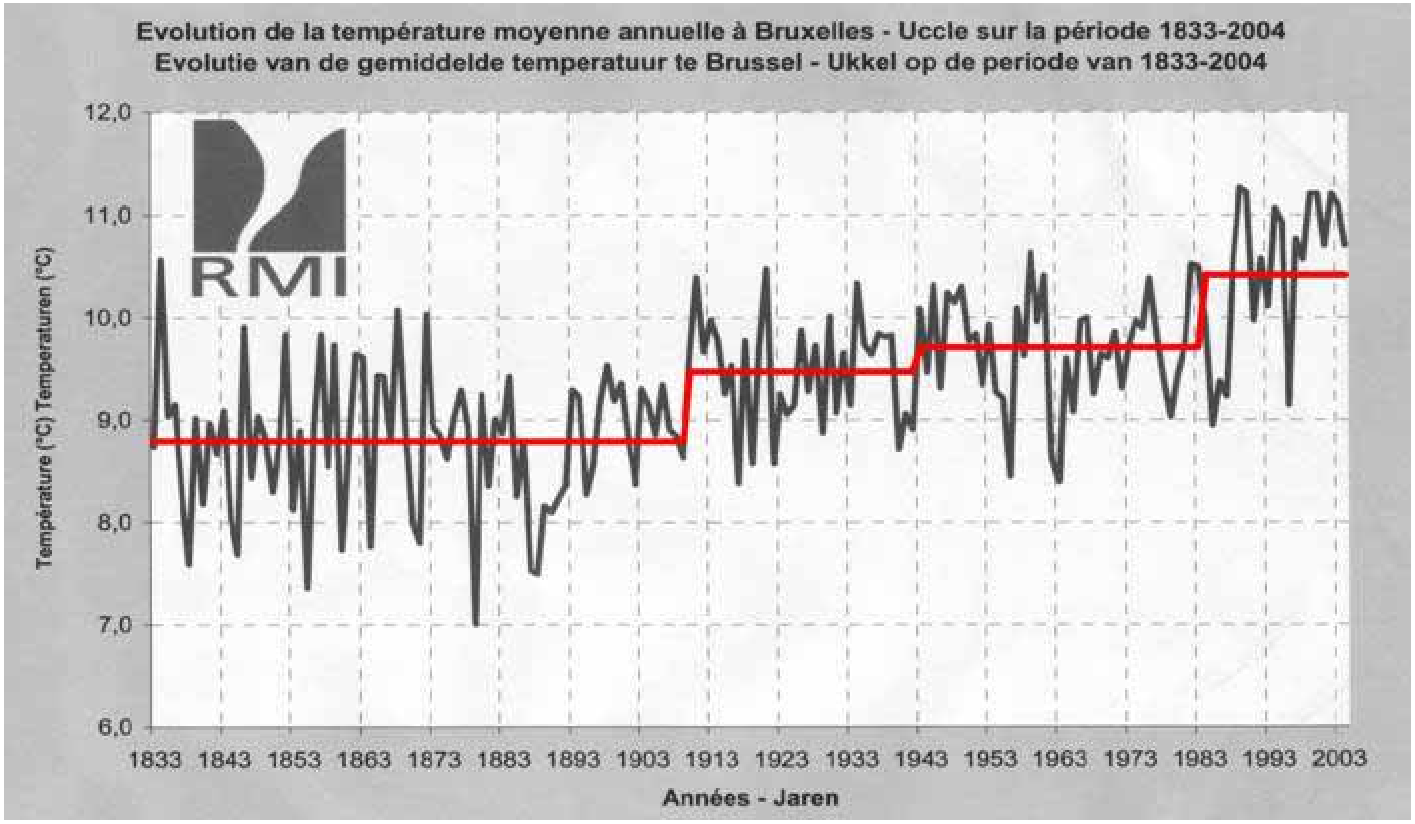
Modelling the contribution of the Brussels heat island to a long temperature record

