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- ensemble techniques
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# A decade of urban weather and climate simulations for urban regions at the Atlantic coast of Morocco

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Meteorological observations, and hence climate data, are scarce in regions like Morocco. The constantly improving capabilities of numerical weather prediction (NWP) models and freely available global data sets offer the opportunity to reduce this problem by providing data on meteorological variables at high spatial and temporal resolution. Longer time periods of years to decades can be simulated by NWP models by successive model runs of shorter periods, which can be described by the term “regional atmospheric reanalysis”. We present a regional atmospheric reanalysis for Northern and Central Morocco focussing on urban regions at the Atlantic coast by using the Weather Research and Forecasting (WRF) model. The innermost model domain covers the cities of Casablanca and Rabat-Sale, where a large fraction of the Moroccan population is living. The region of Grand Casablanca is currently studied within a research project funded by the German Federal Ministry of Education and Research (BMBF) dealing with sustainable urban development in view of climate change. Only three weather stations of the Moroccan Weather Service are located in this model domain, which indicates the aforementioned problem of data availability. The simulations for the decade from 2001 to 2010 are composed of daily re-initialised runs. Each run starts at 12:00 UTC, and time integration is performed for 36 hours. The output for the first twelve hours is discarded since the model results may be negatively affected by spin-up effects. The simulations are conducted with a set of nested domains at three different spatial resolutions of 30, 10 and 2 km using a newly developed cascaded nesting strategy that will be explained in the presentation. Model output is stored at hourly intervals for the 10 and 2 km grids, while three-hourly intervals are used for the 30 km grid. Input data sets are the standard final analysis (NCEP GDAS FNL, 1.0°, 6 h) data from the Global Forecasting System (GFS) with additional sea surface temperature (NCEP RTG SST, 0.5°, daily) input. In addition, land-use/land-cover data has been derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) for adequately describing the urban regions by three distinct urban classes (low intensity residential, high intensity residential, commercial/industrial/transportation). The NOAH land surface model is used, in combination with the two-dimensional single-layer Urban Canopy Model implemented in the WRF model since version 3.2. We will discuss the methodology in detail, as well as present selected results demonstrating the broad spectrum of scientific analyses and applications in the field of urban climatology arising from this approach.