Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS25-P21 Room:Convention Hall Time:May 20 15:30-17:00

Geomorphic Changes due to 2004 tsunami-Kirinda Fishery Harbor, Sri Lanka

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Tsunami can erode and bring in large volume of sand and other sea bed material into the land area behind the beach. The seabed became shallower near the coast at most locations, suggesting deposition of inner shelf or deep-sea sediments in the shallow areas. A variable amount offshore material was incorporated into the deposit even though the amount and depth of erosion offshore were not quantified. Relative to the onshore study of tsunami deposition, the impact of the tsunami on the offshore bathymetry is poorly understood, due to the scarcity of pre- and post-tsunami bathymetric data, which are useful for analysing tsunami erosion and deposition offshore. Numerical sediment transport model is a better approach for understanding the offshore process of the bathymetric change by the tsunami. Even though, various models have been proposed to understand the sedimentary process of the onshore and offshore sediment transport, most of the model yet to be validated using bathymetric data immediately before and after the tsunami. The bathymetric data at nearshore zone measured by JICA on November 2004 and February 2005 at Kirinda harbor (81.3375E, 6.2181N), Sri Lanka, was recoded the bathymetric change by the 2004 Indian Ocean Tsunami. This study is assessing the onshore and offshore geomorphic changes due to tsunami in Kirinda, while testing the validity of the sediment transport model using recorded bathymetry data. Nested grid system which includes six domains with different resolution is used to simulate the tsunami propagation and inundation as well as the bed level change. First of all, bed level change in smallest domain is obtained and compare with the measured data in order to validate the sediment transport model. The model calculated erosion and deposition ratio for the Kirinda harbor after the tsunami wave is 0.61, whereas the ratio was given as 0.52 for the measured data. Furthermore, high sedimentation occurred in the bay areas because of the diffracted tsunami inflow into the bays and erosion had been noted at the headlands, as well as at the artificial coastal structures such as breakwaters. The model predicted results overall are compatible with the measured data, although the model could not perfectly demonstrated the local effects. By applying the sediment transport model for the larger domains, it is found out that about 1 m layer of sediment is eroded at 50-100 m depth by tsunami flow and deposited on the nearshore area.

Keywords: sediment transport model, geomorphic changes, tsunami