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Improvement of air quality simulations over urban areas

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In urban areas, meteorology is affected by the presence of buildings leading to very complex processes which makes air quality simulation particularly difficult in the near-ground layers. To improve the air quality simulation in the urban areas, a chemistry-transport model (CHIMERE) driven by a mesoscale meteorological model (WRF) is used to simulate air pollutant concentrations during the winter 2016 over the Ile-de-France region especially during a short-term pollution episode in December at a resolution of 1.67km. Three urban canopy schemes are examined in this study: (1) a reference scheme (SLAB) that does not consider urban canopy parameters; (2) a multilayer urban canopy model with considered building effect parameterization (BEP); (3) multilayer urban models including energy exchange between inside and outside of the building (BEM). Compared with observations, all the schemes cannot accurately simulate the 2 meters temperature during the pollution episode and two urban canopy schemes underestimated 10 meters wind speed for the whole episode. Nudging above PBL improved 2 meters temperature simulations but did not significantly improves the 10 meters wind speed simulation. The two urban canopy schemes show better performances than the reference scheme for surface PM2.5, PM10 and nitrogen dioxide (NO_2) concentrations. All schemes massively underestimated both primary and secondary organic aerosol concentrations particularly during the short-term pollution episode. These results stress the importance of emissions inventories and meteorological input data for the quality of simulations. A new vertical diffusion parametrization under PBL with input data from WRF will be developed in the next step.