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Master thesis – numerical

Influence of a Complex Terrain on the Propagation of Wind Turbine Noise

Background

Wind turbine noise, influenced by atmospheric propagation, poses a challenge for new wind farm development, potentially causing up to a 70% energy loss at night post-construction. Accurate prediction tools are essential for assessing noise during development and operation, focusing on aerodynamic noise sources and atmospheric sound propagation. The unsteady nature of the sound source makes it particularly disturbing, considering the typically low overall sound pressure level (SPL). Additionally, topography and ground conditions play a vital role in long-distance sound transmission. Here, we aim to model and parametrize the impact of a realistic terrain, see Figure 1, on the wind turbine noise propagation and amplitude modulation. Prediction model must consider ground effects, atmospheric absorption, and refraction in the atmospheric boundary layer (ABL).

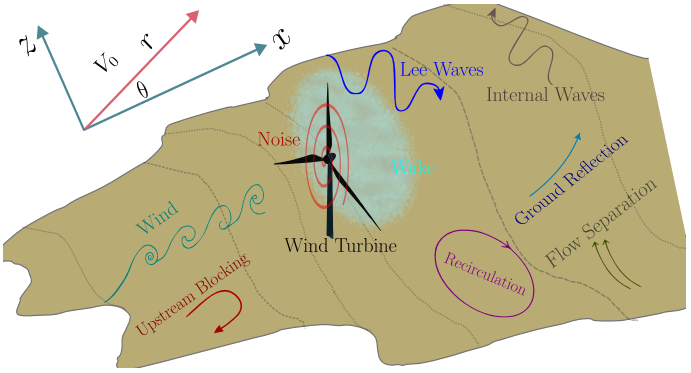

Figure 1: Conceptual description of wind turbine noise propagation with possible microscale processes.

Content of the Thesis

The student will perform flow simulation extending an existing flow case with OpenFoam, which will be augmented with an aeroacoustics model. The mean wind velocity in the ABL and wind turbine wake will be acquired and the wavenumber-frequency spectrum of the noise pressure will be parameterized using linear random advection model. An estimation of the terrain effect and different wind condition on the noise propagation will be produced.

Starting date:

Submission date:

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