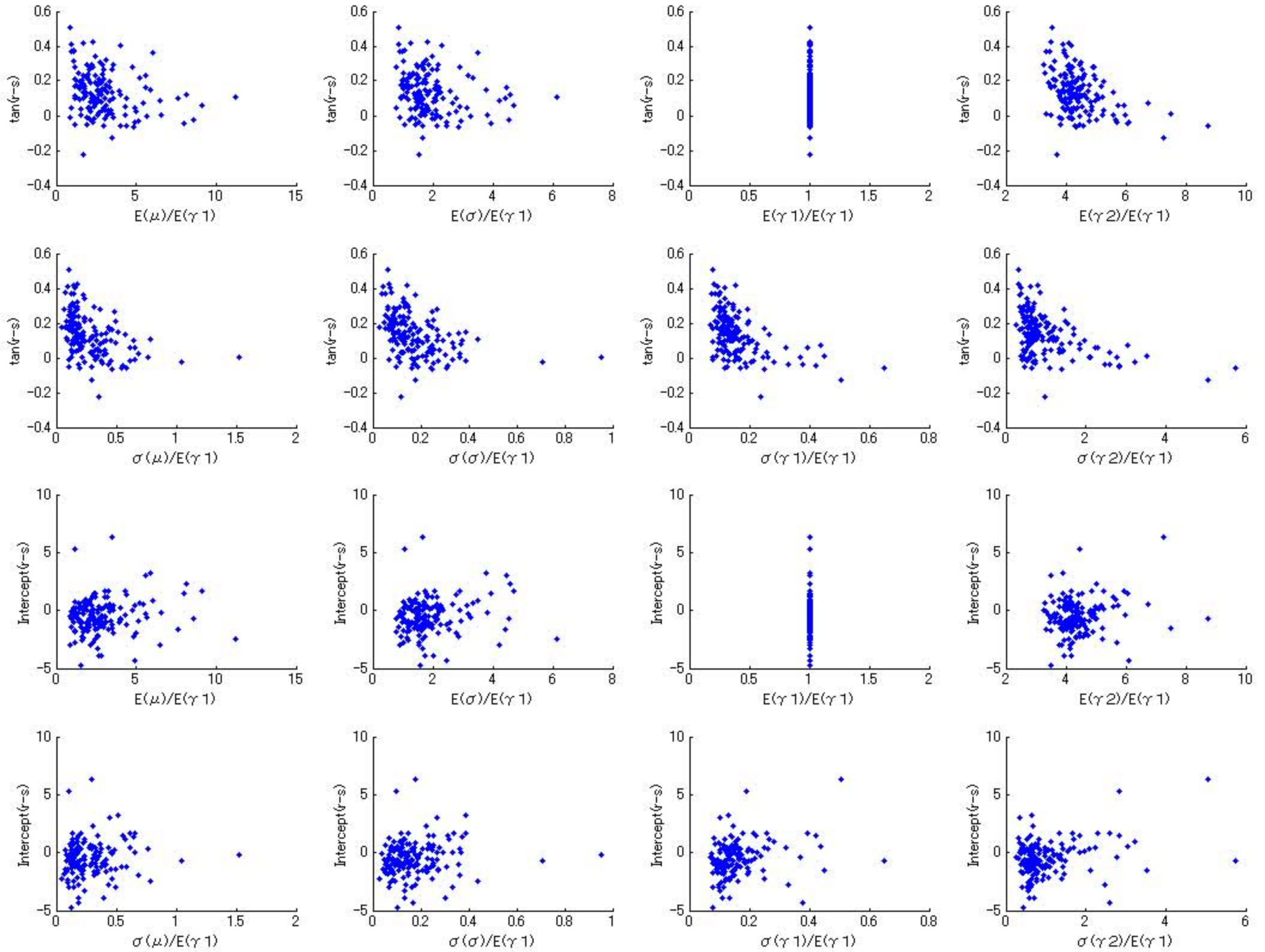


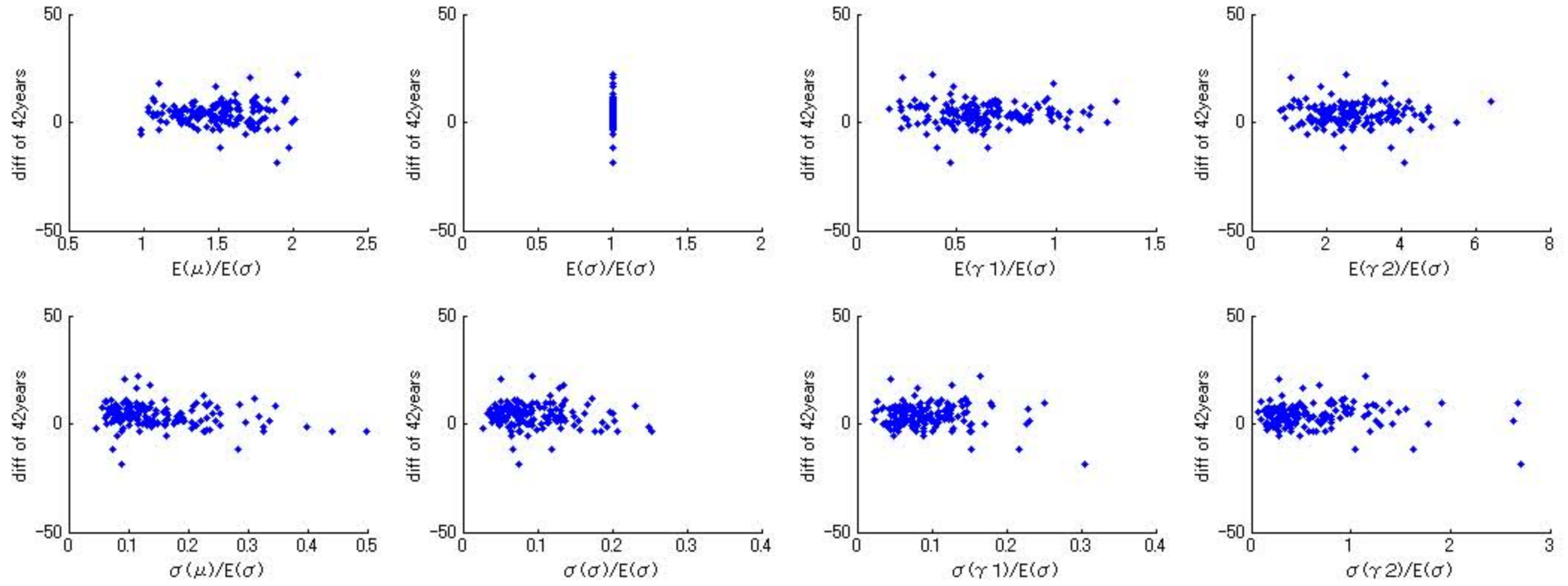


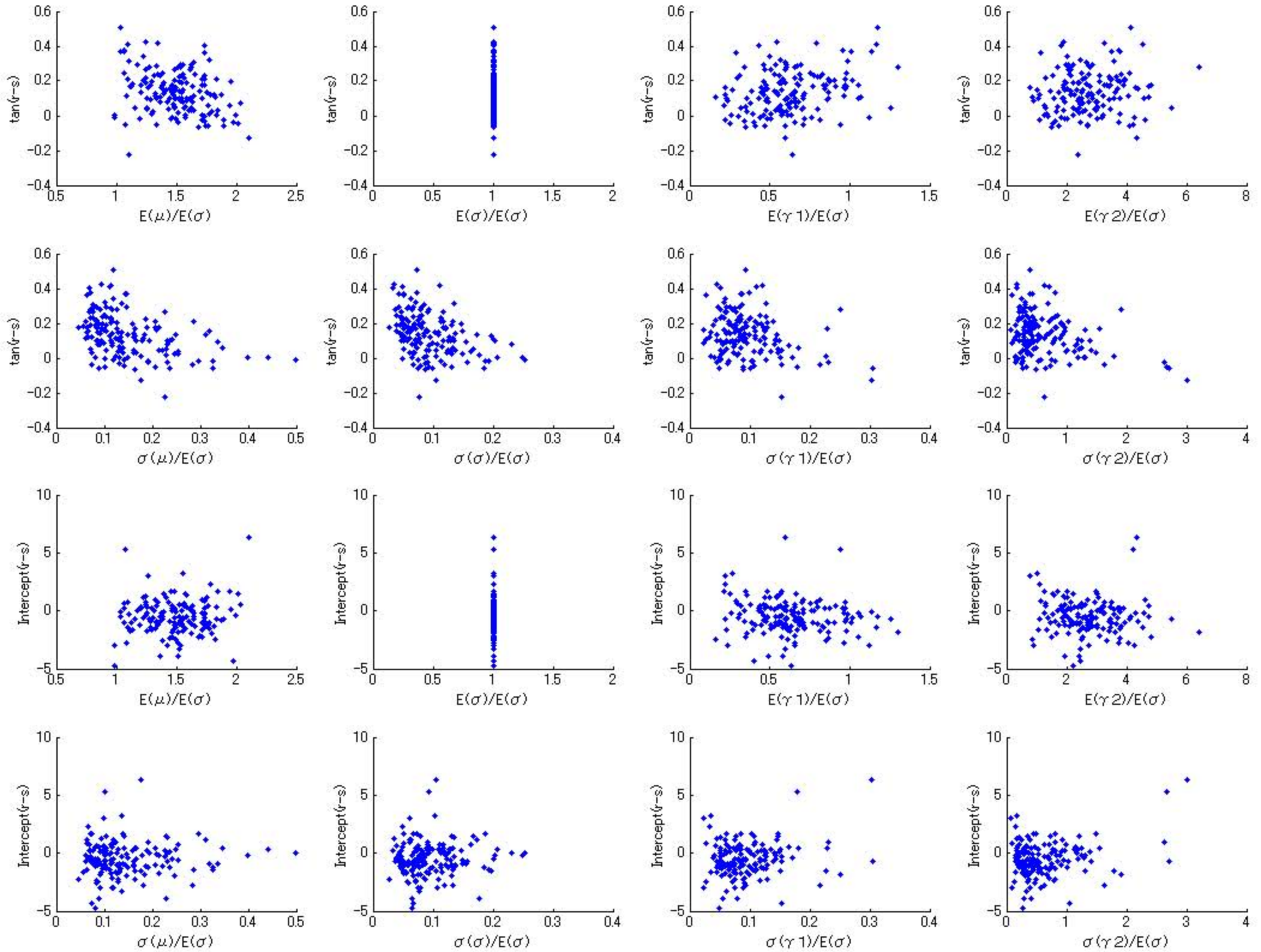
8つのパラメータと傾き・切片の関係

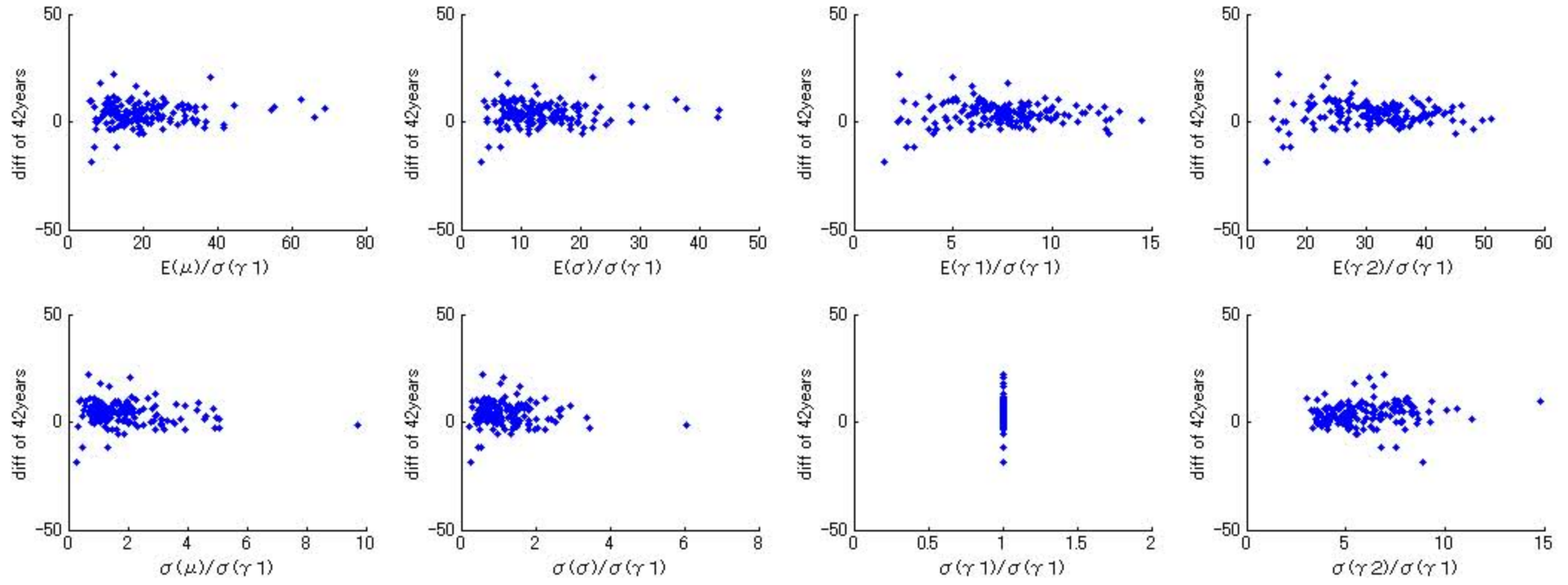


E( $\gamma_1$ )との比と42年再現期待値の差の関係

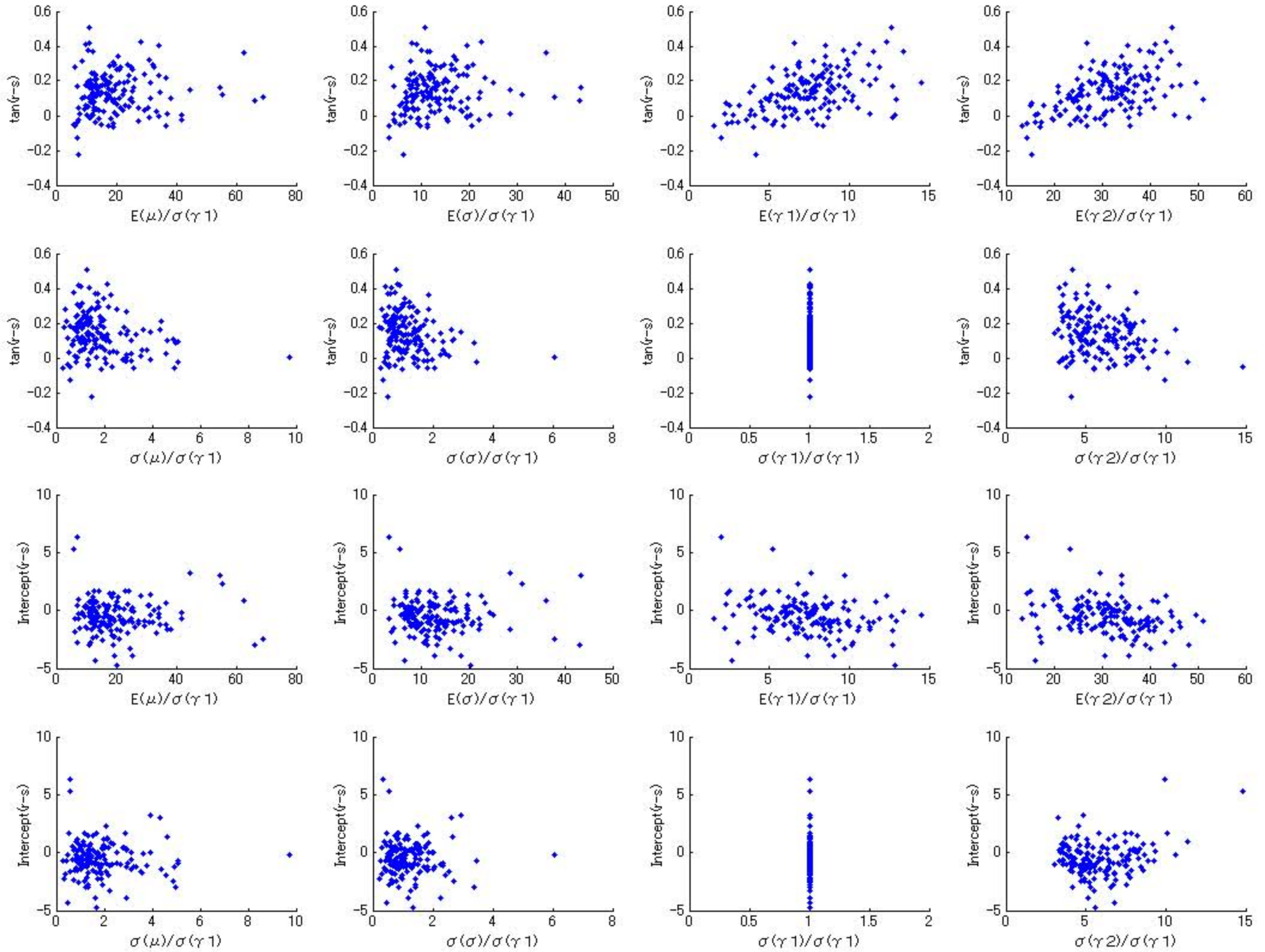
E( $\gamma_1$ )との比と傾き・切片の関係

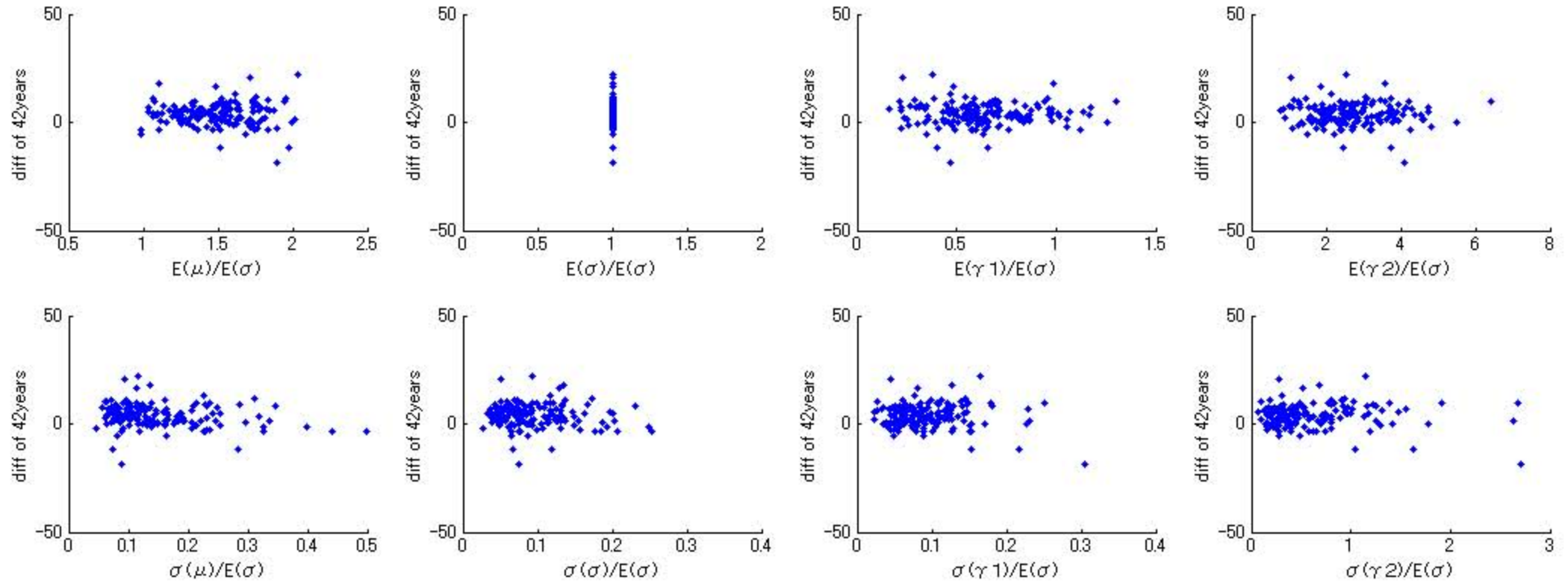
$E(\sigma)$ との比と42年再現期待値の差の関係

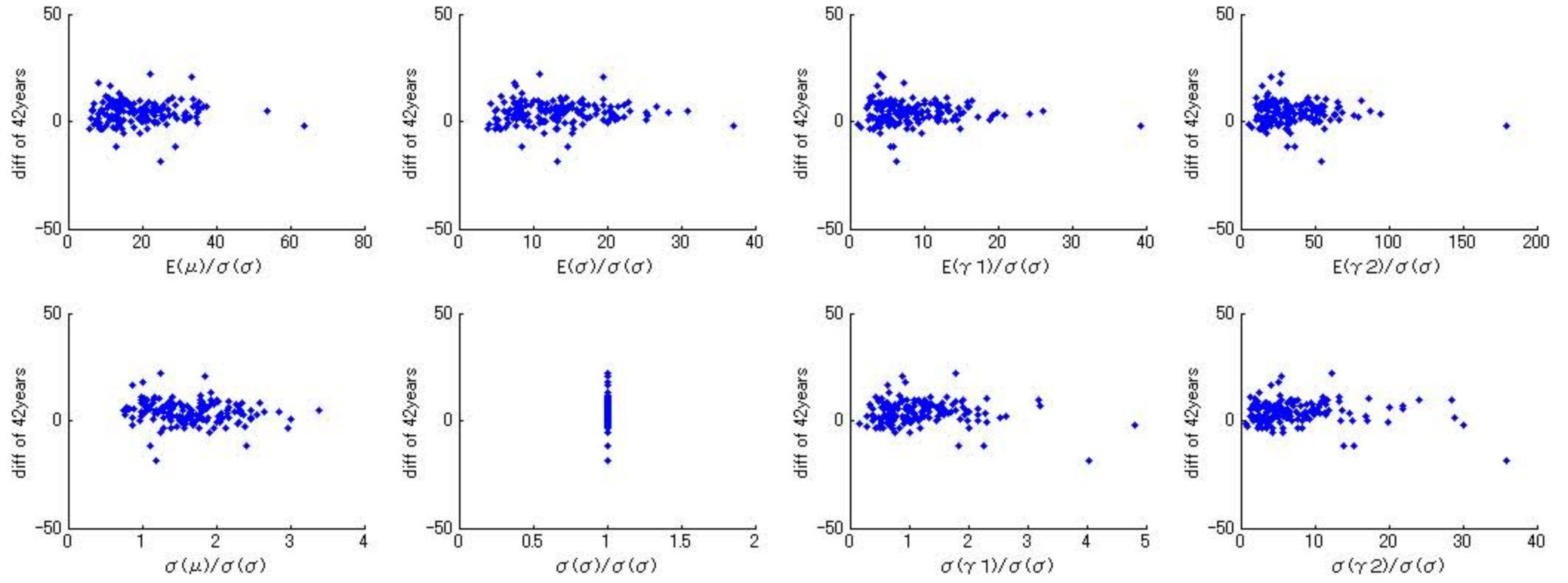
E( $\sigma$ )との比と傾き・切片の関係

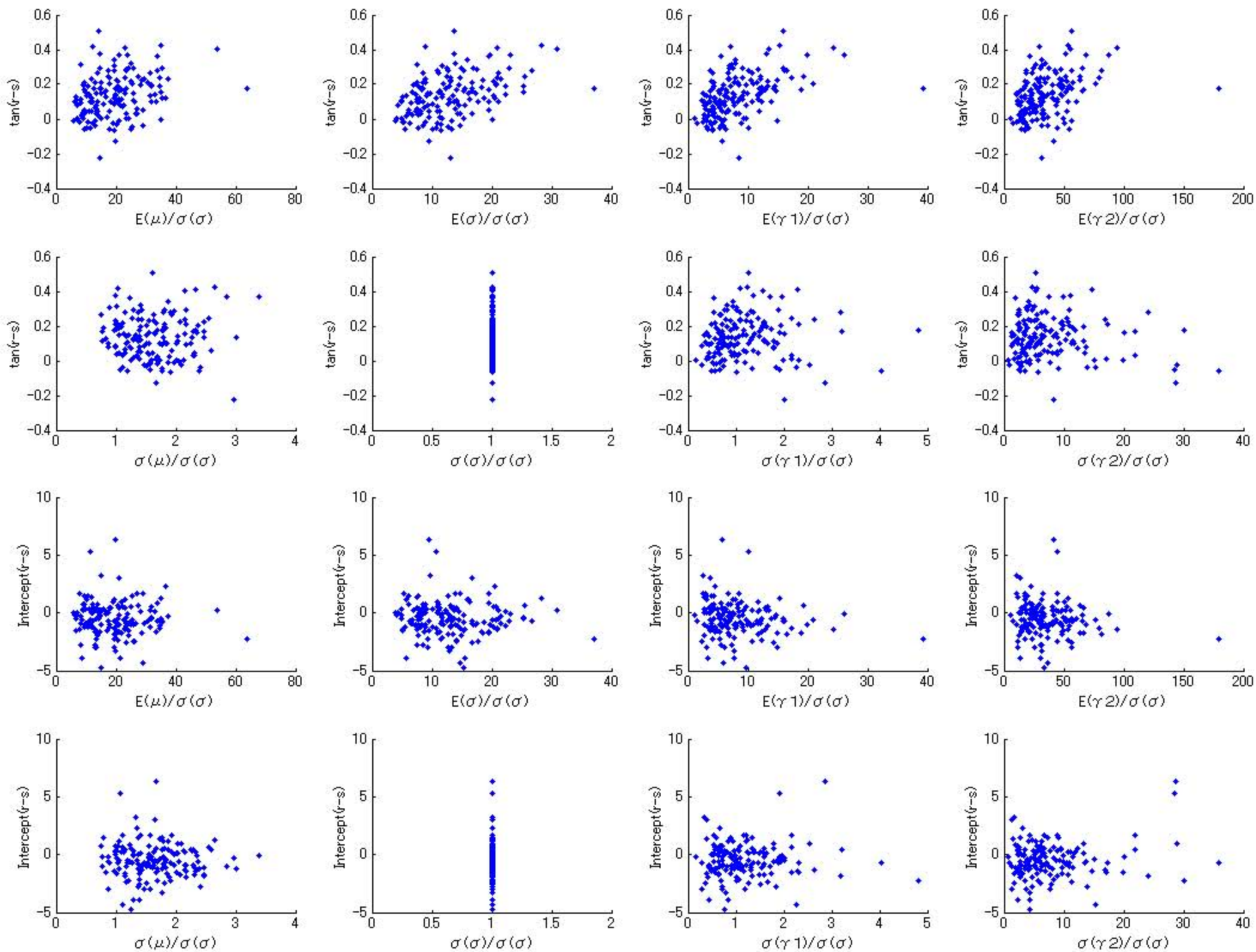
$\sigma(\gamma_1)$ との比と42年再現期待値の差の関係

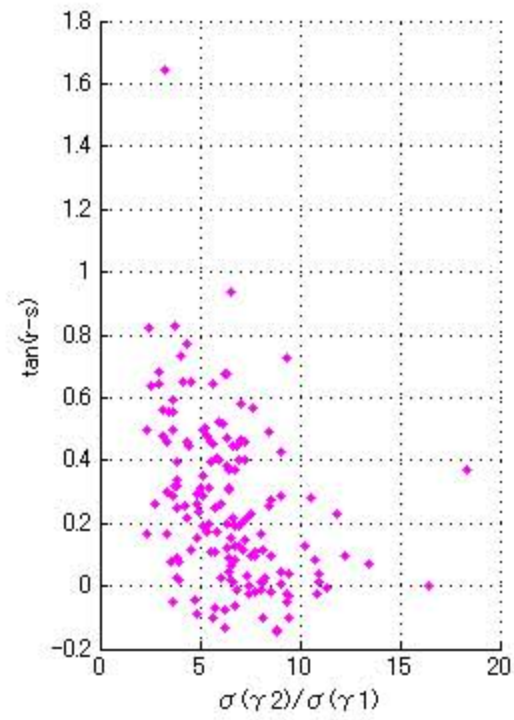
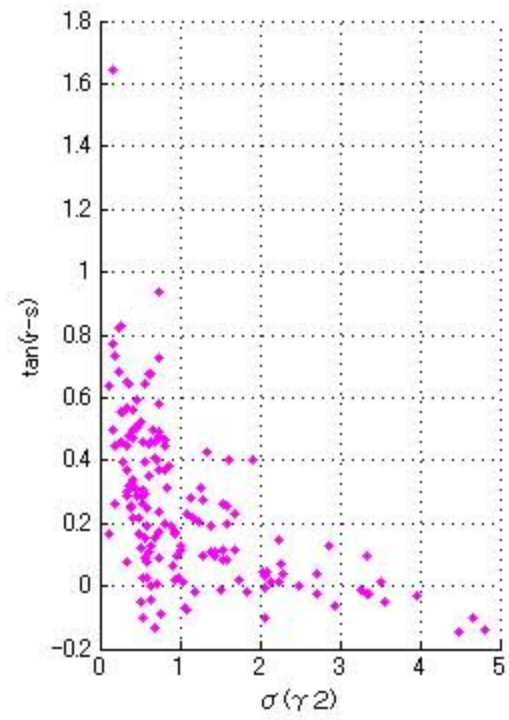
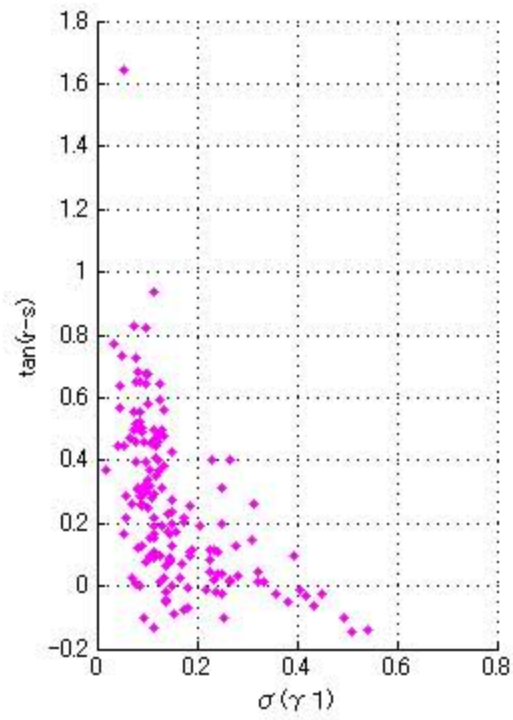
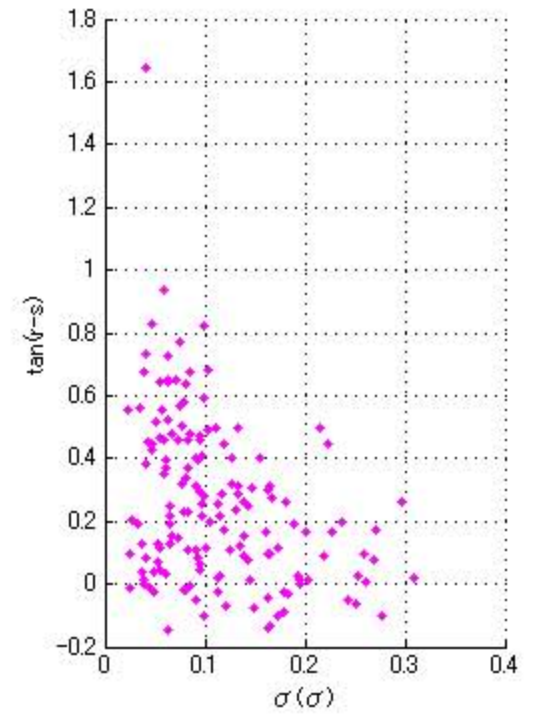
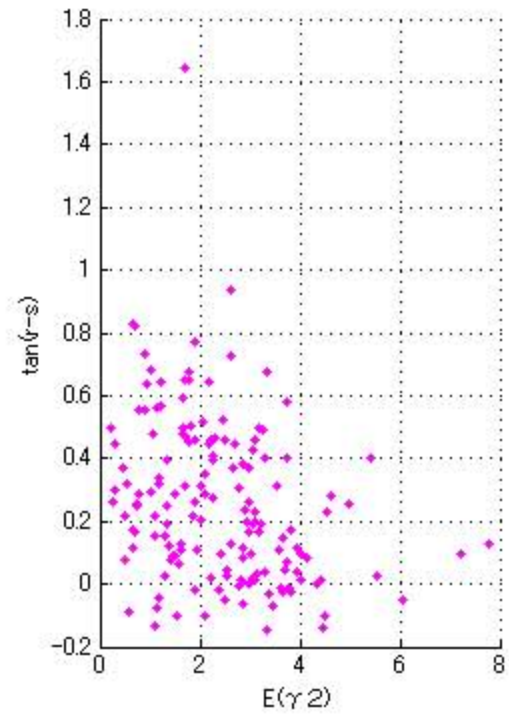
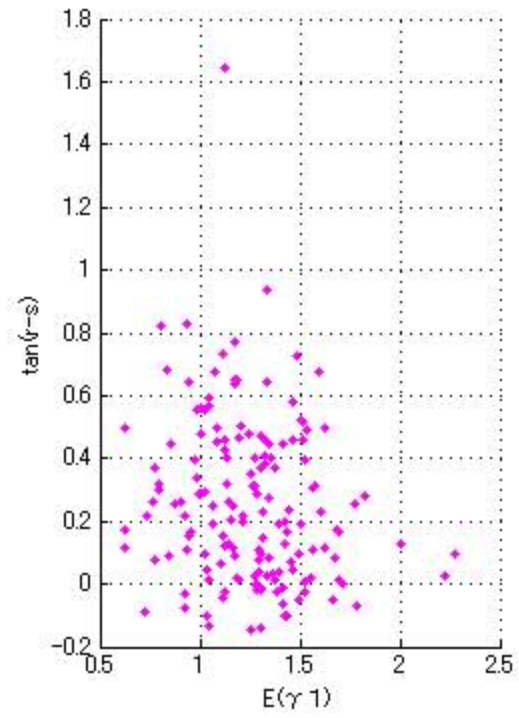
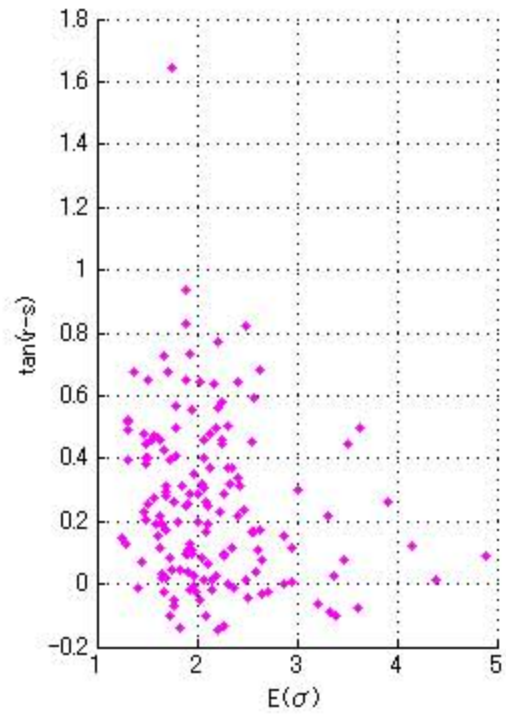


$\sigma(\gamma_1)$ との比と傾き・切片の関係

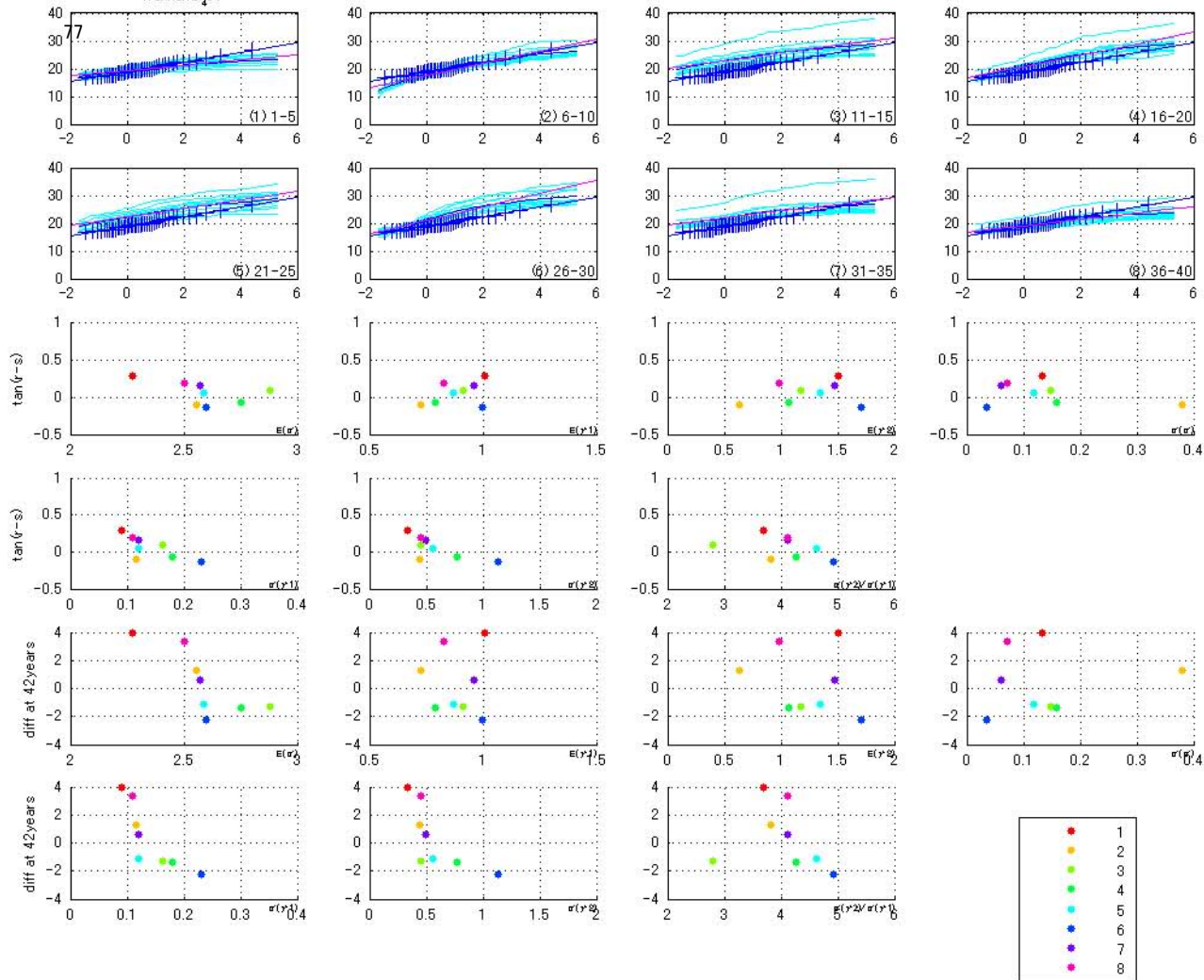
E( $\sigma$ )との比と42年再現期待値の差の関係

$\sigma(\sigma)$ との比と42年再現期待値の差の関係

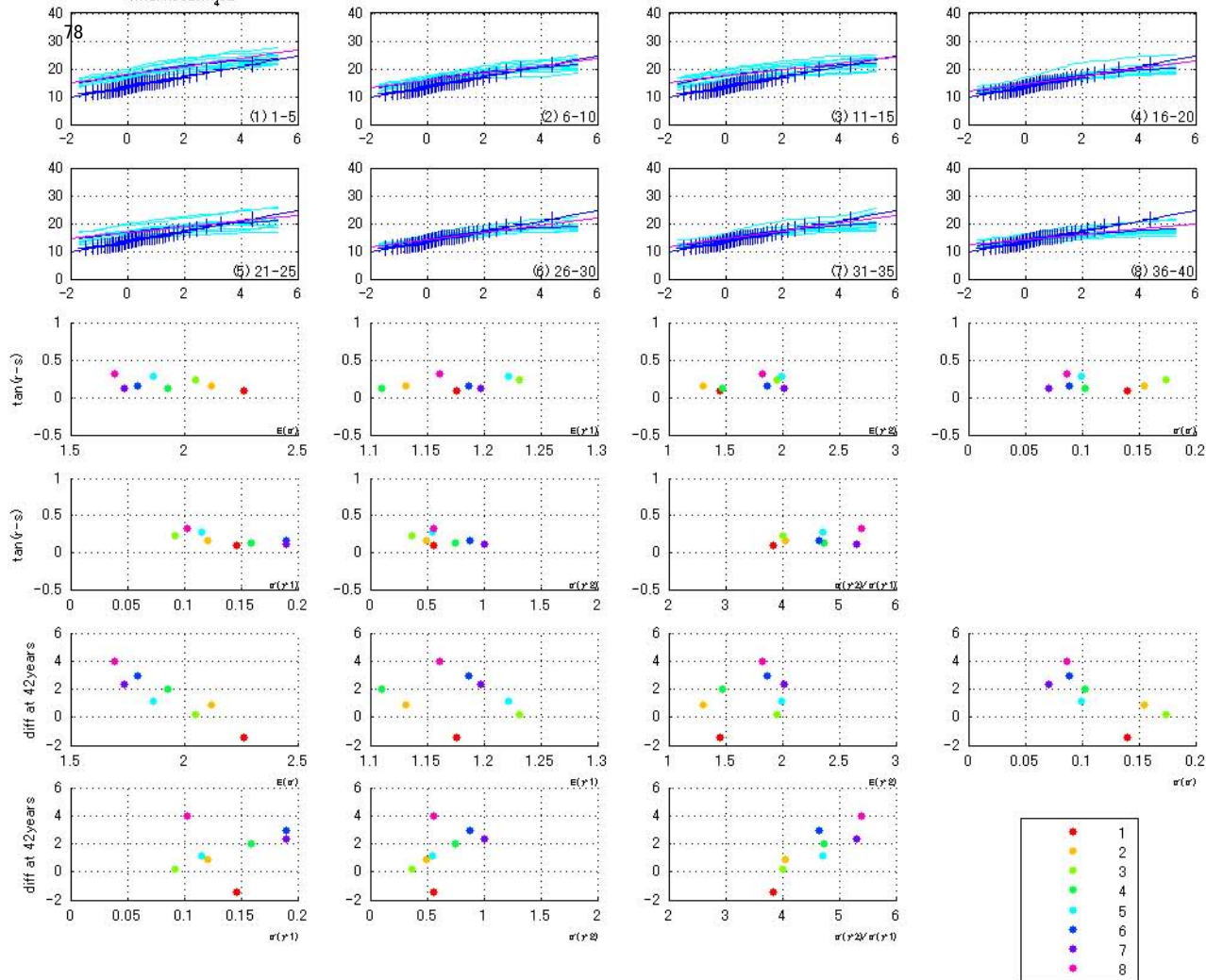
$\sigma(\sigma)$ との比と傾き・切片の関係



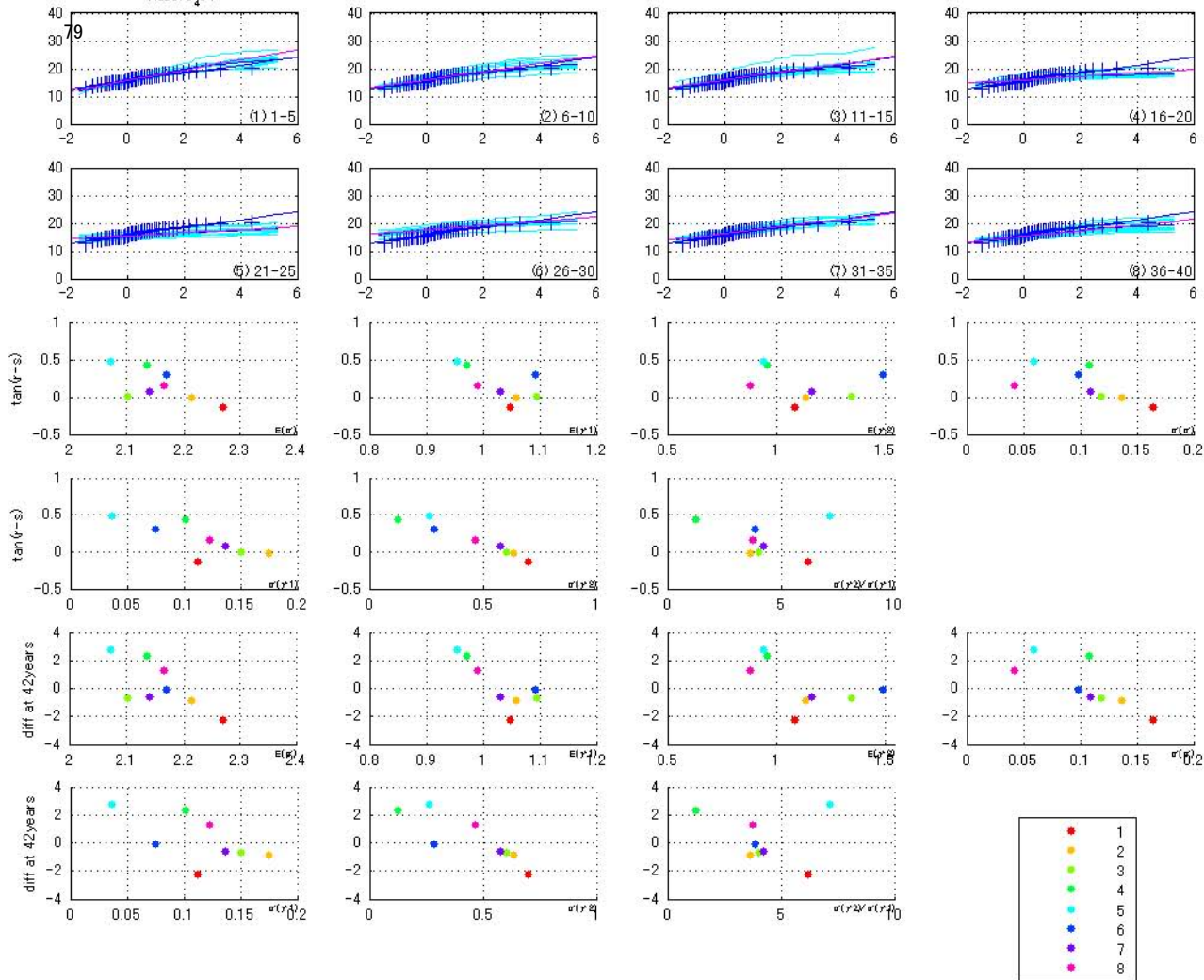
Wakkanai\_01



Kitamiesashi\_02

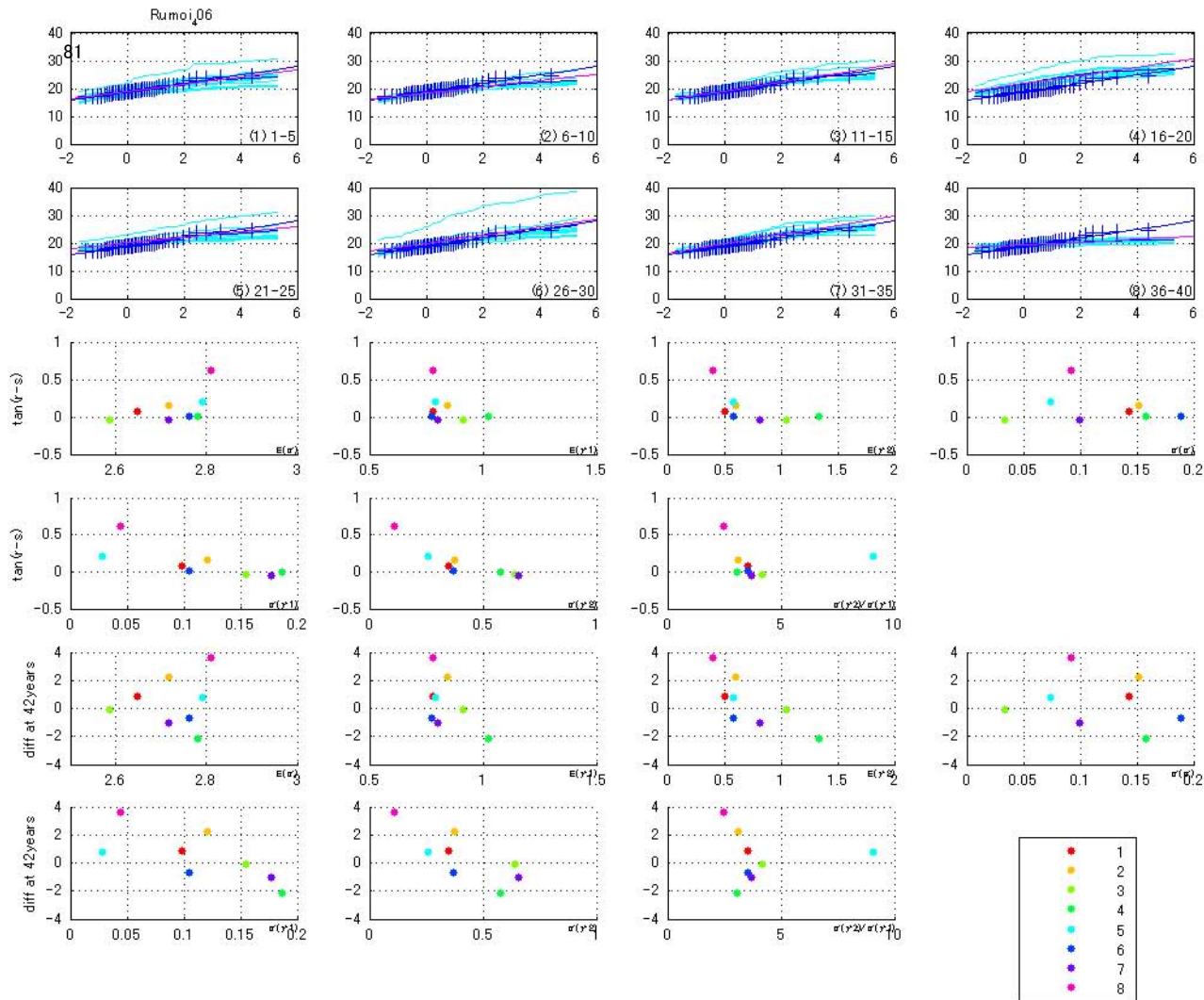


Haboro\_04



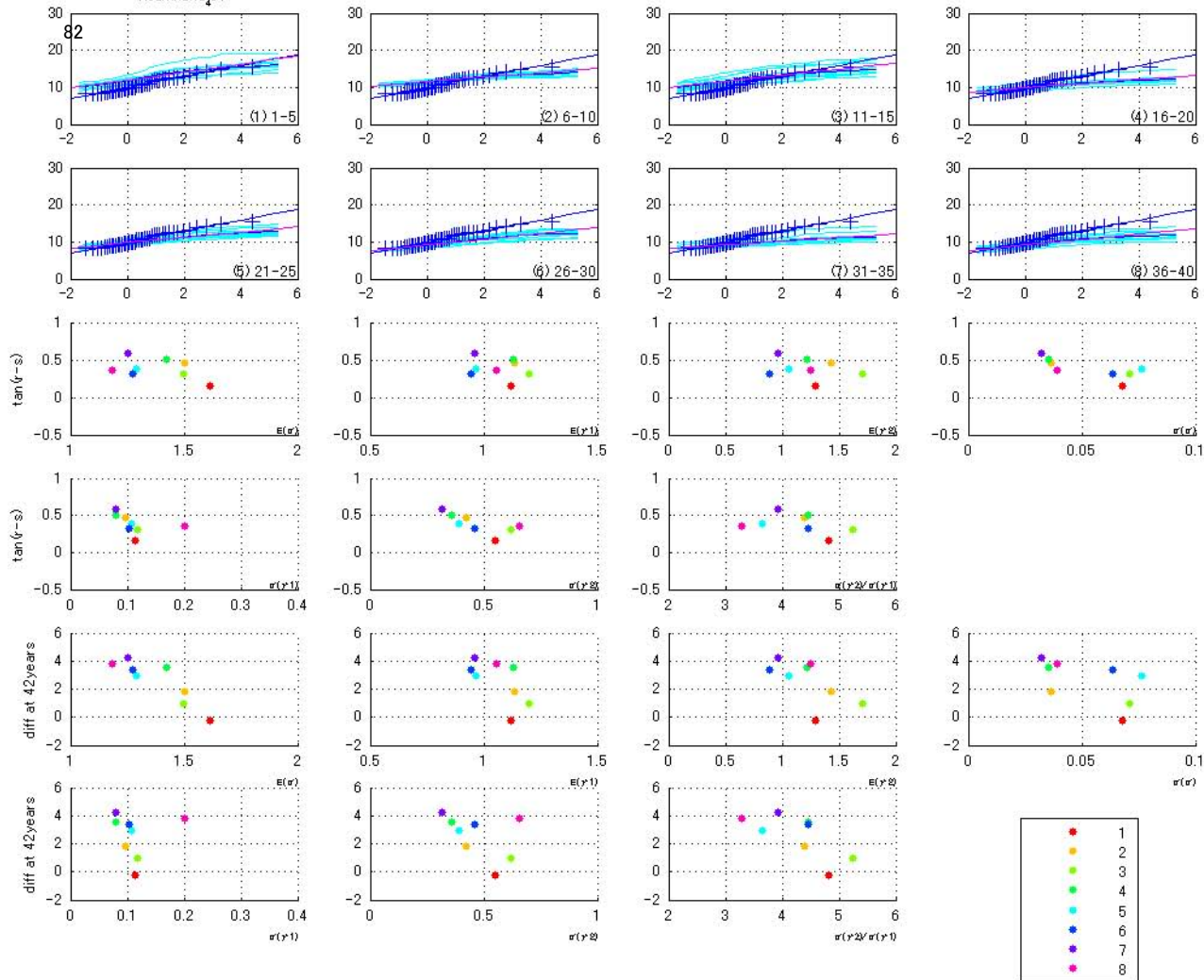






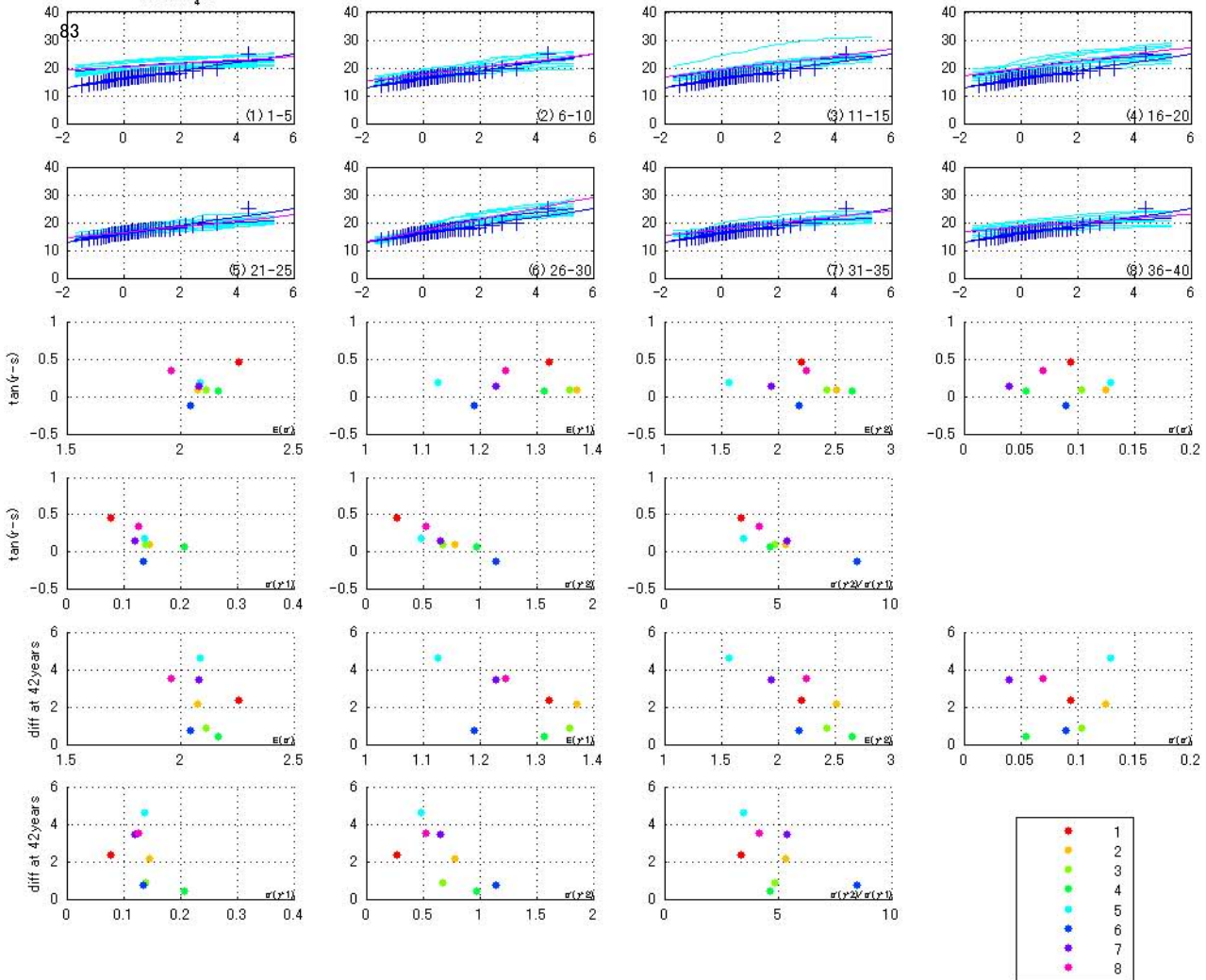
Asahikawa\_07

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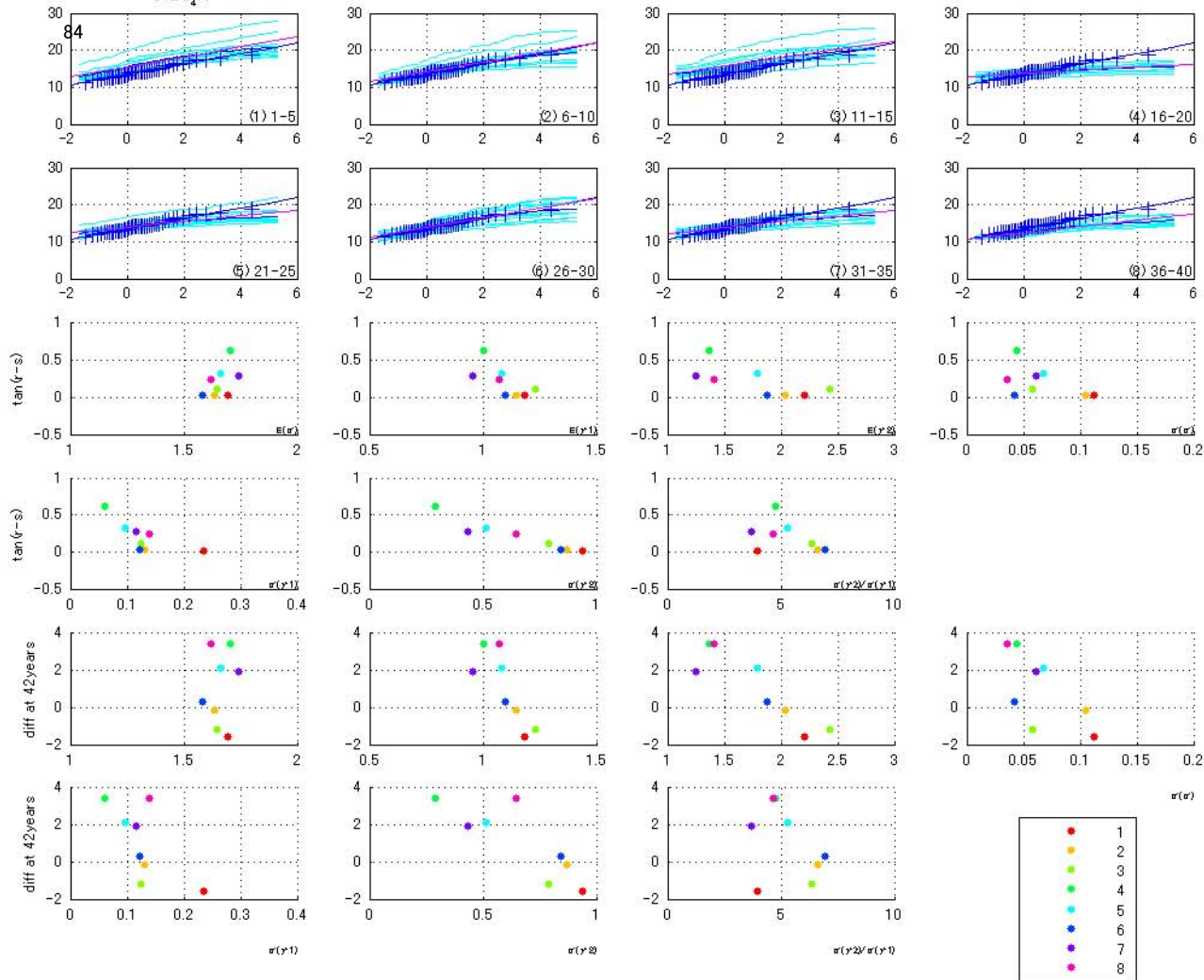
Abashiri\_09

83



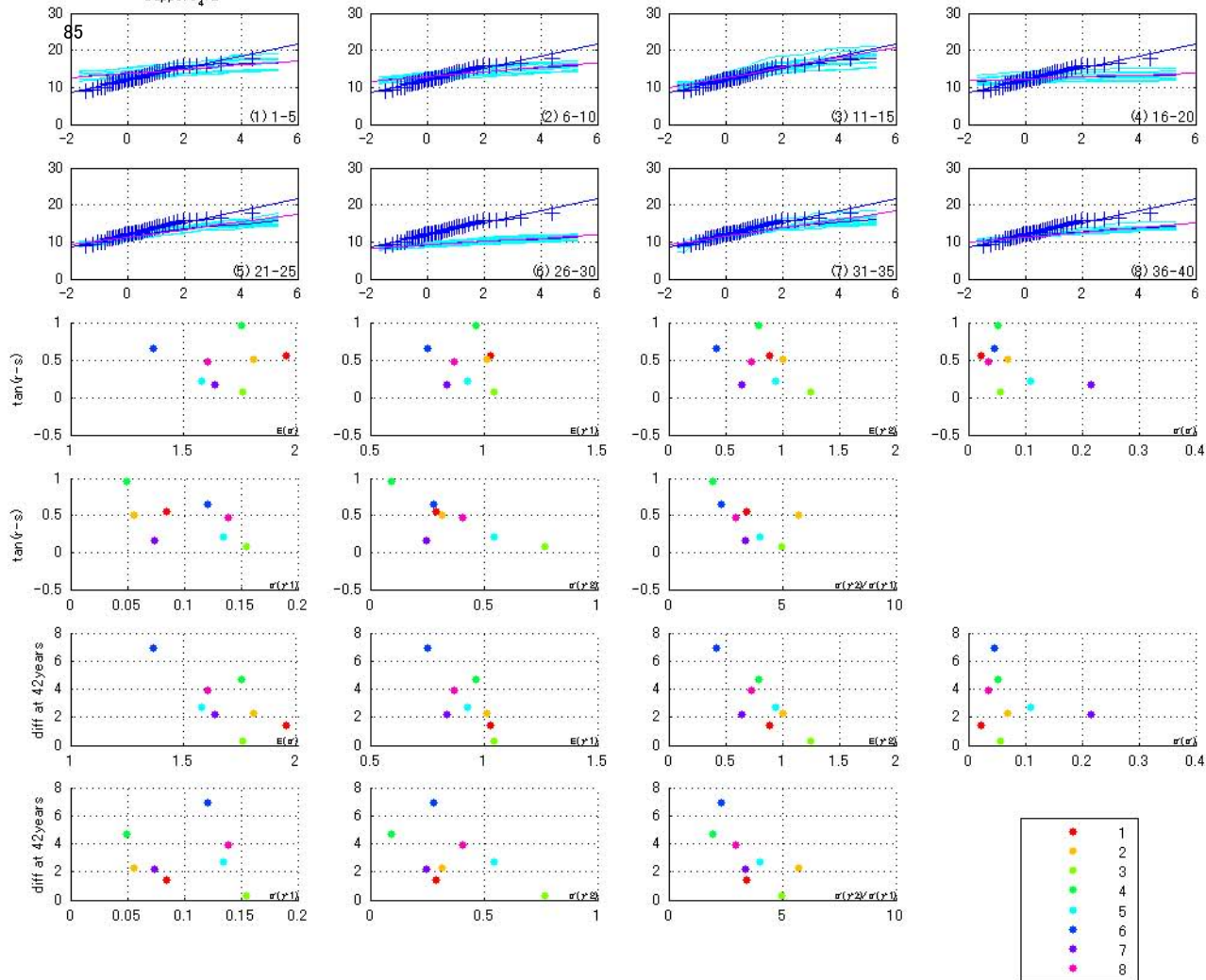
Otaru<sub>4</sub>11

84



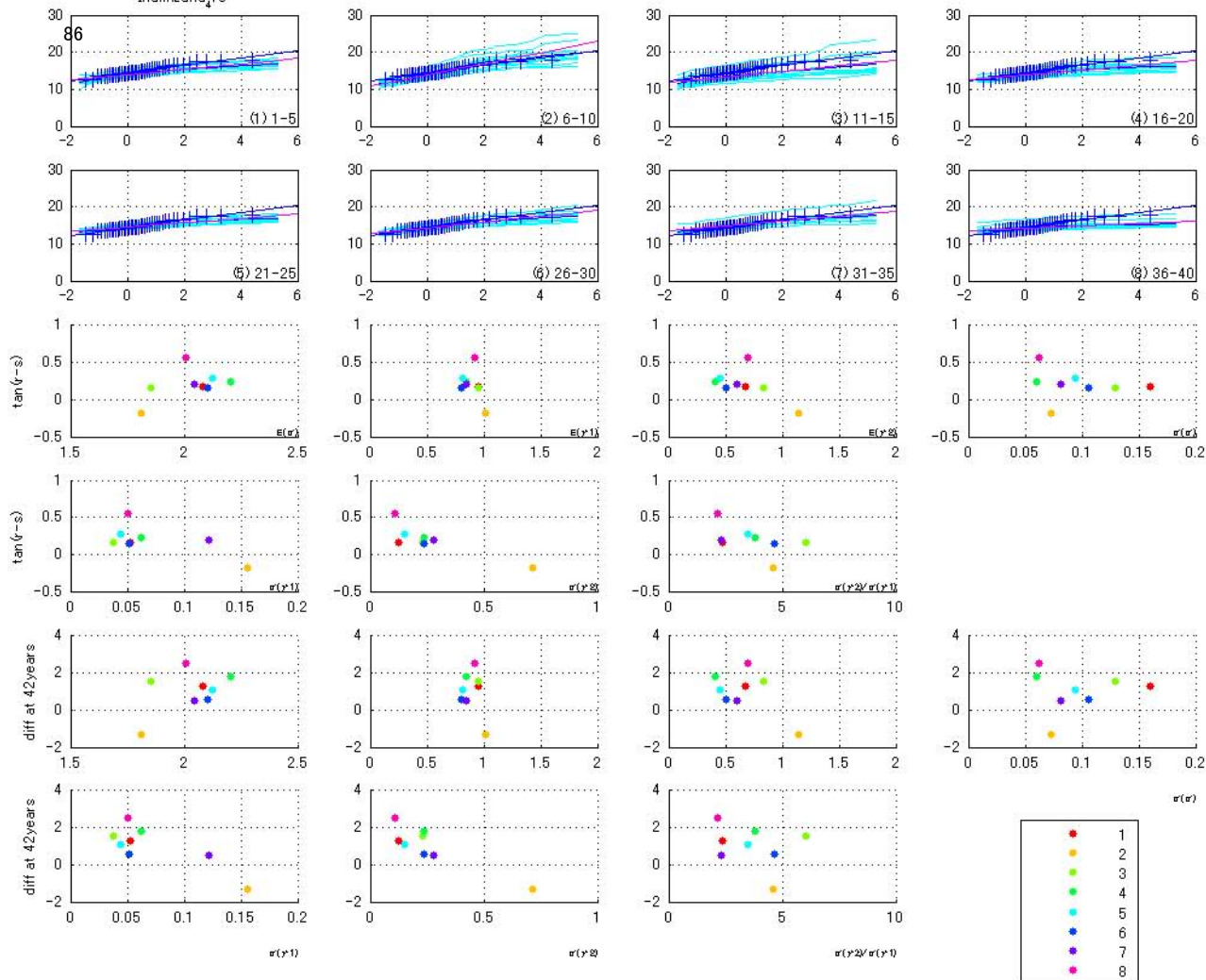
Sapporo<sub>4</sub>12

85

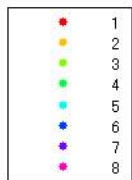
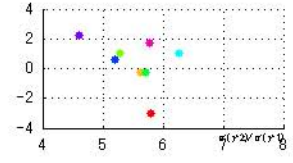
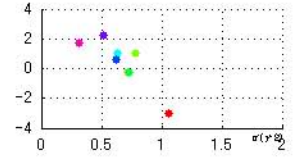
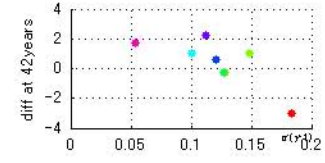
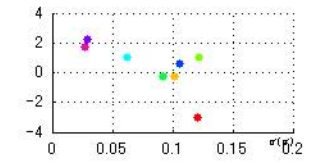
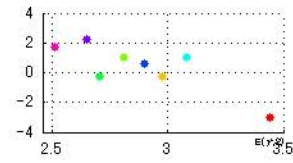
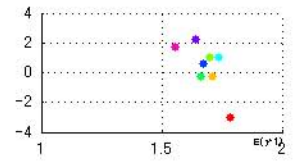
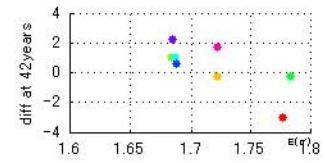
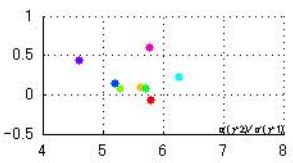
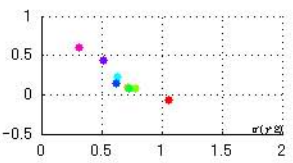
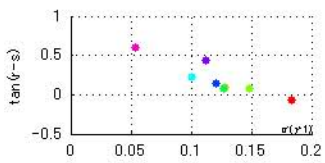
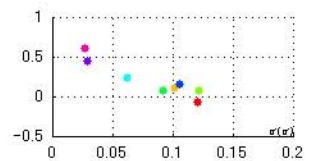
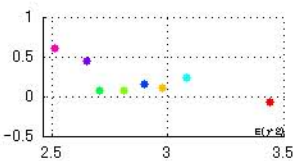
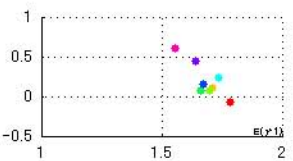
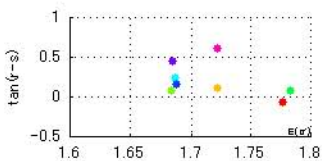
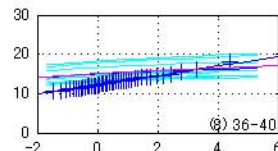
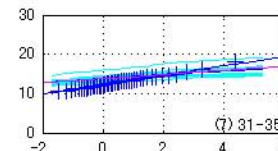
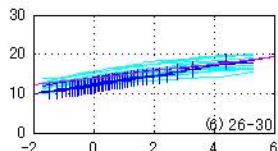
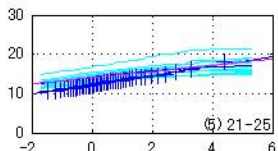
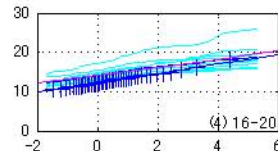
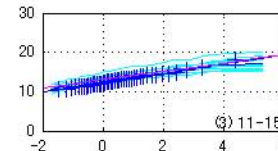
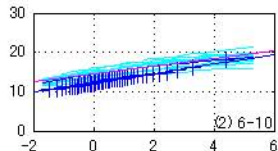
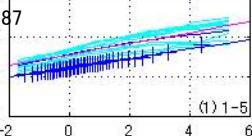


Iwamizawa<sub>13</sub>

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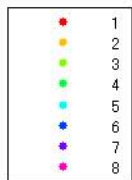
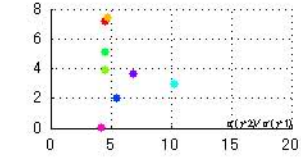
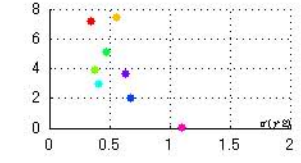
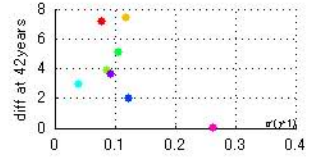
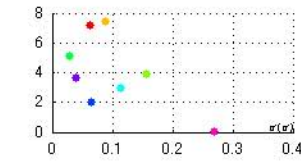
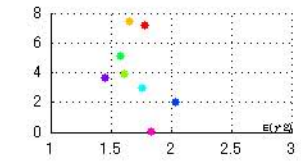
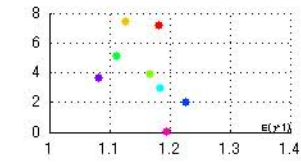
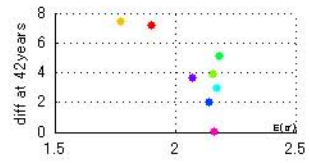
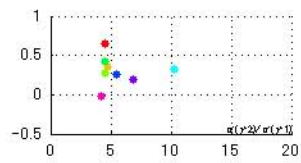
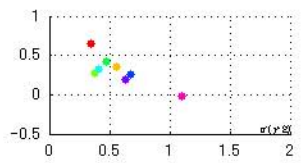
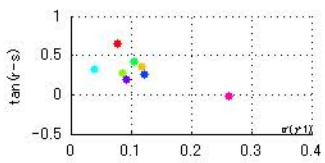
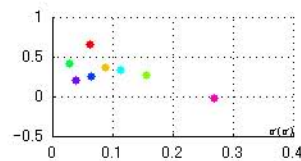
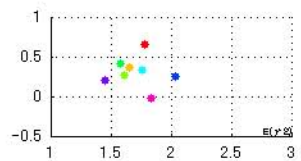
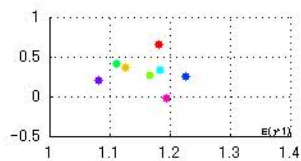
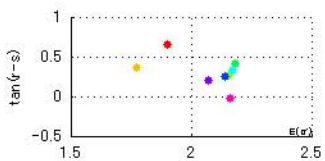
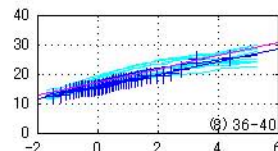
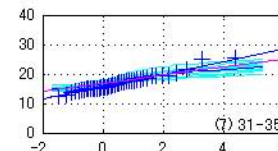
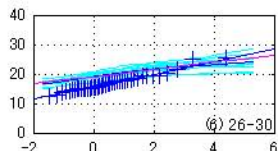
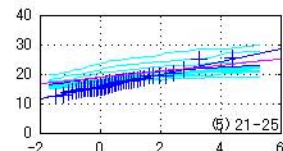
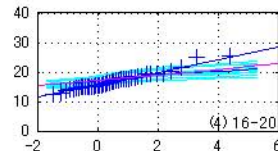
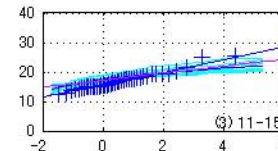
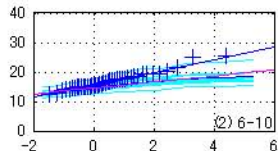
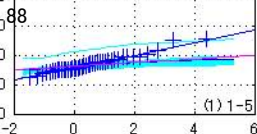


Obihiro<sub>17</sub>

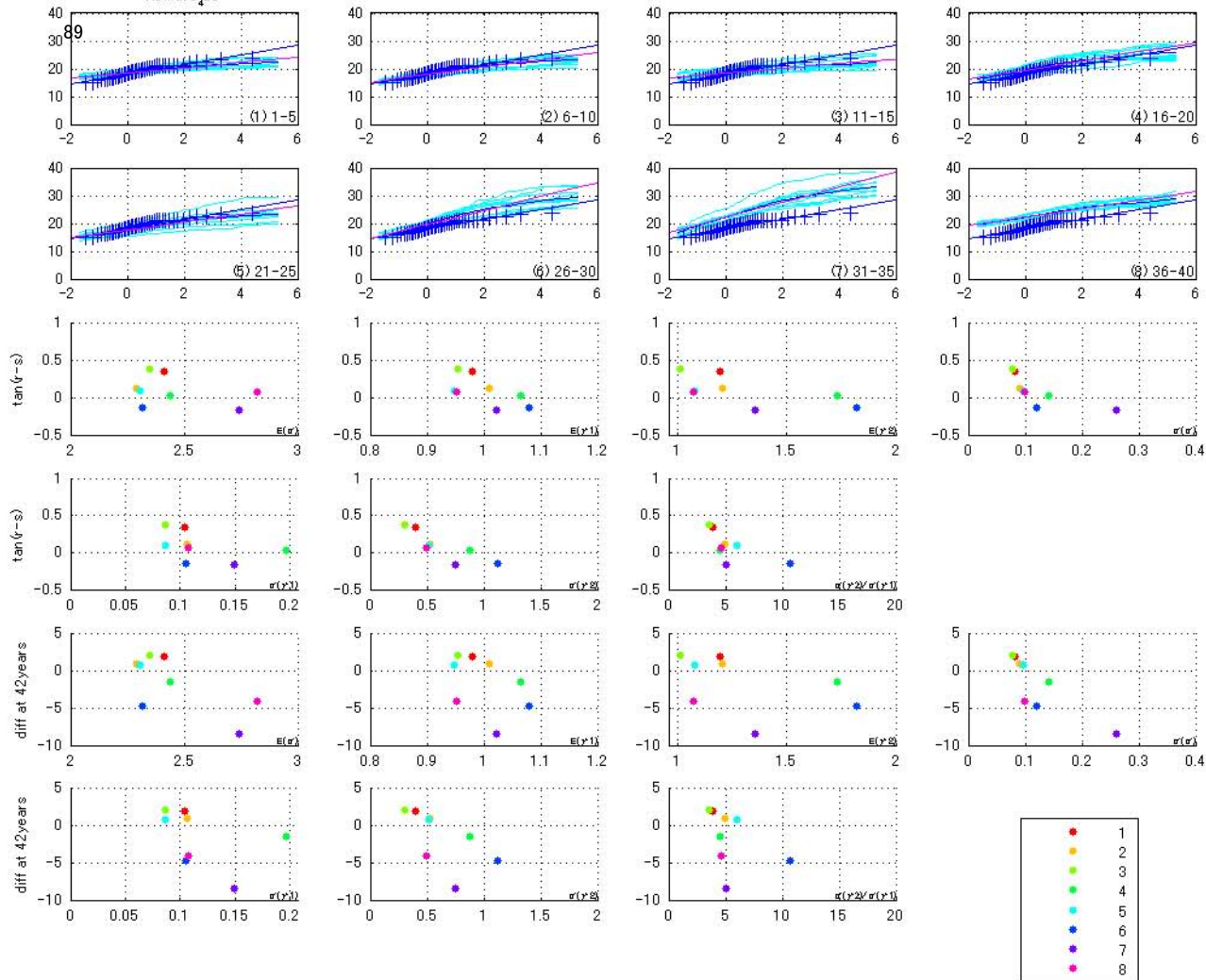


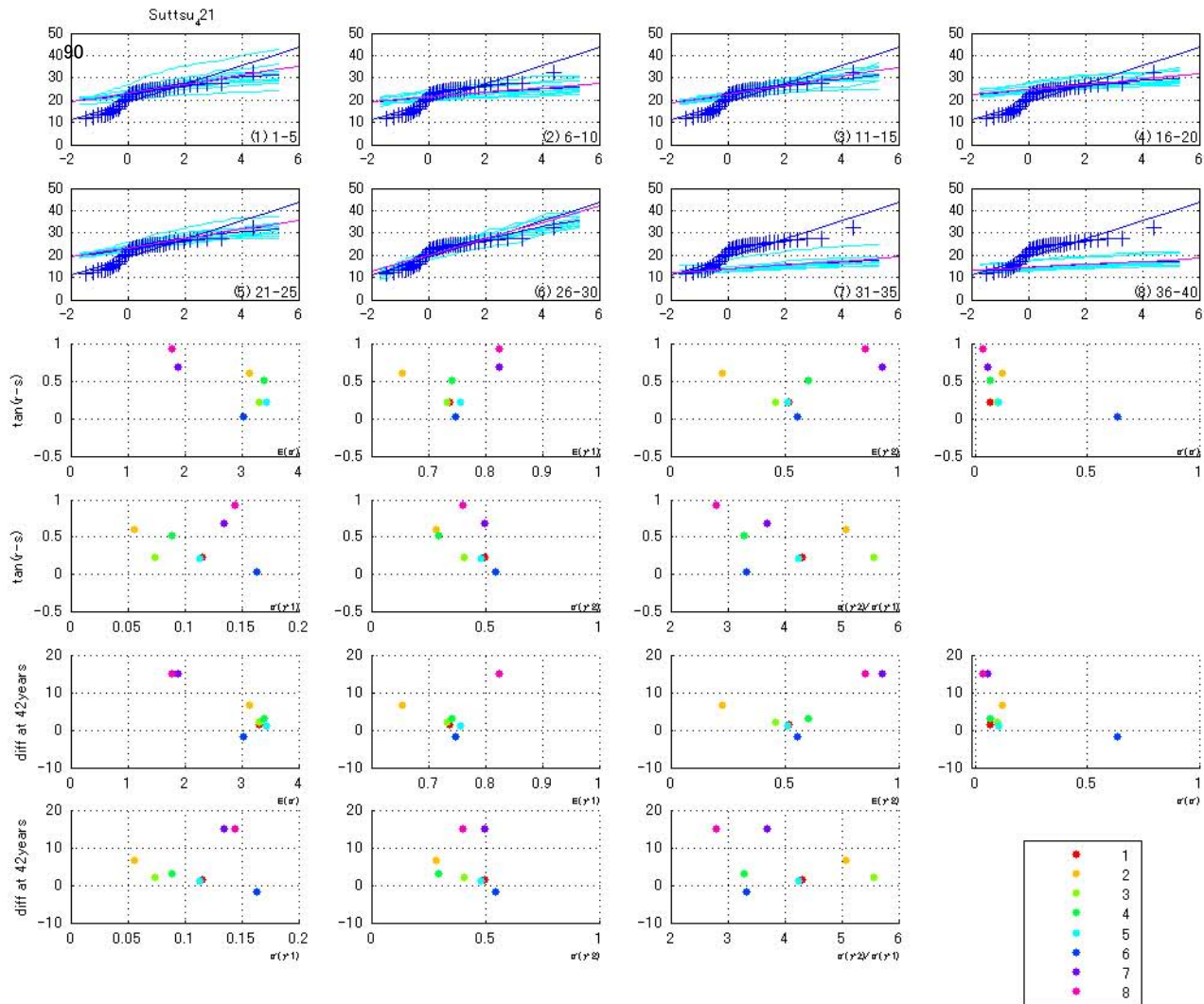


Kushiro\_18

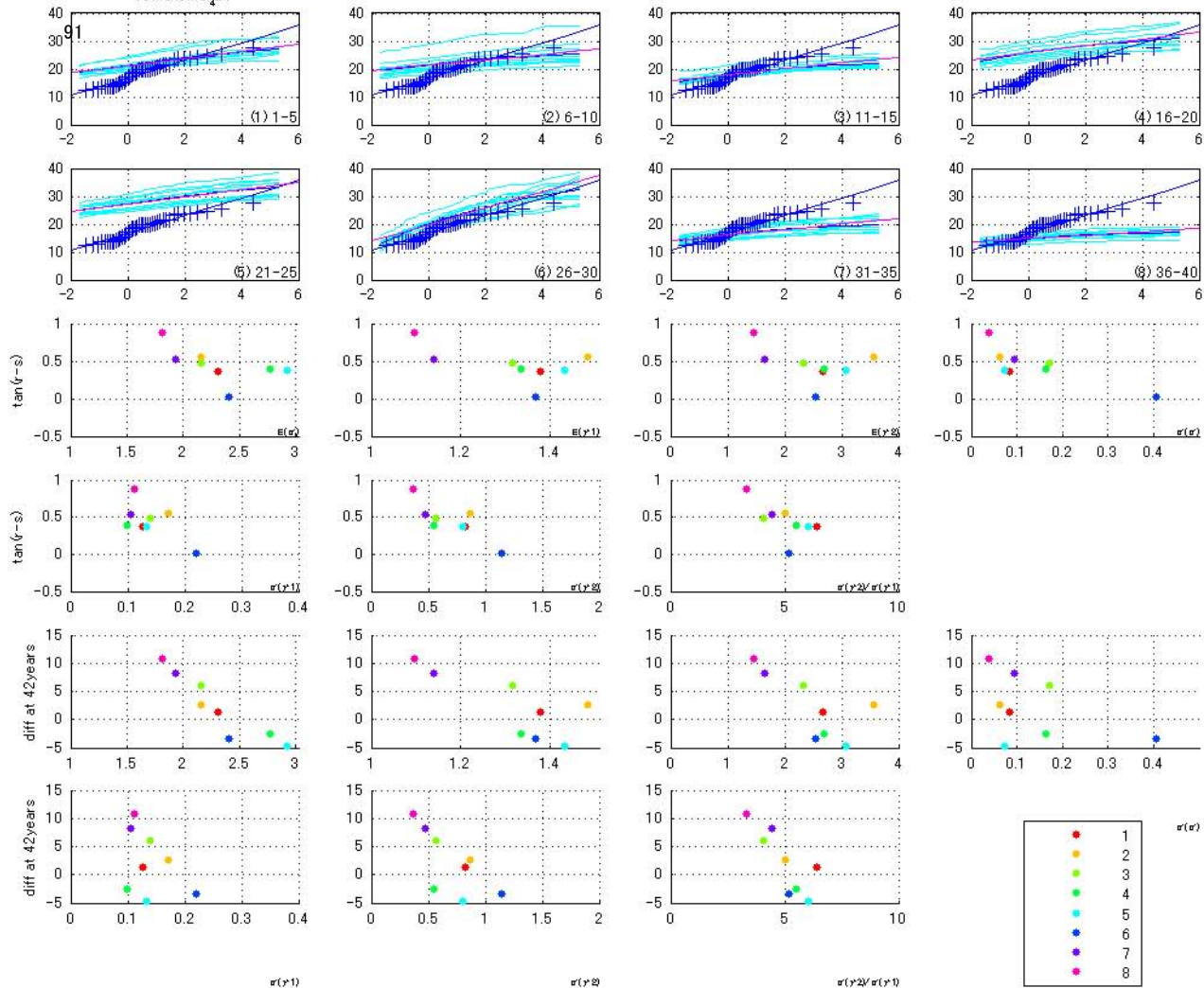


Nemuro\_20

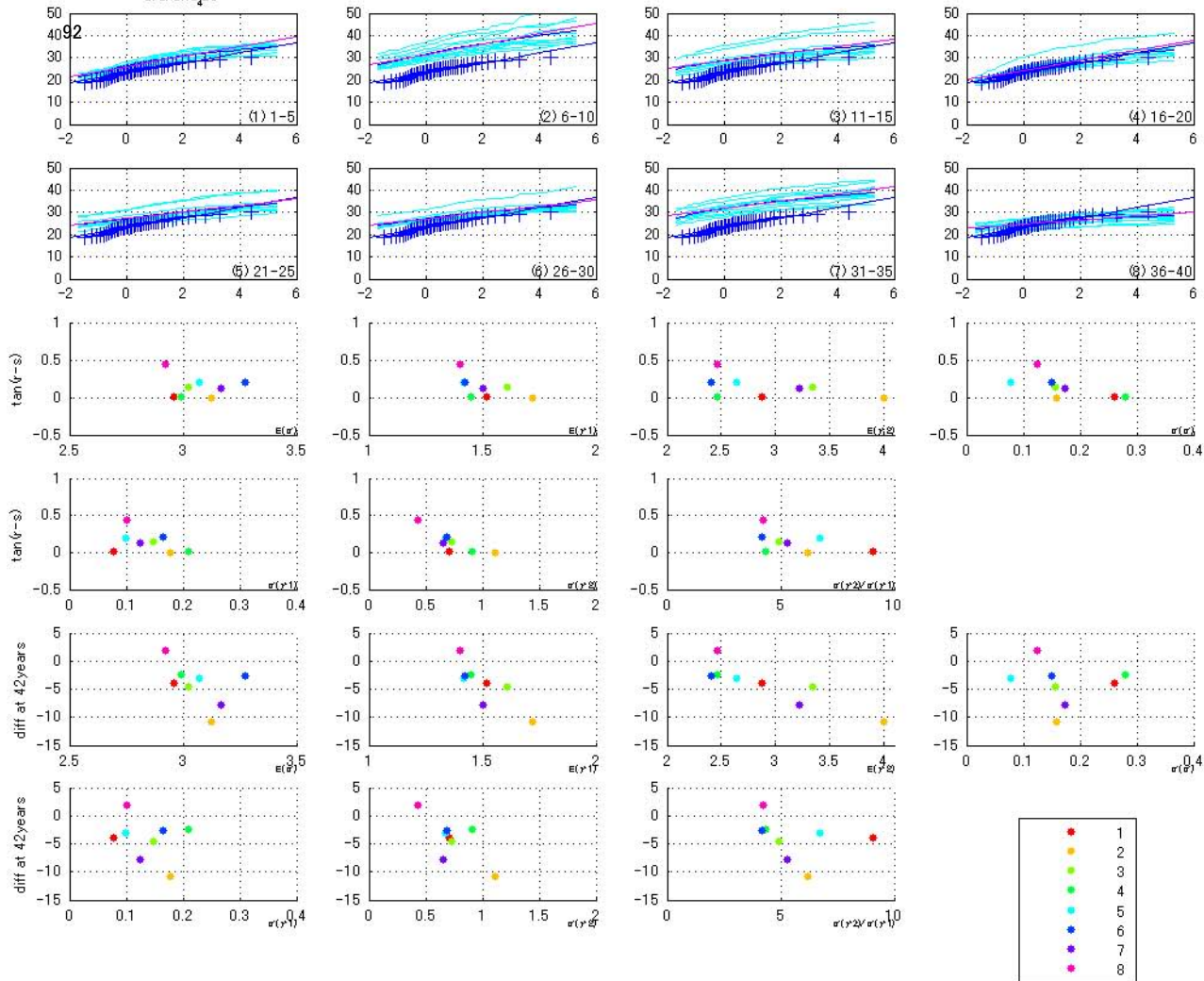


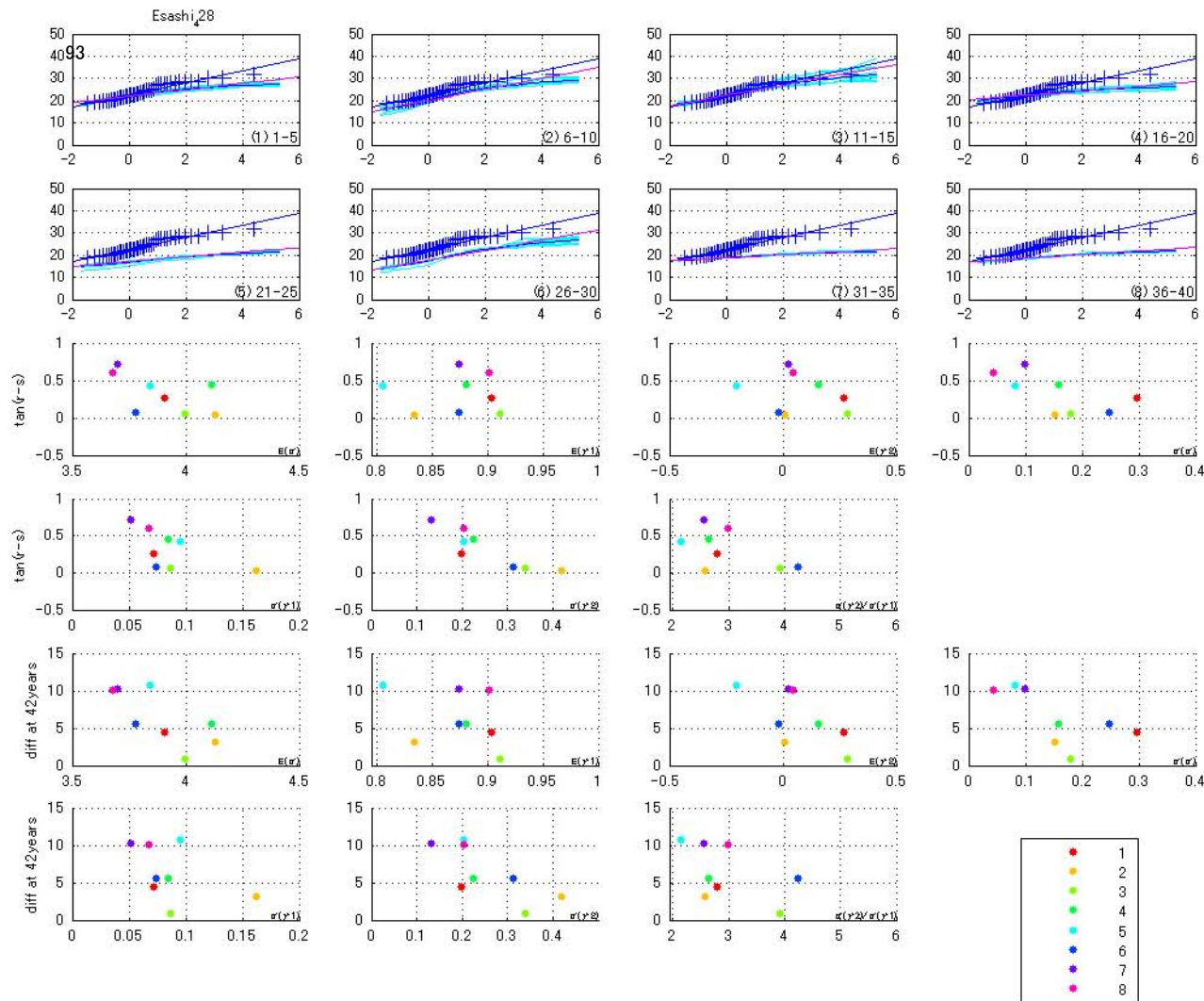


Tomakomai\_24



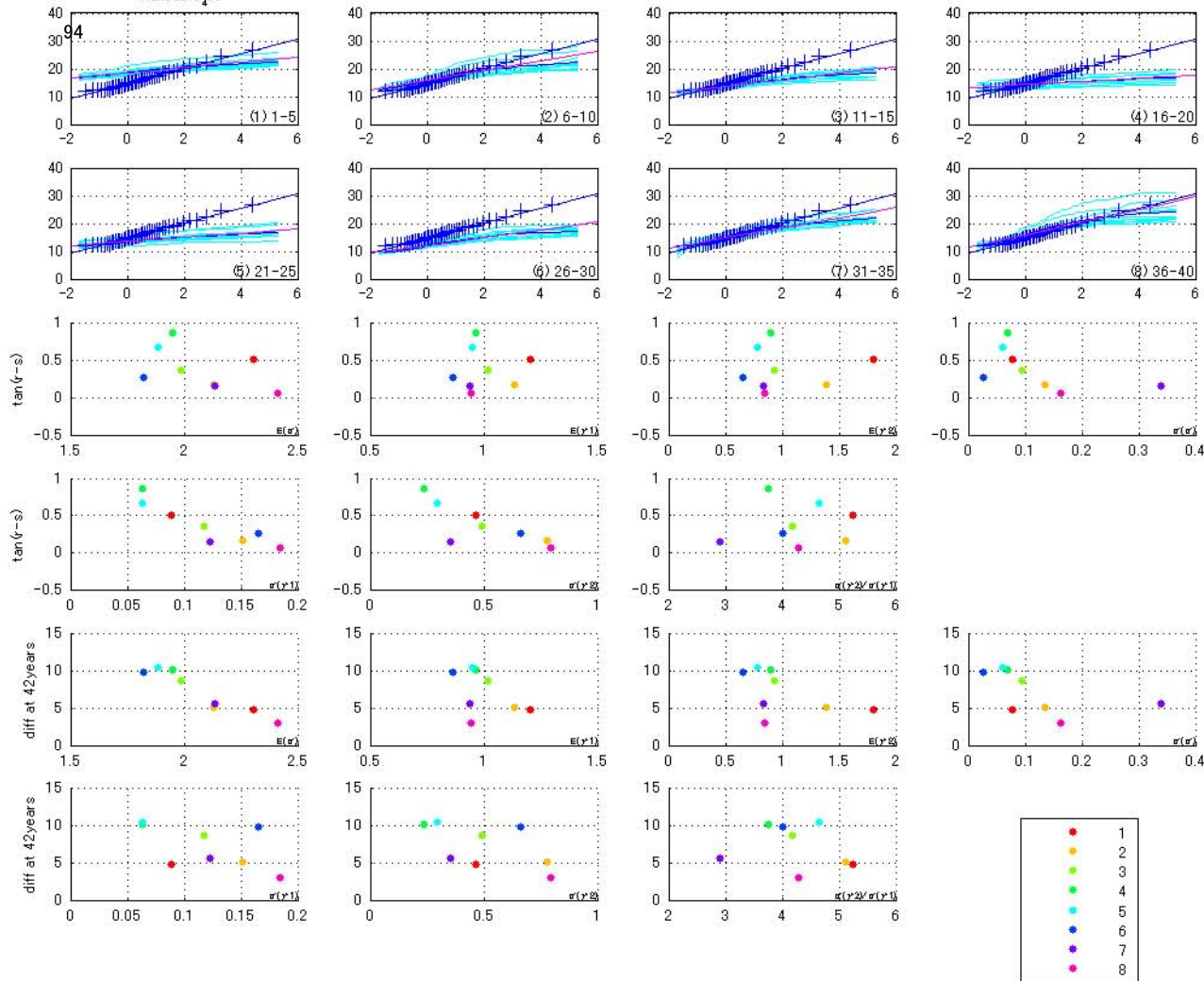
Urakawa\_26





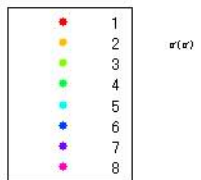
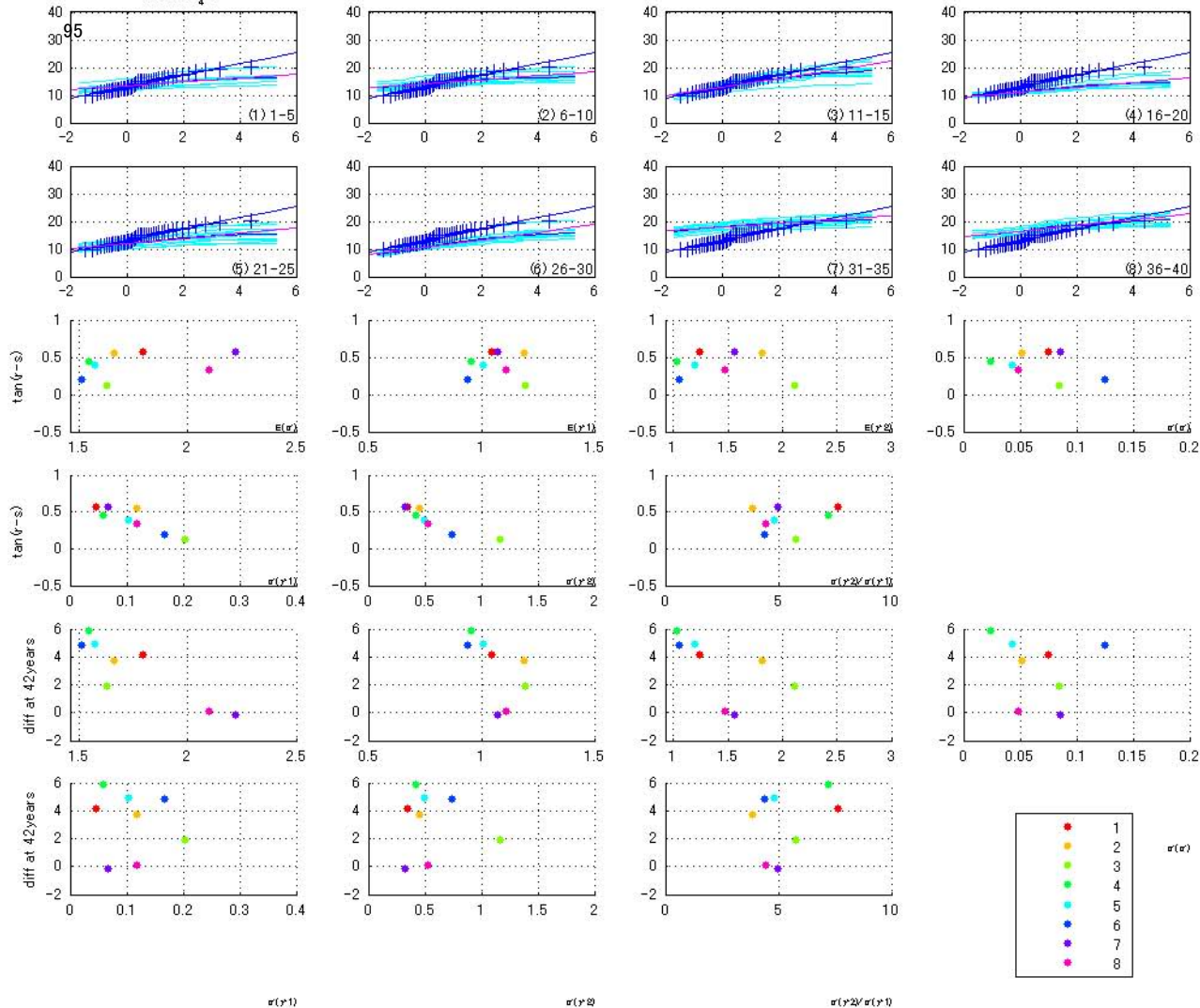
Hakodate\_30

