



Do we need full mesoscale models to simulate the urban heat island? A study over the city of Barcelona.

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As most of the population lives in urban environments, the simulation of the urban climate has become an important part of the global climate change impact assessment. However, due to the high resolution required, these simulations demand a large amount of computational resources. Here we present a comparison between a simplified fast urban climate model (UrbClim) and a widely used full mesoscale model, the Weather Research and Forecasting (WRF) model, over the city of Barcelona. In order to check the advantages and disadvantages of each approach, both simulations were compared with station data and with land surface temperature observations retrieved by satellites, focusing on the urban heat island. The effect of changing the UrbClim boundary conditions was studied too, by using low resolution global reanalysis data (70 km) and a higher resolution forecast model (15 km). Finally, a strict comparison of the computational resources consumed by both models was carried out. Results show that, generally, the performance of the simple model is comparable to or better than the mesoscale model. The exception are the winds and the day-to-day correlation in the reanalysis driven run, but these problems disappear when taking the boundary conditions from a higher resolution global model. UrbClim was found to run 133 times faster than WRF, using 4x times higher resolution and, thus, it is an efficient solution for running long climate change simulations over large city ensembles.