FSI-WT: A COMPREHENSIVE DESIGN METHODOLOGY FOR WIND TURBINES

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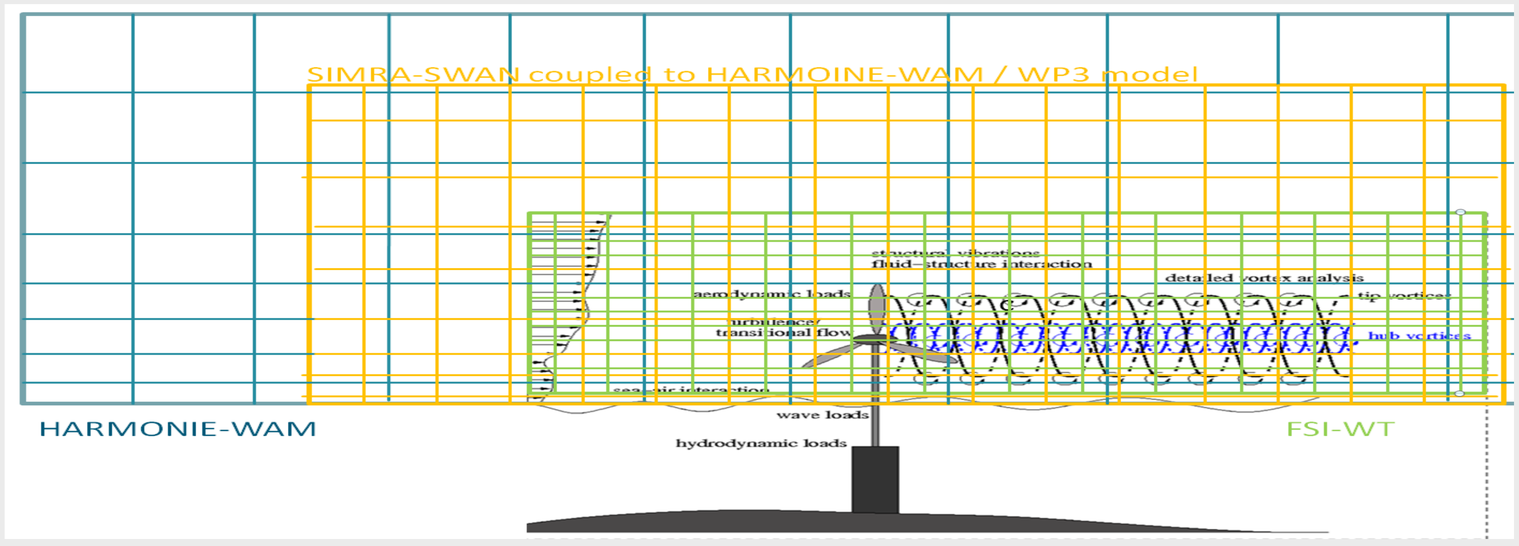
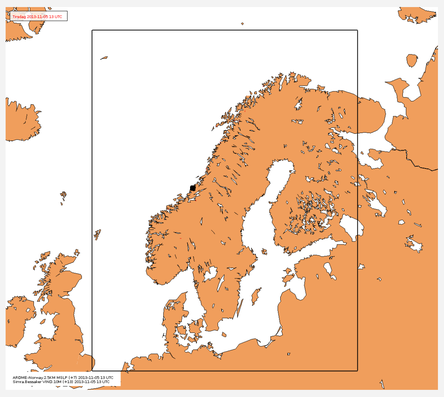
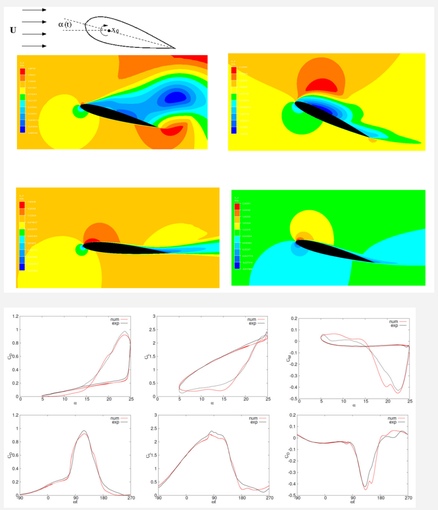
A Multiscale approach to model the entire event from mesoscale meteorology, through microscale meteorology to the aerodynamics of wind turbine blades



