JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 110, D10102, 14 PP., 2005
doi:10.1029/2004JD005192

Development and evaluation of an urban parameterization scheme in the Penn State/NCAR Mesoscale Model (MM5)

A. Dandou
Department of Physics, University of Athens, Athens, Greece

M. Tombrou
Department of Physics, University of Athens, Athens, Greece

E. Akylas
Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Athens, Greece

N. Soulakellis
Department of Geography, University of the Aegean, Mytilene, Greece

E. Bossioli
Department of Physics, University of Athens, Athens, Greece

In the present study, the Penn State/NCAR Mesoscale Model (MM5) was modified by considering recent advances in the urban boundary layer. In particular, the modifications were carried out in two directions: (1) With respect to the thermal properties of an urban surface the surface energy balance was modified by taking into account the anthropogenic heat released in urban areas and the urban heat storage term to account for urban/building mass effects, including hysteresis; and (2) the surface stress and fluxes of heat and momentum were modified following recent advances in the atmospheric boundary layer over rough surfaces under unstable conditions. The whole process was supplemented by detailed information on land use cover, derived from satellite image analysis. The modifications were applied to the high-resolution nonlocal medium-range forecast planetary boundary layer parameterization scheme, based on work by Troen and Mahrt (1986). The improvements seen with the modified model, after comparison with available measurements of temperature and fluxes, refer to (1) the strengthening of the nocturnal urban heat island; (2) the changes in the temperature, which proved to be favorable through the whole diurnal cycle, resulting in decreasing the temperature amplitude wave; (3) the decrease of turbulence and fluxes during the daytime; and (4) the diffusion coefficient and potential temperature profiles that are reduced during daytime and are increased at the lower levels during the night and thus affect accordingly the mixing height.

Received 2 July 2004; accepted 27 January 2005; published 19 May 2005.

Citation: Dandou, A., M. Tombrou, E. Akylas, N. Soulakellis, and E. Bossioli (2005), Development and evaluation of an urban parameterization scheme in the Penn State/NCAR Mesoscale Model (MM5), *J. Geophys. Res.*, 110, D10102, doi:10.1029/2004JD005192.
