EGU22-1713
https://doi.org/10.5194/egusphere-egu22-1713
EGU General Assembly 2022

Numerical modelling of marine dunes: Large-scale evolutions in an OWF context

Noémie Durand[1,3], Pablo Tassi[2,3], Olivier Blanpain[1], and Alice Lefebvre[4]
[1]France Energies Marines, Plouzané, France (noemie.durand@ite-fem.org)
[2]EDF Recherche & Développement, Chatou, France
[3]Laboratoire d'Hydraulique Saint-Venant, Chatou, France
[4]MARUM, University of Bremen, Germany

Marine dunes are sedimentary forms typically encountered on continental shelves. They migrate under the combined action of tidal currents and waves. Such an active environment poses a challenge to the design, safety, and maintenance of offshore and coastal works. Due to the continuous seabed evolution created by marine dune dynamics, offshore wind farm (OWF) elements, such as pile foundations and cables, are at risk of becoming exposed, weakening their integrity and stability, or on the contrary overburied, generating additional mechanical and thermal loads. Local scour at the toe of individual structures, and global scour resulting in the general lowering of the seabed around a group of structures, can also be elements of concern. Being able to predict the evolution and migration of marine dunes is, therefore, critical to limit damage to the infrastructures and to design effective protection works where needed.

In this context, the present work will investigate marine dune dynamics at different spatial and temporal scales (from metres to kilometres, from days to years) using a complex process-based model: the suite of open-source numerical solvers TELEMAC-MASCARET. The objective is to gain a better understanding of the hydrodynamics, the sediment transport and morphological processes at play in a marine dune environment, as well as of the mutual interactions between the dune field and the OWF elements. The model capabilities to reproduce large-scale sediment transport processes in OWF environments and to obtain accurate diachronic predictions of the dunes' evolution will be assessed in this work, and further developed if necessary.

A large dataset (bathymetric surveys over several periods, metocean data, and sediment data) has been collected in the last few years for a proposed OWF project off Dunkirk, France. These data will prove invaluable to assess the model performance. They indicate dune migration rates of tens of metres per year in places. The site is subjected to relatively strong tidal flows, with a predominance of the flood towards the North-East. Waves are primarily from the South-West, travelling in the Channel, but some significant events from the North-North-East have been noted.

This work is part of the 3-year MODULLES project: MOdelling of marine DUnes: Local and Large-scale EvolutionS in an OWF context, funded by France Energies Marines and the French government, under the "Investissements d'Avenir" programme managed by the French National

Research Agency ANR. It is hosted by the Saint-Venant Hydraulics Laboratory (LHSV).