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Inclusion of vegetation in the Town Energy Balance model for modelling urban green areas

A. Lemonsu[1], V. Masson[1], L. Shashua-Bar[2], E. Erell[2], and D. Pearlmutter[2]
[1]Météo France/CNRS, URA1357, Centre de Recherches Météorologiques, Toulouse, France
[2]Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Israel

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Abstract. Cities impact both local climate, through urban heat islands and global climate, because they are an area of heavy greenhouse gas release into the atmosphere due to heating, air conditioning and traffic. Including more vegetation into cities is a planning strategy having possible positive impacts for both concerns. Improving vegetation representation into urban models will allow us to address more accurately these questions. This paper presents an improvement of the Town Energy Balance (TEB) urban canopy model. Vegetation is directly included inside the canyon, allowing shadowing of grass by buildings, better representation of urban canopy form and, a priori, a more accurate simulation of canyon air microclimate. The surface

exchanges over vegetation are modelled with the well-known Interaction Soil Biosphere Atmosphere (ISBA) model that is integrated in the TEB's code architecture in order to account for interactions between natural and built-up covers. The design of the code makes possible to plug and use any vegetation scheme. Both versions of TEB are confronted to experimental data issued from a field campaign conducted in Israel in 2007. Two semi-enclosed courtyards arranged with bare soil or watered lawn were instrumented to evaluate the impact of landscaping strategies on microclimatic variables and evapotranspiration. For this case study, the new version of the model with integrated vegetation performs better than if vegetation is treated outside the canyon. Surface temperatures are closer to the observations, especially at night when radiative trapping is important. The integrated vegetation version simulates a more humid air inside the canyon. The microclimatic quantities (i.e., the street-level meteorological variables) are better simulated with this new version. This opens opportunities to study with better accuracy the urban microclimate, down to the micro (or canyon) scale.

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