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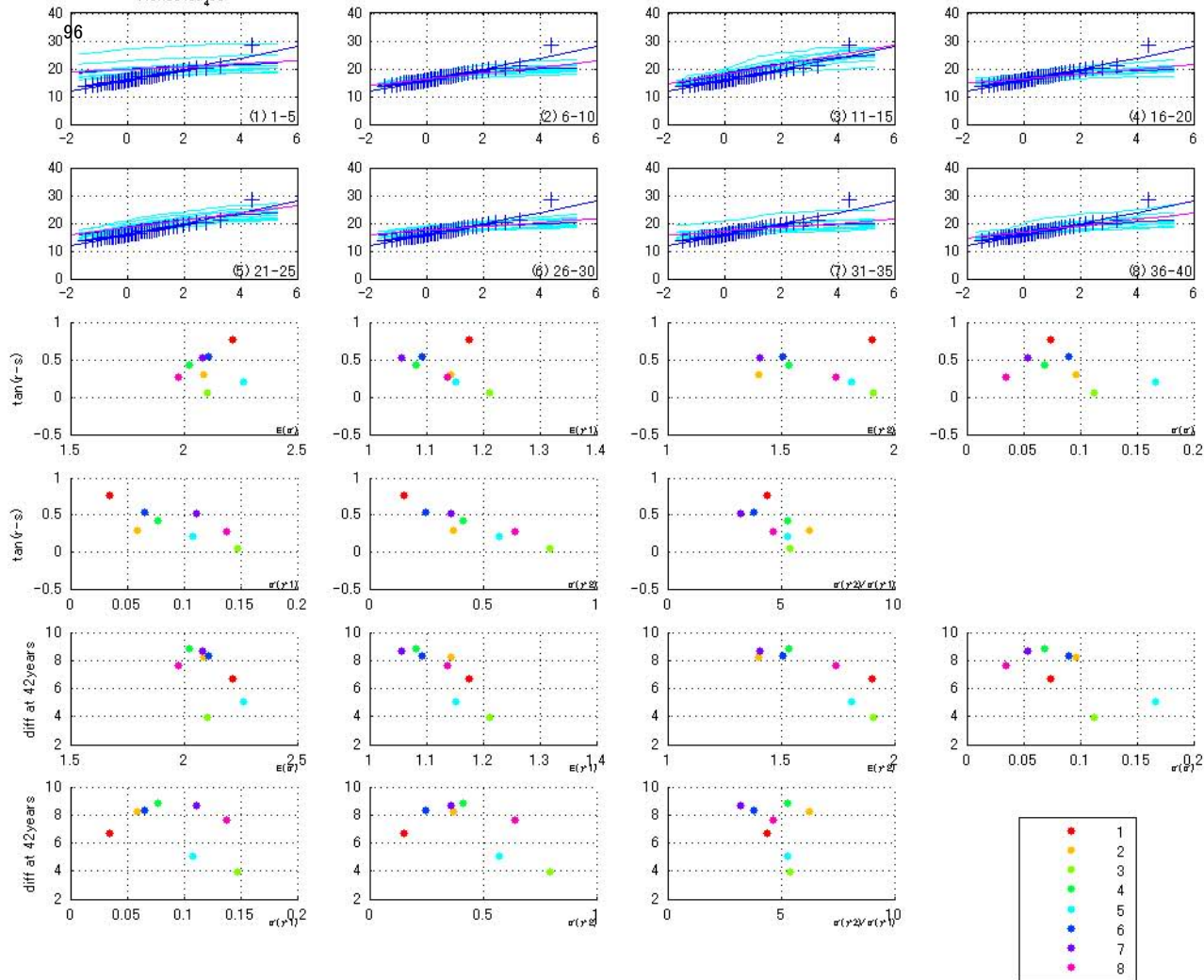
Kutchan\_33

g5

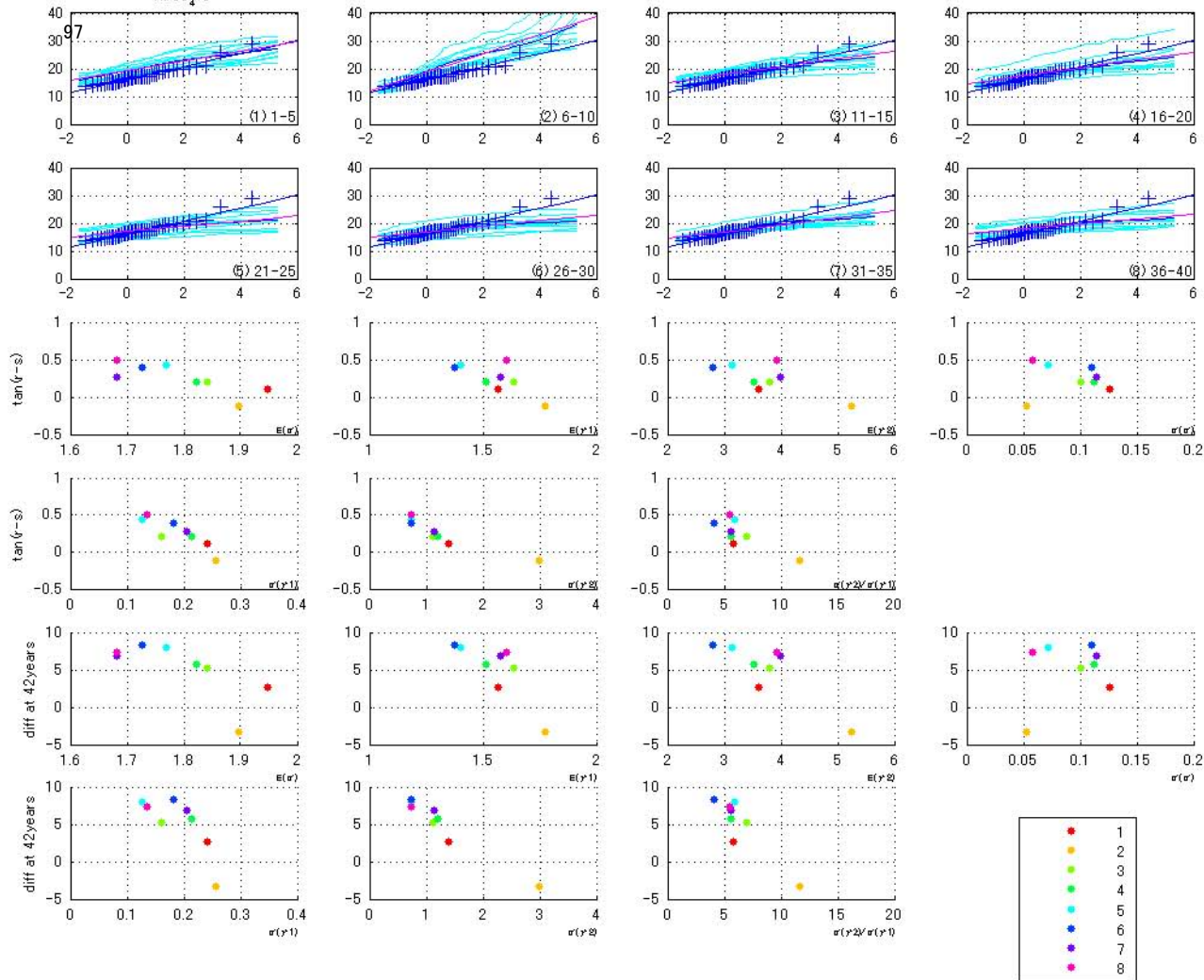




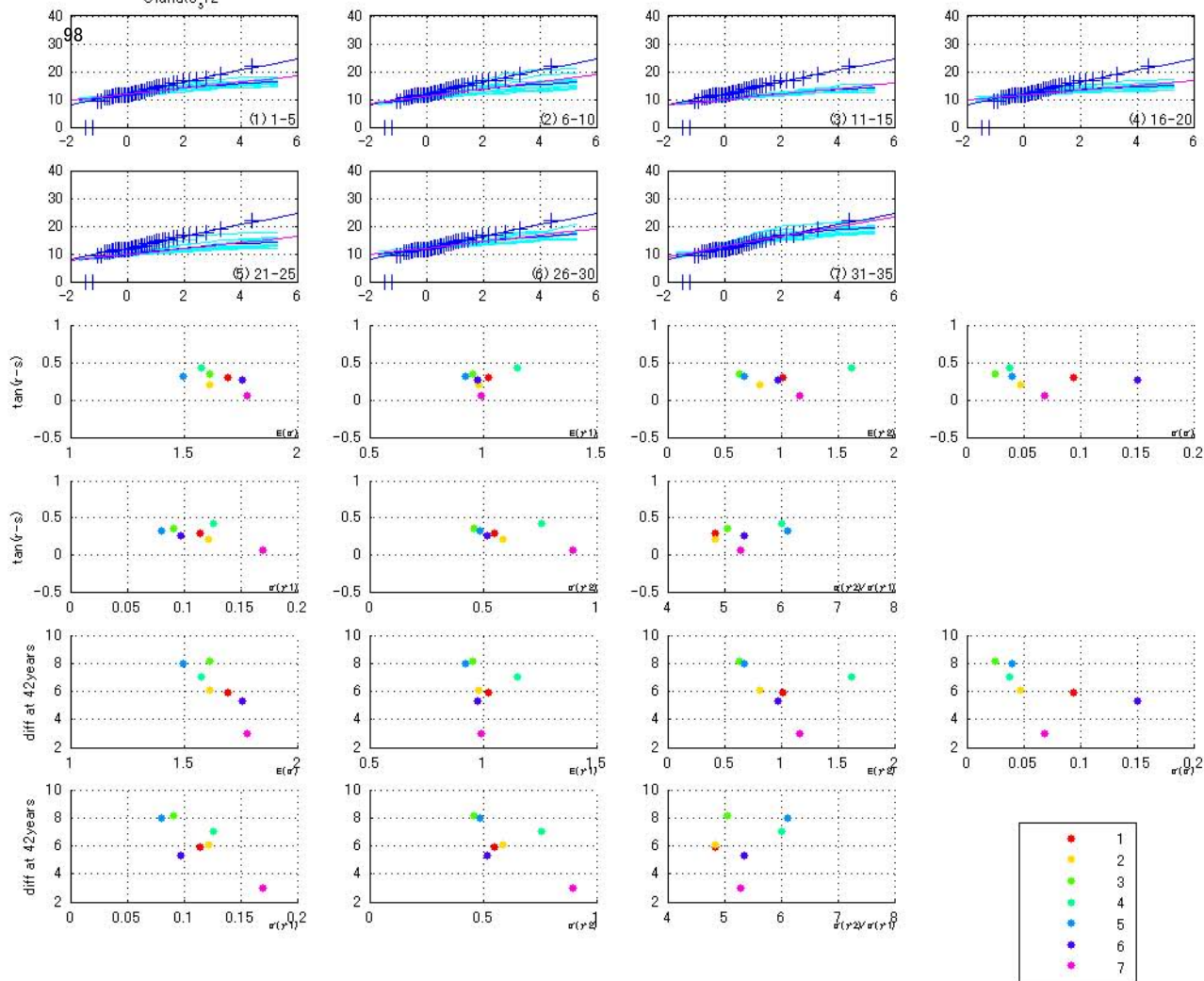
Monbetsu\_35

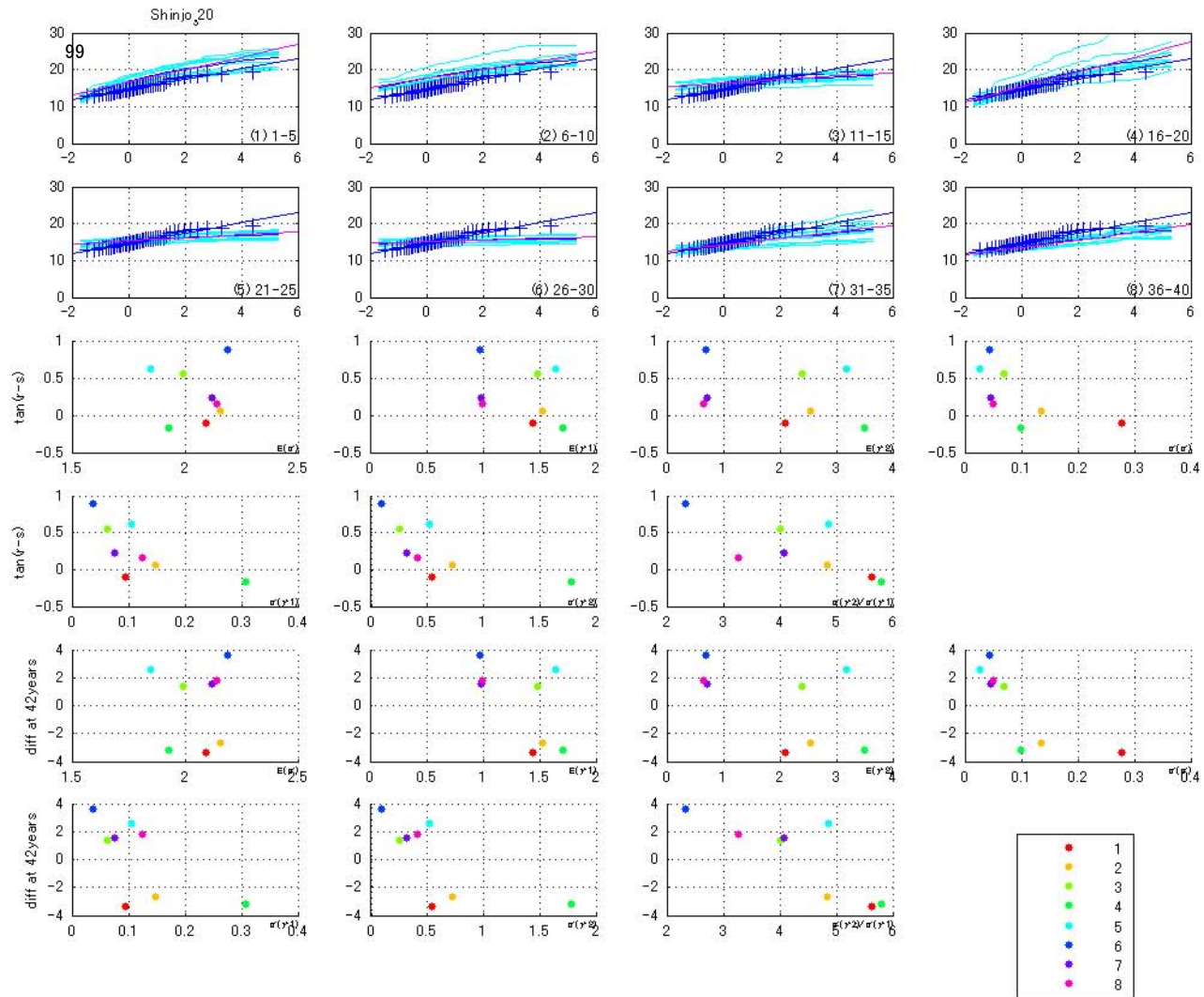


Hiroo\_40

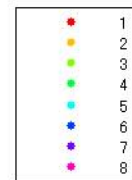
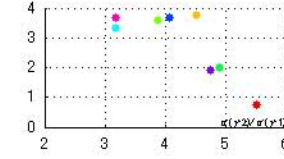
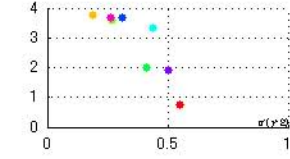
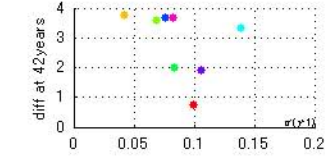
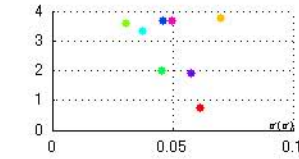
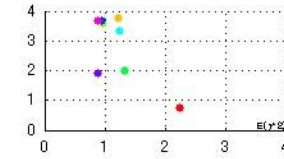
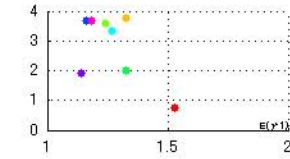
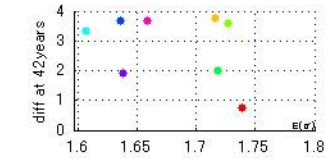
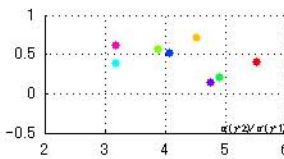
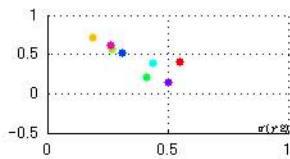
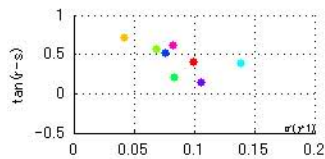
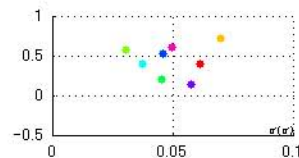
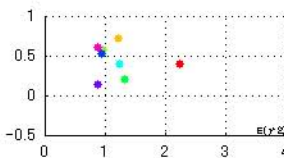
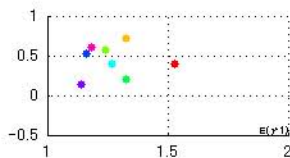
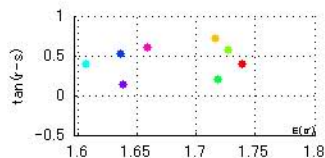
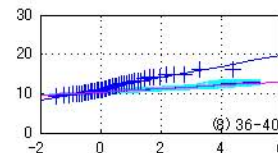
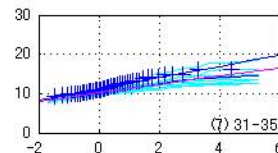
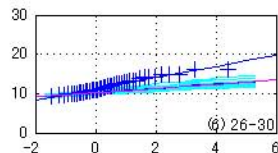
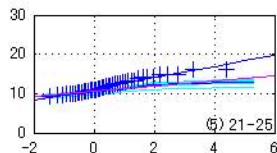
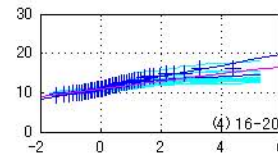
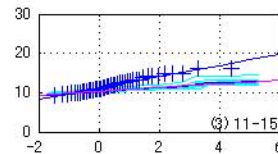
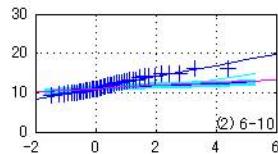
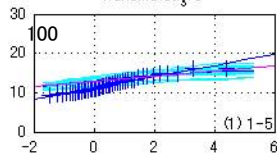


Ofunato, 12

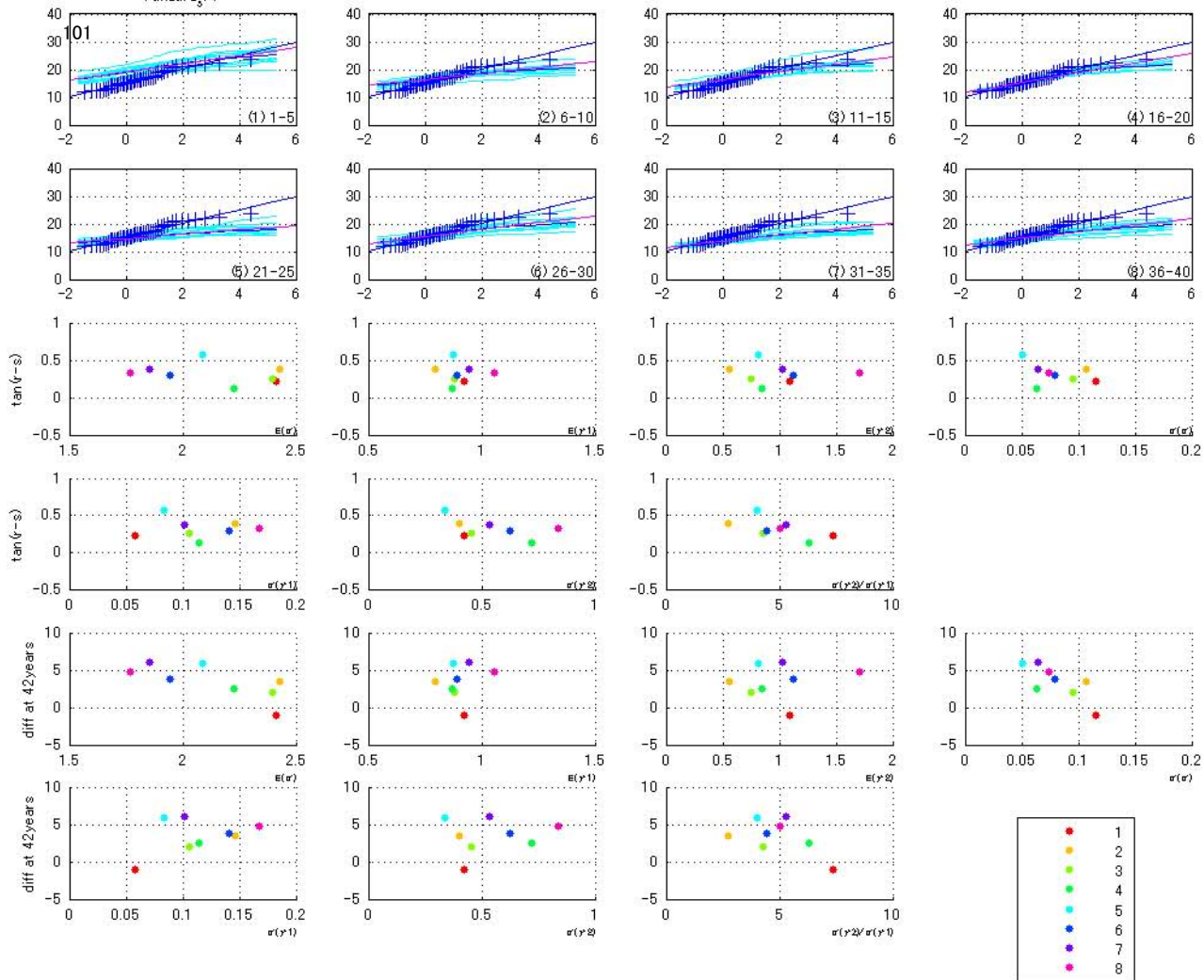




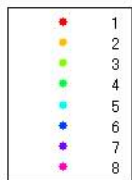
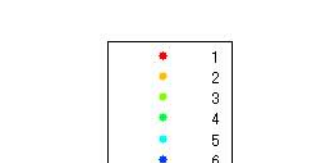
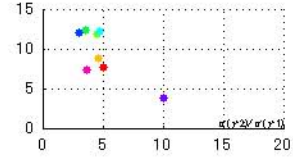
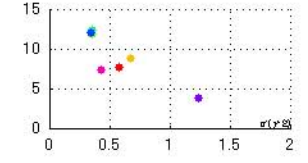
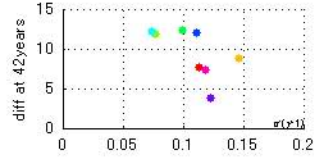
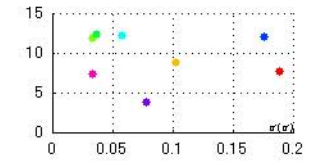
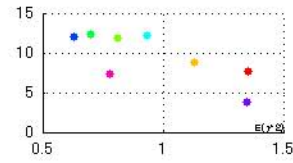
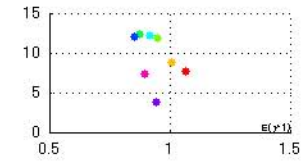
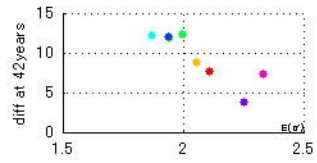
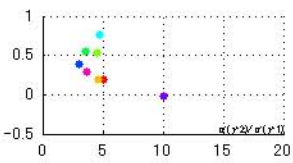
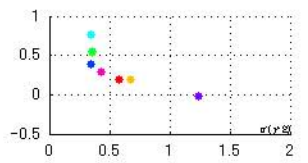
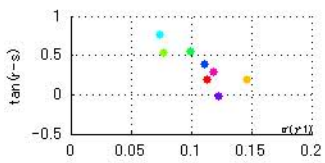
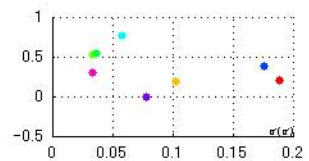
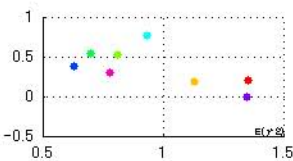
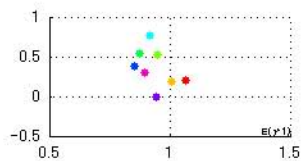
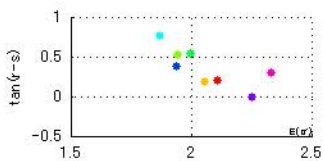
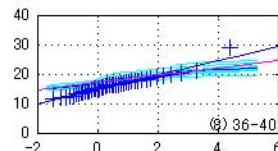
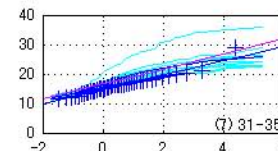
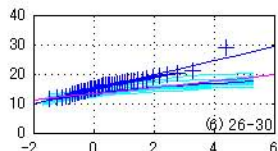
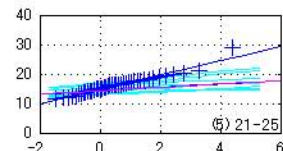
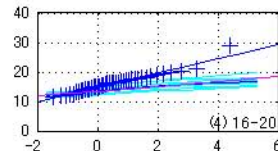
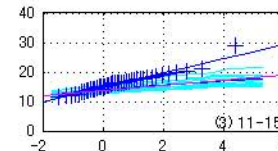
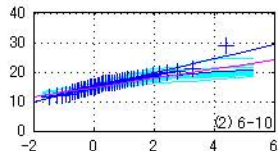
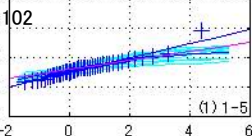
Wakamatsu<sub>y</sub>70

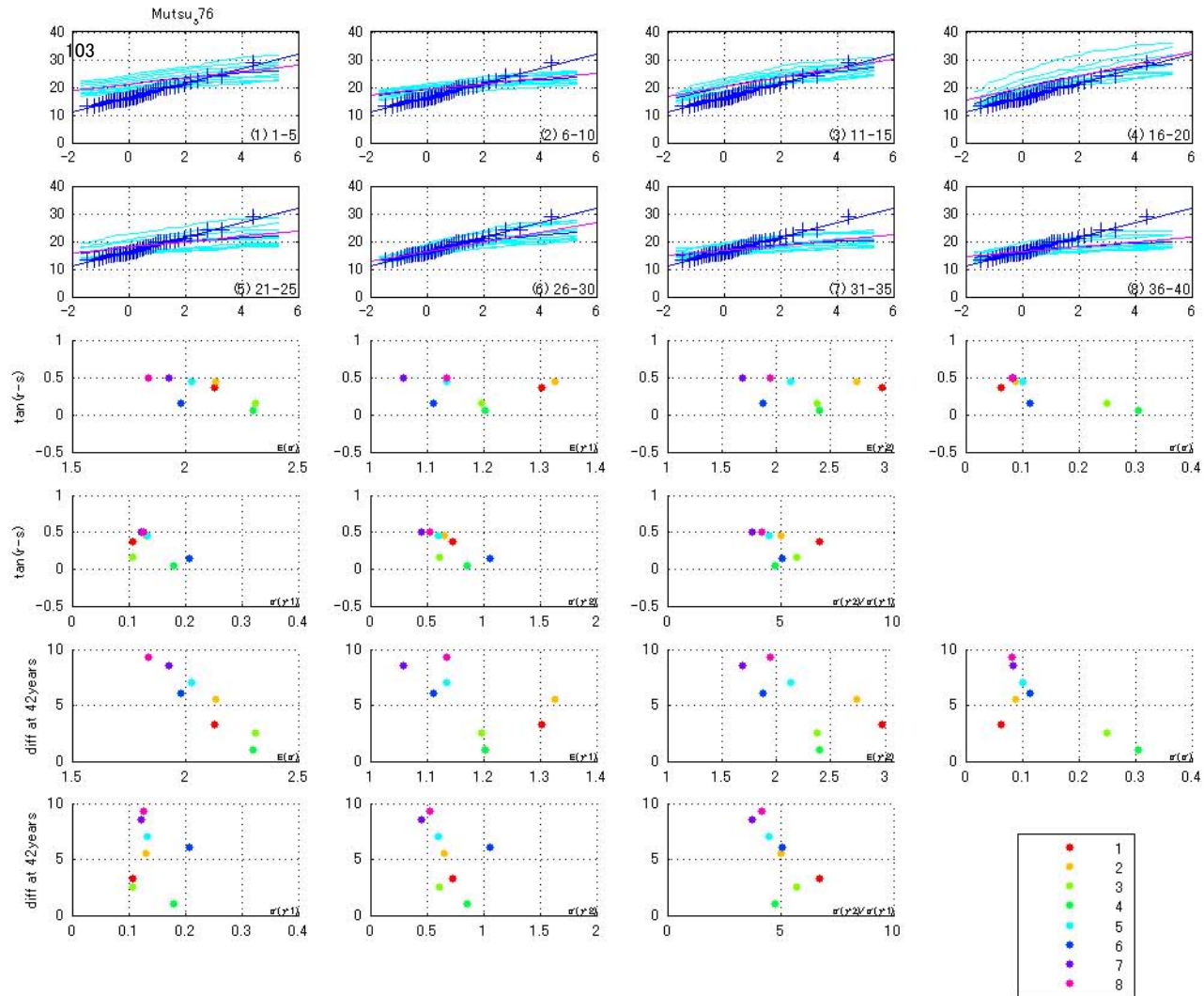


Fukaura<sub>74</sub>



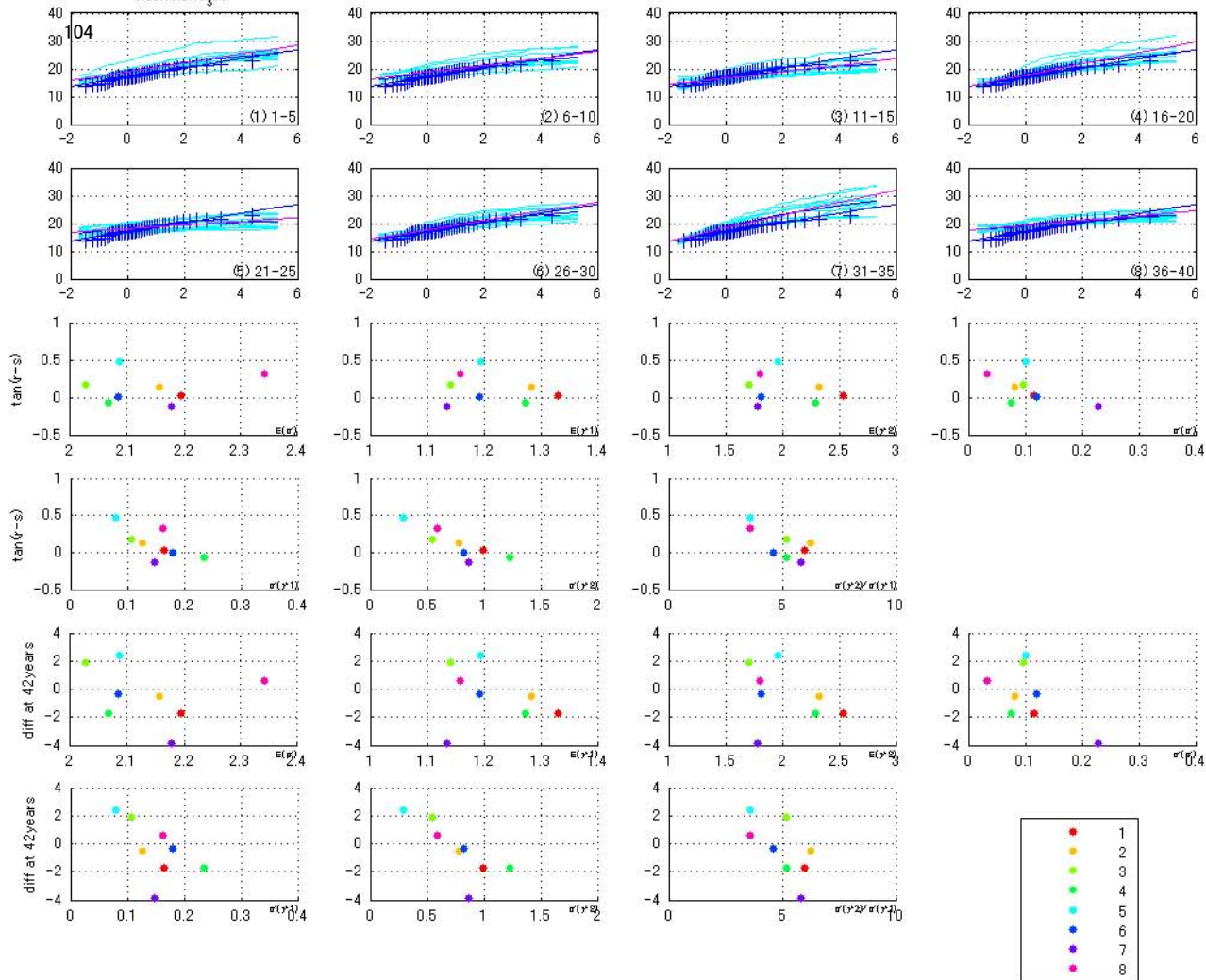
Aomori\_75



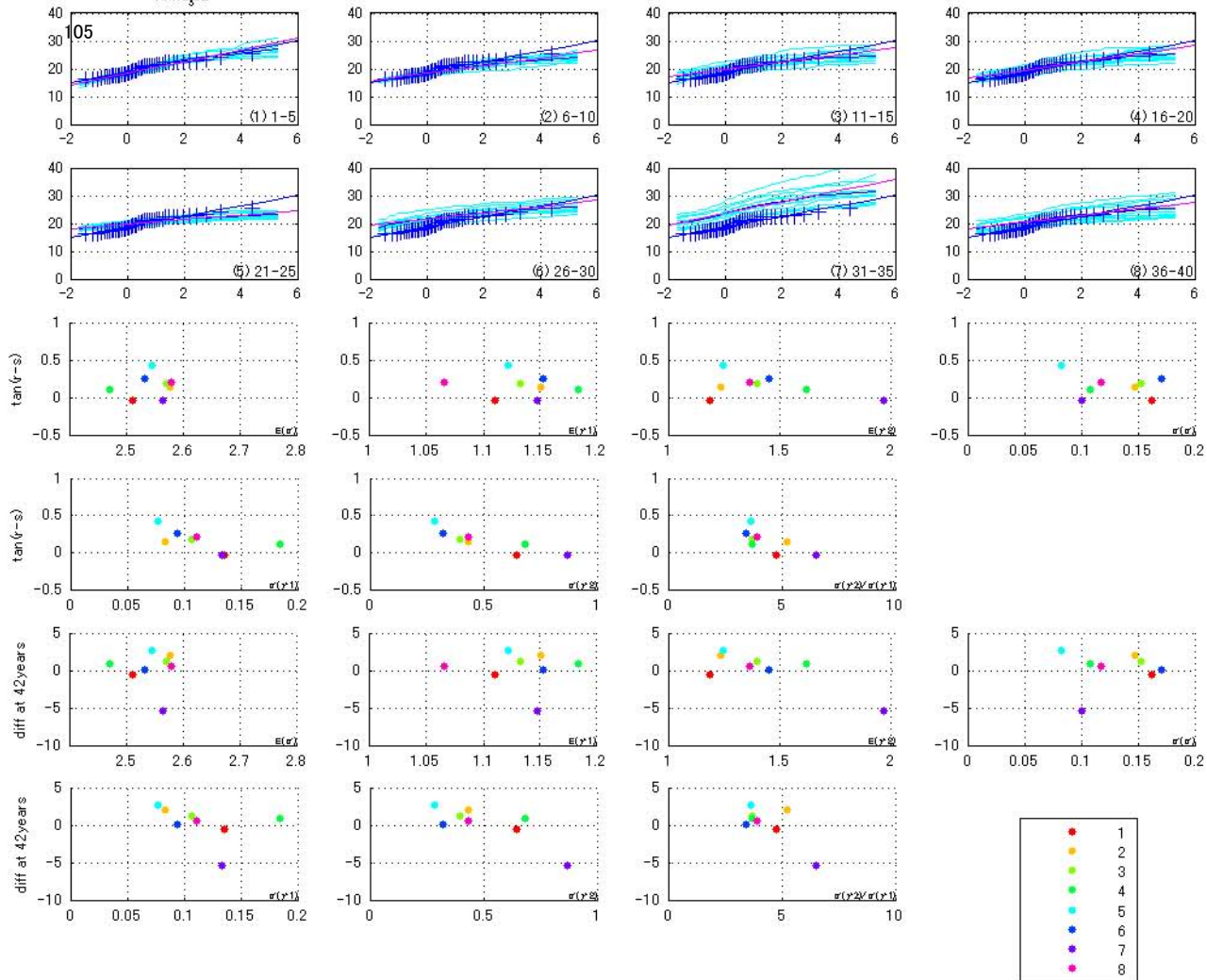




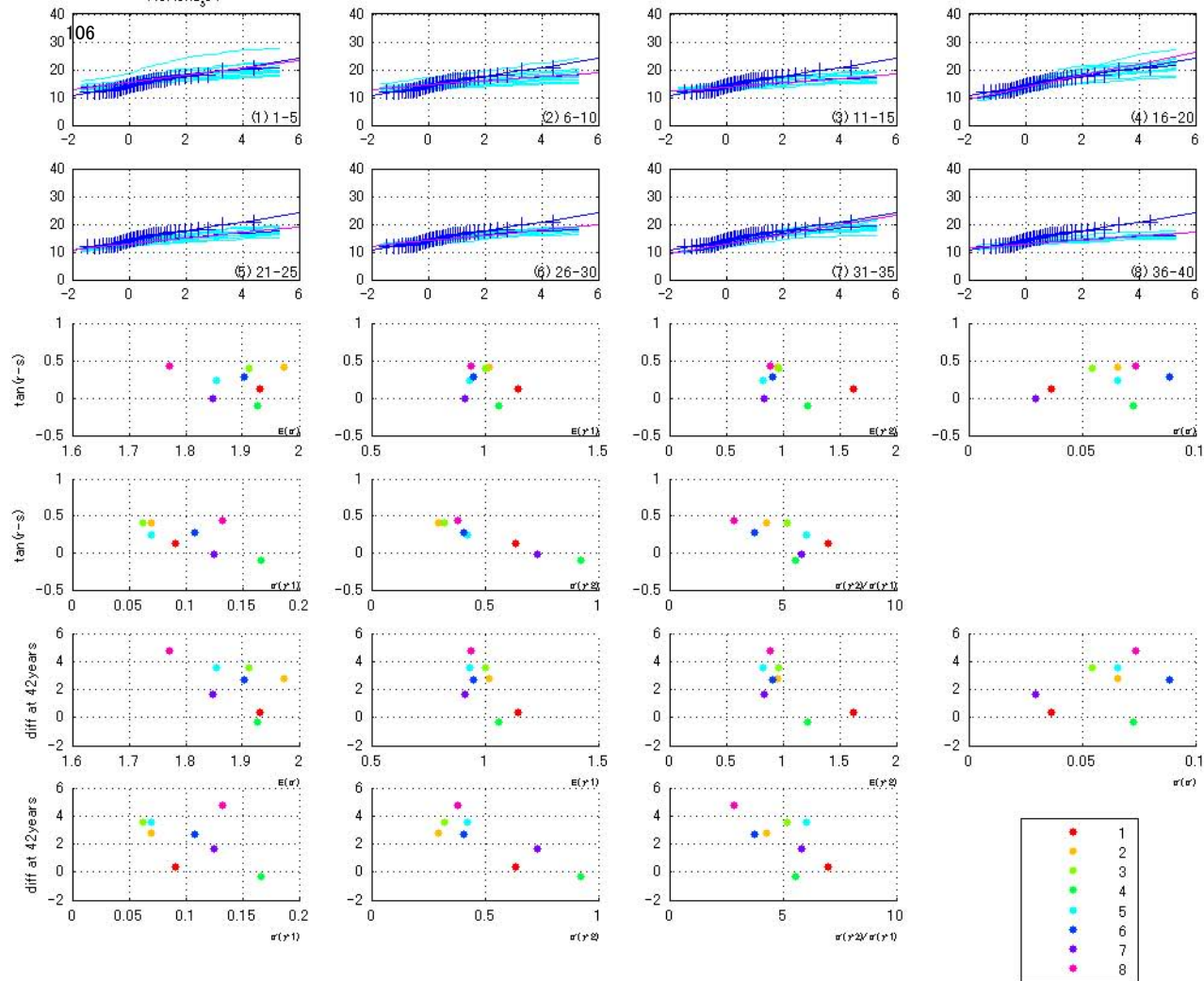
Hachinohe\_81



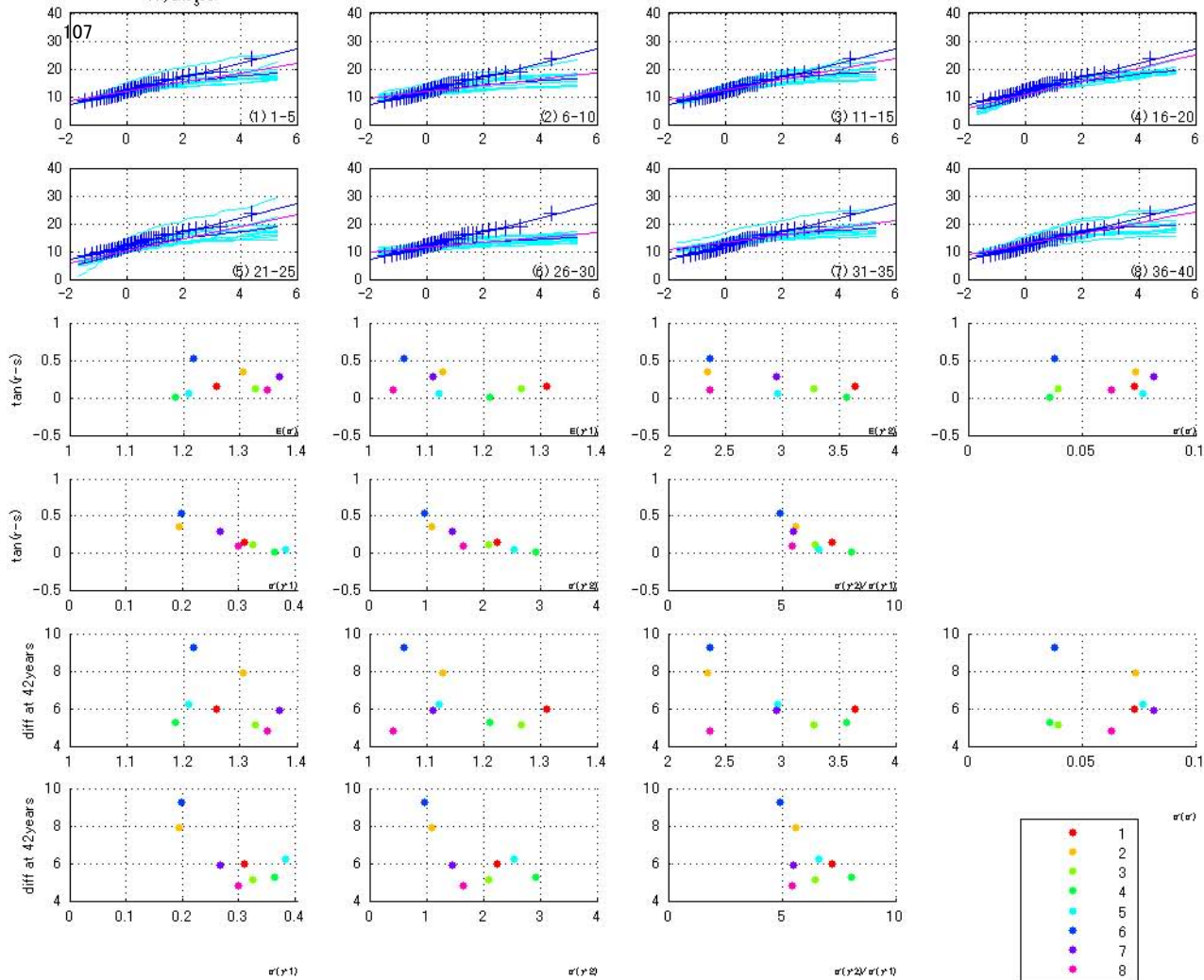
Akita\_82



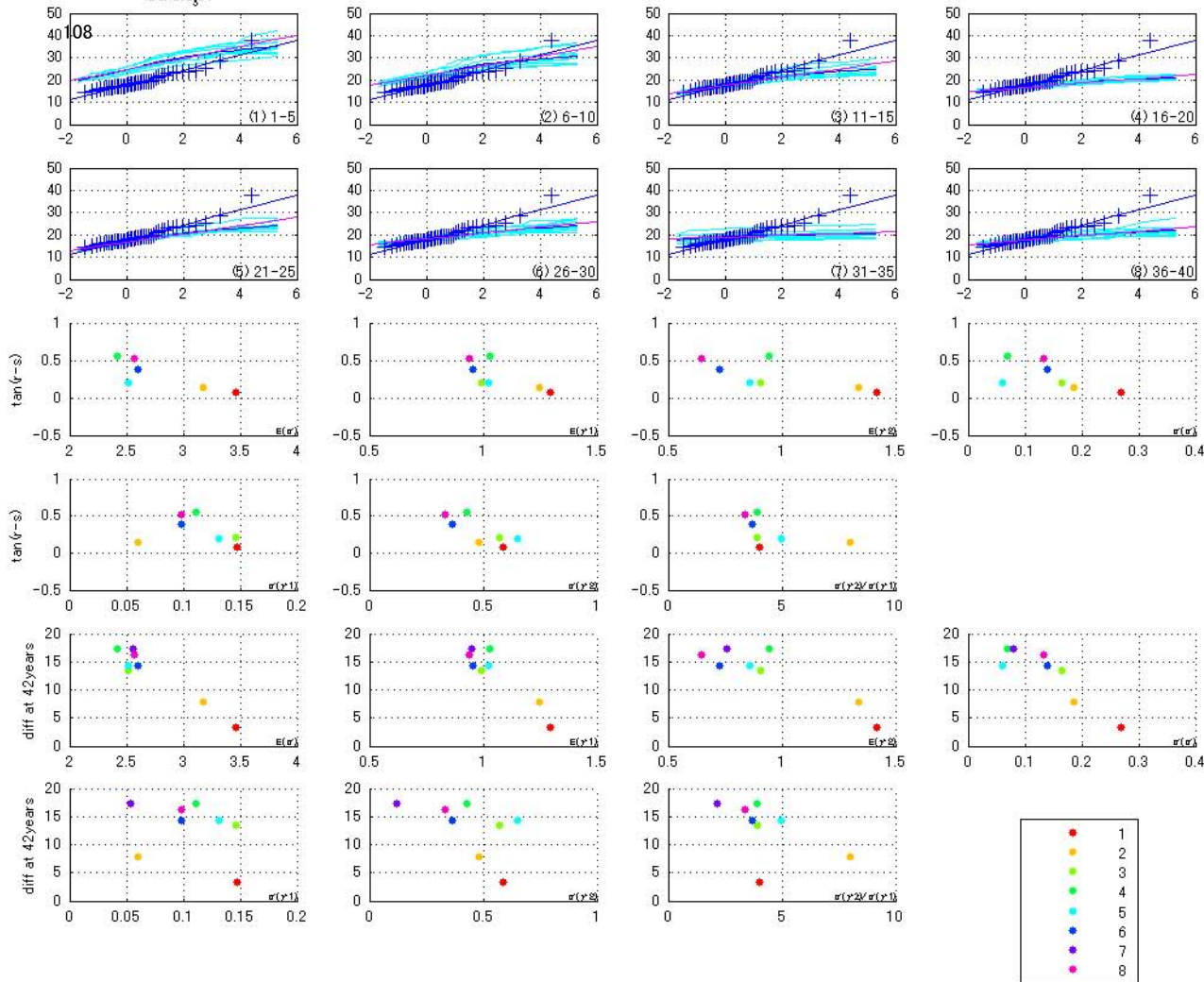
Morioka\_84



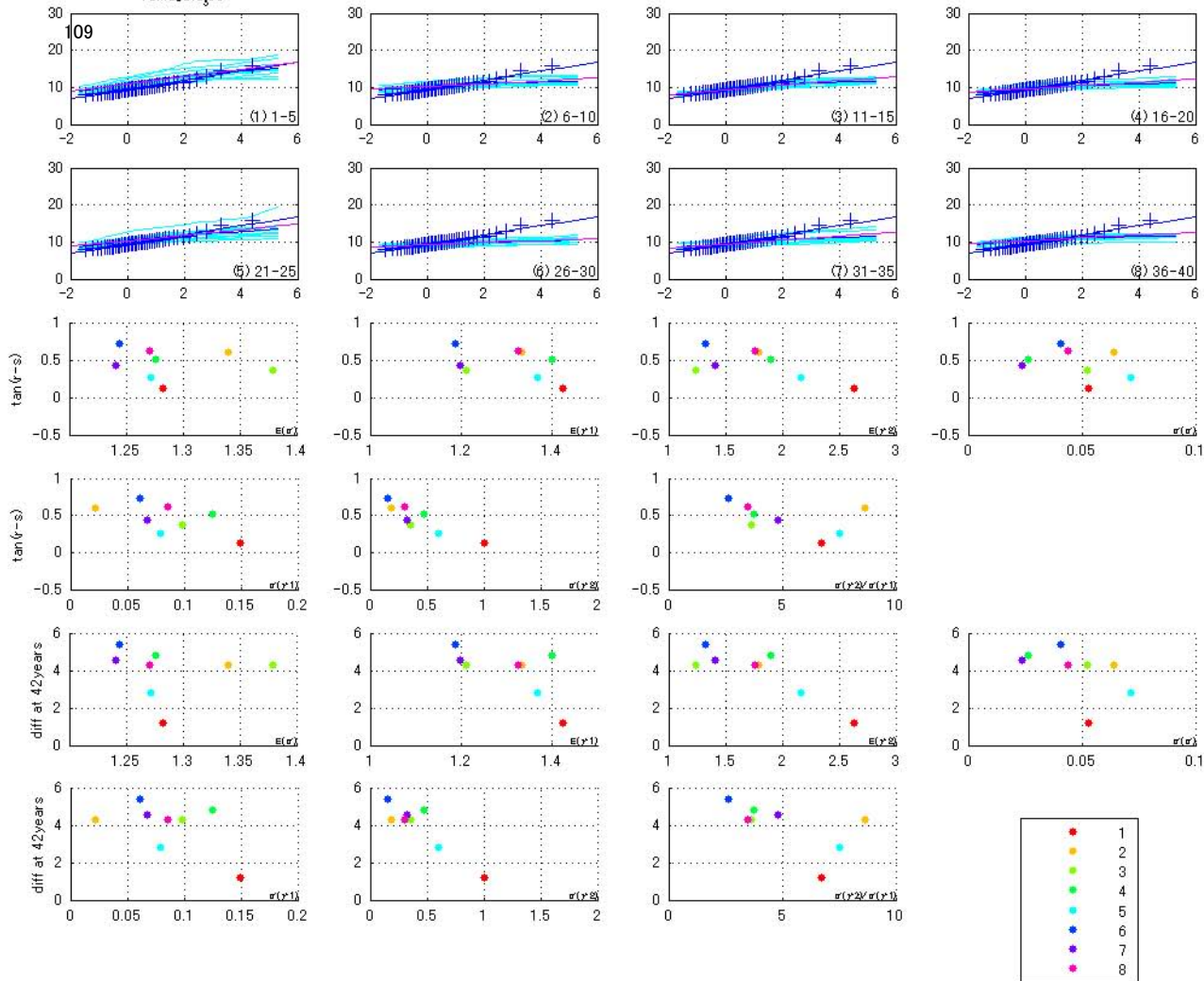
Miyako\_85



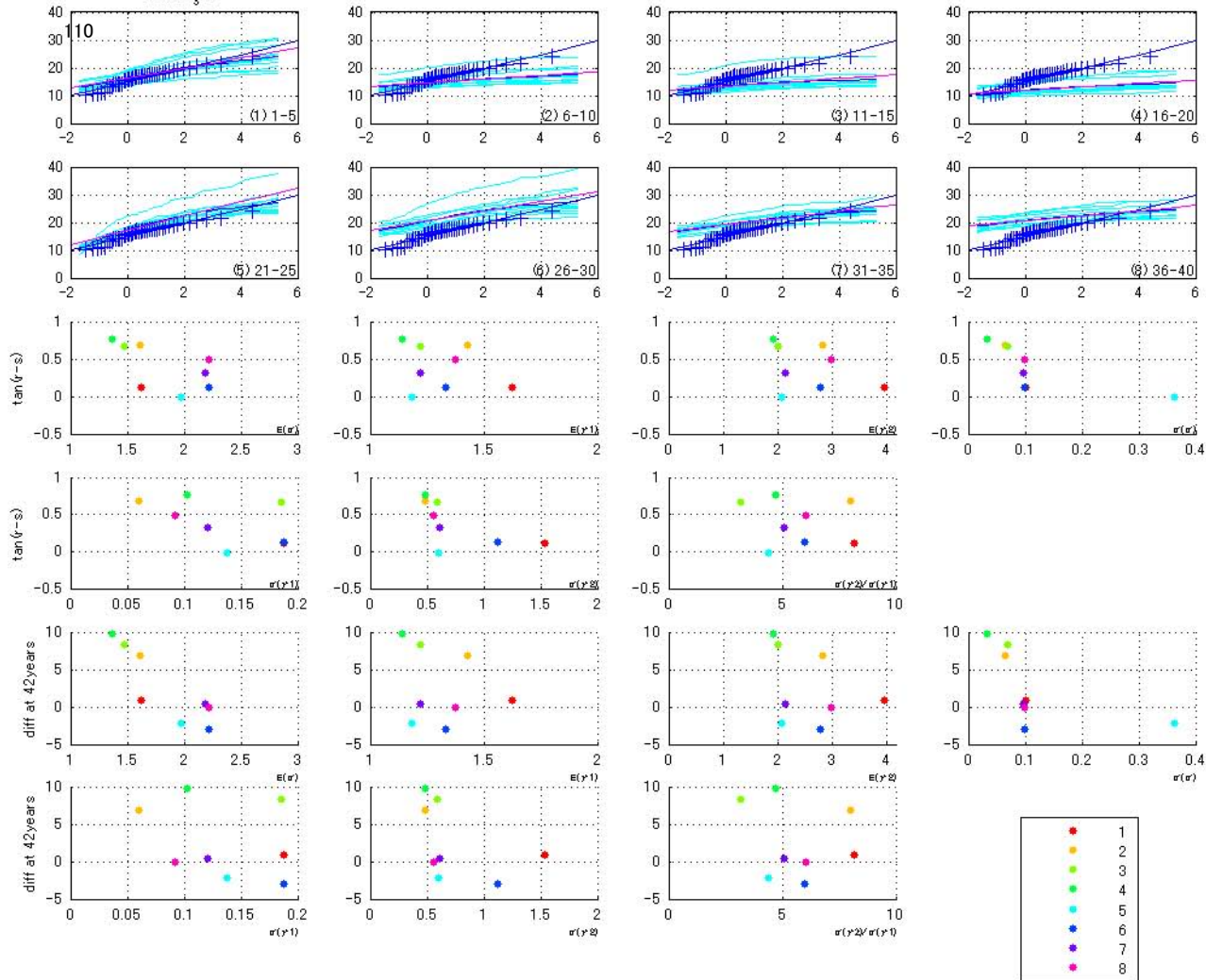
Sakata\_87



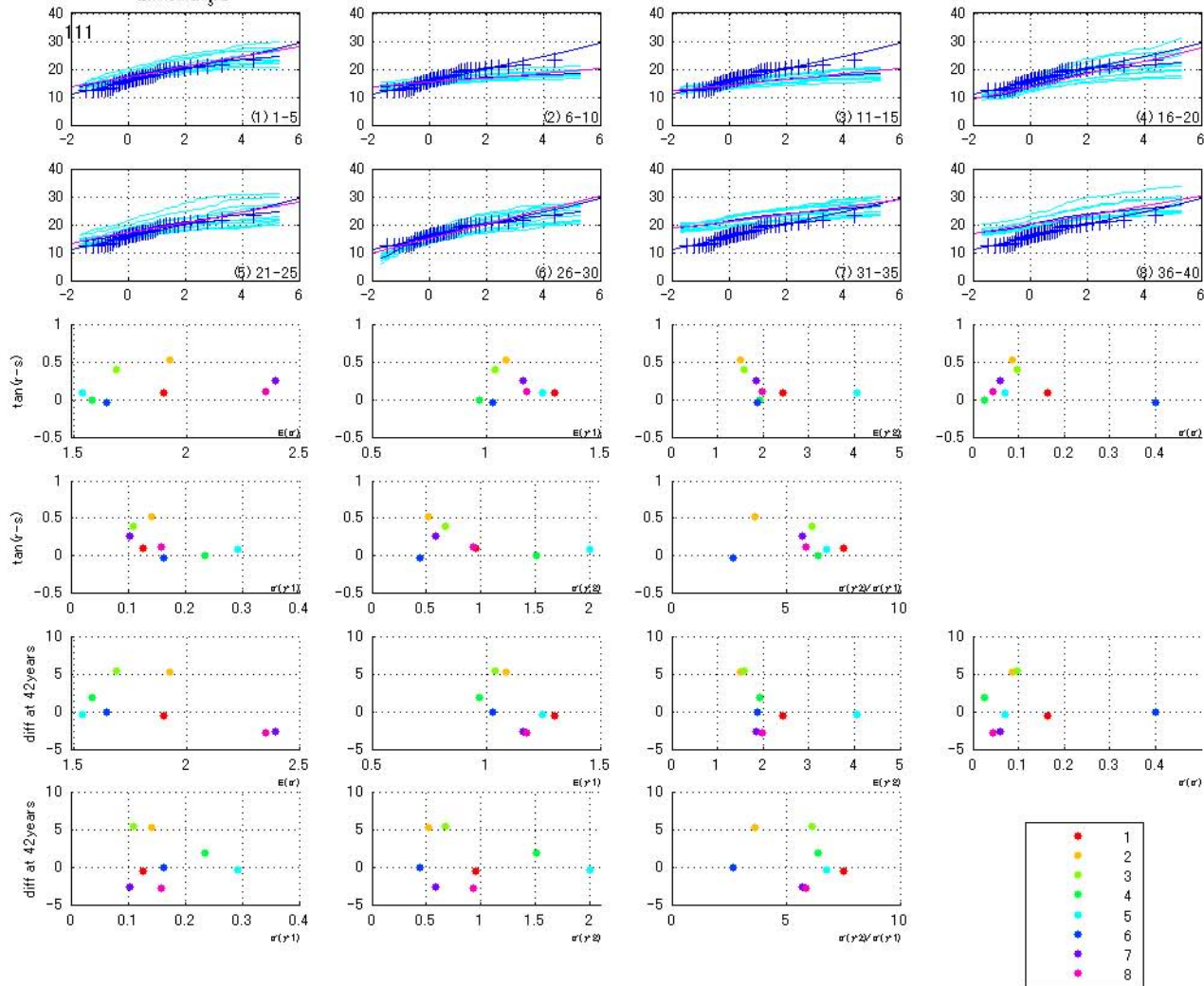
Yamagata\_88



Sendai\_90

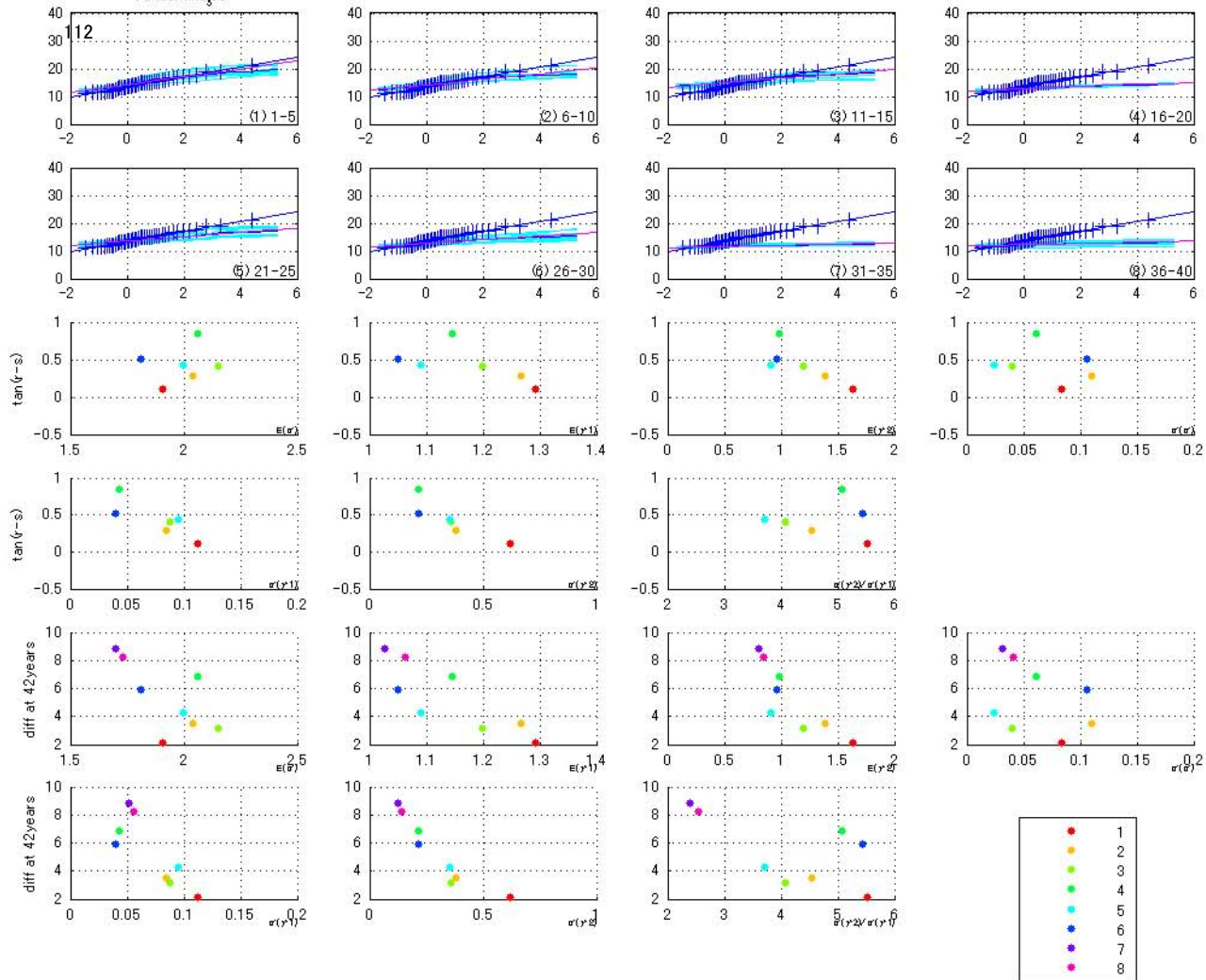


Ishinomaki\_92

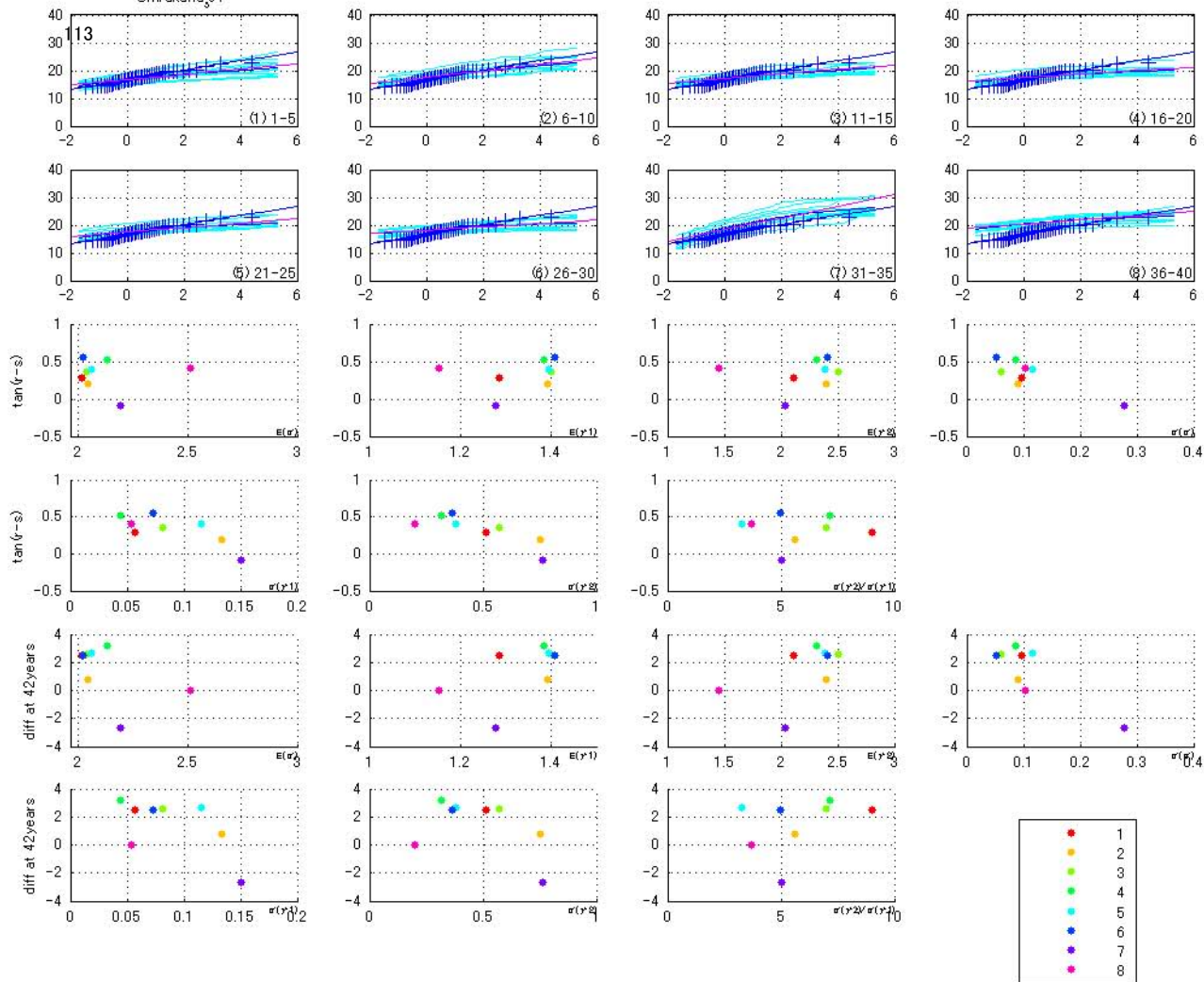




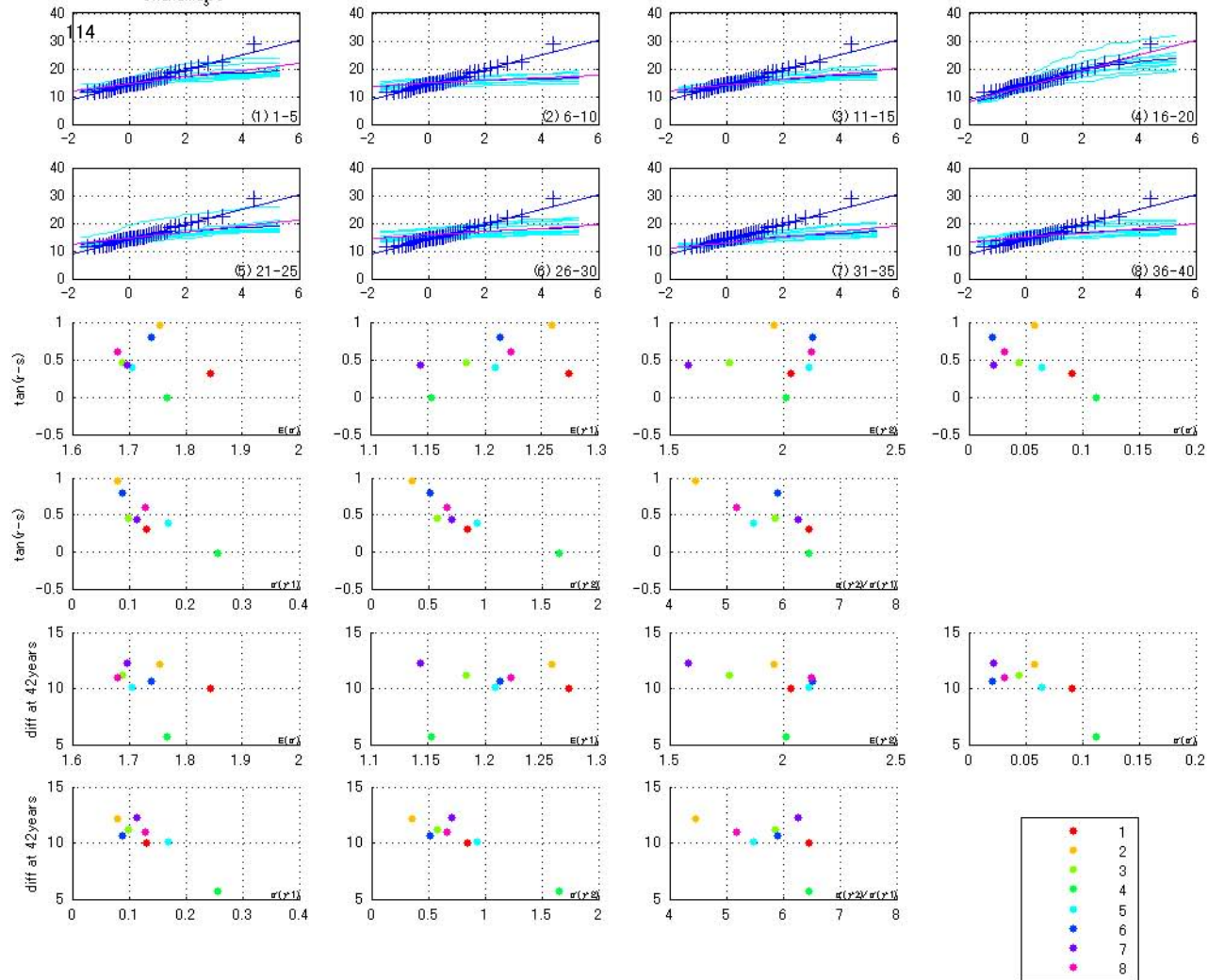
Fukushima\_95



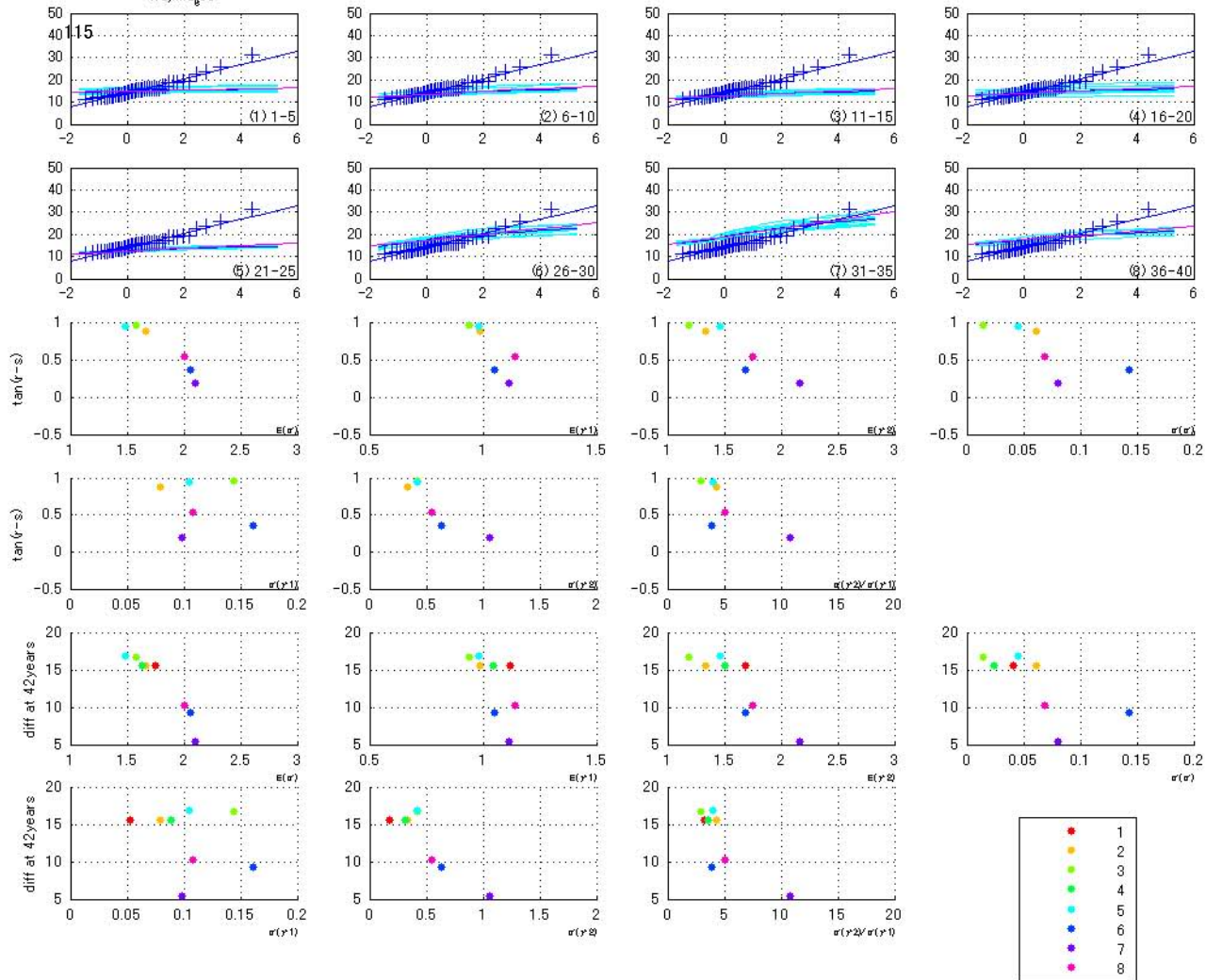
Shirakawa\_97



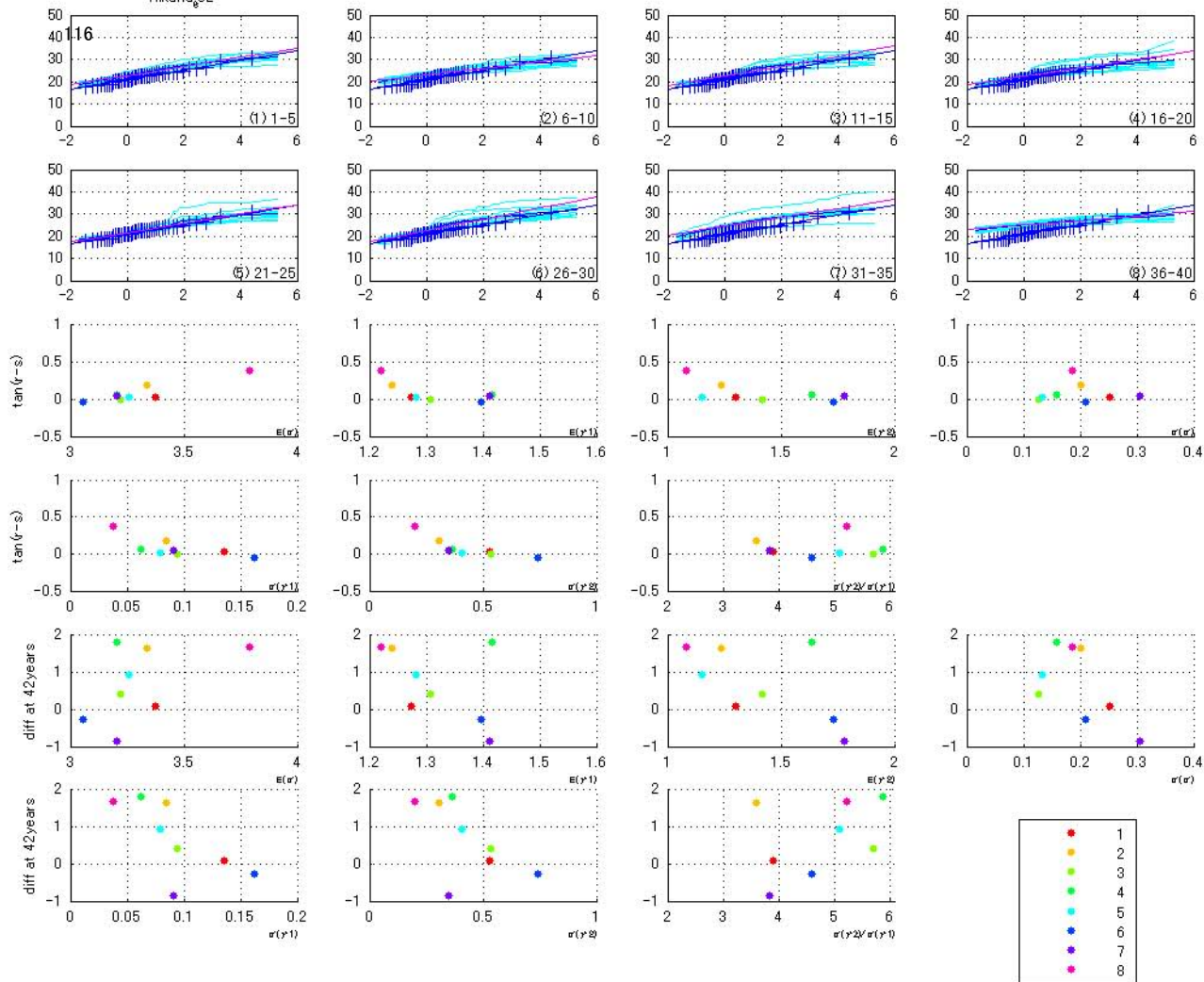
Onahama\_98



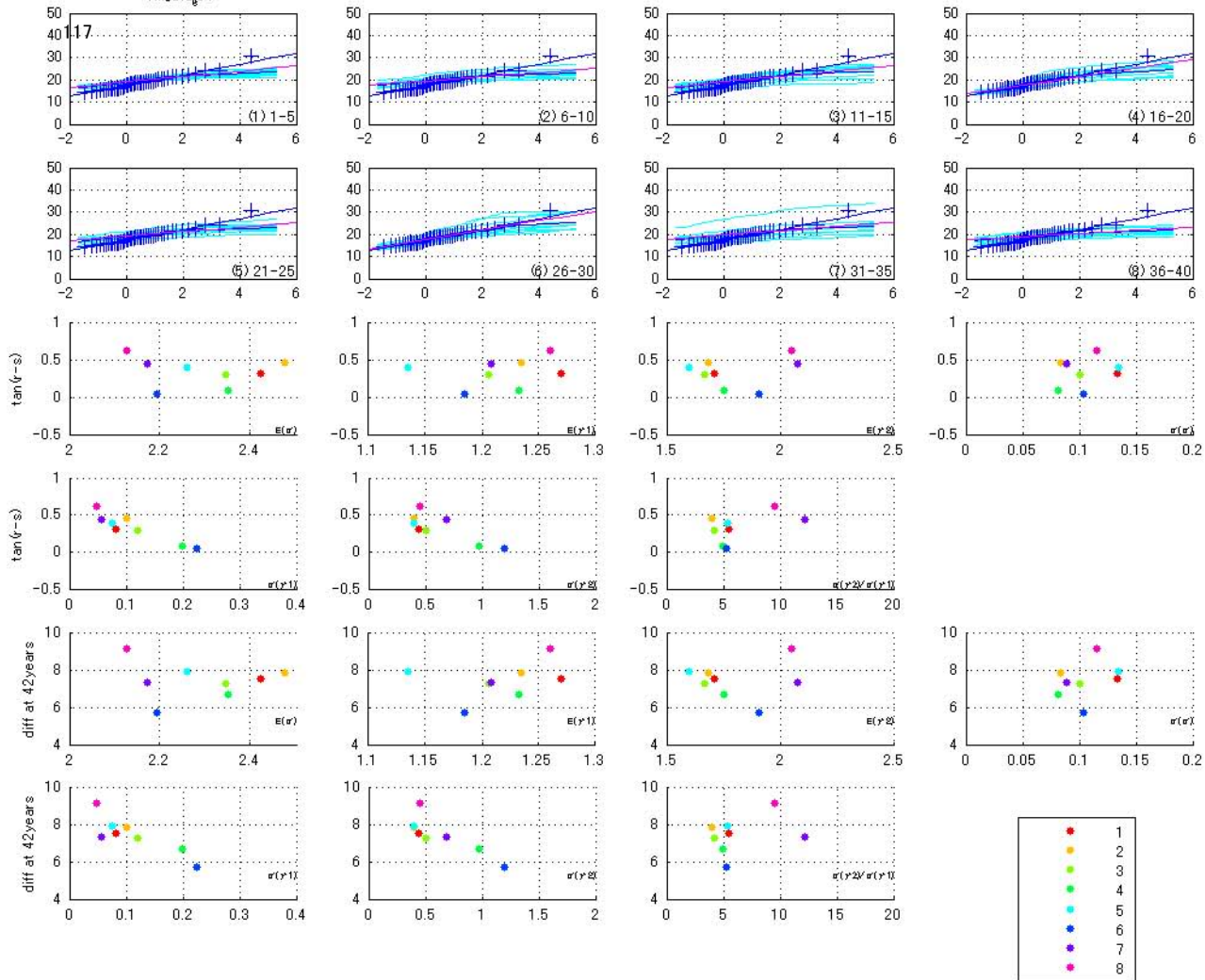
Wajima\_00

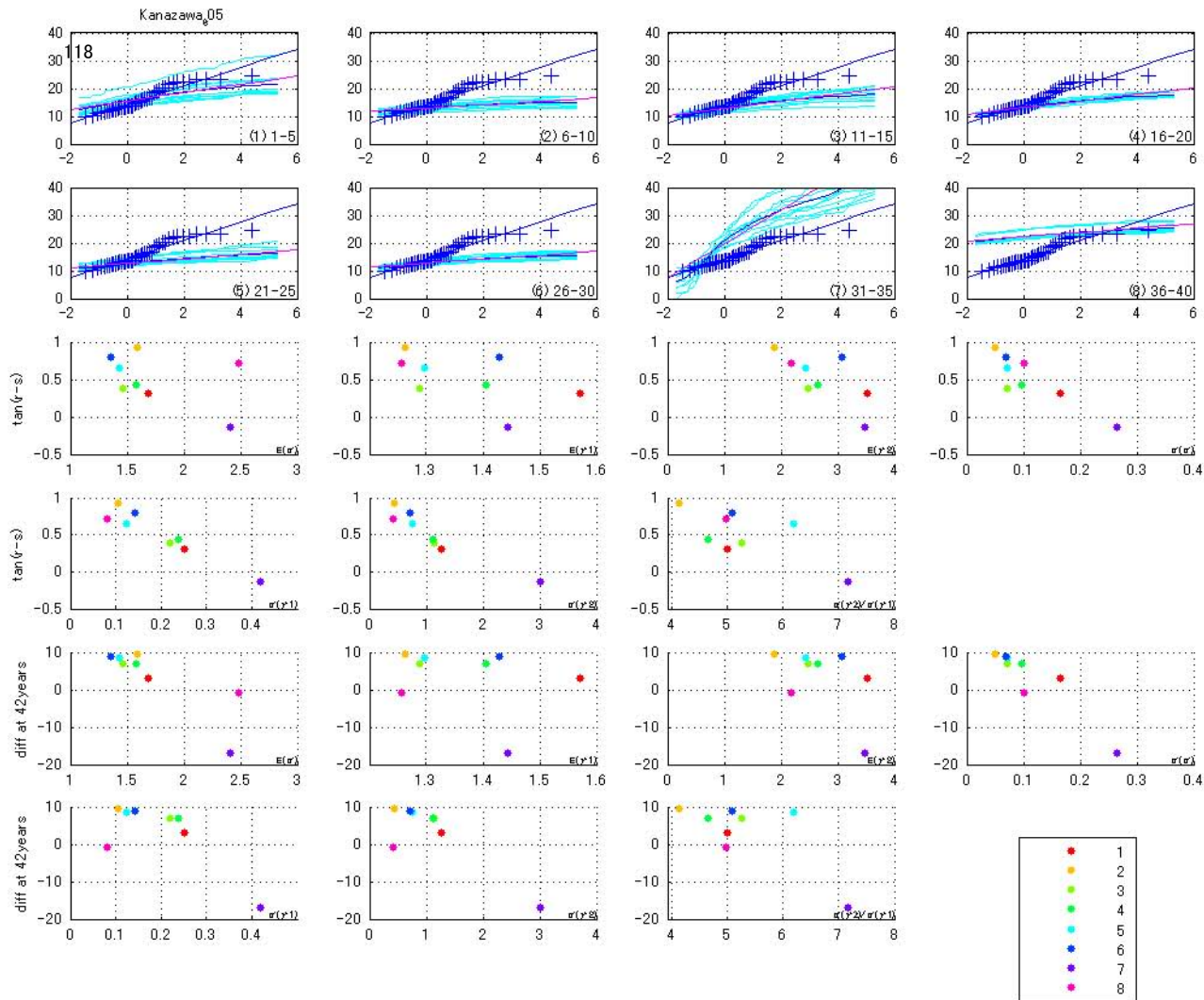


Aikawa\_02

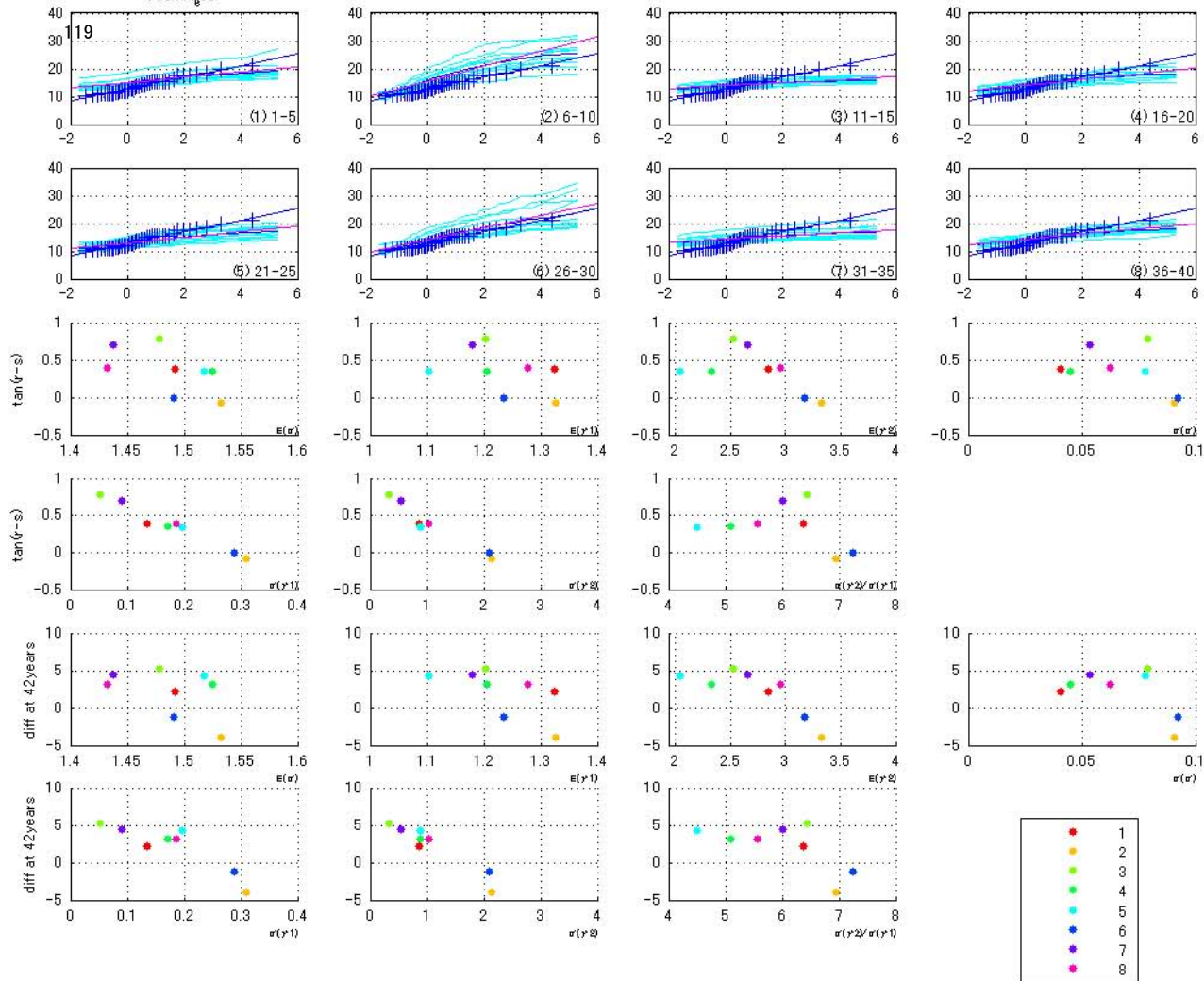


Niigata\_04



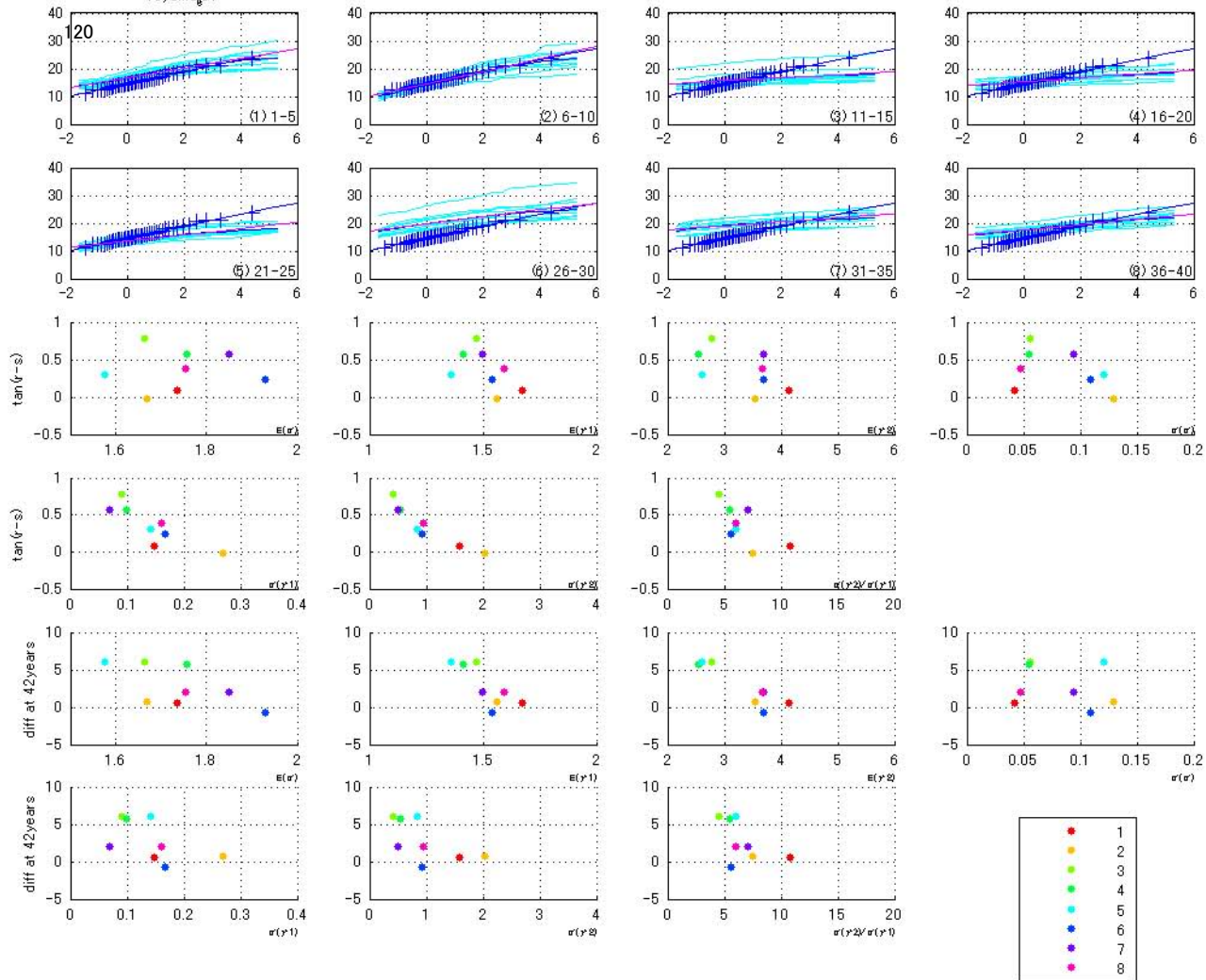


Fushiki\_06

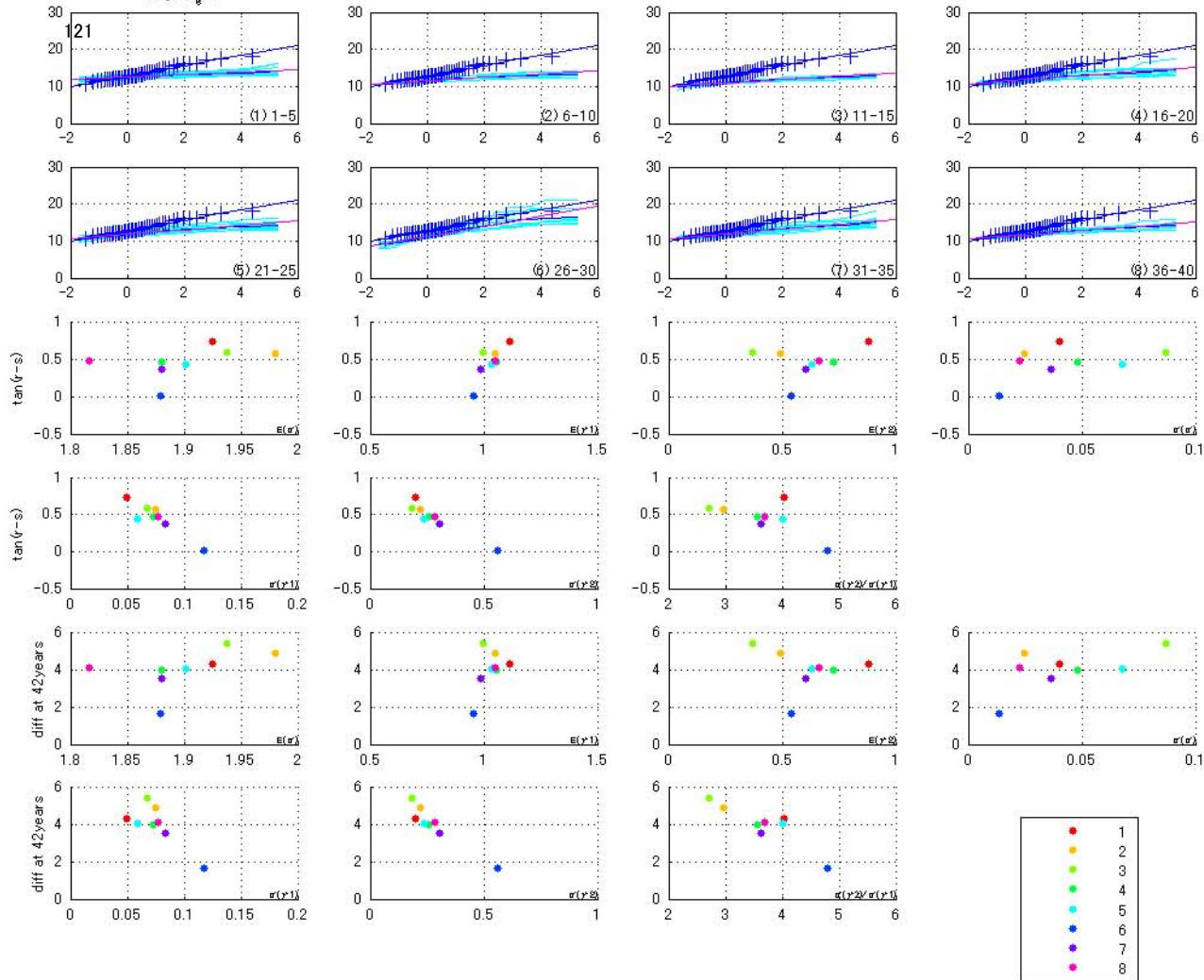




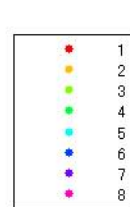
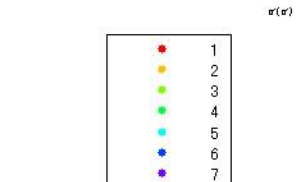
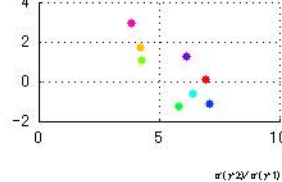
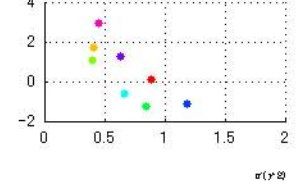
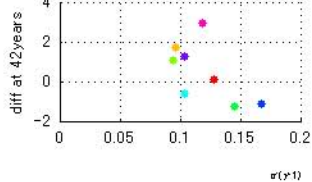
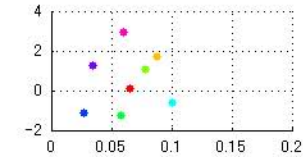
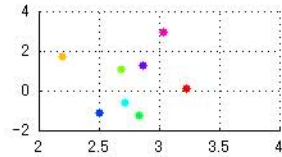
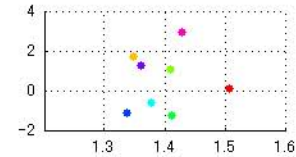
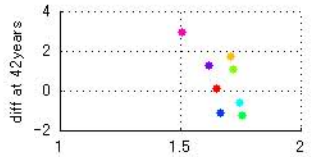
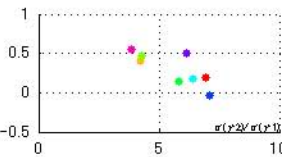
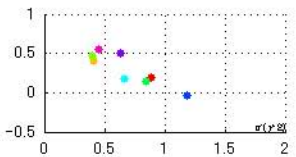
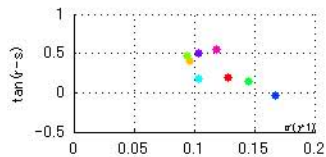
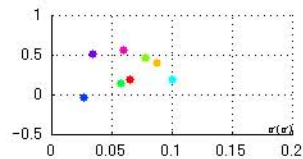
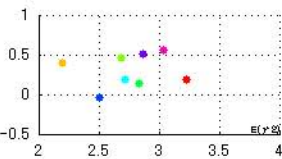
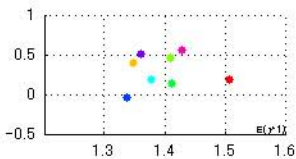
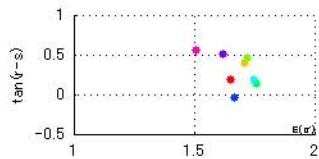
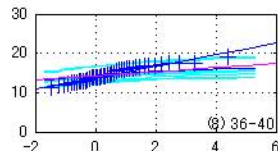
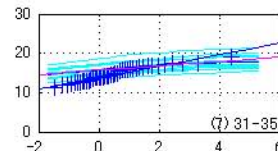
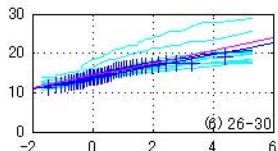
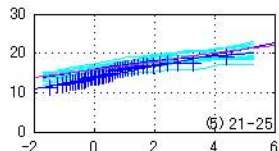
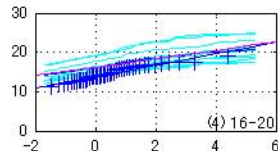
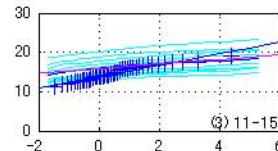
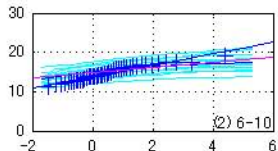
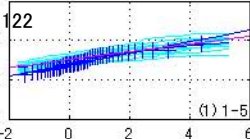
Toyama\_07



