

Impact of coastal forcing and groundwater recharge on the growth of a fresh groundwater lens in a mega-scale beach nourishment

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ABSTRACT

For a large beach nourishment called the Sand Engine – constructed in 2011 at the Dutch coast – we have examined the impact of coastal forcing (i.e. natural processes that drive coastal hydro- and morphodynamics) and groundwater recharge on the growth of a fresh groundwater lens between 2011 and 2016. Measurements of the morphological change and the tidal dynamics at the study site were incorporated in a calibrated three-dimensional and variable density groundwater model of the study area. Simulations with this model showed that the detailed incorporation of both the local hydro- and morphodynamics and the actual recharge rate can result in a reliable reconstruction of the growth in fresh groundwater resources. In contrast, the neglect of tidal dynamics, land-surface inundations, and morphological changes in model simulations can result in considerable overestimations of the volume of fresh groundwater. In particular, wave runup and coinciding coastal erosion during storm surges limit the growth in fresh groundwater resources in dynamic coastal environments, and should be considered at potential nourishment sites to delineate the area that is vulnerable to salinization.

REFERENCES

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