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Investigation of urban boundary layer by high resolution models and ground based observations in Rome area: understanding parameterizations potentialities

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The urban areas largely influence local evolution of the atmospheric boundary layer as the urbanization represents a significant forcing on thermo-dynamical state. The efficiency of the urban areas in storing heat can produce noteworthy mesoscale perturbations of the lower atmosphere. The new generations of high-resolution numerical weather prediction (NWP) models has been also applied to urban area for both weather forecast and research. Therefore, it is critical to correctly reproduce the urban forcing which turns in variations of wind, temperature and water vapour content of the PBL. The new generation model WRF has been used to reproduce the circulation in the urban area of Rome. A sensitivity study is performed using different PBL parameterizations and different surface schemes. The significant role of the surface forcing in the PBL evolution has been verified by comparing model results with observations coming from LIDAR, SODAR, sonic anemometers, soundings and surface stations measurements. A further comparison is performed with the mesoscale model MM5. Different urban canopy models (UCM) have been tested, showing the fundamental role of a correct urban representation at high resolution. Three meteorological event have been studied, chosen as statistically relevant for the area of interest; the WRF model shows a reiterated tendency in overestimating vertical transmission of horizontal momentum from upper levels to low atmosphere, that can be partially corrected if a local PBL is used coupled with an advanced UCM. Depending on background meteorological scenario, WRF shows a reversed behavior in correctly representing canopy layer and upper levels when local and non local PBL are compared. Moreover a tendency of the model in largely underestimating vertical motions has been verified. Comparison with data from surface stations outside the urban area allowed to study its influence on surroundings; also in this case the role of UCM on correctness of high resolved forecast has been evaluated.