Potential thermal impact of wind farms within a dynamic seabed

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ABSTRACT: Offshore wind farms (OWF) have an enormous potential of replacing conventional energy sources. These wind farms are connected to the shore by high-voltage power cables. The cables are usually buried in the seabed. Depending on the power transmission, the cables produce more or less dissipative heat, which is released into the sediments. Heat is carried through the sediments by conduction, and by advection and mechanical dispersion with flowing pore water. Marine dunes are among the most dynamic sedimentary bodies found in the English Channel and North Sea, where most of the future Europeans OWF are expected to be located. However, the heat flow pattern in dynamic marine dunes around such anomalously high heat sources are poorly described. The objective is to better understand the thermal regime of sand around a buried cable under a marine dune and to simulate the impact of dune migration on the thermal processes. This work is part of the 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" program managed by the French National Research Agency ANR.

This study investigates the impact of the thermal regime of sandy sediments within and below dynamic dunes through coupled numerical simulations of heat transport inside the cable and Darcy-groundwater flow and heat transport in the sediments. This study provides a guidance on the choice of optimal models and procedures for numerical modeling of the thermal processes of buried cable.