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Urban heat island in WRF weather prediction

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The impact of cities and urban surfaces on atmospheric processes is well known quite a long time. The modeling approach is often used with inclusion of urban parameterization in land-surface interactions. This is especially important when going to higher resolution, which is common trend both in operational weather prediction and regional climate modelling. Model descriptions of urban canopy related meteorological effects can differ largely given the odds in the underlying surface models and the urban canopy parameterizations, representing a certain uncertainty. We test the effects of different urban canopy parameterizations in WRF model in case studies of short series of weather forecasts in different resolutions with sensitivity tests to some options like fractional or dominant land-use types, some further options of urban parameterizations etc. We compare all the three WRF schemes, i.e. bulk, single layer and multilayer schemes.

There are differences in sensitivity of individual canopy model implementations to the UHI effects, depending on season and size of the city as well. Effect of reducing diurnal temperature range in cities (around 2 °C on average in summer) is seen in all simulation, independent to urban parameterization type. Also well-known warmer summer city nights appear in all simulations. Wind reduction is missing in bulk scheme, which demonstrate the significance of real urban processes parameterization. For extreme events forecasting, rather than the average temperature increase the distribution of it is more important providing the information on extreme UHI effects, e.g. during heat waves. In case studies we have analysed it to be for big central European cities nearly 10°C, even for not so big ones these extremes can go above 5°C.