Geophysical Research Abstracts
Vol. 14, EGU2012-12842, 2012
EGU General Assembly 2012


# An integrated coastal model for aeolian and hydrodynamic sediment transport

F. Baart (2,1), J. den Bieman (1), M. van Koningsveld (3,1), A.P. Luijendijk (2,1), E.J.R. Parteli (4), N.G. Plant (5), J.A. Roelvink (6,2), J.E.A. Storms (1), S. de Vries (1), J.S.M. van Thiel de Vries (2,1), and Q. Ye (2)

(1) Delft University of Technology, Delft, the Netherlands, (2) Deltares, Delft, the Netherlands, (3) Van Oord, Rotterdam, the Netherlands, (4) Universidade Federal do Ceará, Ceará, Brasil, (5) United States Geological Survey, St Petersburg, United States, (6) UNESCO-IHE, Delft, the Netherlands

Dunes are formed by aeolian and hydrodynamic processes. Over the last decades numerical models were developed that capture our knowledge of the hydrodynamic transport of sediment near the coast. At the same time others have worked on creating numerical models for aeolian-based transport.

Here we show a coastal model that integrates three existing numerical models into one online-coupled system. The XBeach model simulates storm-induced erosion (Roelvink et al., 2009). The Delft3D model (Lesser et al., 2004) is used for long term morphology and the Dune model (Durán et al., 2010) is used to simulate the aeolian transport. These three models were adapted to be able to exchange bed updates in real time. The updated models were integrated using the ESMF framework (Hill et al., 2004), a system for composing coupled modeling systems. The goal of this integrated model is to capture the relevant coastal processes at different time and spatial scales.

Aeolian transport can be relevant during storms when the strong winds are generating new dunes, but also under relative mild conditions when the dunes are strengthened by transporting sand from the intertidal area to the dunes. Hydrodynamic transport is also relevant during storms, when high water in combination with waves can cause dunes to avalanche and erode. While under normal conditions the hydrodynamic transport can result in an onshore transport of sediment up to the intertidal area. The exchange of sediment in the intertidal area is a dynamic interaction between the hydrodynamic transport and the aeolian transport. This dynamic interaction is particularly important for simulating dune evolution at timescales longer than individual storm events.

The main contribution of the integrated model is that it simulates the dynamic exchange of sediment between aeolian and hydrodynamic models in the intertidal area. By integrating the numerical models, we hope to develop a model that has a broader scope and applicability than existing models and is capable of simulating both the growth and destruction of coastal dunes.

The integrated version of XBeach and Dune is currently being applied for a test case in Assateague Island in the United States. The integrated version of XBeach, Dune and Delft3D is applied to the Sand Engine in the Netherlands.

In the presentation we show the current status of the development, experiences with the first test cases and our plans for future developments.

[Durán et al., 2010] Durán, O., Parteli, E. J., and Herrmann, H. J. (2010). A continuous model for sand dunes: Review, new developments and application to barchan dunes and barchan dune fields. *Earth Surface Processes and Landforms*, 35(13):1591–1600.

[Hill et al., 2004] Hill, C., DeLuca, C., Balaji, Suarez, M., and Da Silva, A. (2004). The architecture of the earth system modeling framework. *Computing in Science Engineering*, 6(1):18 – 28.

[Lesser et al., 2004] Lesser, G. R., Roelvink, J. A., van Kester, J. A. T. M., and Stelling, G. S. (2004). Development and validation of a three-dimensional morphological model. *Coastal Engineering*, 51(8-9):883–915. Coastal Morphodynamic Modeling.

[Roelvink et al., 2009] Roelvink, D., Reniers, A., van Dongeren, A., de Vries, J. v. T., McCall, R., and Lescinski, J. (2009). Modelling storm impacts on beaches, dunes and barrier islands. *Coastal Engineering*, 56(11-12):1133–1152.