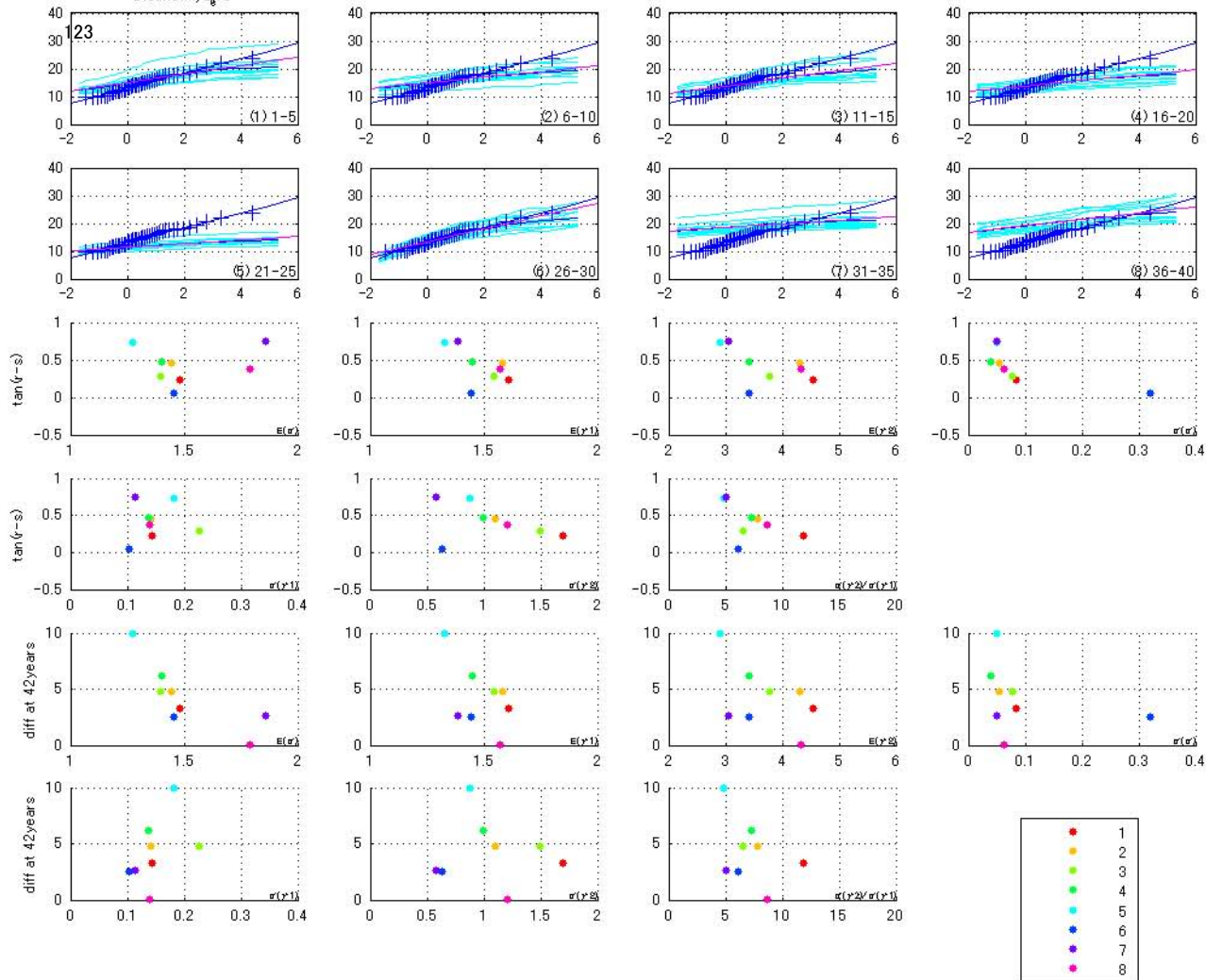
Nagano<sub>0</sub>10



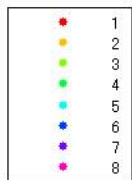
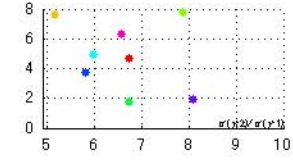
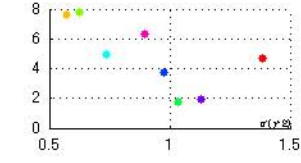
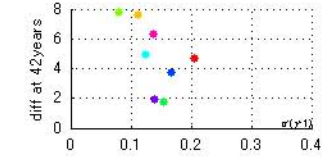
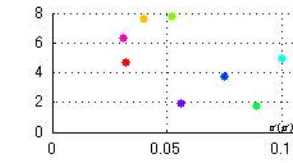
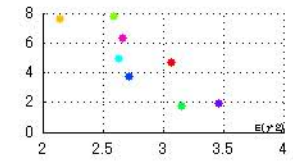
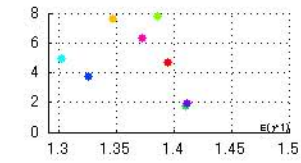
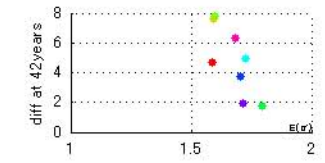
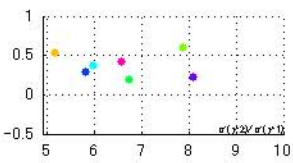
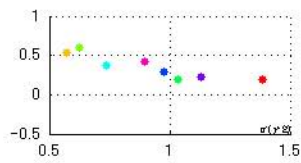
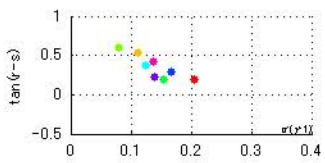
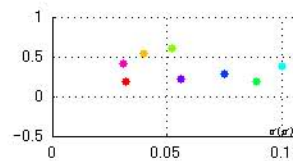
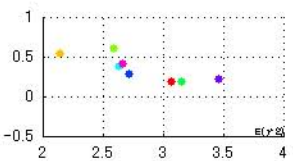
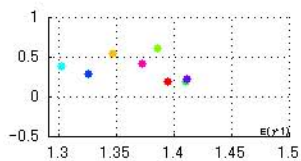
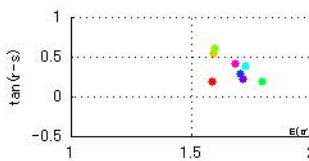
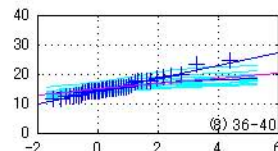
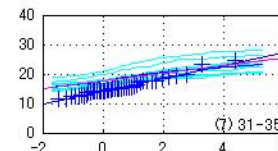
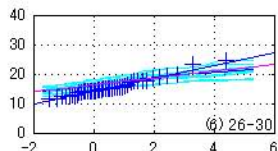
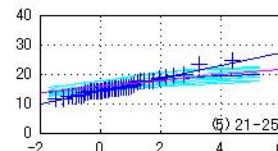
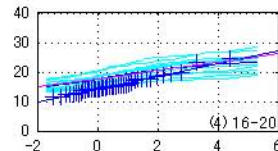
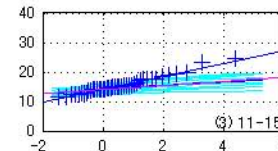
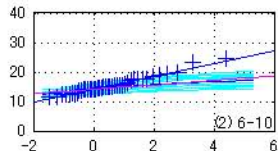
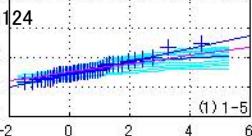
Takada<sub>12</sub>



Utsunomiya<sub>15</sub>

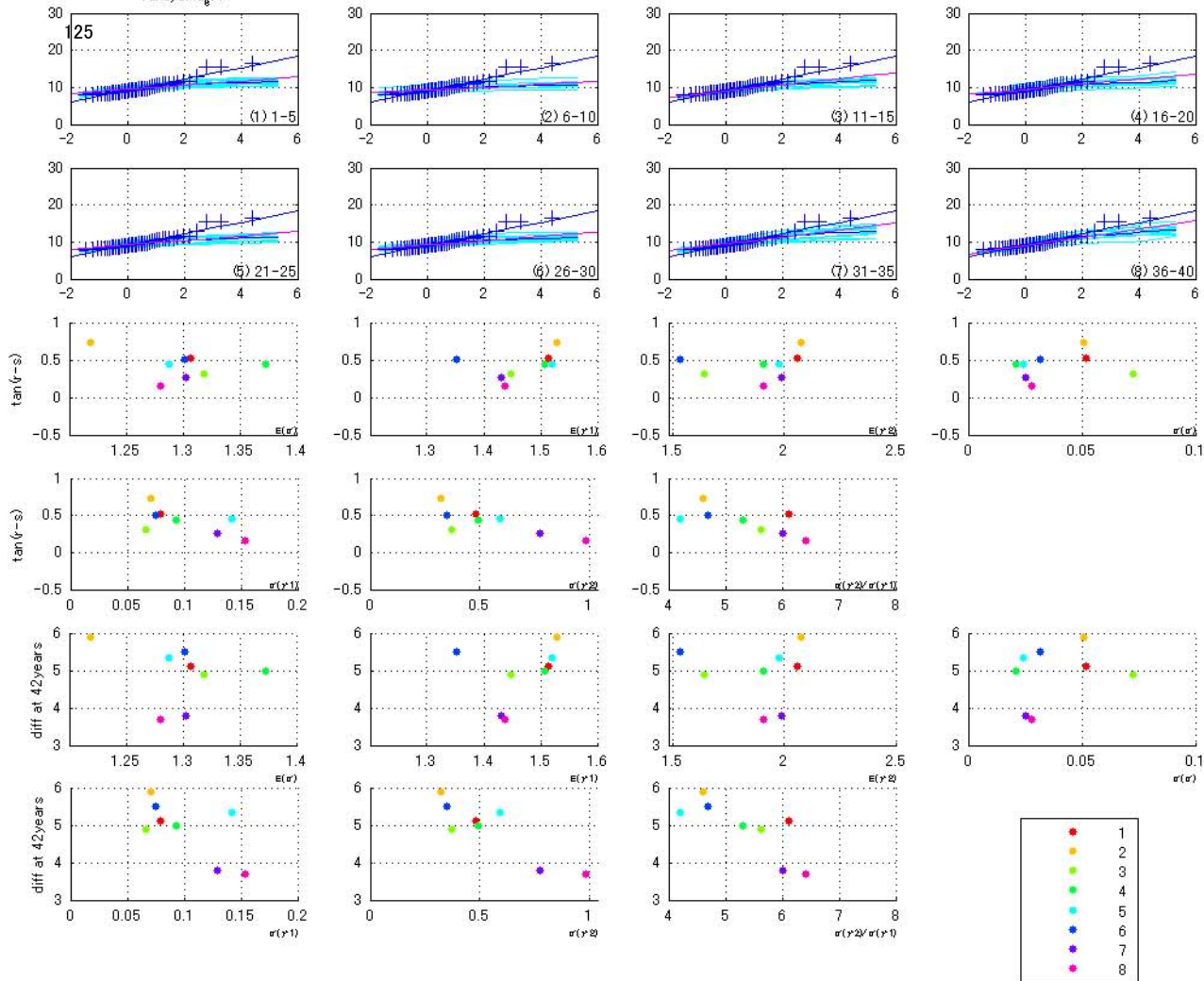


Fukui<sub>g</sub>16

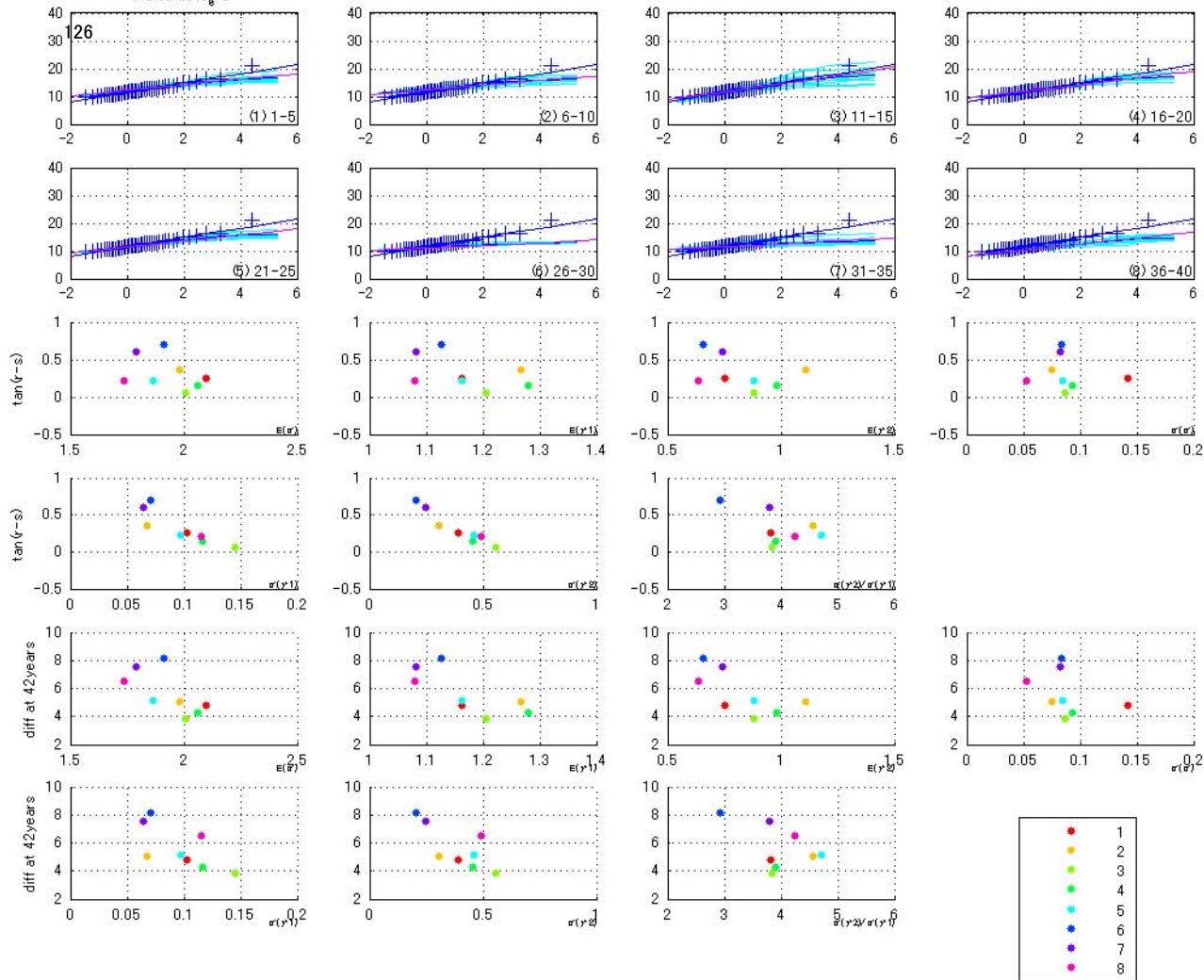


Takayama<sub>8</sub>17

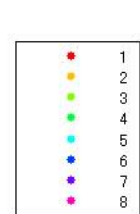
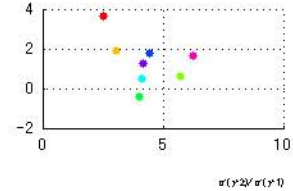
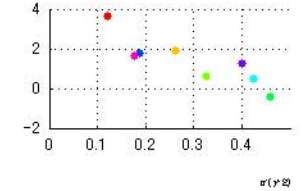
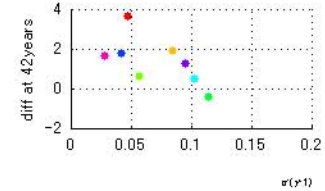
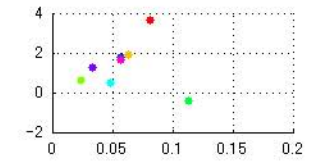
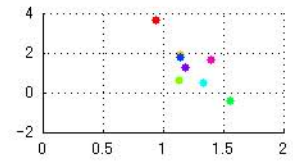
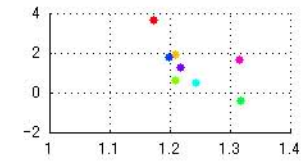
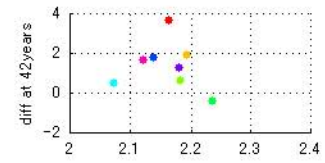
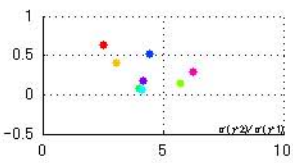
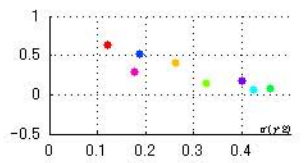
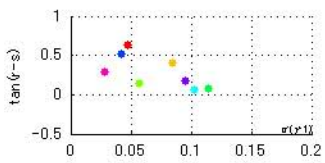
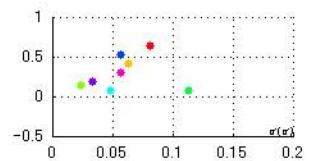
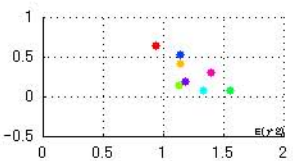
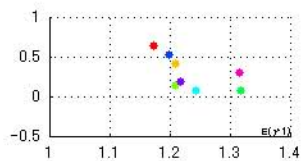
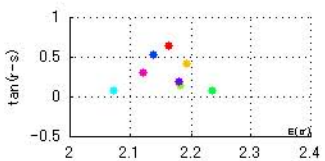
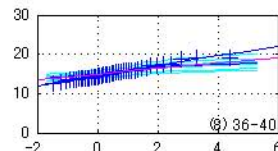
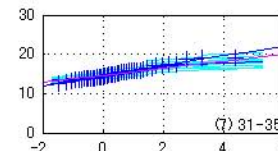
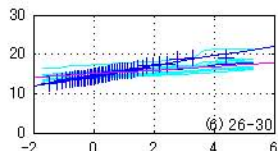
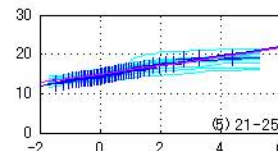
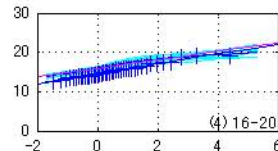
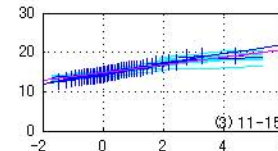
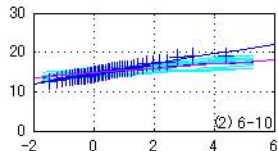
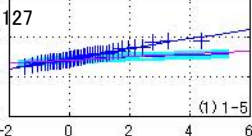
25



Matsumoto<sub>0</sub>18



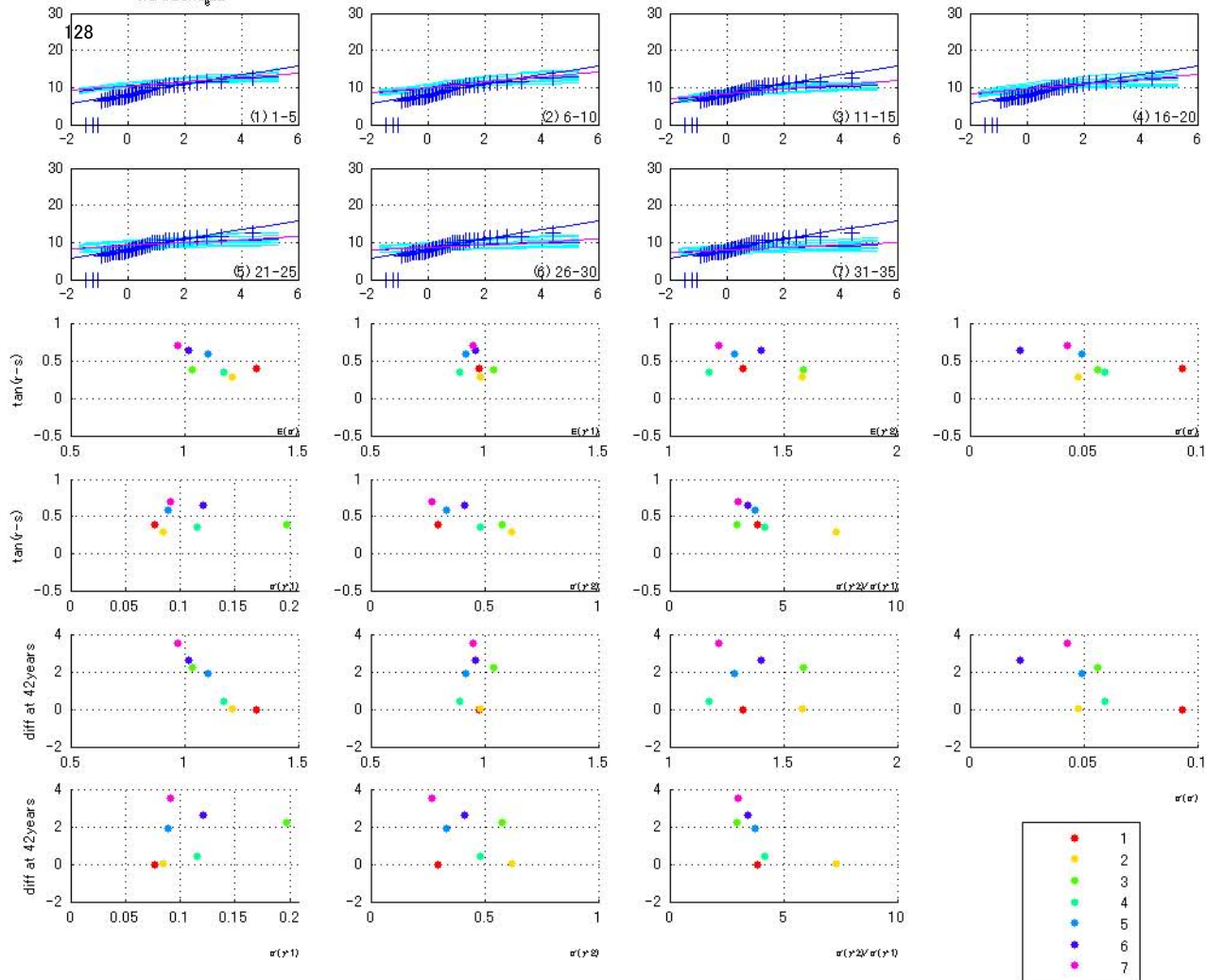
Suwa<sub>20</sub>



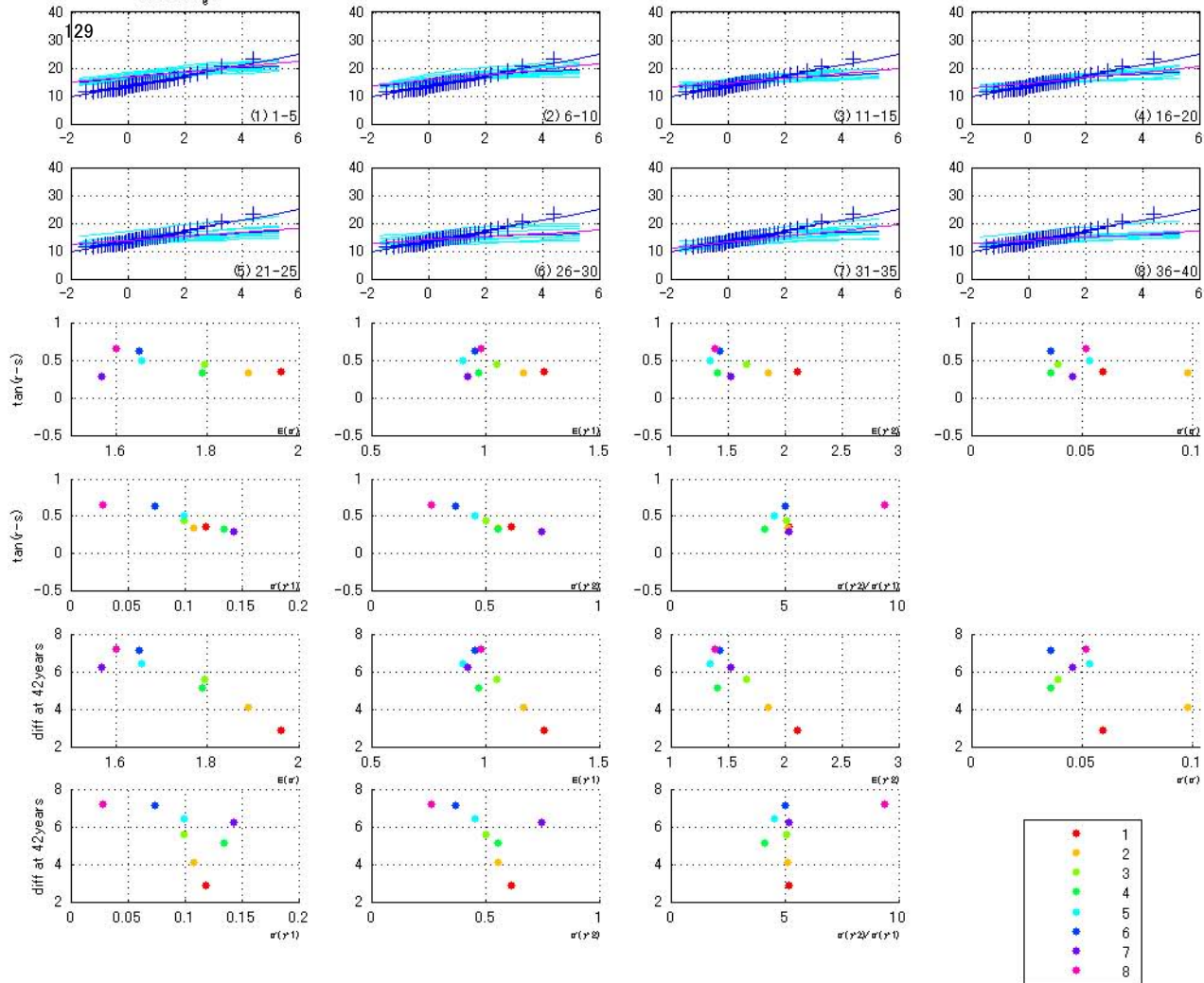


Karuzawa22

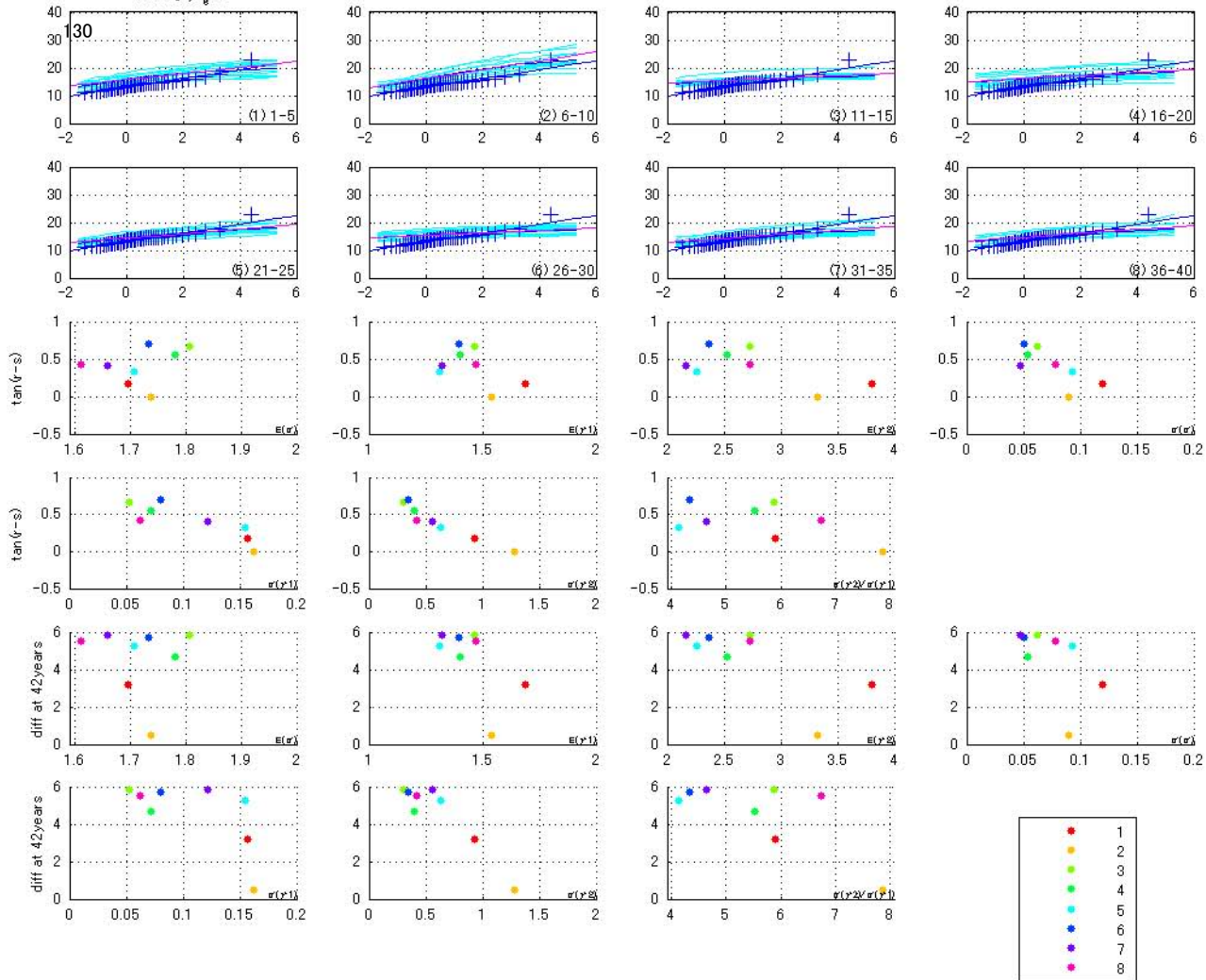
128



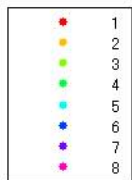
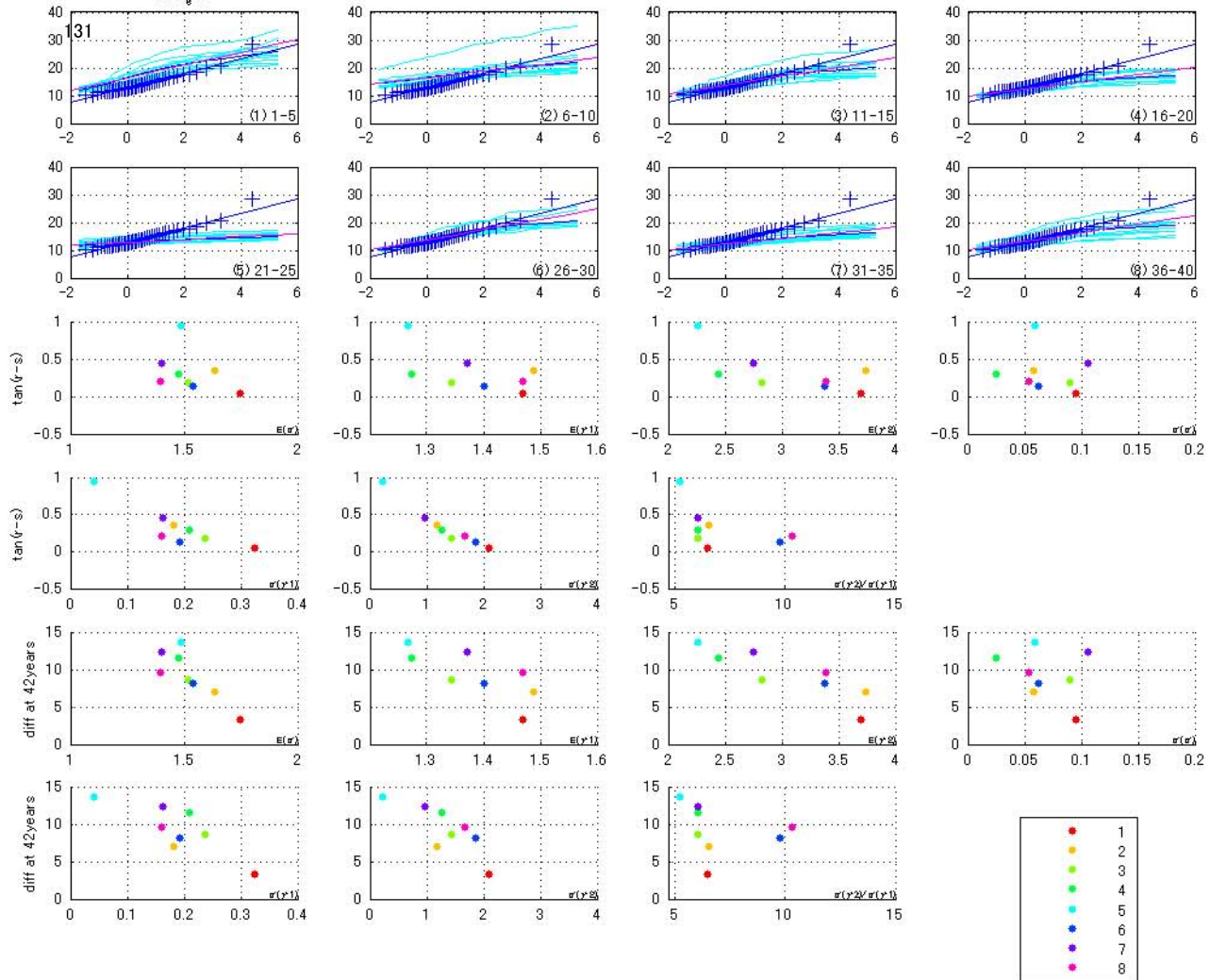
Maebashi<sub>24</sub>

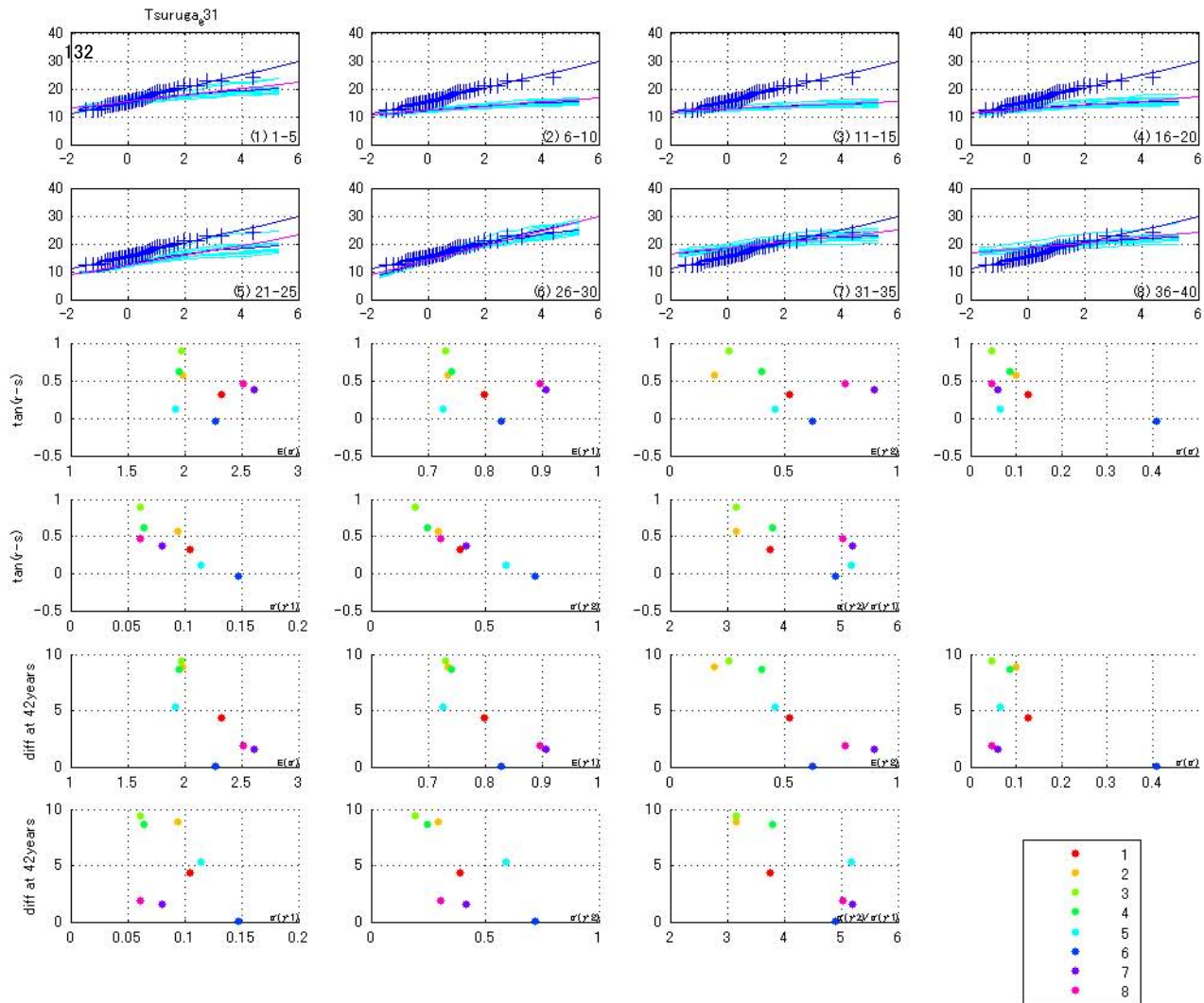


Kumagaya<sub>26</sub>

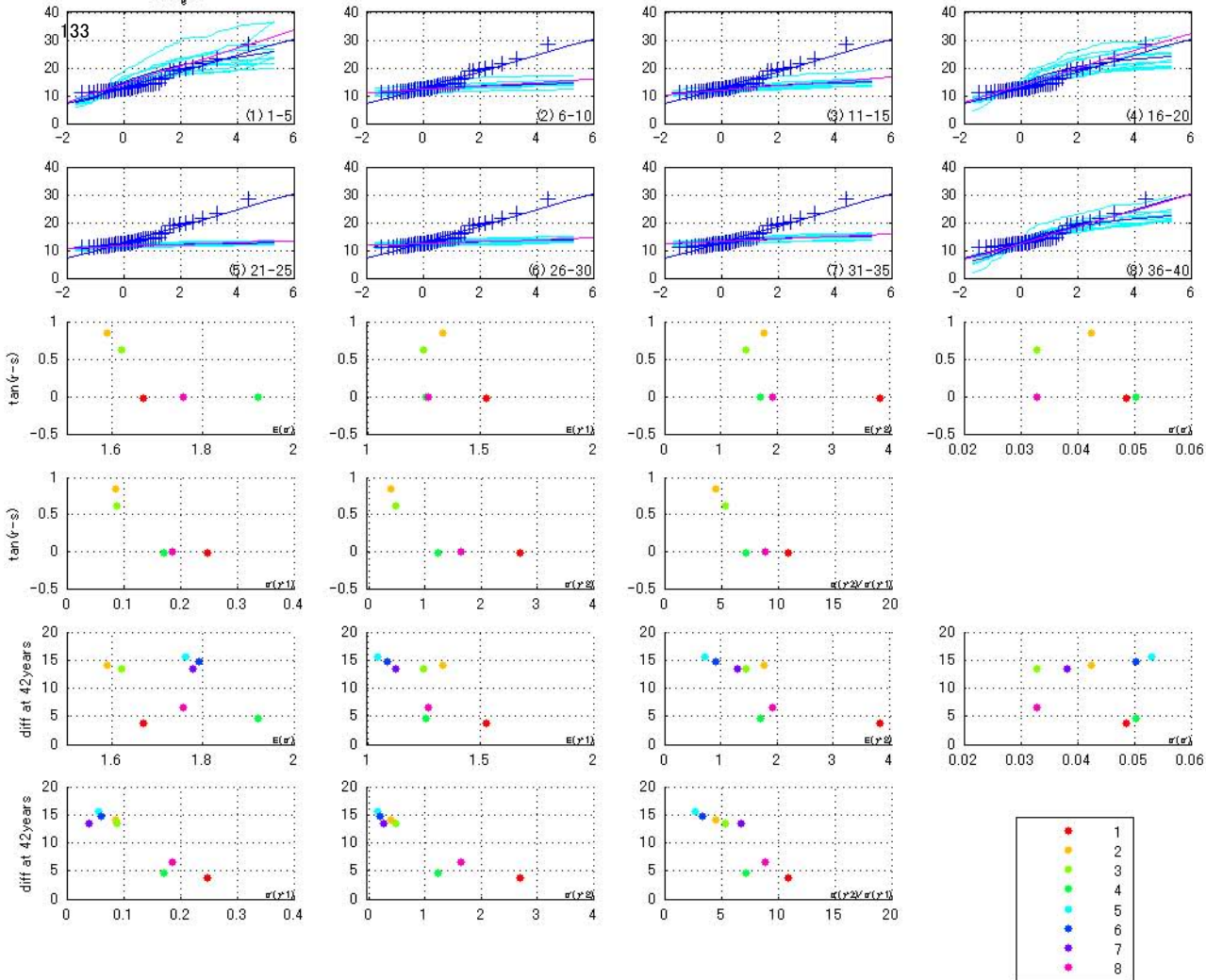


Mito<sub>6</sub><sup>29</sup>



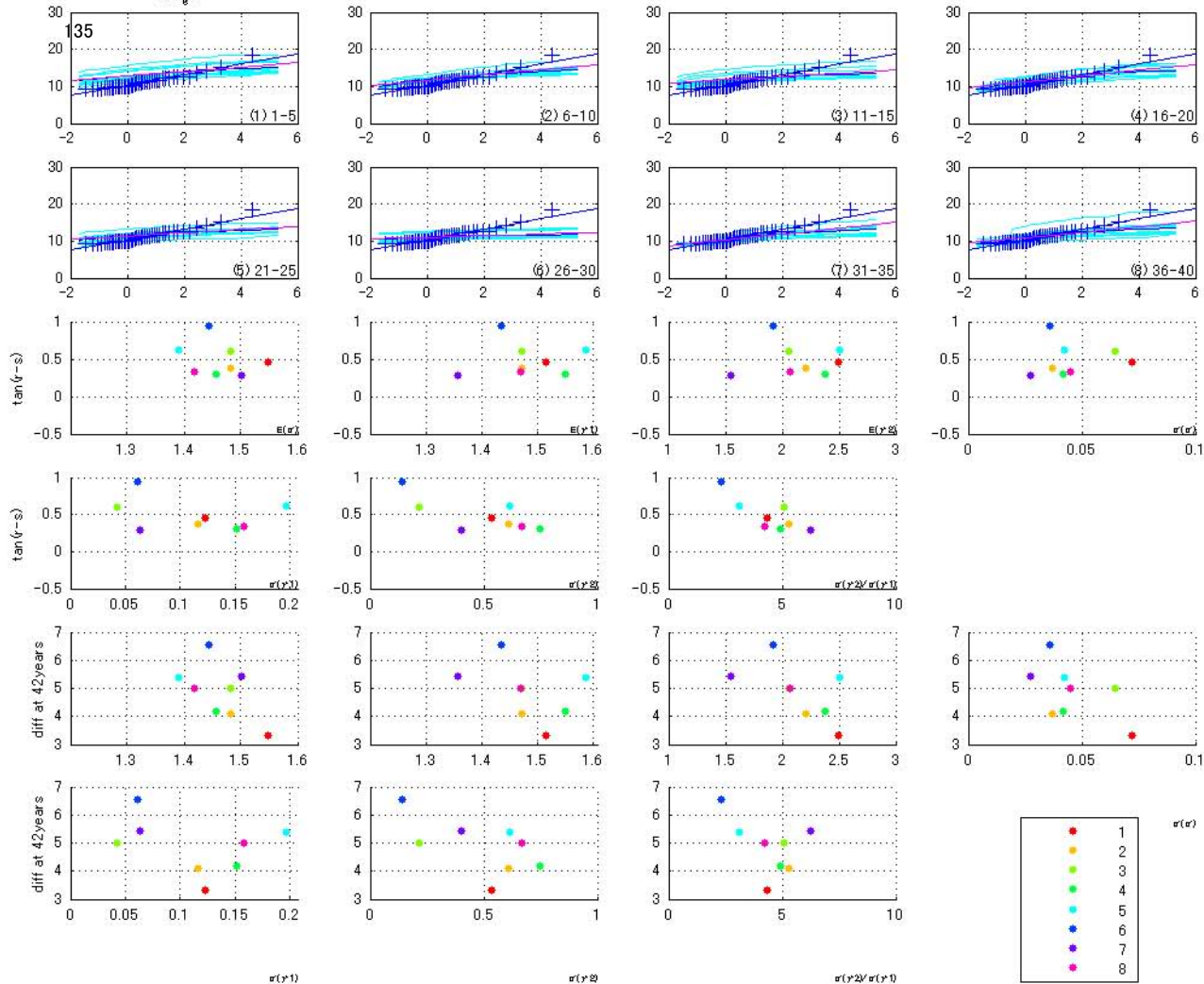


Gifu<sub>32</sub>

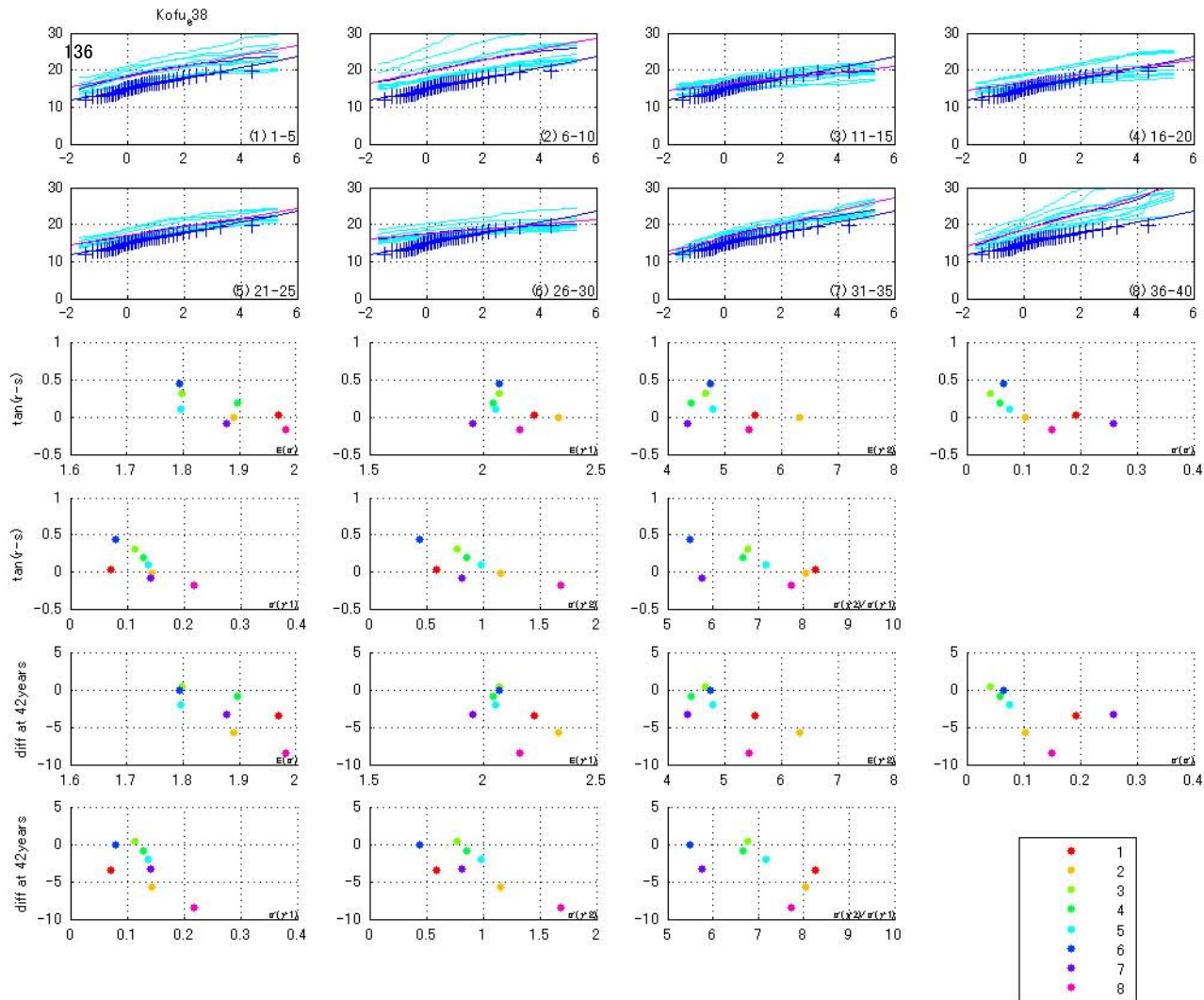




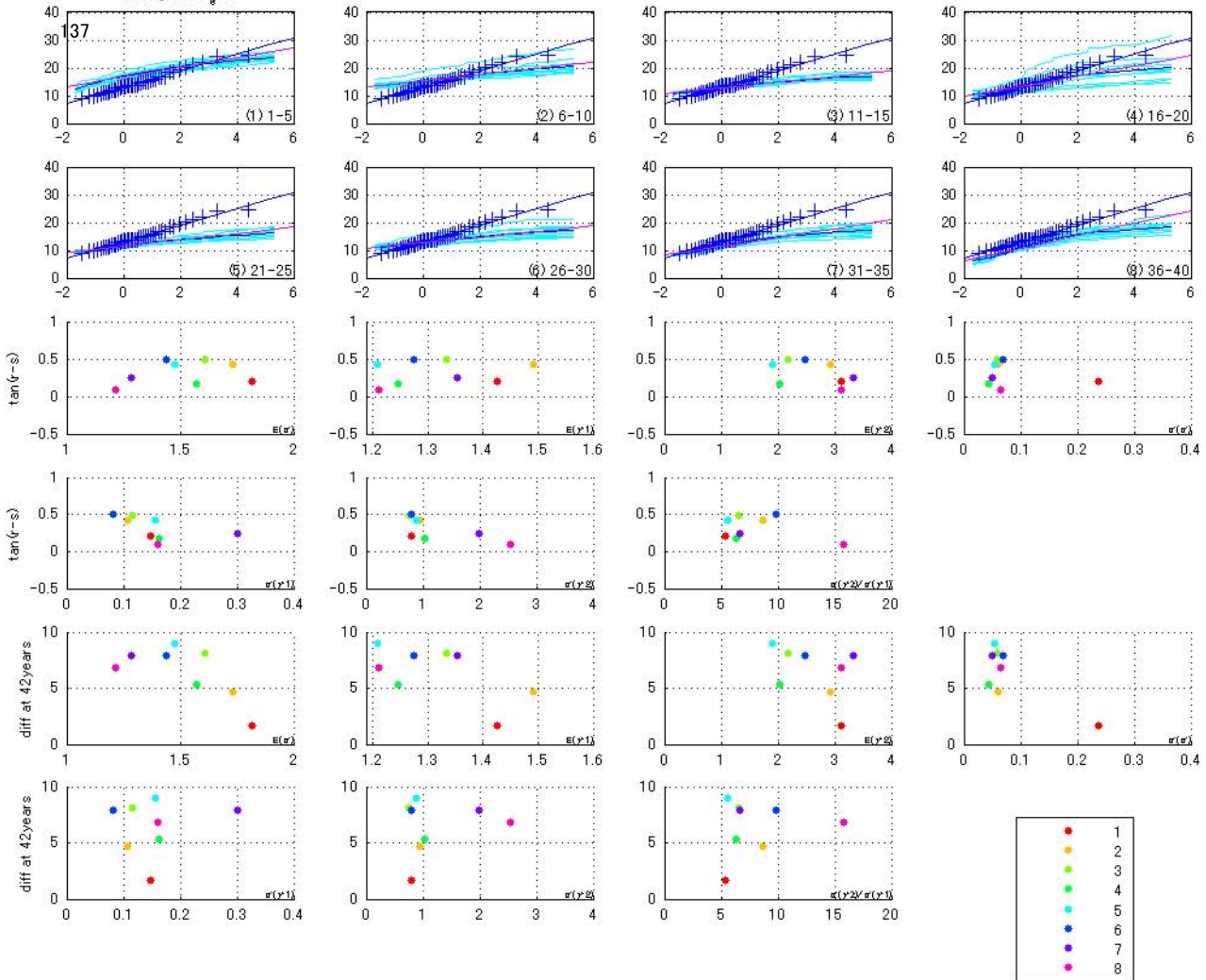
Ida<sub>37</sub>



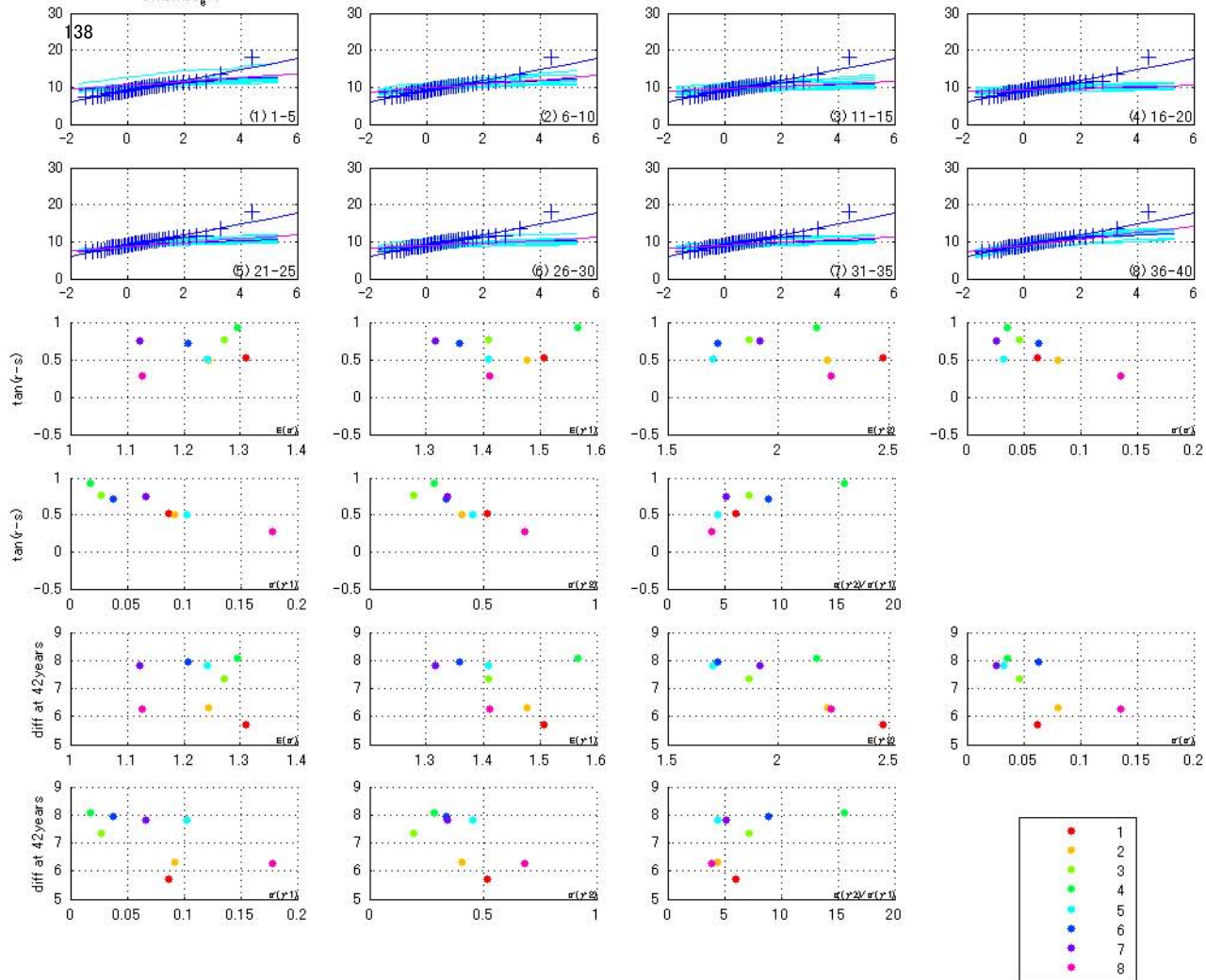


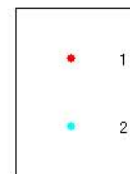
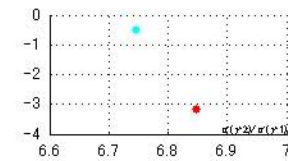
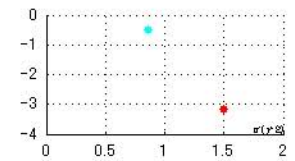
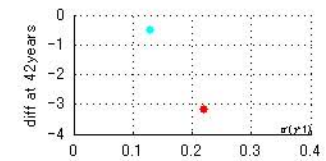
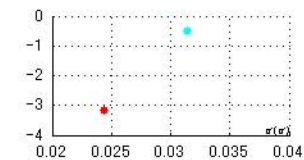
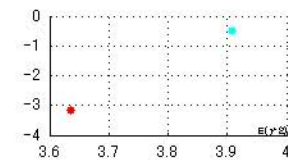
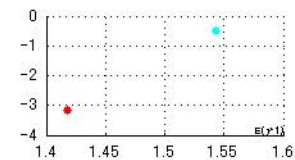
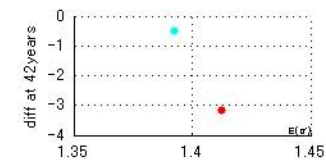
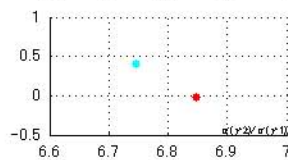
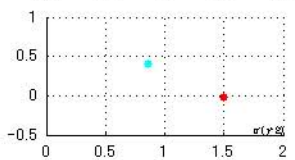
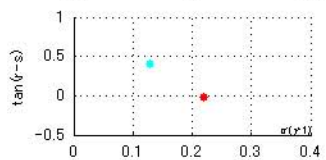
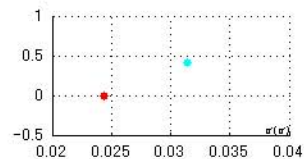
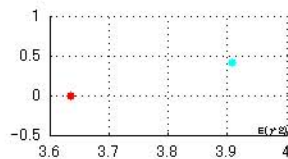
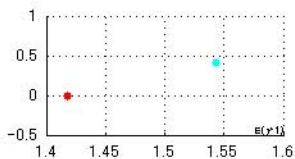
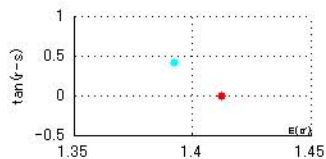
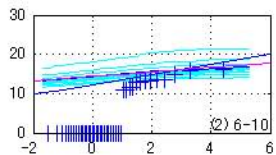
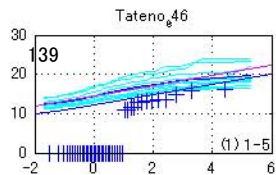


Kawaguchiko<sub>s</sub>40

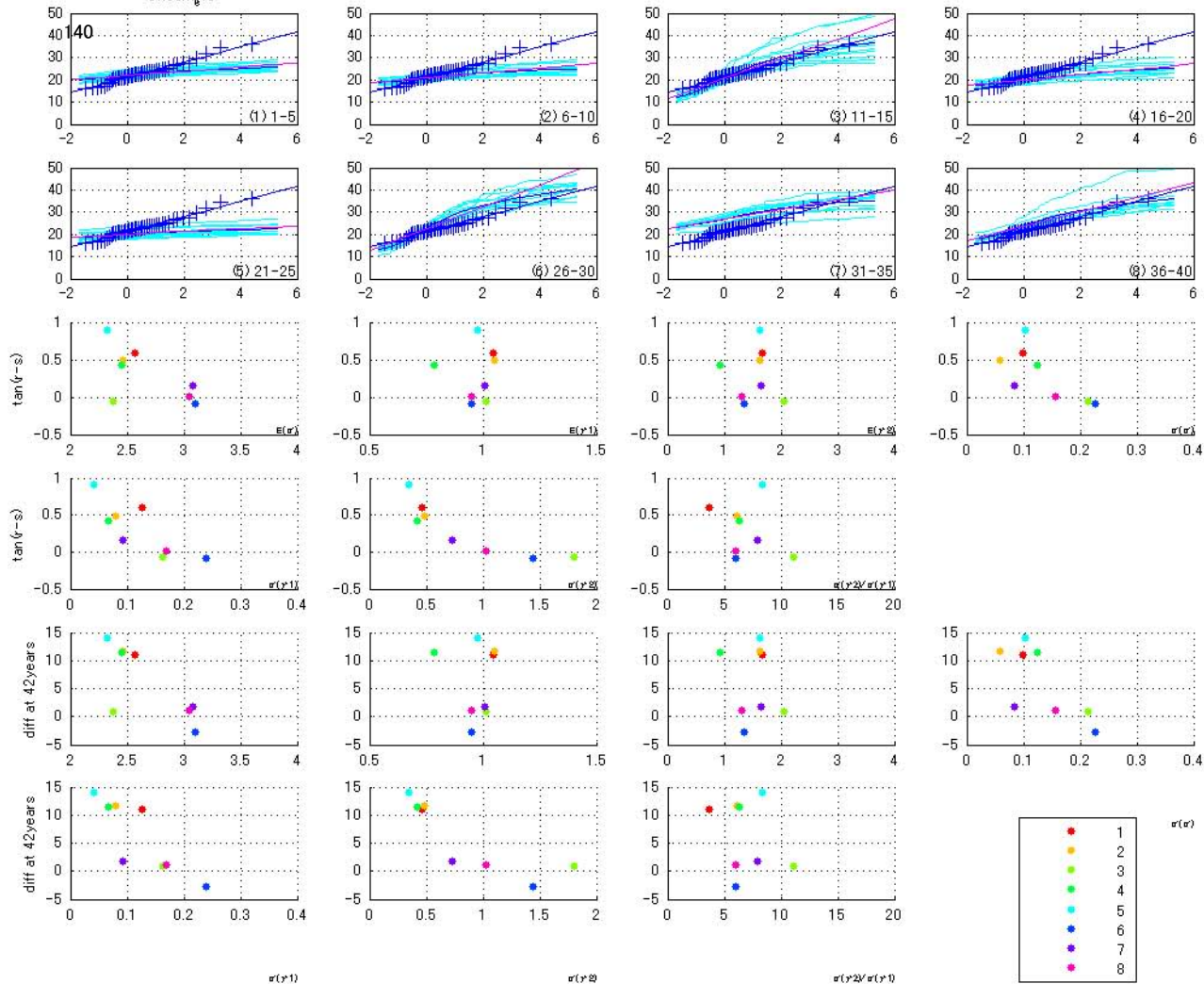


Chichibu<sub>41</sub>

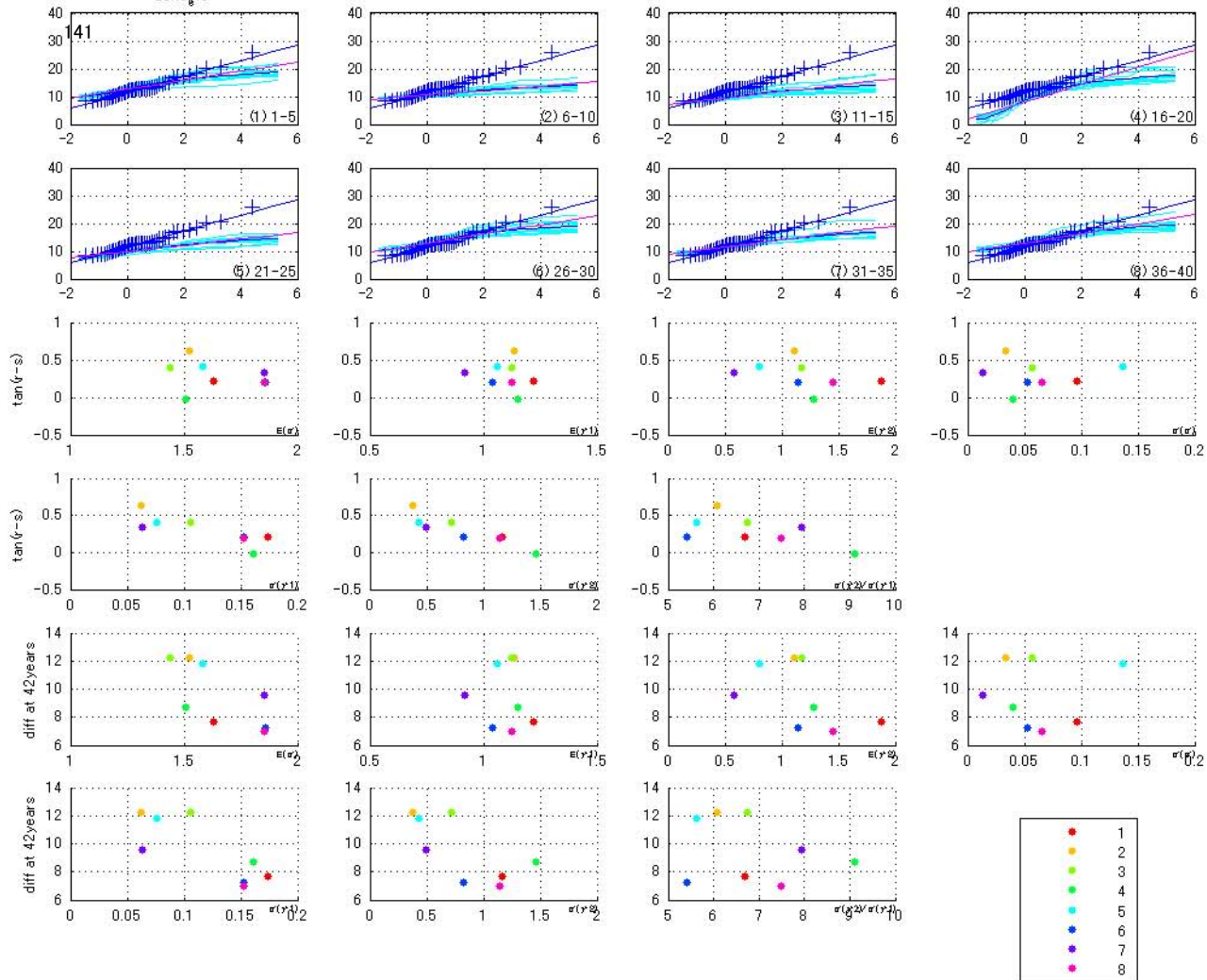


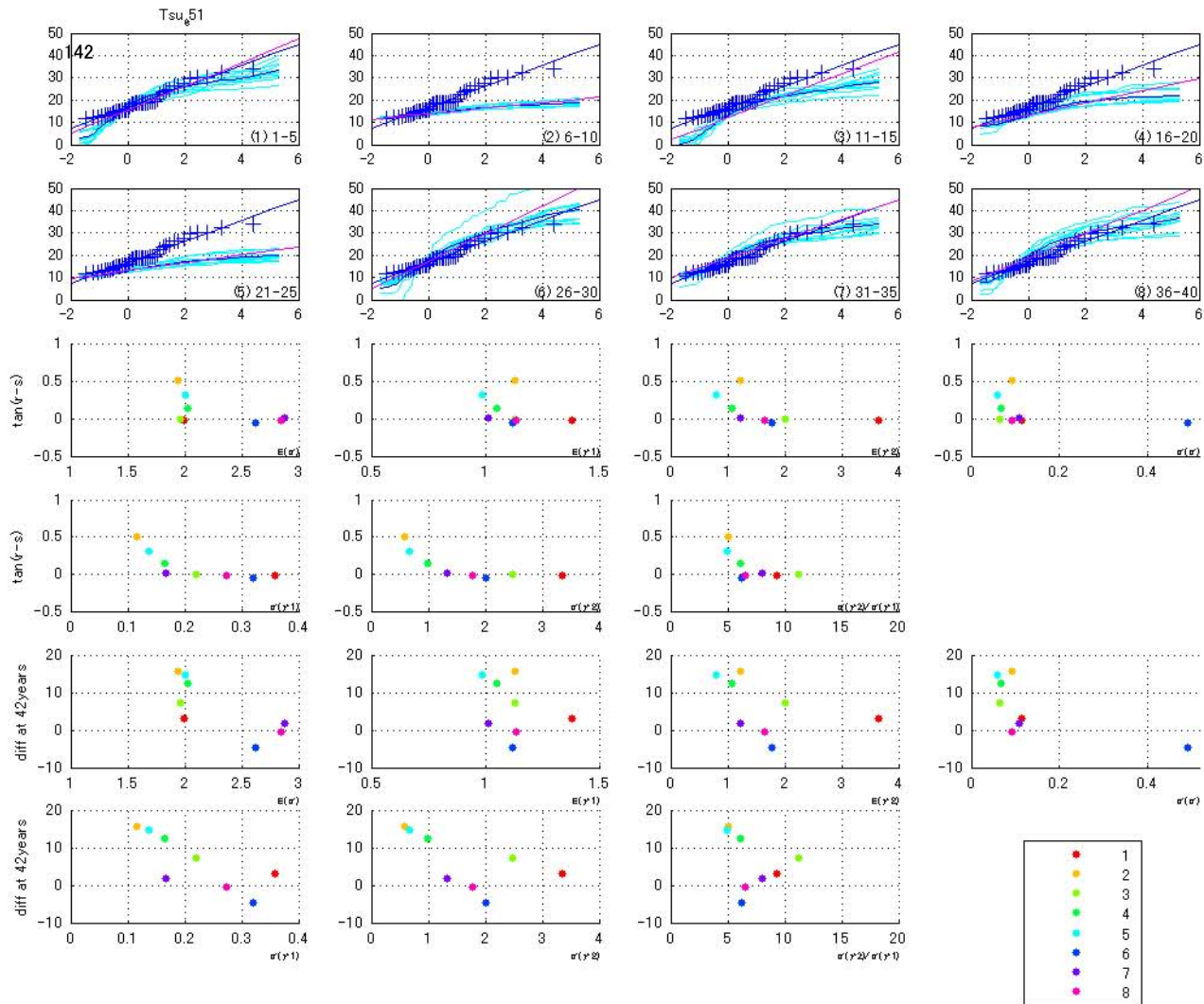


Choshi<sub>i</sub>48

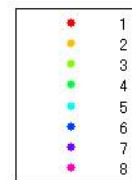
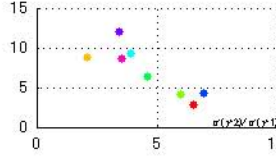
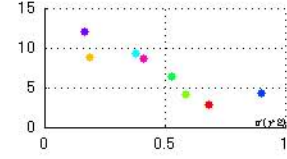
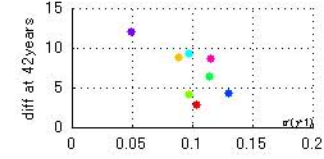
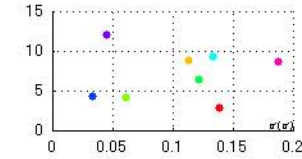
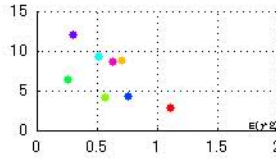
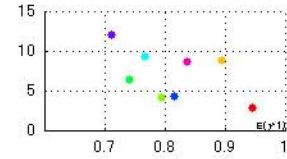
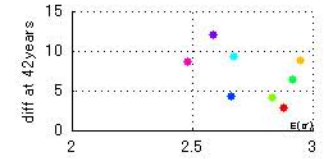
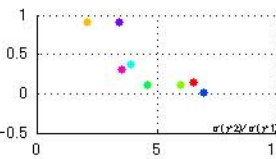
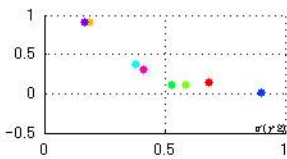
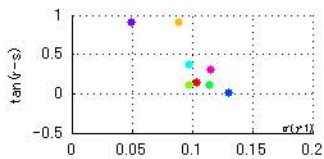
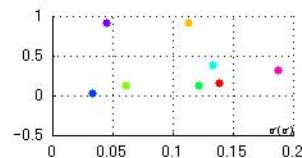
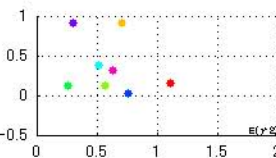
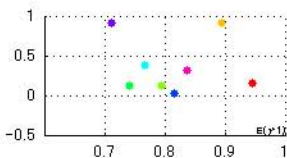
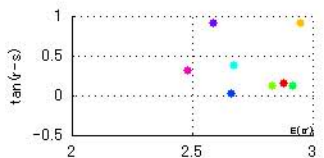
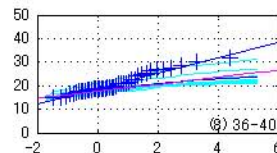
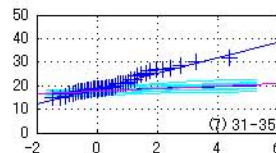
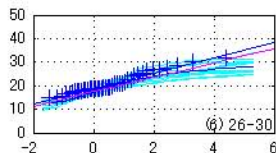
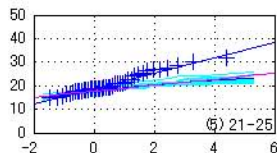
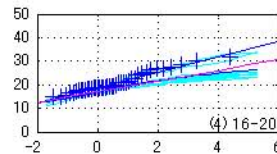
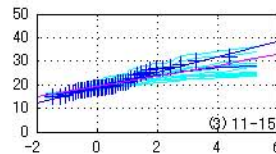
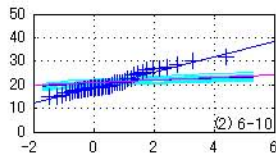
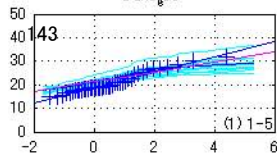


Ueno\_49



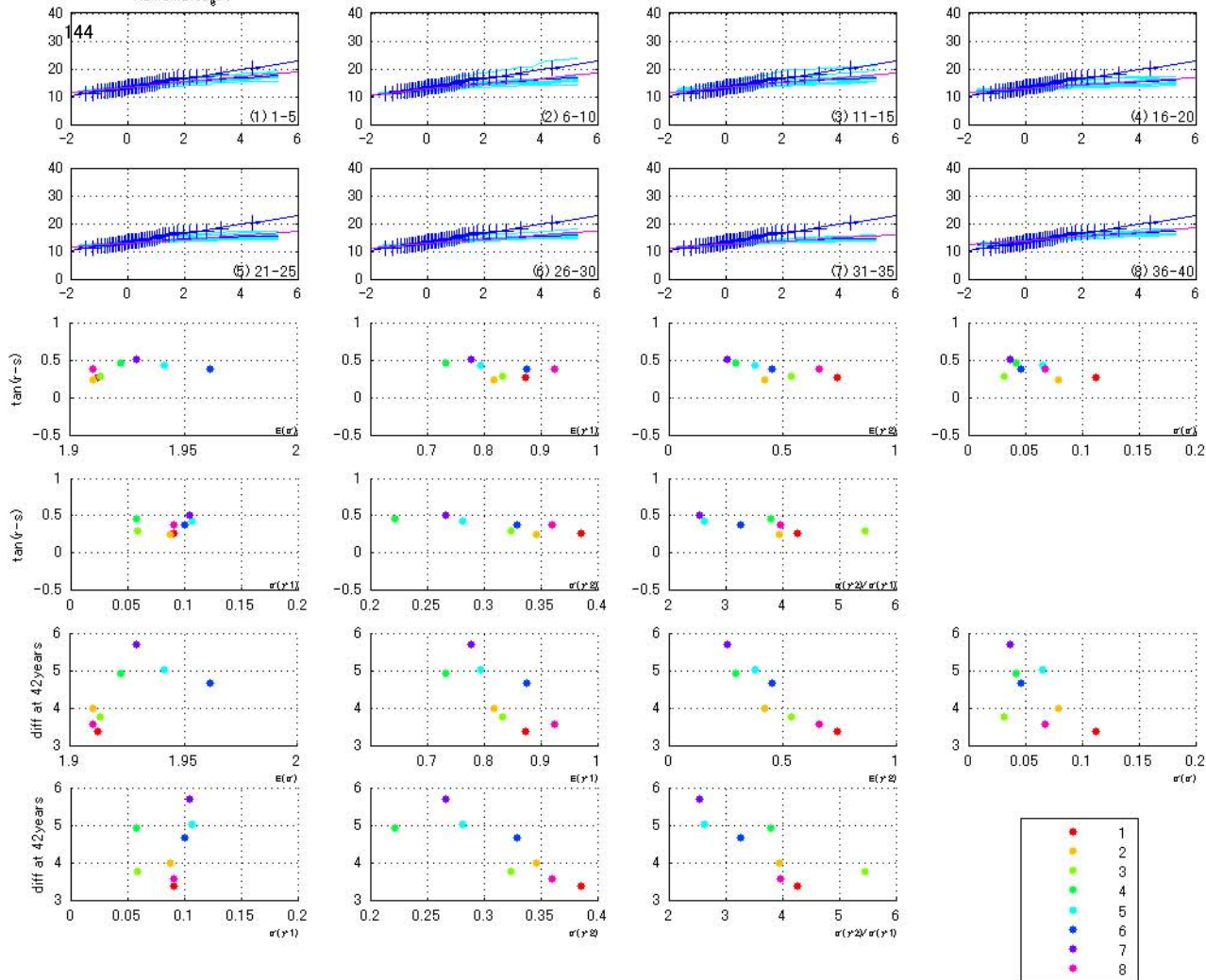


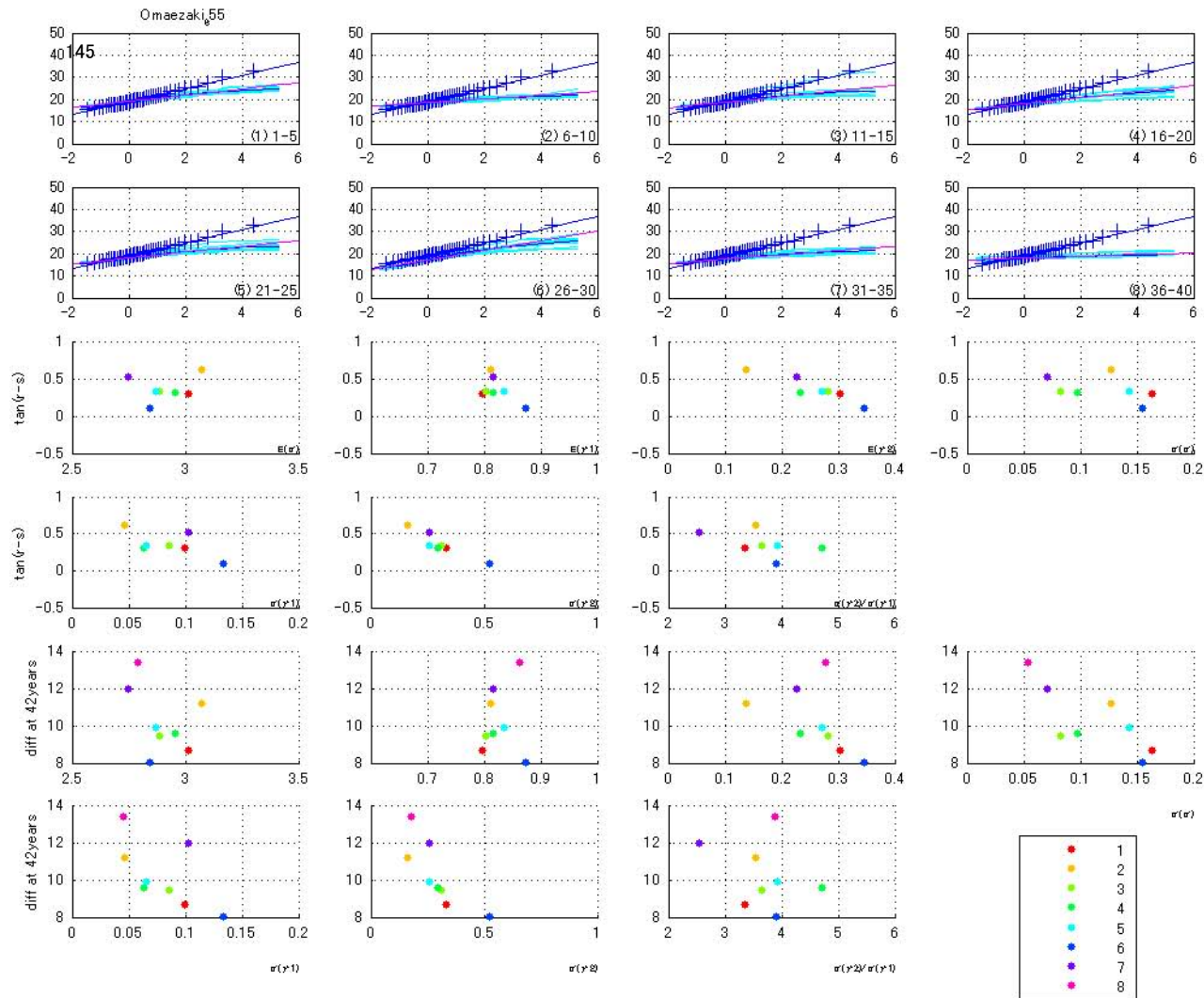
Irako<sub>53</sub>



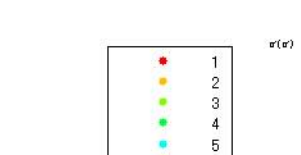
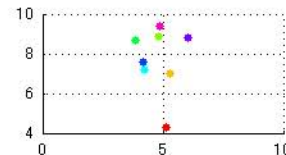
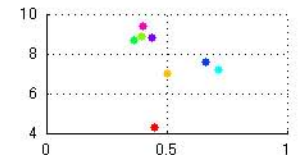
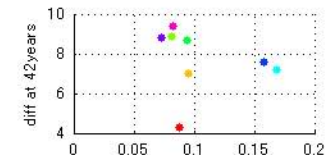
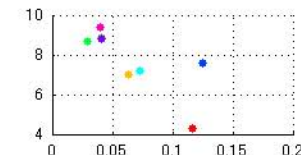
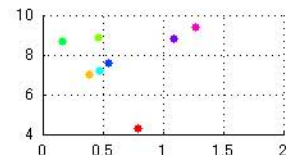
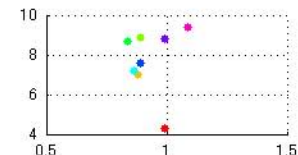
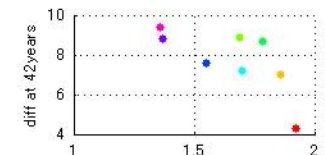
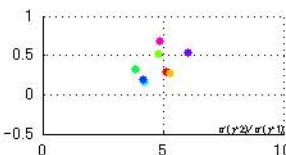
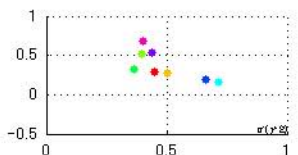
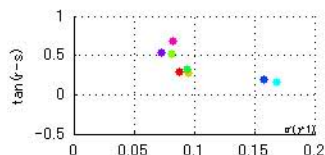
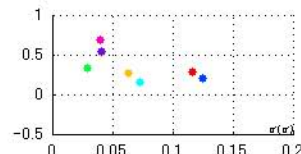
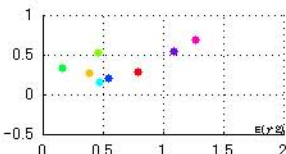
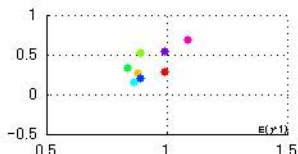
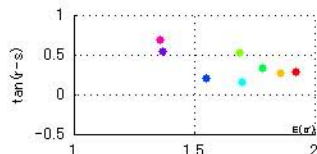
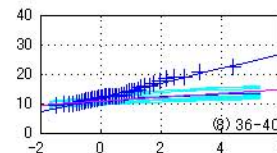
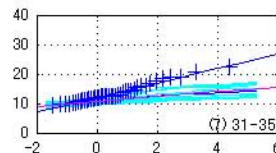
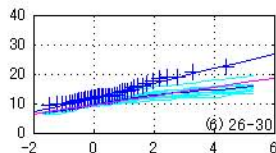
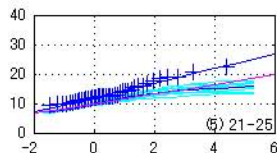
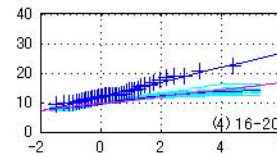
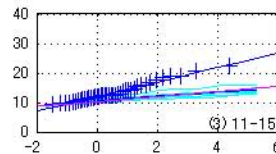
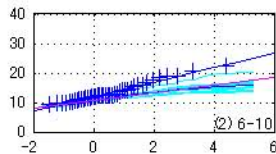
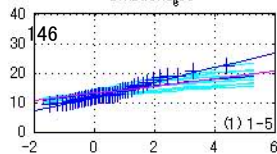


