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Model Performance of different Surface Flux Parameterisations dependent on the simulated meteorological Situation

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The performance of atmospheric models considerably depends on the used parameterisations, which should be different for different model resolutions. For considering sub-grid-scale land-use effects, different parameterisations exist, including parameter averaging and flux aggregation methods with or without blending height. Model evaluations have shown that the model performance not only depends on the parameterisation applied but also on the meteorological situation and grid resolution. Systematic studies are needed to determine the scope of application for each parameterisation.

The mesoscale model METRAS is used to investigate the dependence of model performance on parameterisation, resolution and meteorological situation. METRAS includes three different resolution-independent schemes to consider sub-grid-scale land-use effects. 6-hourly 1d-simulations were performed for years 2002 and 2003 and classified with a newly introduced locality number I_{lt} that characterises meteorological situations with respect to the probable impact of the surface fluxes on the precipitation forecast. For each I_{lt}-class nested 3d-simulations were performed for grid resolutions of 16km, 8km and 4km for a 400x400km^2 area in northern Germany. Flux aggregation with blending height concept as well as parameter averaging are applied to parameterise the sub-grid-scale surface fluxes. Hit rates are calculated from model results using surface measurements for comparison. The comparison of the hit rates leads to an evaluation of the model performance dependent on the meteorological situation, parameterisation and resolution.

The results of the above simulations will be discussed in detail and can be summarized as follows: The simulation results for I_{lt} values between 10 and 40 indicate an overall

better performance of flux aggregation with blending height than parameter averaging for the same resolution. Increasing the resolution does not necessarily improve the model performance for the same parameterisation. In cases of strong vertical exchange (large I_{lt} values) the wind forecast seems to be more sensitive to the model set-up than for lower I_{lt} values. But in general wind is less sensitive to parameterisation and resolution than temperature and dew point. For temperature and dew point the relative humidity was found to be more important for the model performance than the intensity of the vertical exchange.