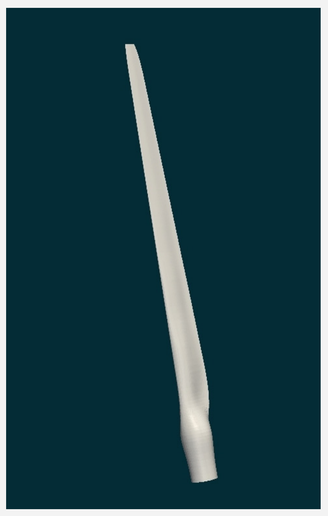


Global-Meso coupling

Isogeometric finite element code to simulate fluid-structure interaction of a rotating turbine



FSI of a moving 2-D airfoil
Output:: Drag, lift and moment coefficient

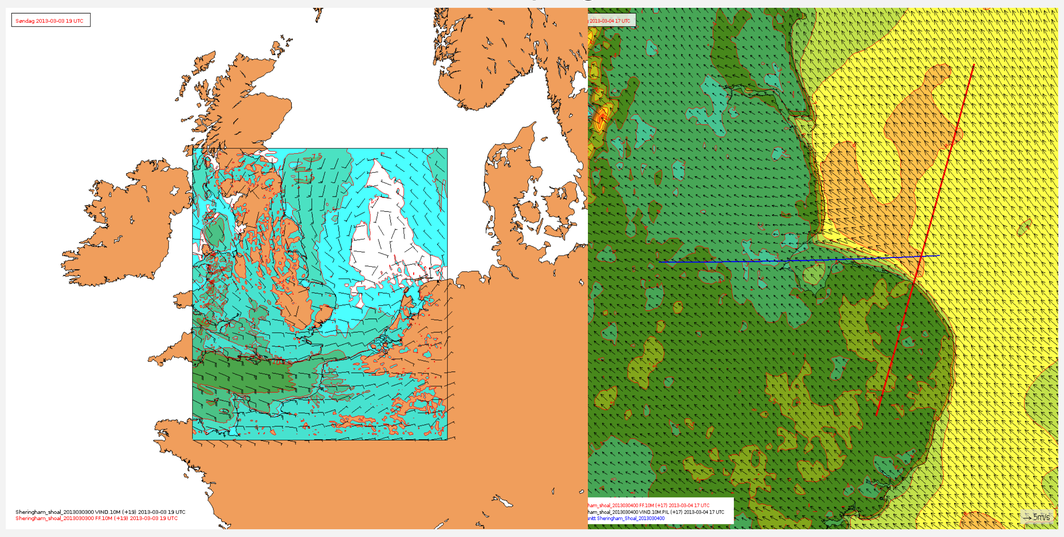


In progress: FSI of a single 3D blade

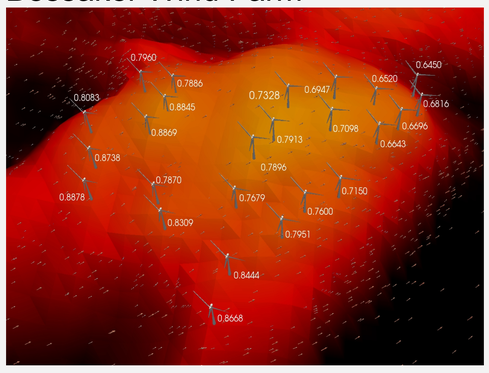
Planned work: FSI of a full 3D rotating turbine