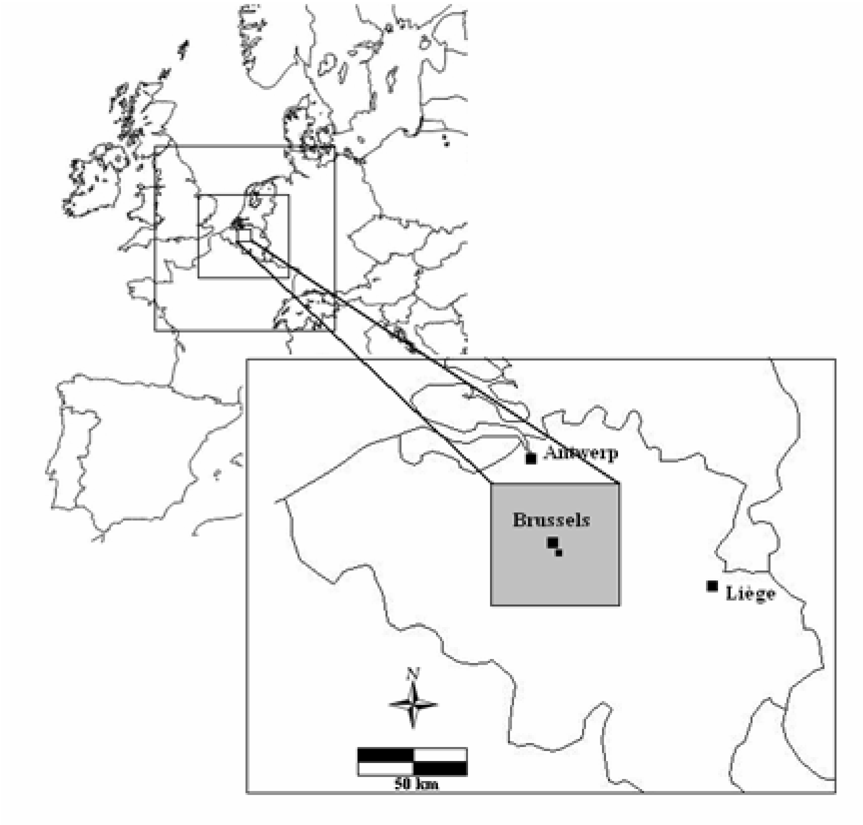
K. Van Weverberg[(1)], K. De Ridder[(2)], A. Van Rompaey[(1)]

(1) Physical and Regional Geography Research Group, K.U.Leuven, Belgium
(2) VITO – Vlaamse Instelling voor Technologisch Onderzoek, Belgium

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

CARTE DE CABINET DES PAYS-BAS AUTRICHIENS LEVÉE A L'INITIATIVE DU COMTE DE FERRARIS

UCCLE 77 (O¹) (2)