Hamamatsu\_54





Shizuoka<sub>56</sub>

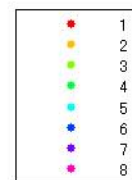


$\sigma(\sigma)$

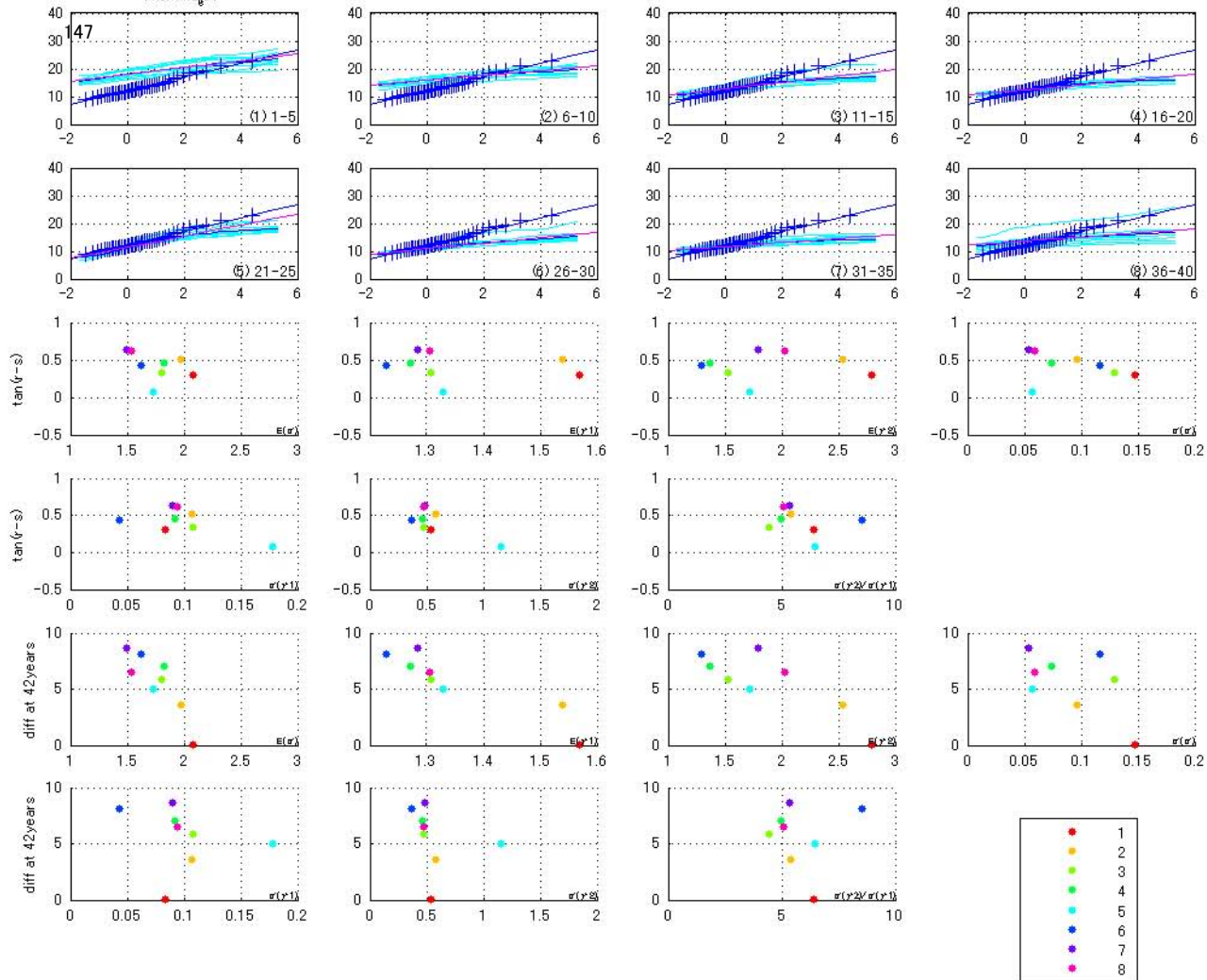
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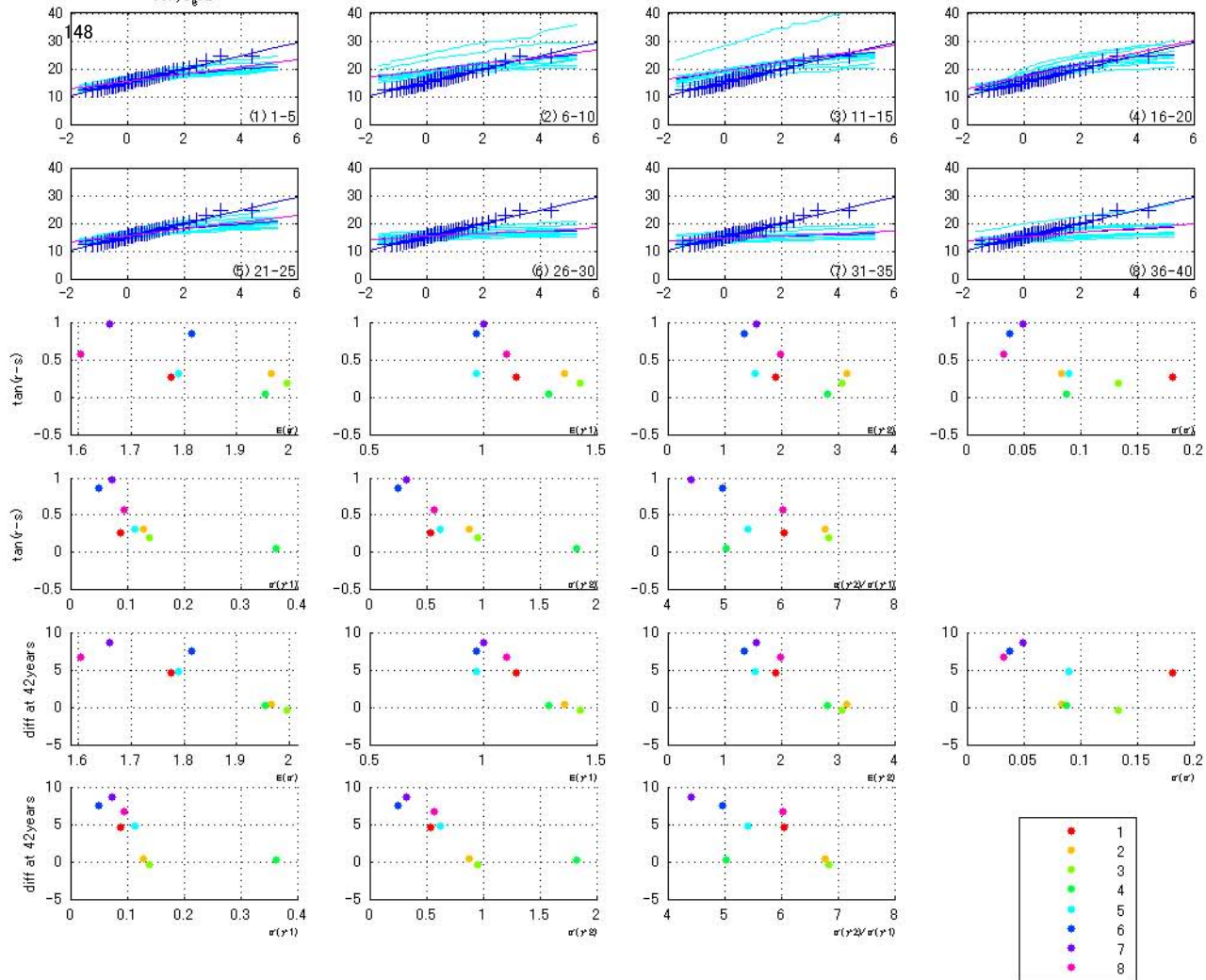
$\sigma(\sigma)$

$\sigma(\sigma)$

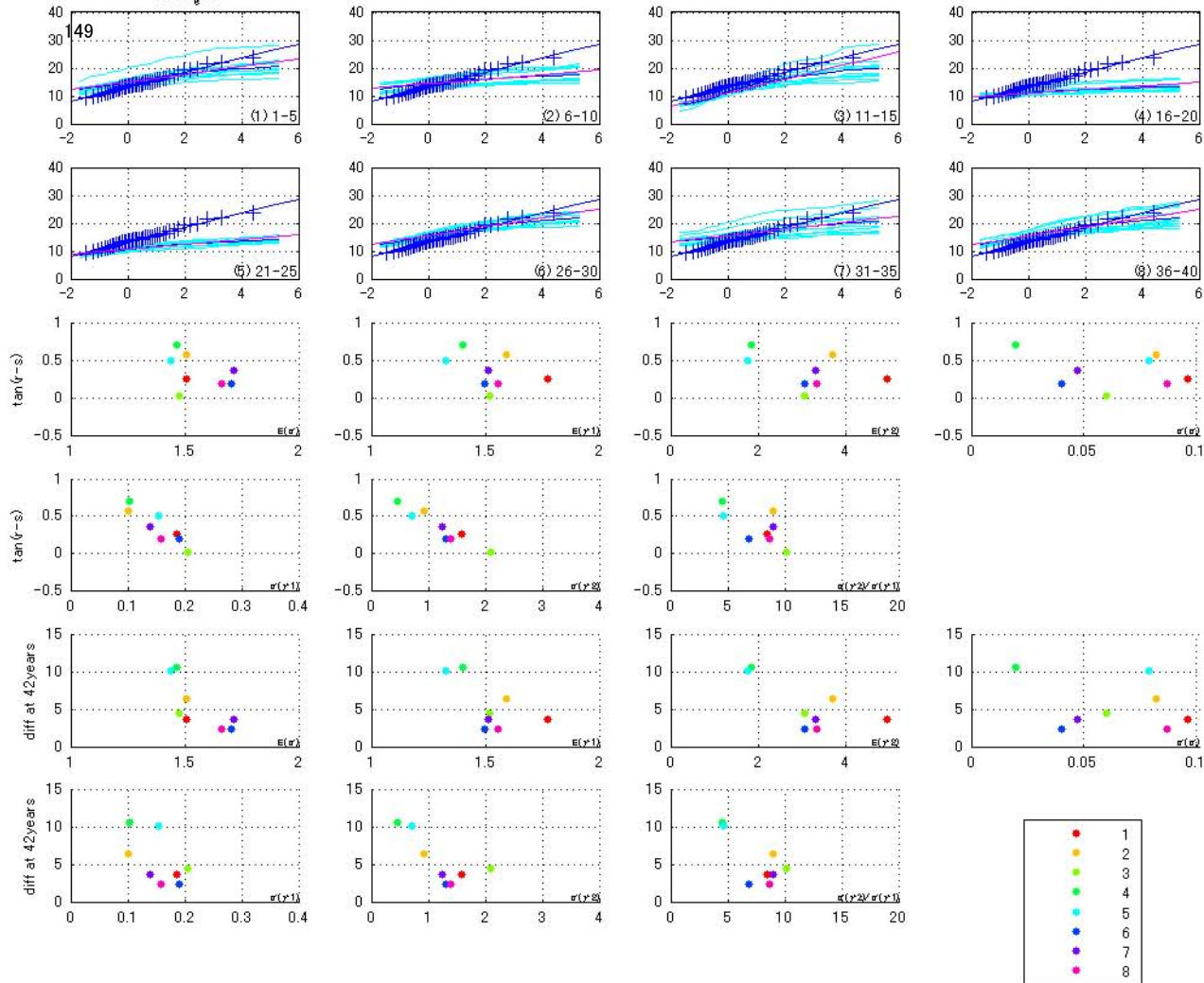


Mishima<sub>57</sub>

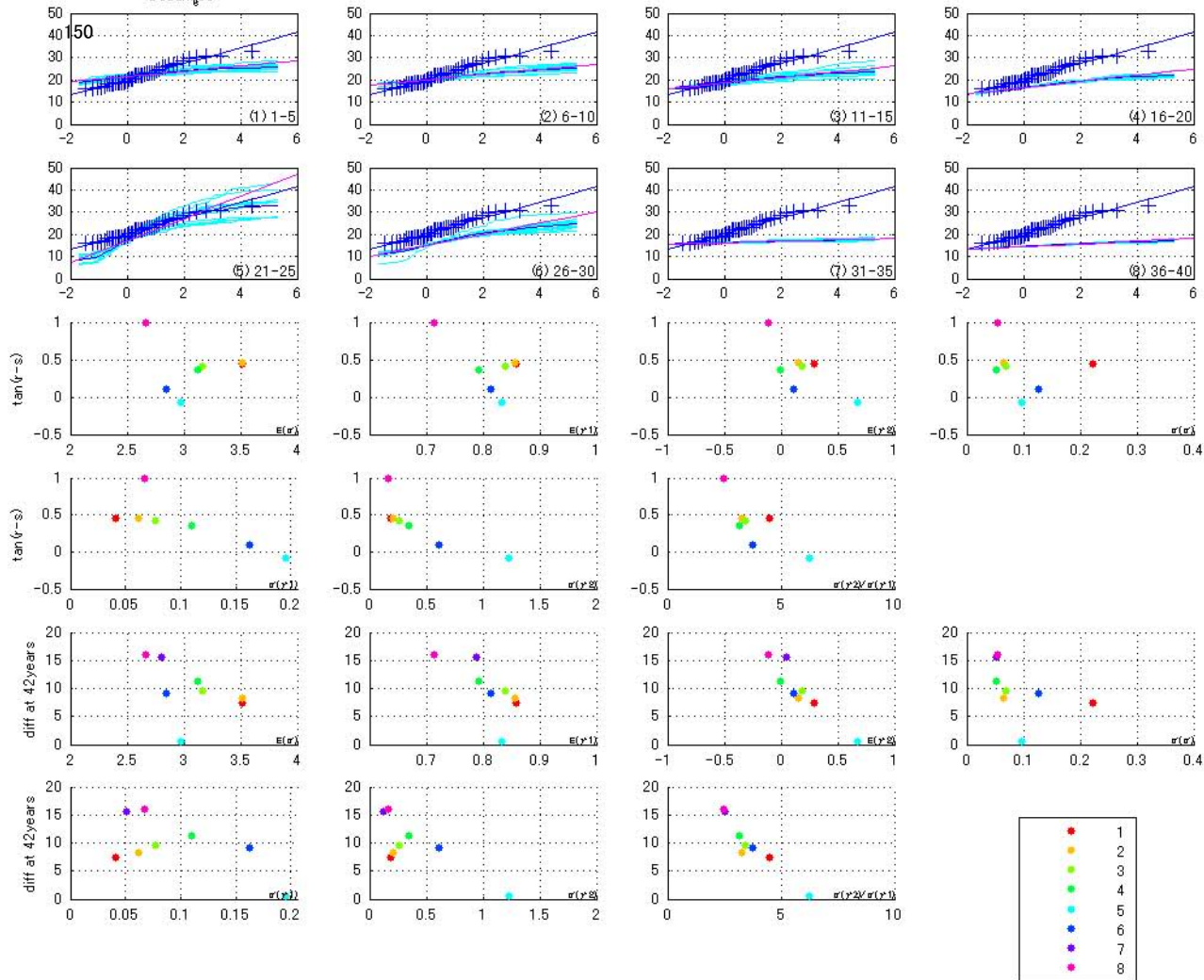


Tokyo<sub>62</sub>

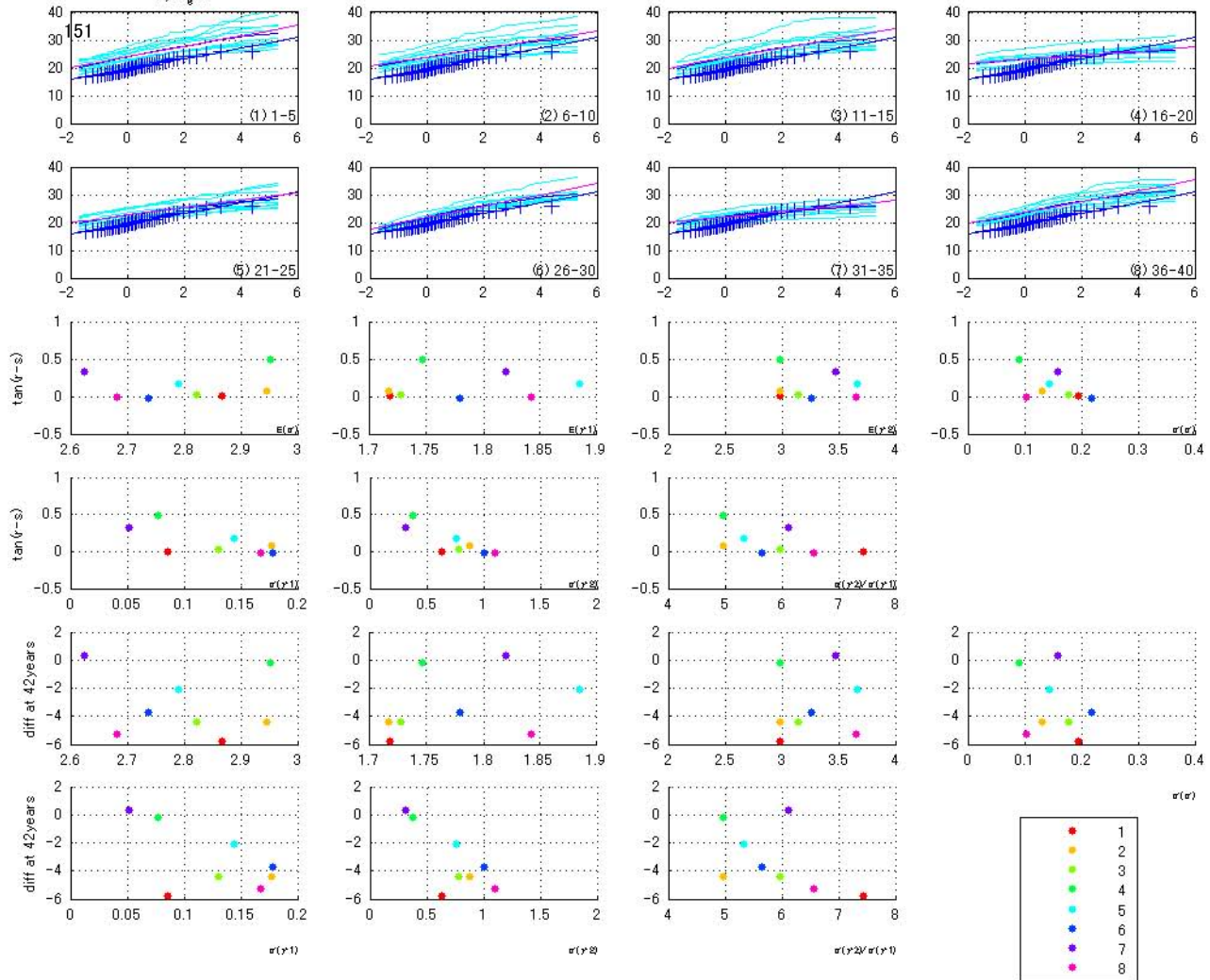
Owase\_63



Irozaki,66

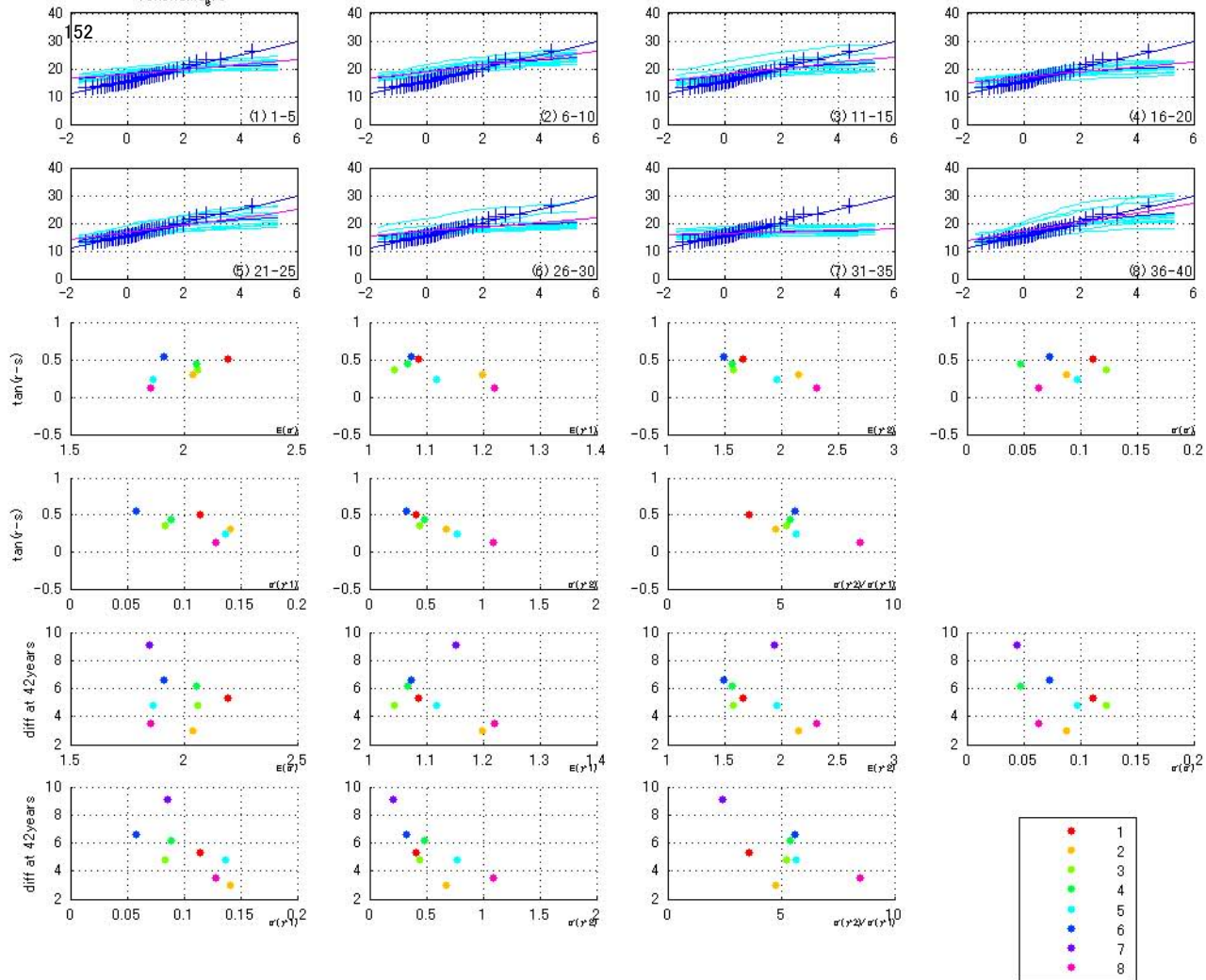


Ajiro<sub>68</sub>



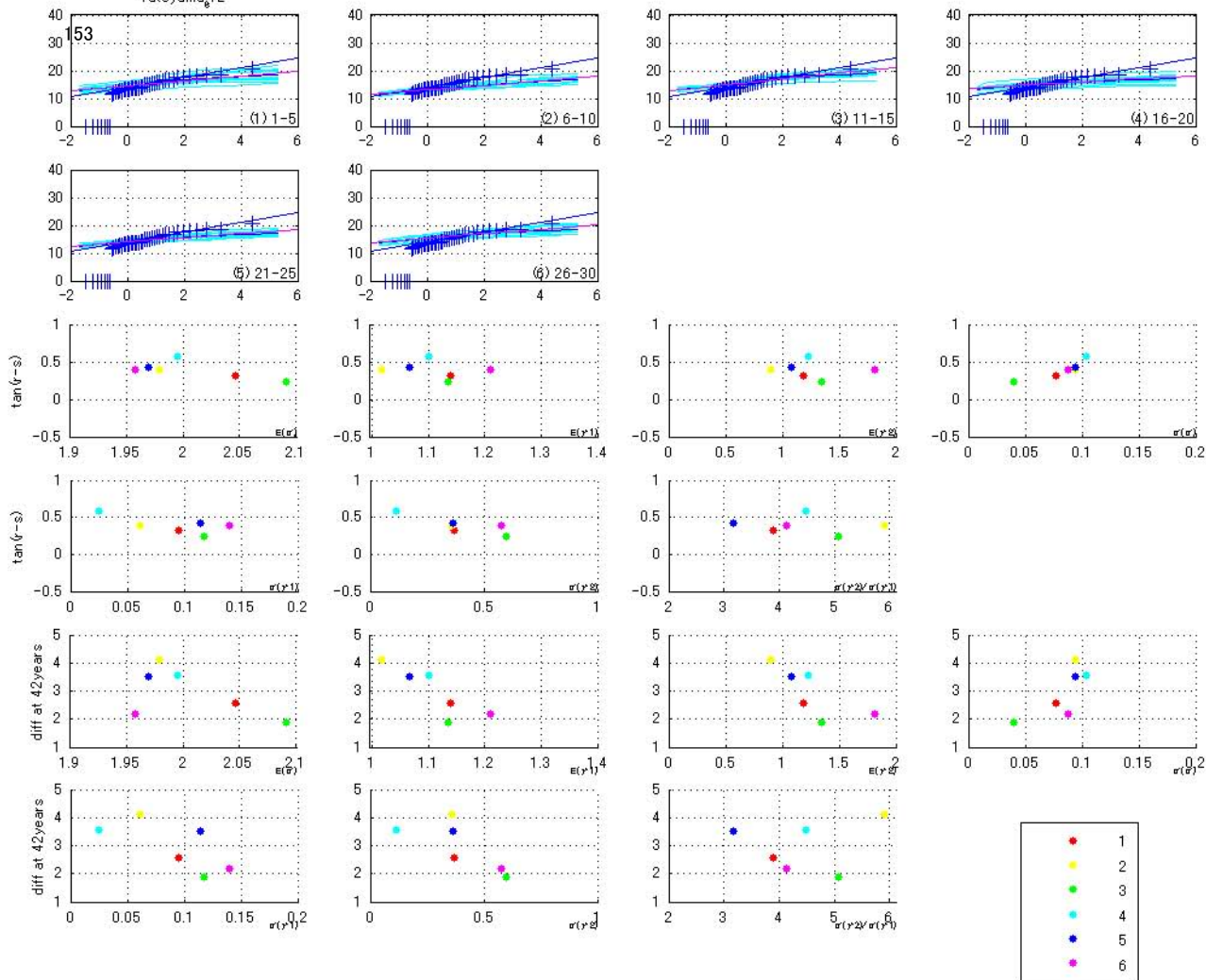


Yokohama<sub>70</sub>

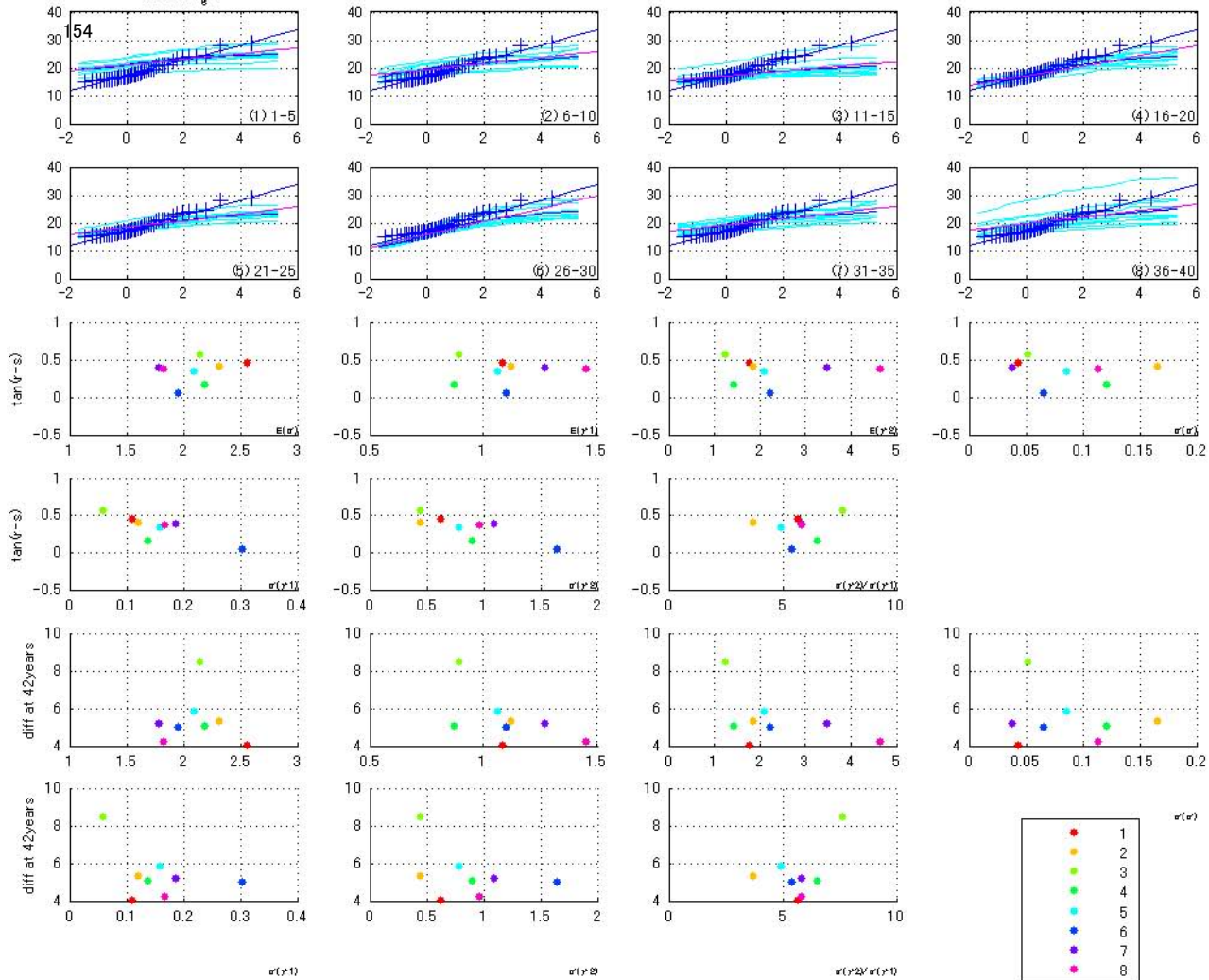


Tateyama<sub>0</sub>72

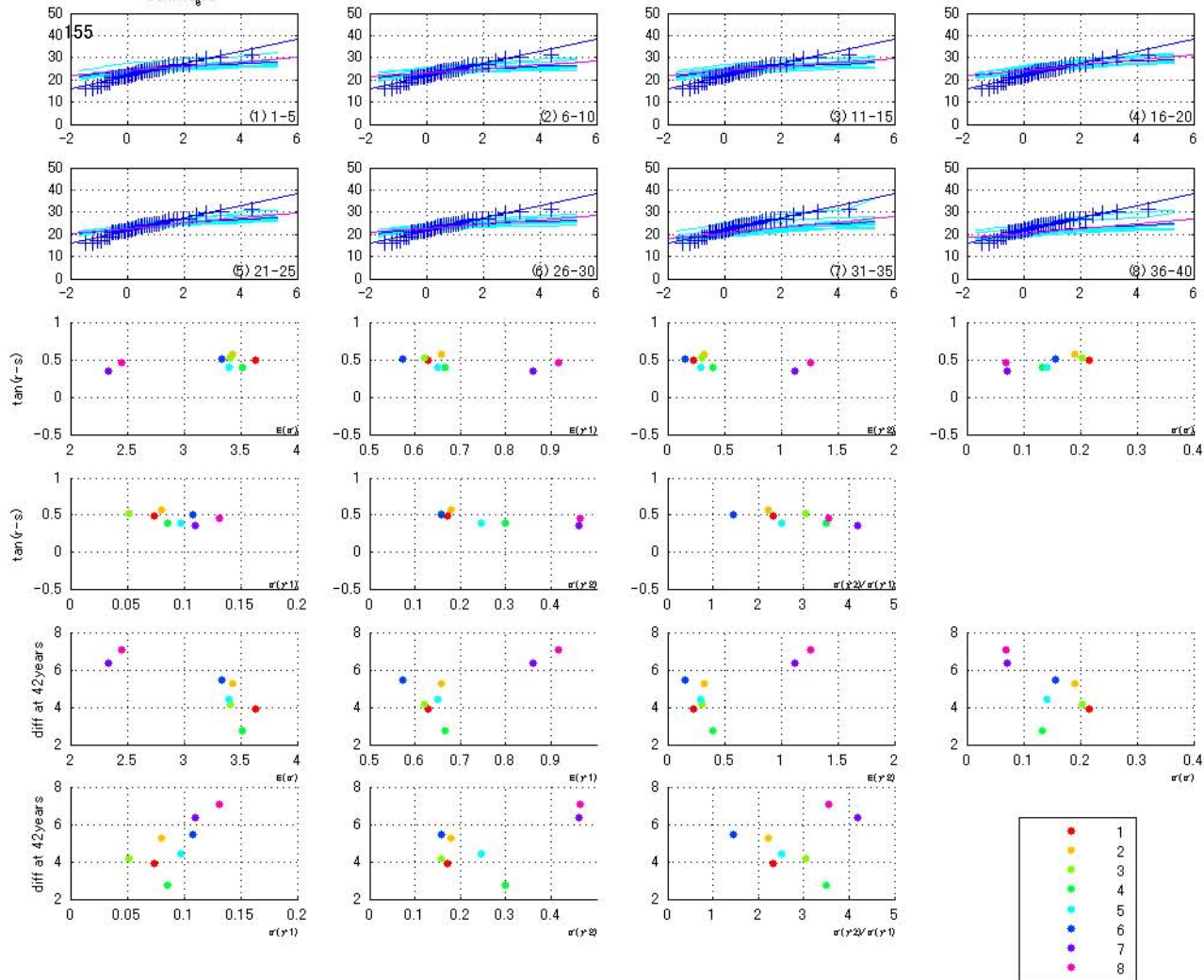
153



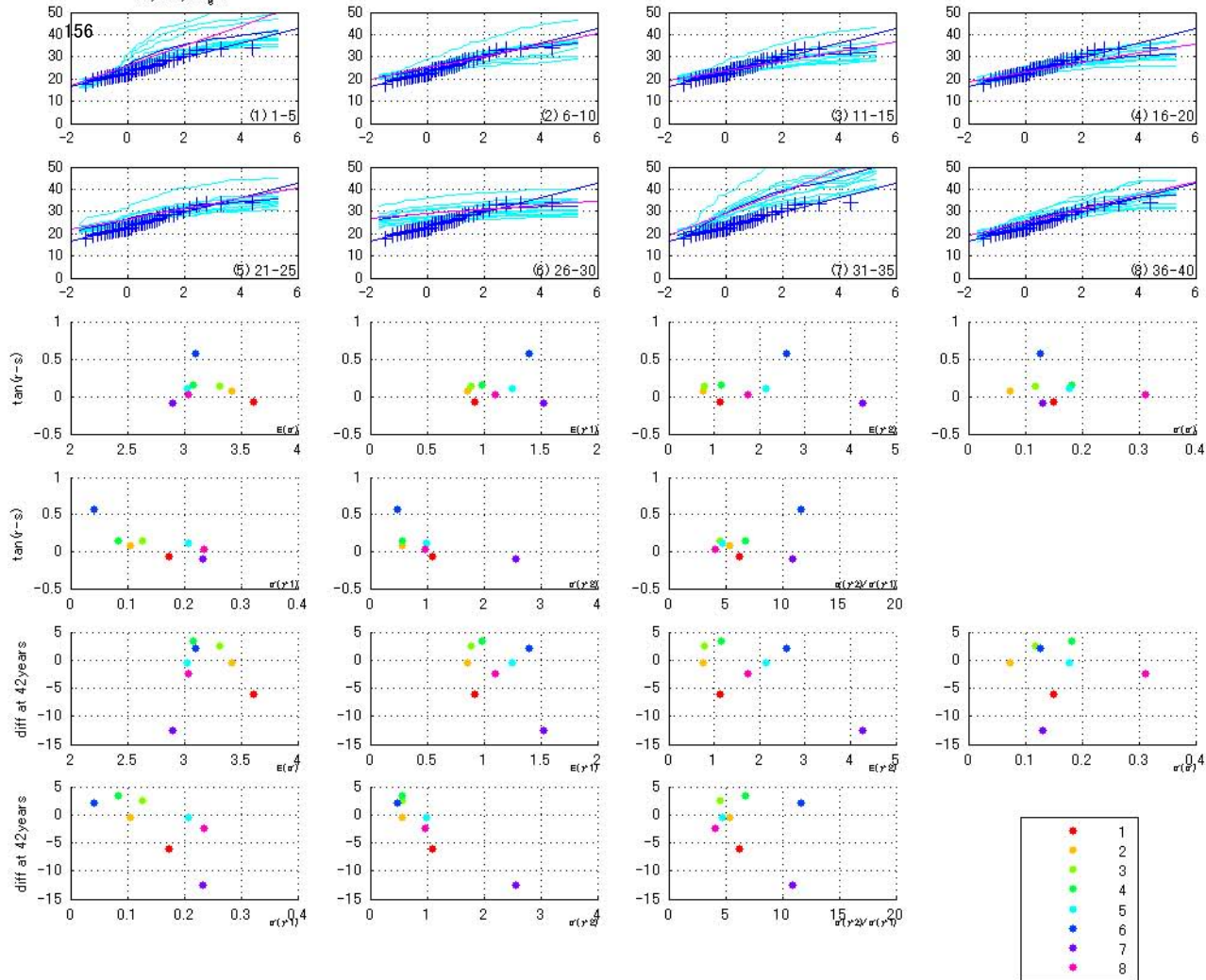
Katsuura<sub>74</sub>



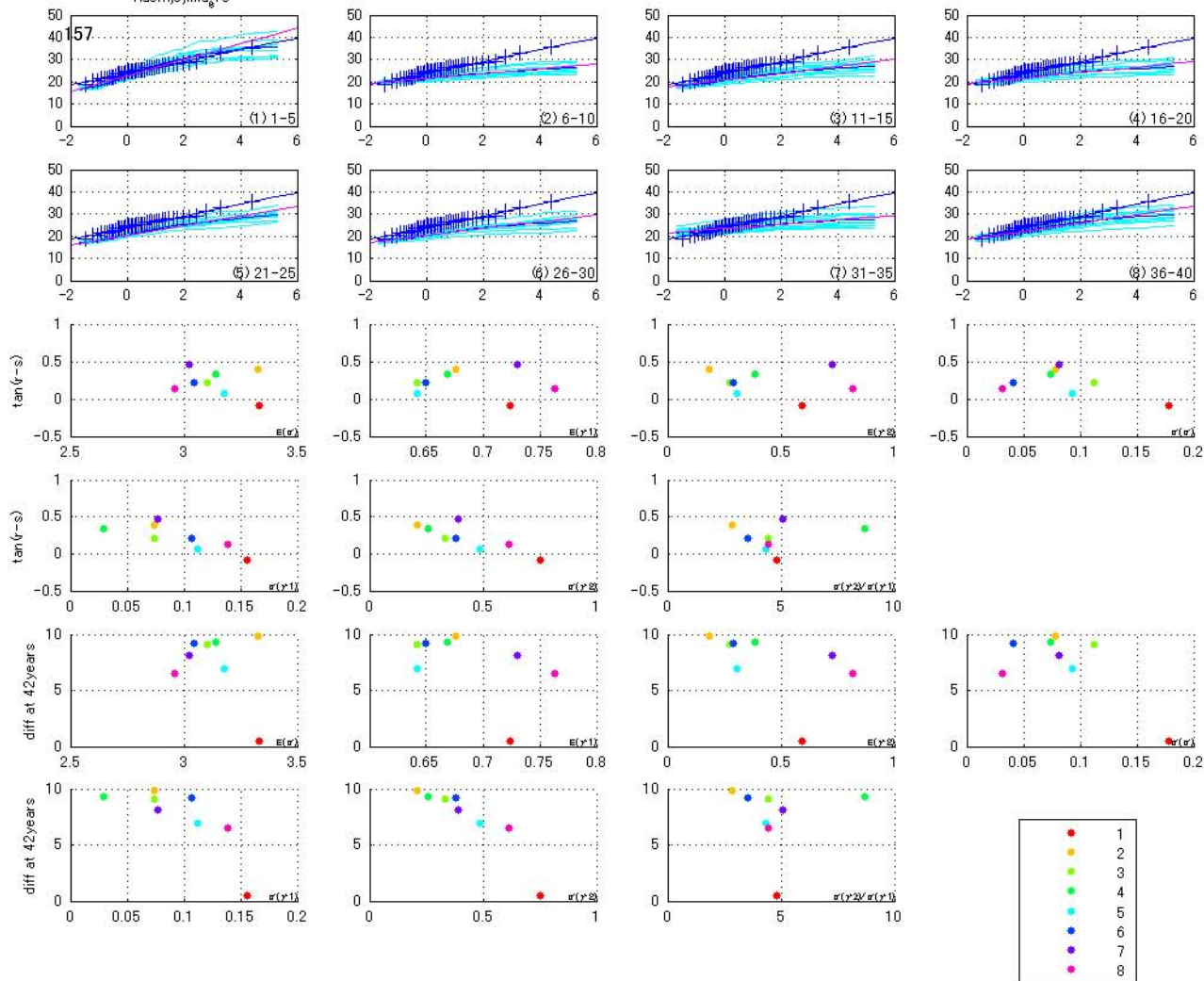
Oshima<sub>a</sub>75



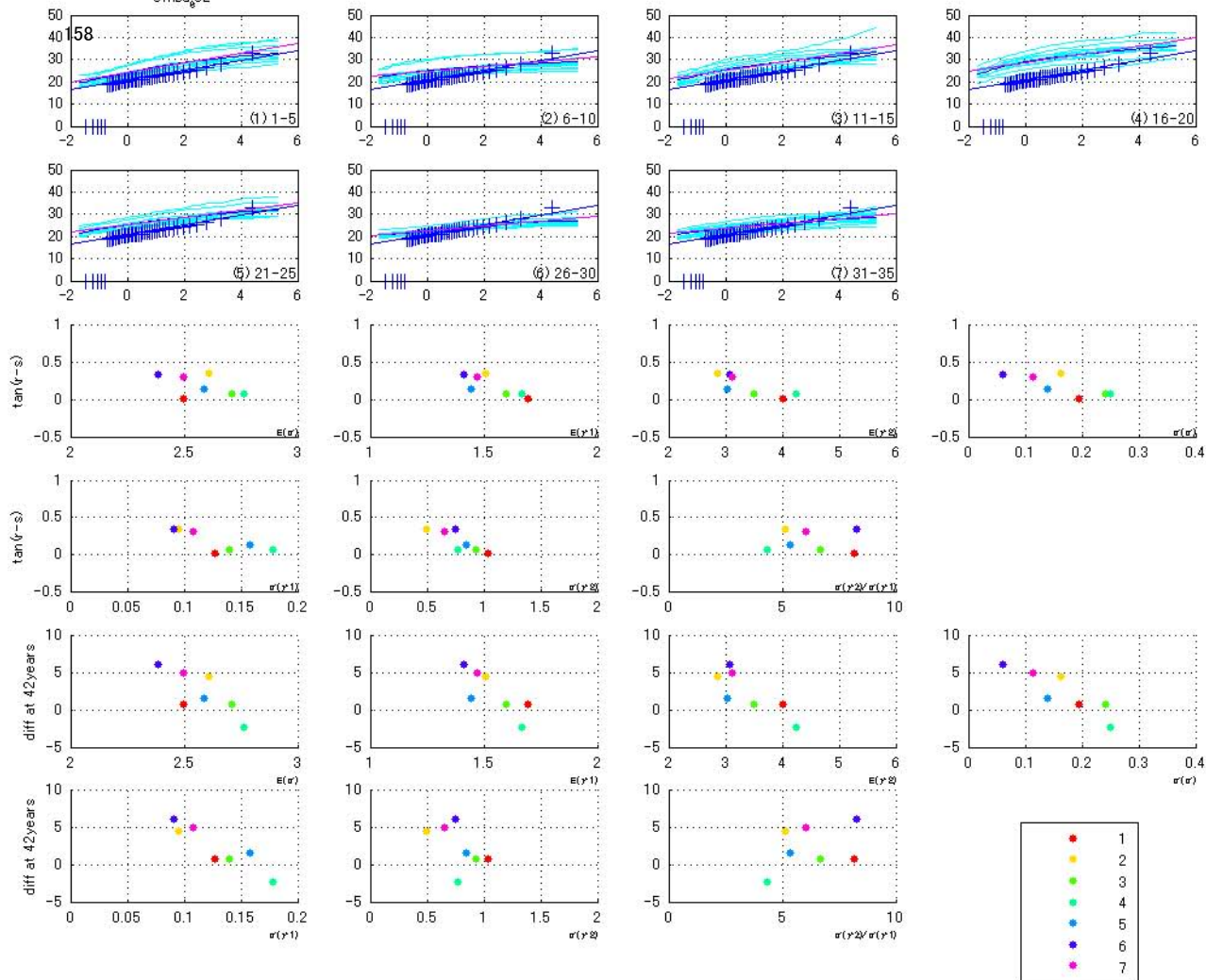
Miyakejima<sub>77</sub>



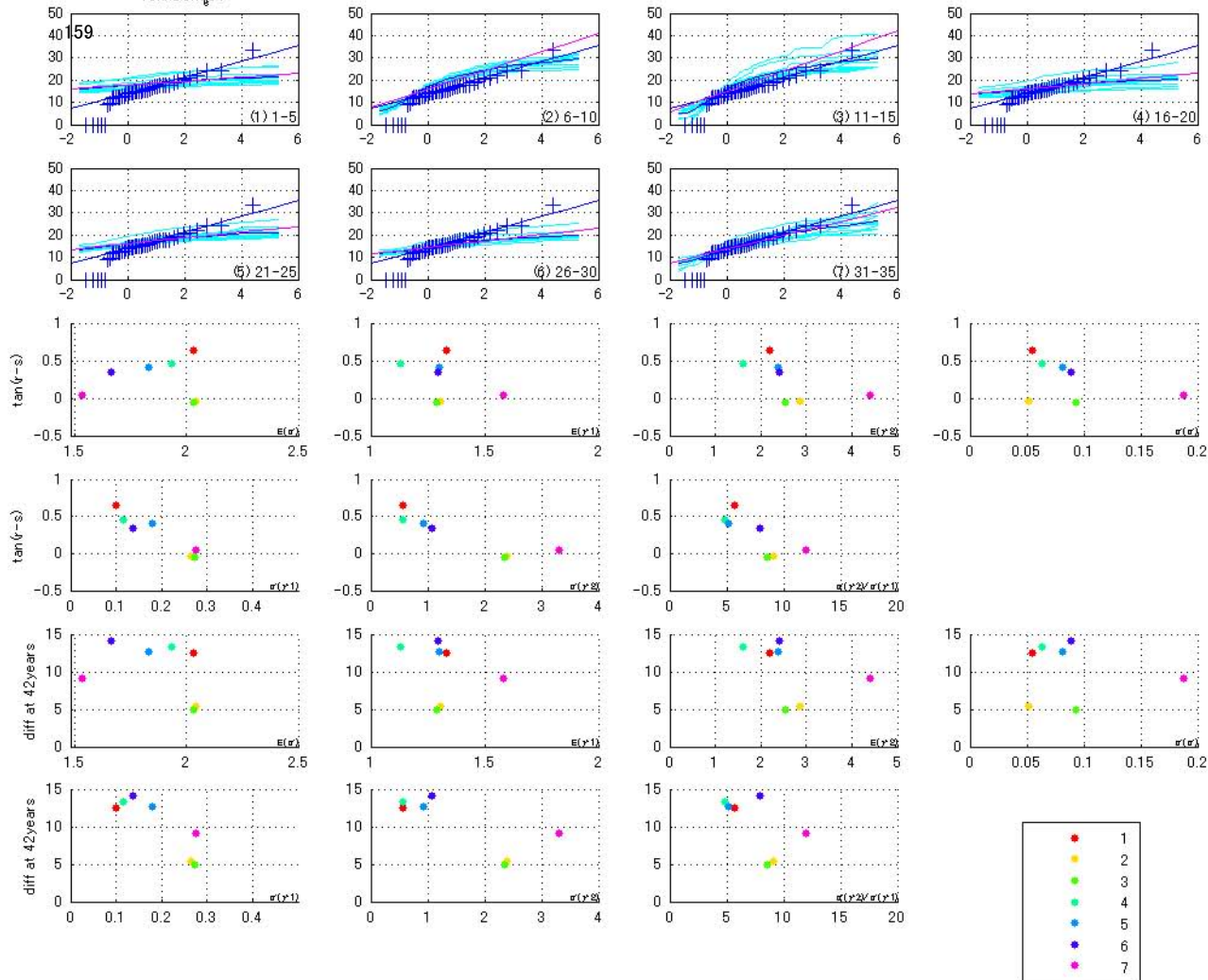
Hachijojima<sub>78</sub>



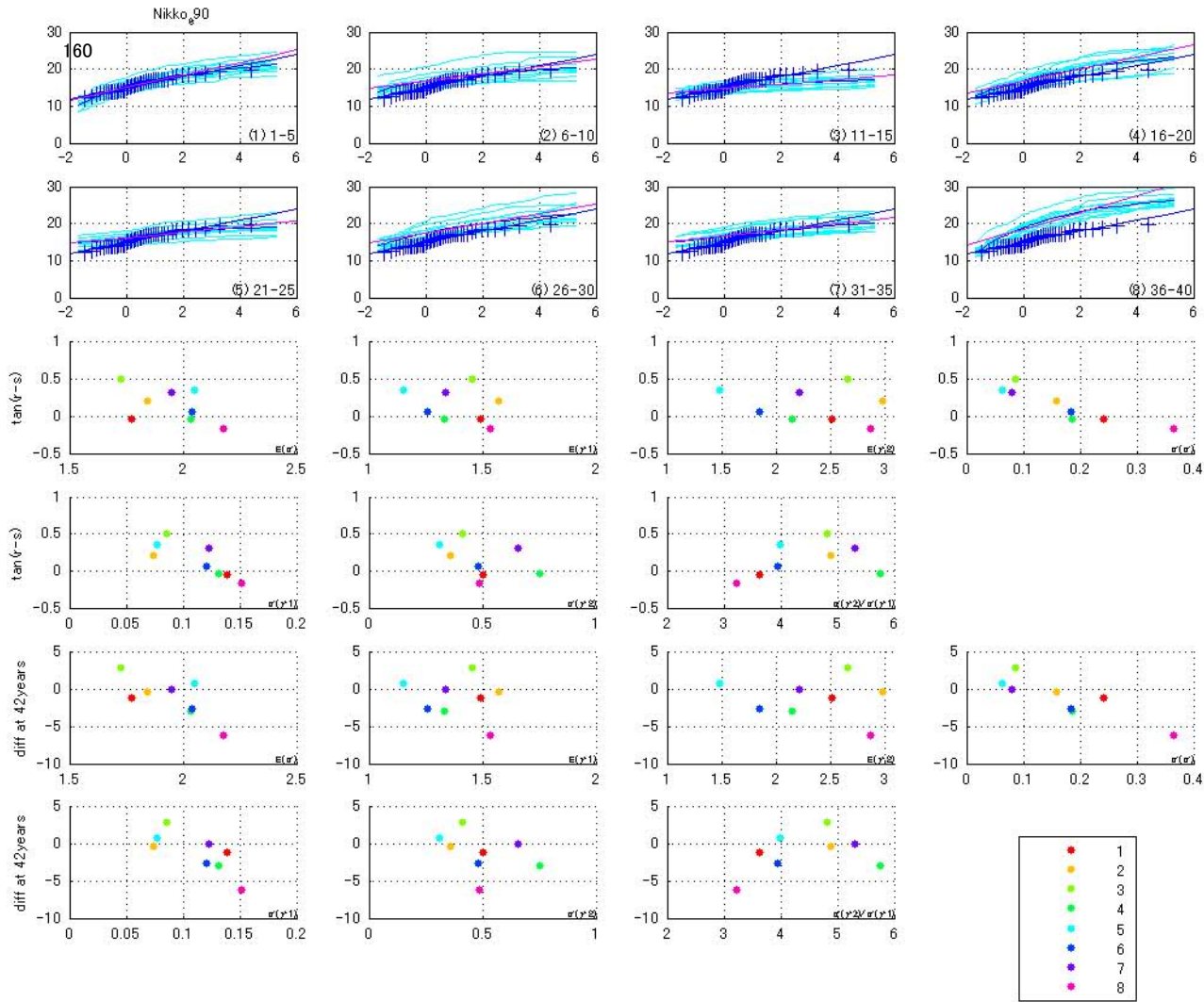
Chiba\_82



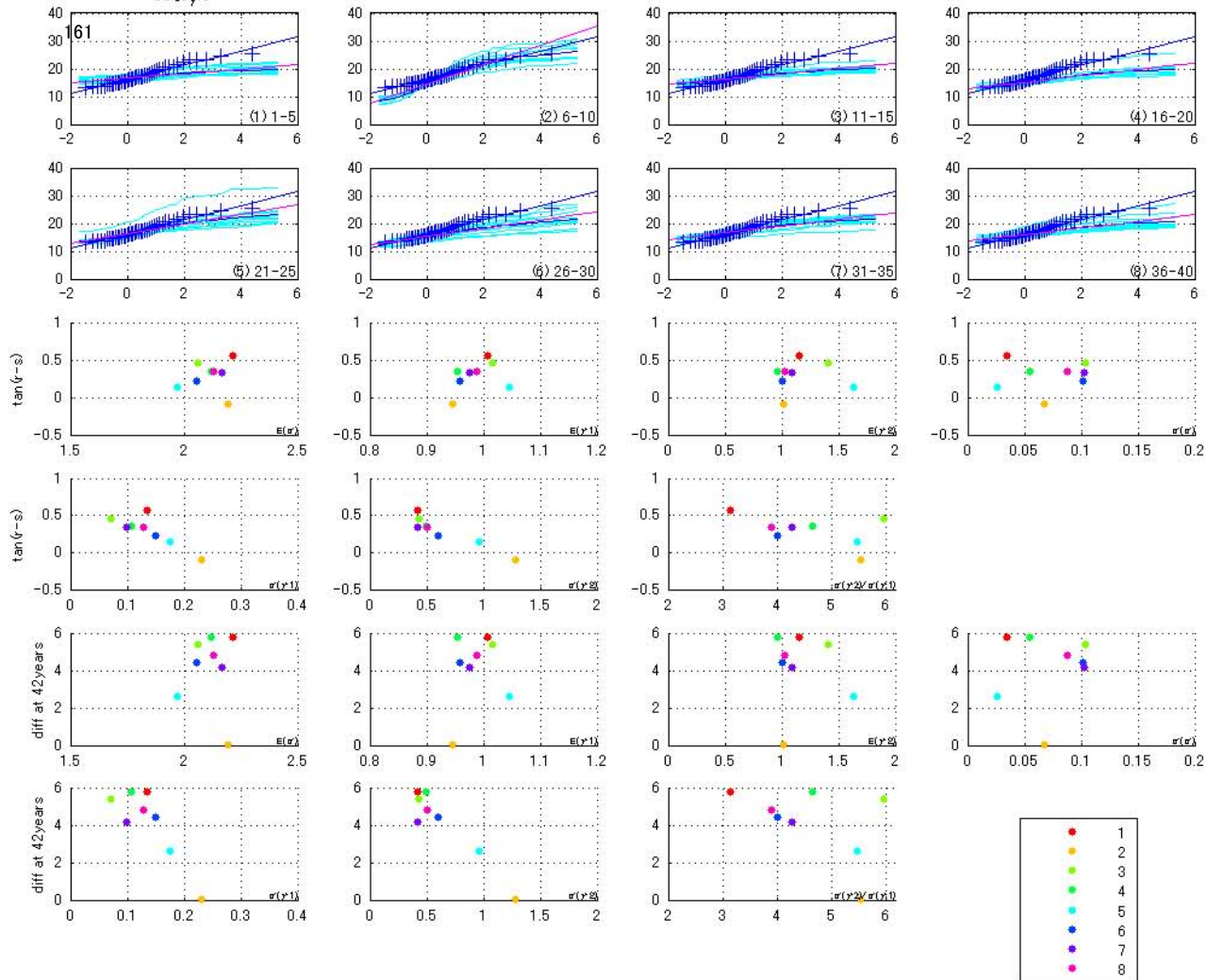
Yokkaichi\_84



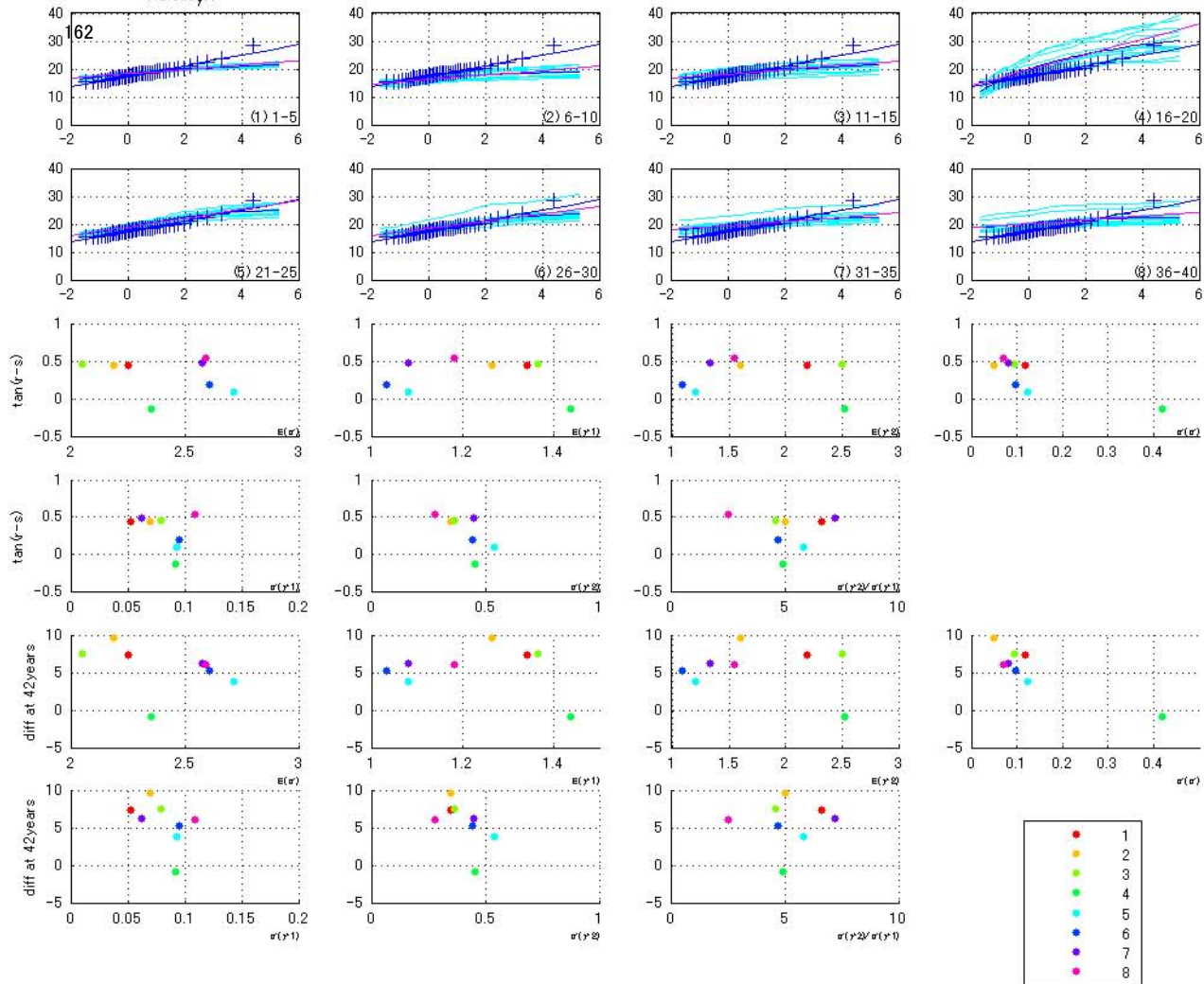




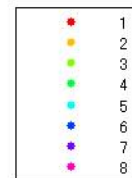
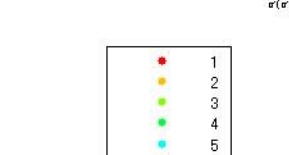
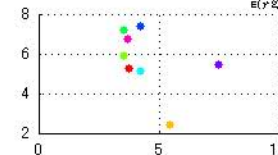
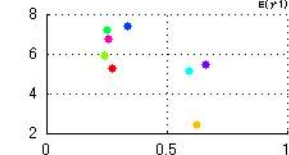
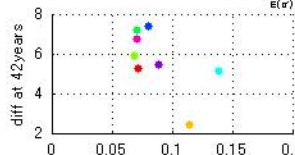
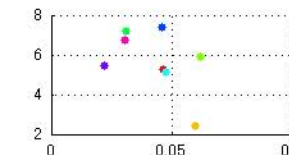
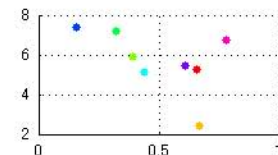
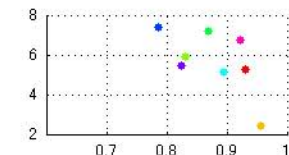
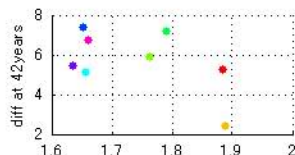
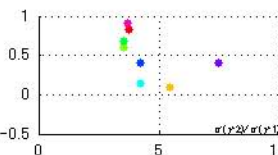
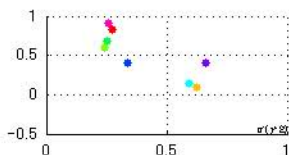
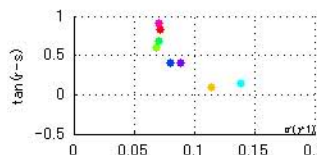
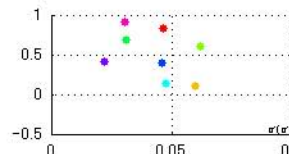
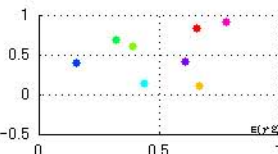
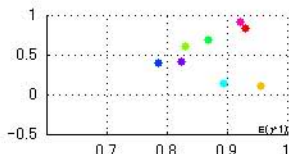
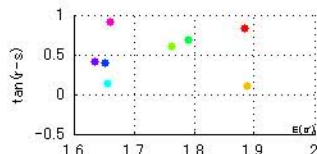
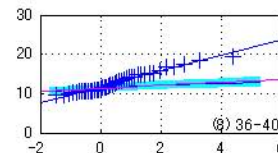
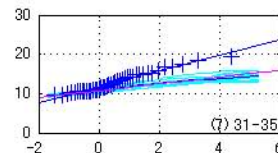
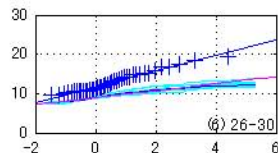
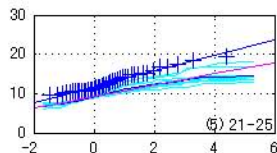
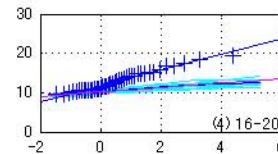
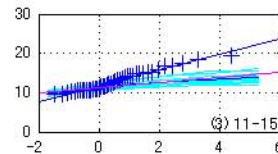
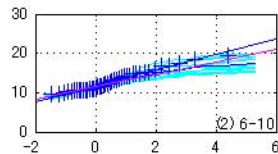
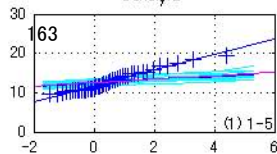
Saigo\_40



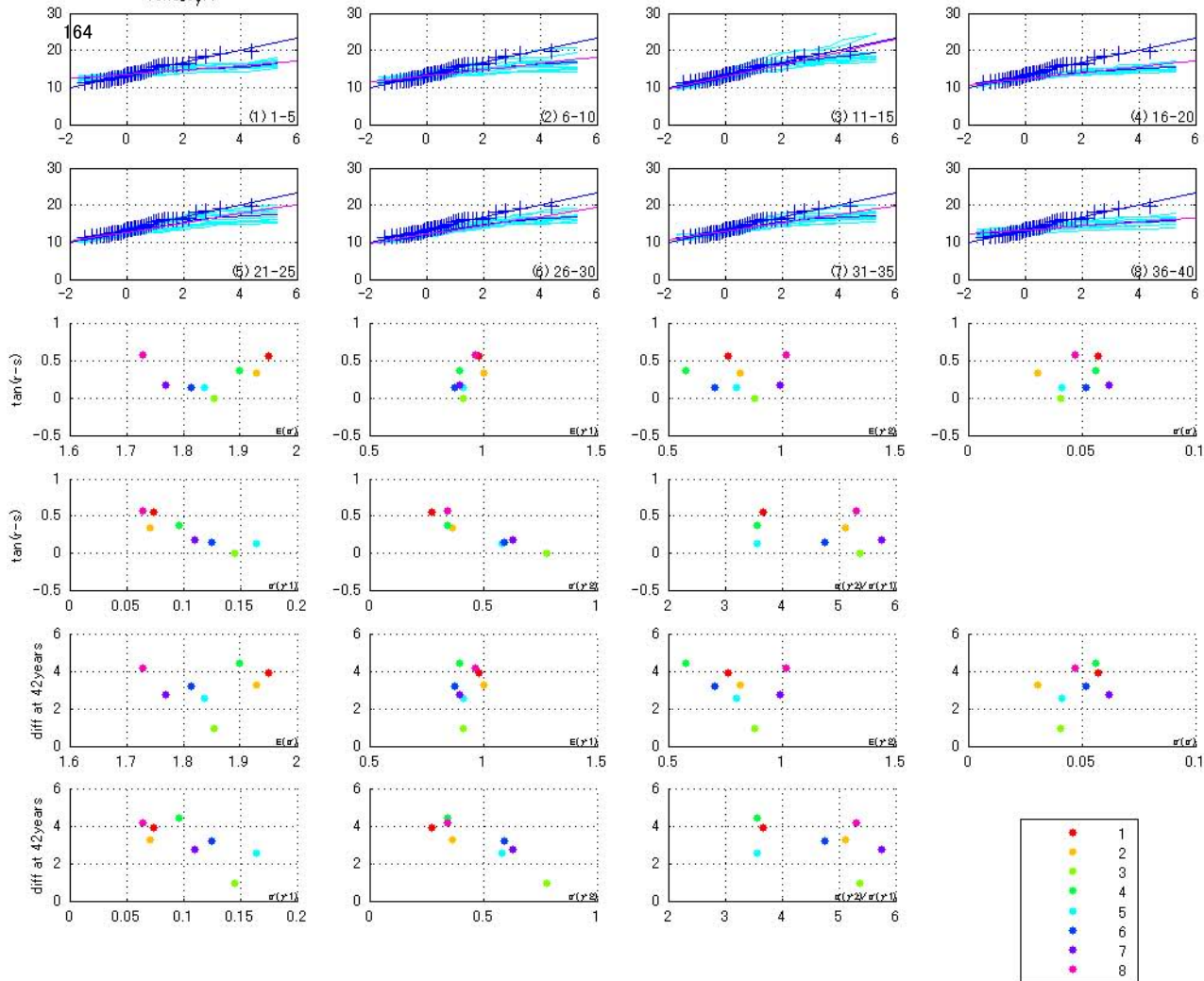
Matsue\_41



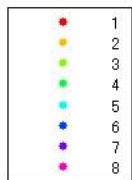
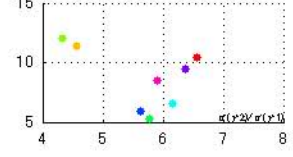
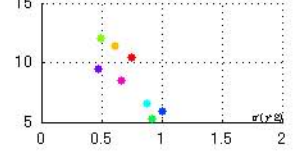
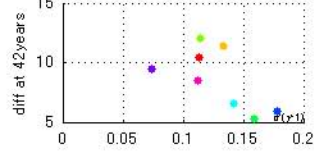
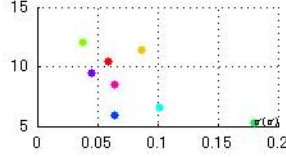
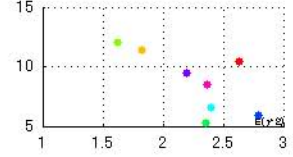
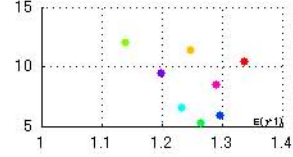
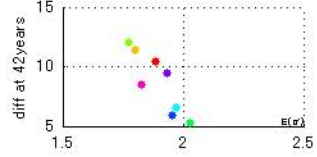
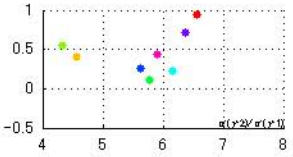
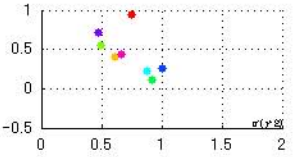
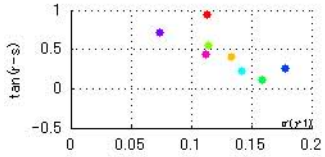
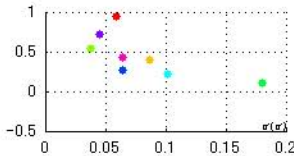
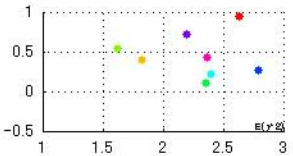
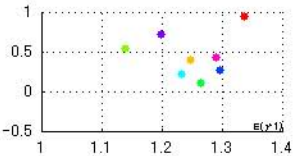
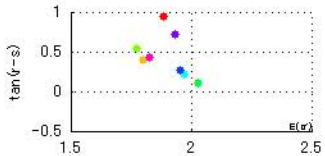
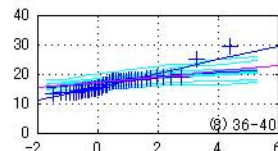
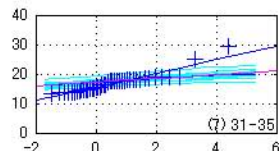
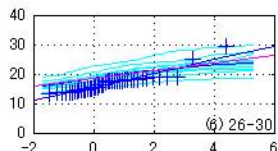
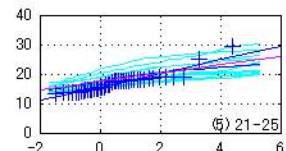
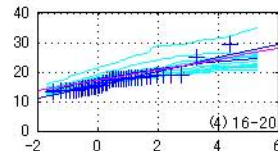
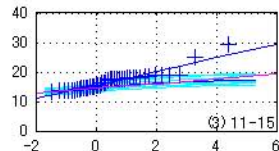
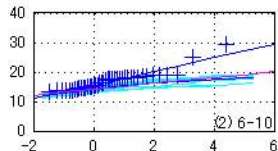
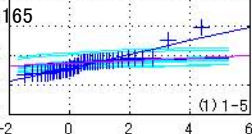
Sakai,42



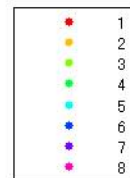
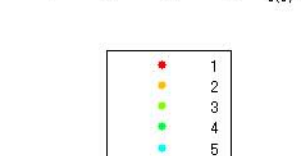
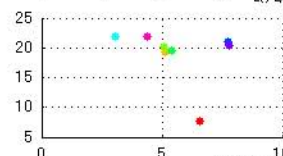
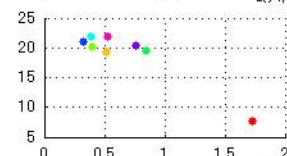
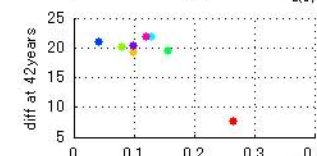
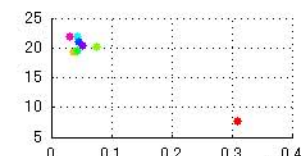
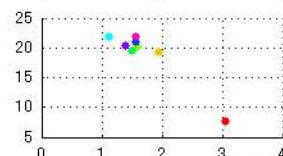
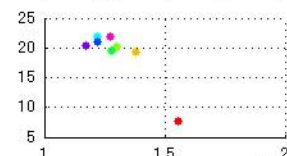
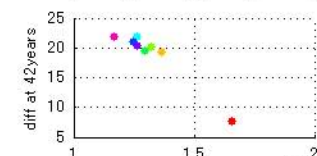
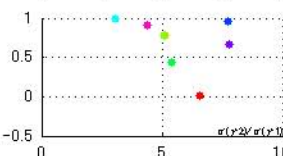
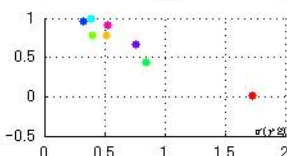
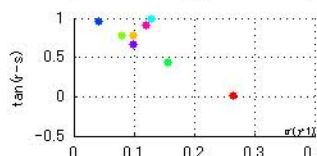
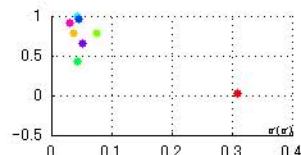
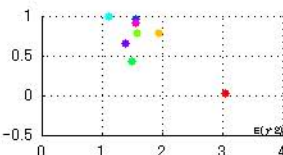
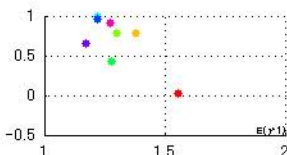
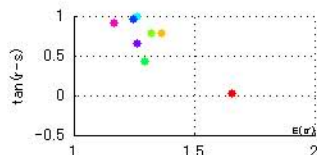
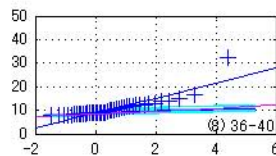
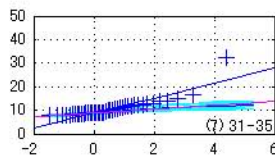
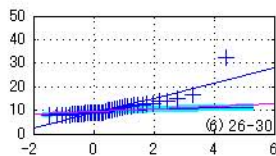
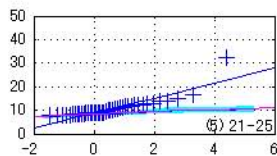
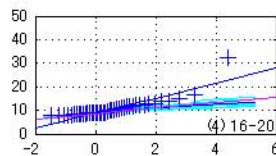
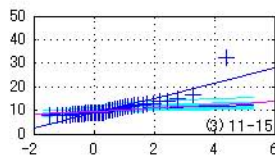
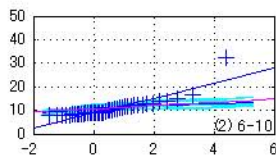
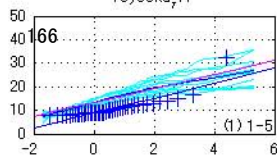
Yonago\_44



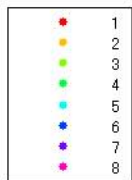
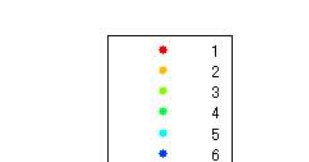
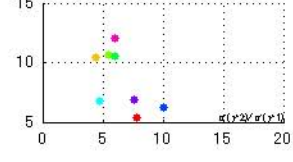
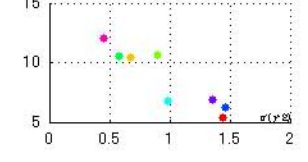
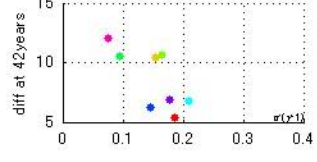
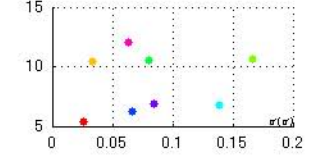
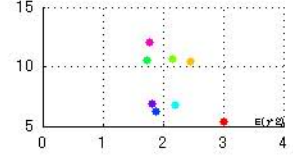
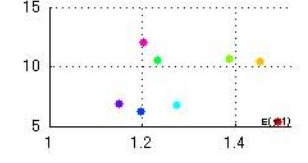
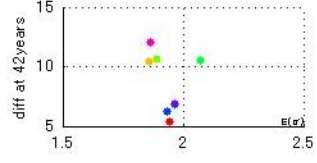
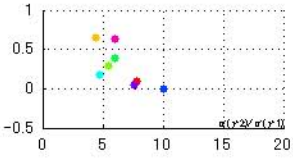
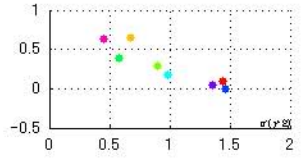
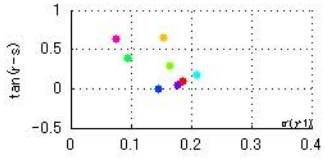
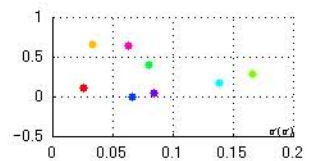
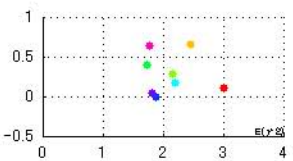
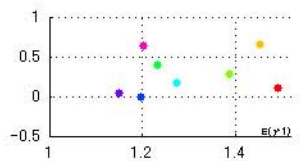
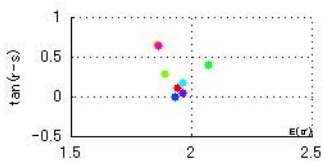
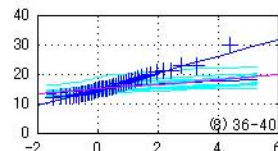
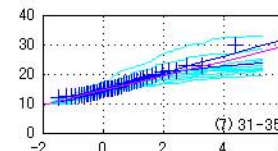
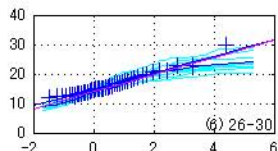
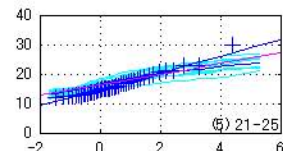
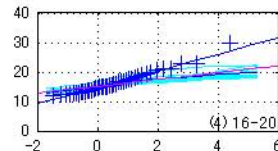
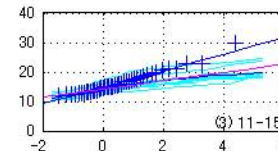
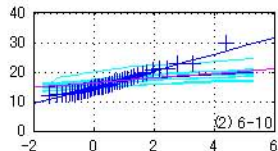
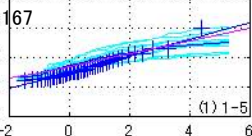
Tottori\_46



