Urban parametrization for a regional climate model: applications for Belgium

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MACCBET final symposium Brussels, June 1st, 2015
Changes in global society

- Technological and scientific advancements
- Industrialization, trading and business

-> Growth in assets, services and population

1800 -> 2014: 1 billion -> 7 billion
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Sensible heat

Ground

Atmosphere

Evapotranspiration = transpiration + evaporation

Transpiration

trees

grass

Evaporation

Runoff

Groundwater recharge

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Trapped solar radiation
Dry surface, no vegetation: no evapotranspiration
Trapped infra-red irradiation
Efficient conversion
Efficient storage in urban structures
Heat release during nighttime.

Stored heat in the atmosphere.

Heat uptake at the ground.

Evapotranspiration = transpiration + evaporation.

Nighttime heat release.

Stored heat.

Hot surface is cooling.

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Regional climate model COSMO-CLM

Urban adaptation – vegetation – water management – energy use – building characteristics

Urban land-use change

Climate change Scenario’s

Urban risk Assessment

City-level impact and extremes: temperature – precipitation

Local impact models:
- Heat stress indicators (heat waves)
- Air quality modelling (ozone peaks)
- River and sewage models (floods)

High-resolution weather prediction for cities

Atmosphere

Temperature, precipitation, wind

Downward radiation

Surface-layer

Sensible heat, Evapotranspiration, Upwelling radiation

Drag on the wind

TERRA-ML → TERRA-URB


Boundary data from GCM or Reanalysis

COSMO-CLM4.8 + TERRA-URB

Vegetation in Spring (%)

Impervious surface Area (%)
Minimum temperatures for cities in Belgium

Hindcast 2000-2010

Urban expansion

Impervious surface area [%]

Climate Change

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Averaged mid-summer Midnight

Wouters, H., Demuzere, M., Blahak, U., De Ridder, K., van Lipzig N.,
The seasonal dependency of urban heat islands and their climatic drivers at the mid-latitude: A model-based case study for Belgium (submitted to JGR: Atmospheres)
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λ -> air-quality model AURORA

Modelled zonal ozone Transect through Brussels on August 2009/08/16 – 9PM – UTC

Regional climate model

COSMO-CLM

TERRA-URB

Scenario's
- Urban land-use change
- Climate change

Urban adaptation
- Vegetation
- Water management
- Energy use
- Building characteristics

Regional climate model

City-level impact and extremes:
- Temperature
- Precipitation

Local impact models:
- Heat stress indicators (heat waves)
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