Echelle : circa 1/25.000

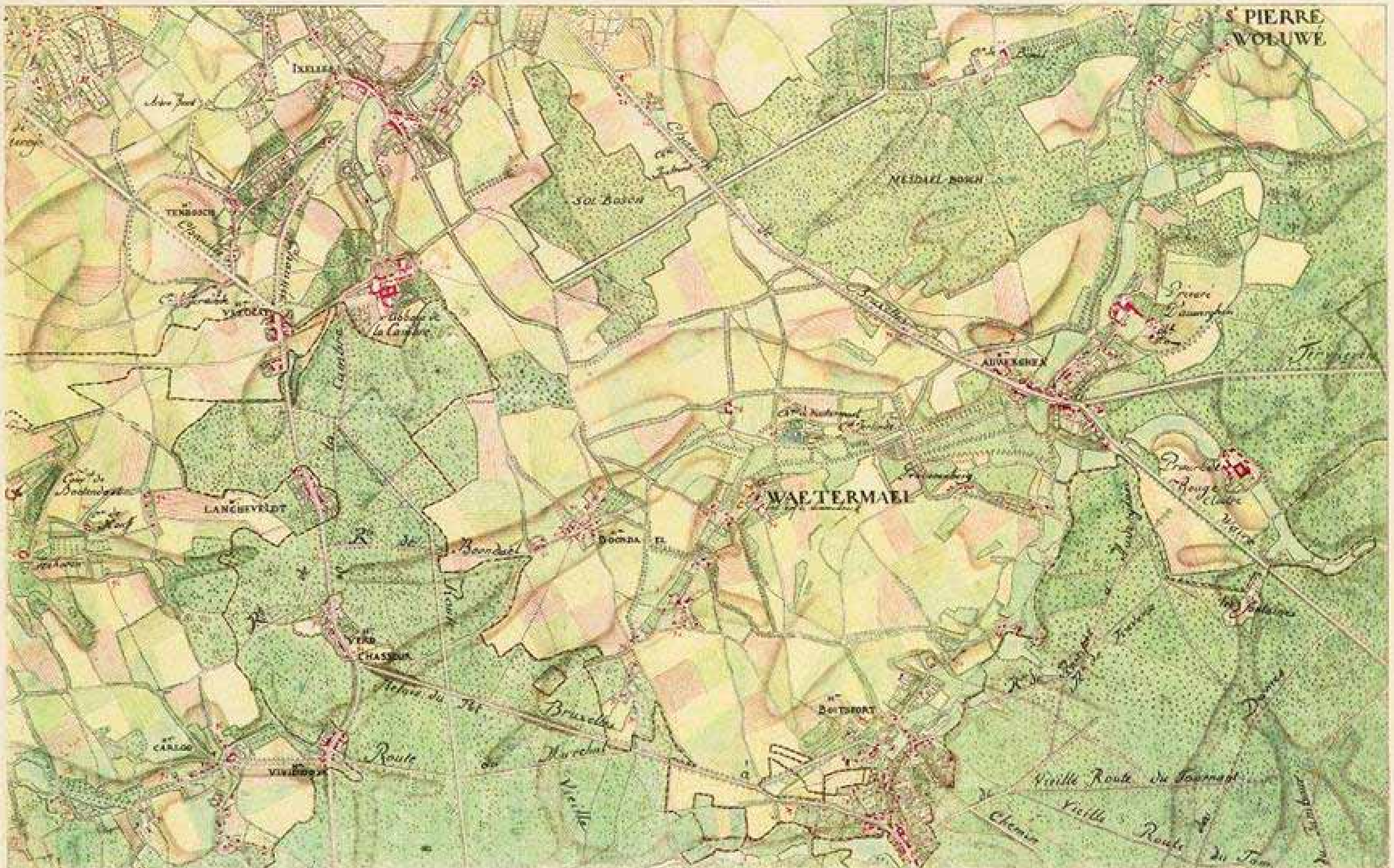
1 Km.

Réduction de l'original : 2,17 fois en longueur; 4,72 fois en superficie.

76 (M¹)

61 (Q¹) 94 (D¹)

78 (F⁸)



