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Urban land surface parametrizations for urban climate model MUKLIMO_3

Vera Heene, Meinolf Kossmann, and Heike Noppel
Deutscher Wetterdienst, Climate and Environment Consultancy, Germany (vera.heene@dwd.de)

The objective of the Copernicus (http://www.d-copernicus.de/) project GUAMO (Utilization of GMES Urban Atlas for urban climate modelling) is the usage of satellite products in urban climate modeling. The project is funded by the German Federal Ministry of Transport and Digital Infrastructure and focused on the determination of physical surface and canopy parameters in urban areas for the micro-scale urban climate model MUKLIMO_3. The Copernicus Land Monitoring Service (CLMS) (http://land.copernicus.eu/) provides up-to-date land data products, processed from Earth observation satellites as well as in-situ sensors. The local component product of CLMS Urban Atlas is used as information about land use and land cover over urban areas. The Pan-European component High Resolution Layers (HRL) products are used for the determination of some necessary parameters like imperviousness and tree cover density. The HRL imperviousness as the percentage of sealed soil does not contain information about buildings so therefore it could not be directly used without additional information. For this reason and for generation of other parameters which are needed to describe buildings (e.g. building height and wall area index), the official German 3D building model in Level of Detail 1 (LoD1) is used. The percentage of tree cover in urban areas is derived from the HRL tree cover density. The other necessary parameters are estimated from published literature.
In urban climate modeling the most common approach to urban land surface modelling is based on land-use classification with definitions of physical parameters for each land-use class. The quality of this approach is closely related to the variety of classes and the possibility to present the variability of physical parameters within a class. An alternative approach is the definition of physical parameters for each grid cell individually. Here the quality of parameters provided for model simulations depends mainly on the resolution of the processed geo-data in relation to the grid resolution of the climate model. To investigate the influences of the two mentioned approaches on urban model parametrization, we use MUKLIMO_3 case study simulations for the city Offenbach am Main (Germany) for the summer day 24 July 2012. The model simulations are initialized with temperature and relative humidity profiles, wind data and soil temperatures from the analysis fields of the operational weather forecasting model COSMO_DE. The above mentioned Copernicus data products and the LoD1 building model are used to parametrize built-up and vegetation surfaces for the model simulations. Both parametrization approaches are evaluated against the data from station observations and from mobile measurement along transects through the city.