B210

The seasonal variation of Hasaki Beach, Japan and the interaction between beach and wave

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Introduction

Climate change has been proven to influence the wave climate which consequently influences the beach's morphodynamic change as the primary driver. The impact of wave on beach morphology is still to be discovered due to the lack of bathymetry data. To achieve a more confident prediction of the shoreline in the future, a better understanding between wave and beach is needed.

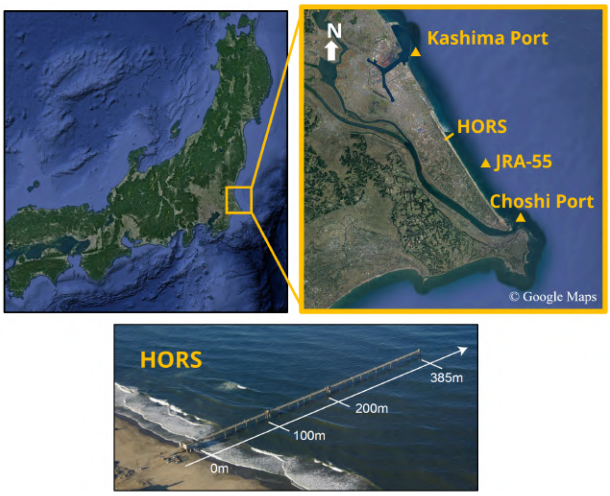

Figure 1 - The location of Hasaki beach and the observatory HORS.

Dataset

The research area of this study, Hasaki Beach, is an open coast located on the east coast of Japan, which has been collecting bathymetry data for nearly 30 years. 500-meter bathymetry in cross-shore direction is measured daily before 2012 to weekly after 2012. The wave condition considers both the hindcast wave data from the state-of-the-art atmospheric model JRA-55 and in-situ measurement at Kashima port.

Results

the shoreline position and biweekly significant wave height show a negative correlation generally through the year (Figure 2). Meanwhile, the shoreline is not only influenced by the current significant wave height but also by the past wave climate, which decides how much available sediment could be eroded from the bed.

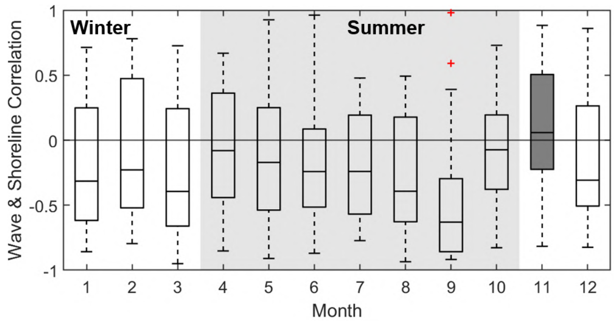

Figure 2 - bi-weekly averaged wave height and shoreline location. (Dark bar: positive median correlation; white bar: negative median correlation)

Monthly averaged nearshore wave experiences a decrease from March to July meanwhile the correlation between wave and shoreline increases, which can also be explained by the sediment availability. The daily-sampled bathymetry data at Hasaki Beach makes it possible to compare the time scale difference of the erosion and accretion process. The more severe storm could erode the deeper bed, but the beach also takes longer to restore from it. The beach morphodynamic behaviors with respect to different reference levels have quite various erosion/accretion pattern. When a storm is coming (significant wave height increases 1 m), the shoreline with respect to mean high water level (MHW) is more likely got eroded but the shoreline with respect to mean sea level (MSL) doesn't show a clear erosion pattern. That's because the higher berm's sediment is eroded and settles down to the lower shoreface meanwhile the local sediment is stirred up by breaking waves. The two processes counteract each other leading to the complicate shoreline change pattern on MSL.

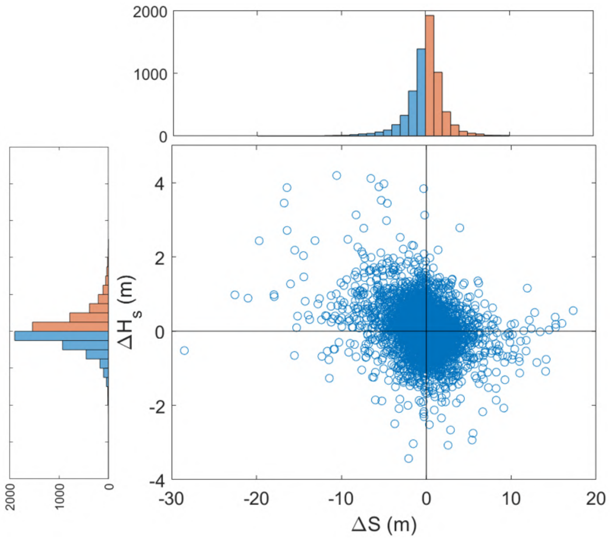

Figure 3 - Correlation between shoreline change and significant wave height change within one day with respect to MHW.

By comparing the observation data, the wave cannot erode all the surface sediment from the bed instantly and when the wave remains on the same level, the erosion process may last more than one day. However, when storm passes, the post-storm accretion due to the sediment settlement from the water column only last for approx. 1 day. And the sediment is constantly transported by the wave from offshore after that. In the end, based on this, the current morphodynamic reduced-complexity model, ShoreFor, is modified with two different time scales for erosion and accretion when simulating shorter time-scale variance.