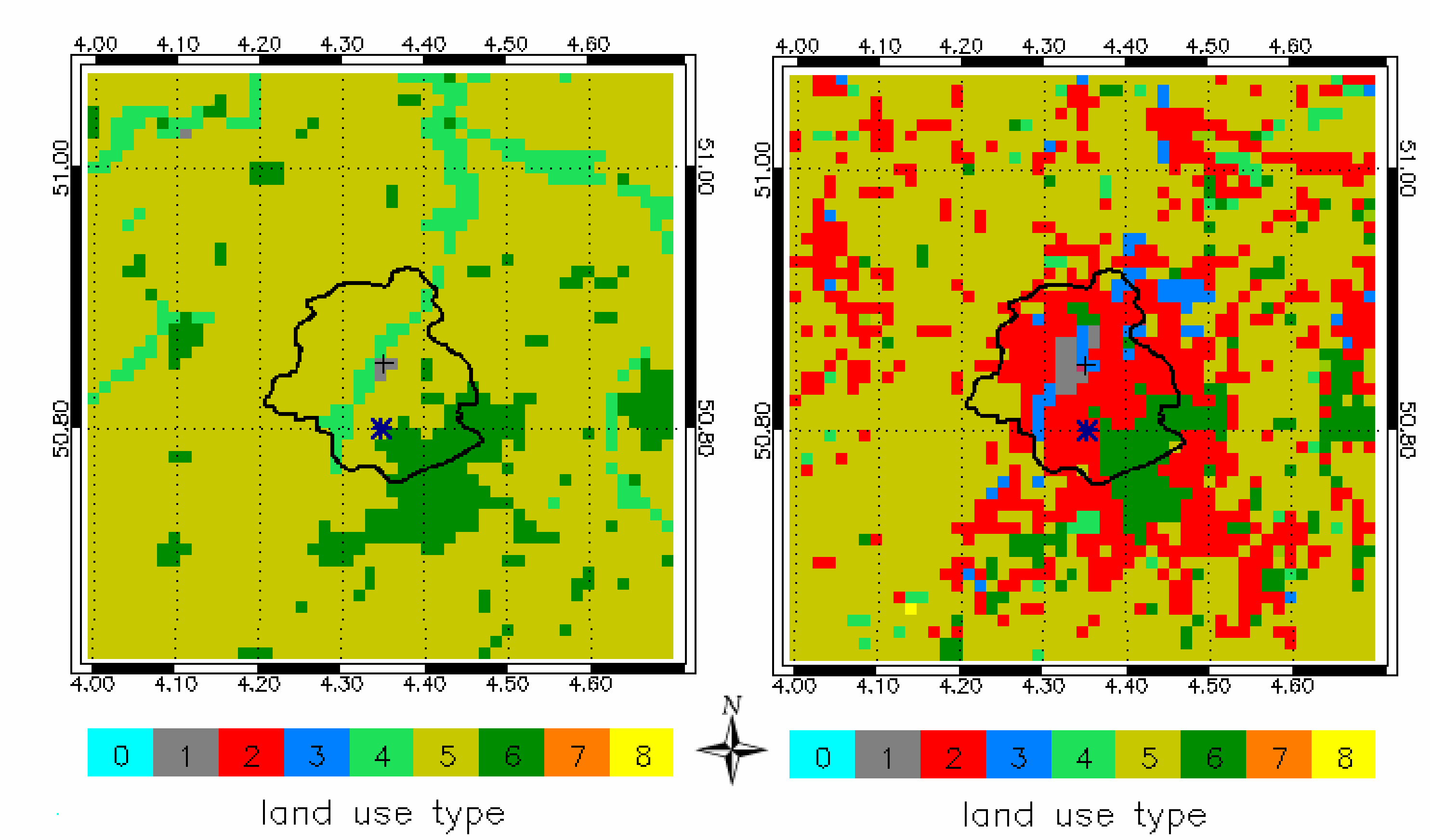
Clichés offset et impression Crédit Communal de Belgique

Pro Civitate

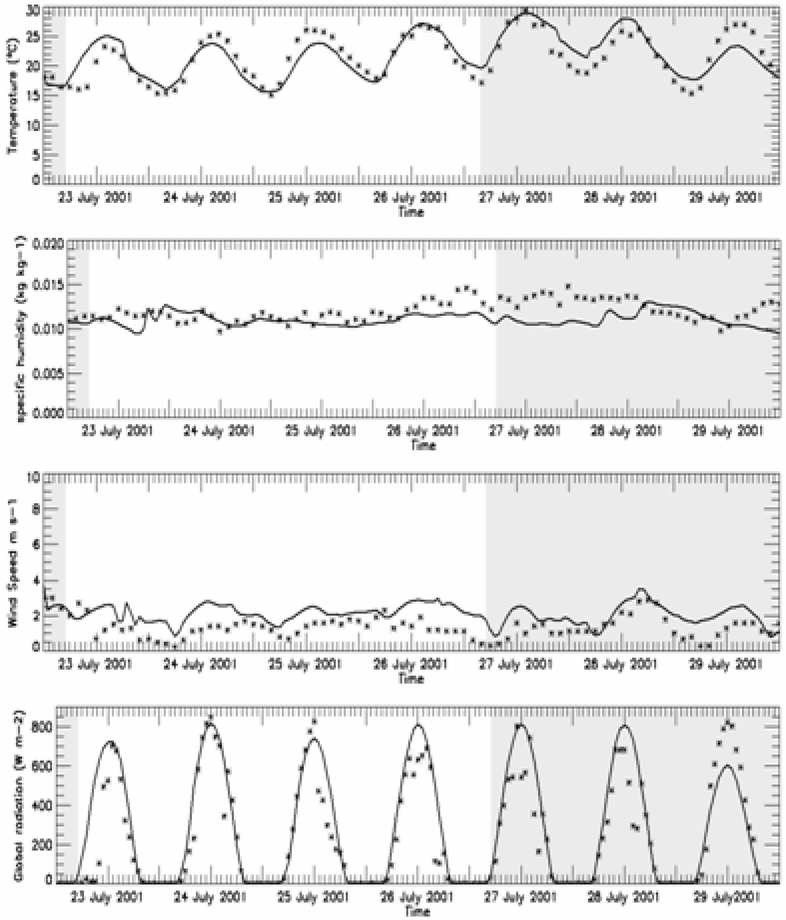
Materials and methods

Land use 1830

Land use 2001



Model evaluation (Uccle)

