Master thesis

Flow conditions at wind-energy relevant heights over realistic non-homogeneous forest canopies -an LES study

Source: http://www.juwi.com/wind_energy/wind_energy_in_forests.html

Forested regions are becoming increasingly attractive for the wind energy industry. The flow conditions over forests and particularly near forest edges are highly affecting the energy yield of wind turbines which has rarely been investigated so far, in particular when it comes to realistic, non-homogeneous forest canopies. The scope of this master thesis is to investigate the flow conditions at wind-energy relevant heights over such realistic forest canopies. To achieve this, the forest canopy parameterization in the large-eddy simulation model PALM (Maronga et al., 2015, Geosci. Model Dev., 8, 2515–2551, doi:10.5194/gmd-8-2515-2015), which is so far only working for homogeneous forests, shall be extended to enable the simulation of the flow over realistic non-homogeneous forests.

After having familiarised with the model PALM, the first step would be to test and verify the current version of the implemented canopy model with existing studies in the literature and available data from two test sites in Sweden. Then, the model has to be modified so that spatially varying forest characteristics can be simulated. Of course, the modified canopy model requires thorough testing and verification.

In the second part of the thesis, the modified canopy model should be applied to the simulation of non-homogeneous forests. Detailed forest data from two test sites in Sweden that should be simulated will be available. The results can be compared with previous simulations of that site with the old canopy model and with the results of other microscale models in the framework of an international modeling benchmark, we are participating in.

Requirements:

1. Bachelor degree in meteorology, physics, engineering physics or a related subject
2. Interest in meteorology and wind energy
3. Basic knowledge in CFD modelling
4. Good knowledge in programming (especially Fortran)

Begin: as soon as possible

Duration: 6 months (a preparatory internship of 2-3 months in the group is highly recommended if you are not yet familiar with PALM)

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