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Uncertainties of shoreline change projections along the sandy coasts of Aquitaine (southwestern France)

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Far from being stable, sandy shorelines are constantly evolving, threatening occasionally human assets such as buildings or transport infrastructures. In these environments, sea-level rise will exacerbate coastal erosion to an amount which remains poorly understood. To investigate this issue, we apply two suites of coastal evolution models applicable at decadal to centennial timescales on the dune-beach systems of the Aquitaine coast (southwestern France): one based on the Bruun rule, and the other based on a simplified version of a dune toe evolution model. Both modelling approaches incorporate the natural variability of shoreline change at seasonal, interannual and multidecadal time scales. They are fed with probabilistic sea-level projections and complementary information on coastal subsidence, in order to design locally applicable sea-level rise projections. For the model based on physical processes of erosion/accretion of the dune toe, a full temporal Monte Carlo simulation of multivariate storm conditions is performed so as to represent hundreds of years of realistic sea conditions.

The results show that even wide dune field has the potential to vanish completely after 150 to 200 years. However, the models predict important shifts towards erosion not earlier than the mid-21st century, suggesting that there remains several decades before current risk management practices become obsolete. Moreover, the results illustrate that mitigation of climate change has large benefits for these coastal systems, as it limits the risks of large sandy shoreline retreats according to the models outcome. As a limitation, probabilistic frameworks ignore the epistemic uncertainties affecting both sea-level projections and shoreline changes models. Here, extra-probabilistic uncertainties theories provide useful complementary information by exploring the fuzzy boundary between possible and impossible future shoreline changes.