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Sensitivity study of simulated wind profiles to model resolution, land cover and climate forcing data

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Due to large inhomogenities in near-surface wind measurements an alternative method for the investigation of surface boundary layer wind fields must be found. For this reason observation data from five high towers (100m up to 250m height) in different regions of Germany and the Netherlands with the regarding differences in surrounded topography and land use is used to compare the reliability of calculated wind profiles from several runs of the German regional climate model CLM (with different parameterizations and initial conditions) and from the Canadian Wind Energy Simulation Toolkit (WEST). The advantage of the regional climate model lies in the high resolution in time where as the mesoscale module of WEST provides mean wind fields over a defined time period of a based climate database. The flexible application of WEST, particularly the much less computation time, allows on the other hand a detailed investigation of the influence of the parameterizations and initial conditions. So the objectives of this study are the investigation of the influence of the forcing data and the land use data on the mean profile and especially the investigation of the existence of an added value for increasing resolutions.

Therefore WEST model runs for West Europe with resolutions of 50, 20 and 10km were conducted and compared to the observational data and calculated mean fields of CLM (50km resolution) at heights of 10, 50 and 100m above ground level. The results of the comparison reveal small differences between the measured and calcu-

lated mean wind profiles for most of the stations over flat terrain and great differences for the stations over complex terrain and land cover. Additionally the WEST runs with the USGS-1km land use data base show no general improvement after increasing the resolution. Two reanalysis datasets (NCEP/NCAR and JRA) were used as forcing data for WEST. No significant deviations between the wind profiles generated with the two forcing data sets were detected. To avoid distortions due to differences of Canadian and European land use definitions the roughness lengths were adjusted by means of the European land use database CORINE. The following calculations with the replaced land use database result indeed in an improvement in the WEST wind profiles compared to the measured wind profiles especially for the northern stations. This shows the high influence of the roughness lengths of WEST and the importance of the accuracy of the classification of the based land use data. An increased model resolution (from 50, 20, to 10km) helped to reduce the model error in most of the cases. But the calculated wind profiles over more complex terrain and land cover were still overestimated. To consider this complexity, high resolution runs of WEST with the resolution of 1km were conducted, which led to a great agreement of modeled and measured wind profiles for four of the stations. However, the systematic overestimation of the wind profile for one station over more complex land cover remains.