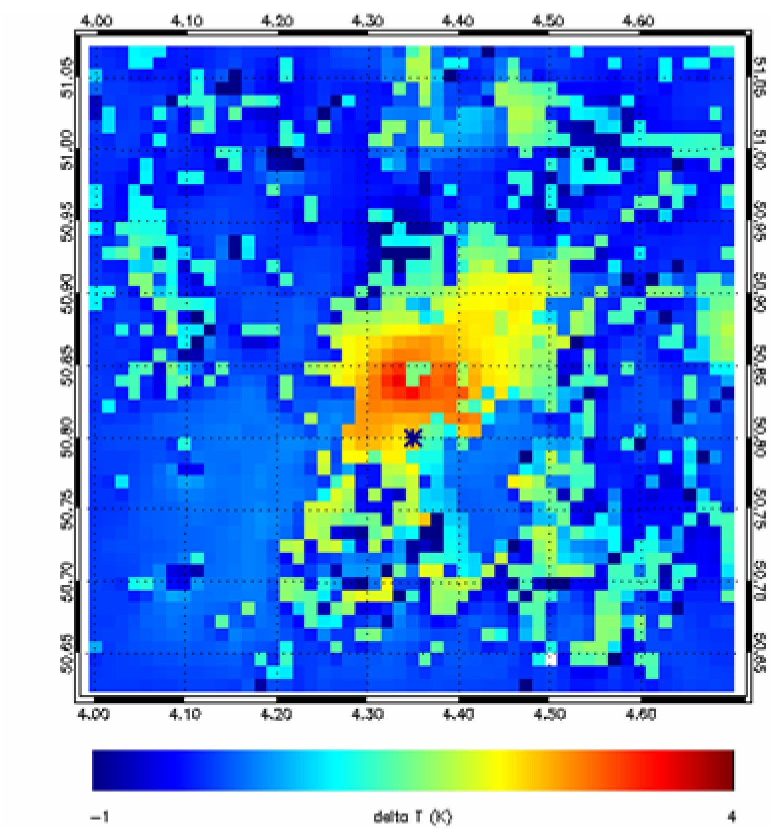


RMSE

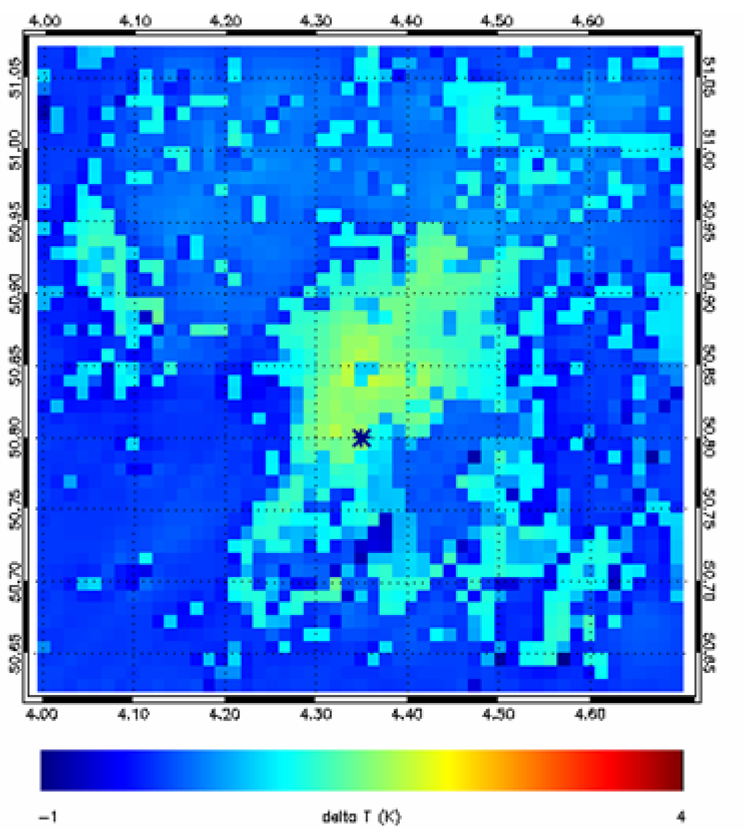
- **T ~ 2 K**
- **q ~ 1 g kg^{-1}**
- **V ~ 1 m s^{-1}**
- **R_s ~ 65 W m^{-2}**

