Modelling the contribution of the Brussels heat island to a long temperature record

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Introduction
Materials and methods

Advanced Regional Prediction System (ARPS)

- non-hydrostatic mesoscale model (Xue et al. 2000, 2001), extended with “urbanised” land surface module (including anthropogenic heating)
- triple one-way nested grid with successive grid resolution of 27 km, 9 km and 1 km, boundary and initial conditions from ECMWF reanalysis
- base case (current situation) and scenario (early 19th century) simulations, using CORINE resp. Ferraris land cover maps
- vegetation abundance obtained from satellite NDVI maps (base case); for the 19th century scenario it was modelled based on NDVI and assumptions regarding its statistical distribution
- simulations of four episodes with different atmospheric circulation regimes
Materials and methods

Land use 1830

Land use 2001

I-SUP
April 24th 2008
Model evaluation (Uccle)

RMSE

- $T \sim 2\,\text{K}$
- $q \sim 1\,\text{g kg}^{-1}$
- $V \sim 1\,\text{m s}^{-1}$
- $R_s \sim 65\,\text{W m}^{-2}$
Results

$\Delta T_{u-r}$ during CW (1 hour after sunset)

$\Delta T_{u-r}$ during WW (1 hour after sunset)
Results

Diurnal $\Delta T_{U-R}$ evolution
CW in Uccle

Diurnal $\Delta T_{U-R}$ evolution
WW in Uccle
Results

Diurnal flux evolution
CW (scenario)

Diurnal flux evolution
CW (base case)

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Conclusions

• an UHI effect was identified at Brussels, intensities exceeding 3 K

• mean UHI-related temperature increase was ~ 0.8 K, as compared to the ~ 1.5 K increase in the long-term records

• the Brussels UHI significantly (in the statistical sense – Mann-Whitney test) affected the temperature record at the RMI station during three of the four selected weather episodes

• future work: more weather episodes / simulation of a full year (or several years) to draw more reliable conclusions)