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4. The Chilean Tsunami of May 24, 1960 in the Vicinity of Chōshi.

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1. Introduction

The Chilean Tsunami of May 24, 1960 was the first of the disastrous ones originating in South America. One of the most striking features of this tsunami was the huge waves which invaded the roots of capes.

Iioka in the vicinity of Inubōzaki (Kanto district of Japan) was such a place where a large inundation height was observed in the case of the Chilean Tsunami of 1960.

One possible explanation for this phenomenon is the diffraction of wave along the coastline, which is developed in subsequent sections.

2. Theory and Discussions

Referring to Fig. 1, the coastline $\widehat{AB}$ may be replaced by the plate $\overline{AC}$ with 40 Km ($=2h$) so long as the diffraction of the waves along the coastline $\overline{AD}$ is considered.

The theory of the diffraction of the waves around the plate was derived previously by the present author[1].

Using the same notations and definitions that were used in Paper (I), we have,

$$\zeta=\zeta_1+\zeta_2\,, \tag{1}$$

$$\zeta_1=2e^{-iwt}\zeta_0\cdot\sum_{n=0}^{\infty}\left[\frac{A_0^{(2n)}ce_{2n}(\eta)ce_{2n}(\theta)}{ce_{2n}\left(\frac{1}{2}\pi,q\right)}\right.$$

$$\left.-\frac{ikA_1^{(2n+1)}ce_{2n+1}(\eta)ce_{2n+1}(\theta)}{ce'_{2n+1}\left(\frac{1}{2}\pi,q\right)}\right], \tag{2}$$

1) T. Momoi, *Bull. Earthq. Res. Inst.*, **41** (1963) 35.
In the following discussions we refer to this paper as Paper (I).

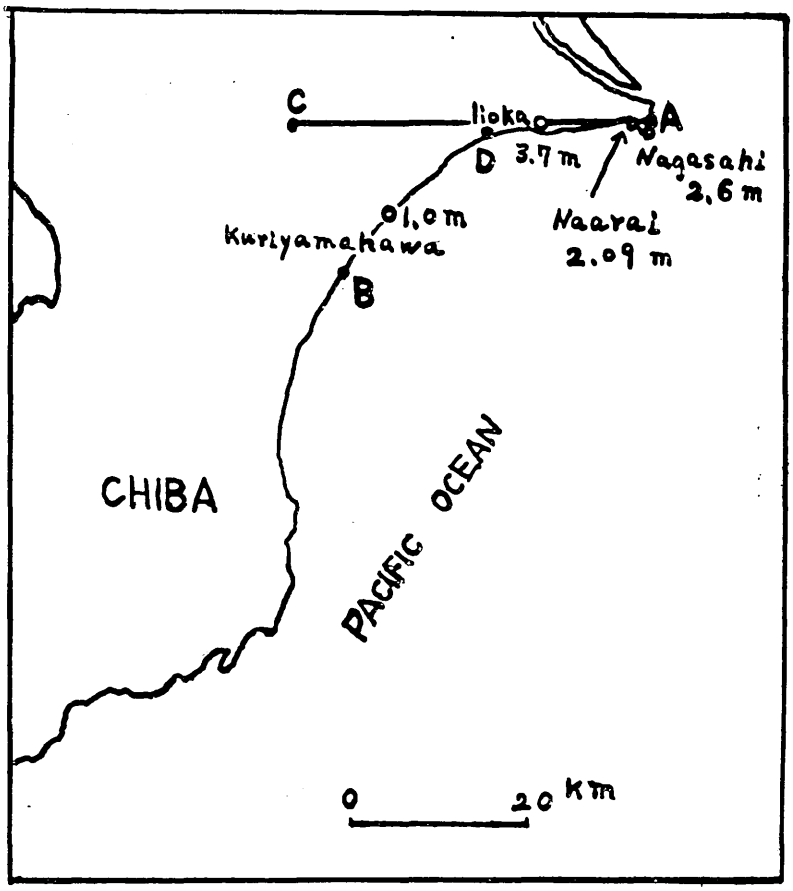

Fig. 1.

$$\zeta_2 = 2e^{-iwt}\zeta_0 \cdot \sum_{n=0}^{\infty}\left[\frac{B_1^{(2n+1)}Gey_{2n+1}(o)se_{2n+1}(\gamma)se_{2n+1}(\theta)}{Ne_{2n+1}^{(1)\prime}(o)se_{2n+1}\left(\frac{1}{2}\pi, q\right)}\right.$$

$$\left. - \frac{ikB_2^{(2n+2)}Gey_{2n+2}(o)se_{2n+2}(\gamma)se_{2n+2}(\theta)}{Ne_{2n+2}^{(1)\prime}(o)se'_{2n+2}\left(\frac{1}{2}\pi, q\right)}\right]. \qquad (3)$$

The refraction diagram of waves (Fig. 2) shows that the waves of the Chilean Tsunami of 1960 approximately impinged upon the coastline AD at an angle of $\theta = 130°$. For calculation of the diffraction of waves along the plate AC, the depth of the sea (H) is taken as about 40 m (Fig. 2), the period of the Chilean Tsunami (T) about 50 minutes[2] and the

2) *Report on the Chilean Tsunami of May 24, 1960, As Observed Along the Coast of Japan*, 310.

