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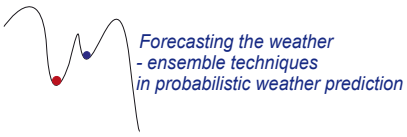

Some recent extensions and applications of the micro-scale model MITRAS

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A non-hydrostatic micro-scale model (MITRAS) is extended for and applied to some different applications in urban areas. The model resolves obstacles using the blocking approach while effects of other unresolved land use characteristics (e.g. water, soil, grass) are considered in the surface fluxes. For the grid, a surface following model is chosen to allow simple consideration of the orography in the model. In the first application presented here, the flow field over a part of Hamburg's city center (1 km x 1 km) is simulated. The actual GIS terrain heights data, the land use data as well as the digital building data are used in the simulation. A comparison of model results (average wind speeds, turbulent kinetic energy, and momentum fluxes) with wind tunnel results is also done and will be presented.

The second application of MITRAS here is the investigation of the impact of wind energy farms on the local meteorology. Wind turbines are changing the wind field by absorbing momentum and adding turbulent kinetic energy. In MITRAS, the shaft of a wind turbine is resolved, while the wind turbine is parametrized by an actuator disc concept. Model results are compared with measurements showing a reasonable agreement for the wake region. Also, the wind turbine's impact on the surrounding is shown.

The third application is analyzing the thermal interaction between buildings and its environment. In fact, the climate in urban areas is influenced by buildings, not only in respect to wind but also thermally. Relevant processes can be the conduction of heat from warm indoor regions through walls and roofs to the environment or changed radiation fluxes compared to rural areas. MITRAS is extended to determine the surface temperature and the energy fluxes at building surfaces by considering short wave and long wave radiation, heat conduction to the building interior and sensible heat flux between surface and ambient air. Solving the energy balance equation the interaction of buildings with their environment is studied. Presented will be the results for the heat budget of an idealized single high-rise building in a cloud-free situation. The wind field leads to slight warming of the air next to the irradiated walls and to an accumulation of warm air in the recirculation area at the downwind side of the building.