Study on the occurrence of knickzones in the Nameri river in Kamakura area

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1. Background

Nameri river is a bedrock-alluvial river located in Kamakura whose riverbed is primarily composed of coarse pebbly sediments along the whole river (Aramaki and Suzuki, 1962). The section of Nameri river in the scope of 700m -2000m from estuary had been observed to have more outcrop of bedrock and the channel was very close to the piedmont of Kinubari mountain (Figure 1).

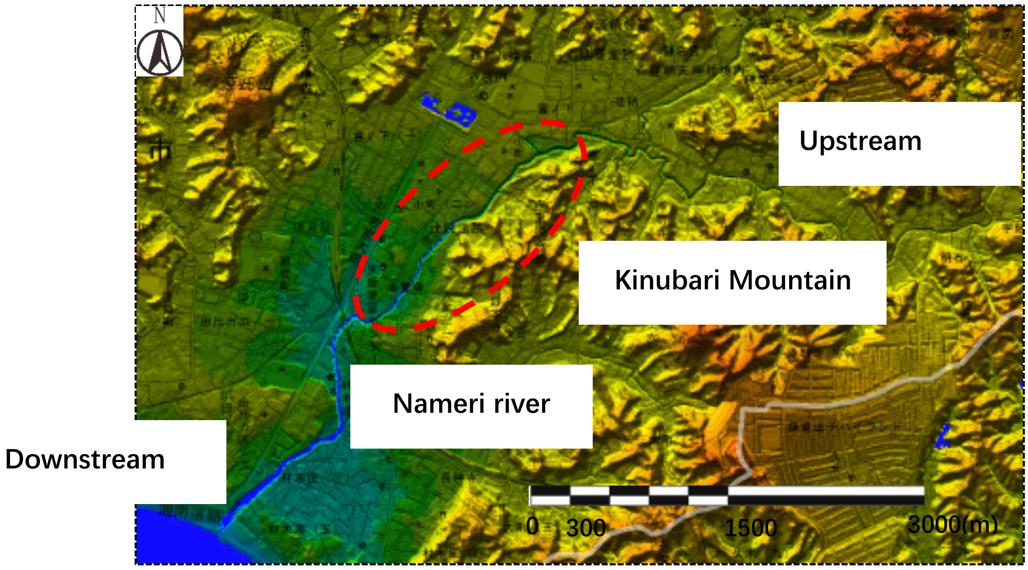

Figure.1 Elevation map of the Nameri river (地理院地図，2015)

2. Objectives of the research

For identifying the possible geological process to cause the phenomenon above, field observation and longitudinal profile were done for checking the characteristics of the river channel, and based on them, knickzones were found. By assuming the knickzones were possibly related to the geological process on Nameri river, the objective is studying the occurrence of knickzones of the Nameri river to analyze the possible geological process happened in the Nameri river.

3. Operations in this research

3.1 longitudinal profile establishment

The main procedure:

① Load DEM into ArcGIS; ②Load topographic map into ArcGIS; ③Determine the representative distance and define river points; ④Determine the river bed elevation along the Nameri river; ⑤Edit river points and assign elevation data; ⑥Edit river points and assign elevation data; ⑦Examine the authenticity of the elevation data; ⑧Establish the longitudinal profile.

The profile:

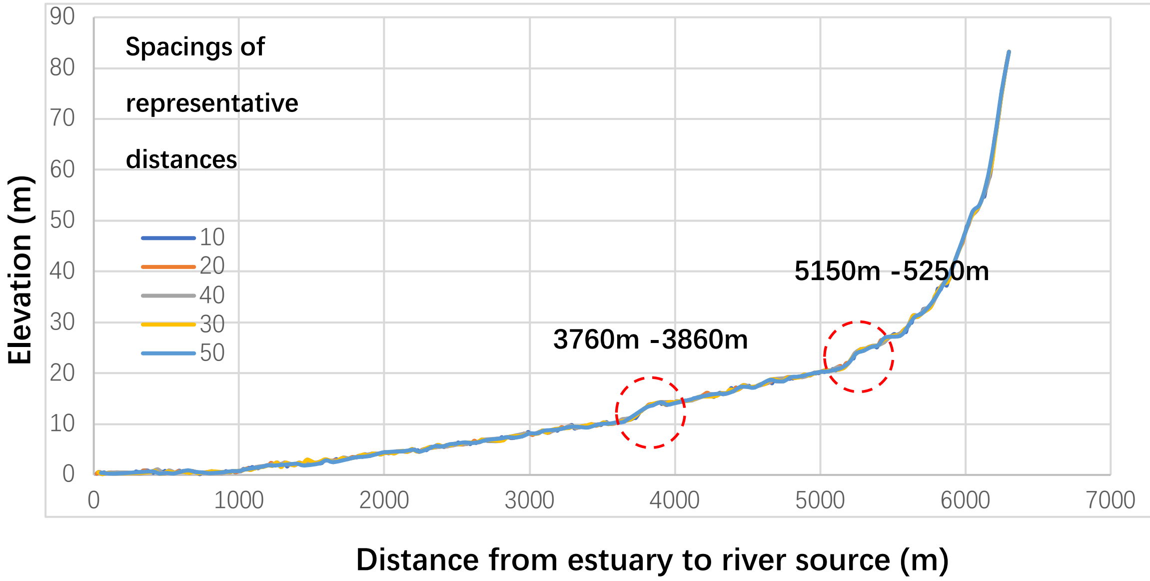

Figure.2 The longitudinal profile of the Nameri river

3.2 Determine the knickzones and knickpoints

In order to determine the knickzones along the river, the local slope-distance profiles were made with different distance spacing (10m, 100m, 200m, 250m and 300m) to compare the position of knickpoints with the longitudinal profile.

