B204

# The prediction of the morphodynamic change in coastal area under climate change

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Climate change has already posed a significant threat to our surrounding environment. The increasing greenhouse gas emissions induce global warming, leading to sea-level rise (SLR). On a global scale, coastal cities undergo a boom in economy and population due to the priority of the transportation which attracts lots of investment. From 2015 to 2019, the global mean SLR rate was at around 5 mm/year(different scenarios can be added). Besides that, severe storm surges and extreme waves are predicted to be less frequent but more intense under the projection of future climate conditions and storm surge heights will increase by around 0.3 to 0.45 meters near Japan (Mori et al., 2021). A severe storm surge or an accelerated sea-level rise can cause significant economic loss and threaten human lives, which is unacceptable for everyone. Under this situation, a proper model which could predict the shoreline change in a large scale and in a long term is urgently needed.

The Hasaki beach is selected as the start research area, at which the Hasaki Oceanographical Research Station (HORS) is located. HORS has been recording the beach deformation since 1986 at a one-day resolution and since 2012 at a one-week resolution. The wave record collected at the two nearby ports, Choshi port and Kashima port, indicates that the wave climate near Hasaki beach is storm-dominated.

A reduced-complexity model is applied in this research, whose aggregation level is between the process-based model (e.g., Xbeach) and the fully empirical formula (e.g., Bruun Rule). The process-based model can simulate the hydrodynamic conditions in a small spatial scale but cannot capture the long-term morphodynamic trend at the beach. In contrast, the empirical formula can project the uncertainty in shoreline change but normally can only take few forcing variants into account. The reduced-complexity model applied here aims to evaluate more forcing variants' influence on shoreline change and try to predict it in a long term. The governing equation is based on the ShoreFor model taking SLR and waves into account.

With the comparison between the hindcast result and the shoreline record at HORS, the performance of model is evaluated, and the free parameters of the model $(\Phi, c)$ are interpreted with physical meaning behind, e.g., wave climate, which could forecast shoreline change in a more comprehensive way. With predictable free parameters, a wave-SLR coupled model is more reliable when predicting future shoreline. The global circulation model and the downscaled regional circulation model are used in future wave projection. Therefore, a more reliable projection could be carried out in a large scale, for example, in a national scale, which gives an evaluation in beaches in a nation-wide scale.

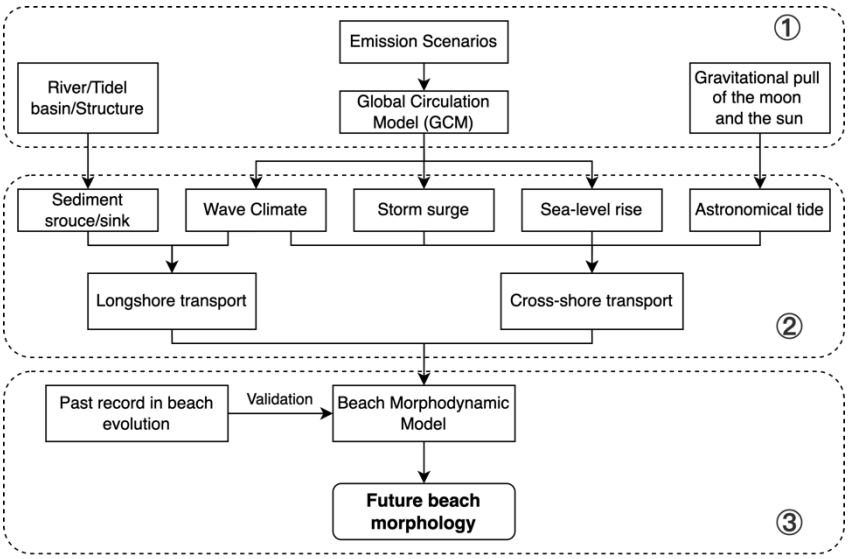


*Figure 1 Flow chart of future beach morphology research*