Results

$\Delta T_{U\text{-}R}$ during CW (1 hour after sunset)

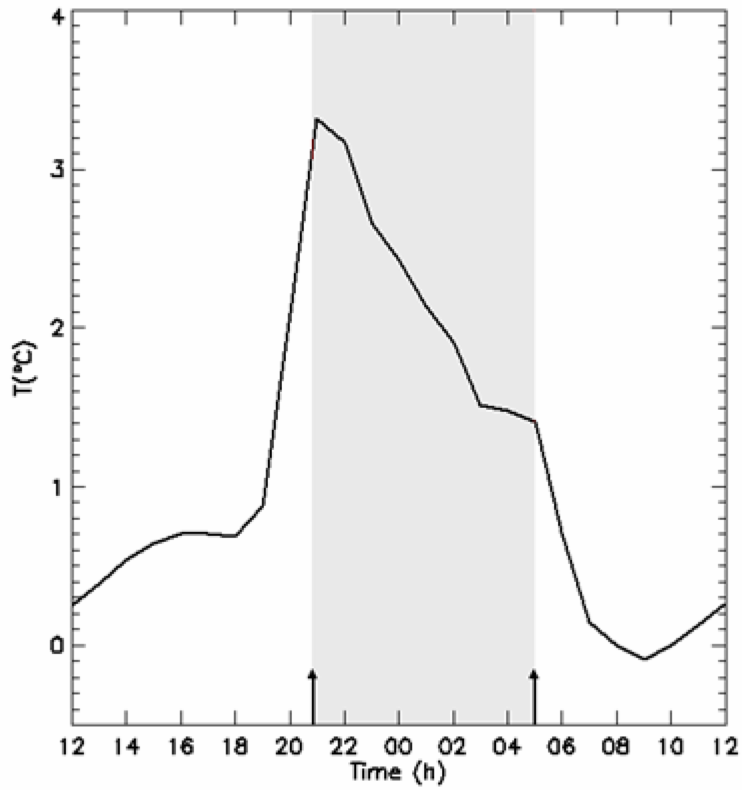


$\Delta T_{U\text{-}R}$ during WW (1 hour after sunset)

