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PARALLEL SESSION B : FRONTIER DOWNSCALING TOOL
B2: HUMAN-CLIMATE REGIONAL INTERACTIONS, TOWARDS RESMS

Urban climate - air quality interactions in regional scale over Central Europe

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When aiming for higher resolution in dynamical downscaling, effects of land use and land use changes play an increasing role. For the purpose of qualifying and quantifying the impact of urban surfaces on climate, surface parameterization in regional climate model RegCM4 has been extended with the Single Layer Urban Canopy Model (SLUCM), which can be used both in dynamic scale within BATS scheme and in a more detailed SUBBATS scale to treat the surface on a higher resolution subgrid. A set of experiments was performed for the period 1990-2010 over central Europe, either without considering urban surfaces and with the SLUCM treatment. Results show a statistically significant impact of urbanized surfaces on temperature and boundary layer height. Additionally, new version of land-surface scheme using CLM with urbanization is tested and the same arrangement of experiments performed for comparison. Both versions will be compared and validated using EOBS data.

For the purpose of qualifying and quantifying the impact of urban emission from Central European cities on the present-day regional air-quality, the regional climate model RegCM was coupled
with the chemistry transport model CAMx, including two-way interactions. A series of simulations was carried out for the 2001-2010 period either with all urban emissions included (base case) or without considering urban emissions. Sensitivity of ozone production to urban emissions was examined by performing reduction experiments with -20% emission perturbation of NOx and/or NMVOC. The model was validated using surface measurements of key pollutants.

Due to urban emissions, significant ozone titration occurs over cities while over rural areas further from them, ozone production is modeled. Air pollution over cities is largely determined by the local urban emissions, considerable fraction of the concentration is attributable to other sources from rural areas and minor cities. The radiative impact of the perturbed air chemistry due to urban emissions is dominated mainly by the aerosol direct/indirect effect. Decreases are modeled for the PBL height as well. The impact of all (urban and non-urban) emissions is up to -0.2, so considerable part of the radiative effects of all emissions is attributable to urban emissions. Partial climate impacts of urban emissions induced ozone, sulfate and nitrate changes are presented as well.

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