Toyooka,47

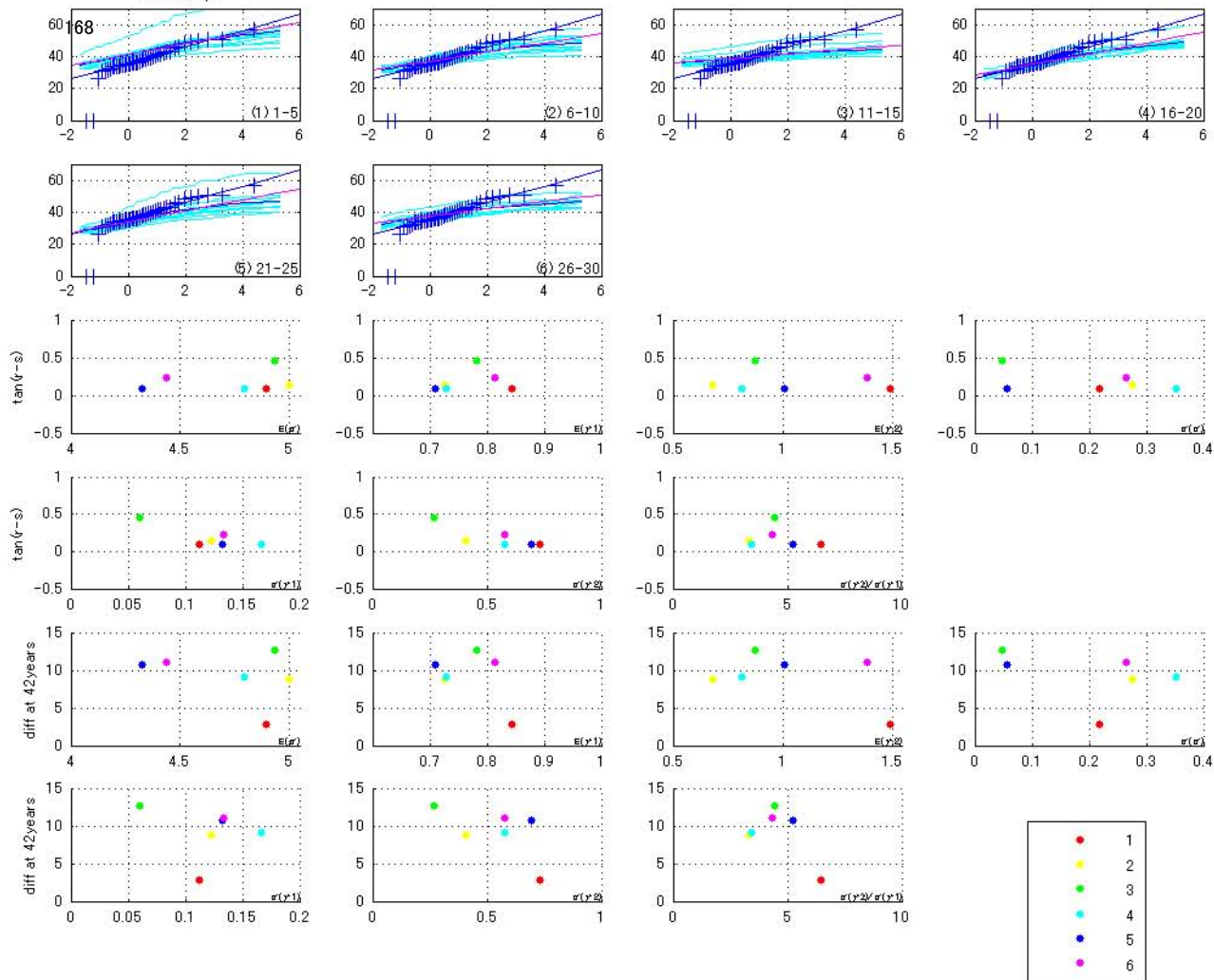


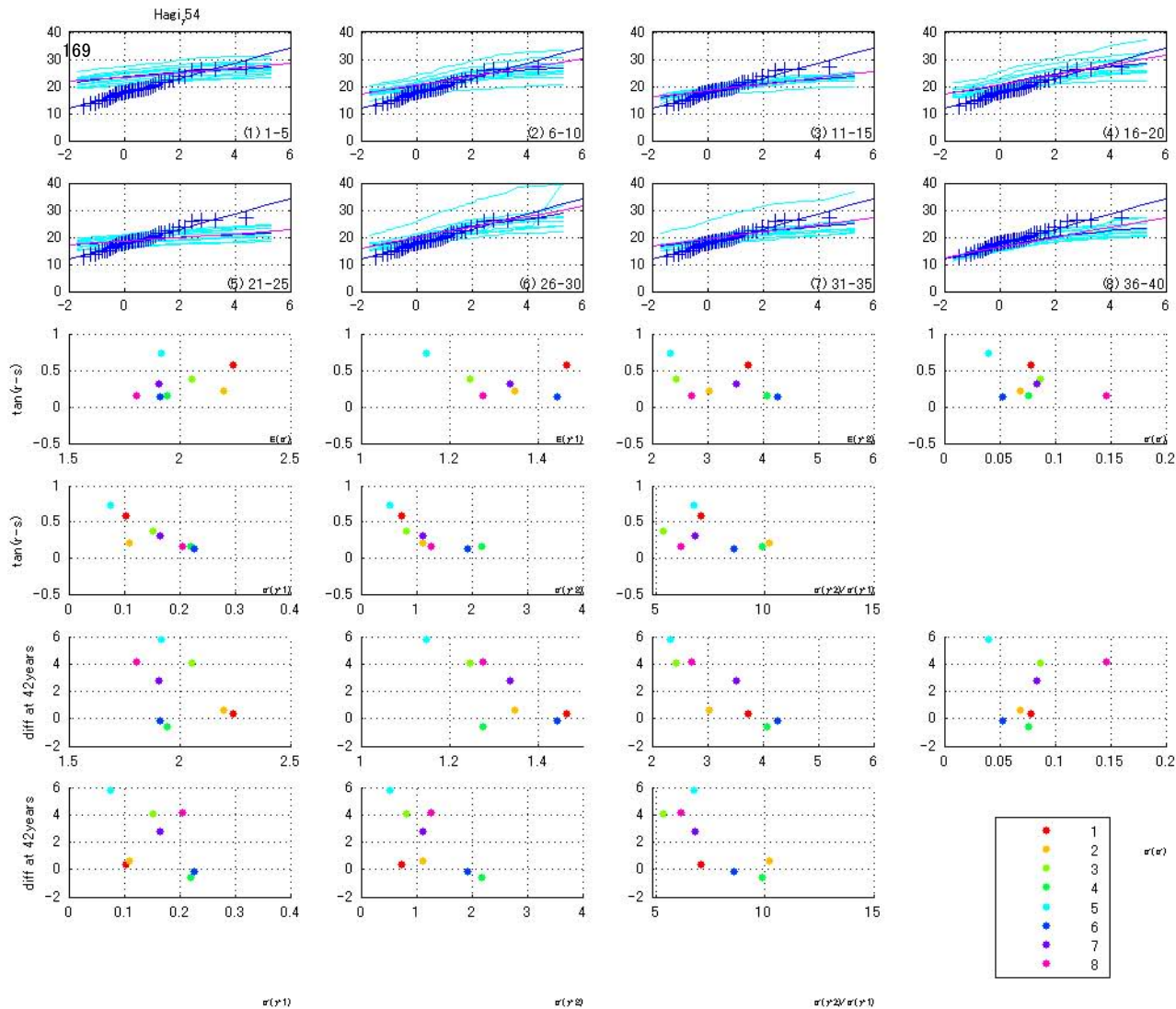
Maizuru\_50



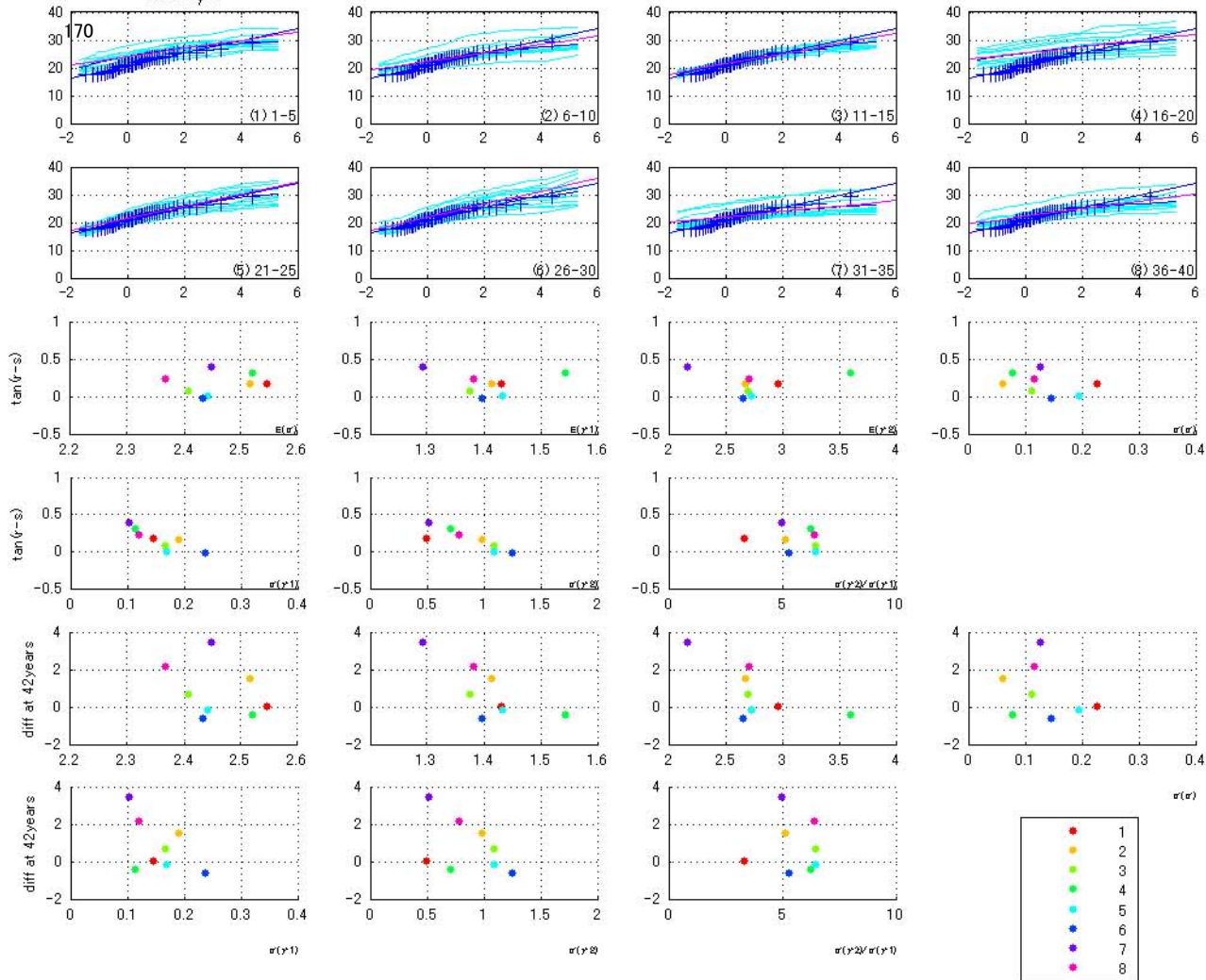


Ibukiyama\_51

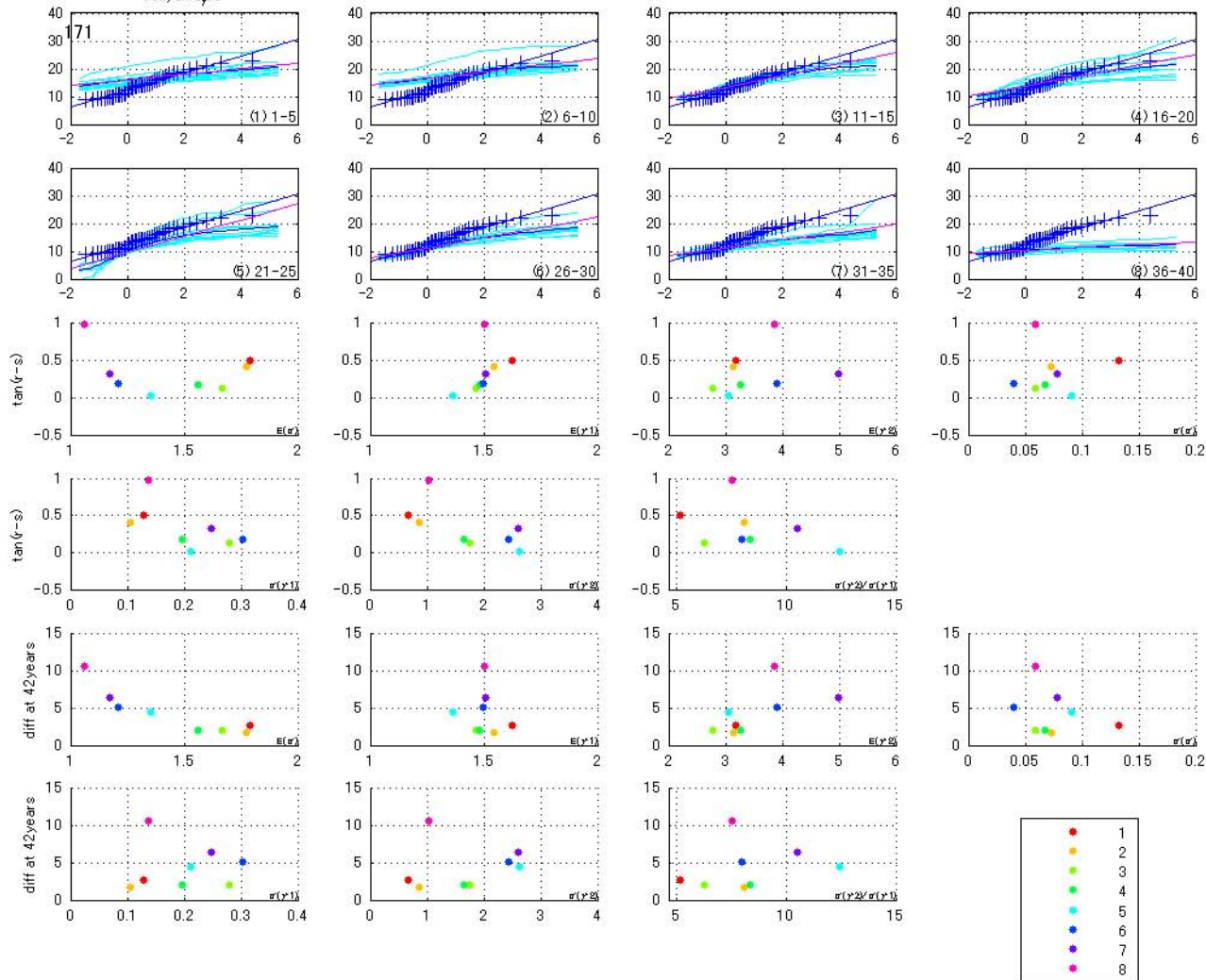




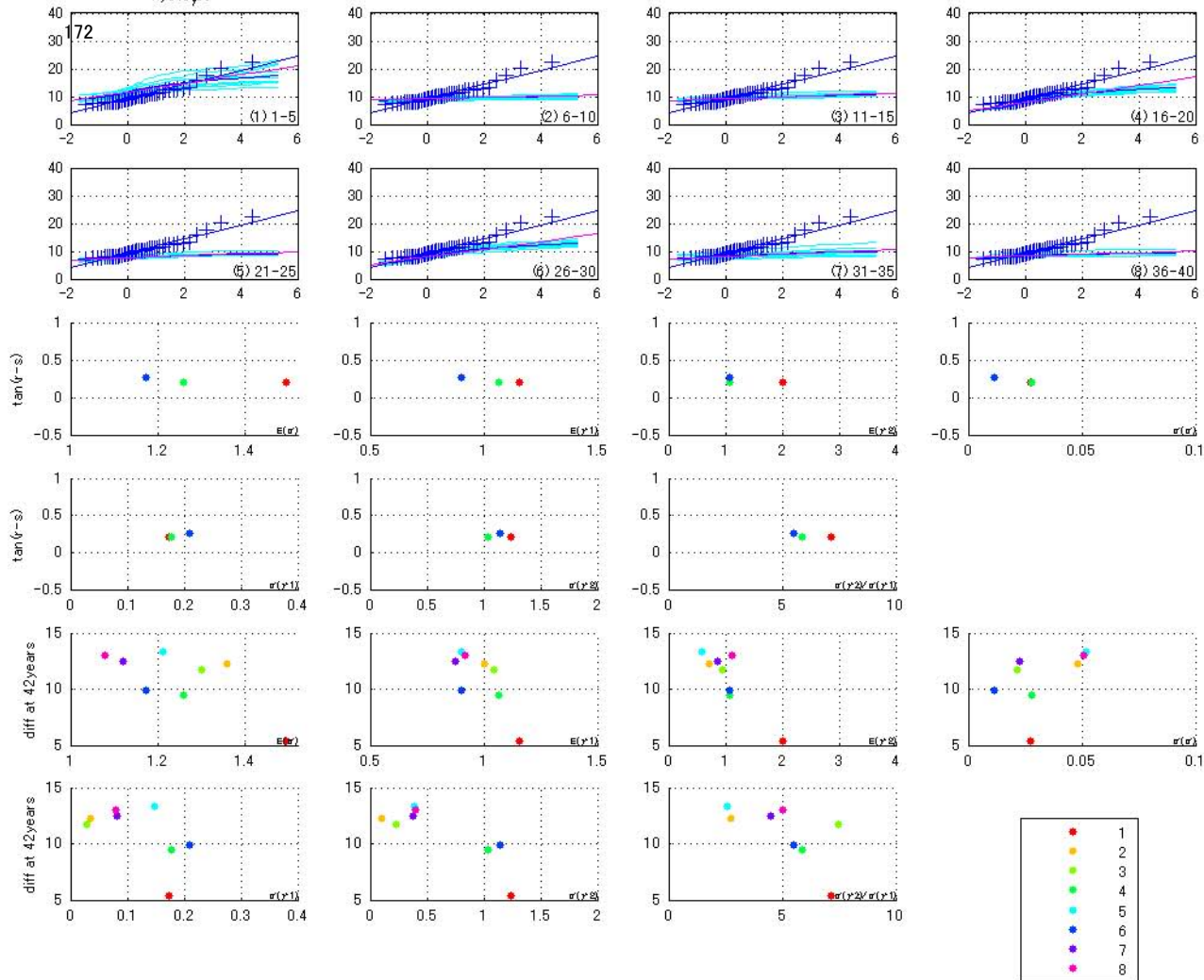
Hamada\_55



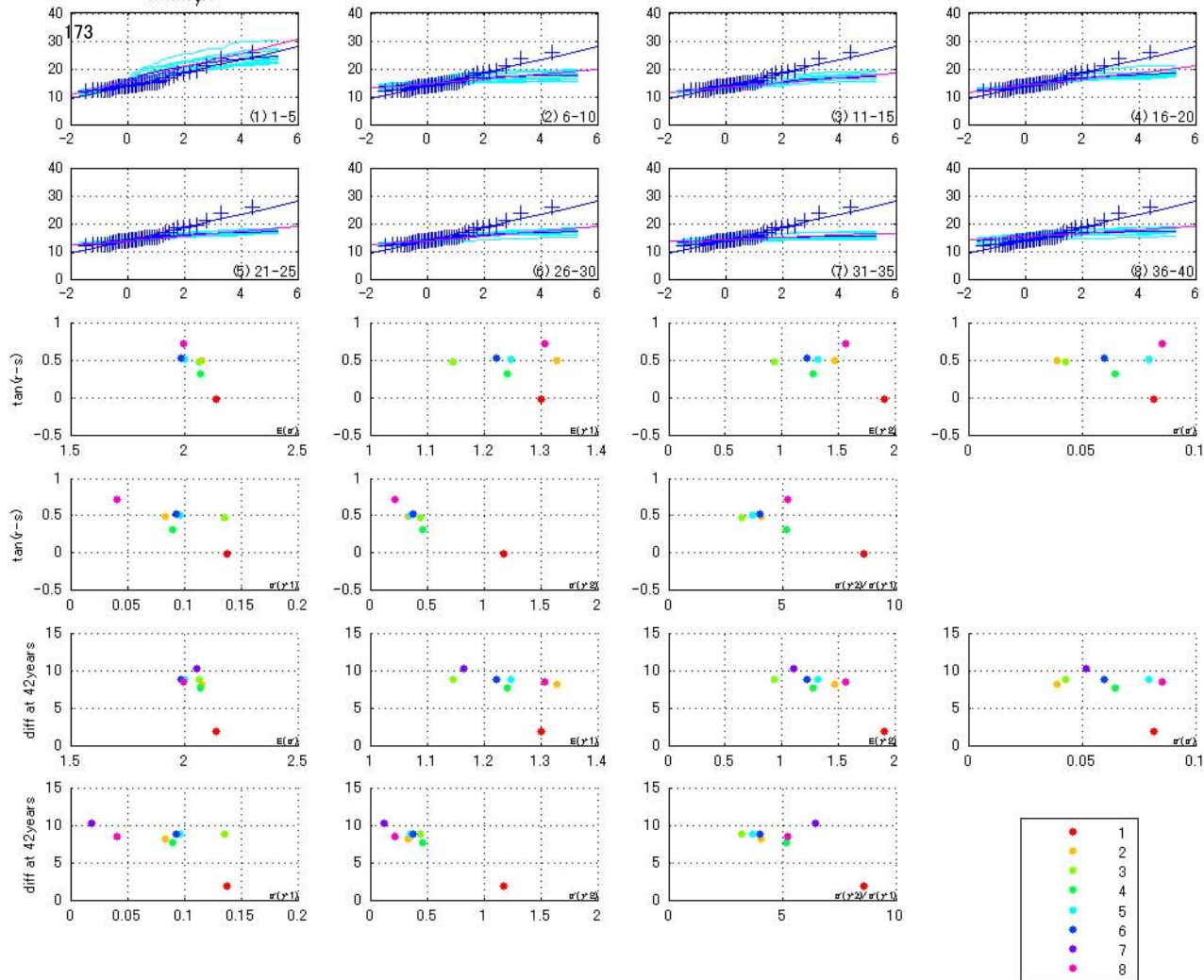
Tsuyama,56



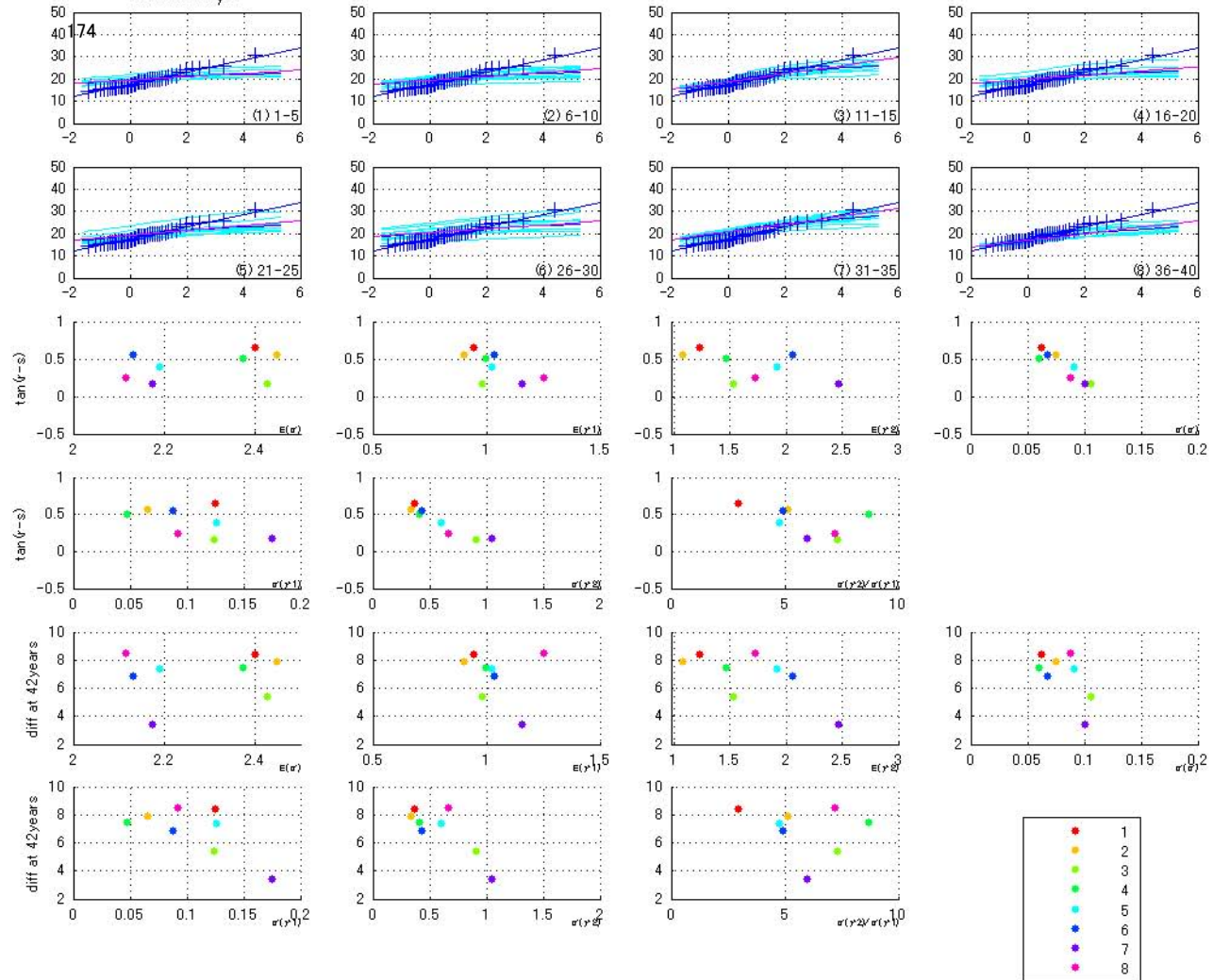
Kyoto\_59



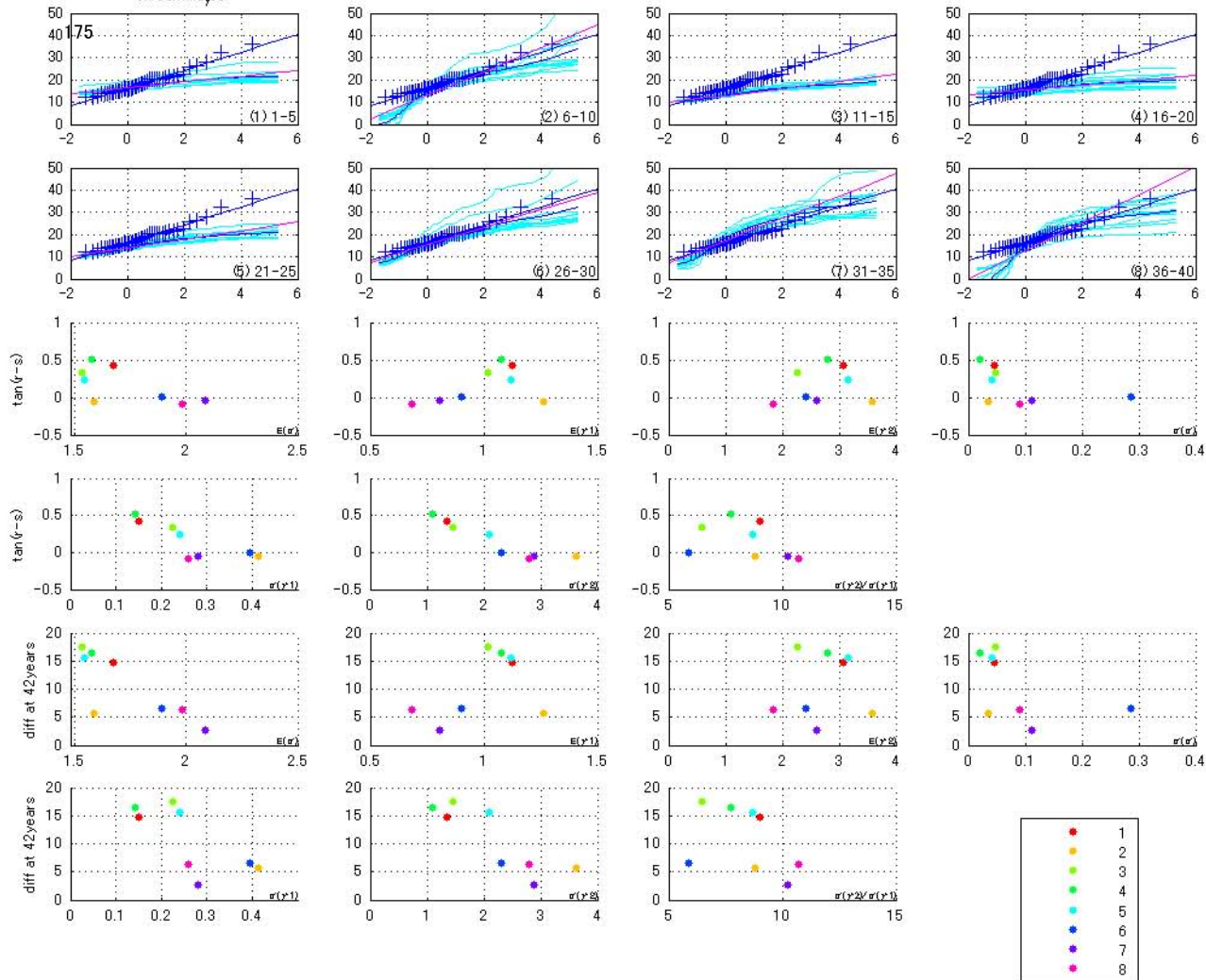
Hikone\_61



Shimonoseki\_62

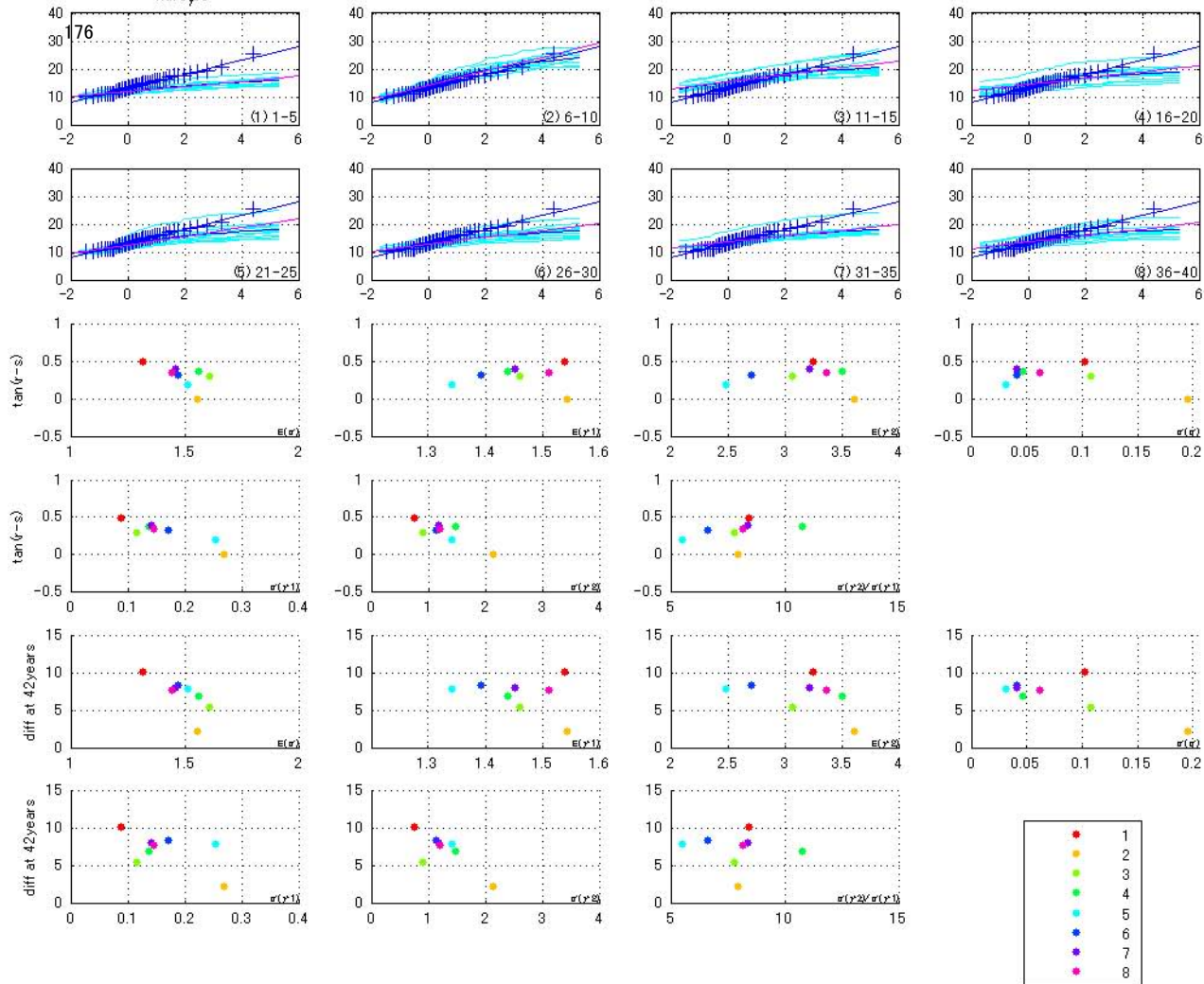


Hiroshima\_65

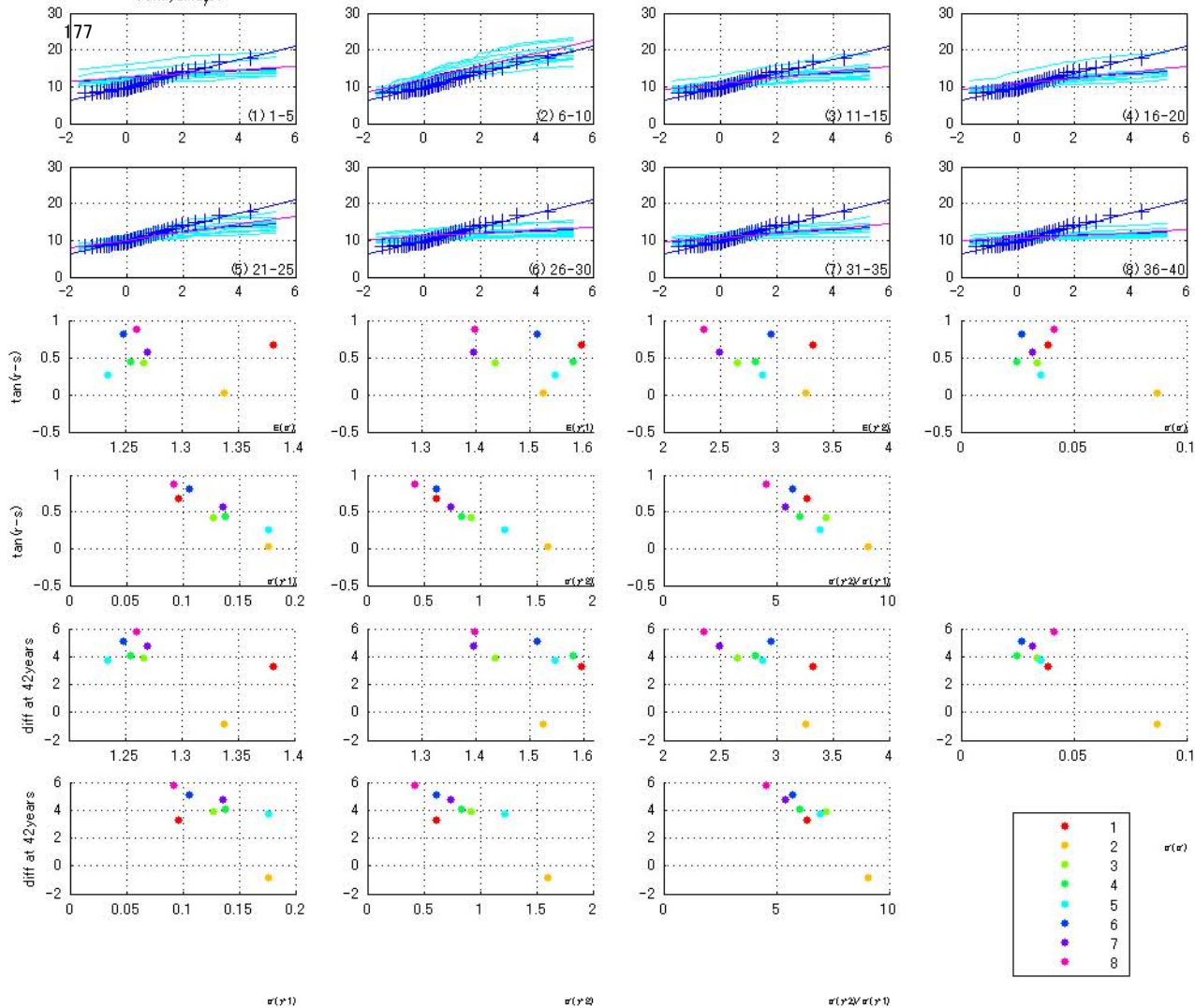




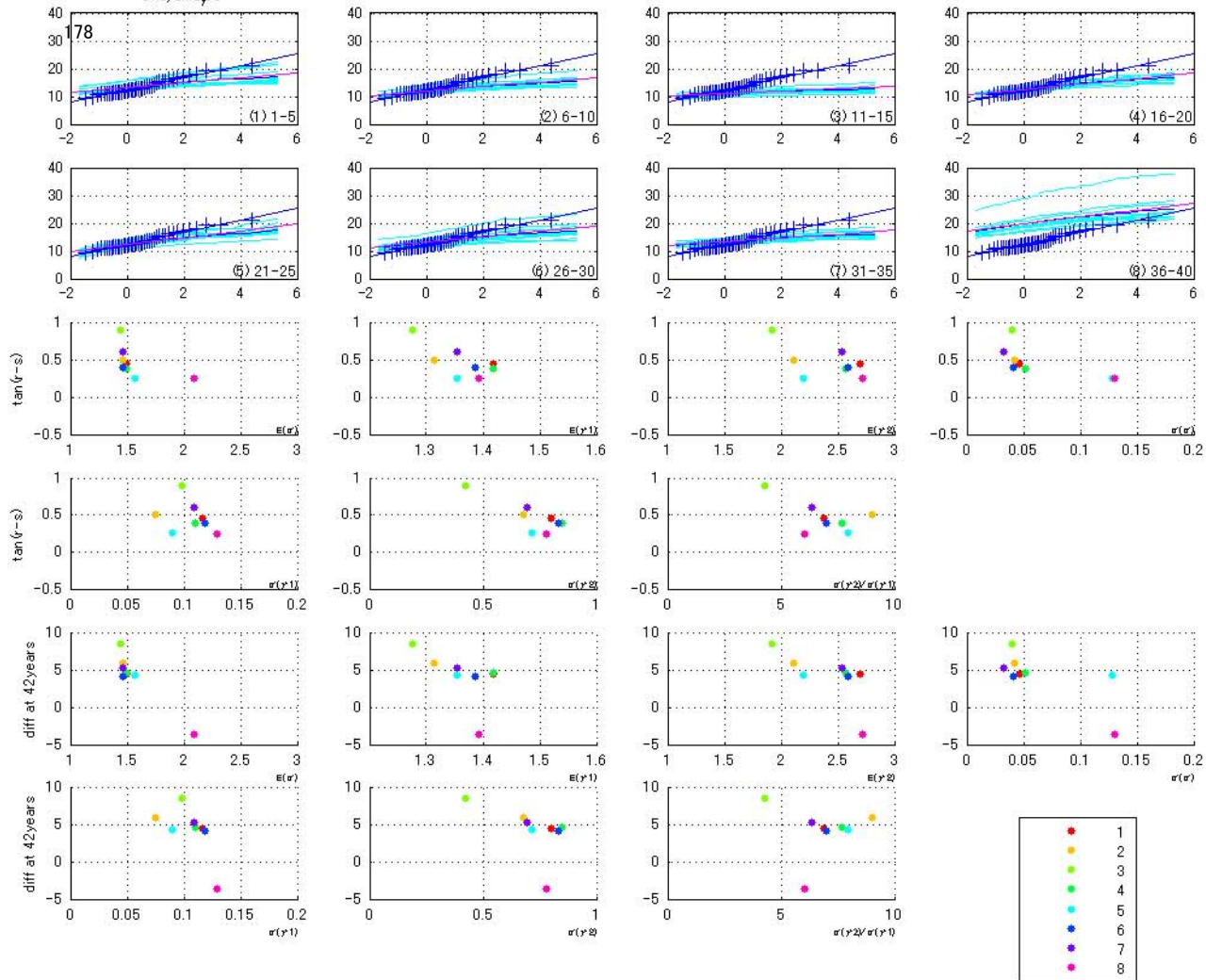
Kure\_66



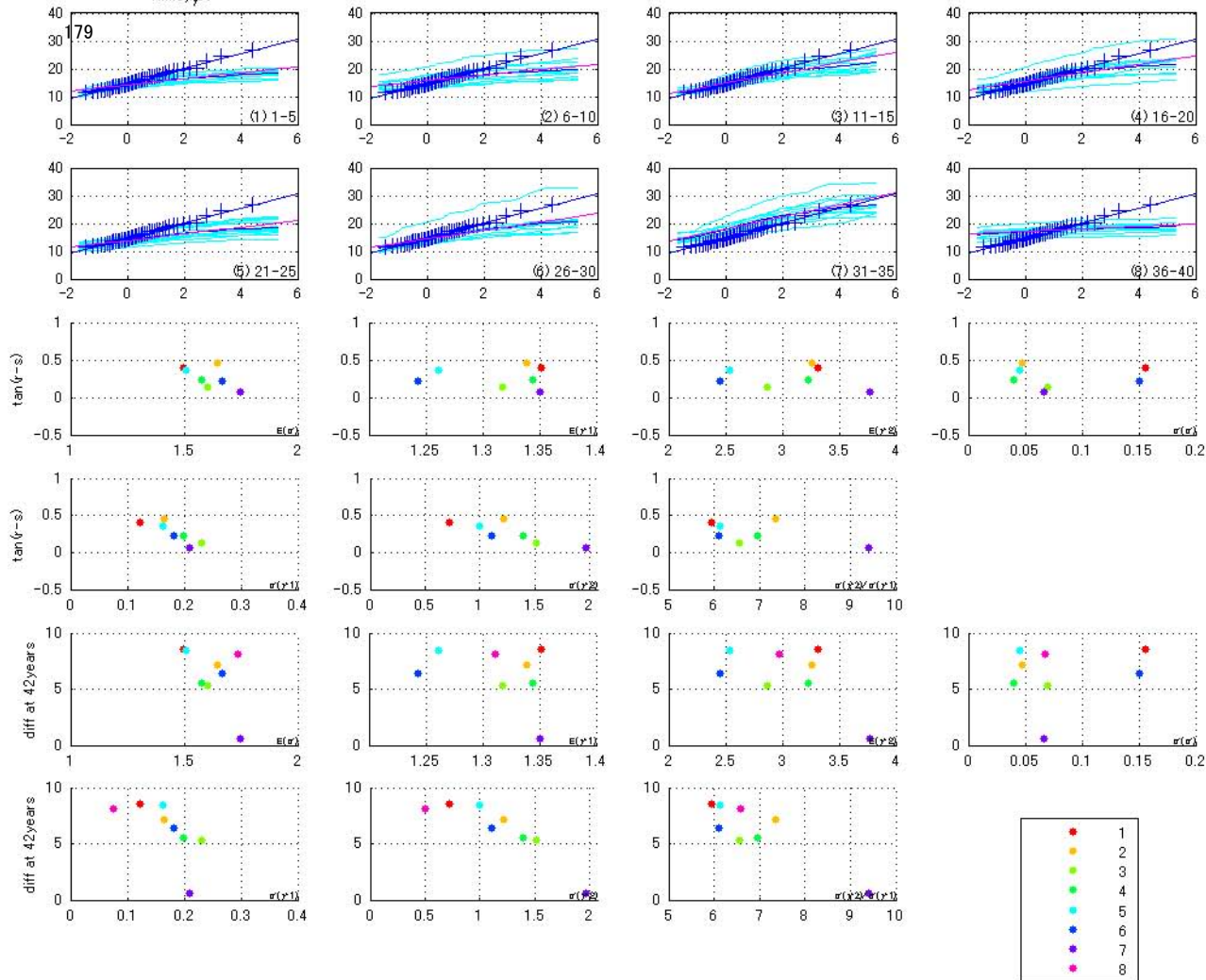
Fukuyama\_67



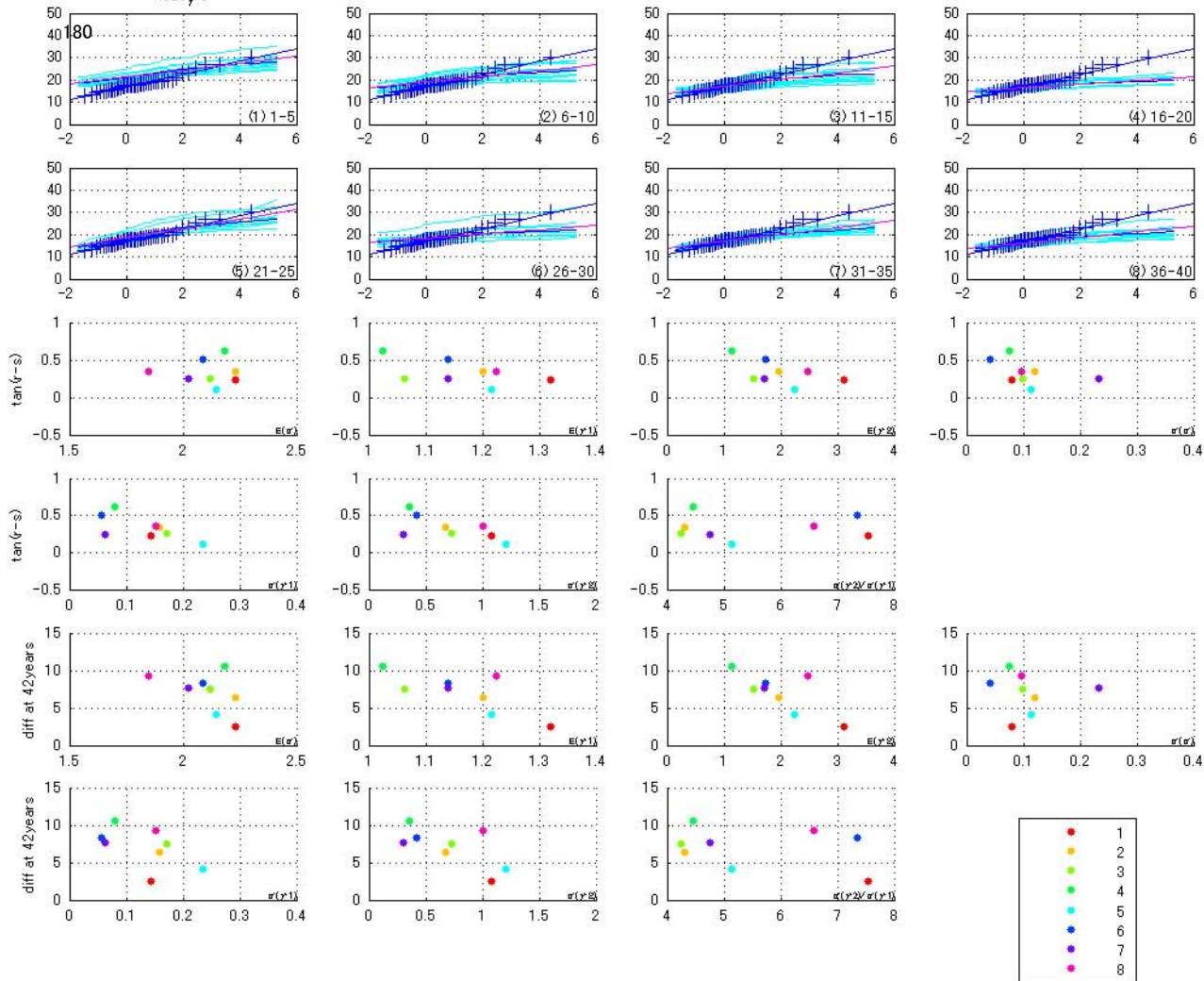
Okayama\_68



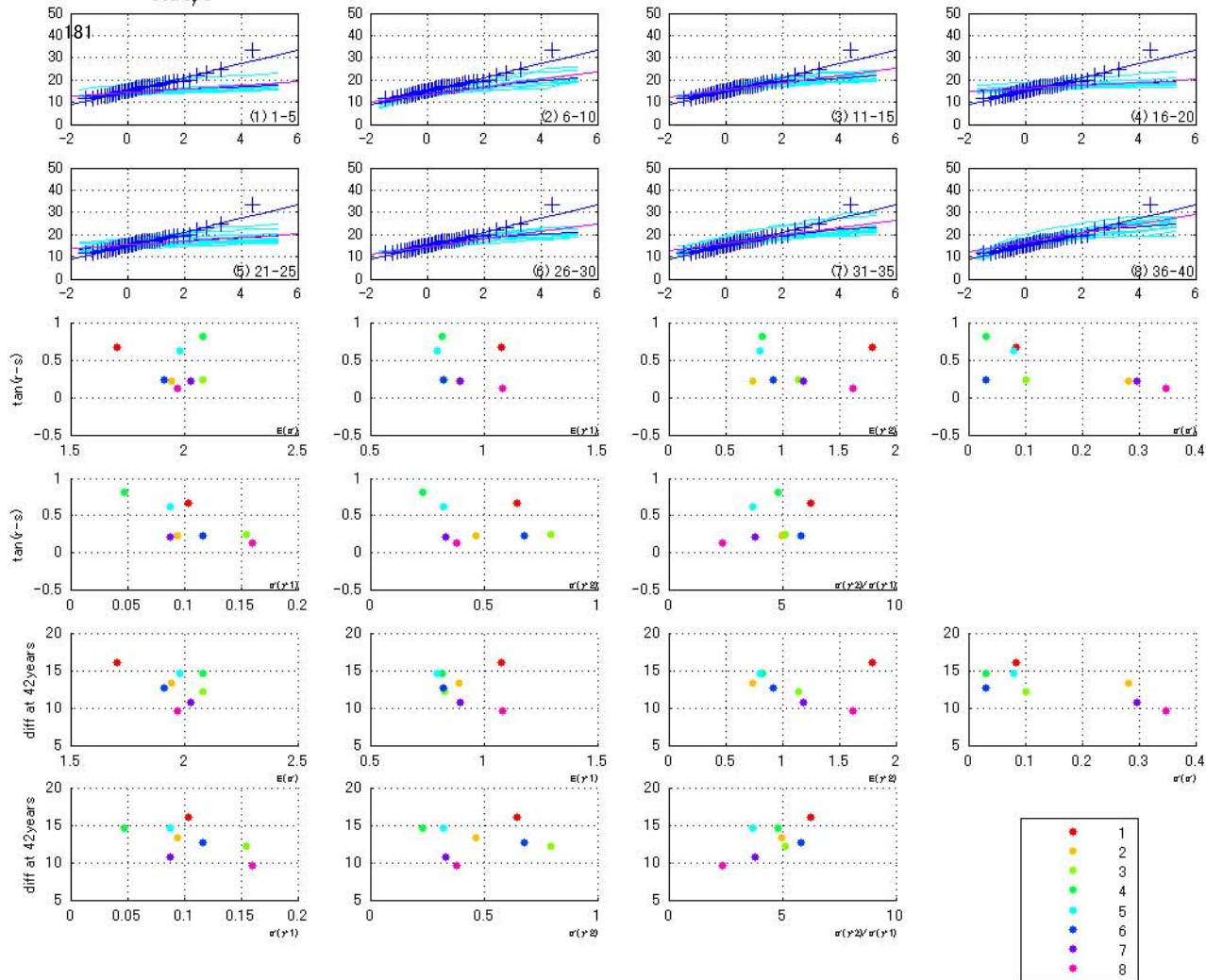
Himeji\_69



Kobe\_70

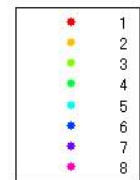
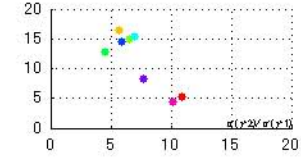
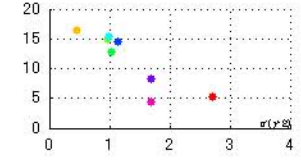
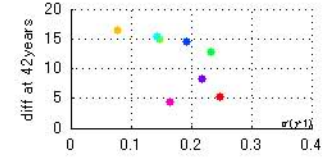
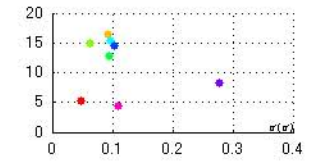
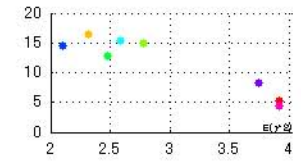
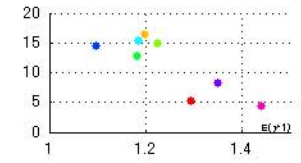
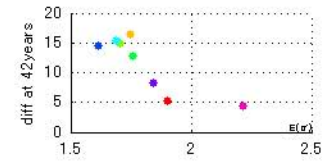
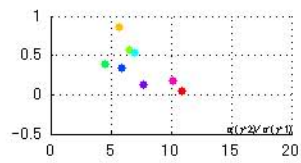
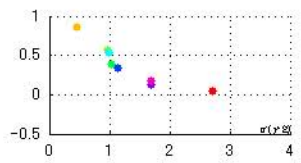
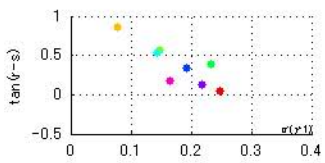
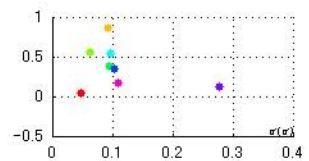
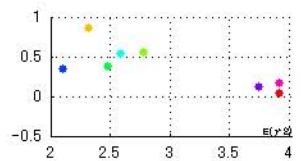
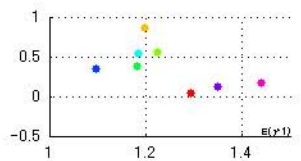
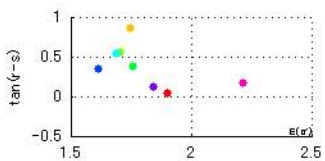
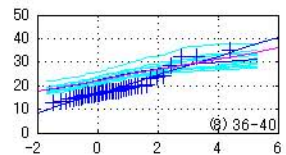
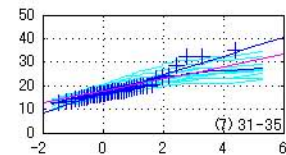
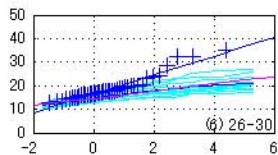
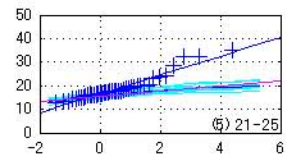
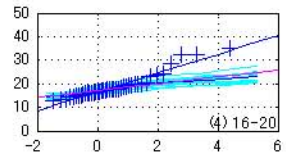
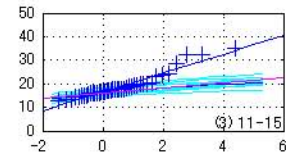
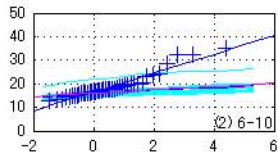
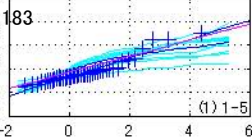


Osaka<sub>72</sub>



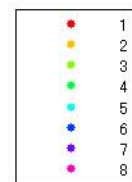
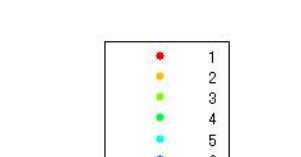
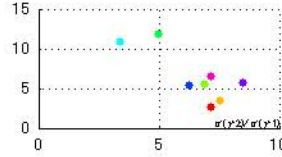
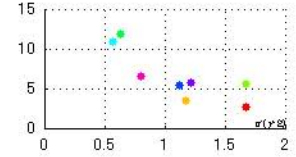
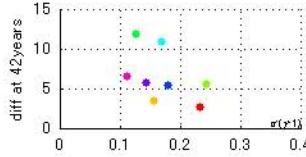
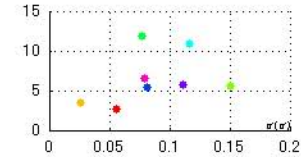
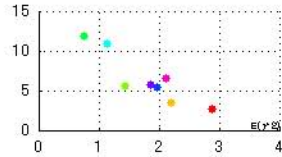
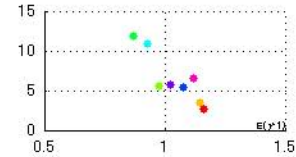
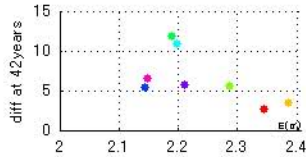
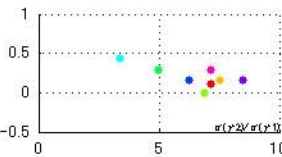
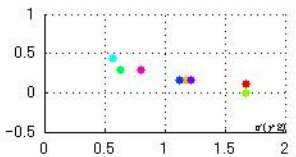
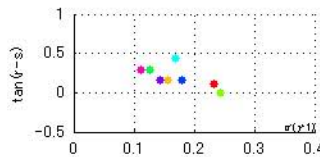
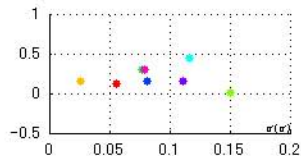
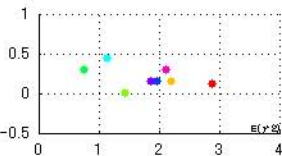
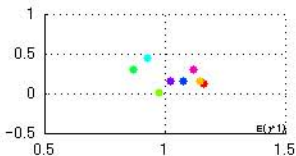
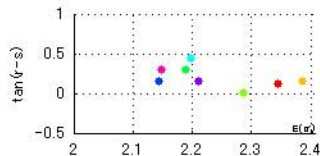
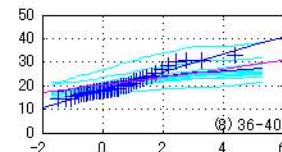
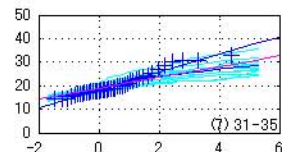
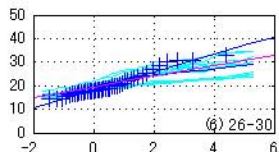
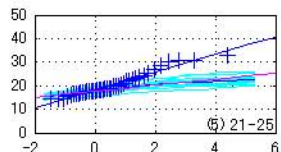
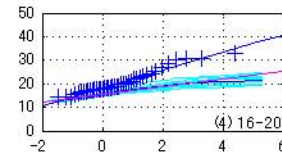
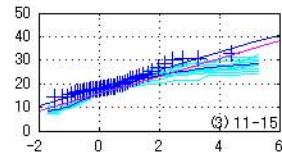
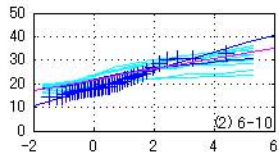
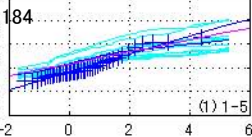


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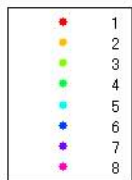
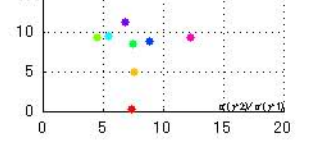
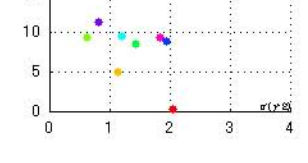
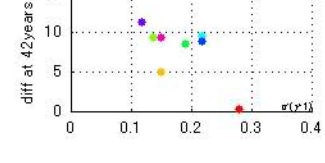
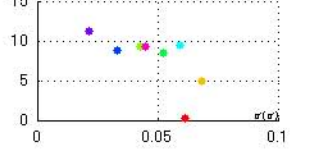
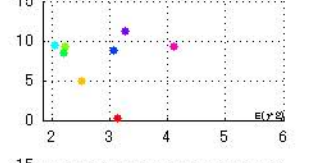
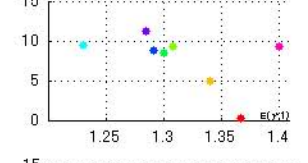
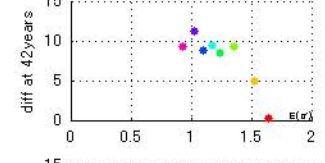
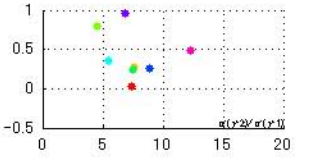
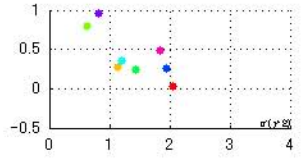
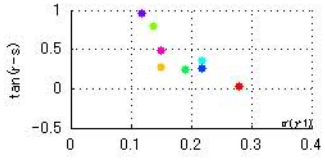
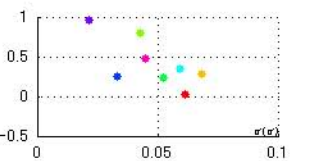
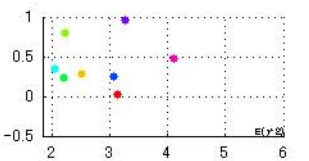
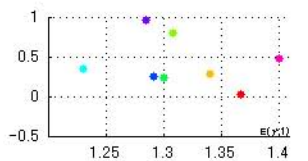
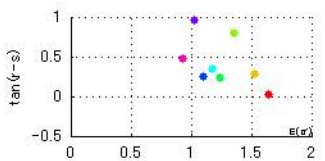
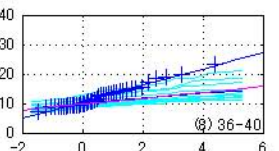
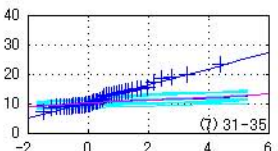
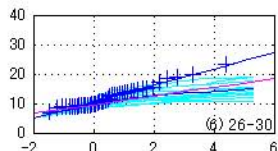
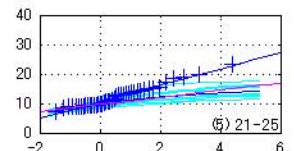
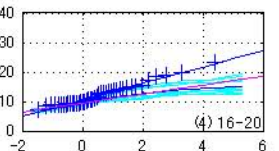
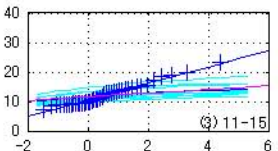
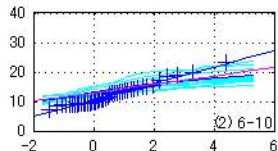
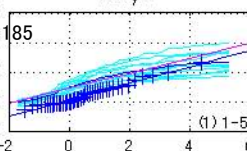




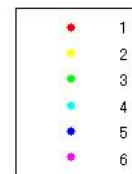
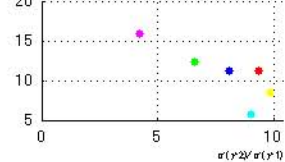
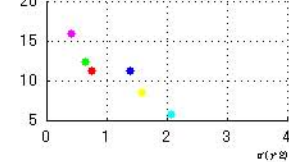
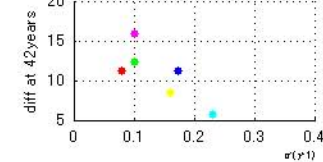
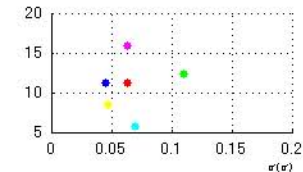
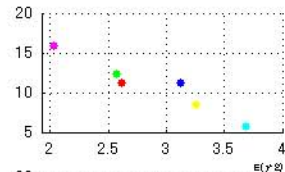
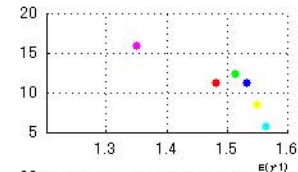
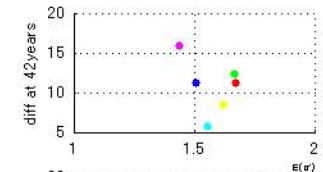
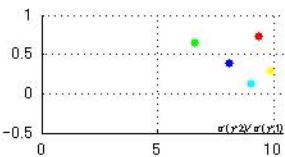
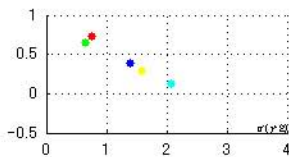
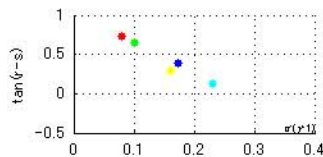
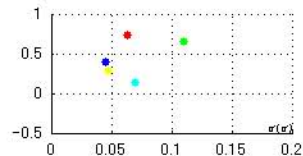
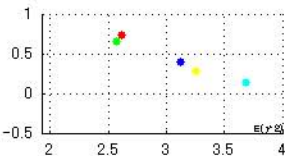
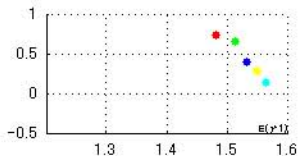
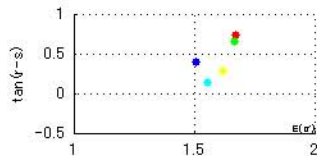
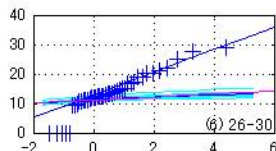
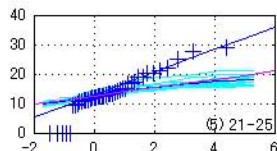
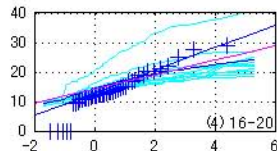
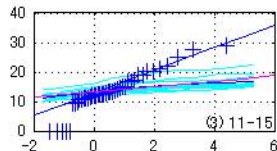
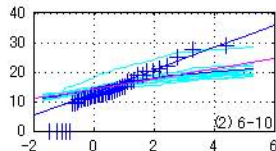
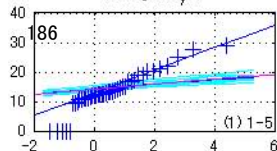
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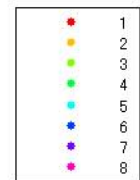
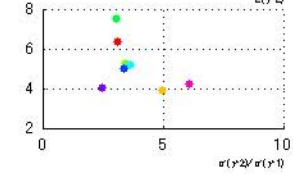
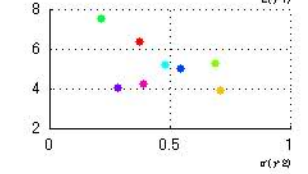
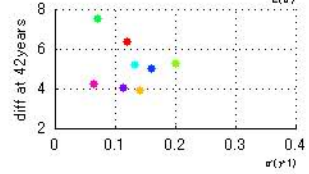
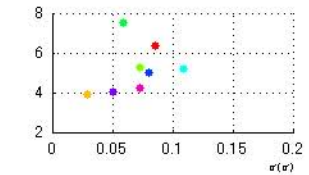
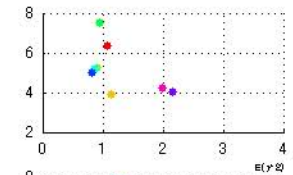
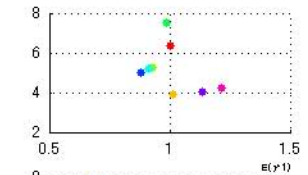
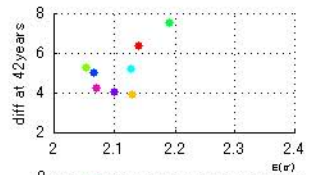
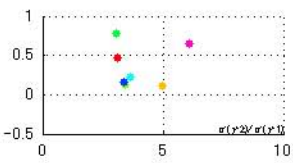
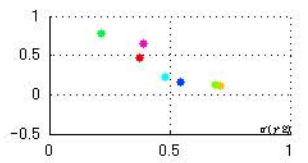
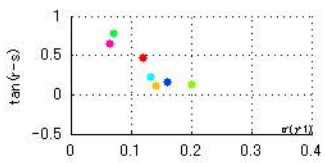
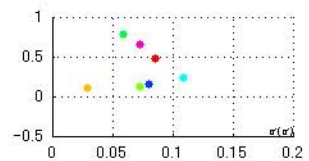
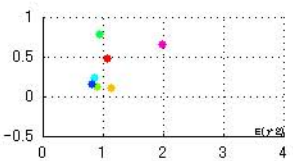
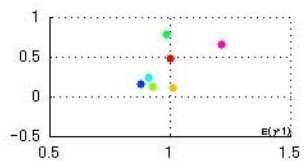
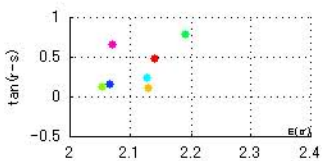
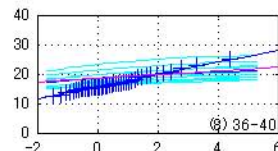
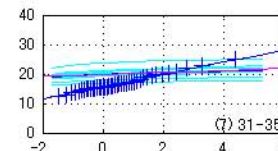
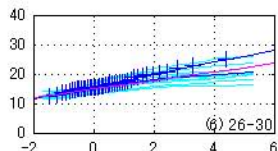
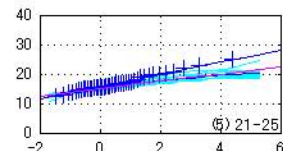
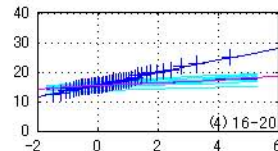
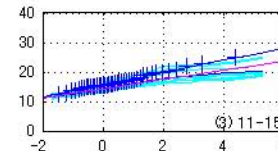
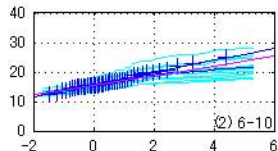
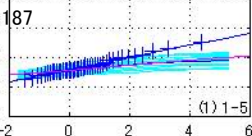
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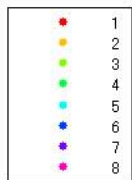
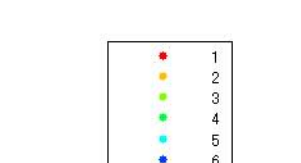
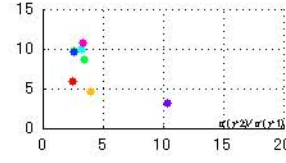
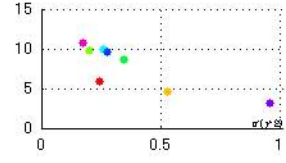
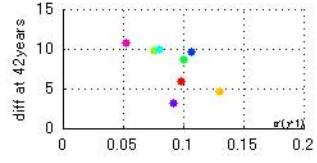
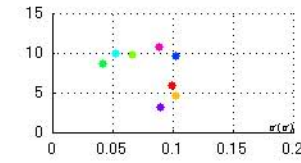
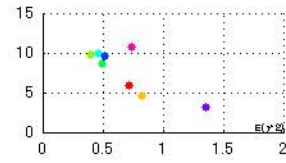
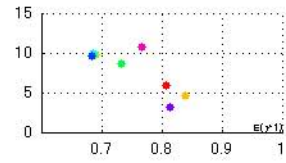
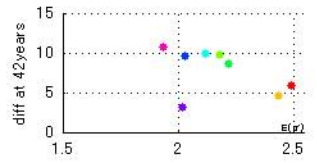
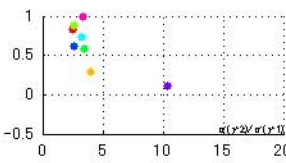
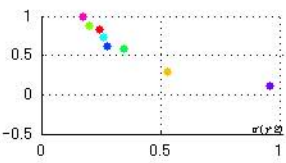
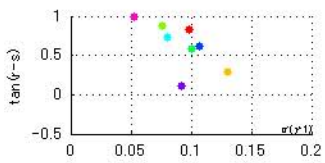
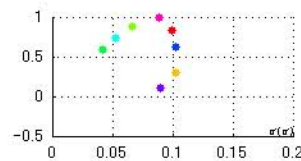
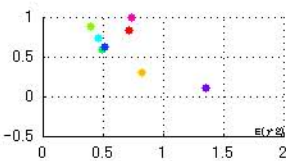
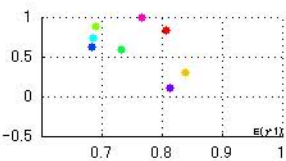
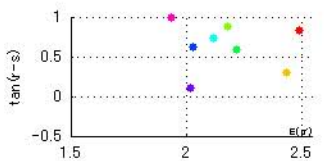
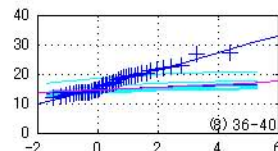
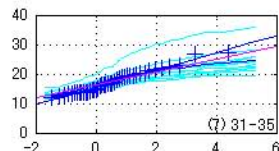
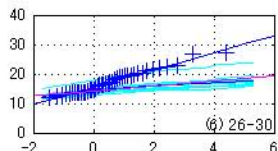
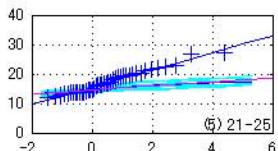
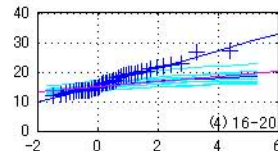
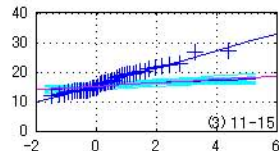
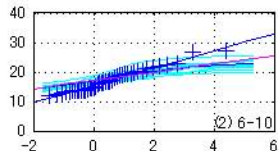
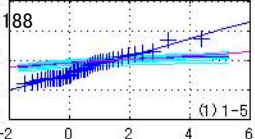
Yamaguchi,84



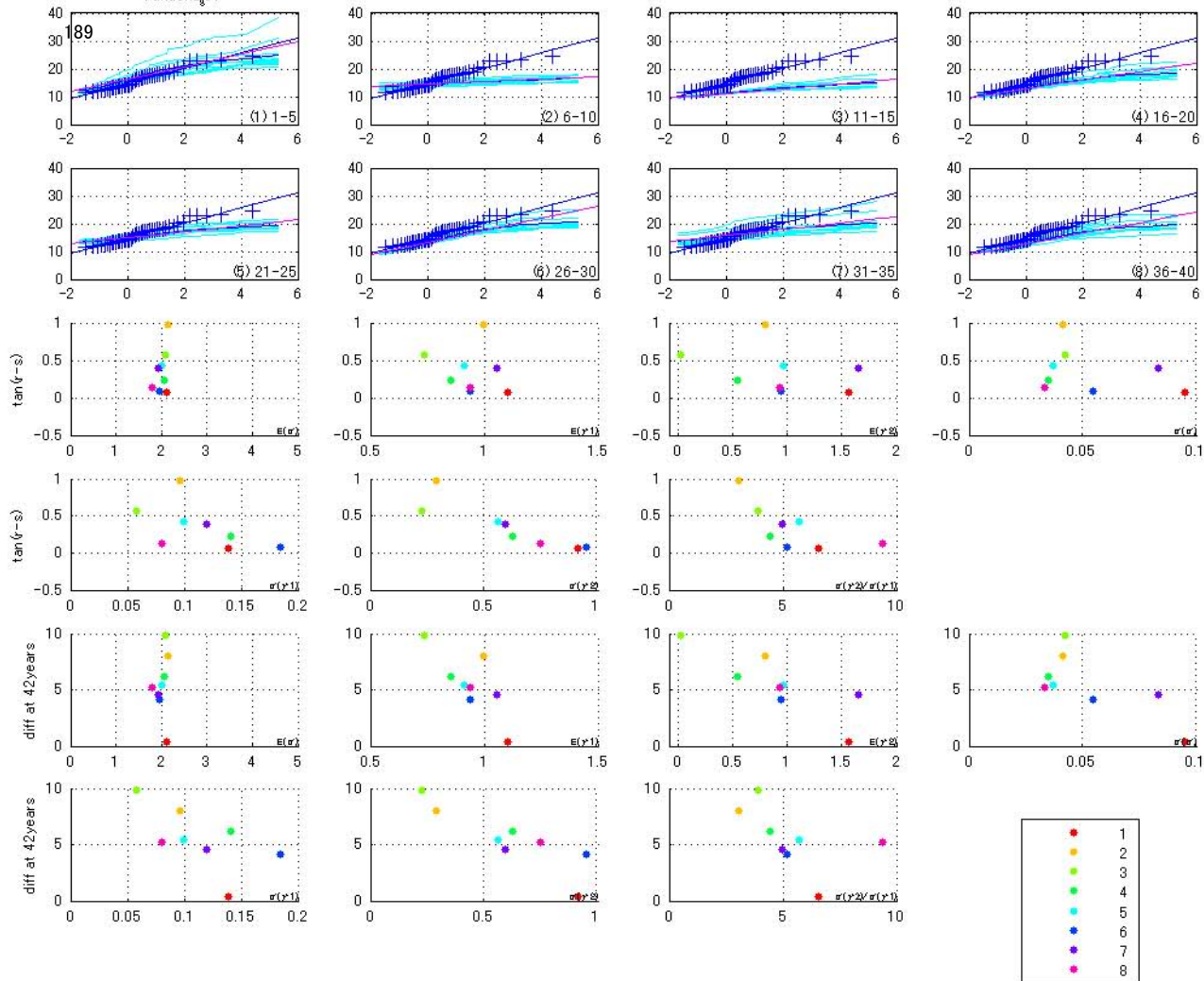
Izuharaga00

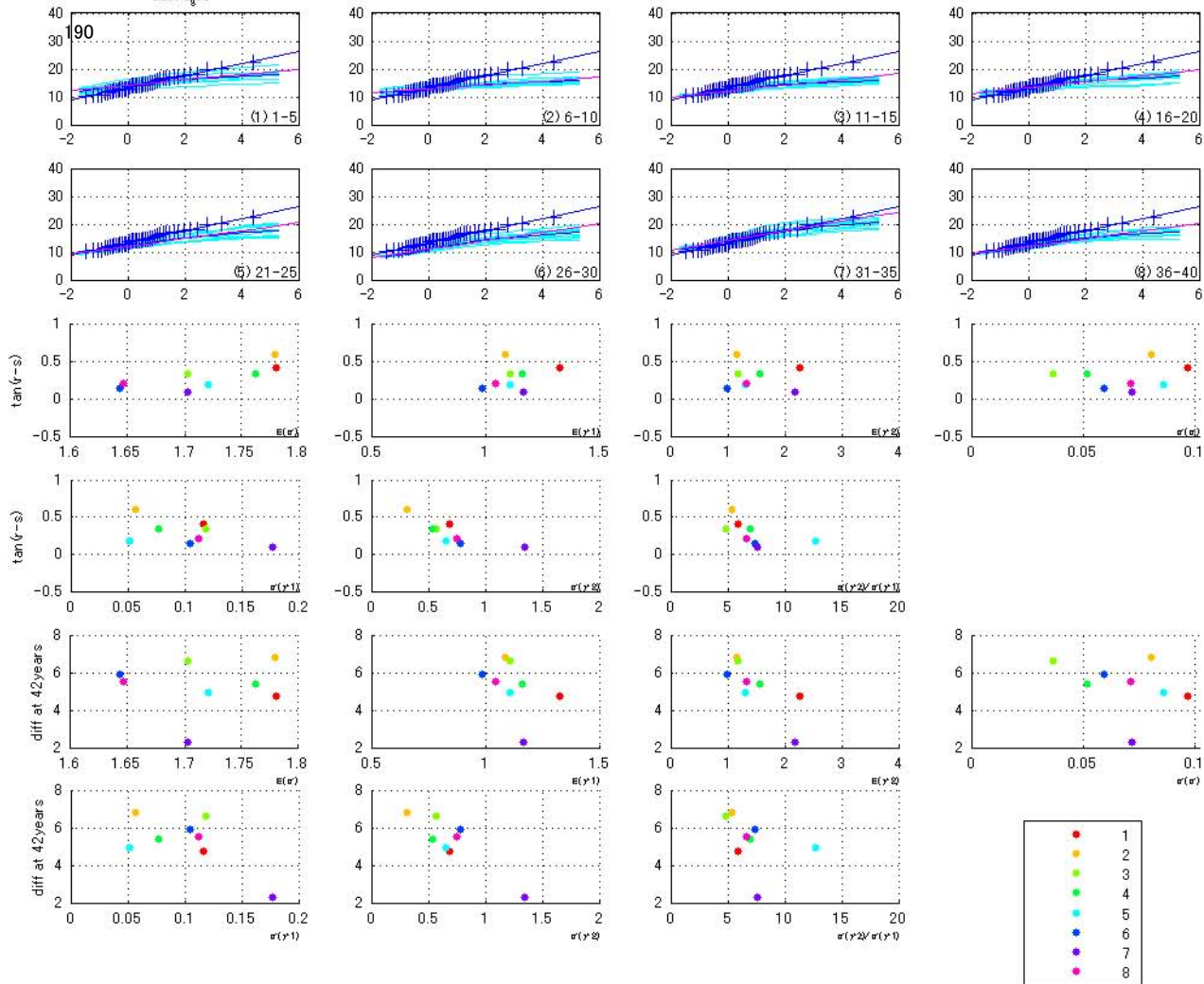


Hirado<sub>05</sub>

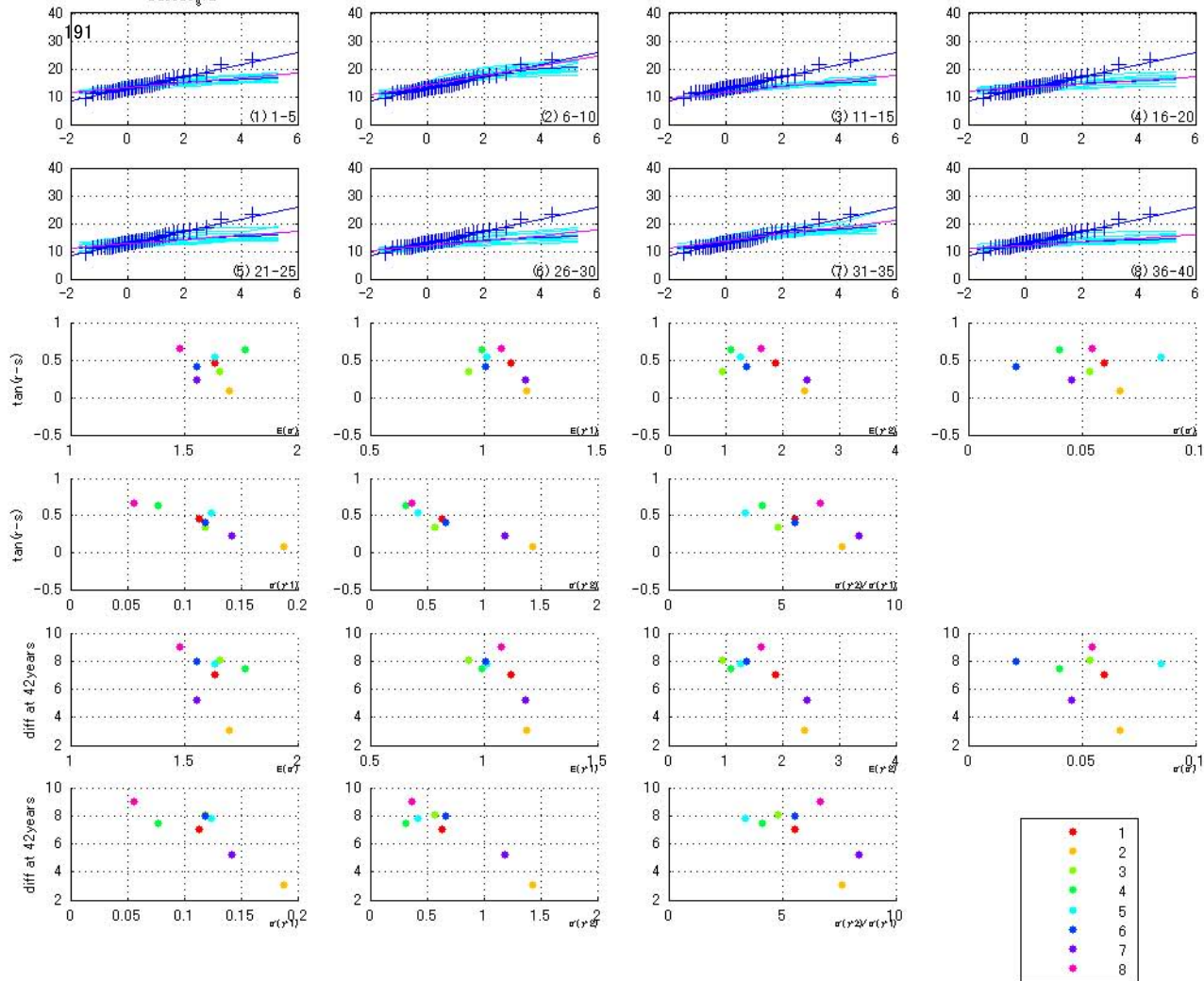


Fukuoka<sub>07</sub>



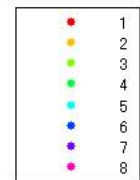
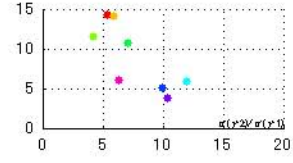
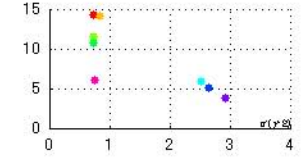
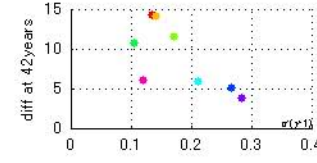
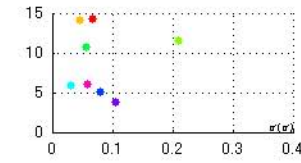
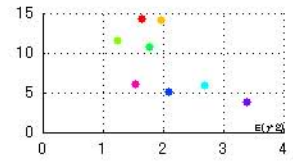
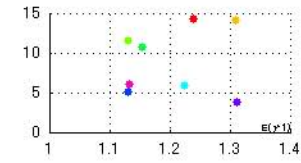
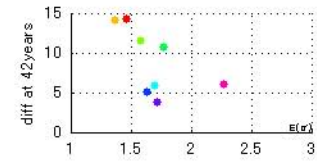
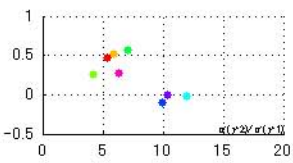
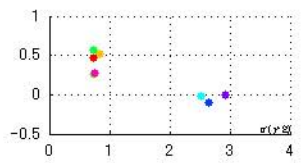
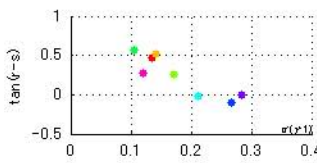
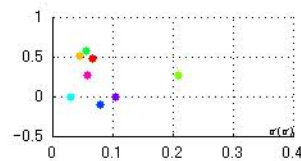
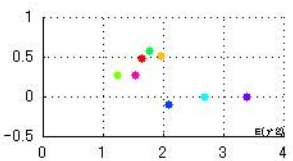
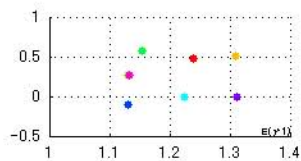
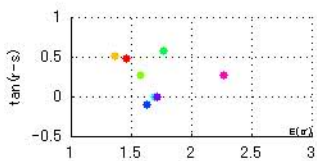
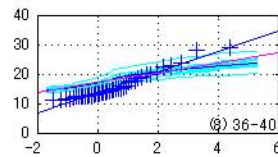
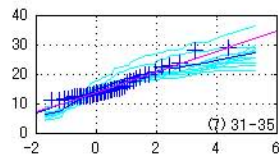
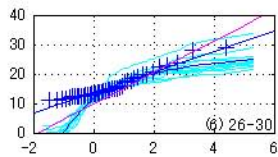
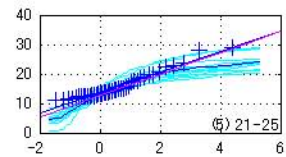
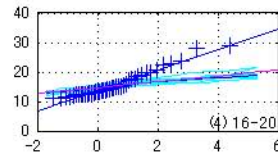
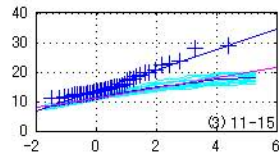
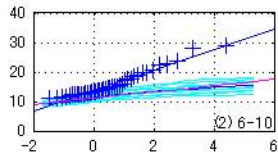
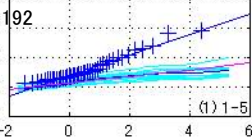
Iizuka<sub>09</sub>

Sasebo<sub>g</sub>12

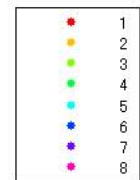
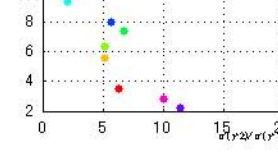
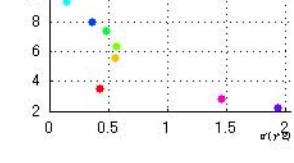
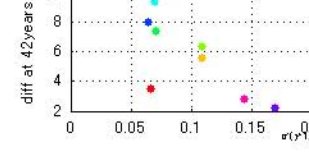
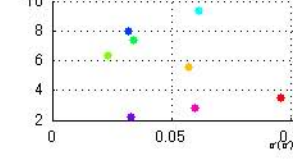
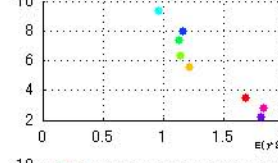
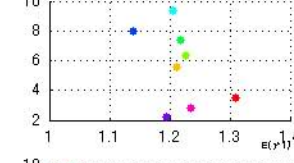
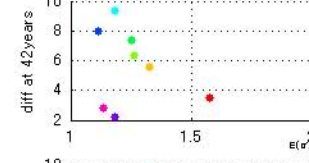
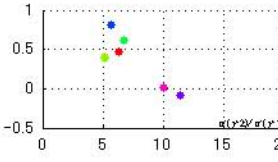
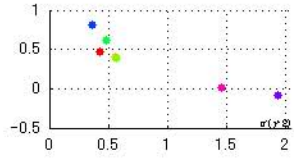
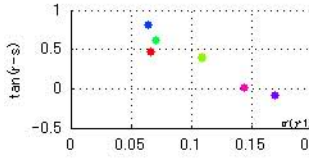
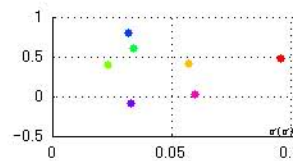
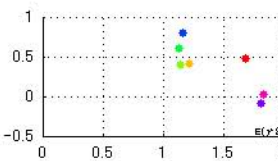
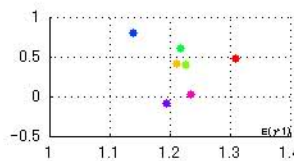
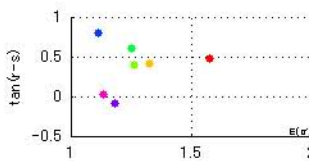
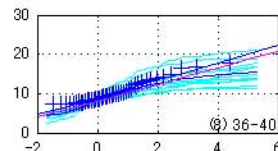
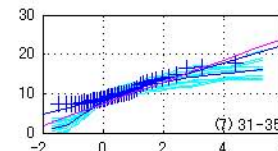
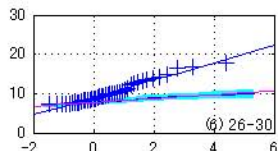
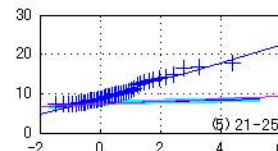
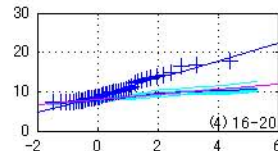
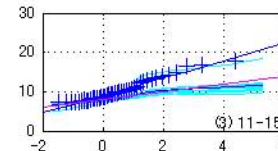
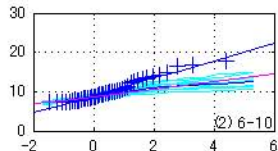
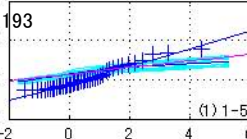




Saga<sub>3</sub>13

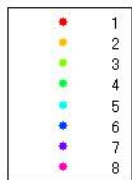
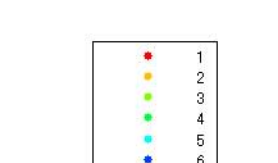
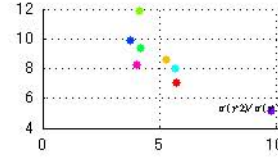
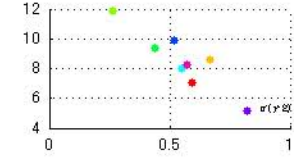
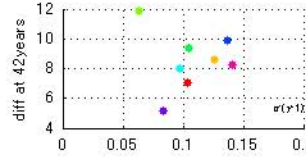
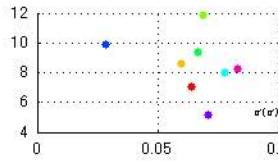
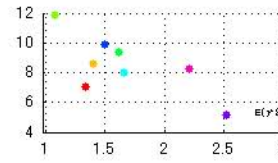
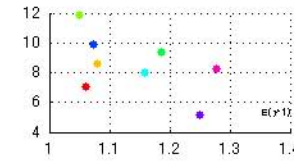
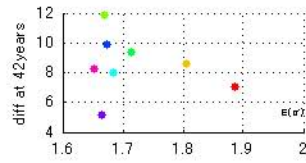
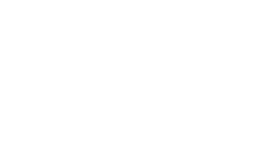
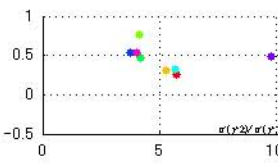
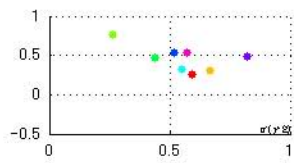
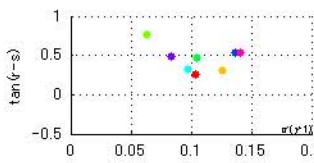
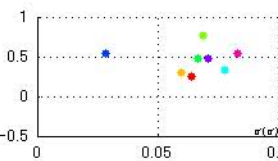
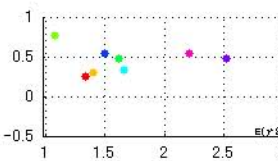
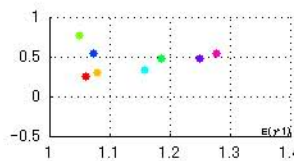
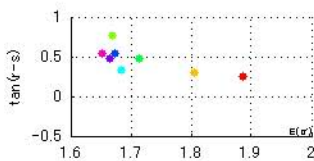
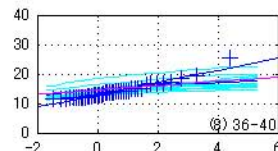
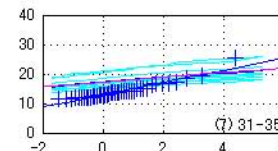
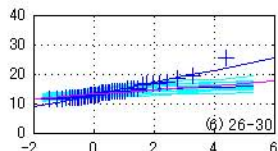
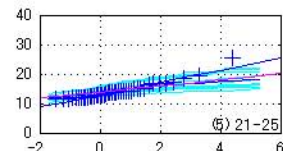
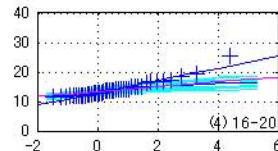
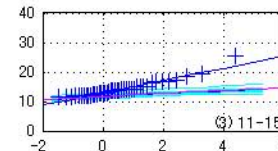
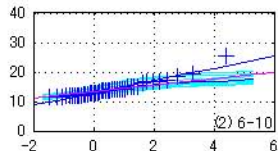
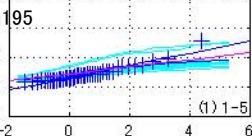


Hita<sub>3</sub>14

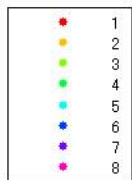
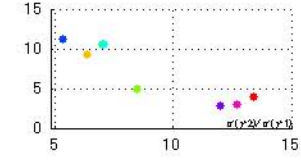
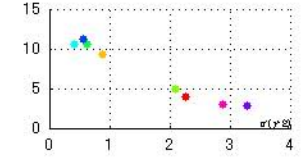
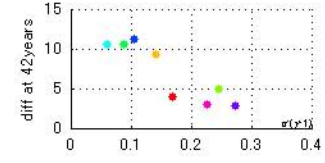
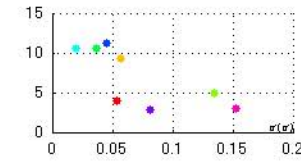
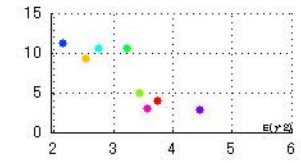
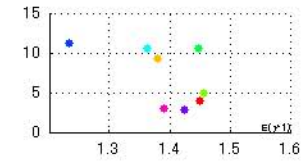
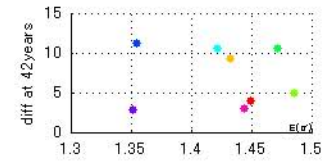
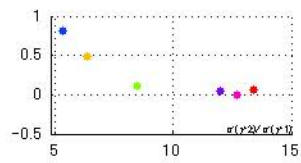
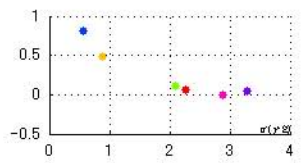
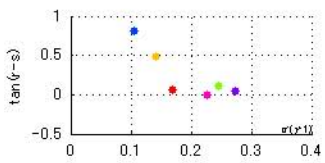
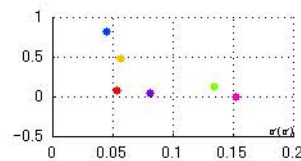
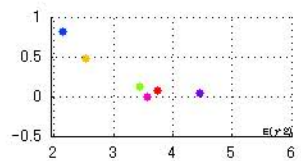
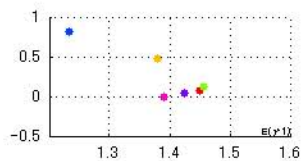
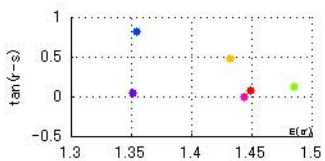
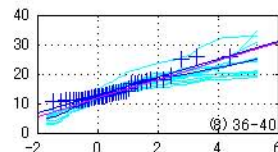
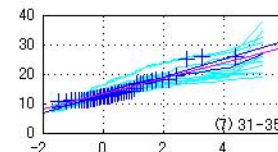
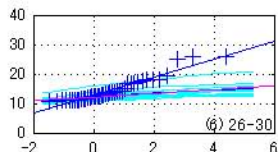
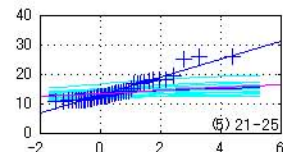
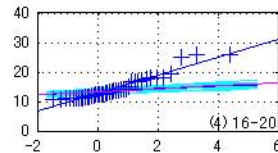
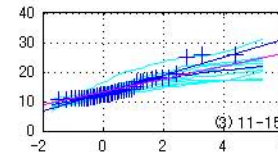
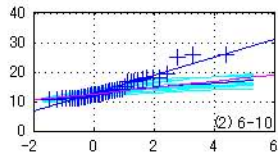
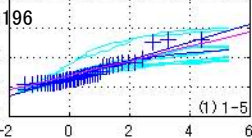




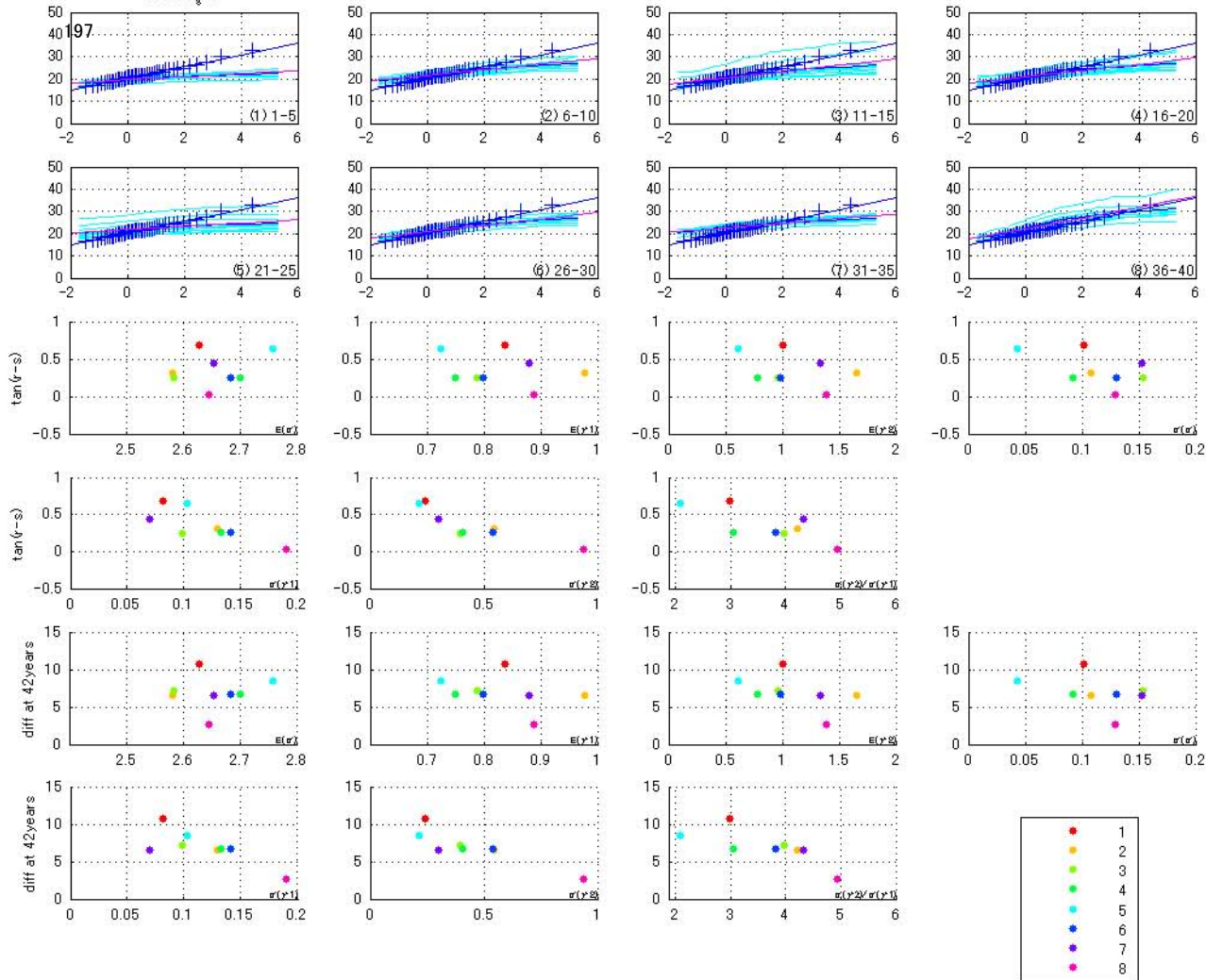
Nagasaki<sub>8</sub>17



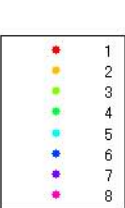
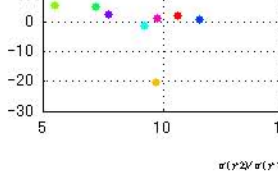
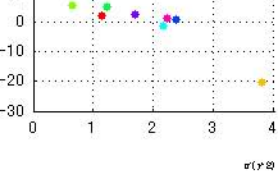
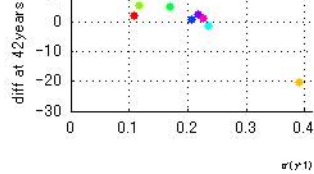
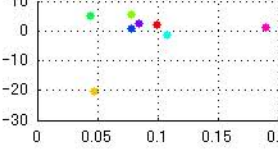
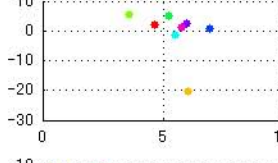
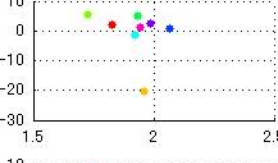
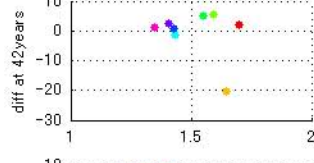
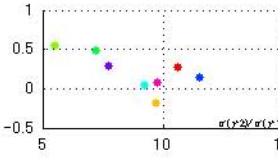
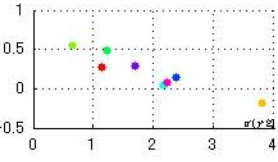
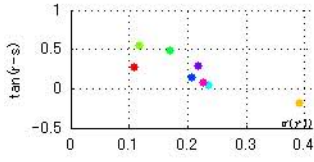
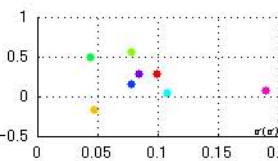
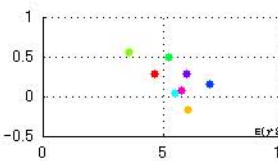
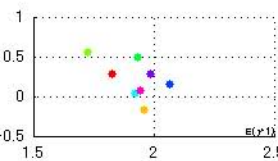
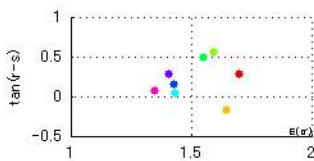
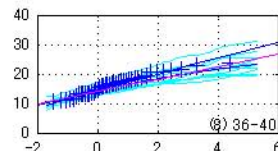
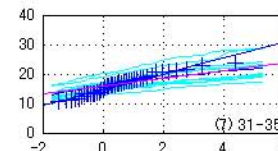
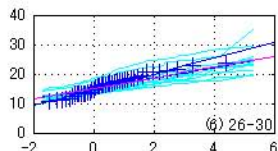
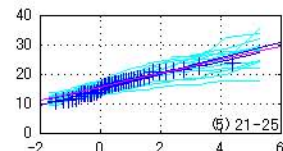
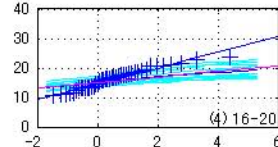
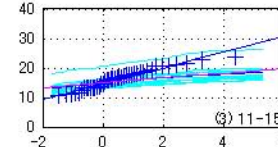
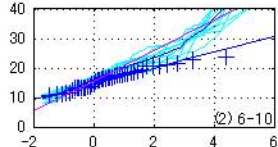
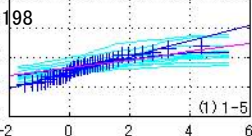
Kumamoto<sub>0</sub>19