Boundary conditions: Wind and Turbulence for FSI simulation

HARMONIE-WAM coupling

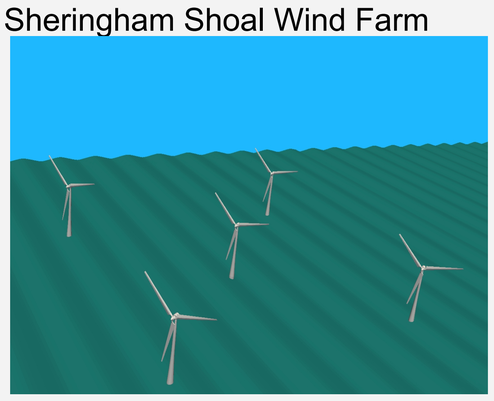


Bessaker Wind Farm



Microscale simulation of a wind farm in complex terrain
Output: Power production forecast and detailed 3D wind, temperature and turbulence field

Sheringham Shoal Wind Farm

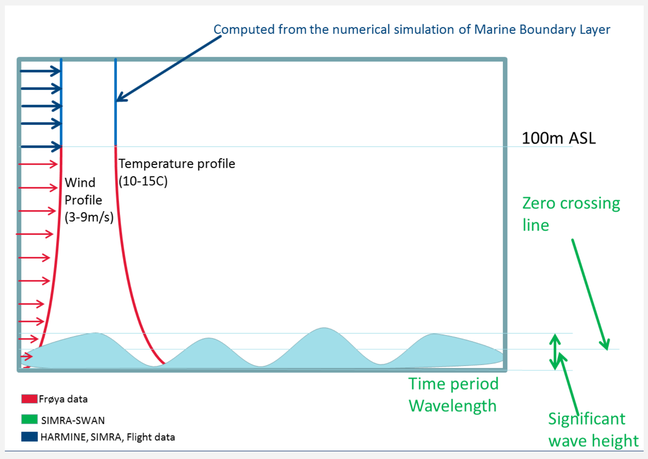


Planned work: Microscale simulation of an offshore wind farm: Power production forecast and detailed 3D wind field

WIND ENERGY FORECAST

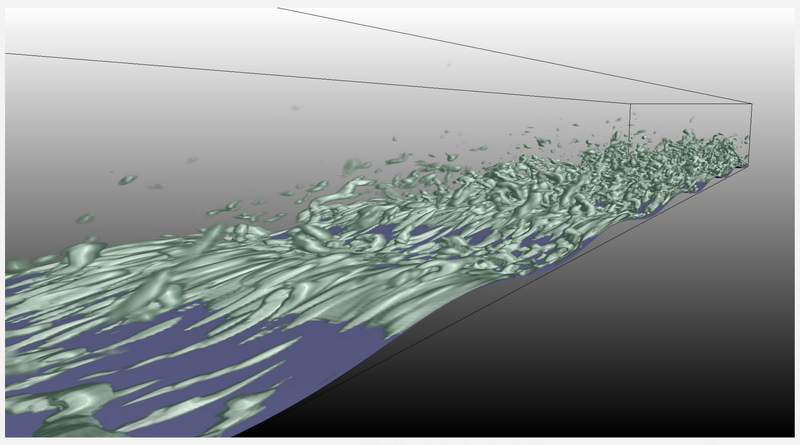
Improved parameterization for modeling of air-sea interaction

Near shore characterization of waves



SWAN results, Meteorological data,and observation data to set up cases for detailed LES

Large Eddy Simulation to capture wave effects on turbulent boundary layers



LES of turbulent flow over wavy wall

Advanced Finite Volume code on unstructured grid

Effects of waves on turbulence in atmospheric boundary layer modeled in detail

Improve parameterization of the sea-atmosphere interface in wave models

Planned work:

Include stratification effects

Two way coupling of air-sea using Volume of Fluid and/or Level Set method

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