EMS Annual Meeting Abstracts
Vol. 14, EMS2017-266-1, 2017

Using data assimilation in WRF to model the urban climate of Amsterdam

Sytse Koopmans (1), Natalie Theeuwes (2), Ronald van Haren (3), Gert-Jan Steeneveld (1), Reinder Ronda (4), Remko Uijlenhoet (5), and Albert AM Holtslag (1)

(1) Wageningen University, Meteorology and Air Quality Section, Wageningen, Netherlands (gert-jan.steeneveld@wur.nl), (2) Reading University, Reading, U.K., (3) Netherlands eSciencecenter, Amsterdam, Netherlands, (4) Royal Netherlands Meteorological Institute, De Bilt, Netherlands, (5) Wageningen University, Hydrology and Quantitative Water Management, Wageningen, Netherlands

Ongoing world-wide climate change and urbanization illustrate the need to understand urban hydrometeorology and its implications for human thermal comfort and water management. Weather and climate models can increasingly help to understand these issues, as they progress towards finer scales. At the higher resolutions, the representation of cities becomes crucial. The complex structures of cities, made up of buildings, streets and vegetation of various sizes and shapes, require a different modelling approach than the more homogeneous rural surroundings. The current urban canopy layer schemes account for these city specific characteristics, but differ substantially amongst each other due to uncertainty in land use parameters and incomplete physical understanding. Therefore, meteorological forecasting and hindcasting of the urban environment requires improvement.
In this study, we improve the WRF (Weather Research and Forecasting) mesoscale model performance at 100m grid spacing for Amsterdam by incorporating observations of a variety of sources using data assimilation techniques. Data assimilation aims to accurately describe the state of the atmosphere by steering the model fields in the direction of the observations.
We will demonstrate the set-up and results of a data assimilation study using WRF especially designed for urban areas. Using WRF-3DVAR, hindcasts were made for July 2014 for Amsterdam at a resolution of 100 m. July 2014 is characterized by both a warm dry period and two days with extreme precipitation (> 100 mm in two days). Assimilated data consists of synoptic weather observations, records by hobby meteorologists in cities, and volumetric radar data. Including each of these data sources improves the model skill.
The final goal of the project is to create a 15 year climatological urban re-analysis data archive of (hydro)meteorological variables. This will enable us to trace trends in thermal comfort and extreme precipitation.