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Impacts of severe wave event to the coastal environment, east Taiwan: a case study of 2015 Typhoon Soudelor

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As an island surrounded by open water bodies, Taiwan faces associated challenges of oceanic events such as tidal, current and seasonsal wave cycles. In addition to the secular variations of the adjacent oceans, researchers have raised public awareness toward extreme wave events such as tsunamis and storm surges that may cause great damage to coastal infrastructures and loss of valuable lives. The east coast of Taiwan is prone to suffer from typhoons every year and records have shown that more than 30% of the low-pressure centers took the east coastline as their landing point. In year 2015, Typhoon Soudelor attacked the east coast of Taiwan and resulted in a great number of casualties and severe damage to the infrastructures all over the island. Soudelor is not the greatest typhoon of the year yet still brought in significant influences to the coastal topography due to its path and robust structure. In order to understand the impacts of typhoons like Soudelor, we investigated the coastal areas of Hualien, east Taiwan, to document how sediments and debris are transported along the shoreline under the extreme wave condition.

Four coastal areas were surveyed to extract applicable information such as local relief profiles, grain size distribution of drifted sediments/debris, maximum inundation limit and so forth. Field observation suggests that the waves displayed great capability of transporting the sediments and redistributing the beach morphology. For instance, the beach of Qixing Lake (Chishingtan) has astonishing records like maximum volume of transported boulder around 3,000,000 cm^3, maximum long axis of transported boulder around 144 cm, maximum distance of boulder transportation of 70 m, and maximum inundation distance of ca. 180 m. The composition and distribution of the drifted sediments in every areas vary with local geological conditions but in general all suggest similar characteristics: 1. the transported materials size down toward inland; 2. The sediments are originated from the vicinity and link positively with the local beach relief; 3. The occurrence of the drifted boulders shows a pattern of boulder field instead of sheet beds which is commonly observed at tsunami-related outcrops. By adding the detailed documentations of coastal environmental changes after the typhoon events, we hope to establish a thorough database that can facilitate tracking and predicting the behavior of extreme wave events in the future.