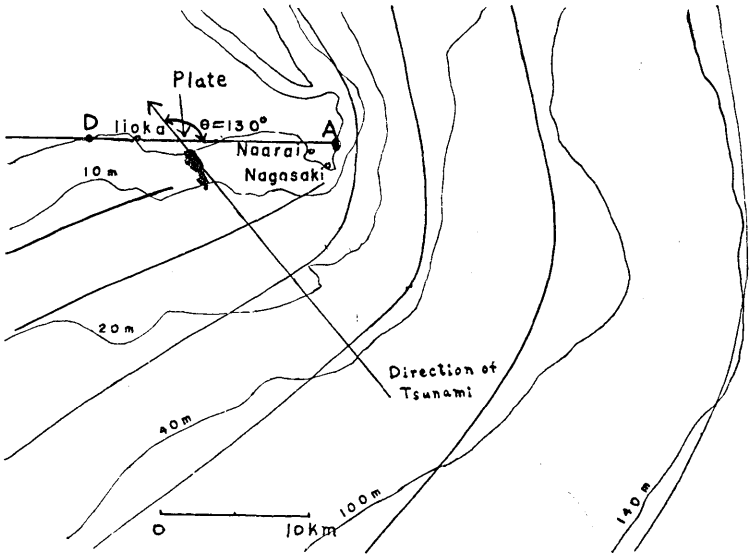

Fig. 2.

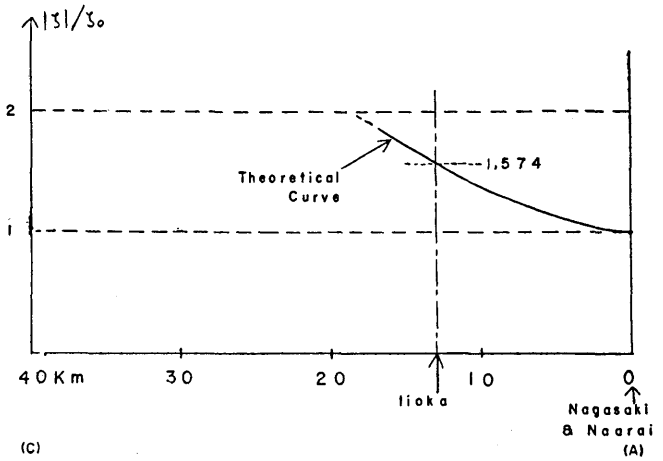

Fig. 3.

acceleration of gravity (g) 9.8 m/s^2.

By use of the values stated above the value $q(=(\pi h/\sqrt{gH}\cdot T)^2)$ contained in the Mathieu and the modified Mathieu functions —$ce_{2n}(Z, q)$, $ce_{2n+1}(Z,q)$, $se_{2n+1}(Z, q)$, $se_{2n+2}(Z, q)$, $Gey_{2n+1}(Z, q)$, $Gey_{2n+2}(Z, q)$, $Ne^{(1)}_{2n+1}(Z, q)$, and $Ne_{2n+2}(Z, q)$— becomes 1. The values of q and θ —1 and 130°— in the present case are the same as those in the case of Paper (I). Hence we

have used the graph obtained in the paper (I) which is shown as the "theoretical curve" in Fig. 3. As the value at the point A the average of the wave heights at Naarai (2.09 m) and Nagasaki (2.6 m)—2.35 m— is used[3]. Taking the tsunami height at A or 2.35 m as a unit, the observed value at Iioka on the occasion of the Chilean Tsunami —3.7 m— is reduced to 3.7/2.35=1.574, which is plotted in Fig. 3. The conformity of the theoretical curve and the wave height observed on the occasion of the Chilean Tsunami of 1960 suggests that the extraordinarily huge wave at the root of Inubōzaki is due to the diffraction of waves along the coast.

3. Acknowledgment

The author is indebted to Professor R. Takahasi and Assistant Professor K. Kajiura of this Institute for their helpful discussions.

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4. 1960年5月24日の銚子近傍におけるチリ津波について

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津波が岬を襲うと，岬の斜めの海岸に沿うて，波の回折がおこる．この回折波と直接に外海から岬の根元の部分に達した波とが干渉して，岬の先端より少し根元に寄つた部分で波高が大になることが予想とされる．この現象は千葉県の犬吠岬近傍において，1960年5月24日のチリ津波の際に見られている．筆者はこの現象を plate model を用いて理論的に取り扱い，理論と実際現象とが良く一致するのを見た．

3) *Report on the Chilean Tsunami of May 24, 1960, As Observed Along the Coast of Japan*, 193.