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Forecasting the weather
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New urban parameterization in COSMO-CLM

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One of the most evident anthropogenic influences on the climate in Europe includes changes of land use and land cover. Human-modified land covers such as human settlements alter surface energy and moisture exchange in a way that differs from the natural environments (Oke 1978): buildings and street canyons have a greater capacity to store heat than vegetated land, water runoff into drainage systems reduces surface evaporation and prevents surface cooling. These human-induced changes may cause significant effects on the local as well as on the regional climate across Europe and, thus, have to be studied closely.

Urban environments impact on the local weather and climate by altering the surface energy budget and a subsequent destabilization of the atmospheric circulation due to urban heat island (UHI) perturbation of the boundary layer. Enhanced convergence due to increased surface roughness in urban environments (Changnon et al. 1991, Bornstein & Lin 2000, Thielen et al. 2000) may induce bifurcating or diverting of precipitation systems by processes related to urban canopy (Bornstein & Lin 2000). Resolving these impacts with models can help to better capture anthropogenic disturbances on the weather and climate.

To resolve these impacts the regional climate model COSMO-CLM will be used. However, as the standard version of COSMO-CLM model does not explicitly resolve urban surfaces a new urban scheme is needed for addressing these objectives.

We implement a new parameterization scheme for urban surfaces, the Town Energy Budget (TEB) model (Masson 2000), into the COSMO-CLM. The coupled system resolves energy fluxes from the urban land fraction separately from the existing land surface scheme TERRA used for vegetated surfaces. The turbulent exchange coefficients for energy and momentum fluxes between urban land and the atmosphere are resolved separately by TEB, thus allowing a more accurate representation of urban effects on the lower atmospheric level in COSMO-CLM. We present the first steps towards evaluation of the coupled COSMO-CLM+TEB system and demonstrate its performance for a Central European domain at the spatial scale of 2.8 km.

References

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