# Two large Mindanao earthquakes on May 17, 1992

# Yuichiro Tanioka[1]

[1] MRI

1) Introduction

On May 17, 1992, two large earthquakes (Ms=7.1, and 7.5) occurred off eastern Mindanao in Philippines. Two earthquakes were separated by only about 25 minutes. These earthquakes caused damage in Manay, at the east coast of Mindanao Island, by shaking and tsunamis. One girl was washed away by tsunamis, but she survived when a fisherman found her floating in ocean in the following day. The tsunami was also observed at a tide gauge at Davao in southern Mindanao. In this paper, the source processes of the two earthquakes are estimated using teleseismic body waves and tsunami waveforms. We also discuss the tectonics in the source region.

2) Analysis of teleseismic body wave

The first earthquake, which occurred at 9:49:19.1 on May 17, was analyzed using teleseismc body waves, 18 P-waves and 2 S-waves. The result showed that the earthquake had a thrust type mechanism with some left-lateral strike slip component (strike=168, dip=39, rake=56). The centroid depth was 14km, the seismic moment was 0.53 x 10**20 Nm (Mw=7.1), and the source time function consisted one pulse with a duration of 23 seconds. The next earthquake, which occurred at 10:15:31.3 in the same day, was analyzed using teleseismc body waves, 6 P-waves and 1 S-wave. The result showed that the earthquake had a thrust type mechanism with a left-lateral strike slip component (strike=198, dip=30, rake=42). The centroid depth was 14km which was deeper than the first event, the seismic moment was 0.44 x 10**20 Nm (Mw=7.1), and the source time function consisted one pulse with a duration of 14 seconds. However, the resolution of the analysis for the second event was poor, because the later phases generated by the first event caused large noises for the second event.

3) Analysis of tsunami waveforms

The linear long wave theory was used to compute tsunami waveforms numerically. A grid spacing of the tsunami computation was 20 seconds. The tsunami caused by the first earthquake was computed using the focal mechanism estimated from the seismic analysis. We found that the fault had to located on the southern part of the one-day aftershock area in order to explain the first pulse of the observed tsunami recorded at Davao in Mindanao Island. The amplitude of the first pulse of the observed tsunami was explained by the computed tsunami waveform from a fault model that had a length of 80km, a width of 60km, and a slip amount of 31cm. The seismic moment is calculated to be 0.52 x 10**20 Nm by assuming that the rigidity is 3.5 x 10**10 N/m**2. This seismic moment is consistent with that estimated from the seismic analysis. The first pulse of the tsunami caused by the second earthquake was difficult to identify because of the interferences with the large later phases of the tsunami from the first event. However, we assumed that the second earthquake ruptured the northern part of the one-day aftershock area, because the first event had already ruptured the southern part of that area. The length and width of the fault model for the second event was assumed to be 70 km and 60 km, respectively. The slip amount was 30 cm to satisfy the seismic moment estimated from the seismic analysis. The tsunami waveform at the tide gauge at Davao was computed using the above fault model and was add to the tsunami waveform from the first event. The observed tsunami waveform was compared with the computed waveform from the two events. We found that the observed and computed waveforms were consistent.

4) Discussion

The two large earthquakes occurred at the almost same location (about 20km apart). The earthquakes occurred in the subduction zone where the Philippine Sea plate subducts along the Philippine Trench. The first earthquake ruptured the plate interface to the south, and then the second earthquake was triggered by the first event and ruptured the plate interface to the north.