



Modeling Changing Morphology and Density Dependent Groundwater Flow in a Dynamic Environment: case study

Sebastian Huizer (1,2), Marc Bierkens (1,2), Gualbert Oude Essink (2,1)

(1) Utrecht University, Department of Physical Geography, Utrecht, Netherlands, (2) Deltares, Utrecht, Netherlands

The prospect of sea level rise and increase in extreme weather conditions has led to a new focus on coastal defense in the Netherlands. As an innovative solution for coastal erosion a mega-nourishment named the Sand Motor (or Sand Engine) has been constructed at the Dutch coast. This body of sand will be distributed slowly along the coastline by wind, waves and currents; keeping the coastal defense structures in place and creating a unique, dynamic environment with changing morphology over time.

The large size and position of the Sand Motor might lead to a substantial increase of fresh ground water resources. This creates an opportunity to combine coastal protection with an increase of fresh water resources in coastal regions. With a three dimensional, density dependent, groundwater model the effects of changing morphology over time and the potential increase in fresh water availability have been studied.

The preliminary model calculations show that in a period of 20 years volume of fresh water gradually increases to ca. 12 Mm³. In the nearby dune area 7-8 Mm³ is abstracted yearly, therefore the first results are promising in increasing fresh groundwater resources. More model calculations will be performed to investigate the sensitivity of the change in the fresh, brackish and salt water distribution.