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A study of the Urban Boundary Layer considering different Urban Canopy Parameterizations and high resolution urban databases with WRF (the case of Houston)

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A study of the Urban Boundary Layer considering different Urban Canopy Parameterizations and high resolution urban databases with WRF
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Today, a significant number of Urban Canopy Parameterizations (UCPs) for atmospheric models exist with different physical descriptions of the city. The choice of the best UCP depends on the purpose of the research, and in some cases a simple bulk scheme is sufficient. However, the more recent and complex UCPs allow the study of new aspects of urban climatology, something that was impossible only few years ago. For example, the impact of the air conditioning systems on the air temperature, the relationships existing between the energy consumption and the meteorological conditions, and the evaluation of strategies to mitigate the Urban Heat Island (UHI) phenomenon only are possible using detailed UCPs. In this contribution, four UCPs, implemented in the Weather and Research Forecast model, WRF (three are available in the public release of the model 3.1, and the other one will be available in the next official release V3.2) with different degrees of complexity have been compared over the city of Houston. Moreover, with the most complex UCP, the impact of the anthropogenic heat (AH) on the air temperature and the energy consumption (EC) have been evaluated using two different urban land use/cover data sets. The results show that the AH could be responsible of an increase of up to 2(ºC)in the air temperature in some areas of the city during the night. The differences in the EC for the two selected days due to the different meteorological conditions were over 20 %.
In conclusion, this study shows that to estimate the Urban Heat Island (UHI) and AH patterns over a city, detailed UCPs and urban land use/cover databases are necessary, obviously accompanied by intensive meteorological campaigns. Nowadays, thanks to the UCPs coupled to mesoscale meteorological models, realistic evaluations of strategies to reduce the EC and mitigate the UHI over big cities can be obtained.