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Validation of Martilli's urban boundary layer scheme with measurements from two mid-latitude European cities

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Abstract. Martilli's urban parameterization scheme is improved and implemented in a mesoscale model in order to take into account the typical effects of a real city on the air temperature near the ground and on the surface exchange fluxes. The mesoscale model is run on a single column using atmospheric data and radiation recorded above roof level as forcing. Here, the authors validate Martilli's urban boundary layer scheme using measurements from two mid-latitude European cities: Basel, Switzerland and Marseilles, France. For Basel, the model performance is evaluated with observations of canyon temperature, surface radiation, and energy balance fluxes obtained during the Basel urban boundary layer experiment (BUBBLE). The results show that the urban parameterization scheme represents correctly most of the behavior of the fluxes typical of the city center of Basel, including the large heat uptake by the urban fabric and the positive sensible heat flux at night. For Marseilles, the model performance is evaluated with observations of surface temperature, canyon temperature, surface radiation, and energy balance fluxes collected during the field experiments to constrain models of atmospheric pollution and transport of emissions (ESCOMPTE) and its urban boundary layer (UBL) campaign. At both urban sites, vegetation cover is less than 20%, therefore, particular attention was directed to the ability of Martilli's urban boundary layer scheme to reproduce the observations for the Marseilles city center, where the urban parameters and the synoptic forcing are totally different from Basel. Evaluation of the model with wall, road, and roof surface temperatures gave good results. The model correctly simulates the net radiation, canyon temperature, and the partitioning between the turbulent and storage heat fluxes.

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