



How fast does a beach recover after a typhoon impact? An example from Haeundae beach, Busan, Korea

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Typhoons and extreme storms are major drivers causing severe erosion of beaches. Previous studies have shown that, after such events, it took two to three years or even longer for beaches to recover naturally in response to the local wave climate, unless human interventions took place in that period. Haeundae beach, located on the south coast of the Korean Peninsula, is the most popular beach of the city of Busan, Korea. The beach has experienced severe erosion over several decades and beach nourishments have thus been implemented almost every year before the summer high season. Concomitantly, the beach is directly or indirectly impacted by at least one typhoon per year. In 2016 Haeundae beach was directly hit by typhoon Chaba.

Here we examine the effects of the typhoon on the morphology and sedimentology of the beach with the ultimate aim of establishing the speed of beach recovery. For this purpose, topographic beach profiles were periodically surveyed along five monitoring transects before and after the typhoon using a VRS-GPS system. In addition, box-cores and sediment samples were collected to identify potential footprints of the typhoon. According to a wave buoy located close to Haeundae beach, the significant wave height during the landfall of the typhoon was 4.7 m with an average wave period of 13.2 sec. The topographic surveys revealed that substantial erosion of the beach face occurred, reaching a local maximum of 1.9 m (1.2 m on average). In response, the beach slope became much gentler, decreasing from 5.3 to 2.5 degrees. At the same time the mean grain size of the beach became coarser, changing from 1.5 phi to 1.0 phi. Wave-formed sedimentary structures in box-cores taken after the typhoon consisted of parallel (upper plane bed) laminations, HCSs and/or wave ripples being absent. The most interesting feature was the rate of beach recovery. In spite of the destructive typhoon action revealed in the study, the beach recovered much faster than expected. Within only two weeks after the typhoon passed, two-thirds of the beach had recovered, thereby initially forming a concave-up morphology. Complete recovery was achieved after three months. It can thus be concluded that, on short time scales, the effects of typhoons are negligible, at least on the beach face. In the sedimentary record, typhoon activity would be recorded as a major erosion surface truncating beach laminations formed during normal weather conditions.