Geophysical Research Abstracts
Vol. 16, EGU2014-14351-1, 2014
EGU General Assembly 2014

High-resolution spatial distribution of temperature over Berlin simulated by the mesoscale model METRAS and comparison with measured data

Sahar Sodoudi (1), Kerstin Schäfer (1), David Grawe (2), Ronny Petrik (2), and K. Heinke Schlünzen (2)

(1) Meteorological Institute, Freie Universität Berlin, Berlin, Germany, (2) Meteorological Institute, University of Hamburg, Hamburg, Germany

The world's population is projected to increase in the next decades especially in urban areas. Additionally, the living conditions are affected largely by the local urban climate. The urban climate is a complex local system which might change differently than the regional climate. Studying the spatial distribution of air temperature and urban heat island intensity is one of the major concerns in the climate change scenarios. Due to the expected higher frequency of heat waves in the future and the related heat stress, high resolution distribution of air temperature is an important key for urban planning and development. In this study the non-hydrostatic Mesoscale Transport and Fluid Model (METRAS) developed at the University of Hamburg is used to simulate the air temperature for the urban area of Berlin. The forcing data have been derived from the ECMWF reanalysis data. We have used three nested domains (resolution of 4 km, 1 km, 200 m) to simulate the temperature in Berlin. Evaluation of these mesoscale model results is challenging for urban areas, due to the sparse and heterogeneous distribution of meteorological stations and the heterogeneous land cover in urban areas.

The Meteorological Institute of the Free University of Berlin organized six measurement campaigns in 2012. Measurements were taken at 31 different routes through Berlin using mobile measurement systems. In comparison with data from permanent weather stations the mobile measurements show a general overestimation of temperature and underestimation of relative humidity values. This may be the result of the different land cover types and places, where the mobile measurements and the stationary measurements were taken.

The highly resolved (200 m) simulated air temperature from METRAS has been verified for three different selected summer days in 2012 with different pressure patterns over Berlin. For the model evaluation, the data from the measuring campaign and 34 permanent stations have been used. The results show that METRAS overestimated the cloud water and rain water content on the first two selected days. The air temperature on the first two days has been underestimated by the model due to the reduced incoming radiation, and the strength of the urban heat island has not been reproduced. The mean absolute error is higher during the day time and especially in the city center. The last selected day is a sunny day with light wind from the Northwest. On this day the diurnal temperature variation is well reproduced by the model, although METRAS predicts short showers for several small areas during the afternoon. The showers do not lead to a temperature decrease over the whole city. The mean absolute error is much smaller in comparison with the other days. The temperature peak and the urban heat island are well consistent with observations. The mean absolute error is smaller in the city center and larger over the green areas. The spatial distribution of simulated temperature is in a good agreement with the measurements.