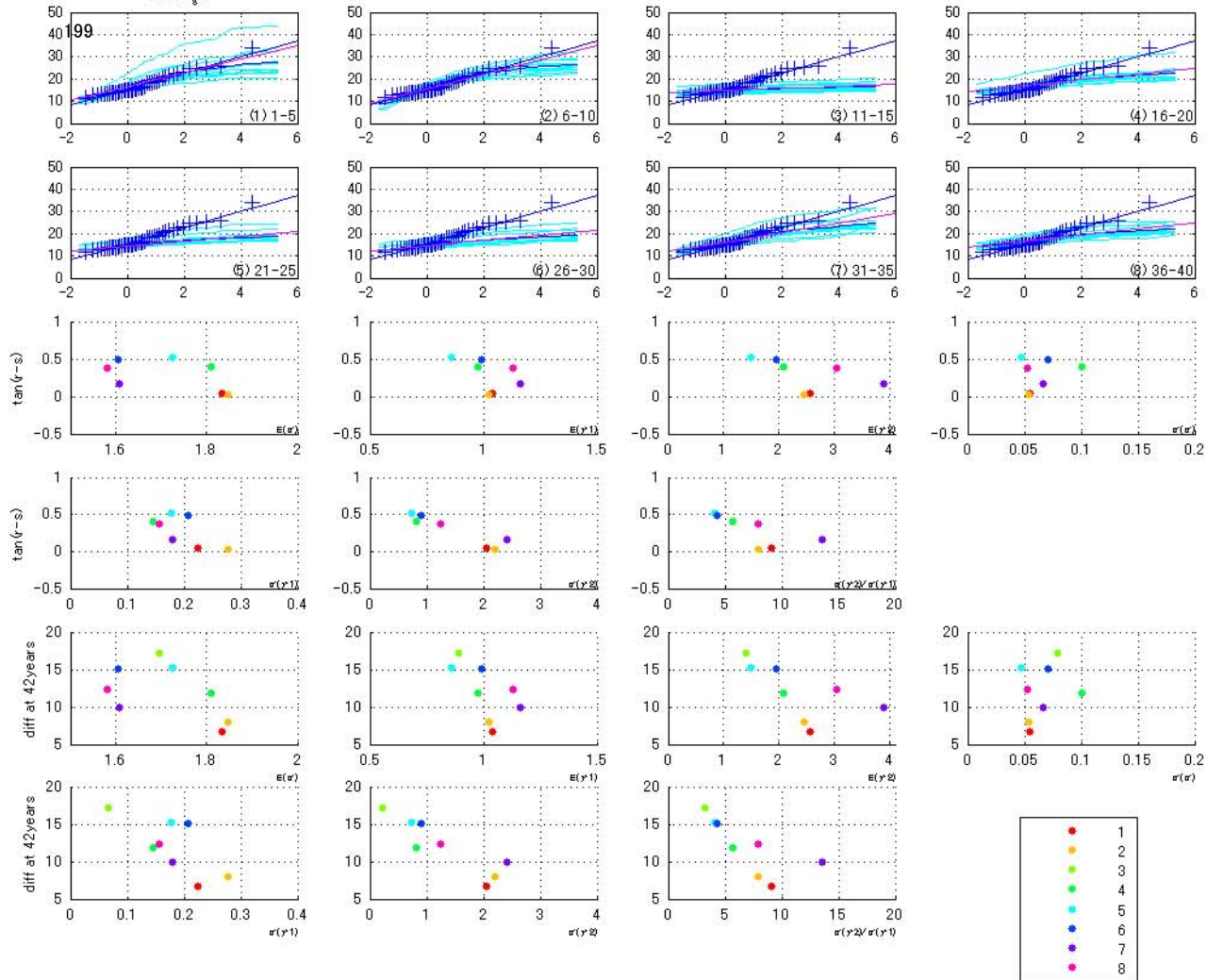
Asosan<sub>21</sub>



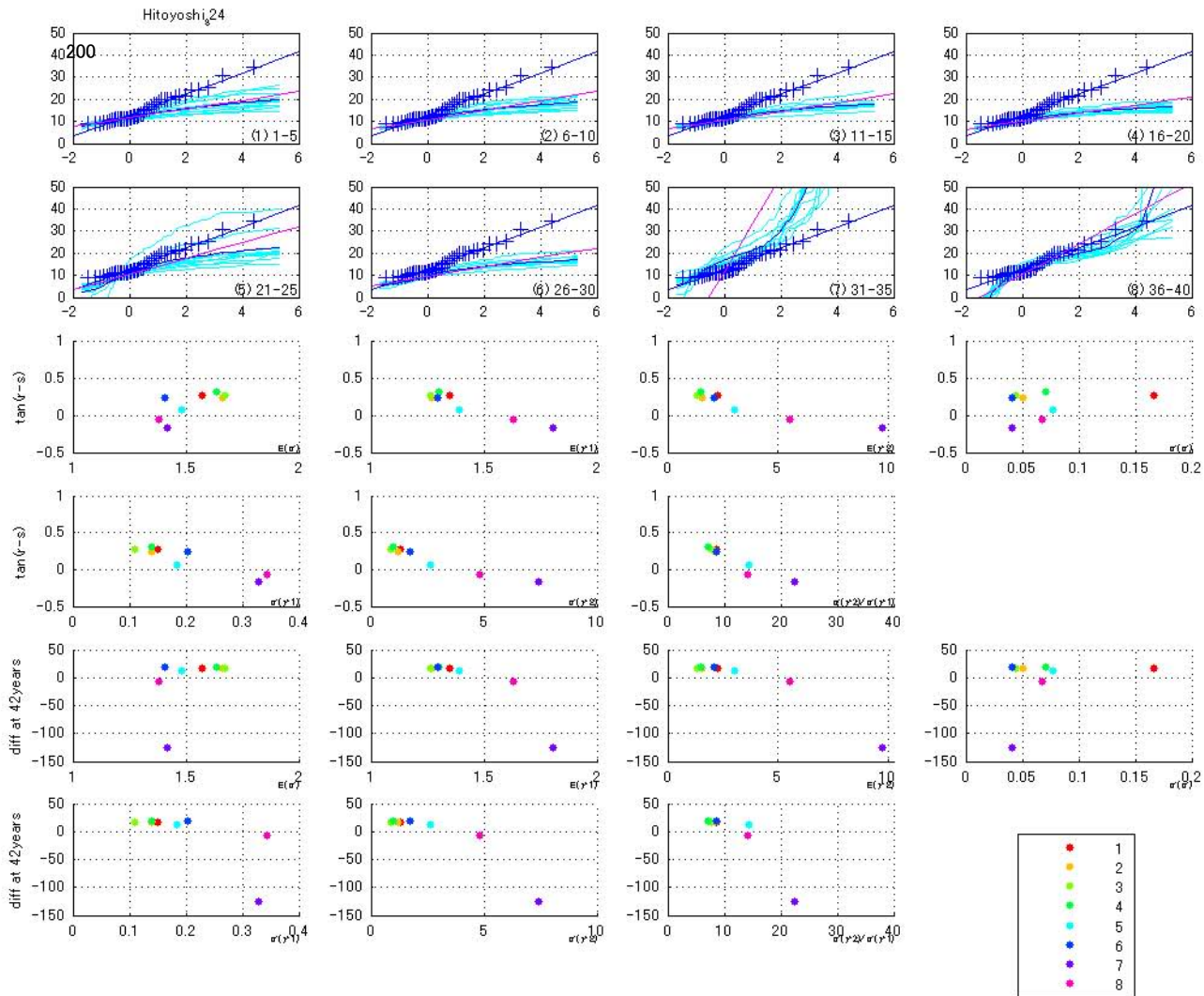
Nobeoka<sub>22</sub>



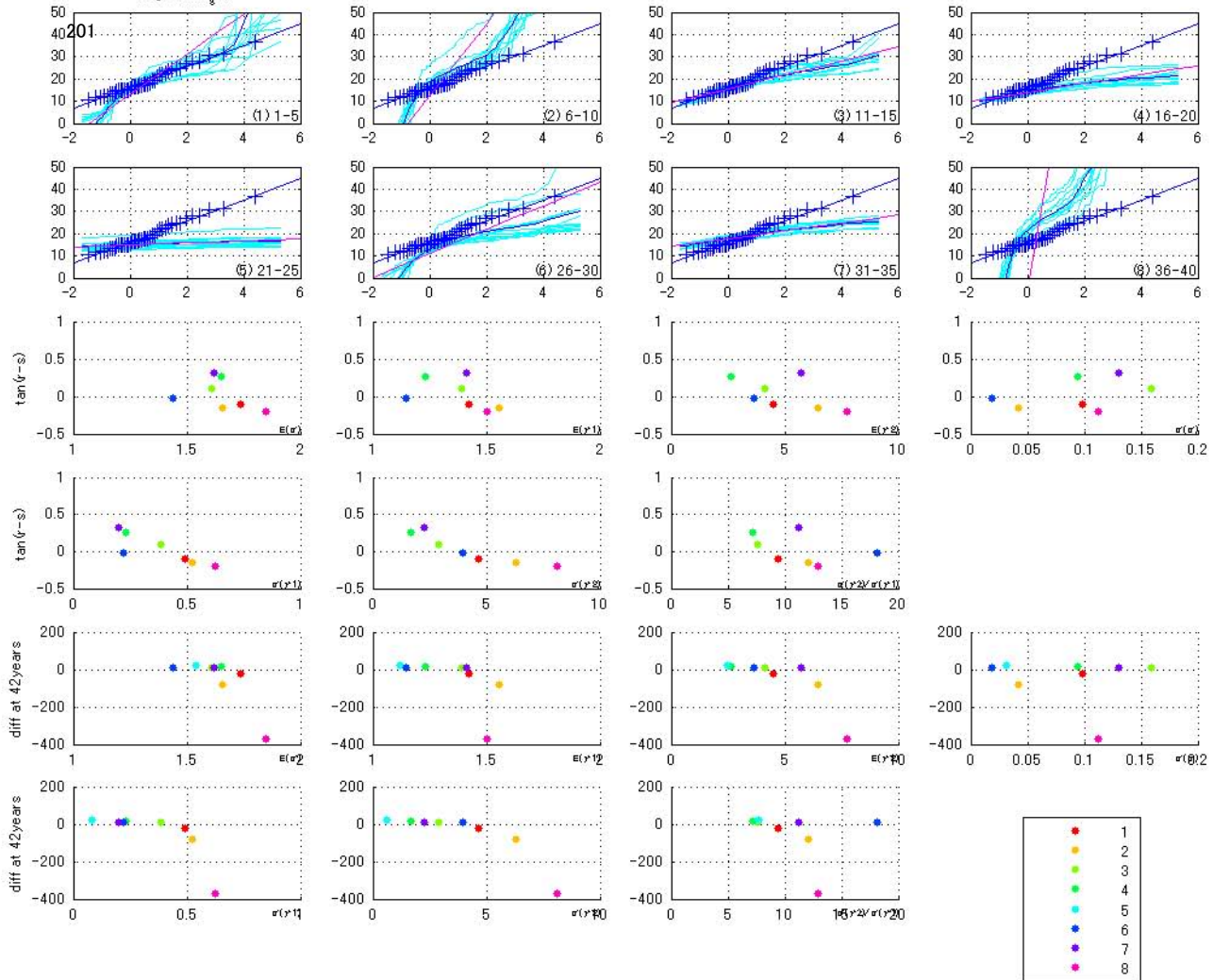
Akuna<sub>23</sub>



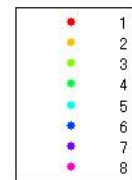
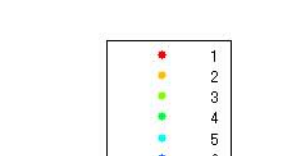
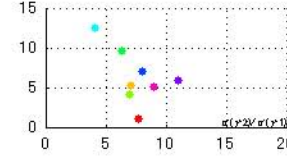
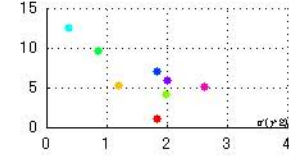
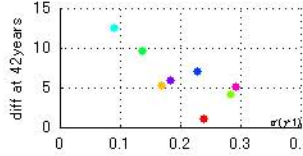
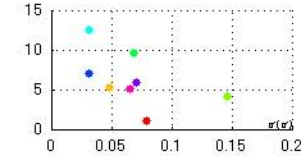
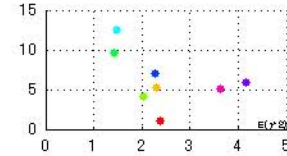
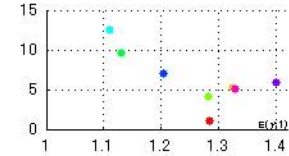
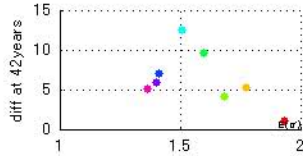
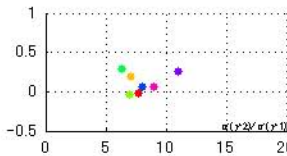
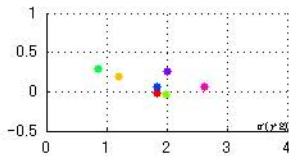
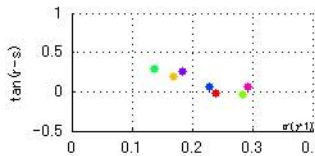
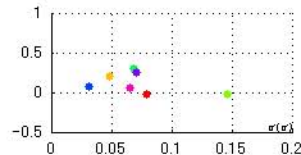
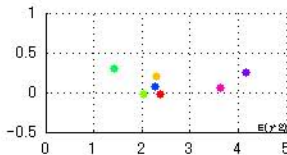
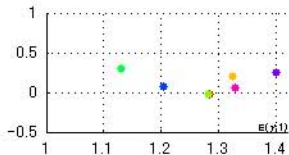
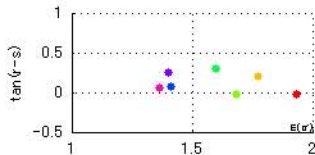
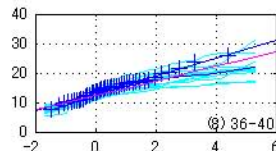
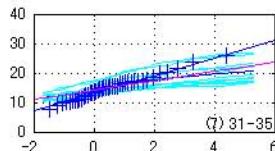
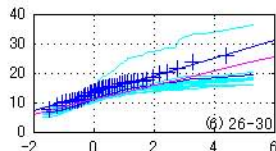
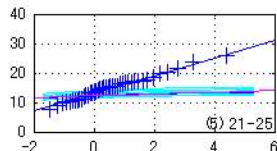
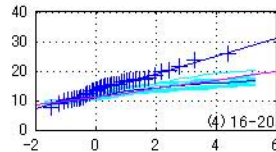
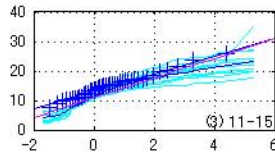
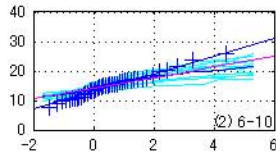
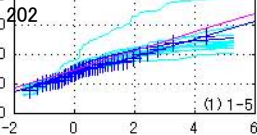




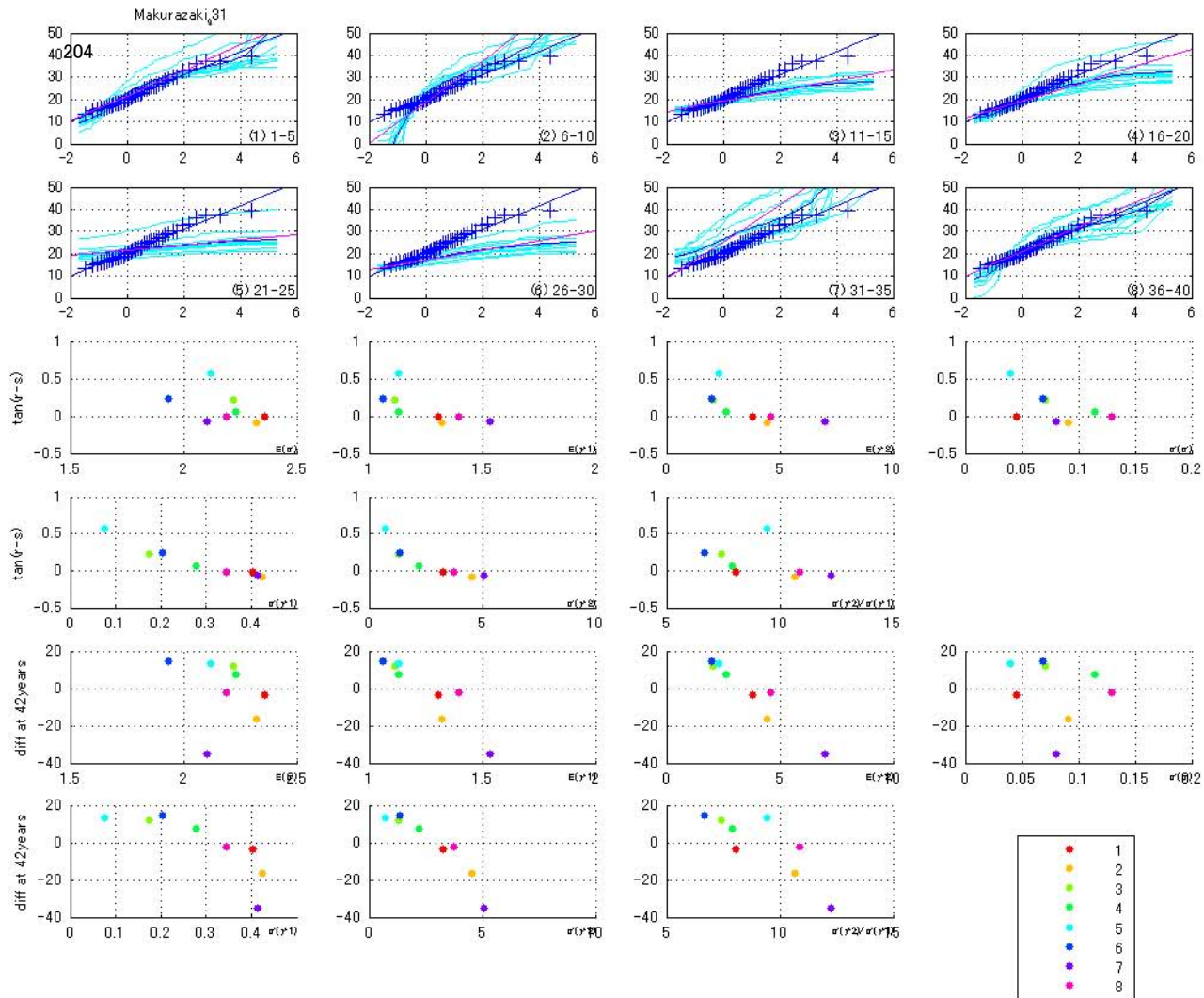
Kagoshima<sub>27</sub>



Miyakonojo\_29

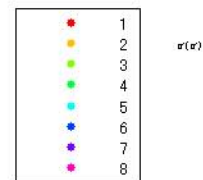
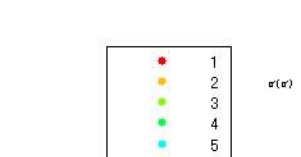
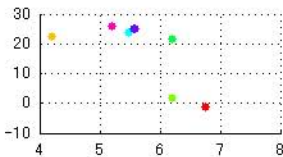
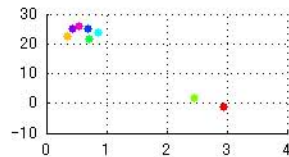
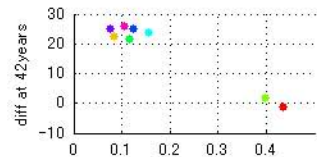
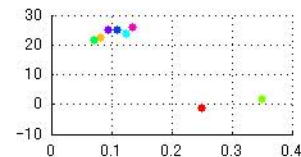
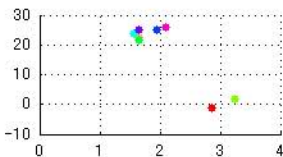
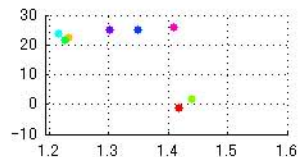
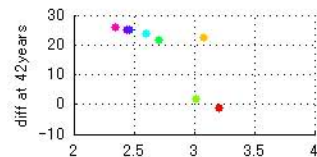
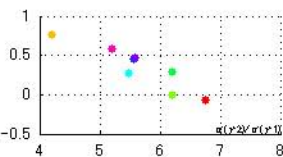
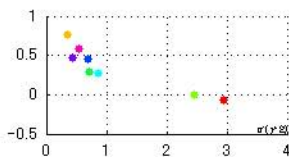
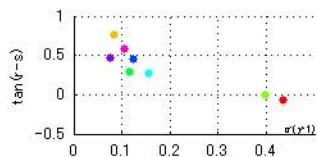
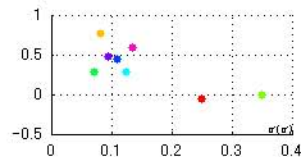
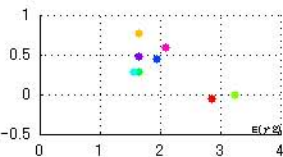
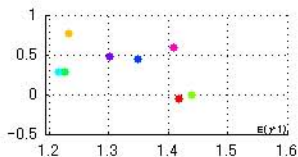
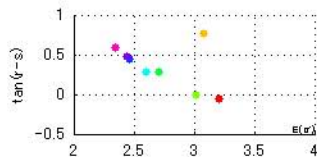
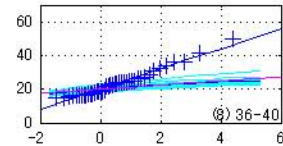
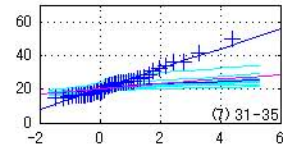
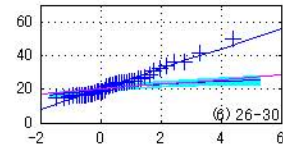
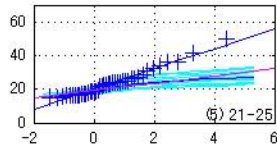
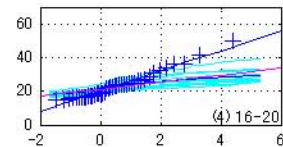
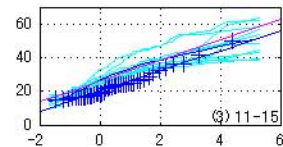
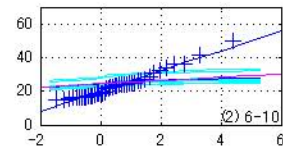
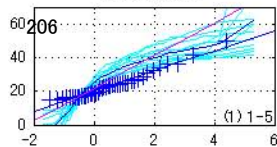








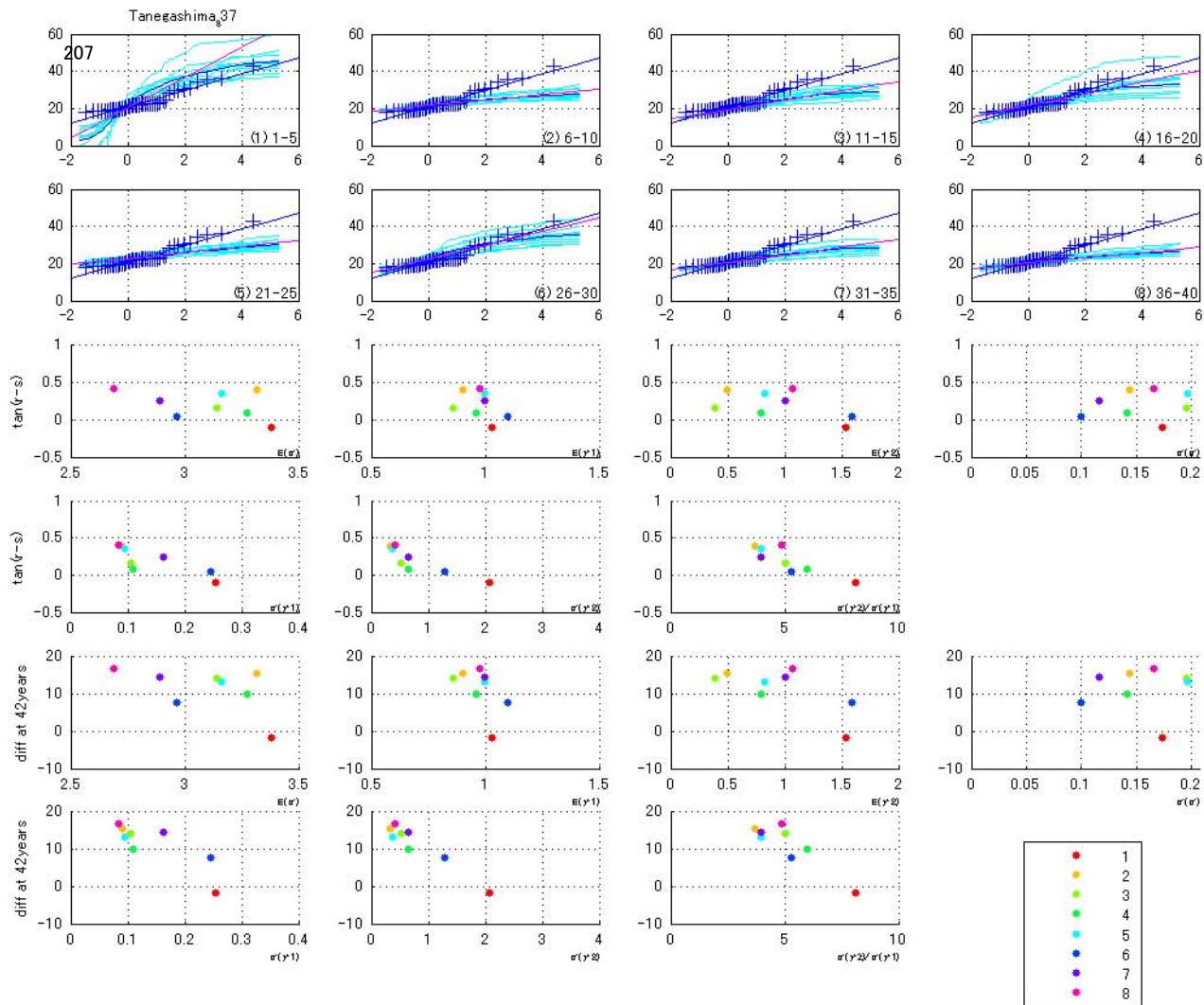
Yakushima\_36



$\sigma(x)$

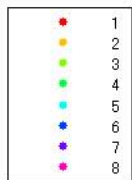
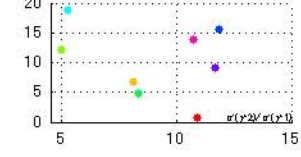
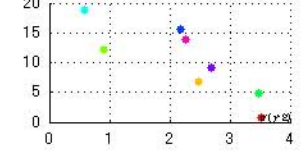
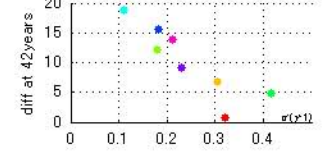
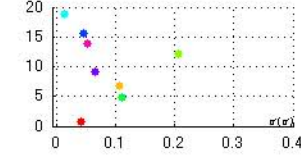
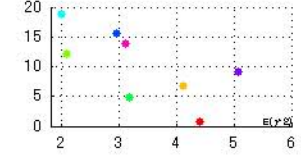
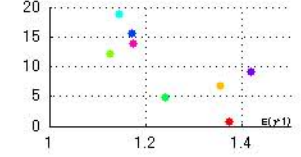
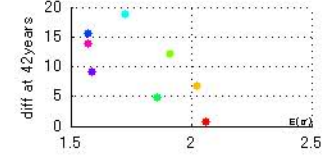
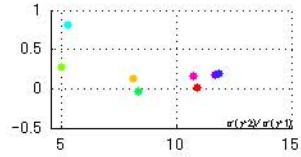
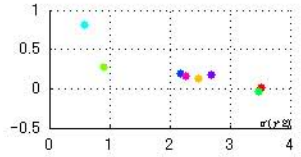
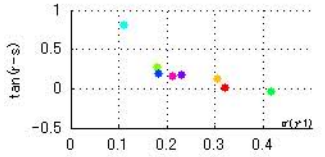
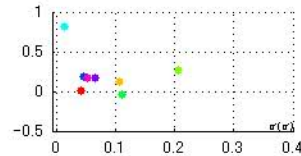
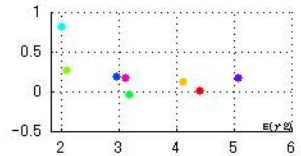
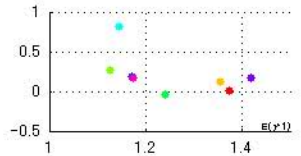
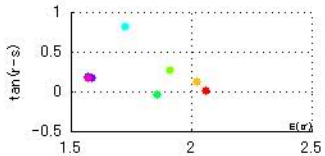
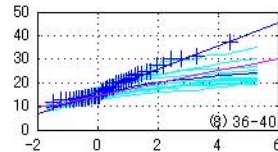
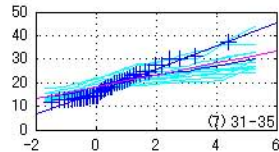
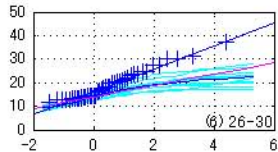
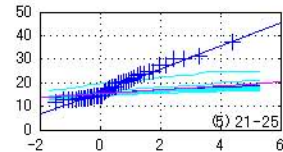
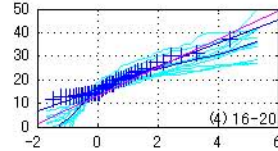
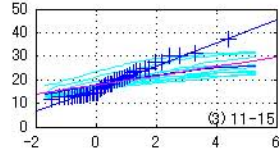
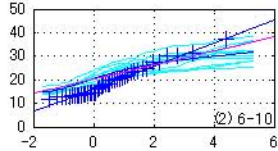
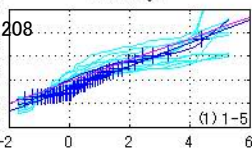
$\sigma(x)$

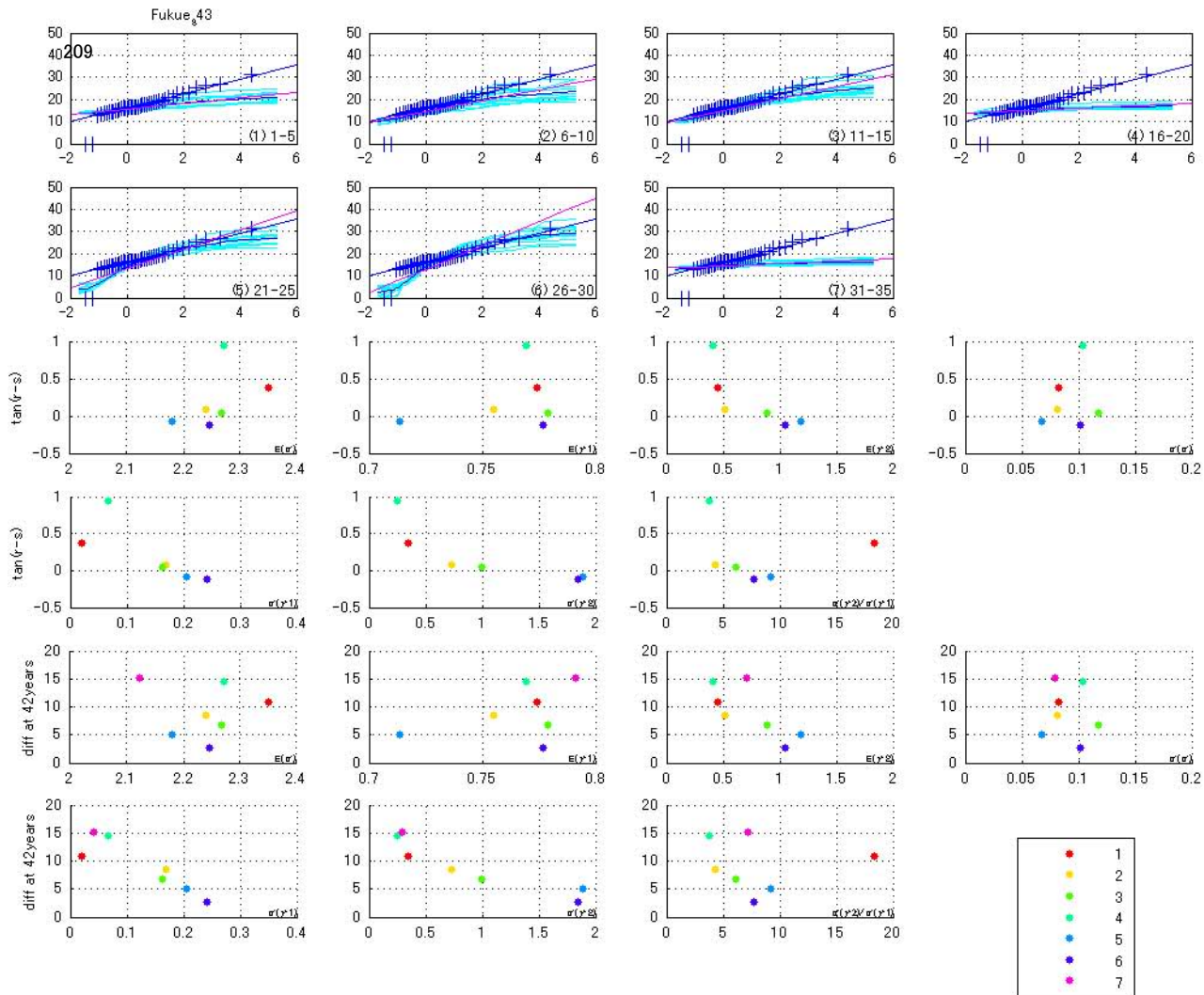
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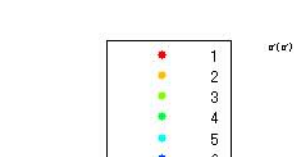
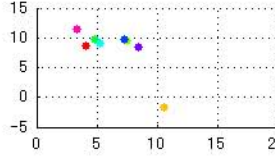
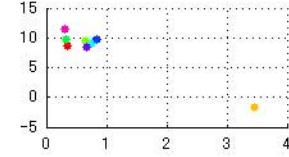
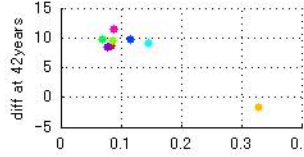
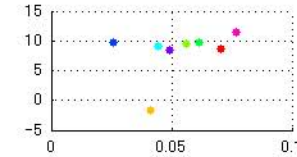
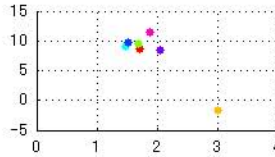
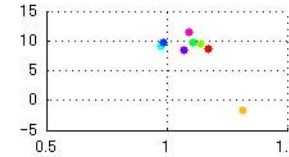
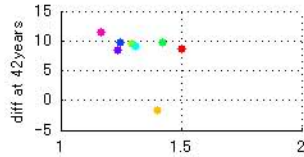
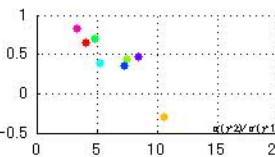
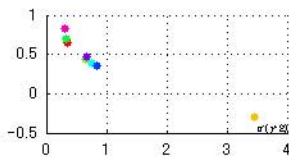
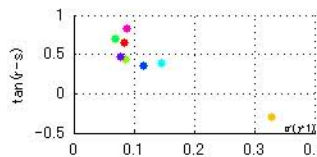
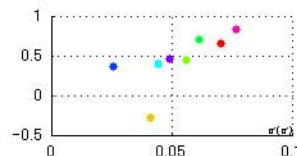
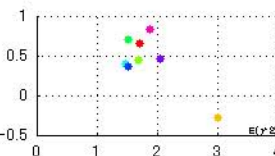
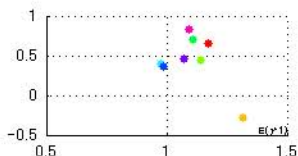
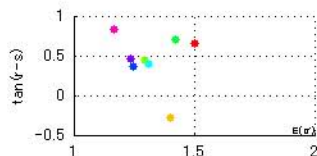
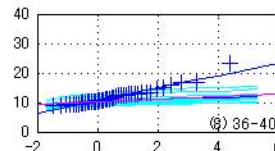
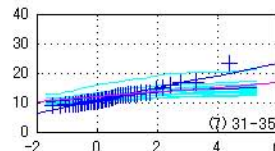
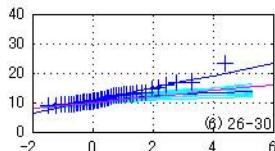
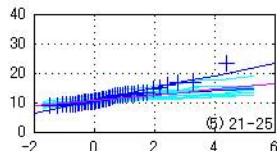
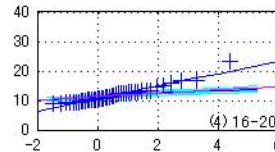
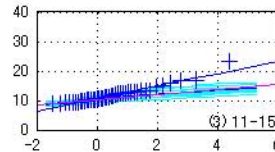
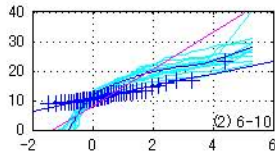
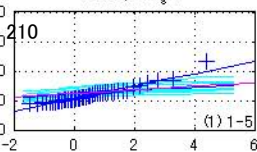


Ushibuka<sub>38</sub>





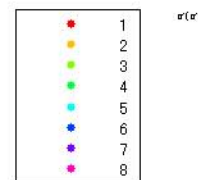
Matsuyama\_87



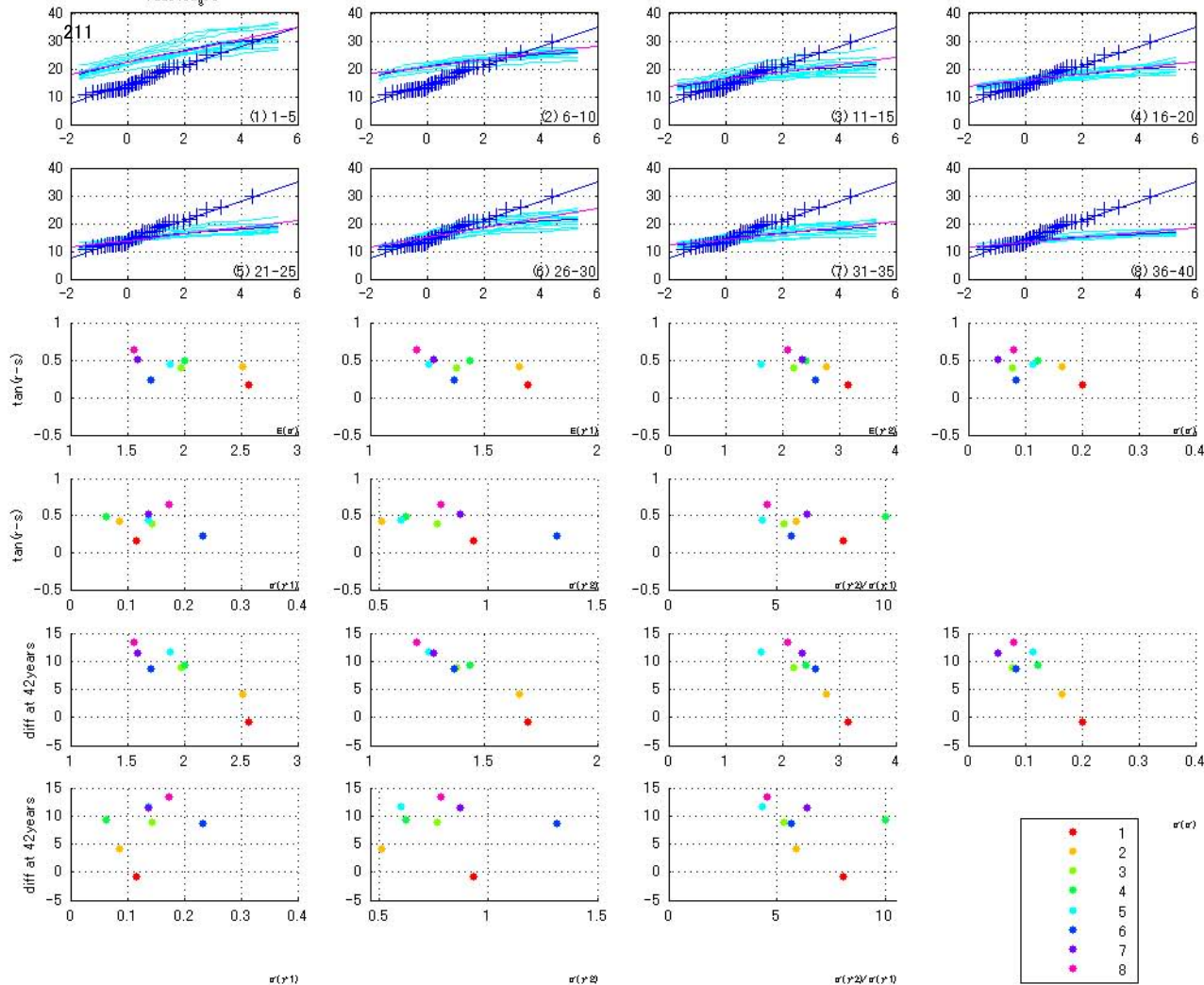
$\sigma(\sigma)$

$\sigma(\sigma)$

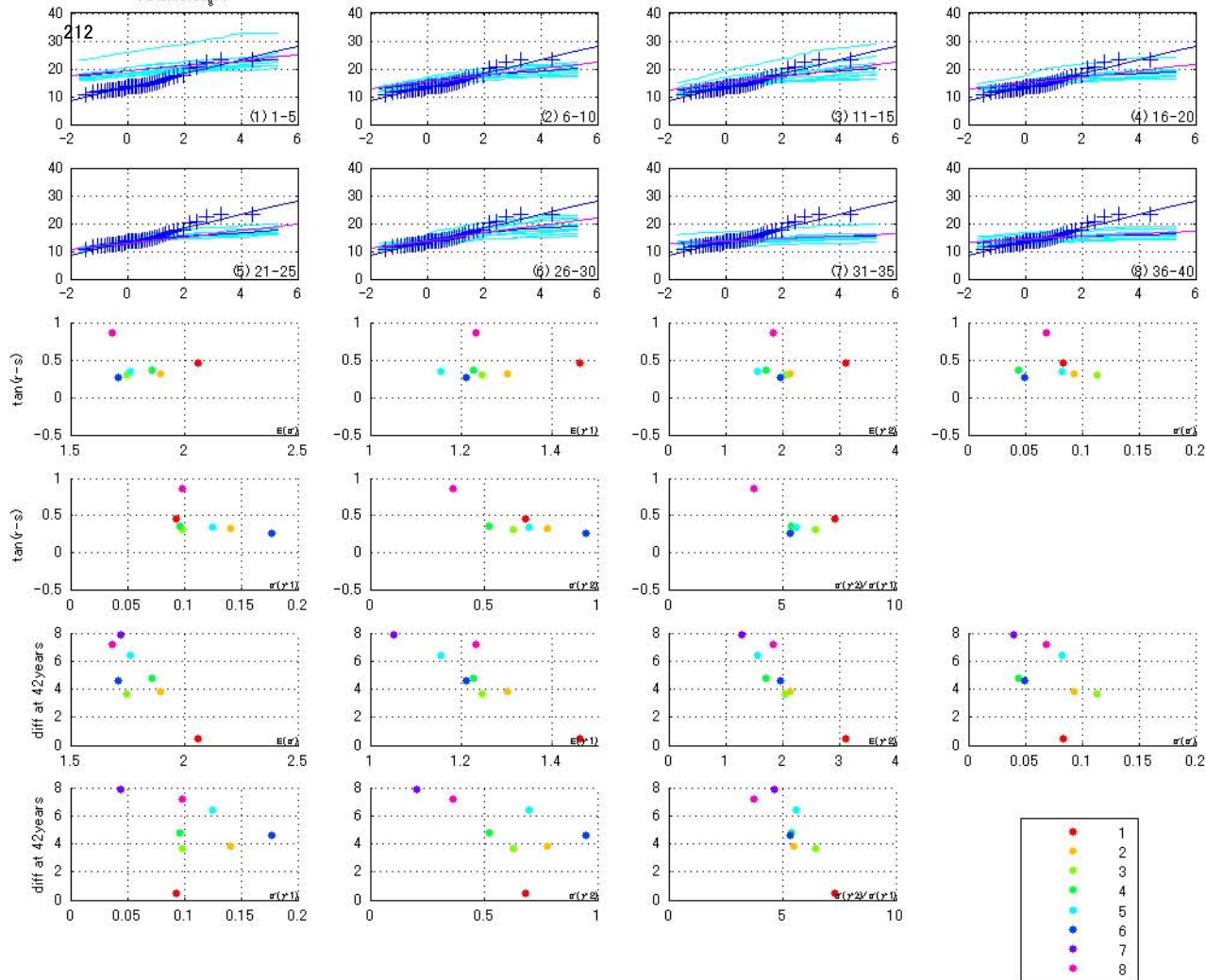
$\sigma(\sigma)$



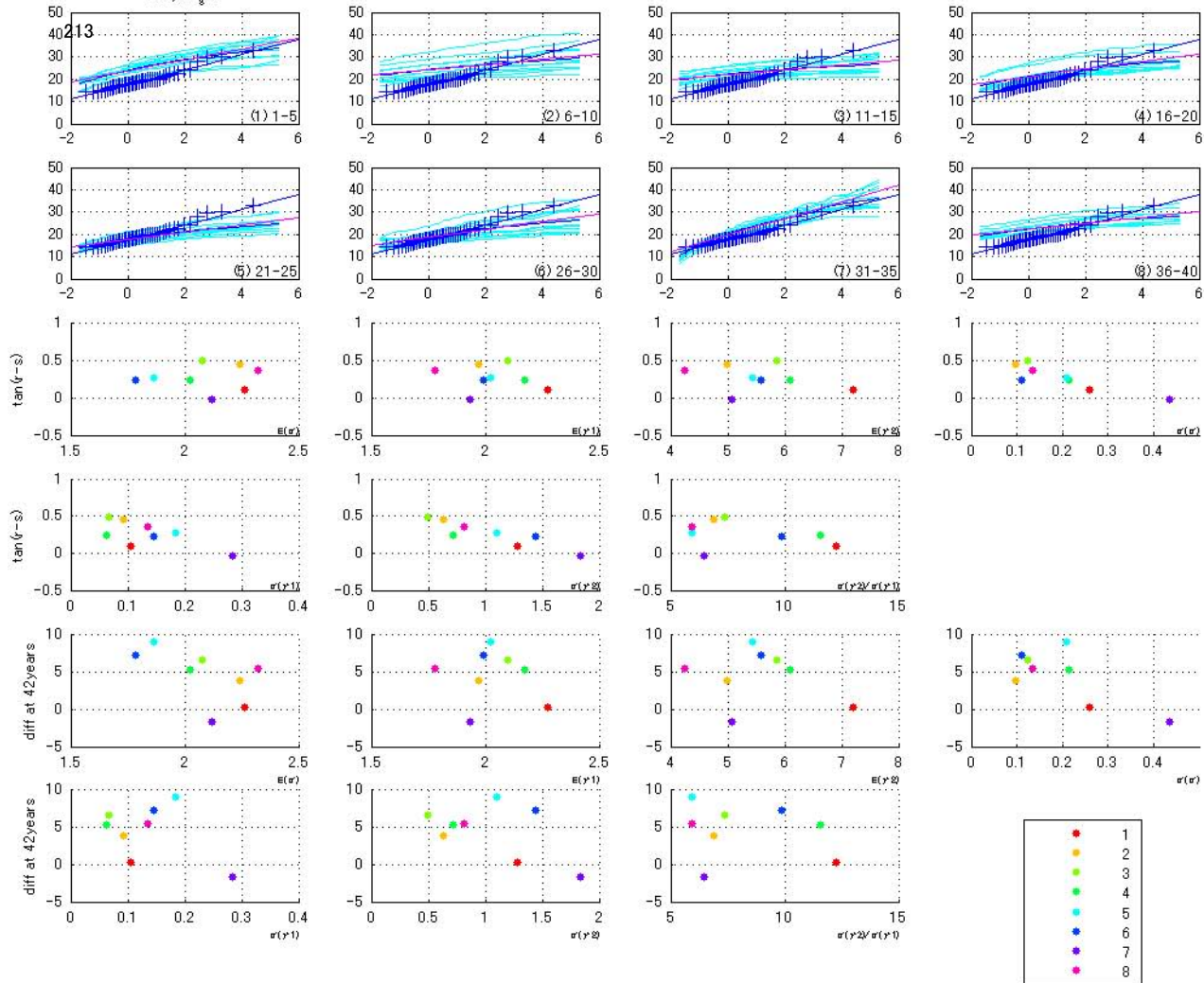
Tadotsu<sub>90</sub>



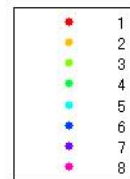
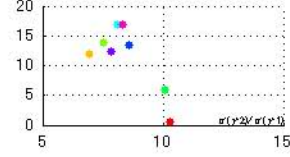
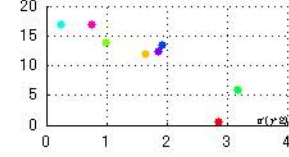
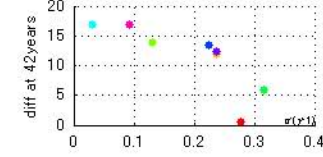
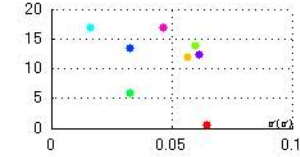
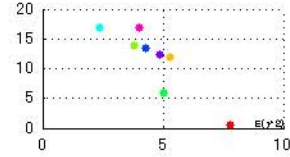
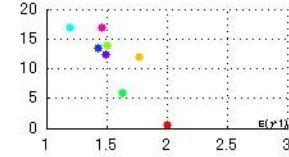
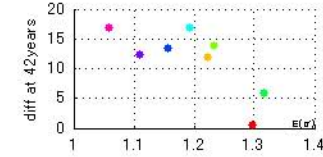
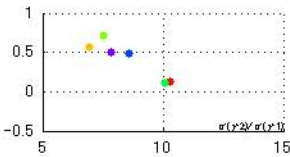
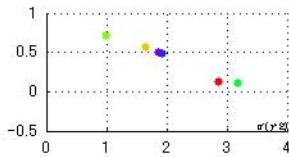
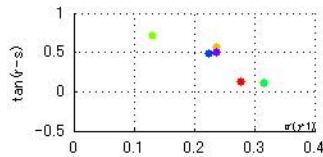
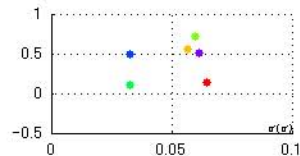
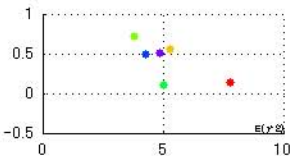
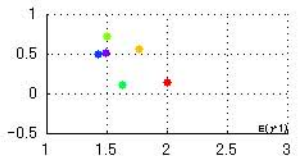
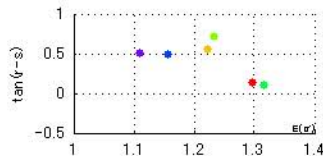
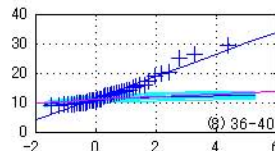
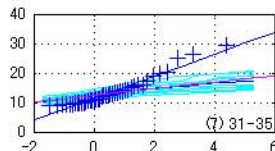
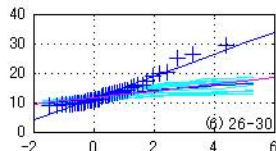
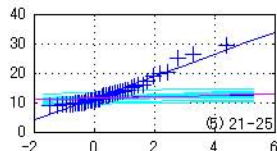
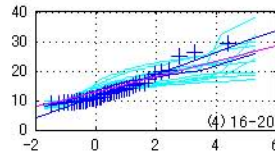
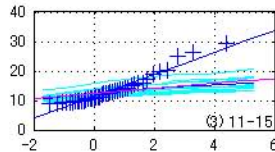
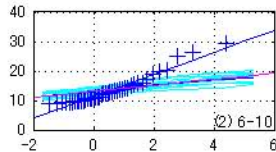
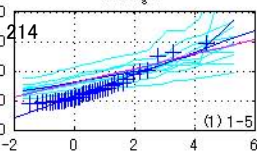
Takamatsu\_91



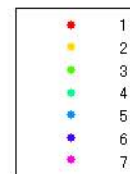
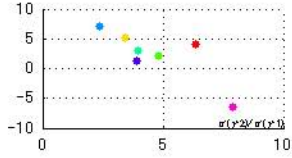
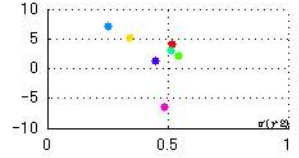
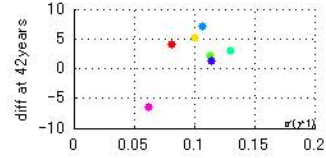
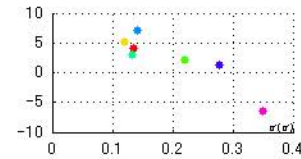
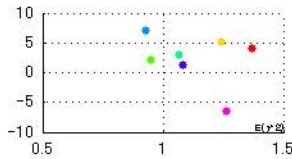
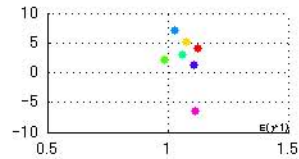
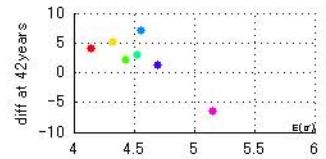
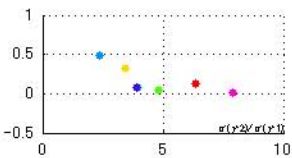
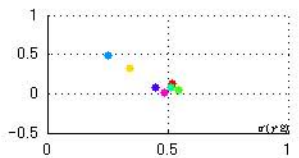
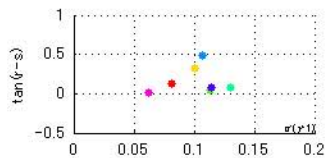
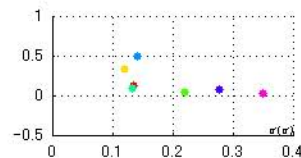
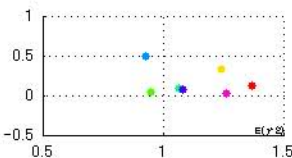
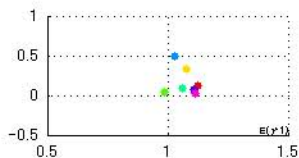
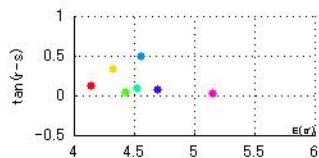
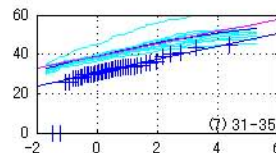
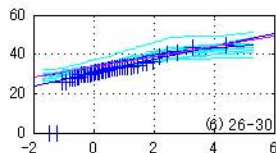
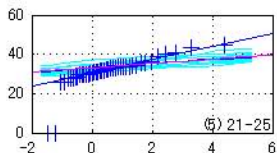
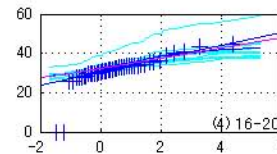
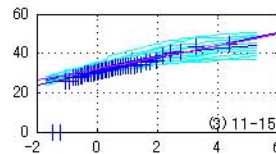
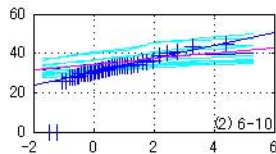
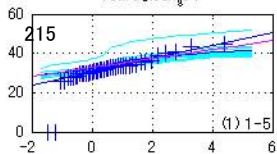
Uwajima<sub>92</sub>



Kochi\_93

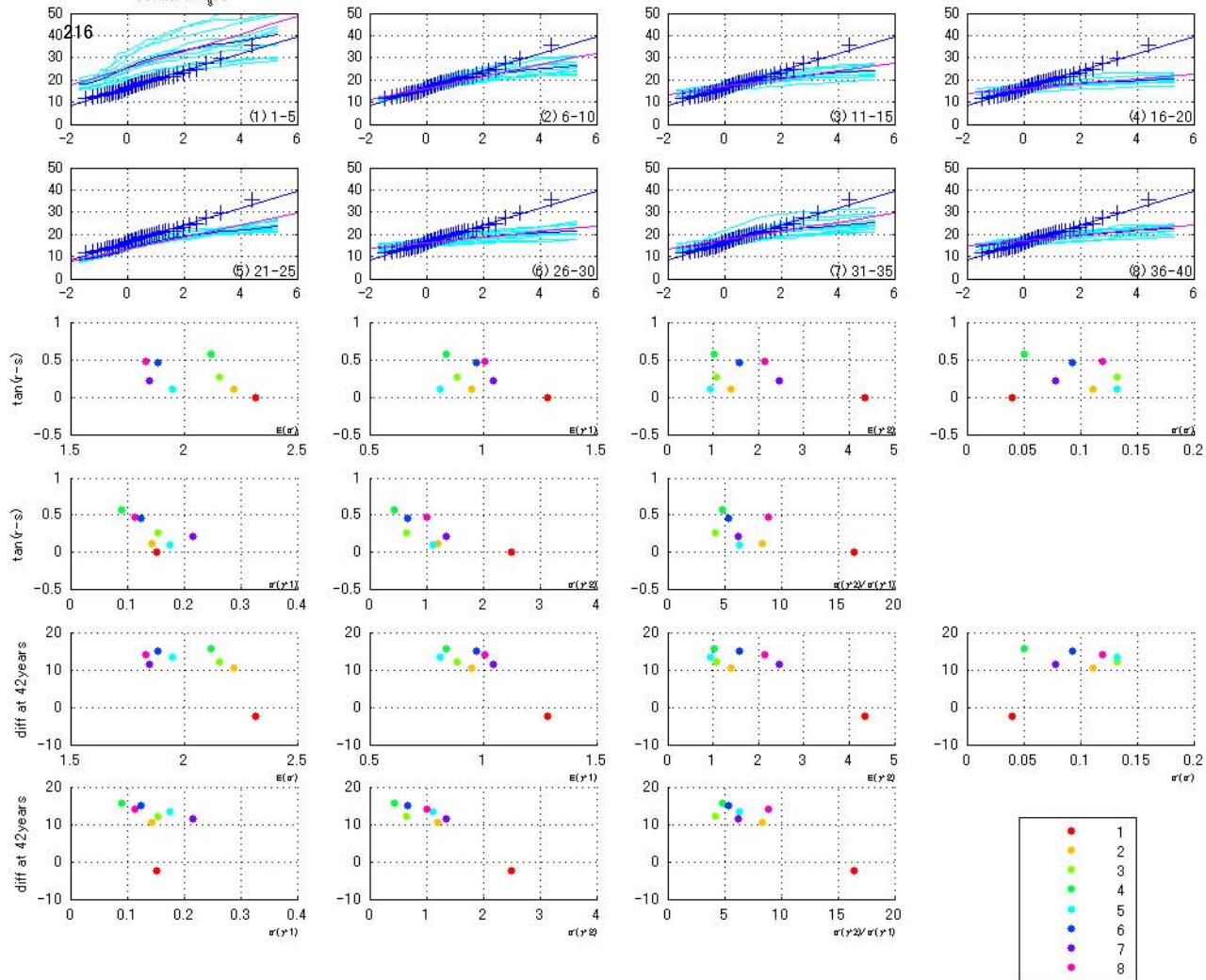


Tsurugisan\_94



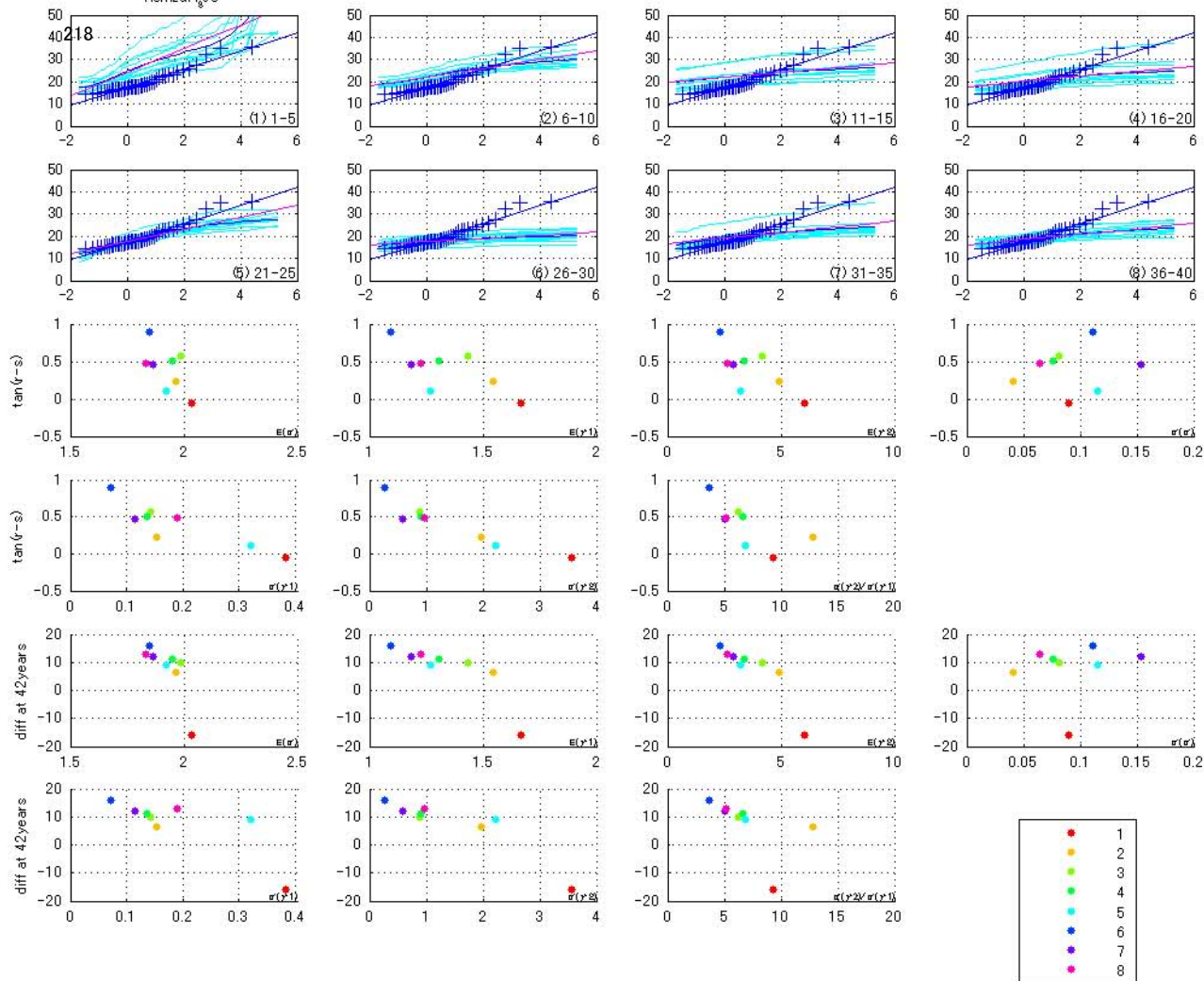


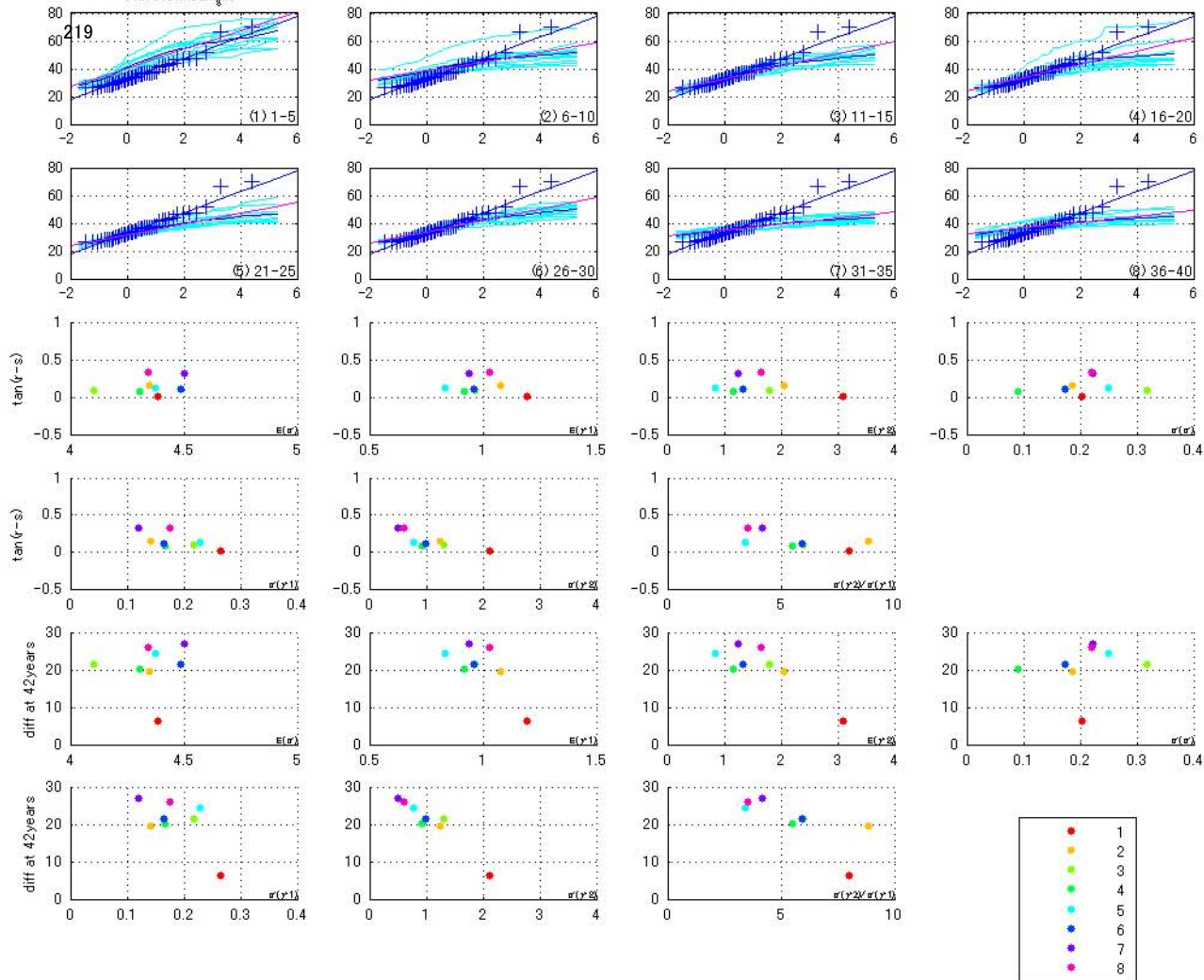
Tokushima\_95





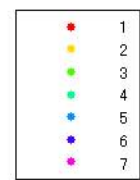
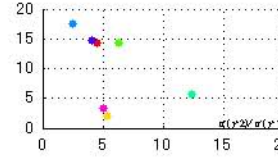
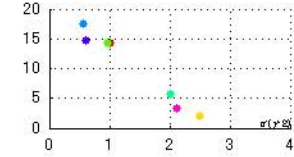
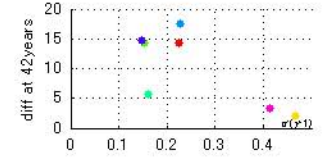
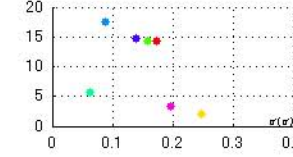
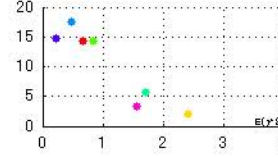
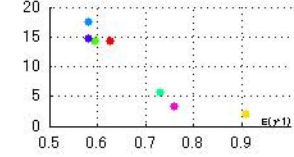
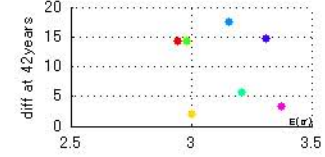
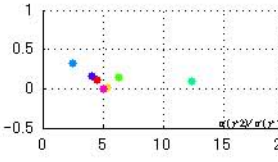
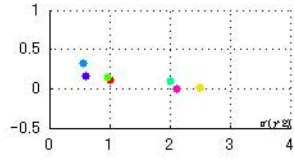
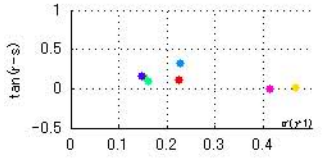
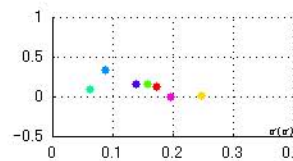
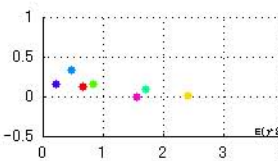
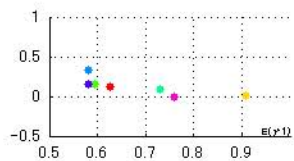
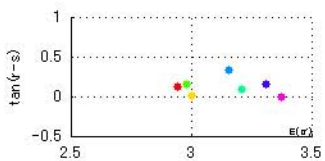
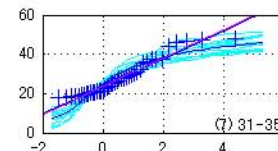
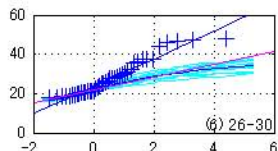
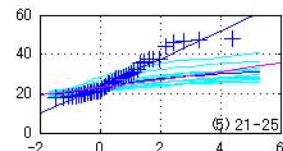
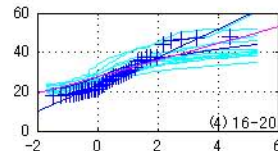
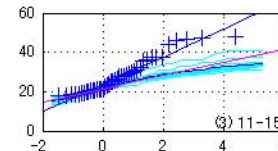
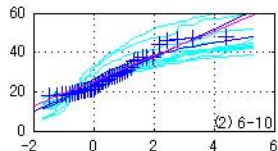
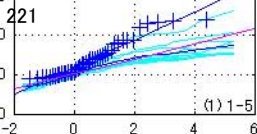
Ashizuri,98



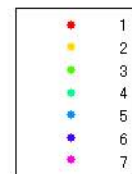
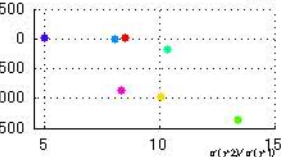
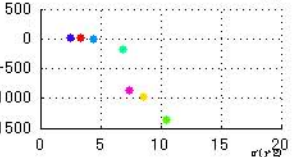
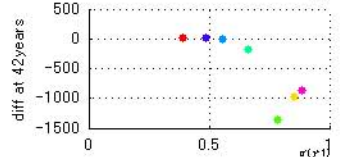
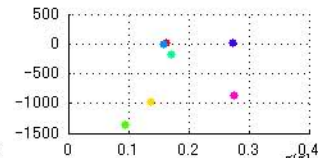
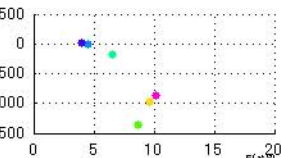
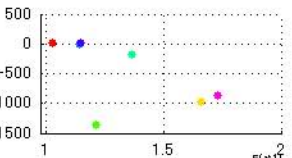
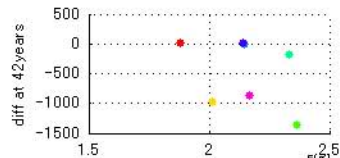
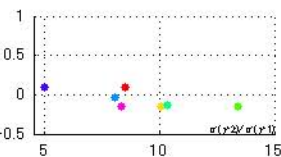
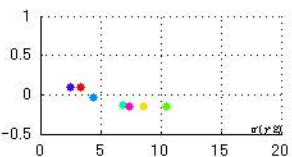
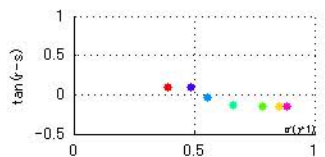
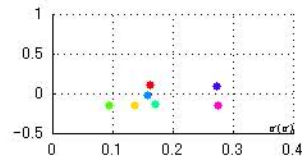
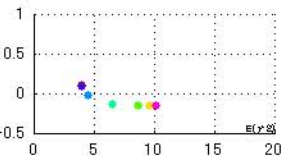
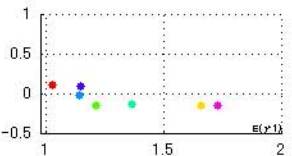
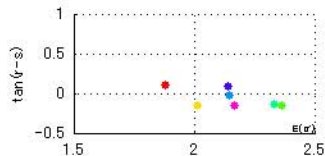
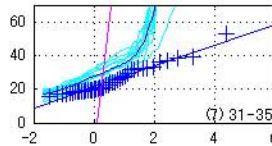
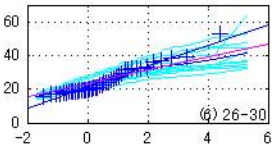
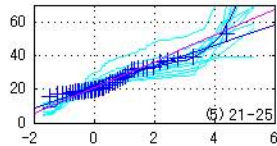
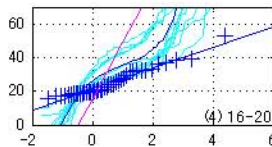
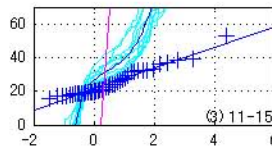
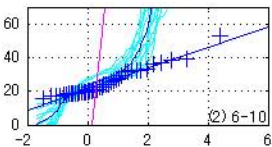
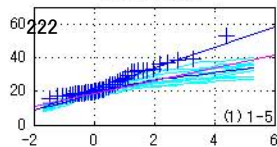




Yonagunijima<sub>2</sub>12

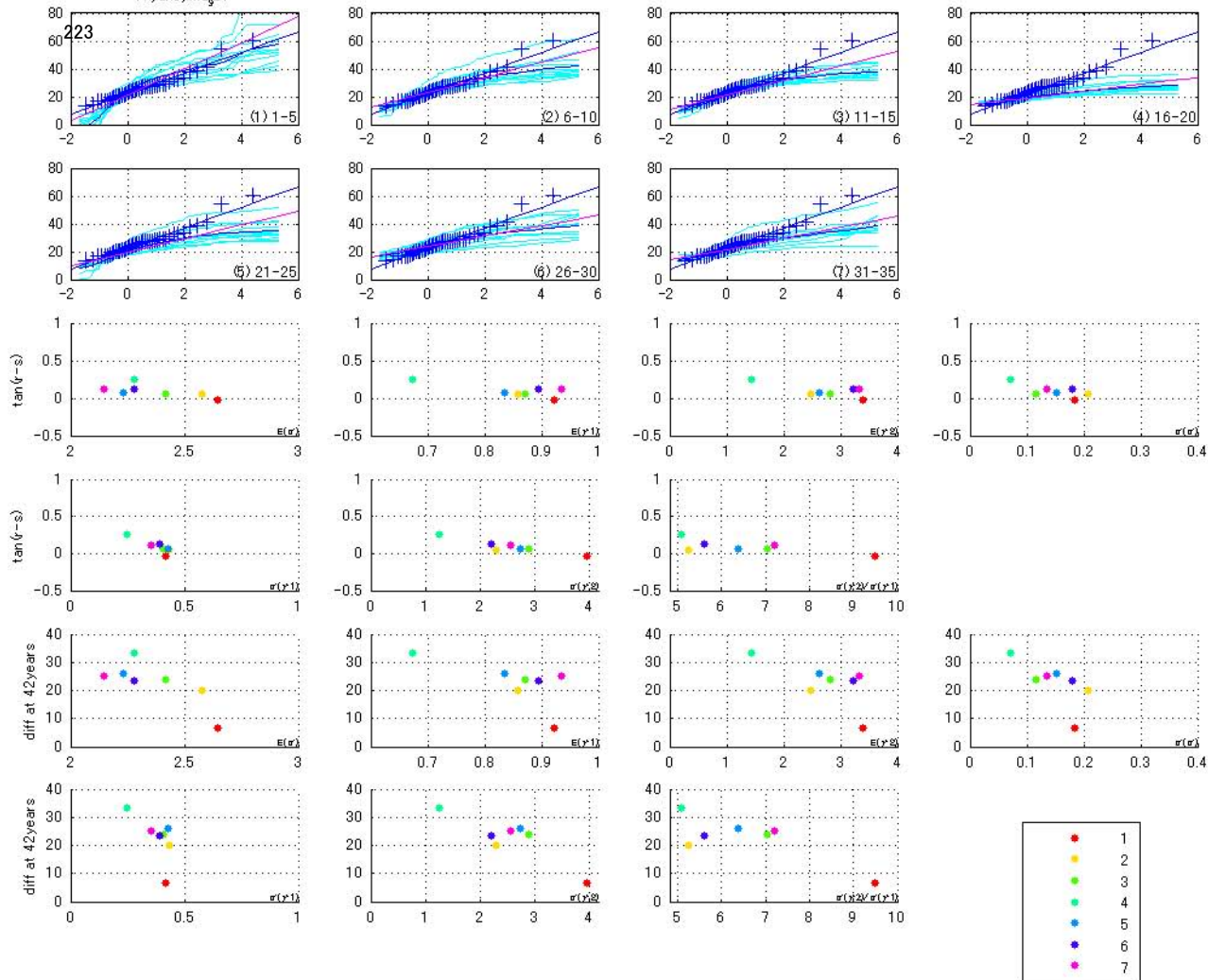


Ishigakijima<sub>18</sub>



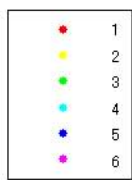
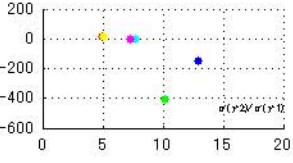
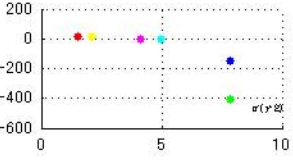
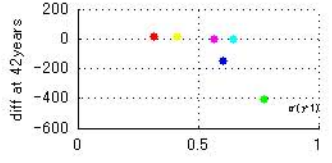
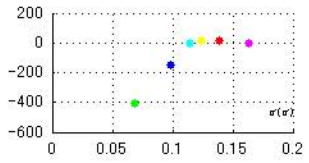
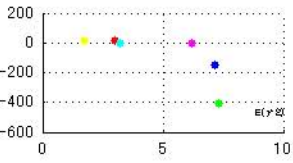
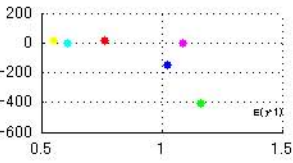
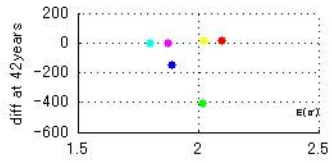
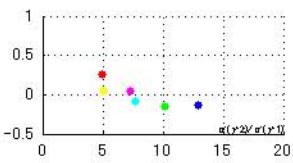
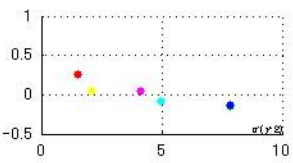
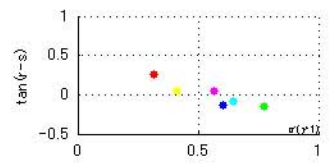
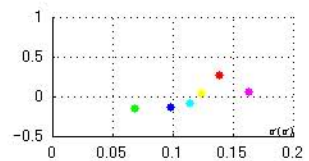
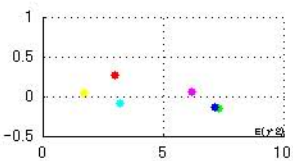
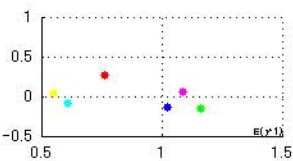
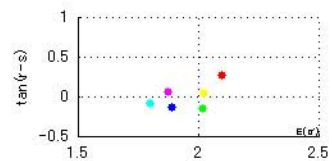
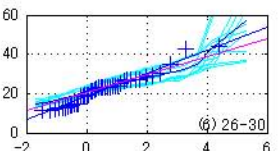
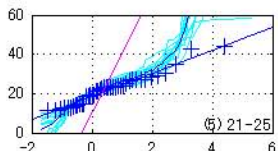
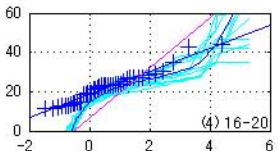
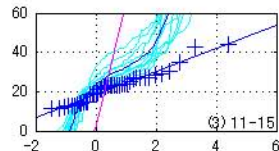
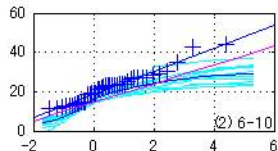
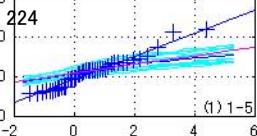
Miyakojima\_27

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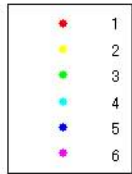
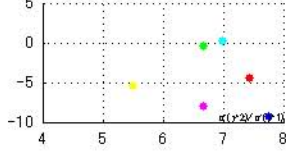
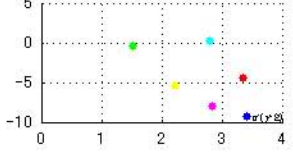
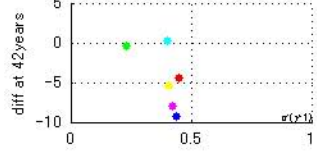
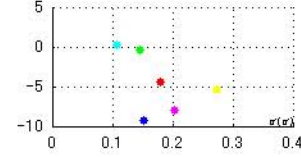
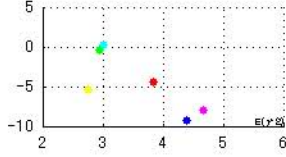
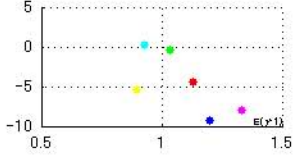
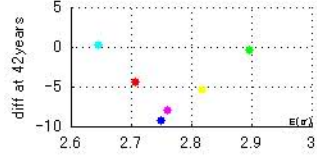
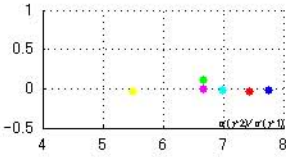
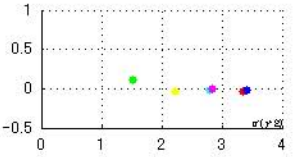
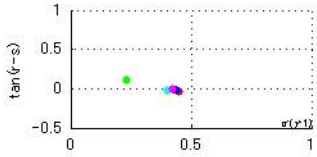
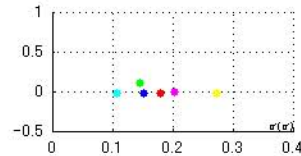
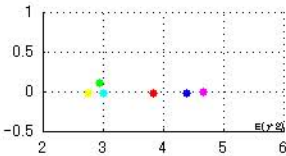
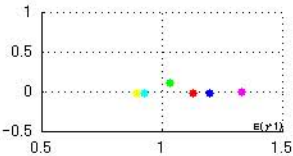
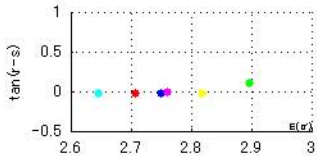
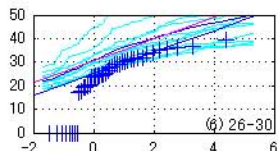
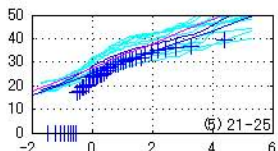
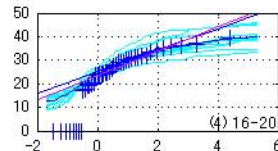
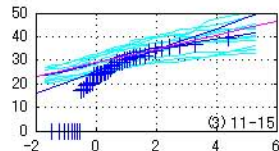
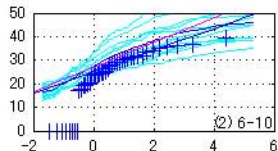
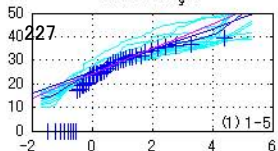
Kumejima<sub>29</sub>

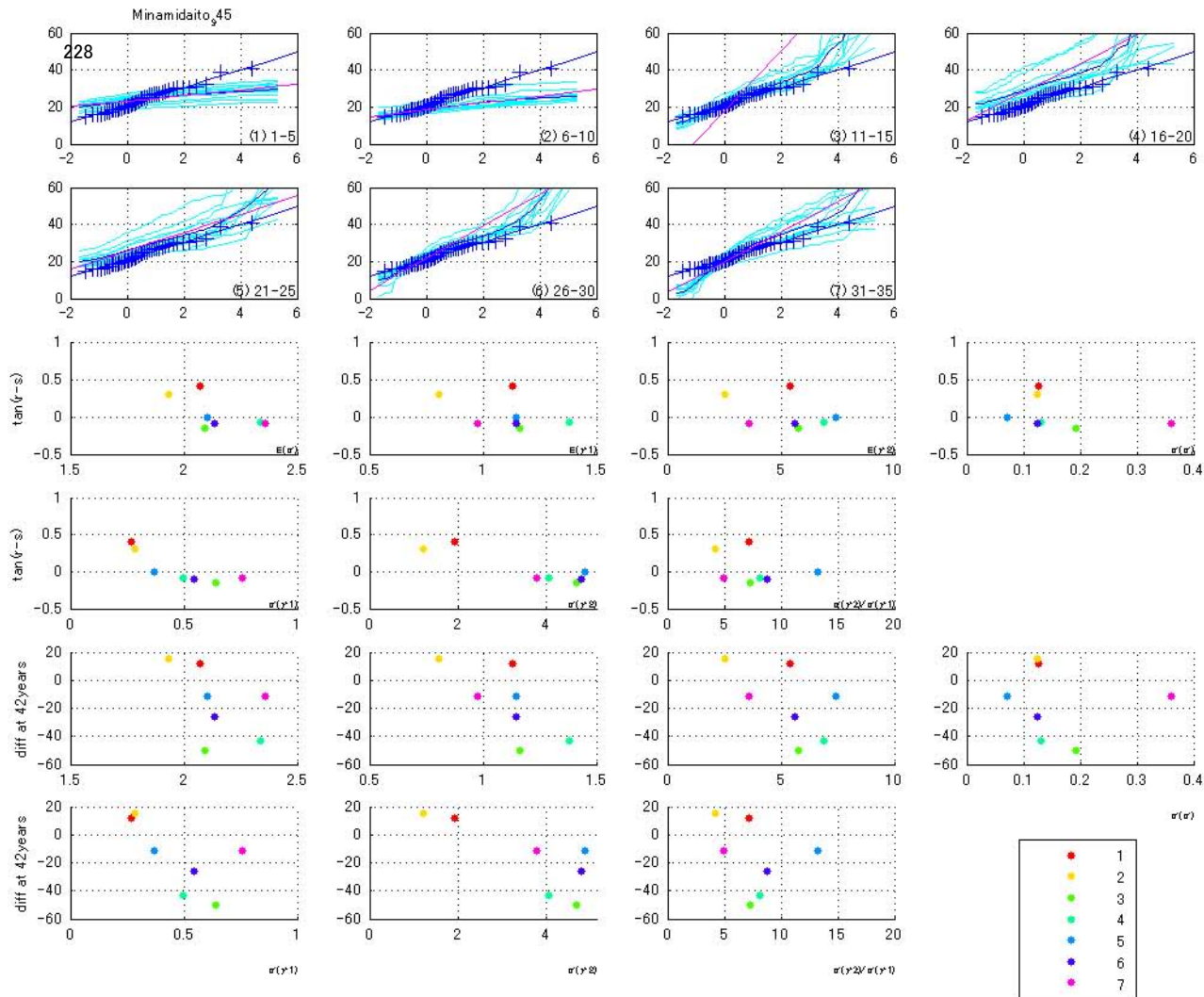




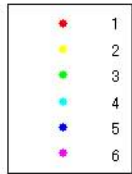
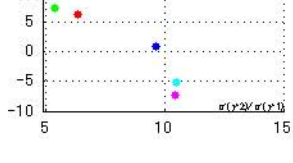
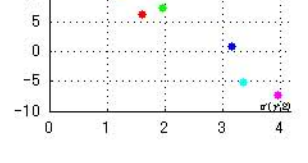
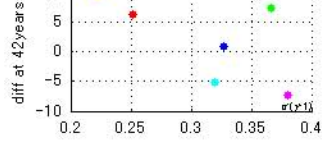
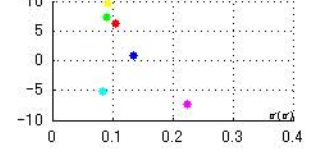
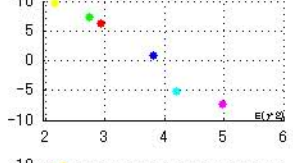
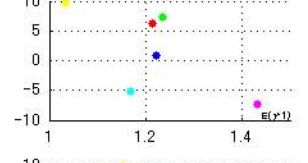
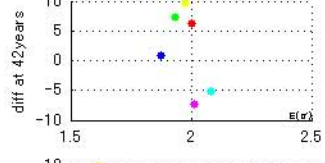
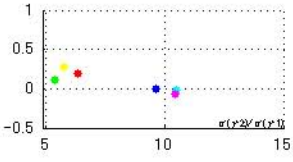
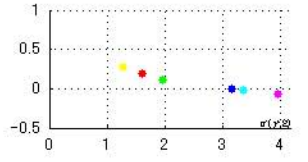
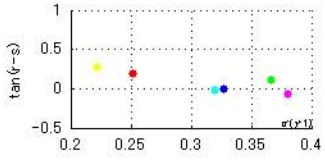
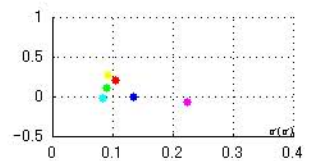
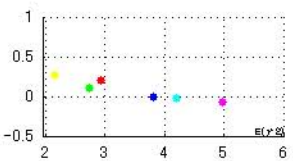
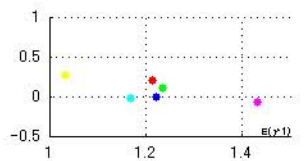
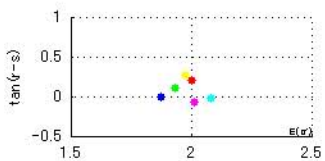
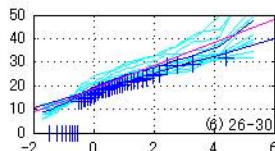
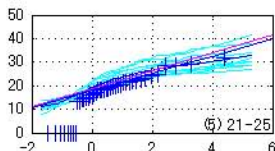
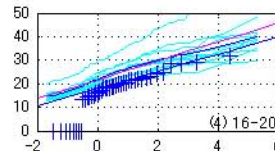
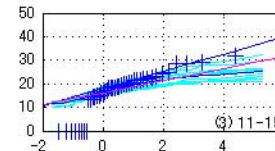
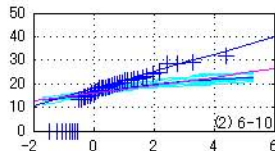
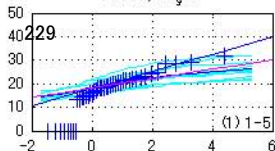


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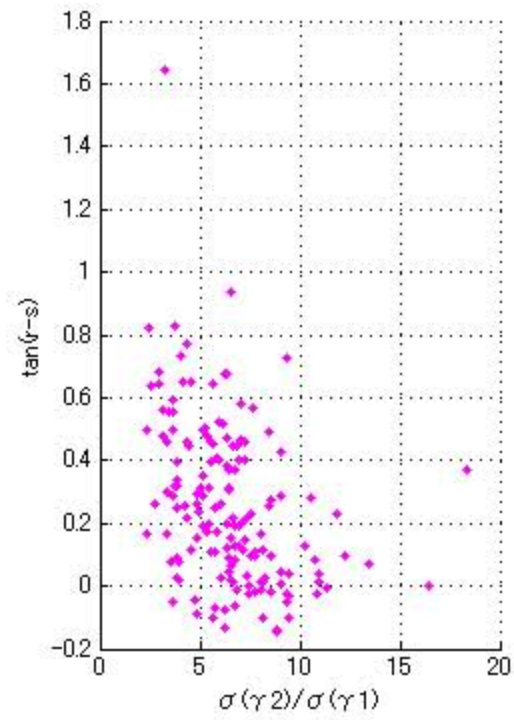
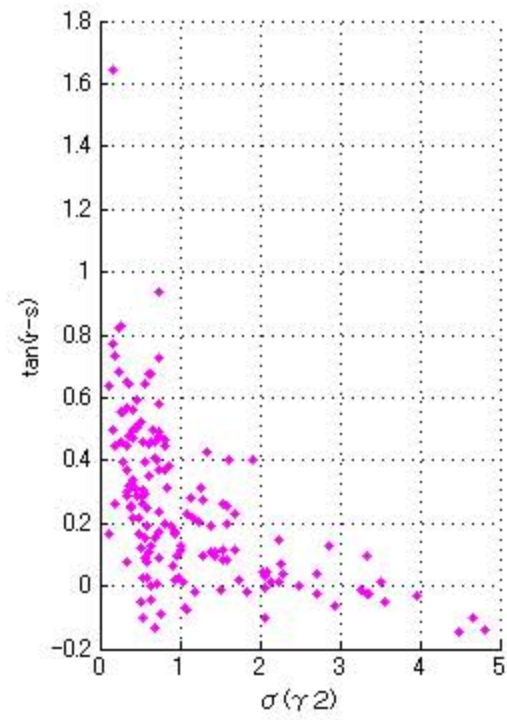
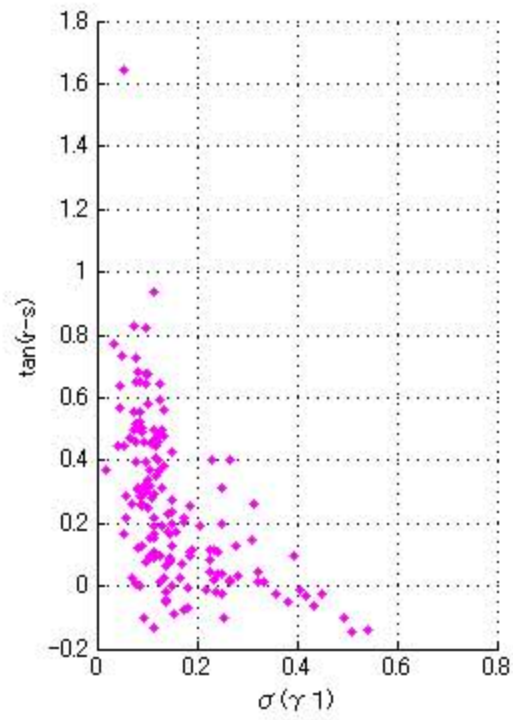
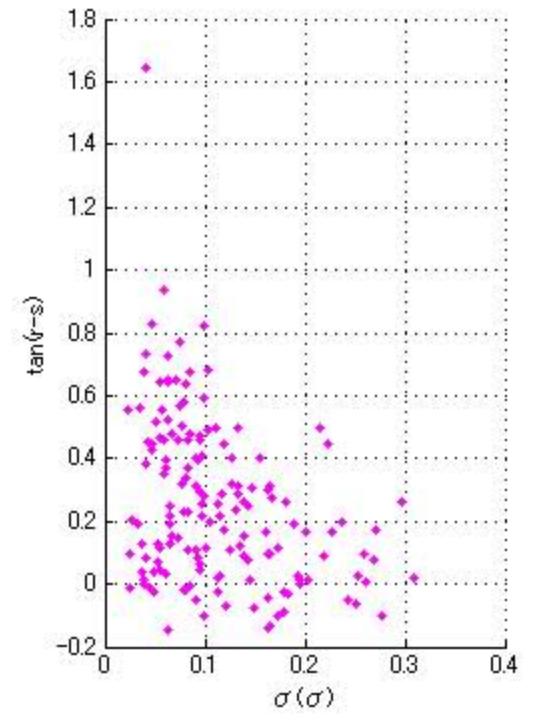
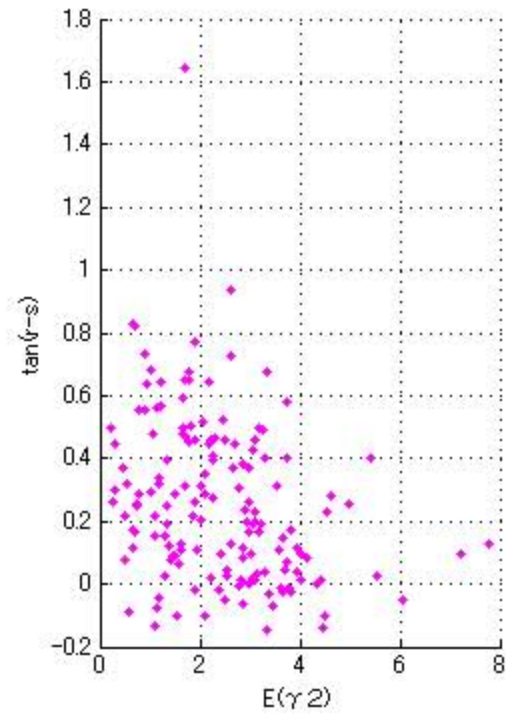
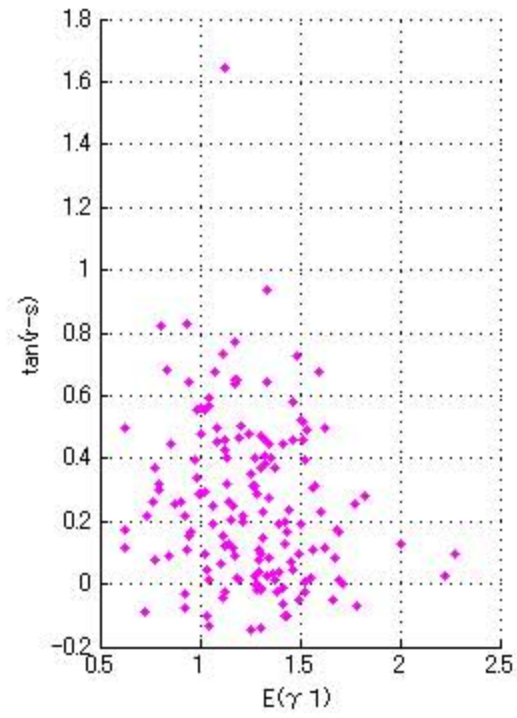
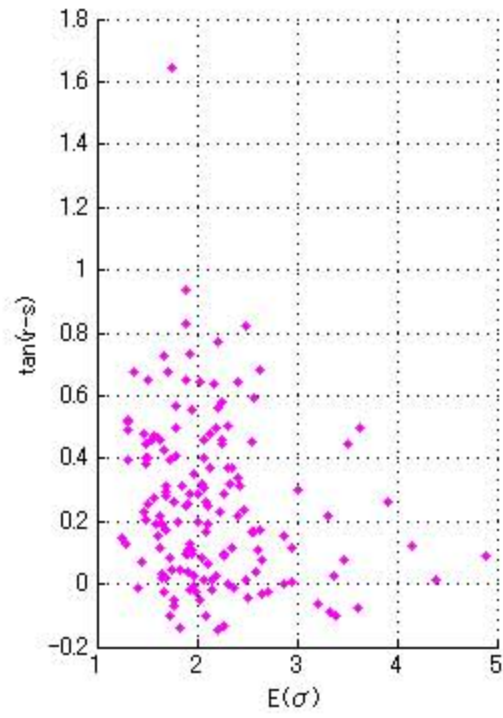




