Project: 1069

Project title: **Boundary layer flows over complex terrain during the Perdigão field campaign** Principal investigator: **Johannes Wagner** Report period: **2019-01-01 to 2019-12-31**

In this project the Weather Research and Forecasting (WRF) model was used to perform simulations of the boundary layer flow during the Perdigão 2017 field campaign. This campaign took place during May/June 2017 over the double-ridge site in Portugal (see Fig. 1) to measure the boundary layer flow over complex terrain and its interaction with a single wind turbine by means of a huge number of remote sensing and in situ-measurements. In this project a forest parameterization is used in WRF to model the forest drag near the surface and simulations with and without forest parameterization are compared to tower and lidar observations. This comparison is done for both short-term simulations with a simulation time of 12 hours and for long-term simulations over a period of 49 days. Figure 2 shows a comparison of simulated and observed wind speeds at meteorological towers across the double ridge for long-term simulations with (LT F) and without (LT NF) forest parameterization. Without forest drag surface wind speeds are considerably overestimated and the interaction of the boundary layer flow with the double ridge is not well reproduced (not shown). With forest parameterization the correlation coefficient, root-mean-square error and the mean bias is improved. Further studies have to be conducted to make the forest distribution in the modelling domain more realistic by applying improved landuse data sets.



Figure 1: Topographic map of the Perdigão double ridge site



Figure 2: Comparison of simulated and observed wind speeds at locations of meteorological towers. Shown are results for long-term WRF simulations with (LT_F D3) and without (LT_NF D3) forest parameterization.