3.3 Comparison with 2m DEM with 5m DEM

2m DEM and 5m DEM were all used for comparing the longitudinal profiles with different resolution data. The comparison result shows that 2m DEM is better on the clarity of longitudinal profiles than 5m DEM.

4. Comparison with the Boso area.

4.1 Study in the Boso area

KUMAKI, etc. 2016 had demonstrated that uplift had led to the occurrence of knickzones in the Boso area in Chiba. And Okuno, etc. 2014 had demonstrated had occurred in Kamakura area. So, knickzones in the Boso area were also studied in this research for determining the possibility that knickzones in Nameri river were also caused by uplift.

Longitudinal profiles of fiver rivers (Nukuishi river, Mihara river, Wadamachi river, ChoJa river and Sugai river) were constructed.

Based on the longitudinal profiles, knickzones at the position around 700m and 1700m were respectively occurred. The result can reveal the distribution of knickzones which had been caused by uplift in the Boso area (Figure.3).

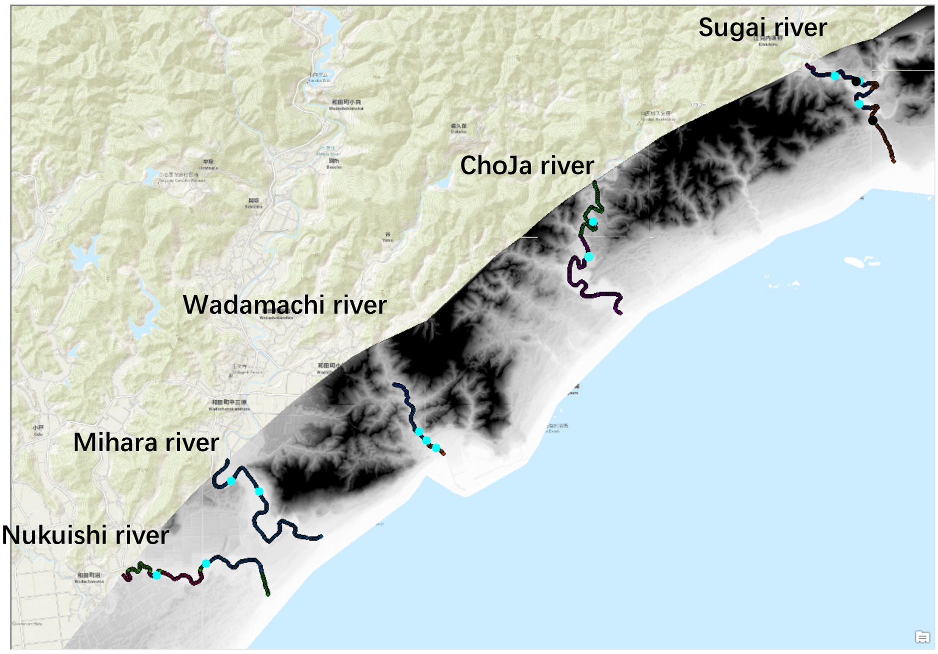

Figure.3 Distribution of knickzones in the Boso area

Also, KUMAKI, etc. 2016, the knickzones occurred at 700m were determined that had been caused through Genroku Kanto Earthquake in 1703, and the knickpoints average receding rate was given.

Based on the information, the age of origin of knickopoints at 1700m in the Boso area were calculated to be 1405. The result which was between Shoo Kanto earthquake (1293) and Meio Kanto earthquake (1495) can possibly reveal the earthquake condition that had not been clarified yet in the Boso area before Genroku Kanto earthquake (1703).

4.2 Compare the knickzones between the Nameri river with rivers in the Boso area

The local slope-distance profiles of the Nameri river and fiver rivers in the Boso area were respectively constructed. The local slope of knickpoints in the two areas were compared as the parameter was assumed to be able to reveal the strength of the geological forces on the occurrence of knickpoints.

The table.1 shows the magnitude of local slope:

River	Nameri river		Nukuishi river		Mihara river		Wadamachi river			ChoJa river		Sugai river	
Knickpoint	1	2	1	2	1	2	1	2	3	1	2	1	2
Local slope (* 10^{-2})	2.2	3	0.7	1.1	0.33	0.45	3	5	8	0.8	1.7	1.2	2.7

Tabel.1 Comparison of local slope

The result shows that the local slope of knickpoint the Nameri river are almost larger than Nukuishi river, Mihara river, ChoJa river and Sugai river. The result possibly reveals the stronger geological force in Nameri river compared with the uplift in Genroku Kanto Earthquake in 1703 in Boso area.

5. Conclusion

1) The distribution of knickzones caused by uplift in the Boso area in Genroku Kanto Earthquake 1703 was determined.
2) The megathrust earthquake condition in the Boso area was determined, one was a megathrust earthquake in around 1400, another was the Genroku Kanto Earthquake in 1703.
3) The local slope comparison result shows that a stronger geological force was possibly happened in the Nameri river to cause the knickpoints. Based on the result and the background earthquake information, the possible geological process was assumed as the uplift in the Nameri river.

6. Reference

Aramaki, M., Suzuki, T., 1962. The prevailing direction and mechanics of beach drift inferred from variation series of beach sediments along the Sagami Bay coast, Japan. Geographical Review of Japan 35, 17–34.

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