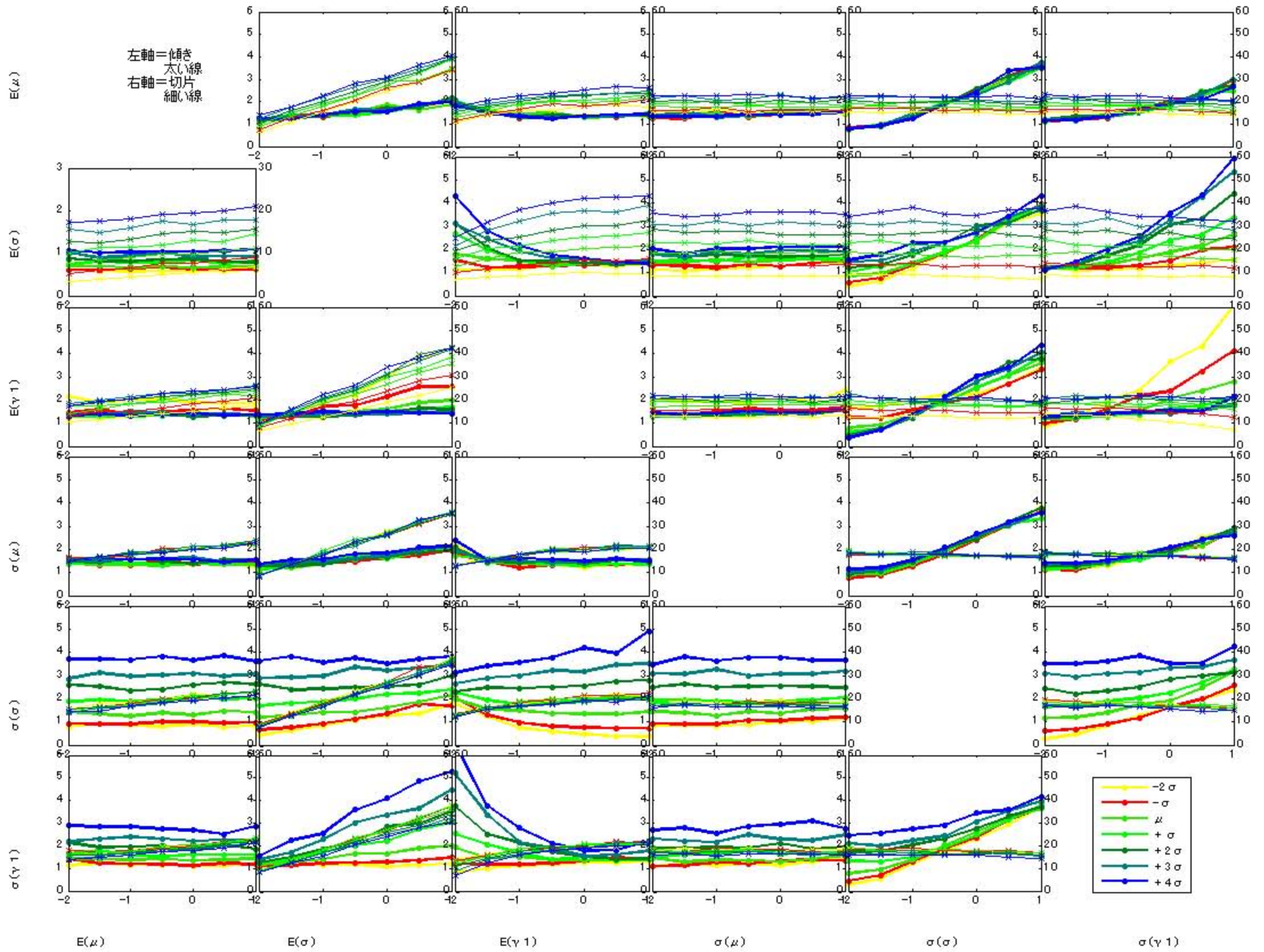
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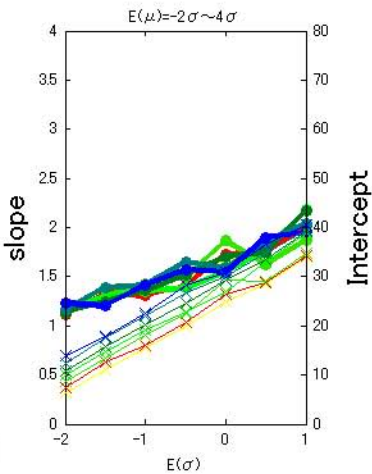
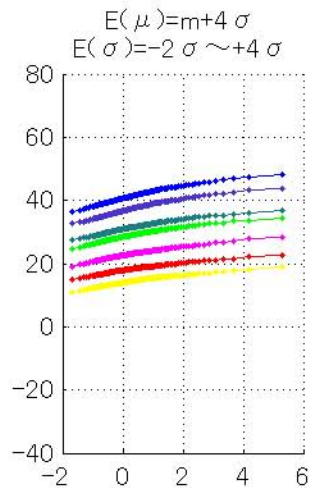
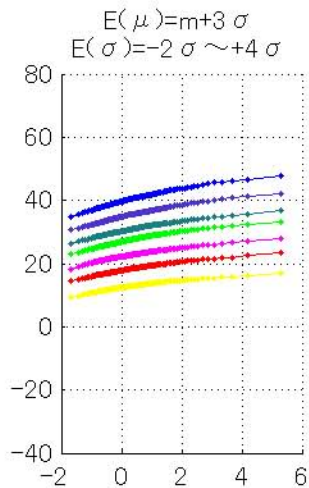
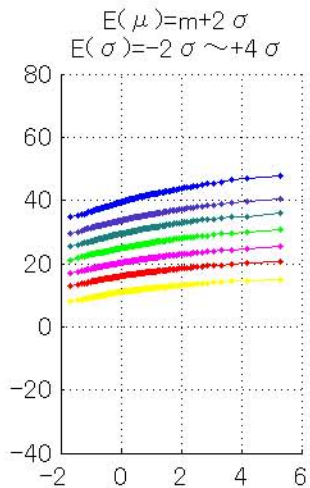
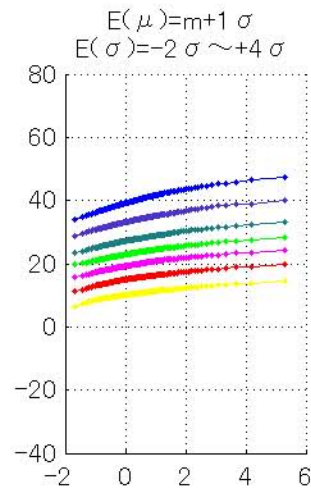
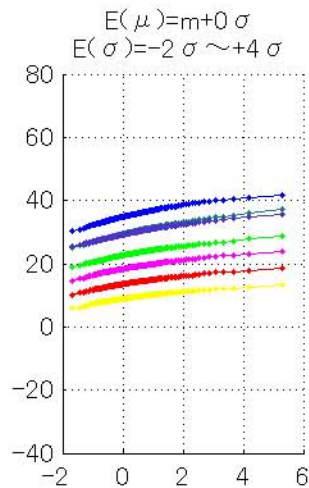
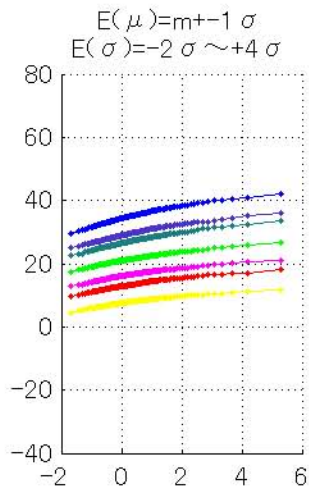
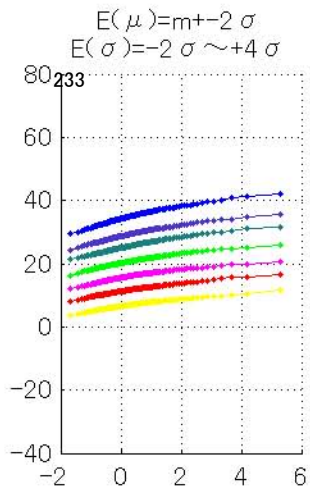


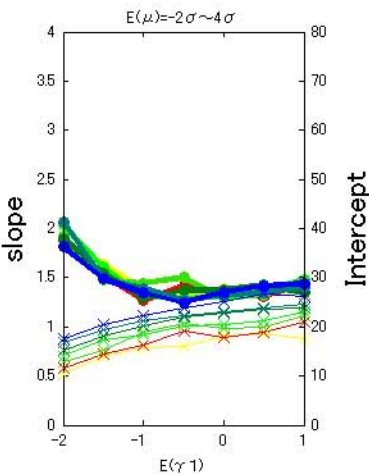
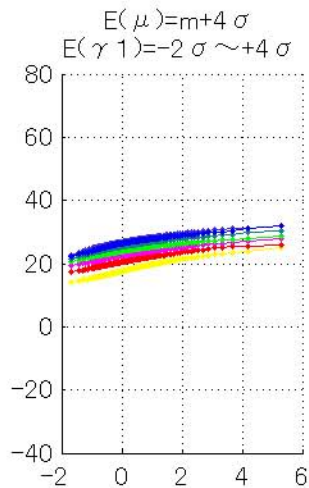
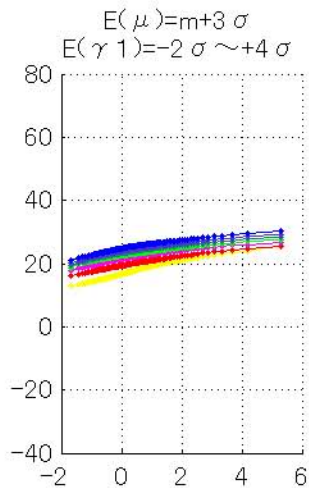
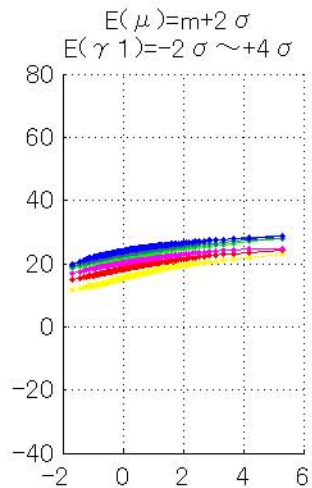
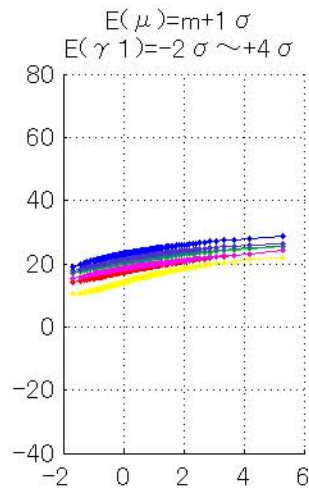
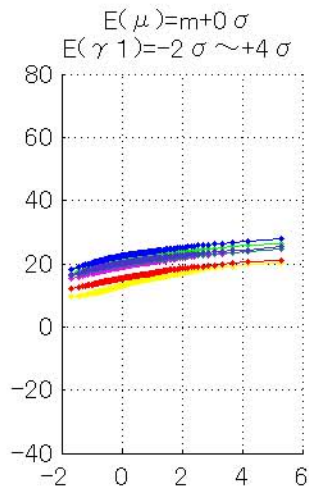
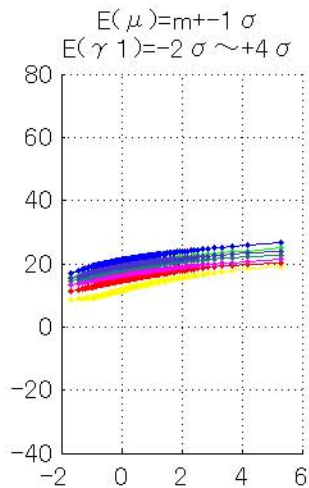
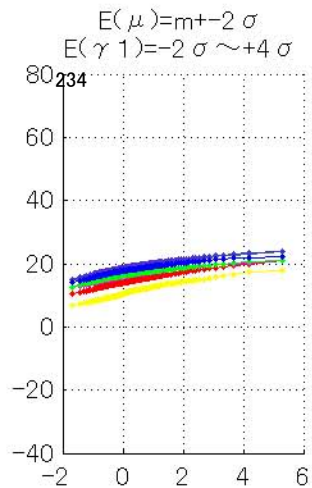


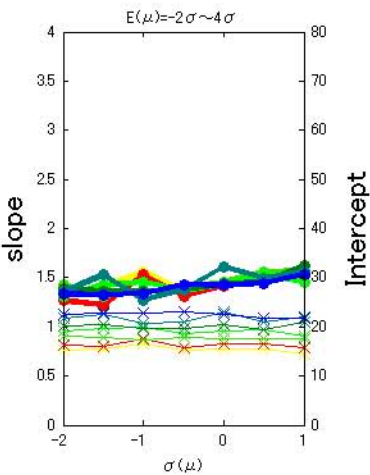
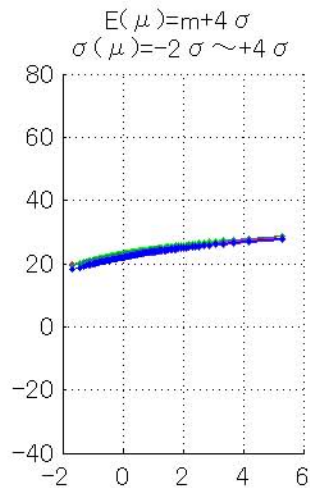
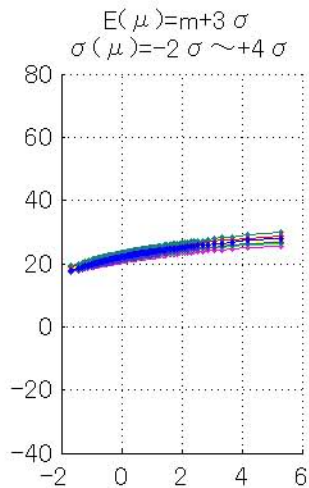
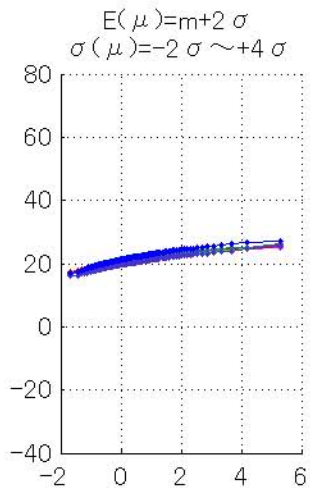
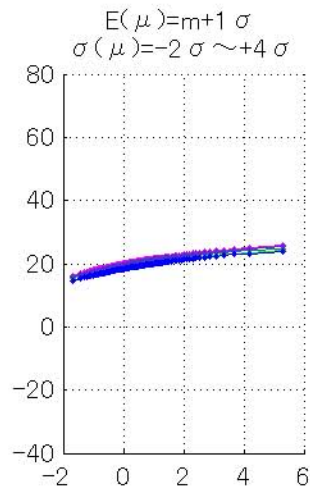
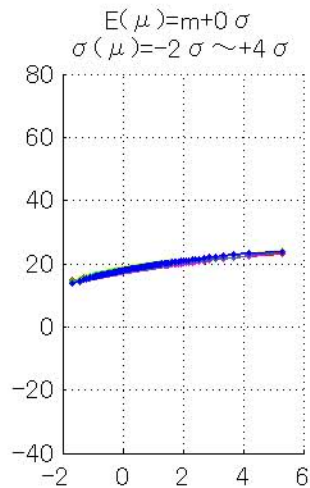
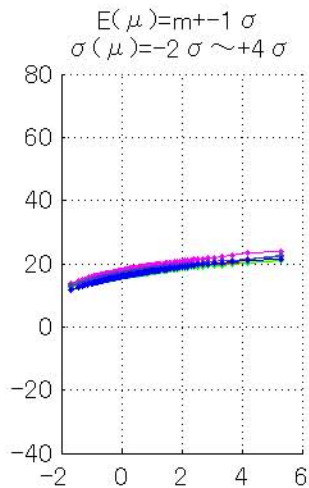
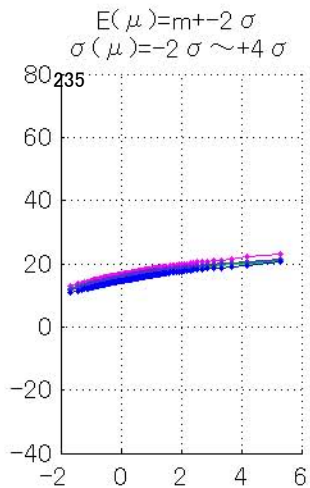


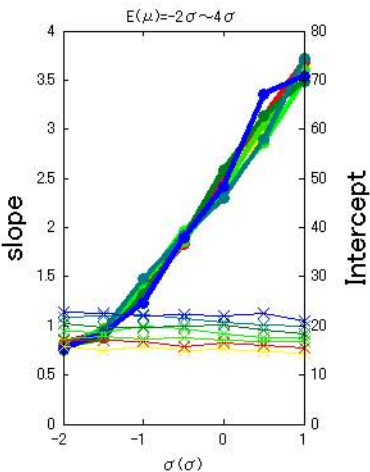
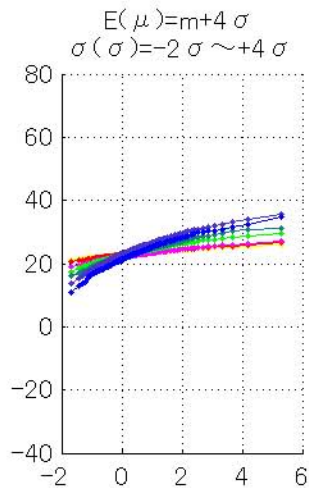
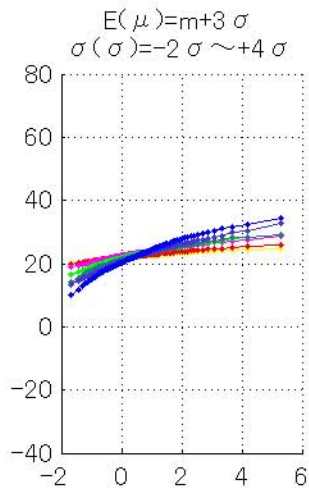
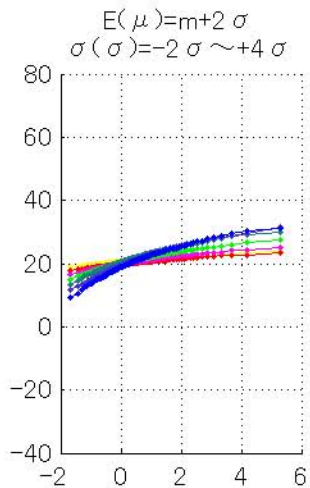
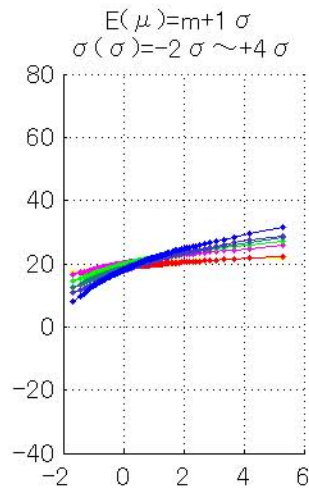
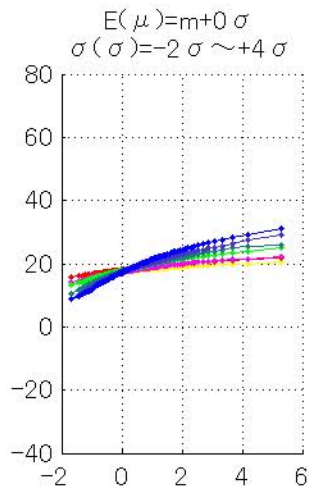
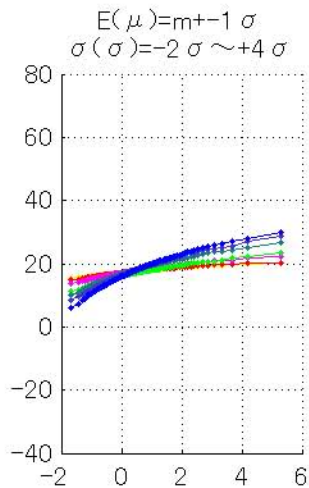
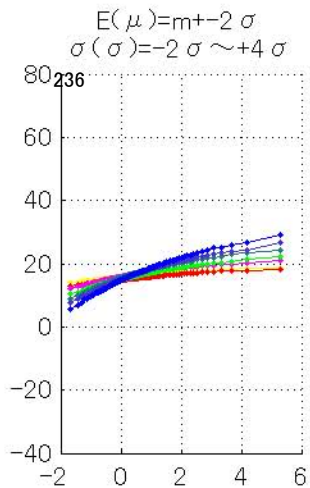


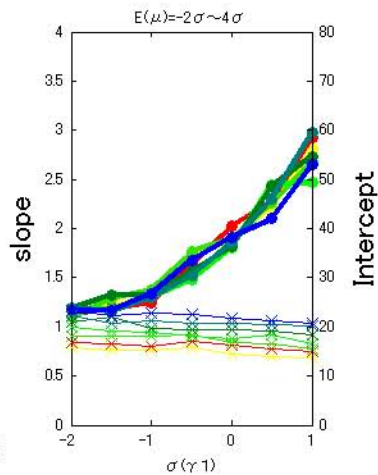
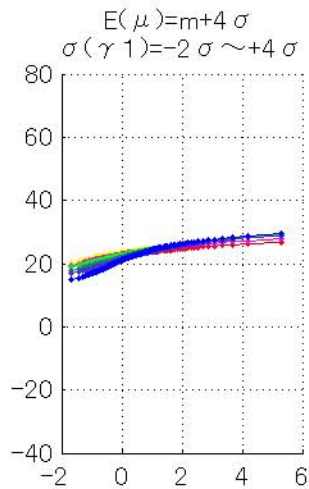
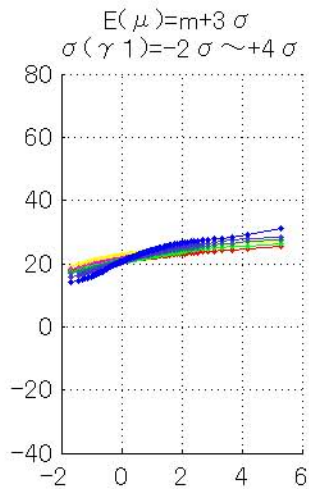
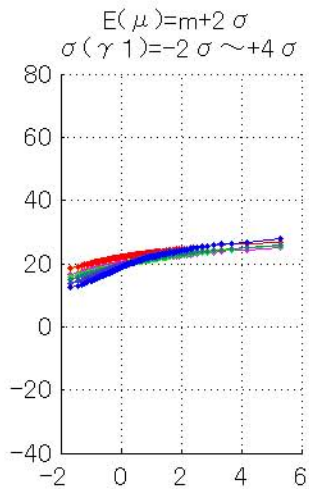
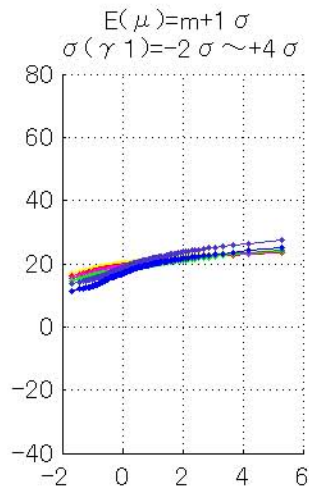
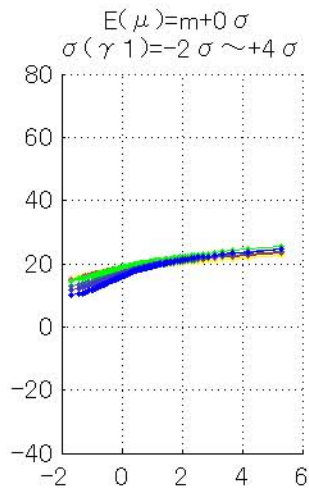
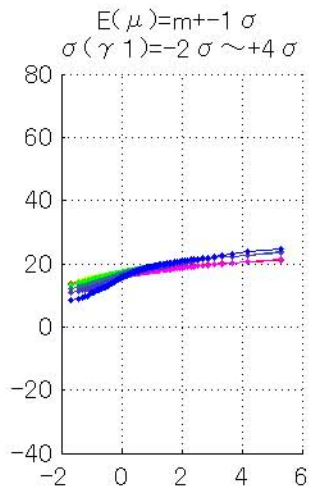
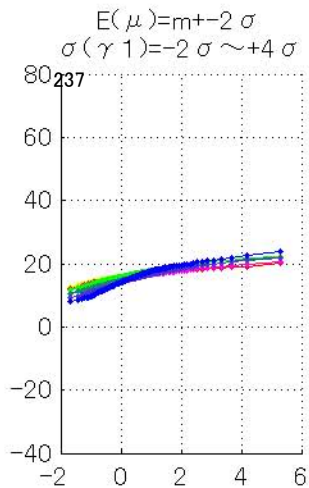


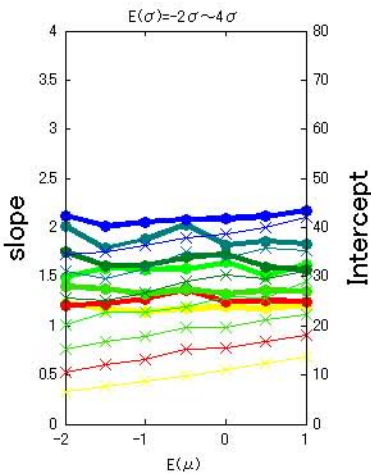
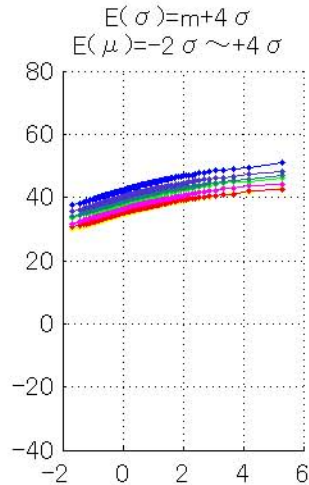
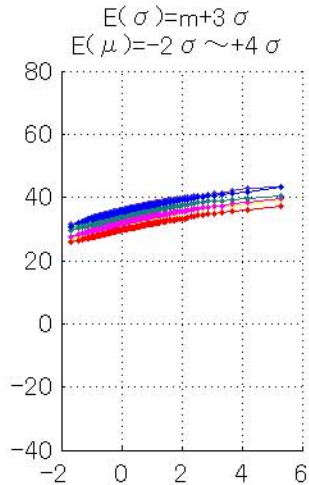
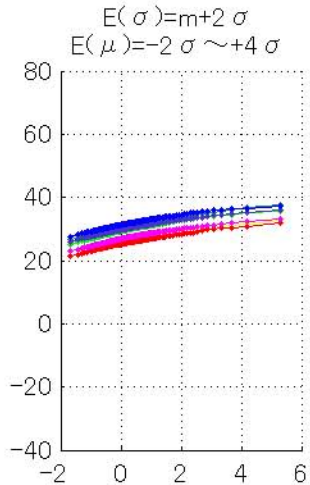
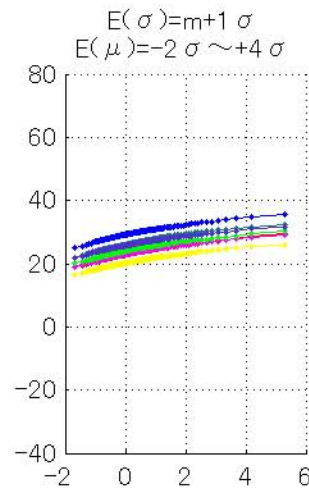
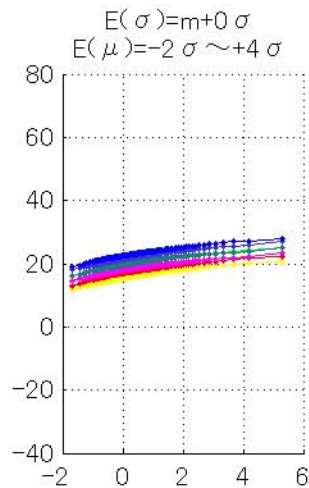
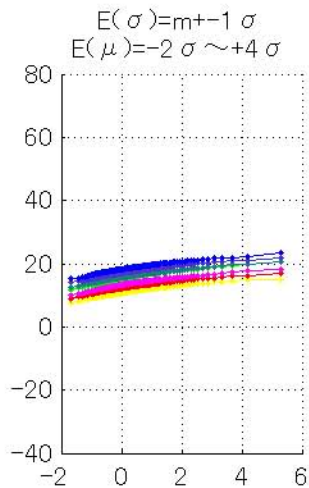
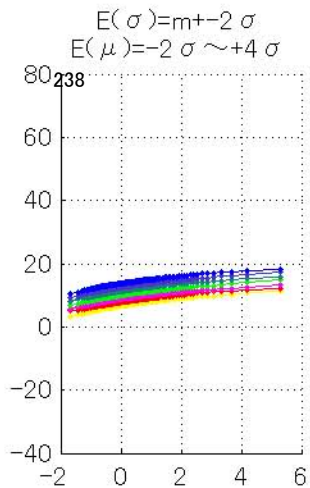


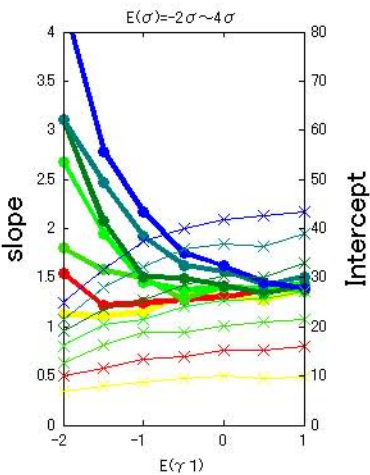
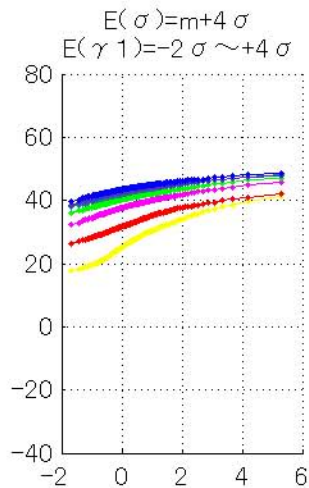
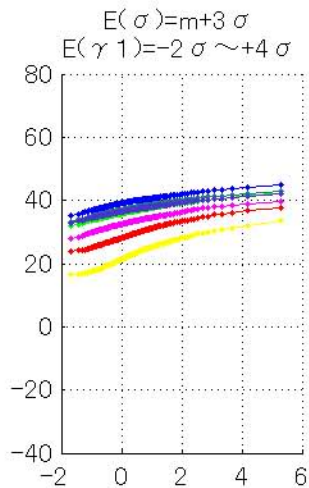
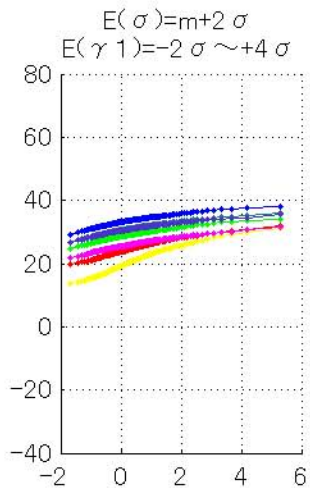
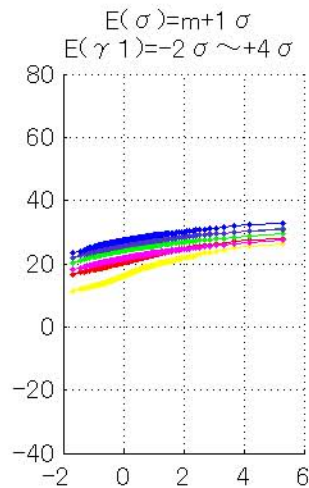
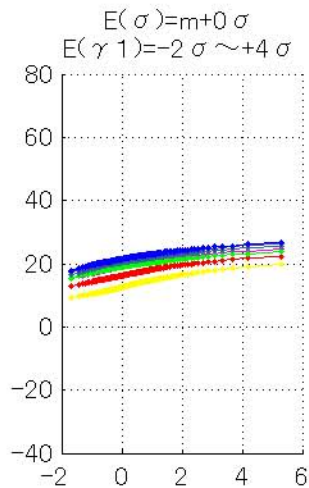
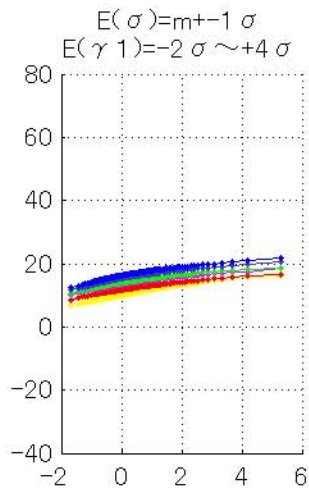
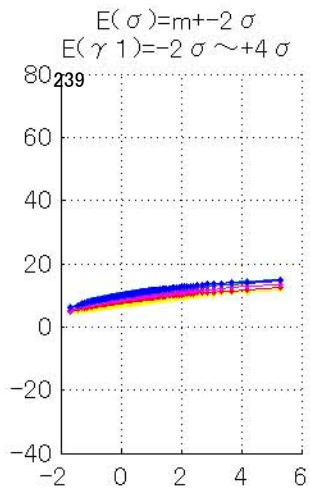




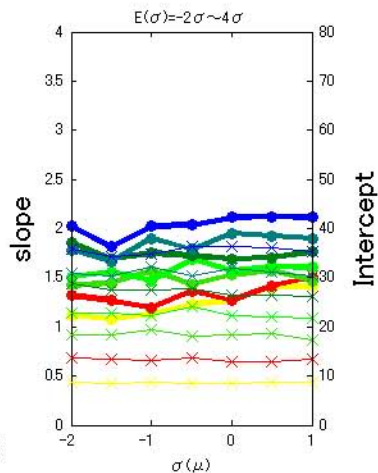
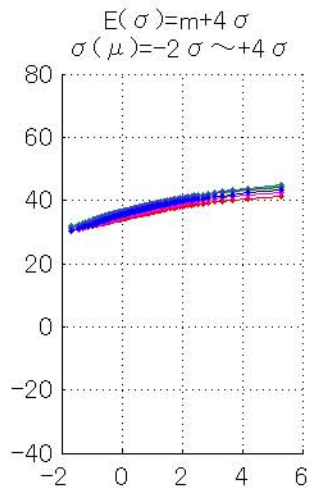
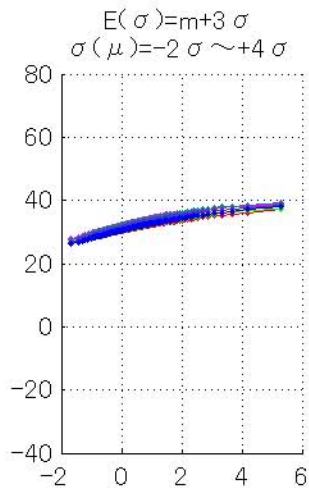
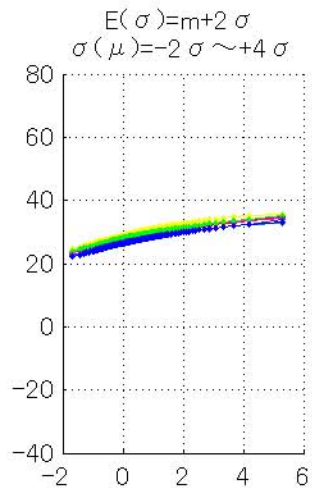
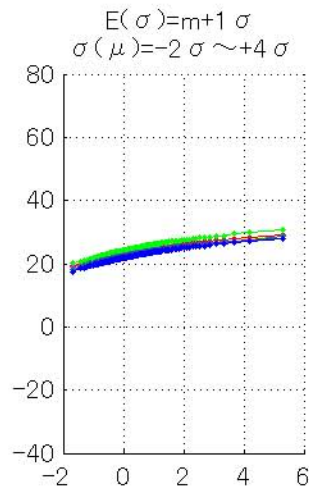
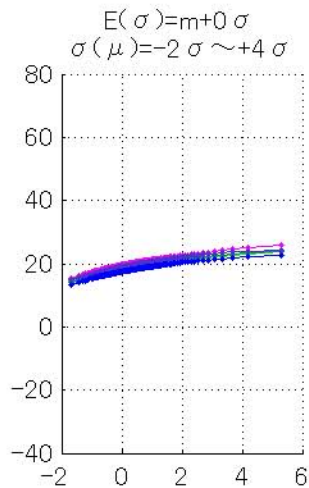
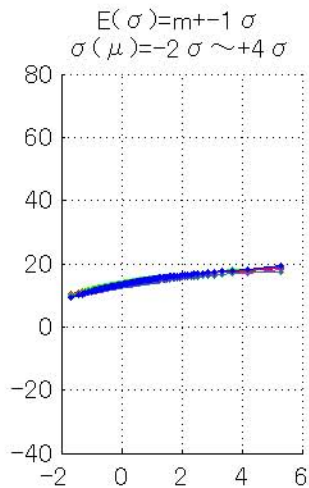
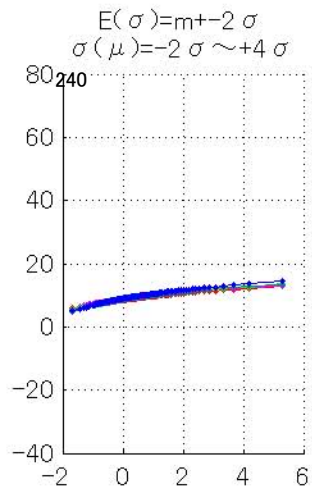


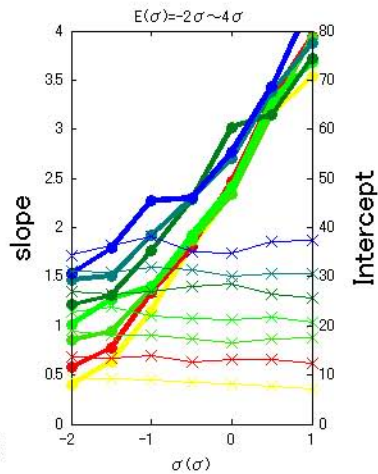
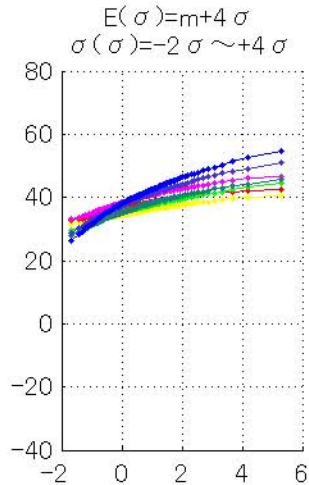
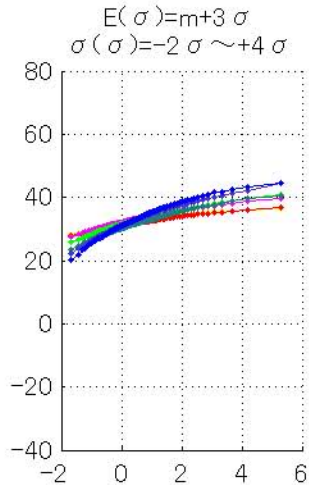
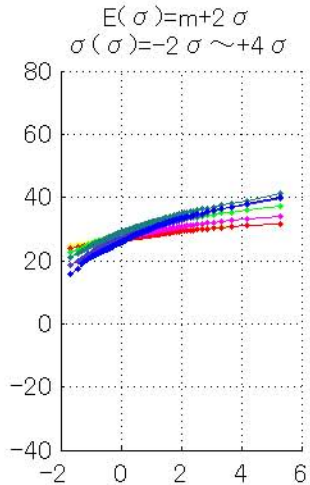
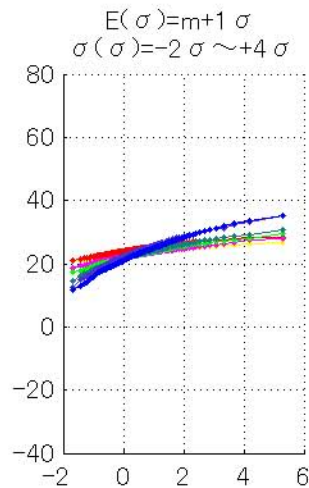
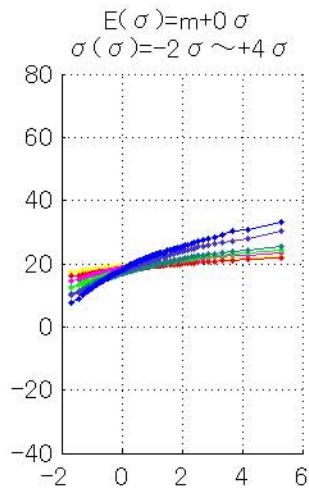
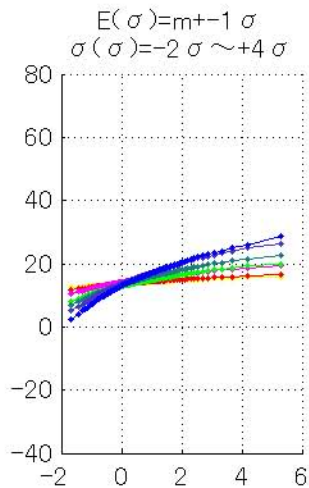
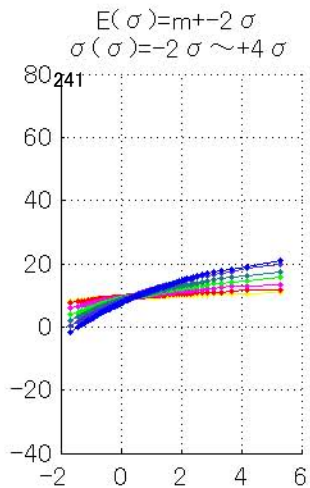


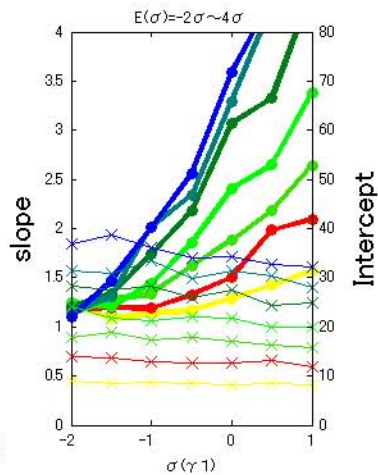
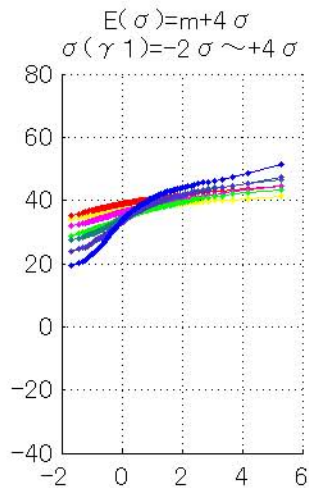
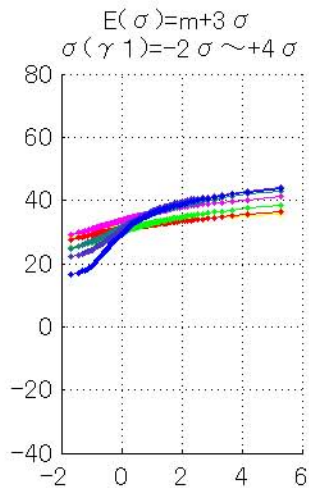
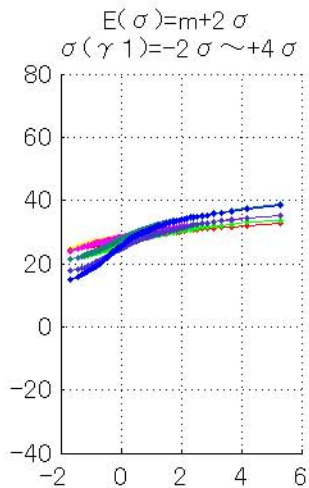
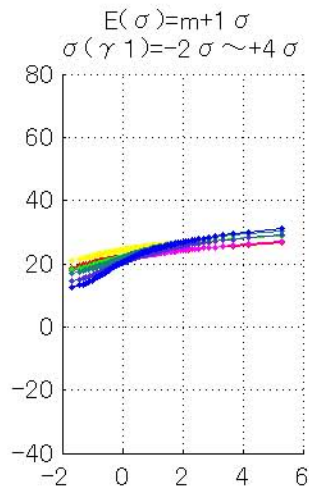
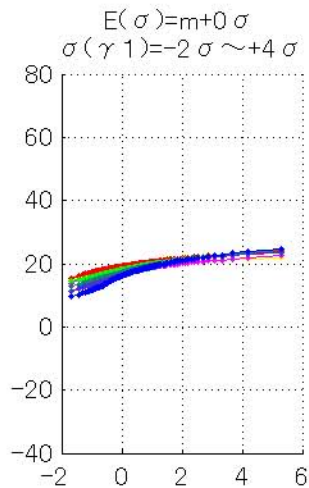
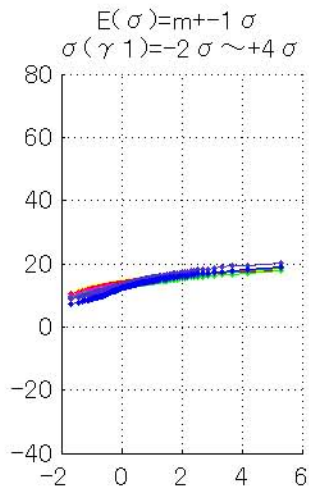
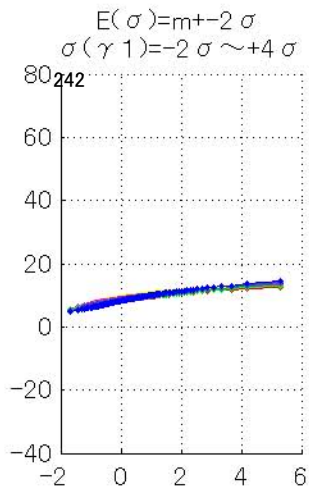


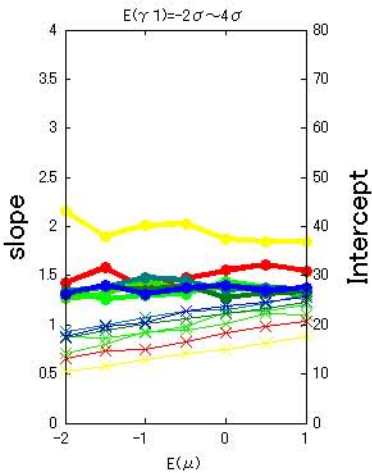
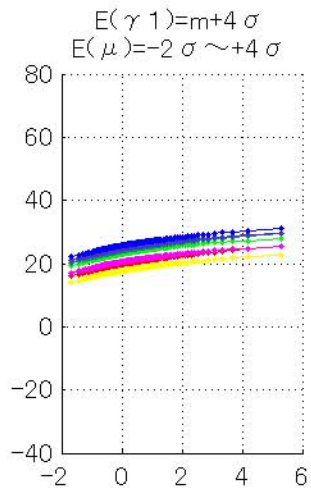
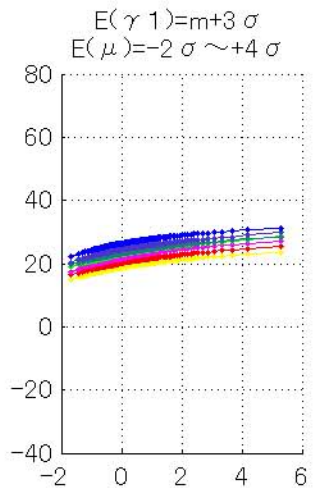
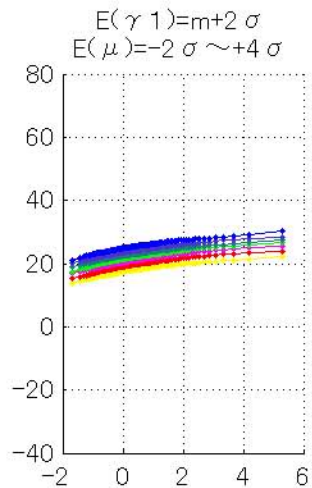
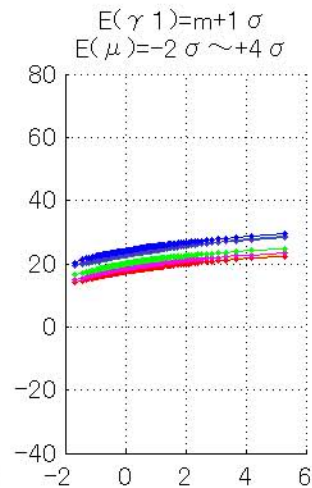
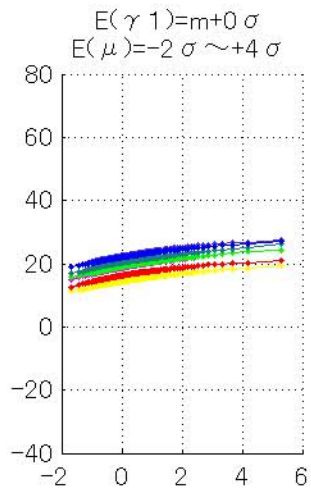
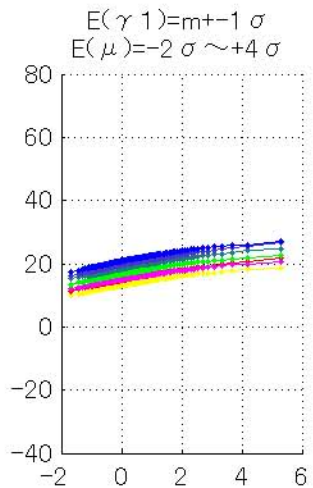
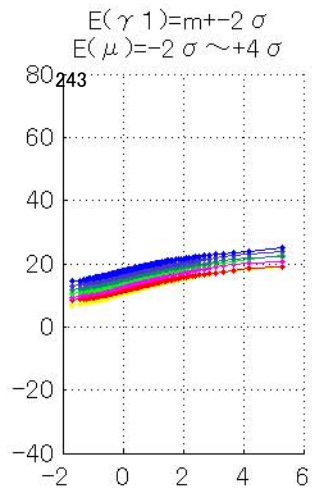


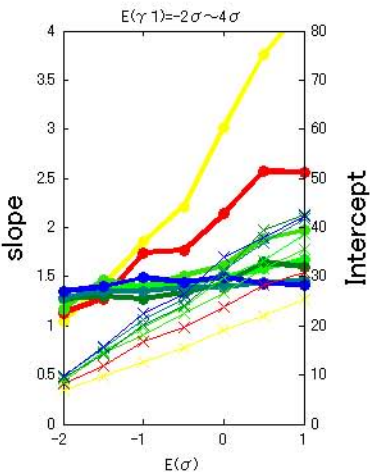
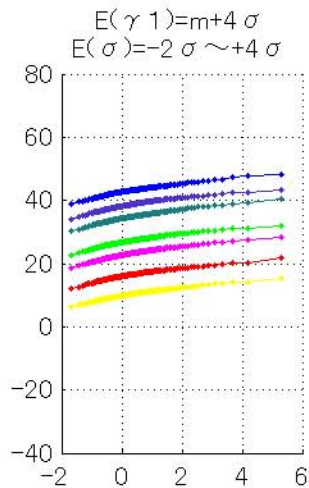
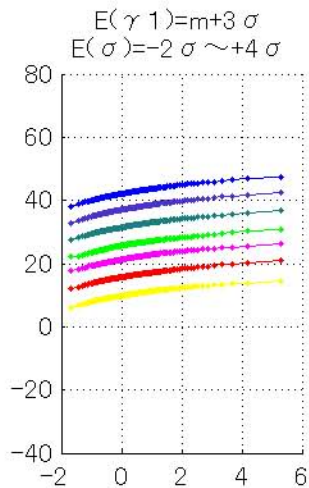
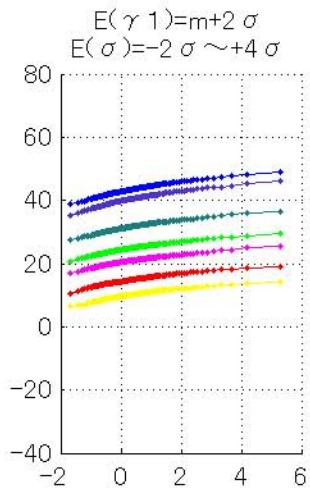
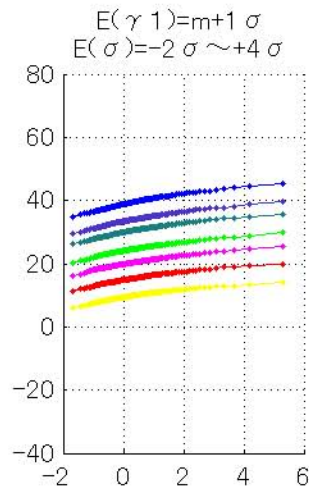
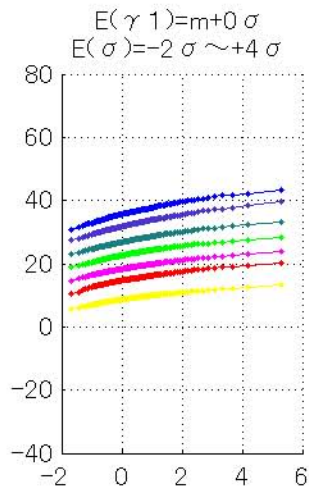
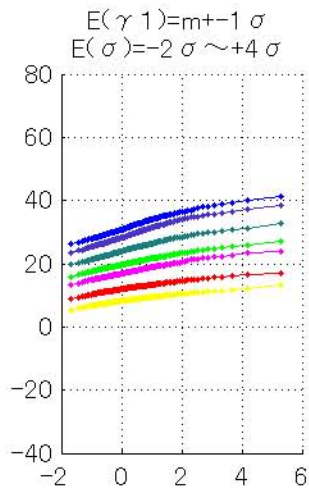
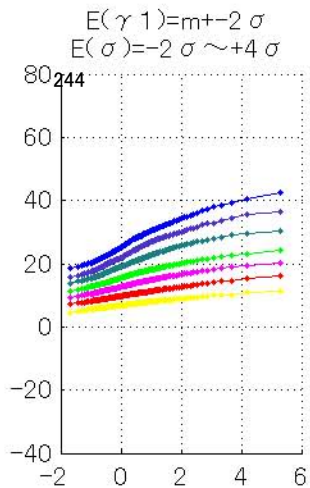


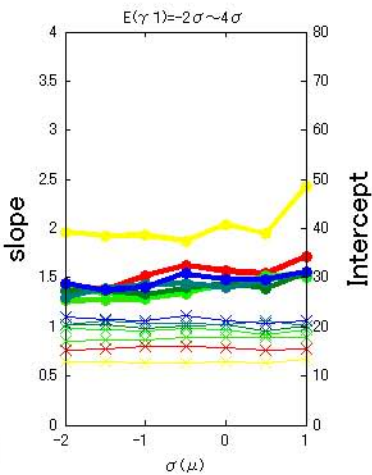
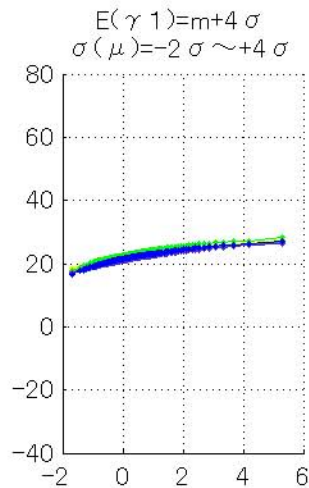
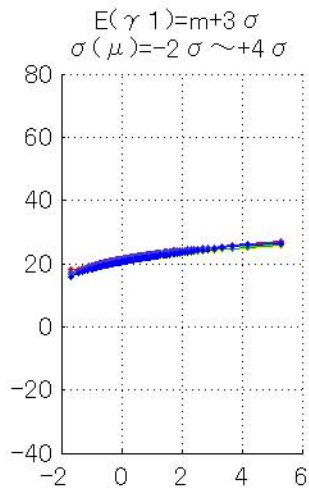
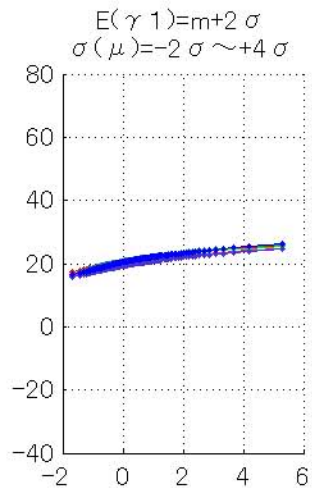
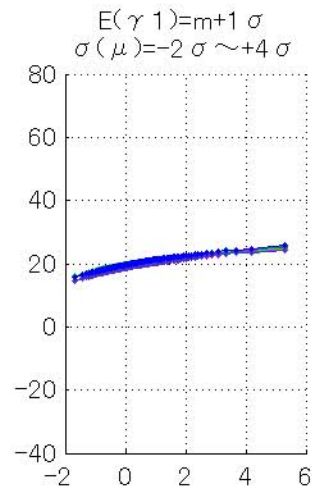
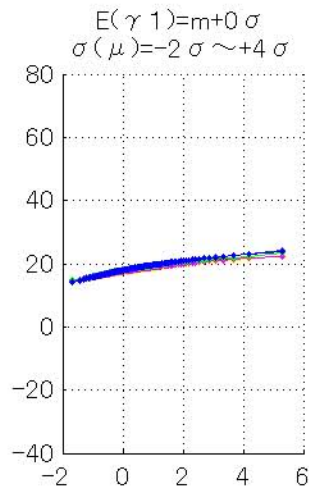
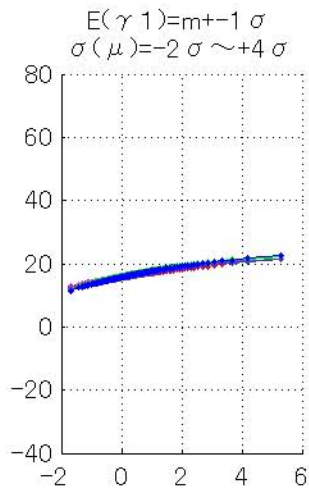
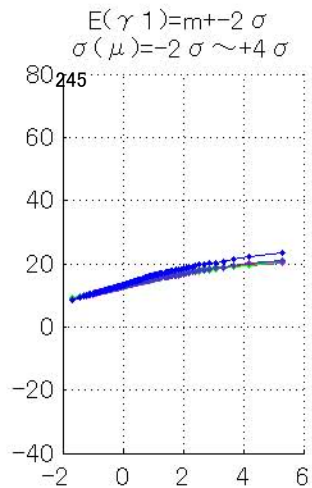


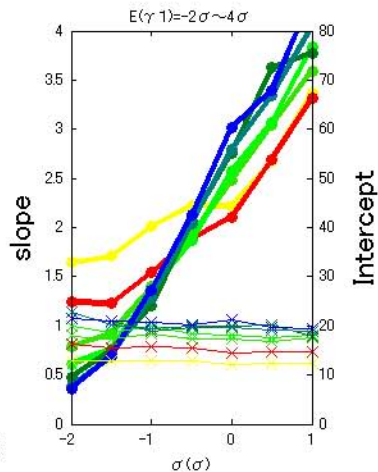
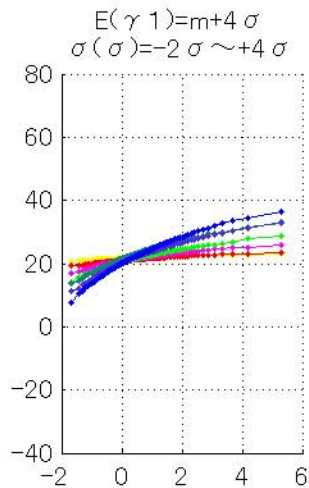
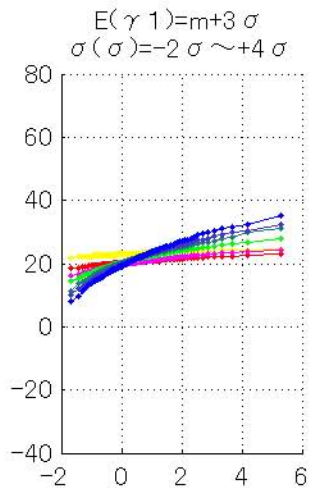
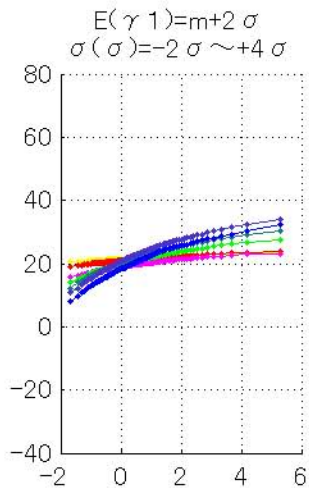
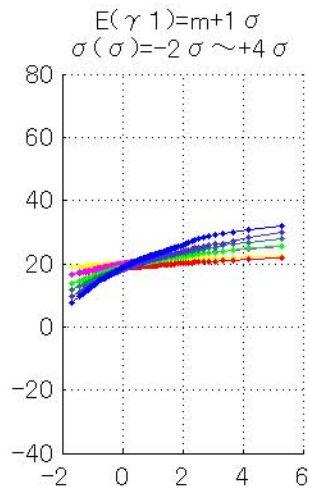
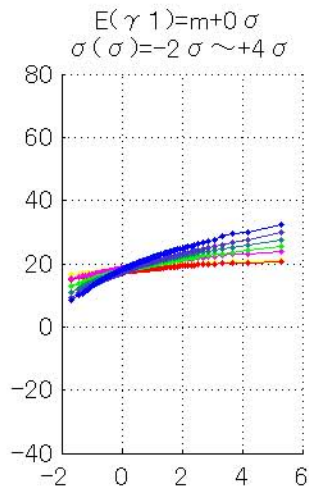
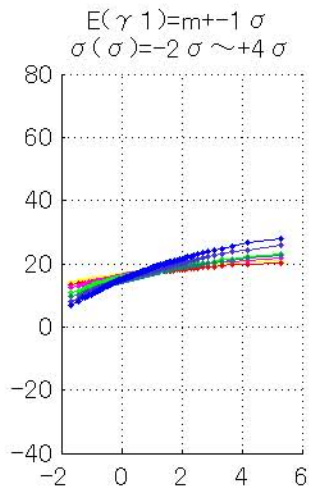
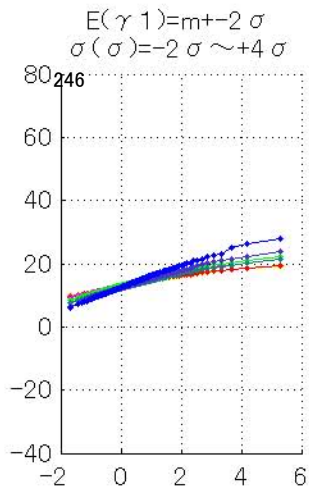


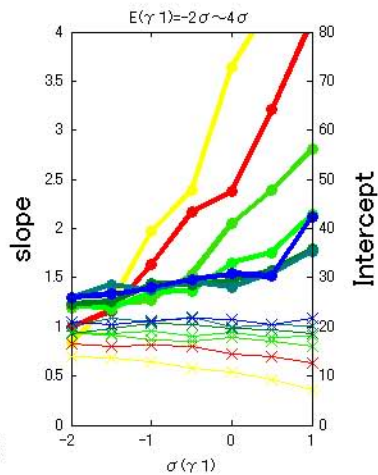
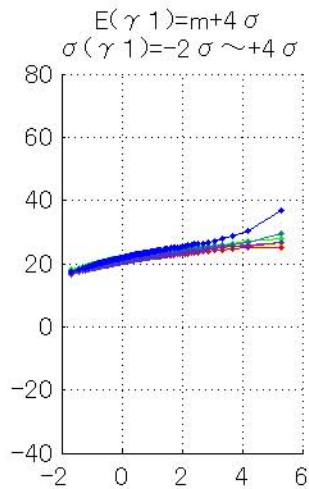
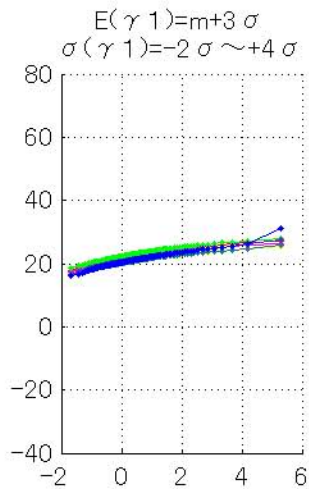
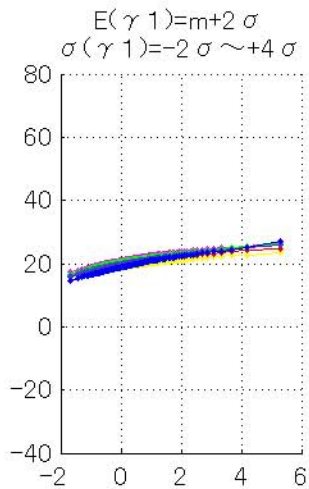
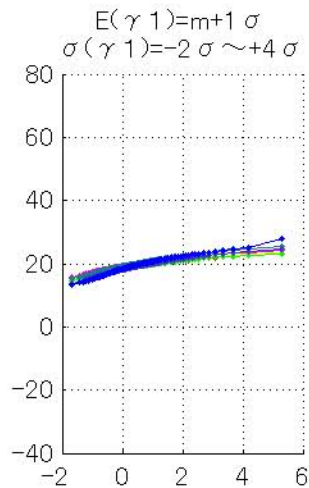
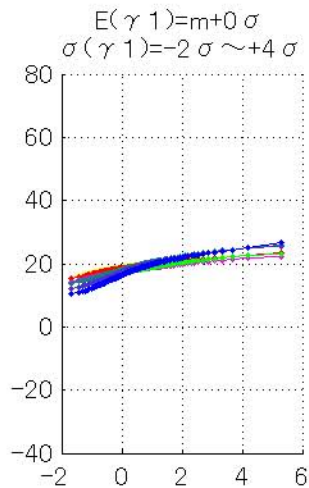
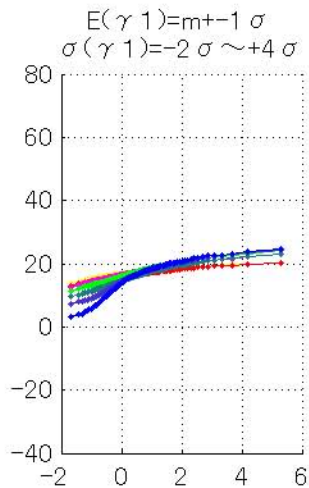
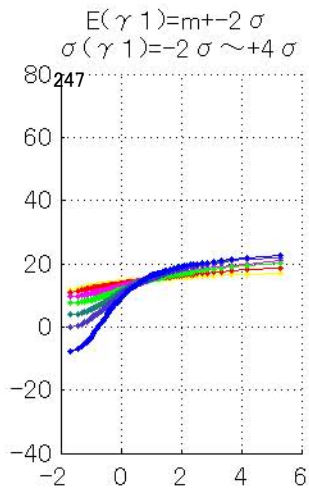




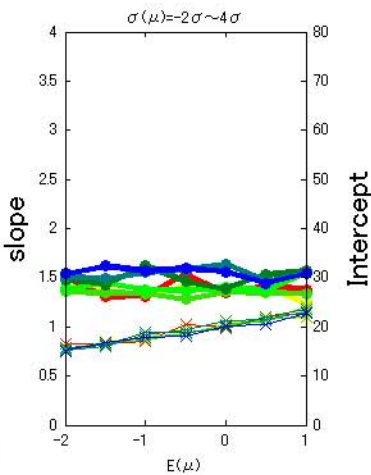
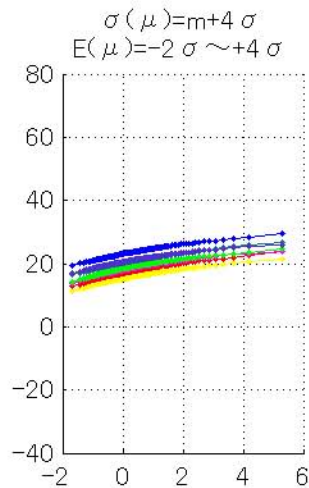
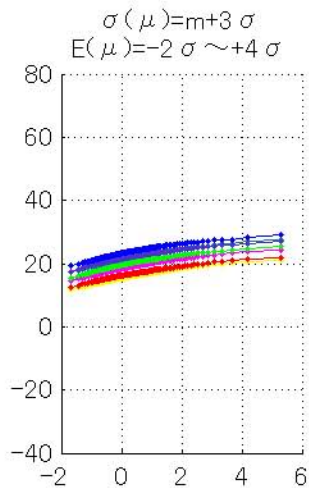
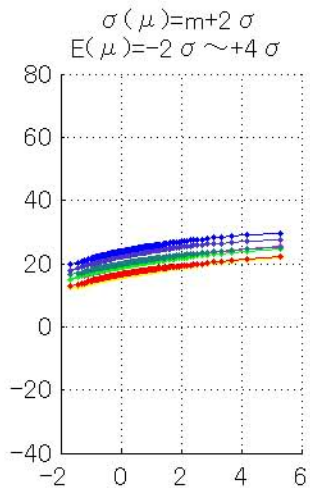
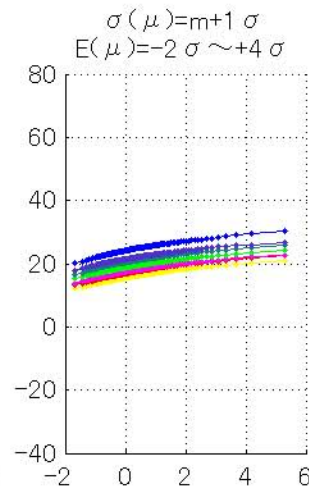
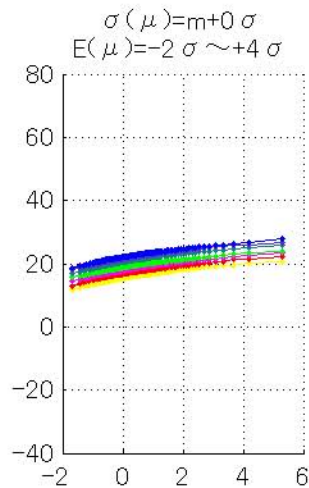
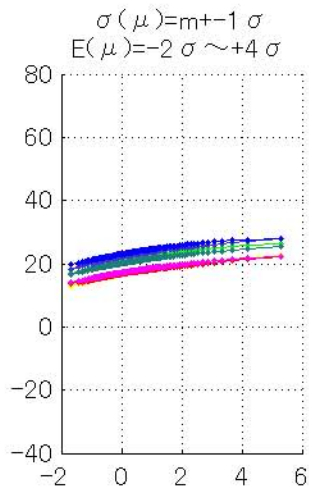
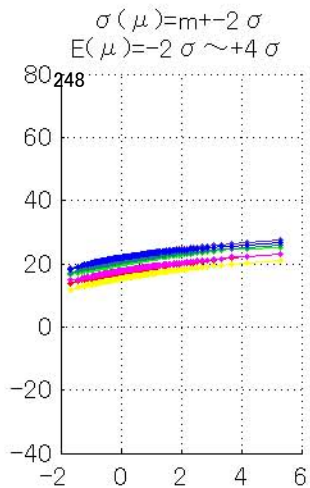


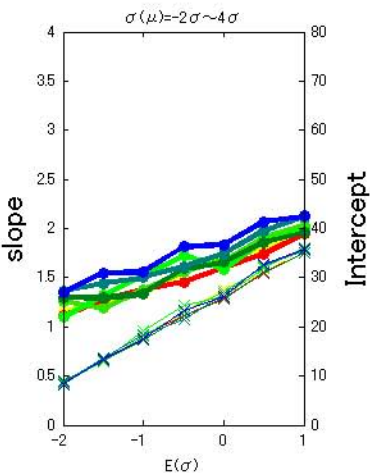
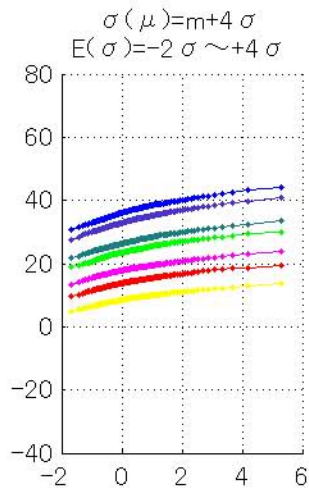
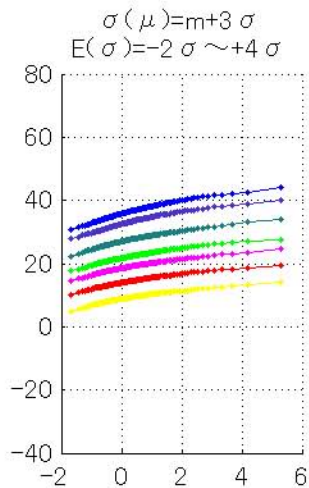
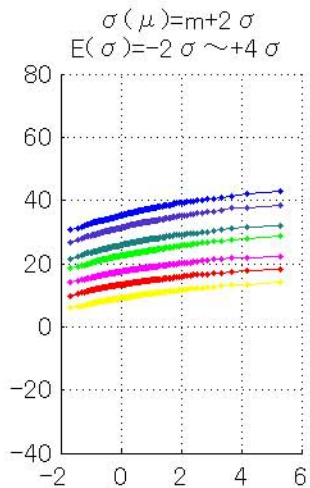
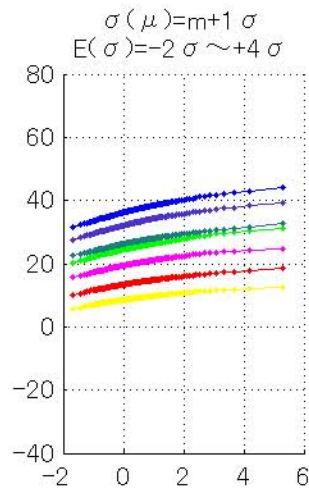
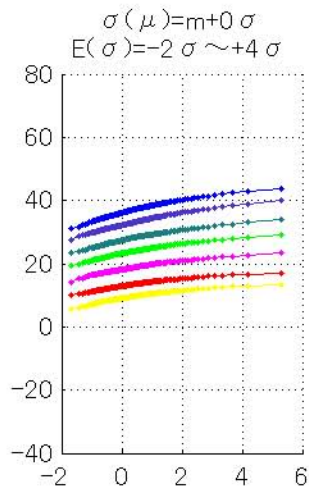
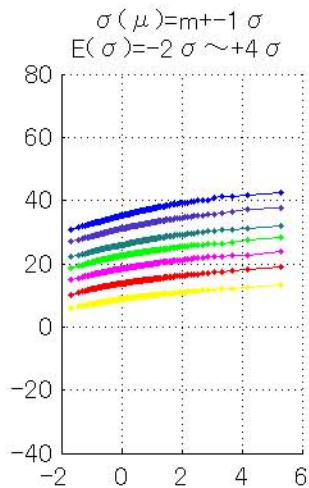
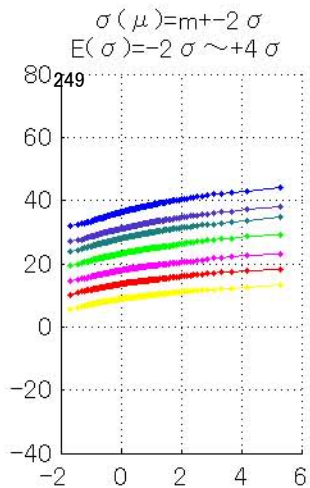


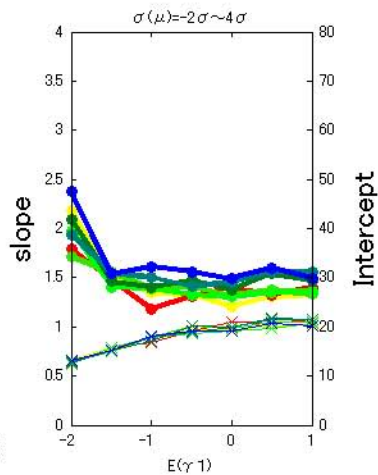
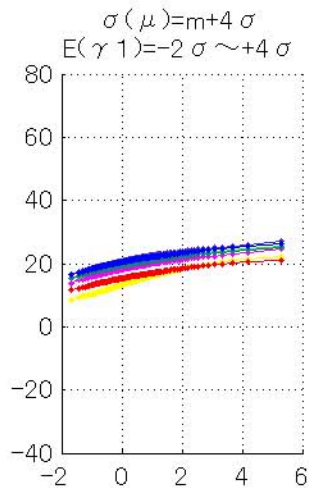
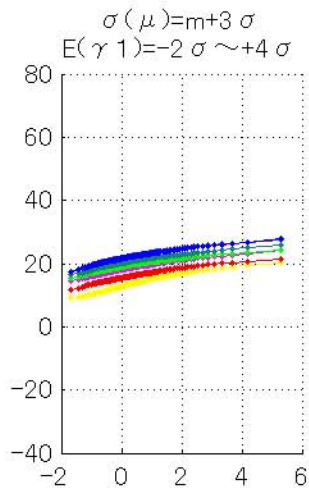
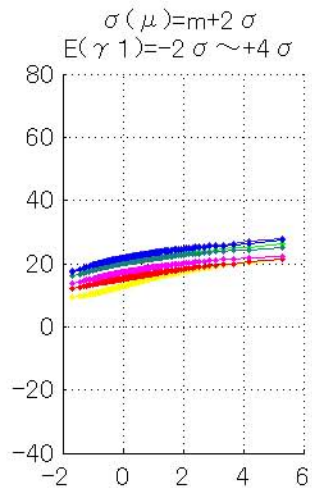
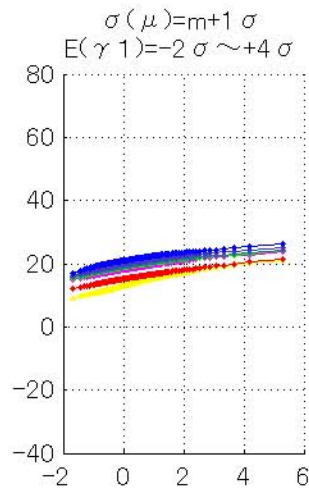
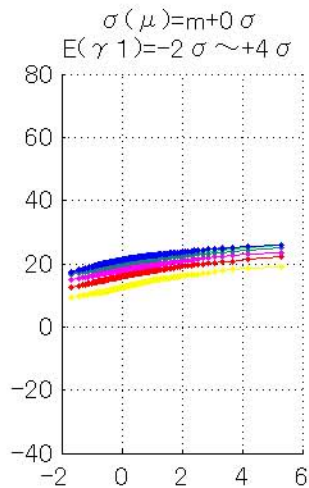
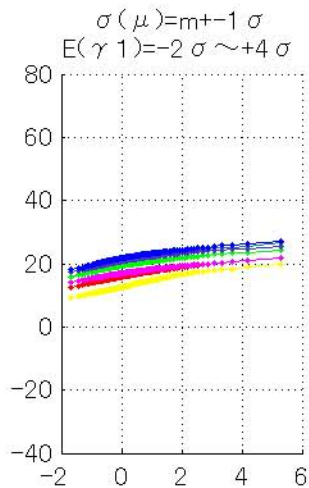
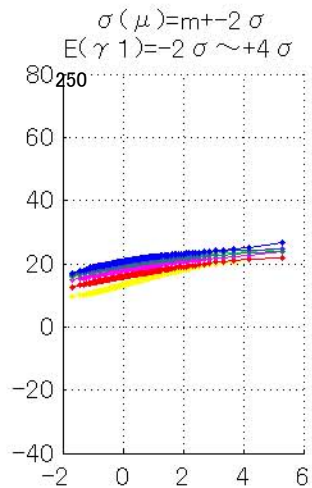


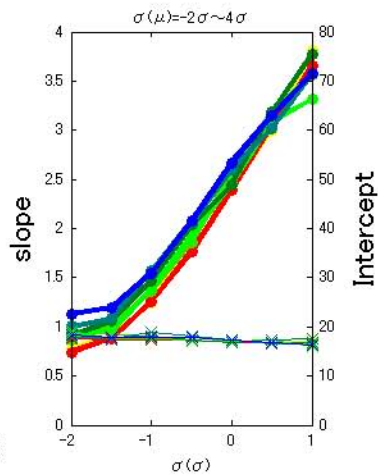
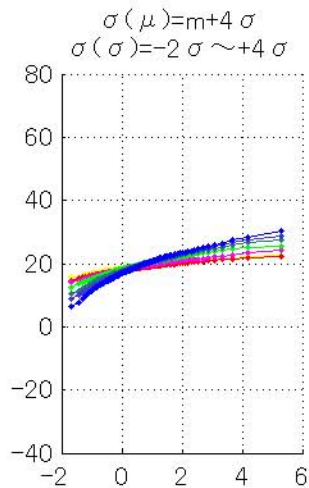
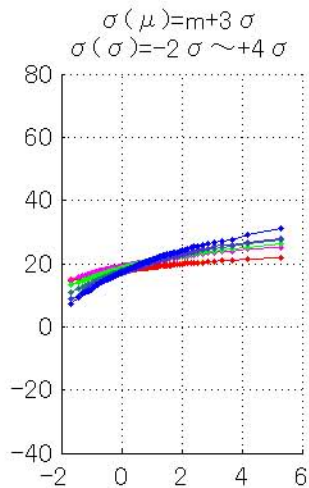
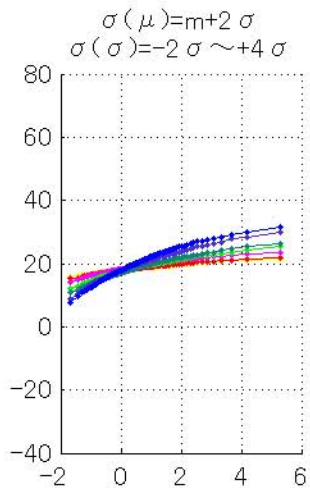
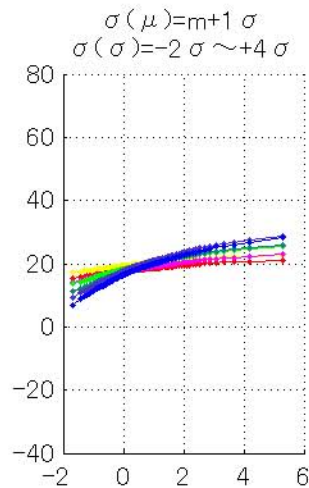
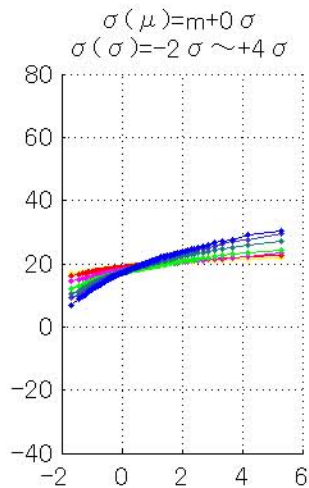
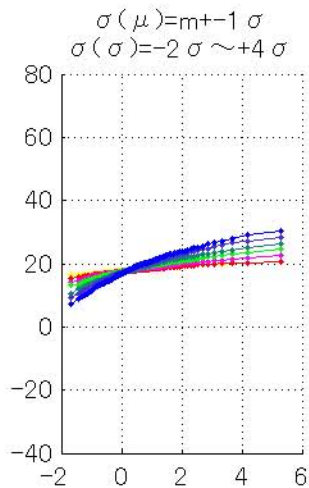
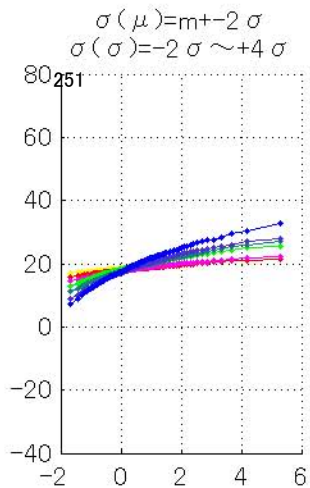


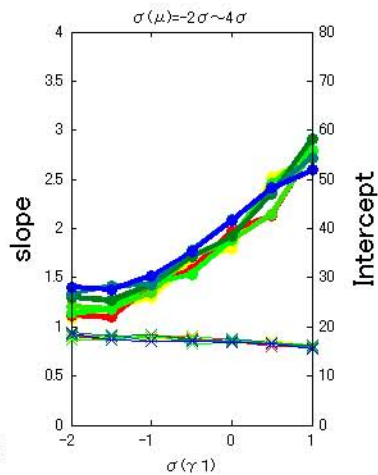
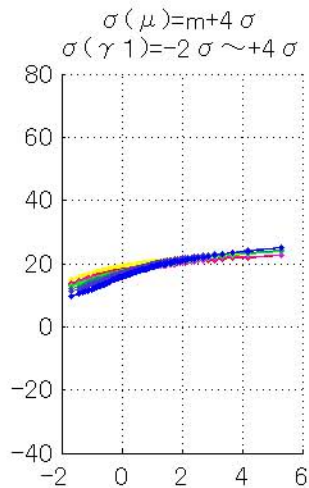
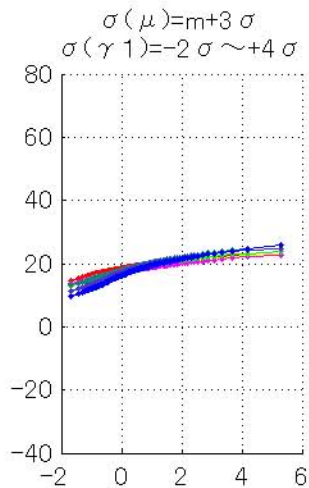
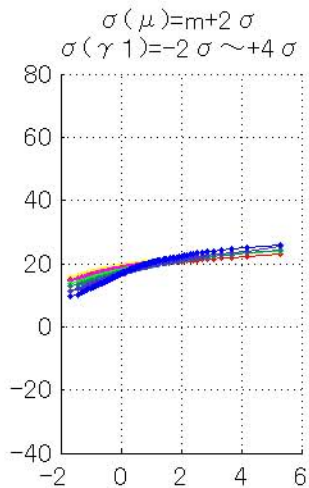
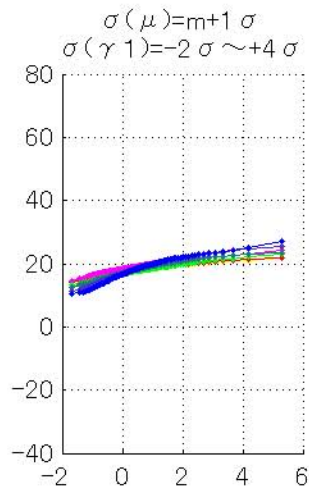
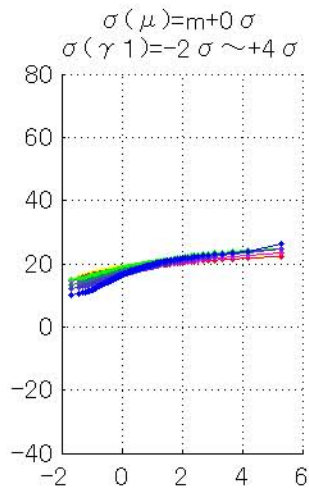
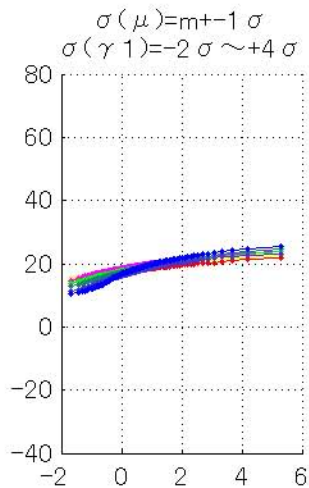
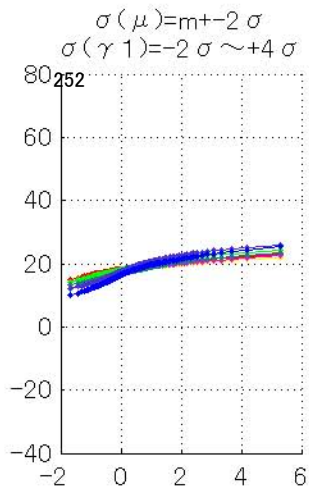


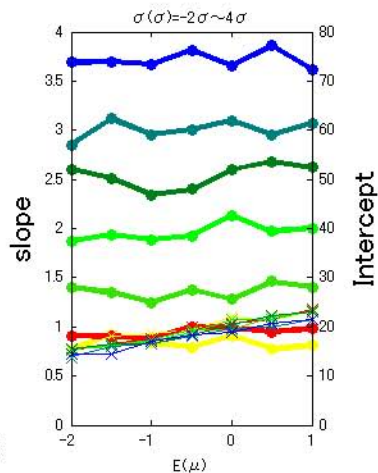
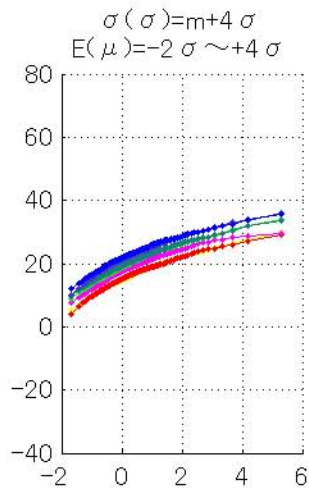
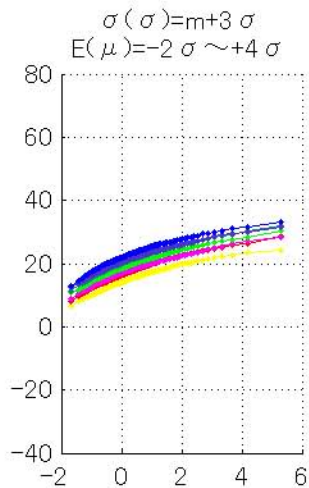
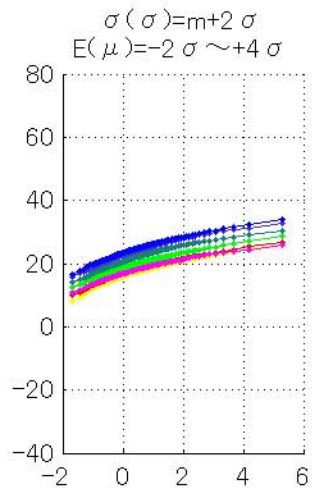
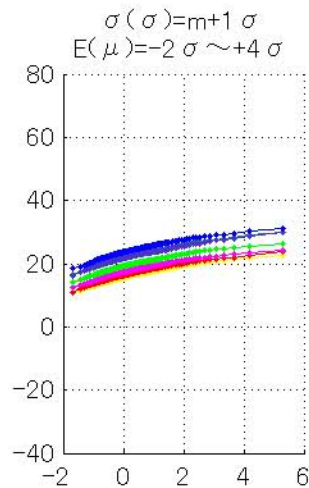
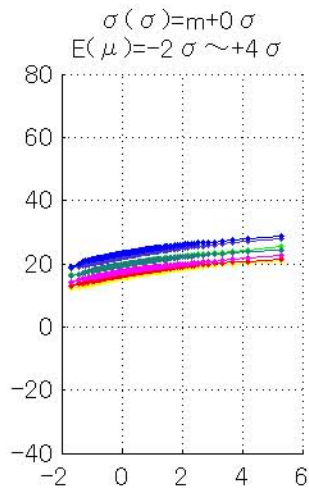
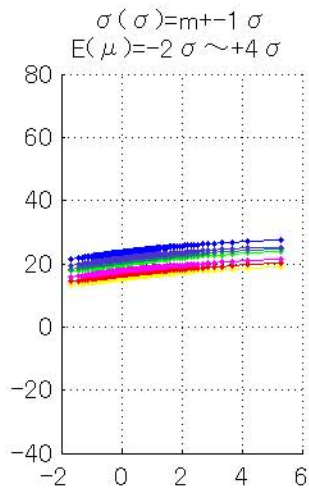
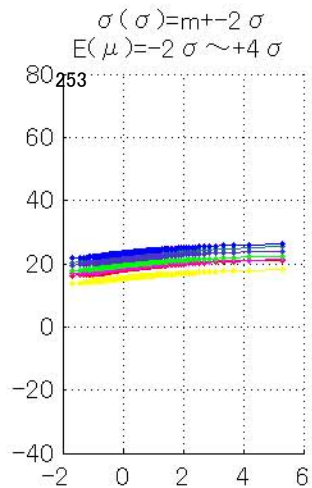


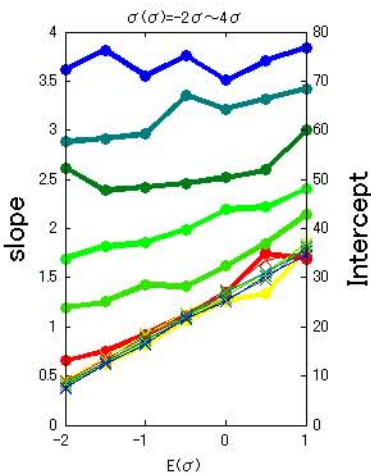
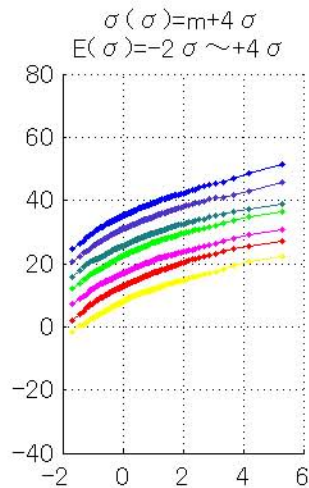
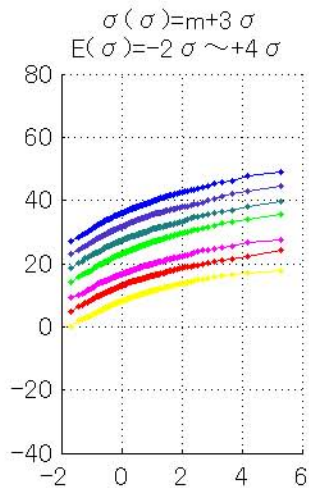
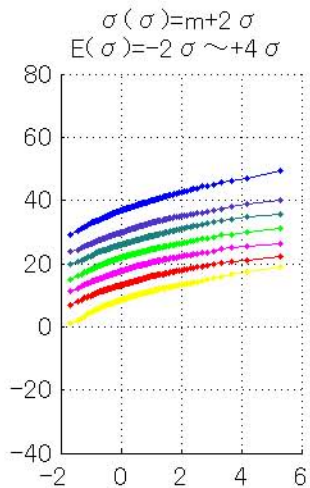
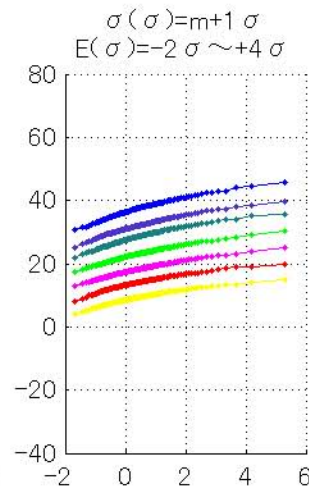
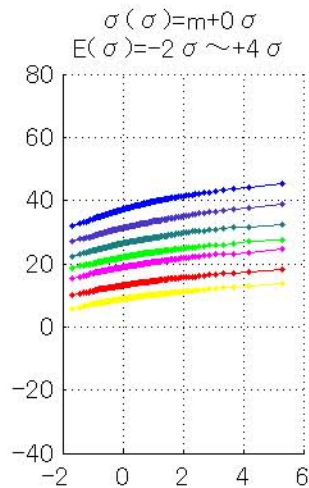
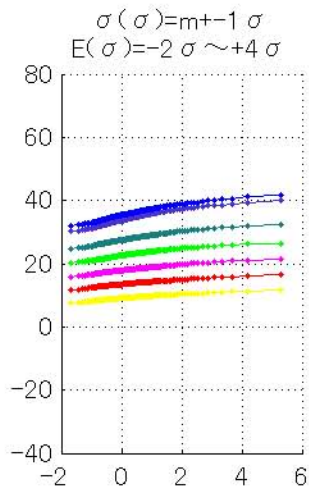
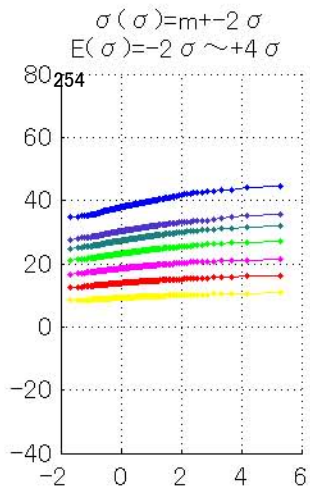


