Tsunami and coastal effects of the 1992 Manay earthquake, Davao Oriental, Philippines

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Generally, major subduction-related earthquakes like the 1992 Bislig earthquakes are events usually accompanied by tsunami. During these events, tsunami invaded the eastern coastlines of Mindanao islands several minutes after the strong ground shaking. This study illustrates some preliminary simulations and findings of field mapping activity undertaken more ten years after the event.

For initial simulations, the source processes of the two earthquakes were estimated using teleseismic body waves, tsunami waveforms and eyewitness accounts. Estimates from the MTRF inversion for the determination of focal mechanism and best depth for both events indicated a thrust type mechanism with some left-lateral component. Considering these results in the analysis of tsunami waveforms, it was apparent that the first event ruptured the southern part while the second earthquake ruptured the northern part of the aftershock area.

With regard to the filed investigations, data and information were gathered from eyewitnesses and survivors through interviews. True wave heights of tsunami were measured and/or estimates based from the descriptions of the interviewees, landmarks, and other natural features found in the area. People generally observed the tsunami between 1-10 minutes after the strong ground shaking related to the 1992 event. Moreover, the big tsunami wave was preceded by the lowering of water level down to about 50-250m. True wave height varies from several centimeters up to 5 meters in some areas. The most common observations were the oscillation of tsunami for several minutes with the first wave the biggest. Tsunami inundation reached as far as 200 meters inland. There was no unusual uplift and/or subsidence observed in the eastern coast but an alleged subsidence was reported in Lupon. During the field visits, at least two places were identified for future stratigraphic logging or trenching of tsunami deposit.

The highest wave was measured in Bunga, a northern barangay of Manay municipality. It has a very big difference in height relative to the measured waves at Santiago and Zaragoza by about 400% and thus, caused the worst effect in terms of damages due to wave inundation. The cause of the unusual height of the tsunami in this area is most probably the following features or the combination of these features: the direction of the wave as it approaches the shore, submarine topography and the shape of the shore fronting Barangay Bunga. In terms of tsunami intensity, it generally decreases southwards and northwards relative to Bunga and Zaragoza areas. Wave arrival times in the southern area, however, have some variation particularly in Bobon and Panompon. The period of the tsunami wave was quite difficult to determine because of sketchy details and so much variation in terms of the number of waves that attacked the areas investigated.

On the other hand, the 1992 event caused very minor changes in terms of regional and local geomorphology effects,. Tsunami sediments were dumped in very few places. Barangay Central at Baganga, Barangay Sta. Fe at Caraga, Barangay Zaragoza at Manay and Barangay Bobon at Mati are among these areas where the sediment left by the tsunami waves ranges from several centimeters up to about half a meter at Baganga area. Other coastal feature observed during the study is the coral reefs that were usually located between 100-200m from the shore of eastern Mindanao.

For tsunami hazard mitigation, new tsunami simulations would be undertaken not only for Davao Oriental but hopefully for the eastern coastal areas of Mindanao. Furthermore, more detailed study of shore morphology, setting up of signages, as well as intensive trainings for disaster preparedness are highly recommended to minimize future tsunami disaster in the area.