EMS Annual Meeting Abstracts
Vol. 12, EMS2015-173, 2015
15th EMS / 12th ECAM

Impact of urban emissions on tropospheric chemistry and climate

Peter Huszar, Michal Belda, and Tomas Halenka
Charles University, Meteorology & environment protection, Prague, Czech Republic (huszarpet@gmail.com)

Cities represent large concentrated emission sources that can alter the tropospheric chemistry not only on local scale but at regional distances as well. This study aims to evaluate the impact of emissions of short lived gases and aerosols from large cities on the tropospheric chemistry and climate over Central Europe. A coupled modelling system with two way interactions consisting of the regional climate model RegCM4 and the chemistry transport model CAMx was implemented with a 10 km x 10 km resolution over the region in focus. For the period of 2001-2010 several experiments were performed: one with urban emissions removed, one with urban emissions included. The chemistry-climate impact is evaluated as the difference between the corresponding experiments.
In the radiation calculations, the effects of tropospheric ozone, primary (black and organic carbon) and secondary inorganic aerosols (sulfates and nitrates) are taken into account including the first and second indirect aerosol effects. Regarding the impact on chemistry and aerosol, urban emissions greatly contribute to the total aerosol burden not only over cities themselves but over rural areas as well. The impact on ozone is characterized by high titration over urban areas but a clear ozone enhancement - especially in terms of extreme ozone values is modelled in the vicinity of cities, mainly over southern Europe. Evaluating the
radiative impacts, we found that the total effect on 2 m temperature over central Europe is characterized by small but statistically significant summer cooling up to -0.08 K as the 2001-2010 average. The impact on daily maximum temperatures in summer is sligthly higher (up to -0.1 K). These are considereble numbers compared to the effect of all (urban and non-urban) aerosols (up to -0.2 K as summer average and -0.3 K as summer average daily maxima). Further the impact on radiative fluxes, precipitation, PBL height and wind speed is presented as well.