Geophysical Research Abstracts
Vol. 15, EGU2013-12899, 2013
EGU General Assembly 2013

Characterization of the thermal structure inside an urban canyon: field measurements and validation of a simple model

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The results of measurement campaigns are analyzed to investigate the thermal structure in an urban canyon, and to validate a simplified model simulating the air and surface temperatures from surface energy budgets. Starting from measurements at roof-top level, the model provides time series of air and surface temperatures, as well as surface fluxes. Two campaigns were carried out in summer 2007 and in winter 2008/09 in a street of the city of Trento (Italy). Temperature sensors were placed at various levels near the walls flanking the canyon and on a traffic light in the street center. Furthermore, the atmosphere above the mean roof-top level was monitored by a weather station on top of a tower located nearby. Air temperatures near the walls, being strongly influenced by direct solar radiation, display considerable contrasts between the opposite sides of the canyon. On the other hand, when solar radiation is weak or absent, the temperature field remains rather homogeneous.Moreover, air temperature inside the canyon is generally higher than above roof level, with larger differences during summertime. Air temperatures from the above street measurements are well simulated by the model in both seasons. Furthermore, the modeled surface temperatures are tested against a dataset of wall surface temperatures from the Advanced Tools for Rational Energy Use Towards Sustainability–Photocatalytic Innovative Coverings Applications for Depollution (ATREUS–PICADA) experiment, and a very good agreement is found. Results suggest that themodel is a reliable and convenient tool for simplified assessment of climatic conditions occurring in urban canyons under various weather situations.