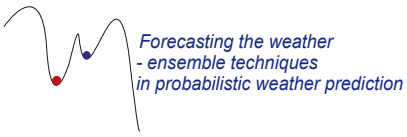
EMS Annual Meeting Abstracts
Vol. 8, EMS2011-325, 2011
11th EMS / 10th ECAM



A multi-canyon radiation scheme for urban canopy models

S. Schubert (1), S. Grossman-Clarke (1,2), and A. Martilli (3)

(1) Potsdam Institute for Climate Impact Research, Germany, (2) Arizona State University, USA, (3) CIEMAT, Unidad de Contaminacion Atmosferice, Spain

We developed a multi-canyon radiation scheme based on the Building Effect Parameterization model (BEP) and implemented it in the regional Climate Local Model (CCLM) in order to improve model performance in weather and climate simulations for urban areas.

The modifications introduced in BEP incorporate the inclusion of radiative interactions of roofs with other urban canyon surface elements such as walls, roads and roofs, and the closure of the radiative energy balance. Currently, roofs at all height levels in the urban canyon receive the full radiation from the sky, i.e. shadow effects of walls and other roofs are neglected. The roofs' reflected radiation is also fully emitted into the sky. Moreover, due to shadow effects on low wall elements for direct radiation as well as the distribution of the incoming diffuse radiation from the sky in the urban canyon, the incoming radiation in the original BEP scheme is not conserved. Other BEP modifications were motivated further by the goal to achieve the consistent treatment of all urban canyon surfaces in the radiation balance and to make fully use of BEP's modeling approach.

Sensitivity tests show that the radiative interactions of roofs with other urban surfaces have potentially a significant effect on the simulated urban canyon albedo, surface temperatures and subsequently on the long and short wave radiation balances and meteorological fields.

The new model was first tested for the cities of Basel, Switzerland, and Berlin, Germany. We developed an algorithm that computes urban input parameters for each model grid cell based on a 3d building model that covers the entire city of Berlin (CityGML format; >460000 buildings). It is shown that the application of the urban scheme significantly improved the quality of the simulations and enabled CCLM to simulate characteristics of the urban surface energy balance and subsequently the urban heat island effect.