Urban morphology characterization from earth observation and land use classification for applications in urban climate models

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We demonstrate (1) the use of earth observation in providing urban morphological and vegetation parameters needed by urban climate models, (2) an objective approach to create two different land use classifications based on the morphological parameters, and (3) the comparability of the new approach with in-situ derived land use classes and physical parameters (reference run). The new approach is developed and tested for Munich, Germany by integrating the obtained land use classifications and physical parameters into a 3-dimensional urban climate model (MUKLIMO_3). The model results of a case study are compared to the reference run and evaluated against meteorological measurements.

Eight morphological and vegetation parameters (building surface fraction, wall-area index, building height, impervious surface fraction, leaf area index and vegetation cover of low vegetation, tree cover, as well as tree height) were derived using 3 different earth observation data sets. An IKONOS scene of 17th September 2003, a Rapid Eye scene of 27th July 2009 and stereo images from the High Resolution Stereo Camera of 15th September 2004 were used. The accuracy and spatial resolution of the three input data sets is sufficient for use in MUKLIMO_3. The two different land use classifications were prepared through the use of GAP statistic and cluster analysis based on (i) urban structure types of Munich and (ii) MUKLIMO_3 model grid with a horizontal resolution of 100 m.

A comparison of the three different land use classifications with aerial photographs of the measurement stations shows that the classifications based on earth observation describe the land cover of the stations surrounding more realistically then the in-situ classification.