The impact of impervious water-storage parametrization on urban climate modelling*

Hendrik Wouters^{1,2}, Matthias Demuzere¹, Koen De Ridder³, Nicole van Lipzig¹

¹Catholic University of Leuven, ²University of Ghent, ³Flemish Institute of Technological Research

*Details and references are published in:
Wouters, H., M. Demuzere, K. De Ridder, and N. P. van Lipzig, 2015:
The impact of impervious water-storage parametrization on urban climate
modelling. Urban Climate, 11, 24–50, doi:10.1016/j.uclim.2014.11.005.

hendrik.wouters@ees.kuleuven.be

Background

- Evapotranspiration is the component of the urban surface energy balance with the largest uncertainty
- What is the role of water reservoirs over impervious surfaces in urban climate modelling and high-resolution weather forecasting?

Highlights

- A new impervious **water-storage parameterization (WSP)** is presented for urban land.
- This was implemented in TERRA-URB, a urban extension to COSMO-(CLM)'s surface module.
- Water-storage parameters of the impervious surface at Toulouse centre are estimated.
- Model accuracy for evapotranspiration is improved for two observation campaigns (CAPITOUL and BUBBLE).
- The impact of water reservoirs on the surface-energy and water balance is quantified.

Open questions and applications

- What is the role of urban expansion versus climate change on temperature, moisture and precipitation? See poster session Y123 – EGU2015-8990 Friday, 17 Apr, 13:30–15:00
- Which adaptations are needed to cities as hotspots of climate change? See poster session Y122 – EGU2015-8806 Friday, 17 Apr, 13:30–15:00
- Where does run-off water end up... to the rivers and/or to the local natural land? How does that influence pluvial flooding?

Theoretical framework

- The depths of the water reservoirs are described with a Probability Density Function (PDF)
- Assuming a linear and decreasing PDF, a 2/3th-power relation is retrieved (see above)
- Two reservoir parameters: w_m and d_m

Parameter estimates

- TERRA-URB with WSP is configured for a dense urban site (Toulouse centre), 92% impervious
- Forced with observations during the CAPITOUL campaign
- A likelihood function is constructed by combining model results after rainfall with eddy-covariance measurements for evaporation

Impact on energy and water balance

- The urban surface-energy balance is affected until 12 day-time hours after precipitation.
- Annual-mean (2005 → 2006) evapotranspiration for Toulouse centre (modelled) is 5 times lower than that for the natural surroundings (observed).
- 12.5% of the annual precipitation falling on impervious surfaces evaporates back to the atmosphere from the reservoirs. The remainder (87.5%) is lost to run-off.