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Validation of a high Resolution forecast modelling system against detailed mean flow and turbulence observations and state-of-the-art LES model simulations

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Urbanization affects human thermal comfort and health, especially for vulnerable groups such as the elderly and people with established health issues. Physical properties of the urban fabric often induce worse thermal human comfort, work productivity and public health than on the surrounding countryside, particularly on hot summer days. To facilitate meaningful weather forecasts for the urban environment, we have developed a high-resolution numerical weather prediction system for human thermal comfort in urban areas. The forecasting system is based on the WRF meso-scale model which is run with a numerical grid and landuse map of 100 meter resolution . A resolution of 100 m is relatively fine for simulations performed in forecast (“real”) mode and approaches resolutions that are currently used in state-of-the-art Large-Eddy Simulation (LES) models. To assess the system’s validity in simulating the convective boundary-layer evolution, we evaluate the WRF model in forecast (“real”) mode against observations of near-surface and boundary-layer turbulence and thermodynamic variables for the CASES99 campaign. Furthermore, WRF model results are compared to results from the Dutch Large Eddy Simulation Model (DALES)and from WRF in LES mode. Preliminary results show that WRF in forecasting mode can be considered as a coarse LES with turbulent spectra that are relatively close to observed spectra. Furthermore, vertical profiles of resolved turbulent fluxes are found to be lower than in a detailed LES, especially in the layers with strong vertical gradients close to the surface and within the entrainment zone.