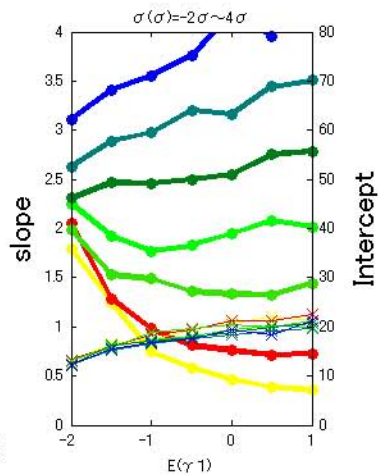
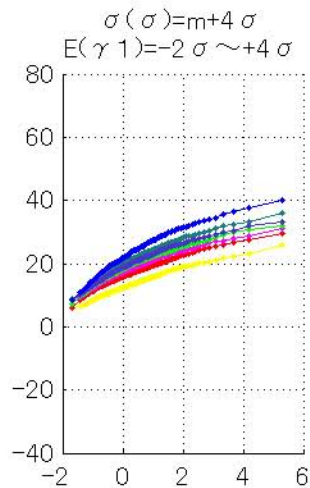
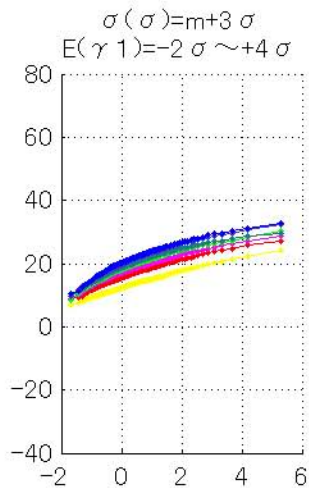
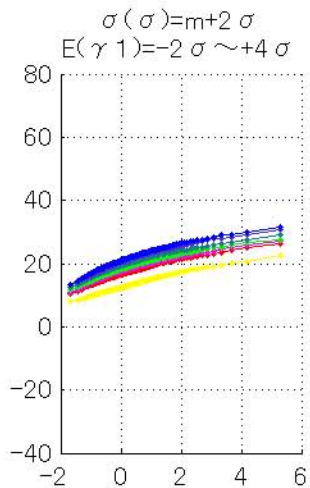
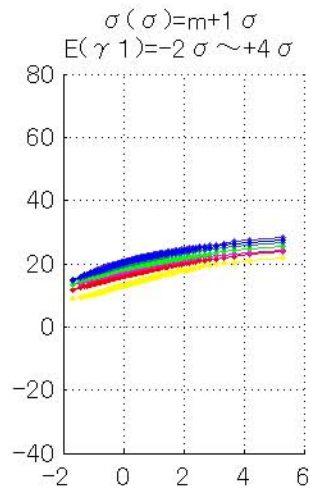
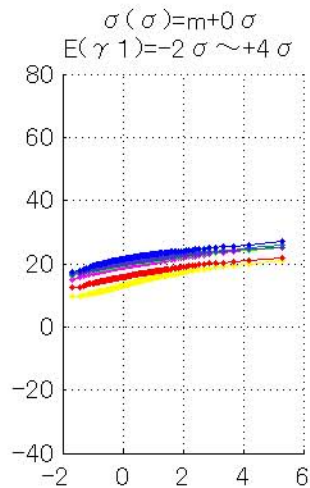
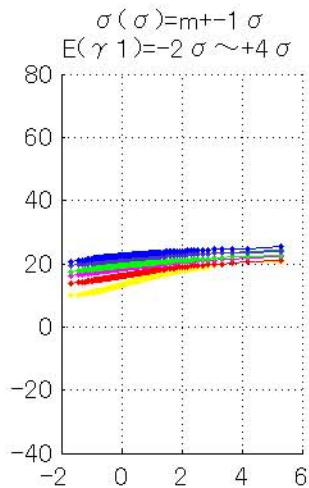
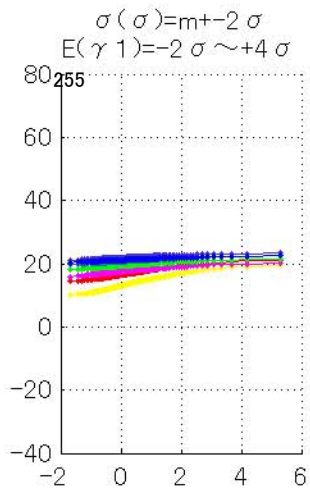




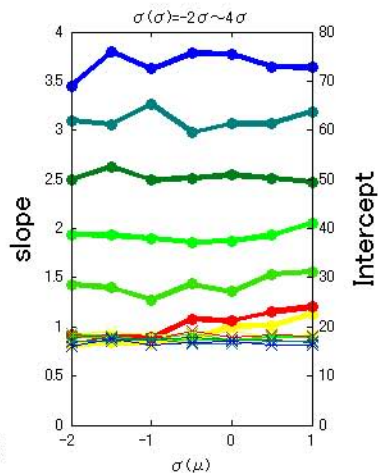
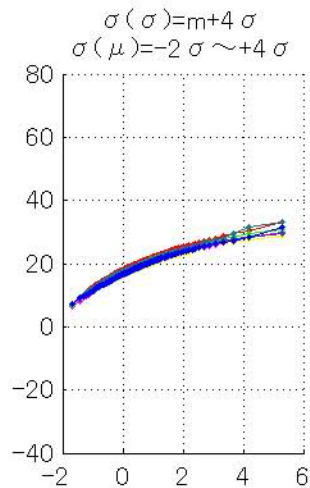
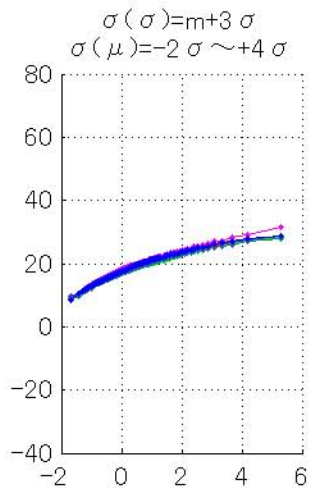
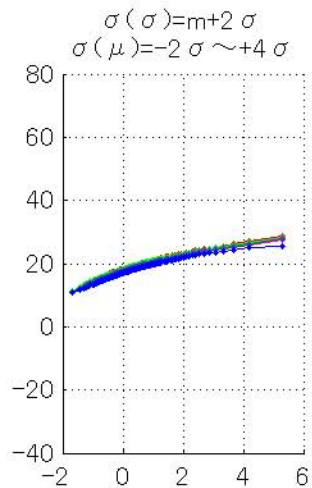
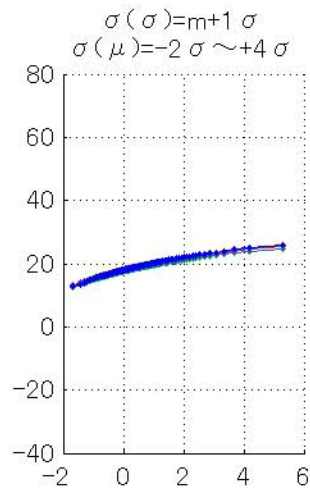
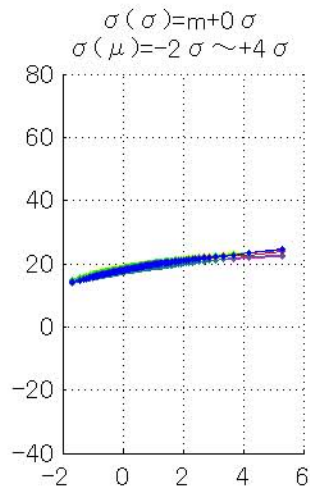
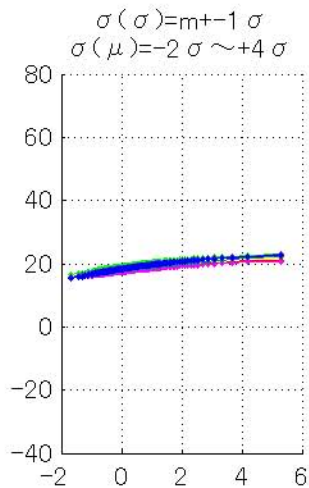
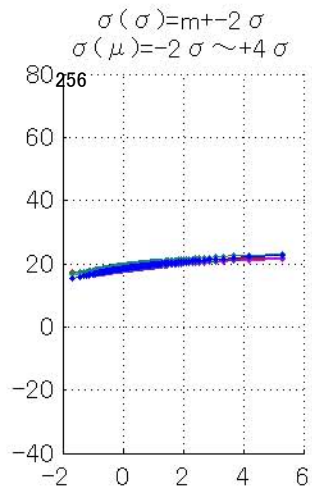


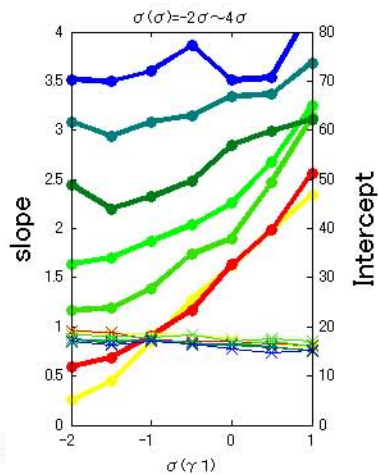
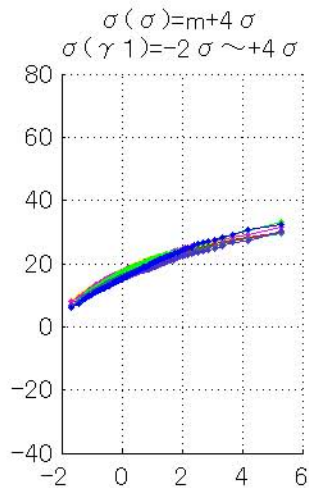
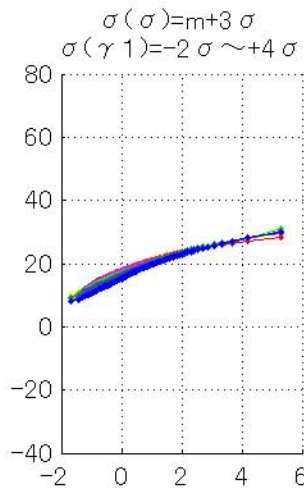
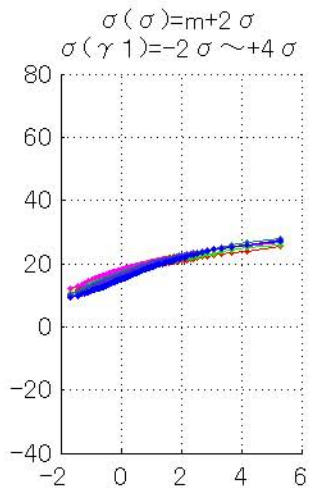
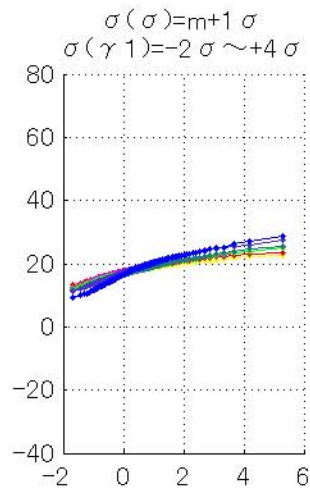
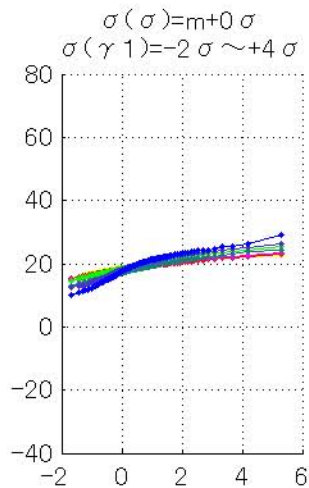
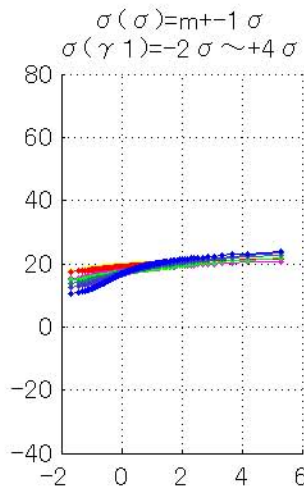
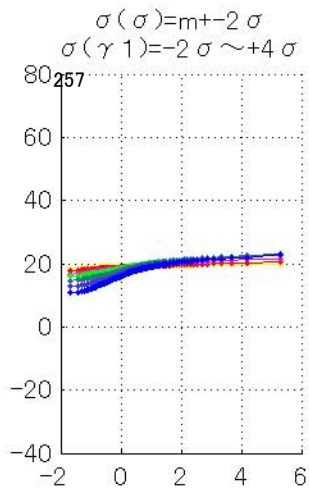


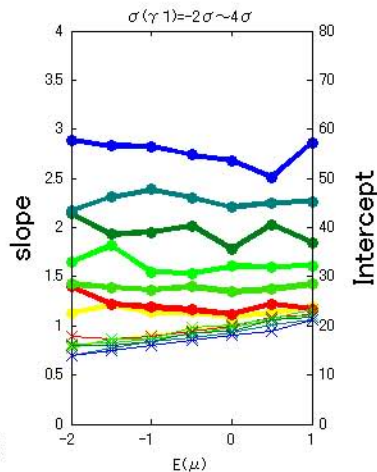
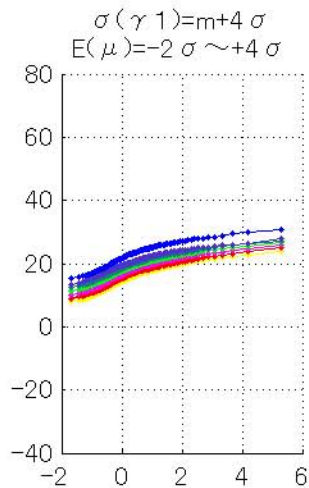
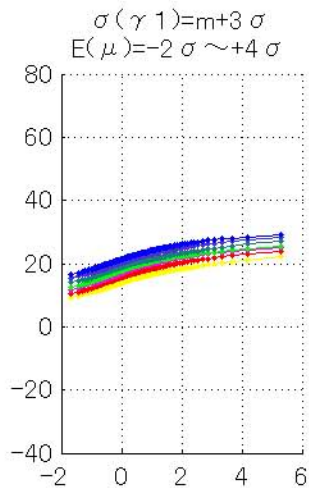
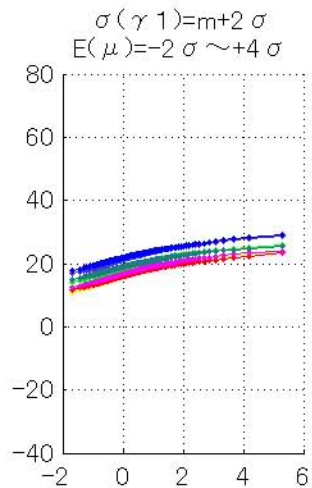
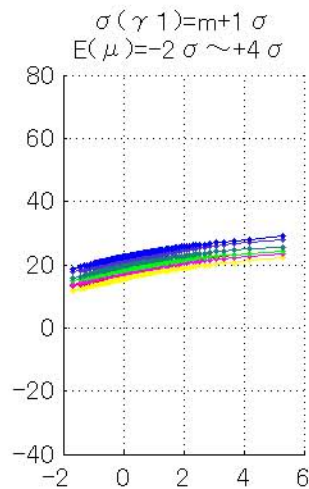
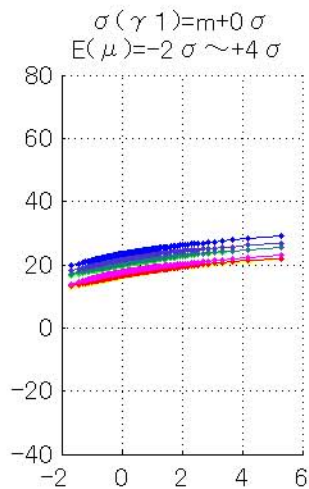
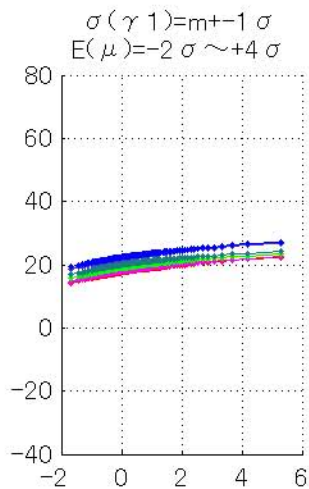
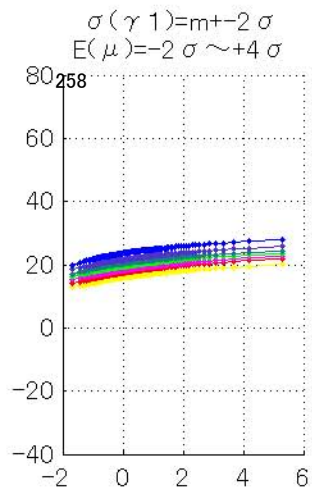


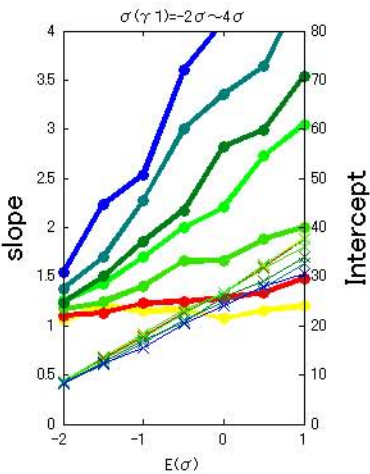
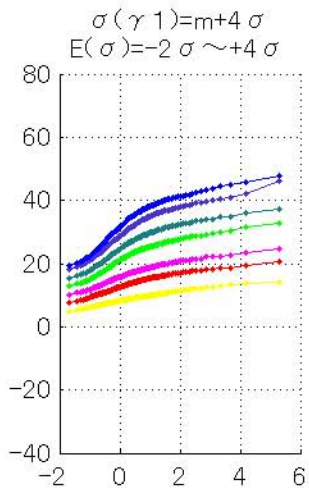
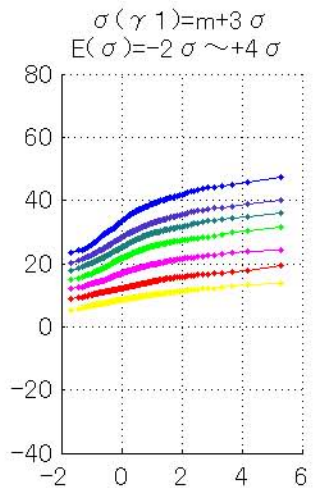
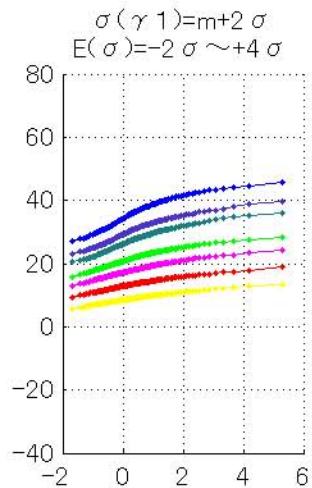
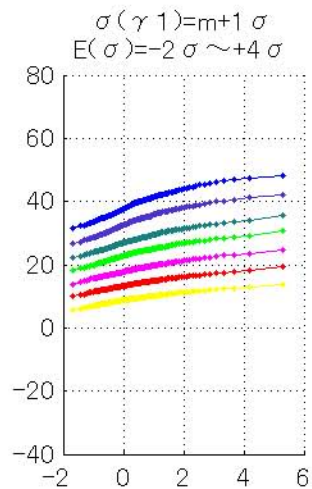
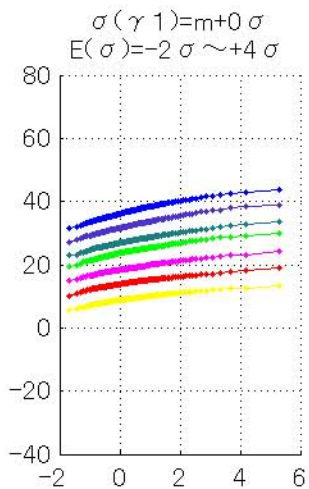
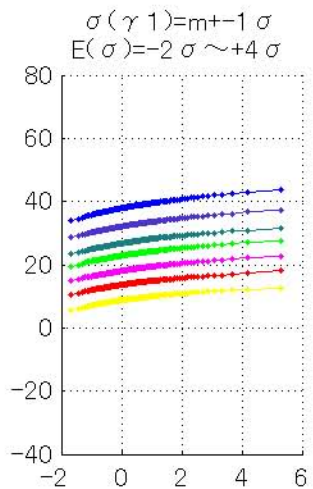
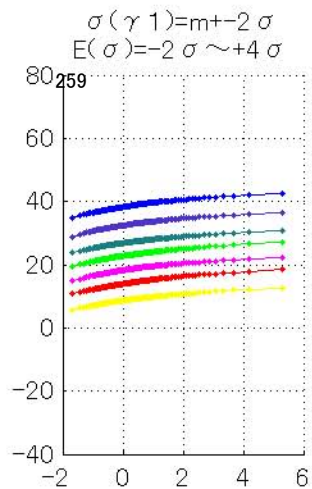


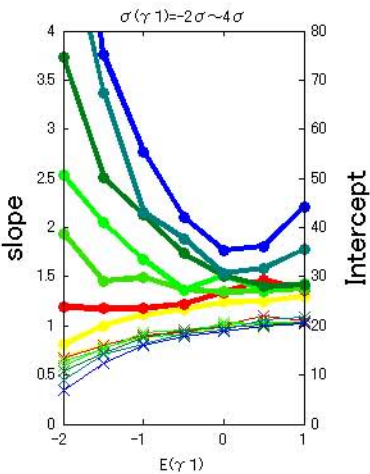
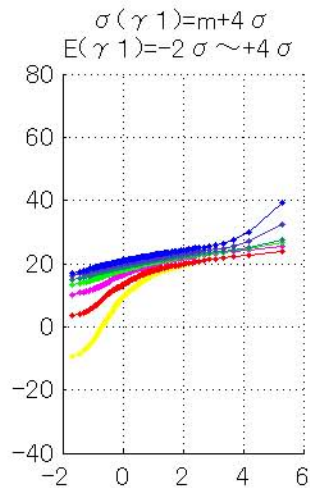
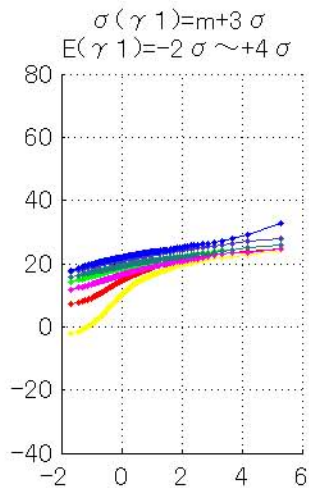
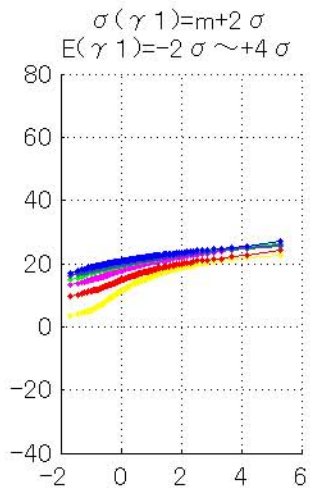
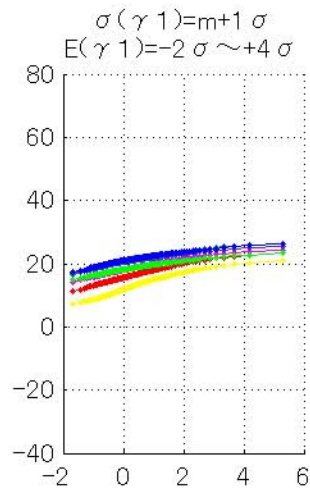
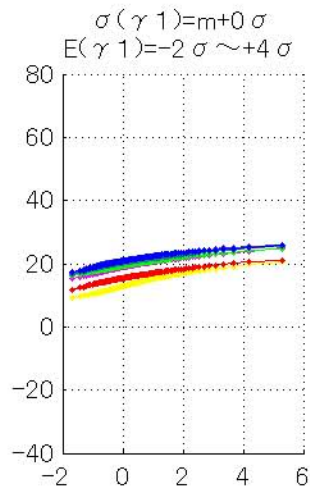
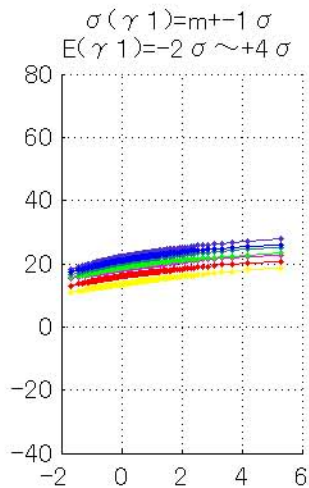
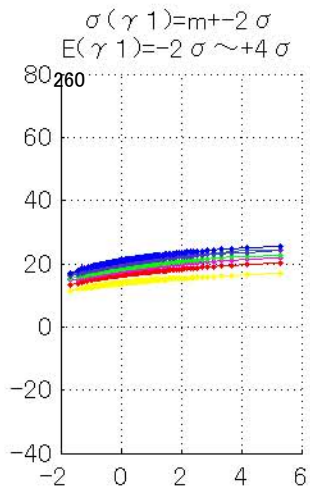


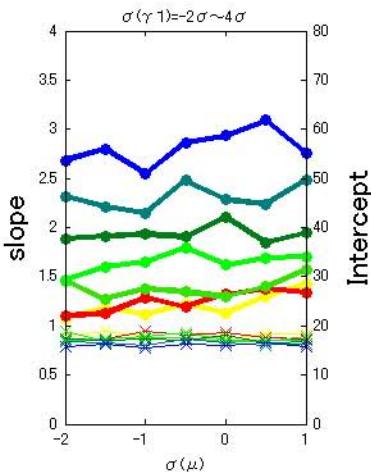
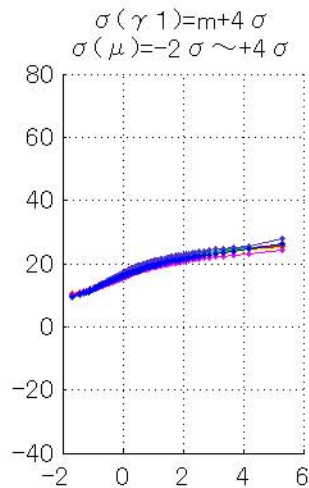
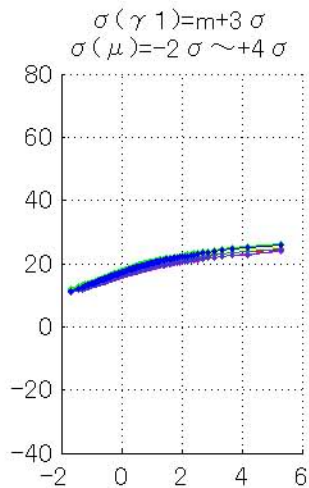
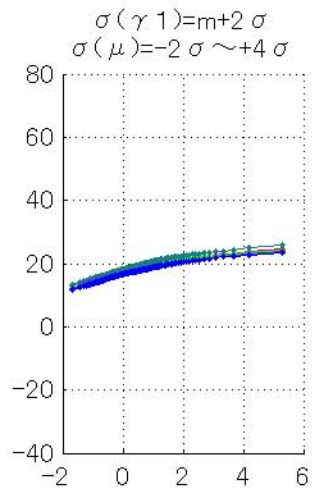
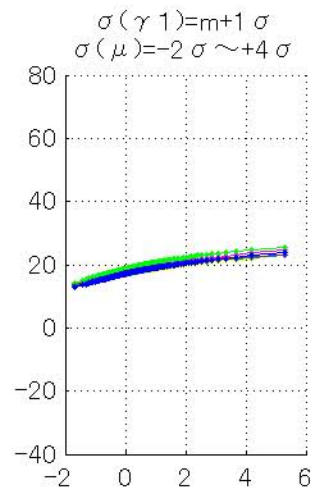
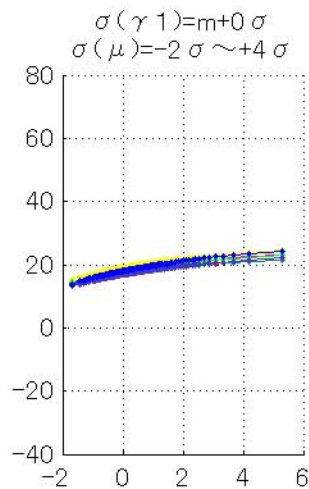
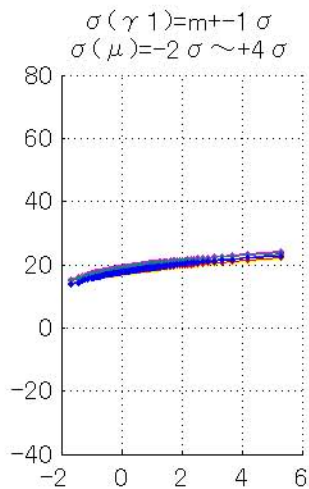
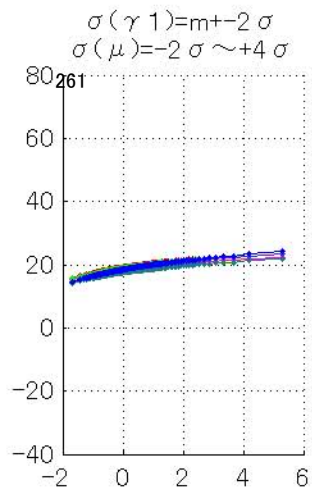


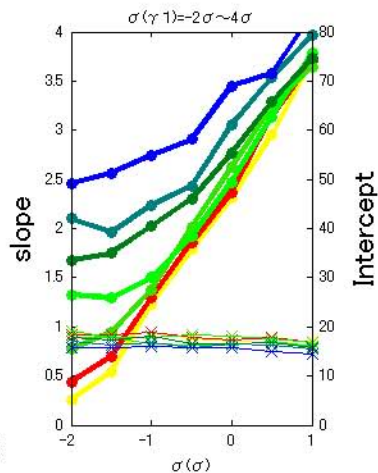
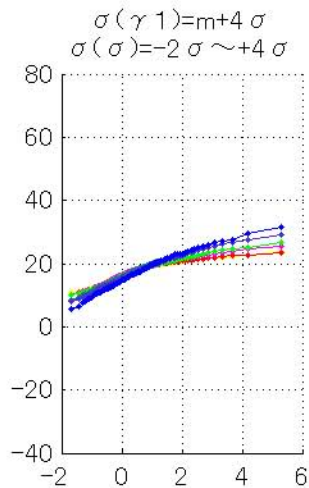
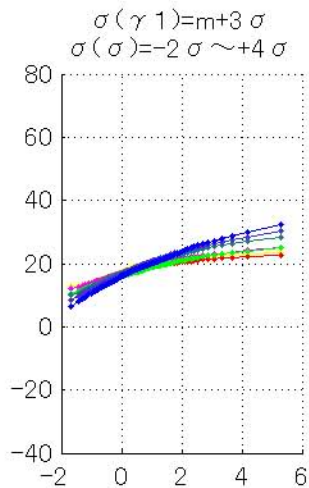
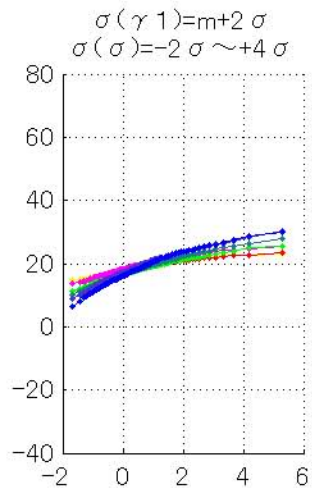
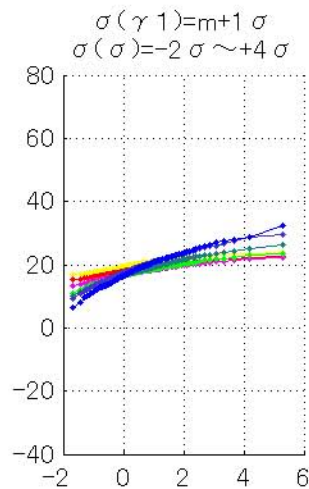
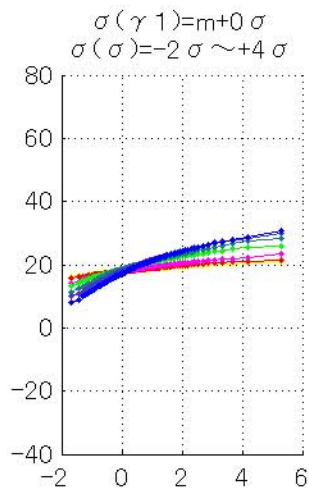
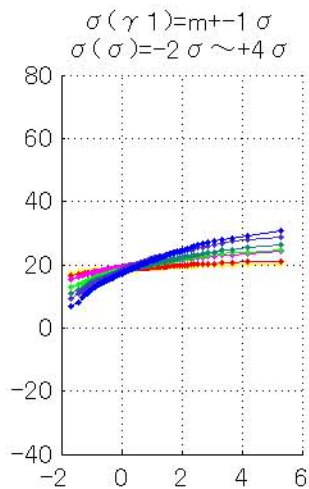
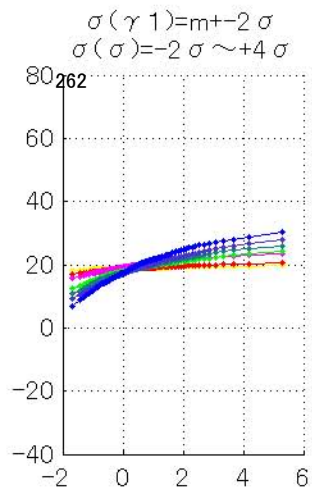




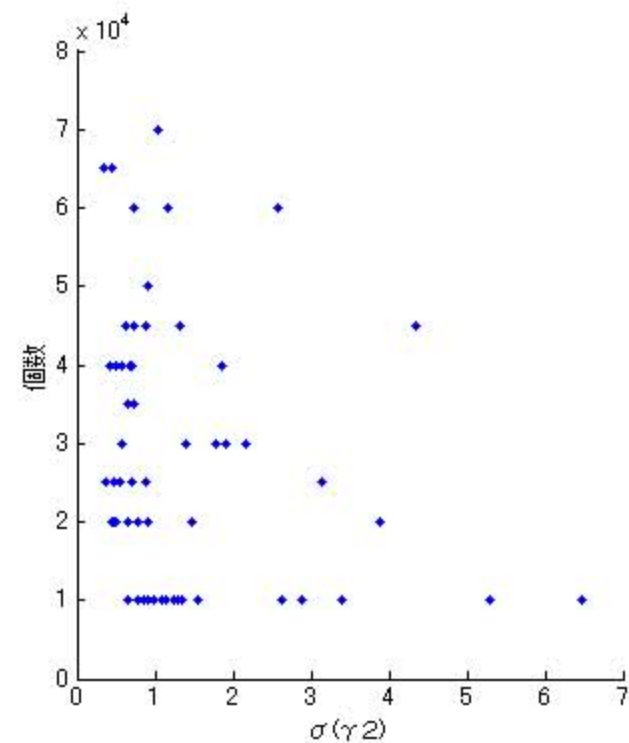
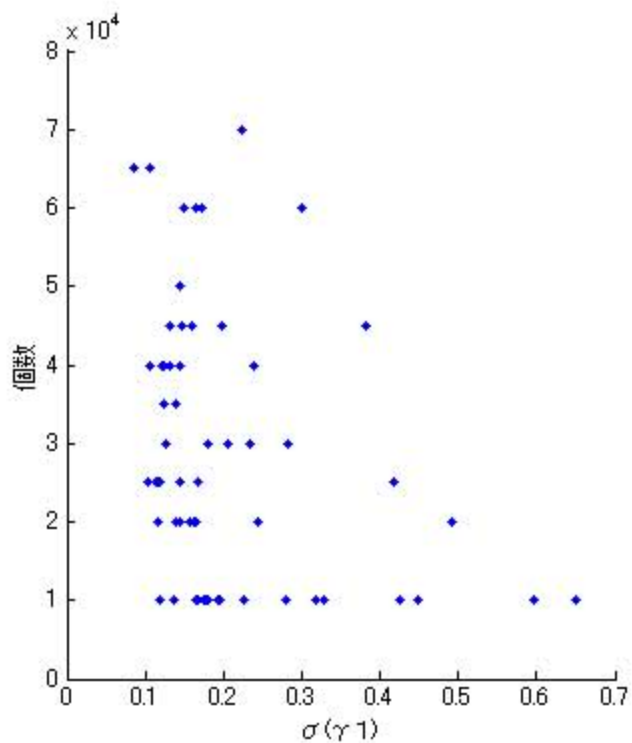
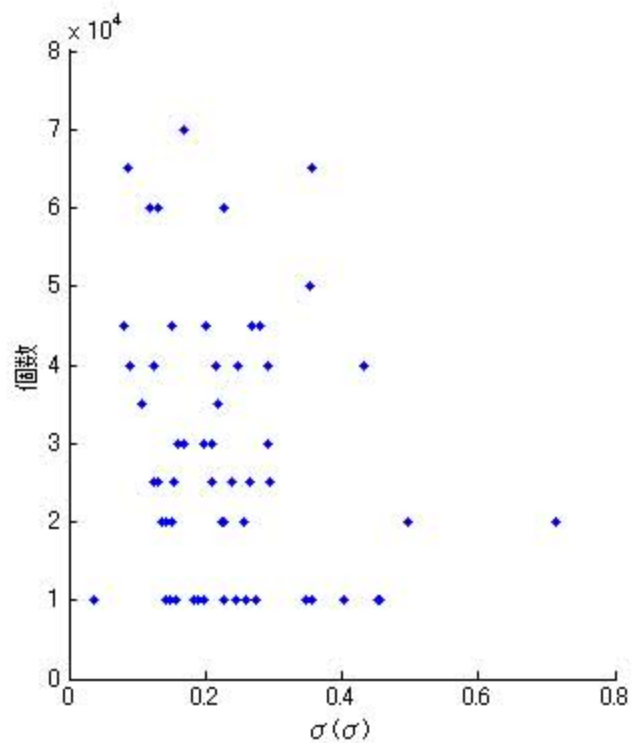
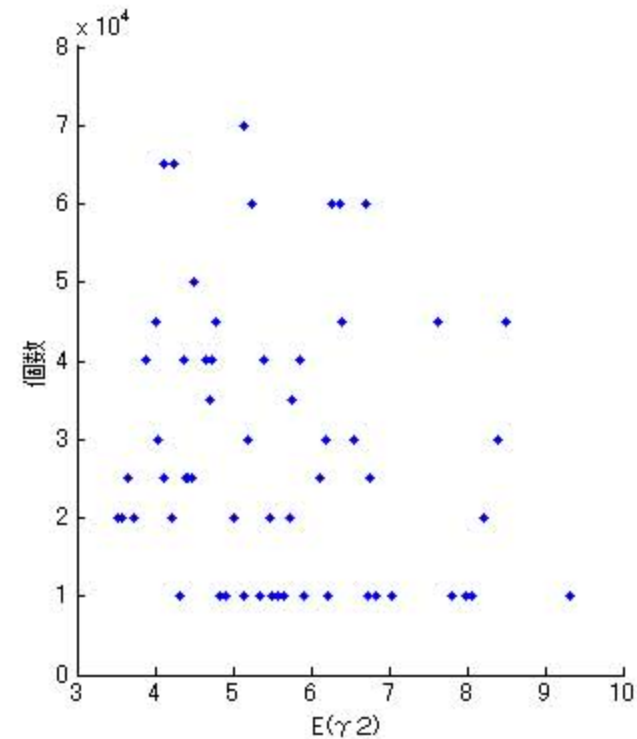
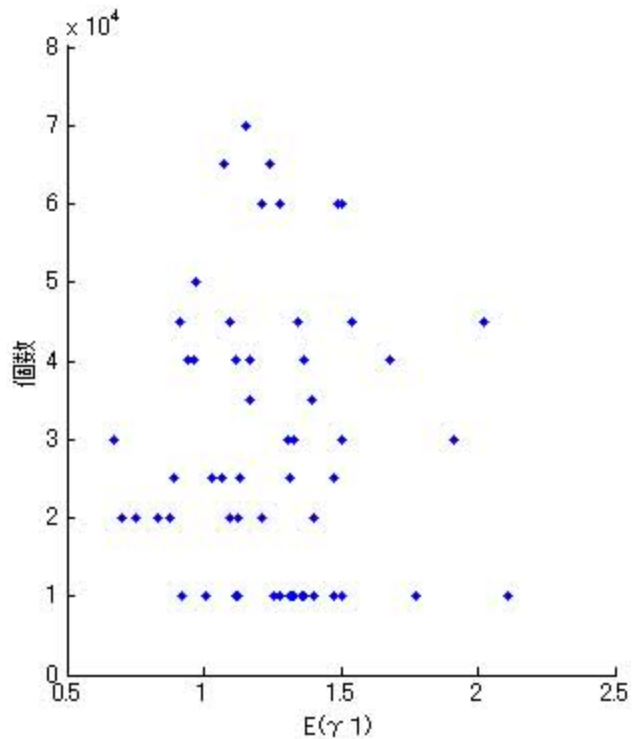
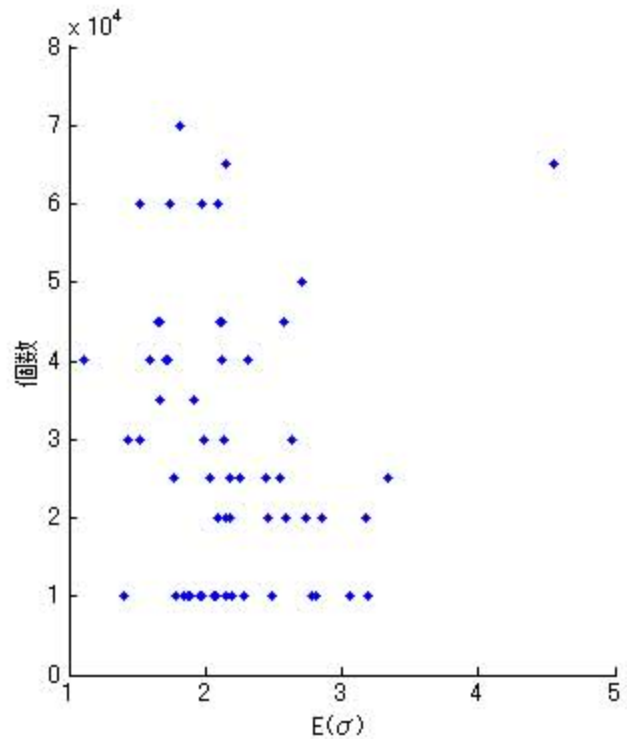




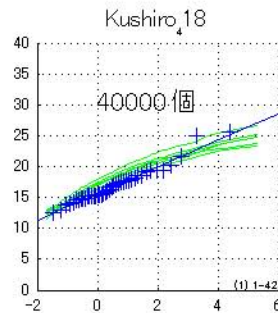
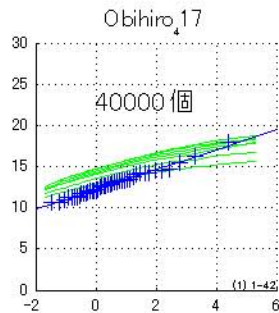
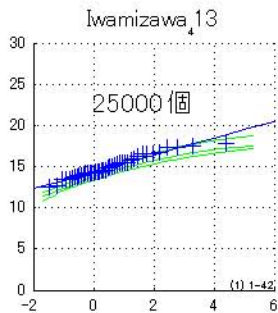
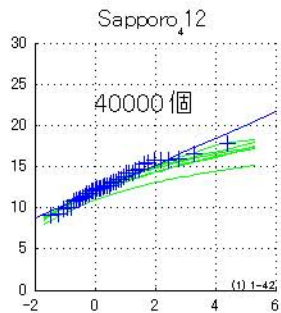
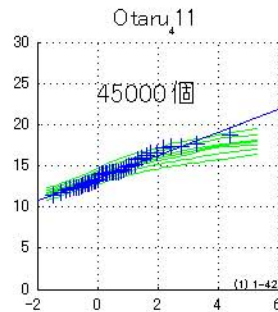
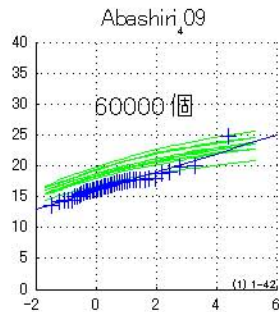
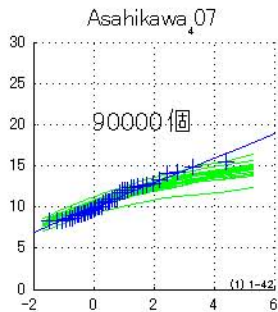
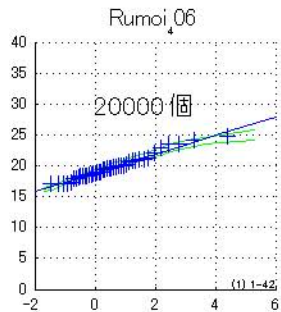
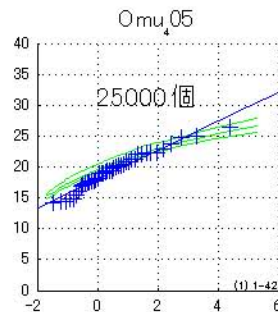
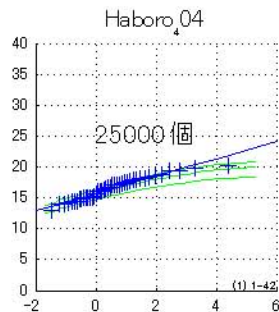
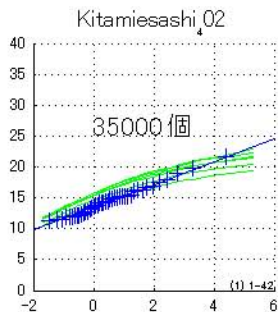
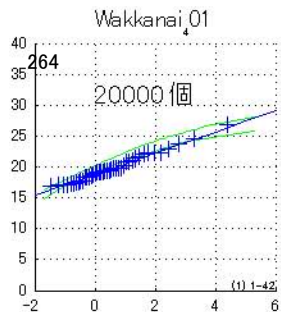


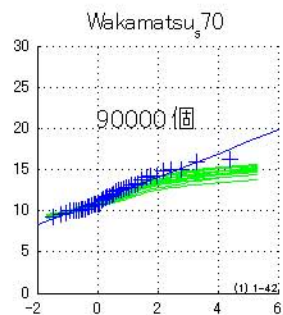
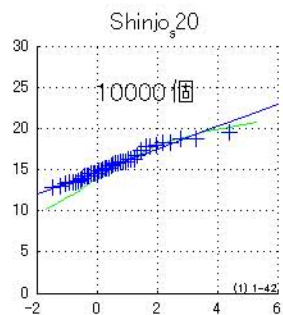
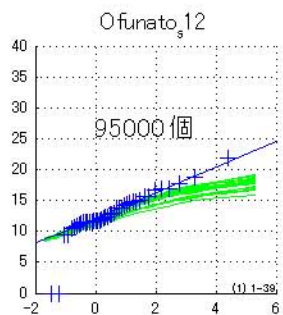
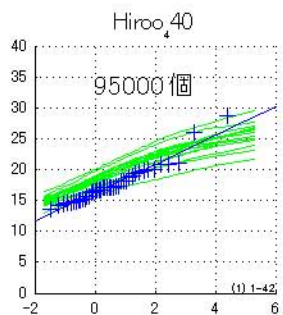
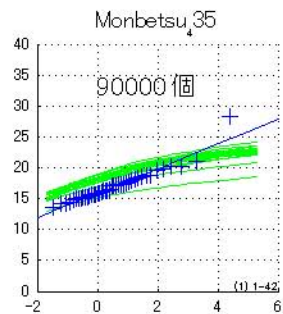
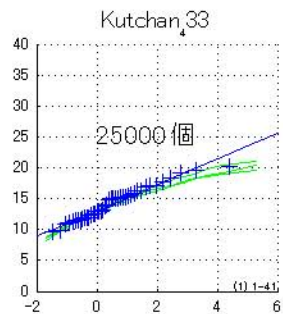
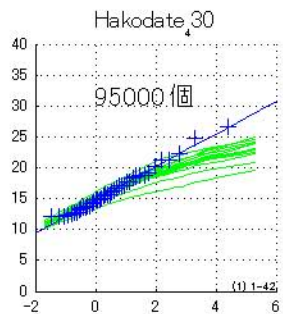
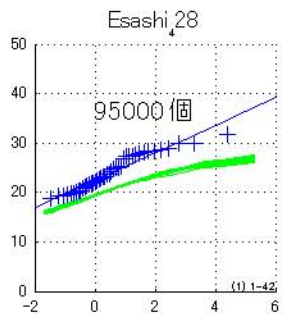
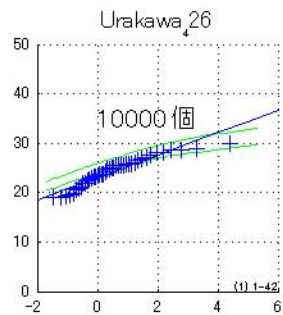
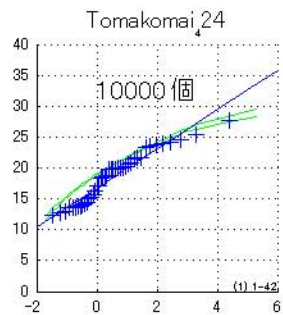
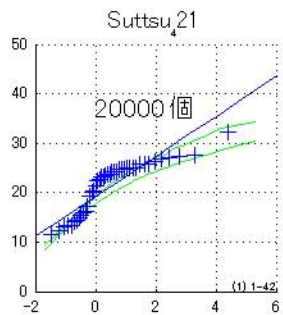
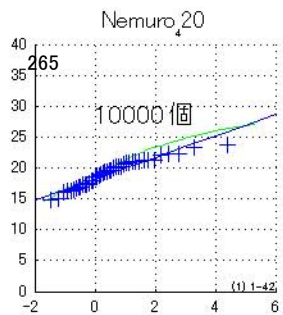


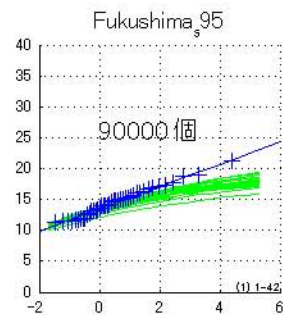
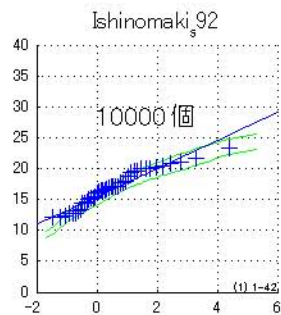
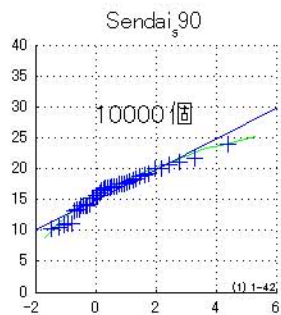
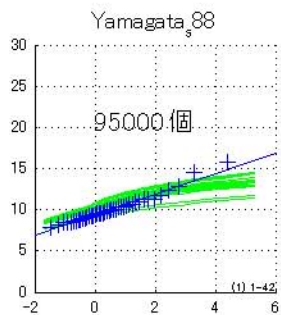
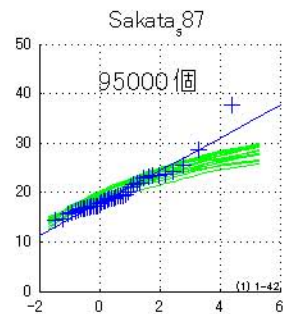
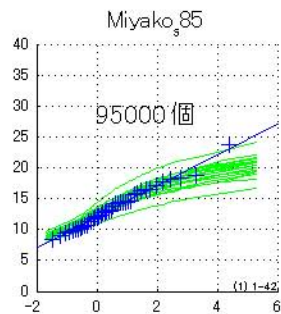
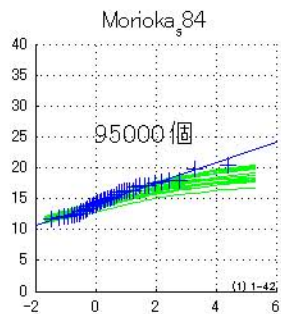
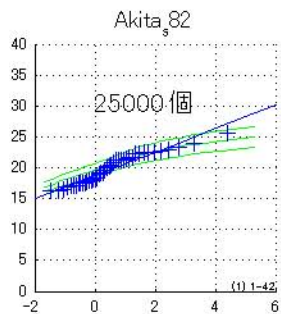
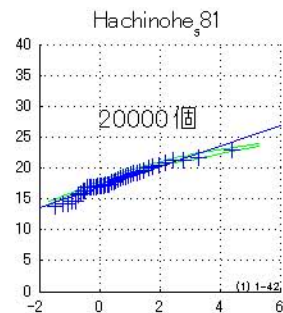
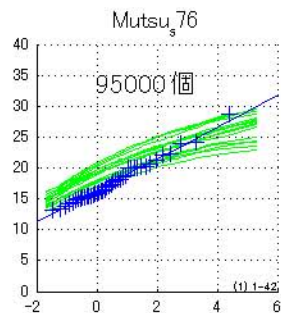
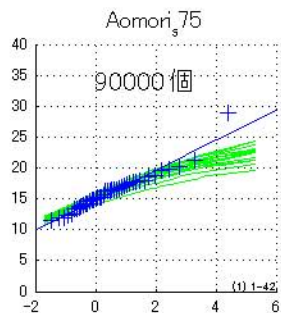
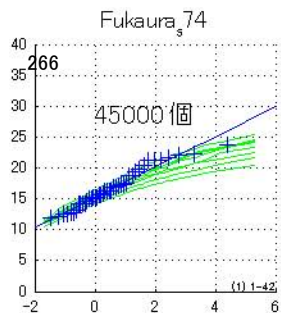
モーメントとシミュレーションに用いる適切な個数の関係

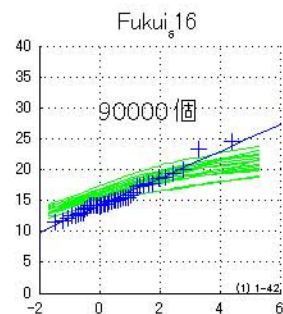
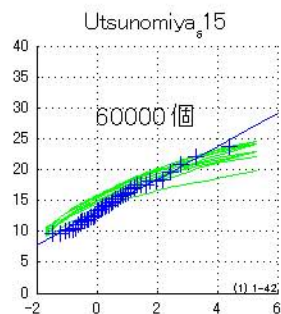
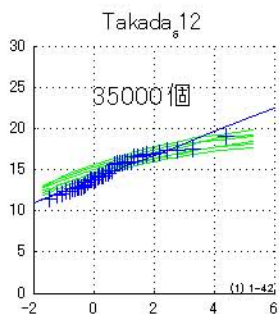
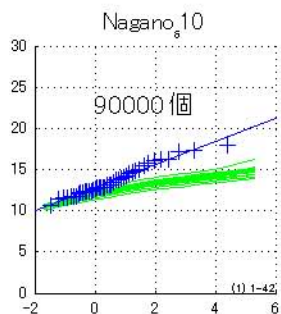
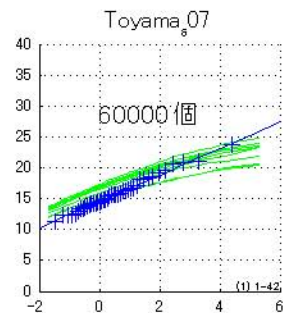
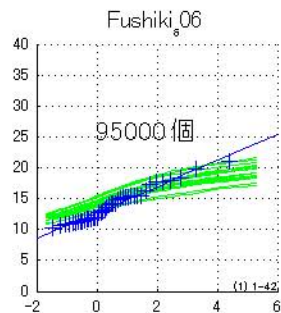
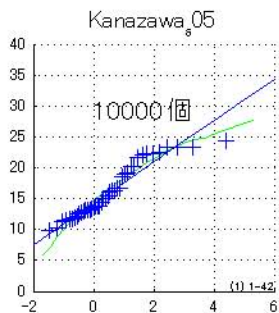
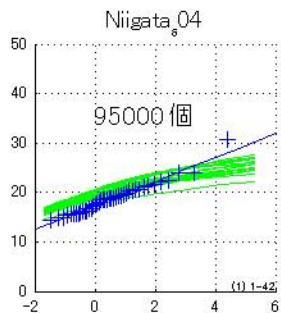
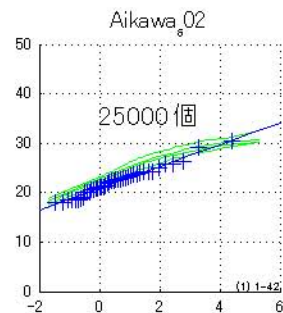
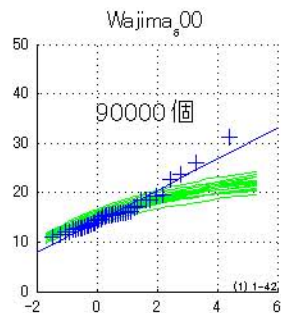
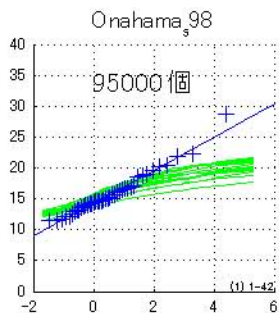
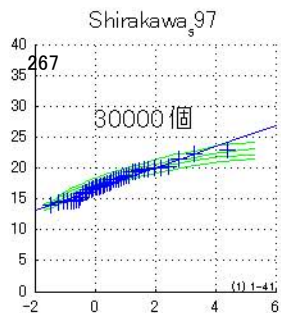


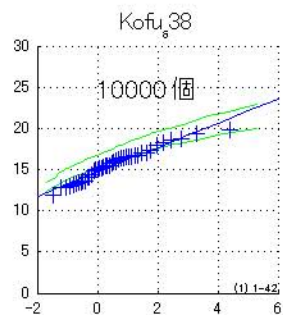
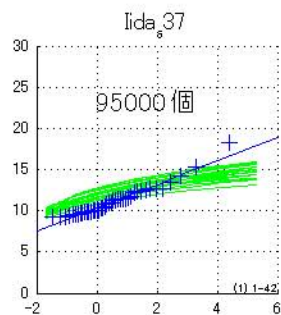
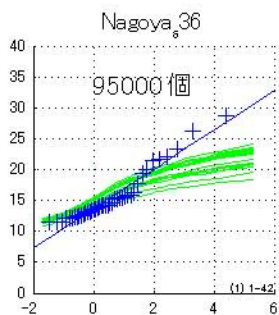
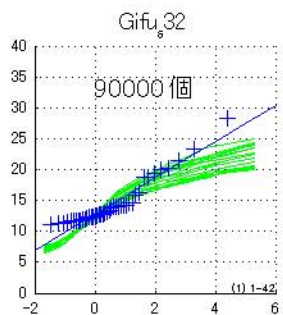
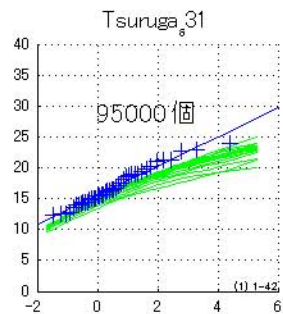
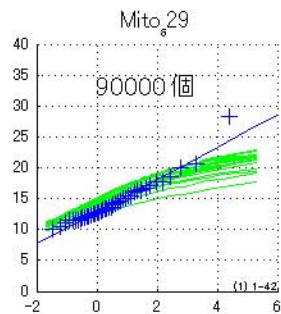
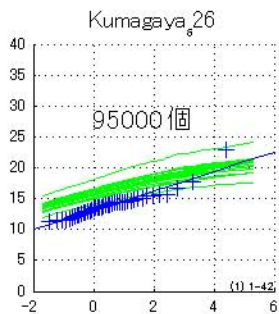
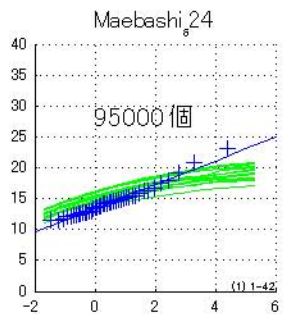
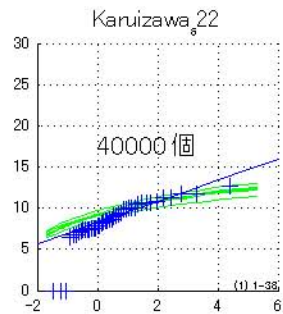
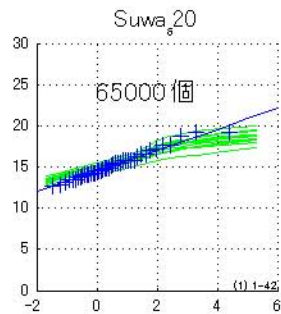
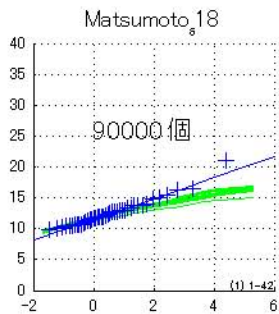
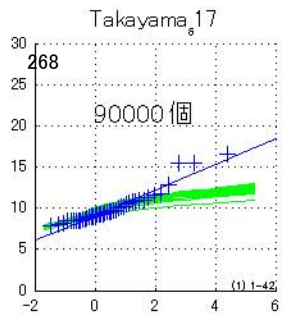


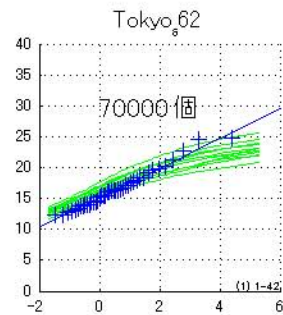
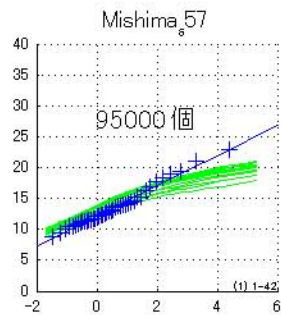
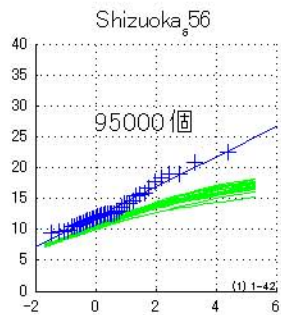
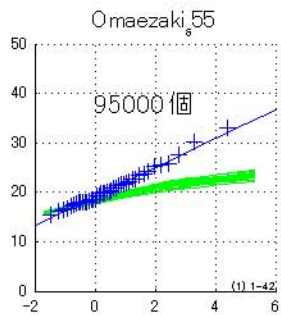
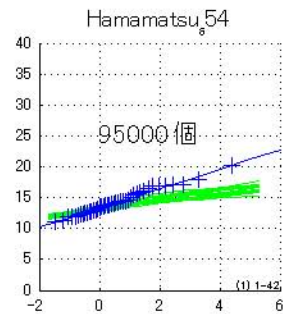
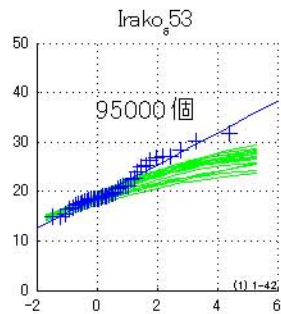
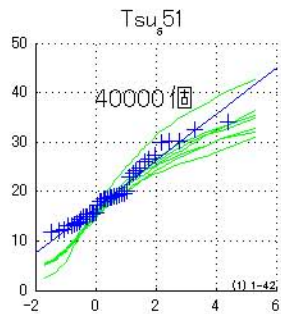
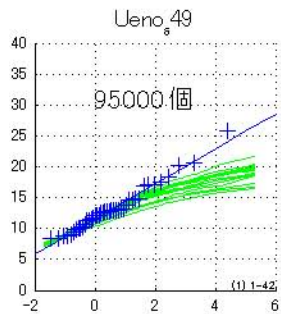
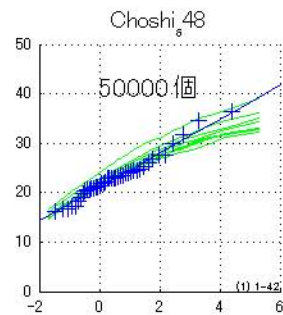
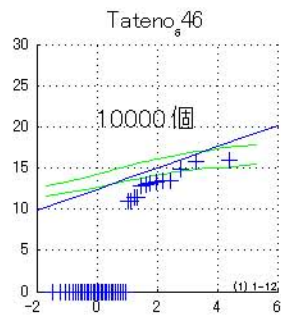
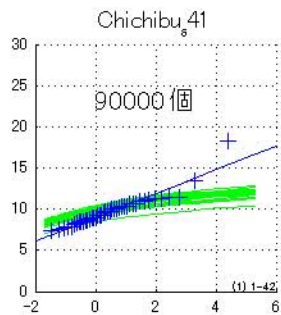
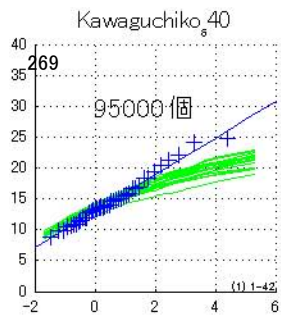


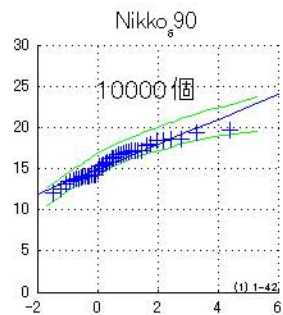
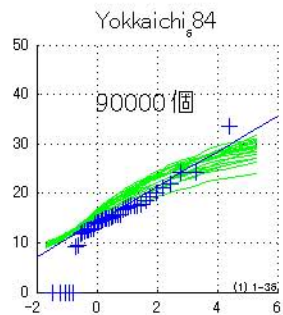
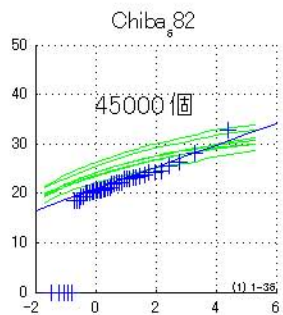
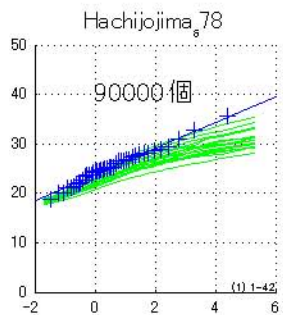
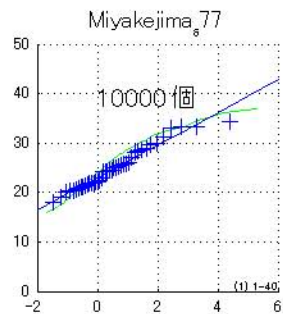
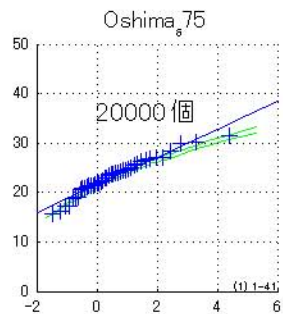
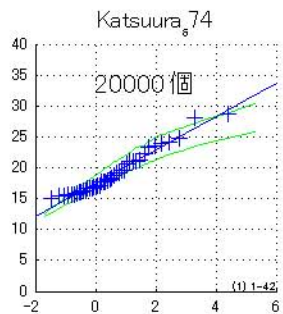
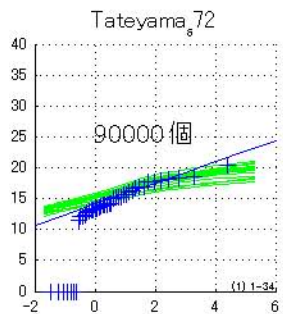
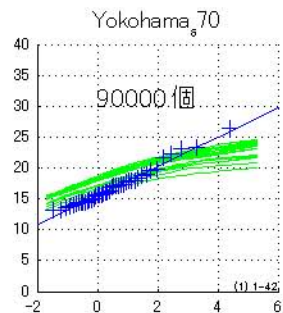
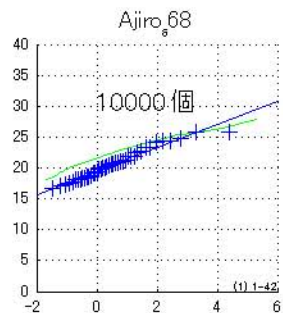
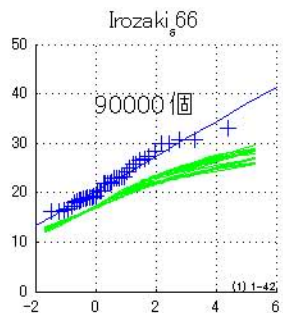
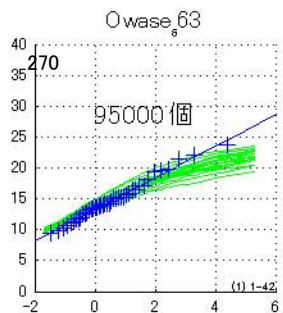


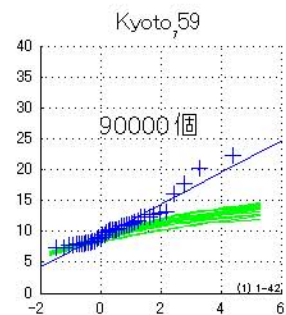
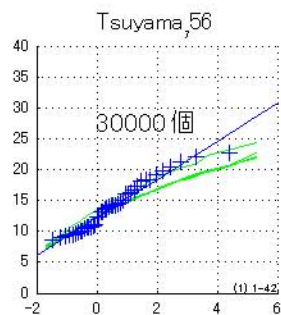
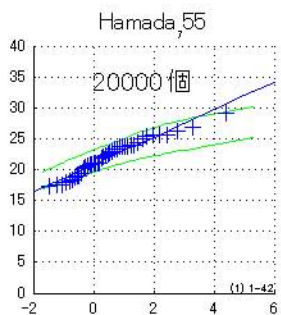
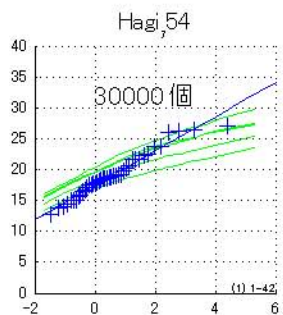
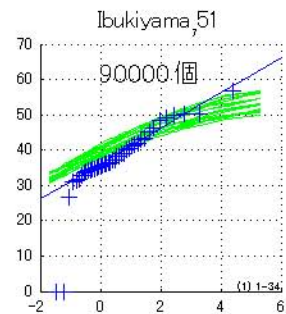
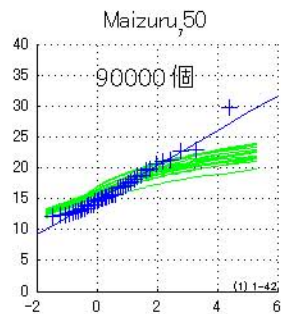
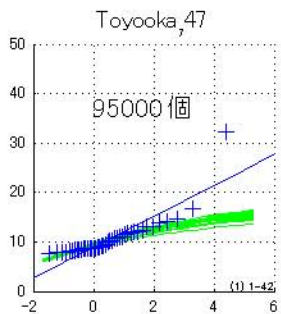
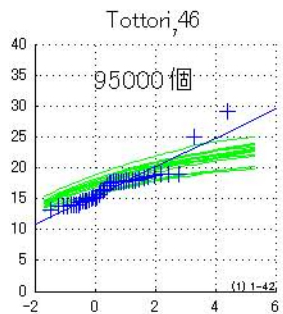
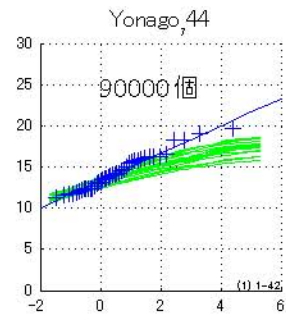
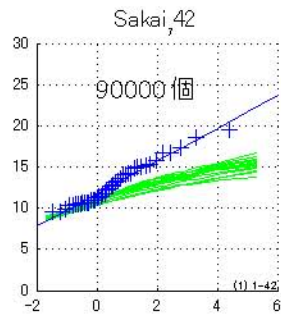
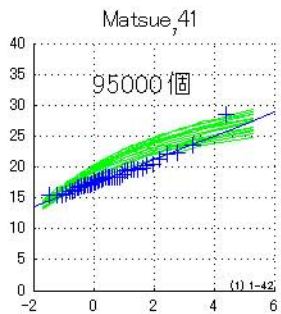
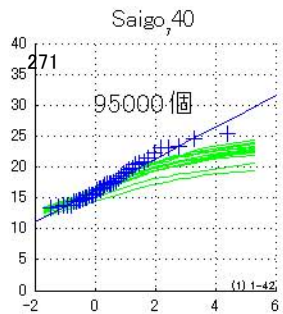




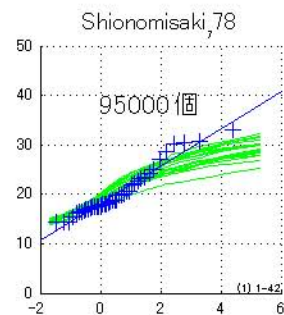
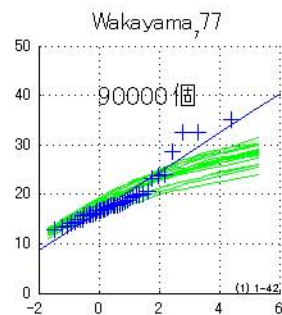
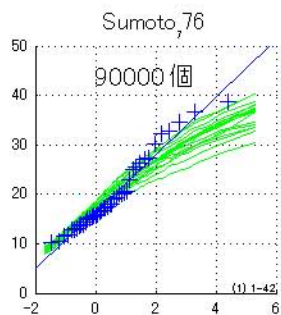
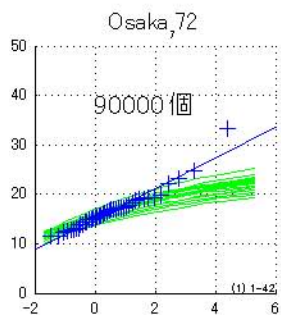
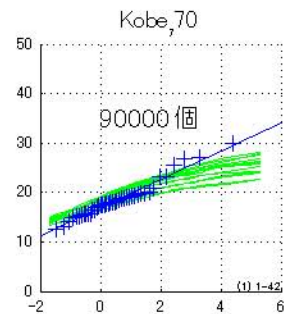
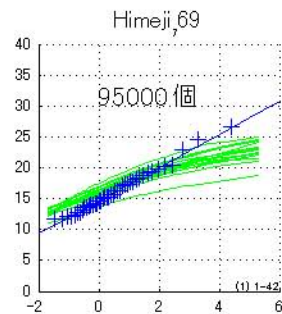
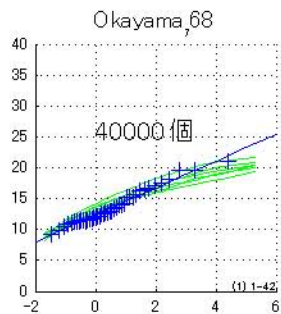
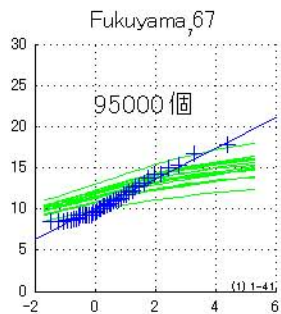
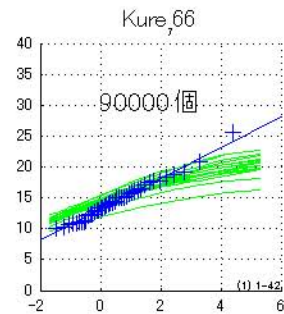
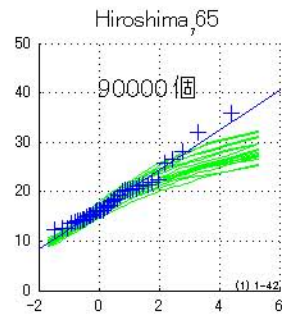
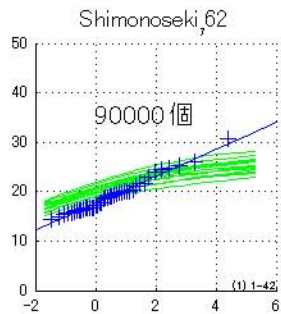
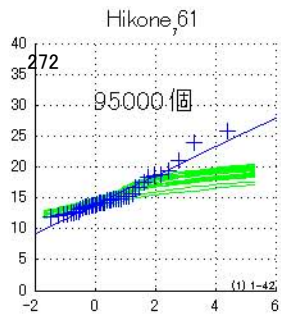


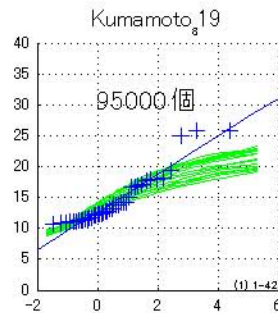
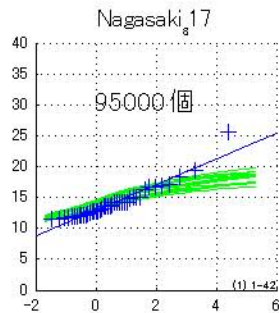
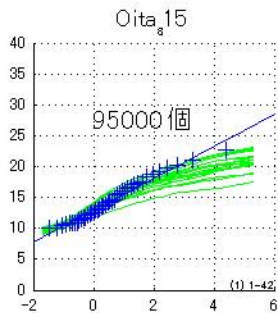
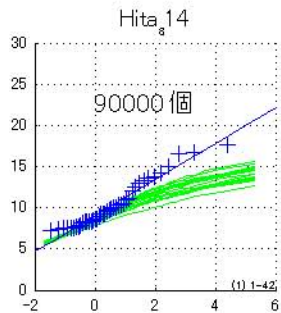
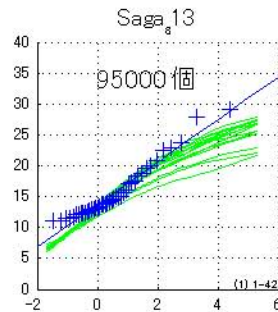
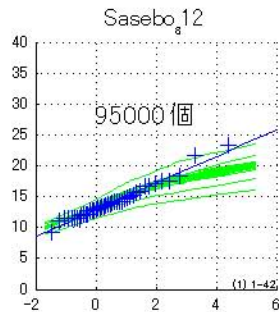
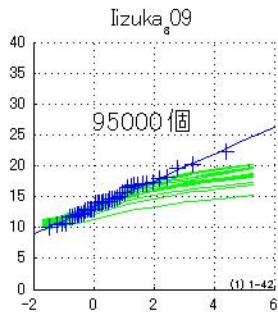
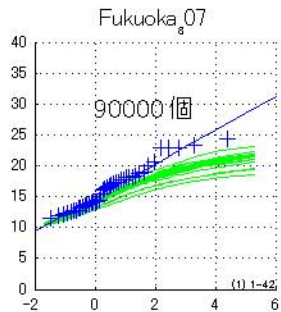
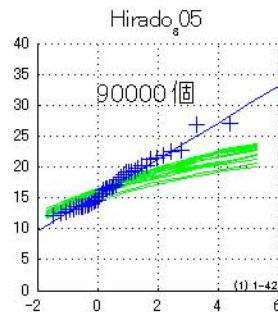
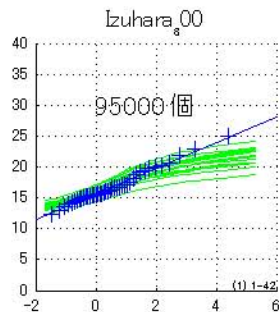
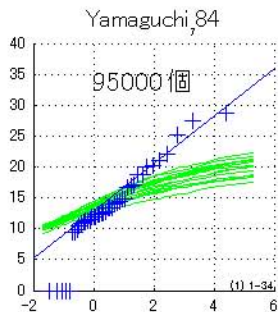
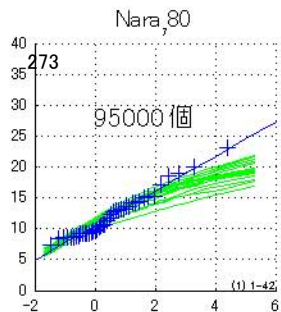


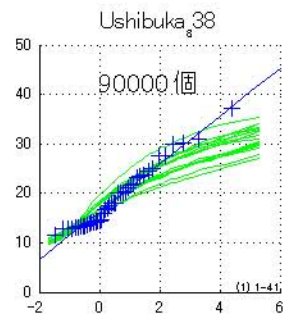
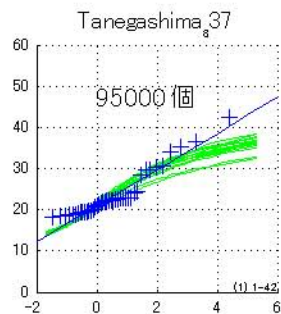
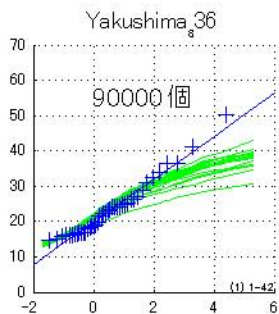
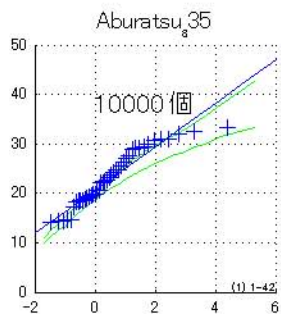
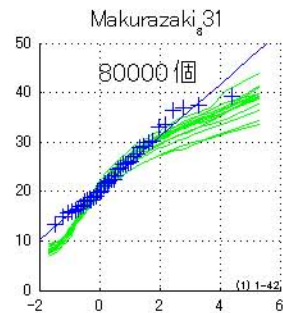
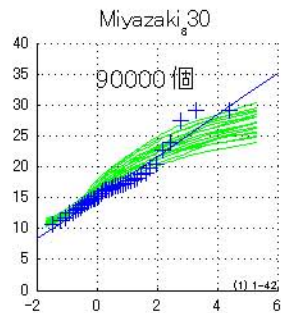
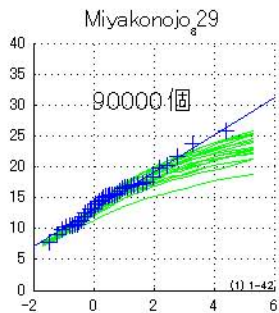
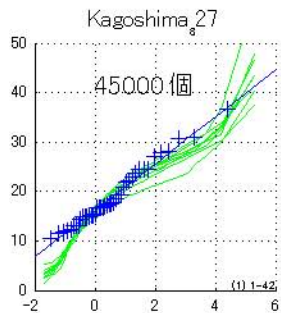
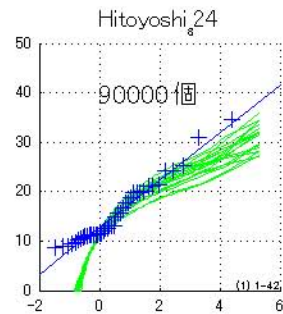
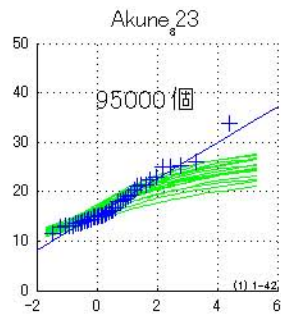
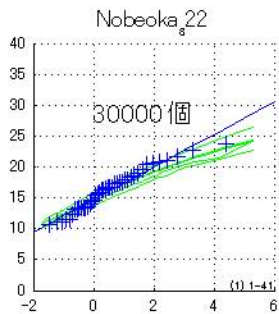
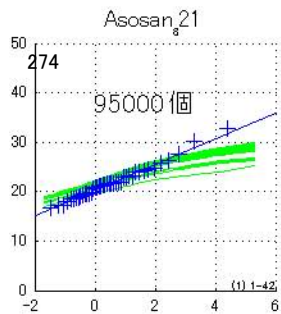


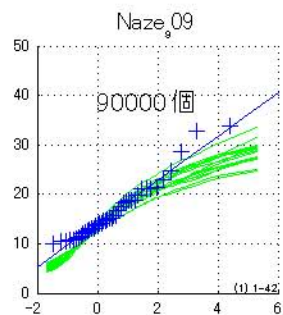
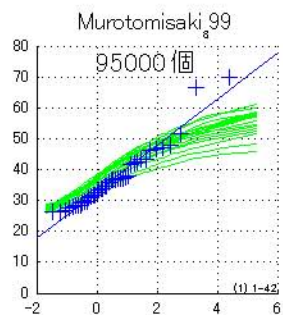
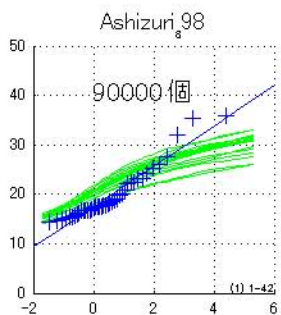
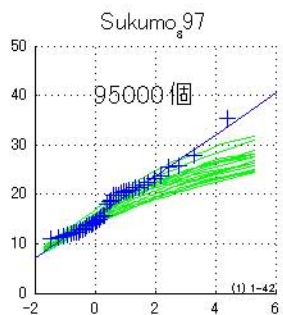
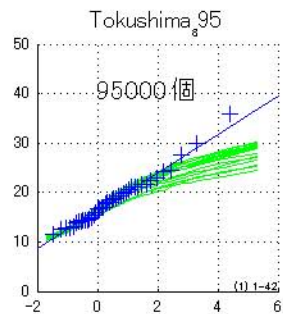
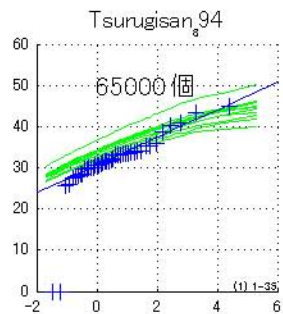
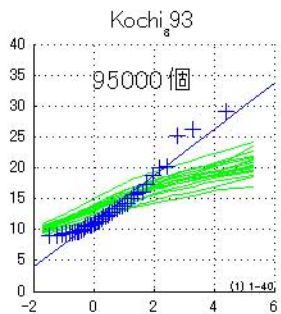
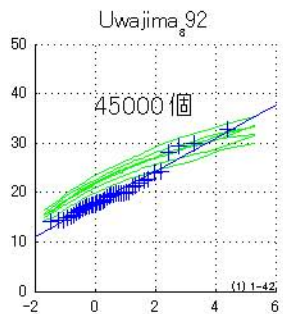
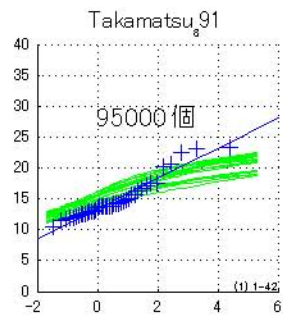
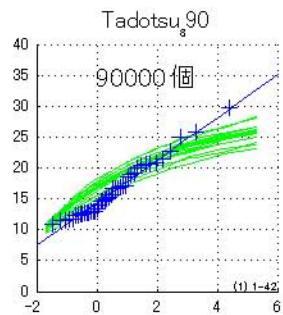
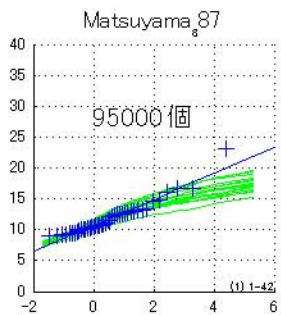
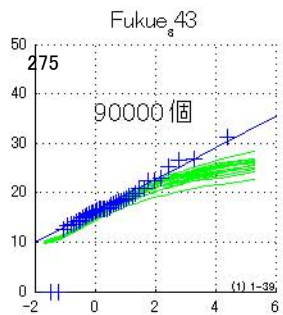


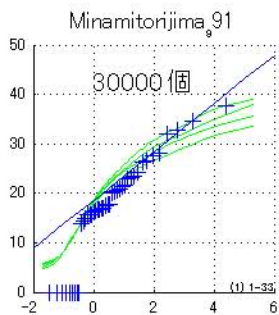
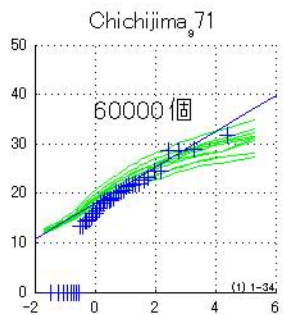
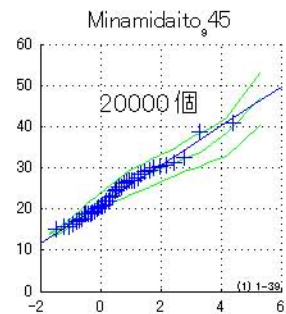
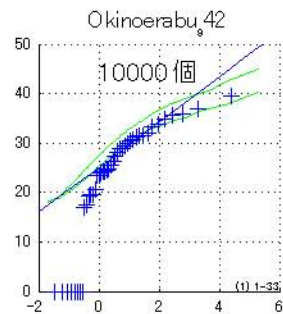
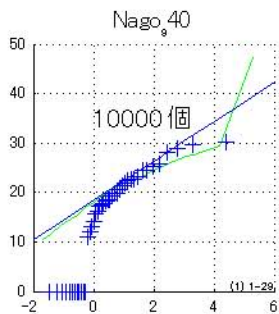
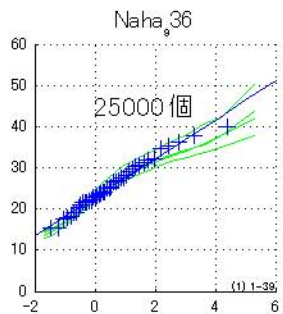
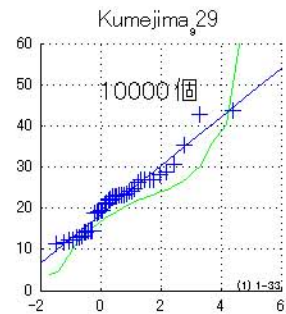
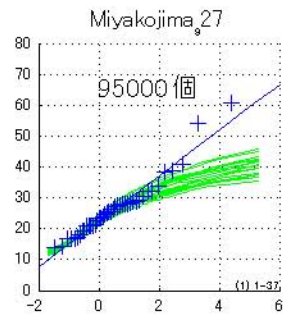
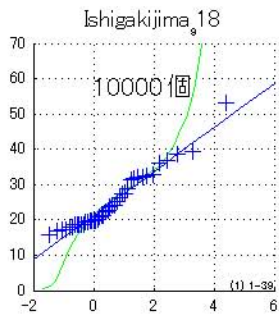
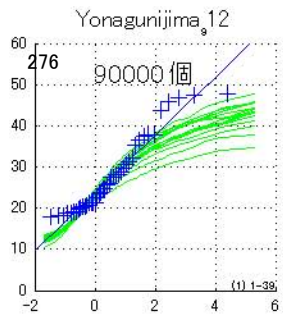




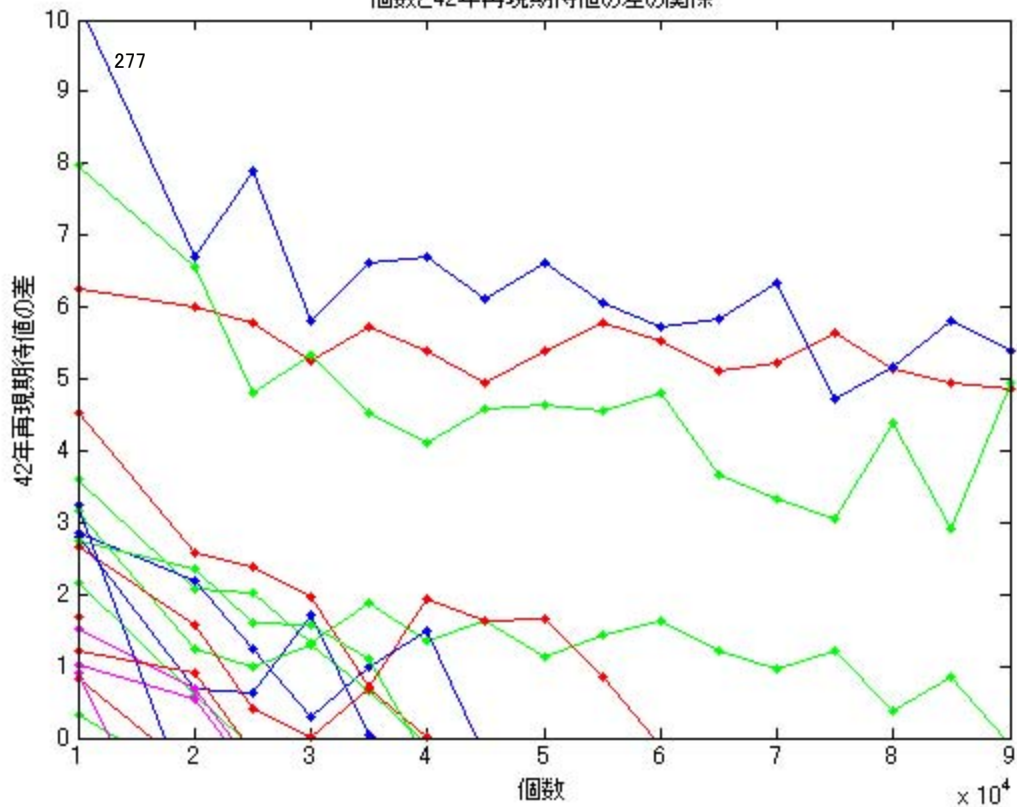








個数と42年再現期待値の差の関係



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