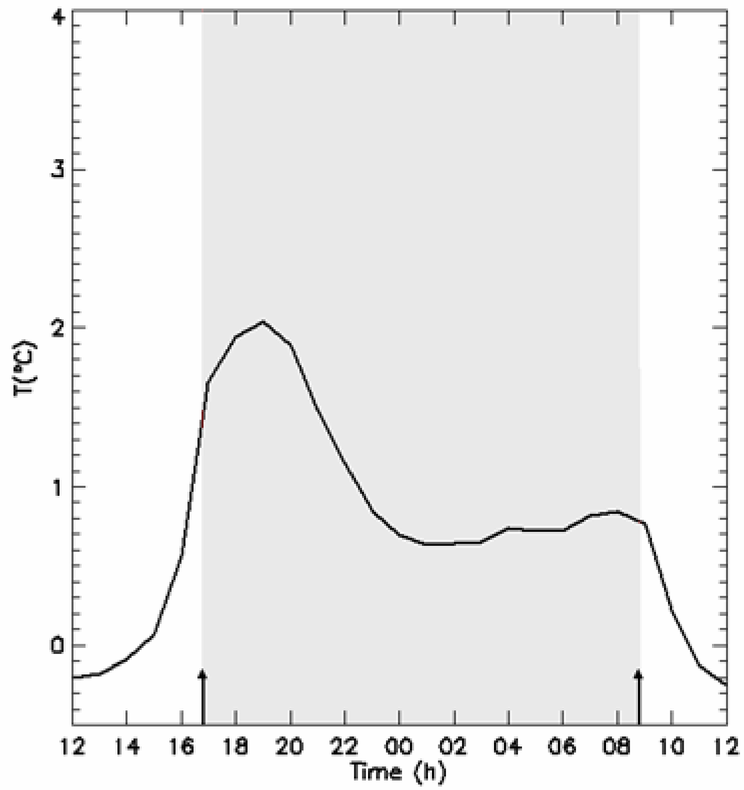


Results

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



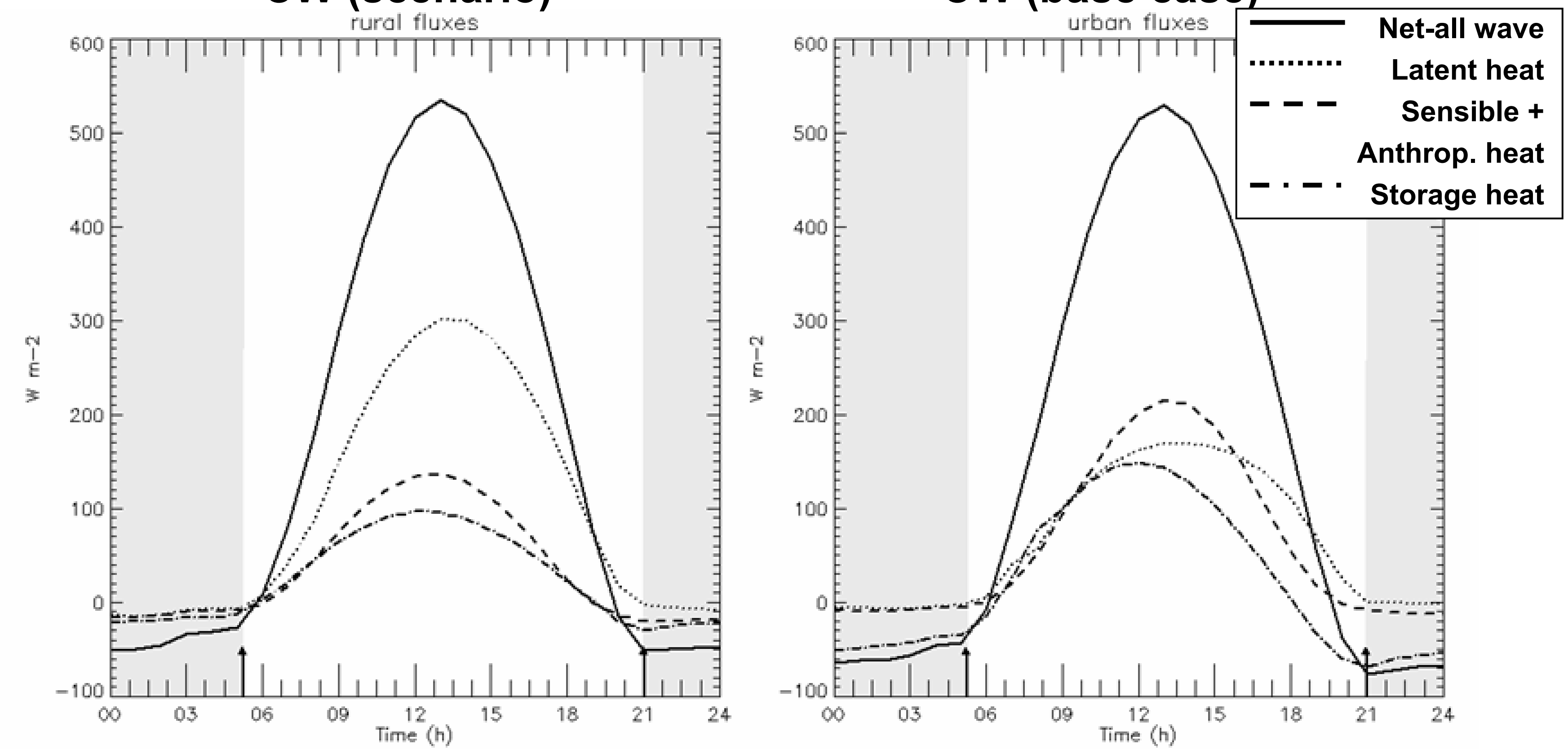
Diurnal $\Delta T_{U\text{-}R}$ evolution WW in Uccle



Results

Diurnal flux evolution
CW (scenario)

Diurnal flux evolution
CW (base case)



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)