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Temperature and wind statistics with convection-permitting model WRF in the context of heat waves and urban heat island events

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Recent studies have shown two-way interactions between aloft large-scale structures in the atmosphere
and local features such as surface temperature, wind, and land use. This requires the use of high-resolution land use schemes and convection-permitting models (CPM) for large eddy simulations (LES). Weather
Research and Forecasting model (WRF) is being increasingly used with resolutions that allow convection
to be fully simulated, and efforts (such as CORDEX FPS URB RC) have been made to introduce more
precise land use schemes to model the impacts of urban zones on temperature and wind statistics. In
this study, we focus on the 2003 summer heat wave and compute temperature and wind statistics from
surface to upper tropospheric pressure levels, ranging from microscales (~50m) to mesoscales (~500km) in
North-western France. The emphasis is put on extreme values of temperature by computing its Probability
Density Function (PDF) over the domain and across different spatial scales. Results pertain to second,
third, and fourth-order moments of temperature and wind reflecting variance, direction of across-scale
interactions, and extreme events' occurrence probability, respectively. Finally, we correlate mean large-scale
temperature gradients with those extreme events. This study provides new insights into the complex and
continuous across scales two-way interactions between local features and large-scale climate.