A new high-fidelity tool to simulate wind farms within a realistic atmospheric boundary layer

The growth of offshore wind energy leads to an increase of wind turbine sizes. As the trend is to develop larger and closely packed wind farms, it leads to potential deeper interactions with the troposphere.

In order to properly model the interactions between wind turbines, the surface and the atmospheric boundary layer, a new numerical tool has been developed: an actuator line model has been implemented in the open source non-hydrostatic mesoscale atmospheric model Meso-NH, based on a Large-Eddy Simulation (LES) framework.

Several validations have been performed [1]. A comparison of the LES results with the wind tunnel data of New MEXICO experiments was conducted. Then, the capacity of the tool to reproduce the well-known Horns Rev 1 photo case was evaluated. The results highlight the capacity of this new tool to represent interactions between wind farms and the lower atmosphere with a high level of details.

[1] *P.-A. Joulin, M.-L. Mayol, V. Masson, F. Blondel, Q. Rodier, M. Cathelain, C. Lac. (2020). Frontiers in Earth Science, 7, 350.*