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Use of a forecast atmospheric-ocean-sediment model for assessing the impact of typhoon-induced surge to coastal geomorphology

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USE OF A FORECAST ATMOSPHERIC-OCEAN-SEDIMENT MODEL FOR ASSESSING THE IMPACT OF TYPHOON-INDUCED SURGE TO COASTAL GEOMORPHOLOGY

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ABSTRACT

In the Philippines, intensity of typhoons is measured by maximum wind speed attained, with damage resulting mostly from the ferocious winds and sometimes torrential rains. However, typhoons also inflict damage by changing the onshore and offshore landscape at a faster rate than normal through morphological processes such as erosion and sedimentation. Typhoon Haiyan (Yolanda) is an intense typhoon that devastated the Visayas region in the Philippines on November 8, 2013. The coastal towns along San Pedro Bay were among the most affected when Typhoon Haiyan made landfall. An atmospheric forecast model (WRF) and an ocean model (Delft3D-Flow/Wave) were used to simulate the typhoon surge and sedimentological changes during and immediately after Haiyan. Parameterization of WRF atmospheric model focused on varying microphysics schemes and using the wind and pressure output from the best combination scheme as inputs for the Delft3D ocean model. In Tacloban City, a 2 meter surge was produced using WRF wind, compared to a 5 meter surge produced using input from best-track data of Joint Typhoon Warning Center (JTWC). The difference was due to the significantly weaker wind produced from WRF simulation. There are erosion and sedimentation hotspots in the coasts of San Pedro Bay, with Tacloban and Tanauan as areas with significant erosion and Basey with significant sedimentation. To some extent, hydrodynamic process, coastal erosion and sedimentation that led to the morphological changes in the study area were reproduced and is consistent with previous studies. This study is the first of its kind that tried to couple atmospheric, oceanographic, and sedimentological process in simulating the damage from Typhoon Haiyan.

Keywords: Typhoon Haiyan, Hydrodynamics, Storm Surge, Sediment Transport, Coastal Erosion and Sedimentation