

## Rupture area of the 1894 Nemuro-oki earthquake is larger than that of the 1973 Nemuro-oki earthquake

# Yuichiro Tanioka[1]

[1] Hokkaido U

### 1. Introduction

A future great Nemuro-oki earthquake has been expected by the Headquarters for Earthquake Research Promotion in Japan with the high probability of the occurrence during 30 years from October 1, 2003, 20-30%. It is important to discuss the source process of the future Nemuro-oki earthquake.

Previously, the great earthquakes occurred off Nemuro in 1973 and 1894. The source process of the 1973 Nemuro-Oki earthquake was previously studied by many researchers. The magnitude of the earthquake was estimated to be 7.4 by JMA. The total seismic moment was  $6.7 \times 10^{20}$  Nm ( $M_w = 7.8$ ) and the average fault slip was 1.6 m determined by Shimazaki (1974) using surface-wave data. Tada (1974) estimated that the average fault slip was 1.0 m using geodetic data. However, the source process of the 1894 earthquake was not studied well because no seismograph or geodetic data are available for this event. The tsunami generated by the 1894 Nemuro-oki earthquake was observed at the tide gauge station in Ayukawa. This tsunami waveform is the only one instrumental record for this earthquake. In this research, we study the source process of the 1973 and 1894 earthquake using the tsunami waveform at the tide gauge in Ayukawa to discuss the future Nemuro-oki earthquake.

### 2. Data and Method

The tsunami waveforms from both the 1973 and 1894 Nemuro-Oki earthquakes were observed at the tide gauge at Ayukawa. The observed tsunami waveform of the 1894 Nemuro-Oki earthquake is very different from that of the 1973 Nemuro-Oki earthquake. Fortunately, the bathymetry near Ayukawa has not been changed much since 1894, so the difference between two tsunami waveforms should be related to the different source processes between two earthquakes. However, the absolute time of the record in 1894 does not have enough accuracy for this analysis, so we shifted the time of record by comparing the observed and computed waveforms.

We numerically computed the tsunami waveform for the 1973 earthquake by assuming the fault model consistent with the previous studies, the length of 80km, the width of 80km, strike of  $240^\circ$ , dip= $14^\circ$ , rake= $111^\circ$ . The tsunami for the 1894 earthquake was computed using the various fault length and width to find the fault model which could explain the observed 1894 tsunami waveform. The focal mechanism was assumed to be the same as that of the 1973 earthquake.

Finite difference computations for the linear long-wave were carried out on the actual bathymetry. The grid size was basically 20 sec of arc (about 600m), but finer grid (4 sec) were used around the tide gauge stations.

### 3. Results

For the 1973 Nemuro-Oki earthquake, the slip amount of the 1973 was estimated to be 2m in order to explain the observed tsunami waveforms at Ayukawa. The seismic moment was calculated to be  $5.1 \times 10^{20}$  Nm ( $M_w 7.8$ ). For the 1894 Nemuro-Oki earthquake, the length of the fault was estimated to be 200km, much longer than the length of the fault of the 1973 earthquake. The width of the fault is found to be 100km, and the slip amount is estimated to be 2.4m by comparing the observed and computed tsunami waveforms. The seismic moment was calculated to be  $19.2 \times 10^{20}$  Nm ( $M_w 8.2$ ).

### 4. Discussions

The future Nemuro-Oki earthquake can be larger than the 1973 Nemuro-Oki earthquake because the 1894 Nemuro-Oki earthquake has a fault length of about 200km, much larger than the 1973 Nemuro-Oki earthquake. Also the source area of the 2003 Tokachi-Oki earthquake was smaller than the 1952 Tokachi-Oki earthquake. The seismic activity in the source region of the future Nemuro-Oki earthquake is very low now. This may suggest that the coupling at the plate interface in the source region is strong.