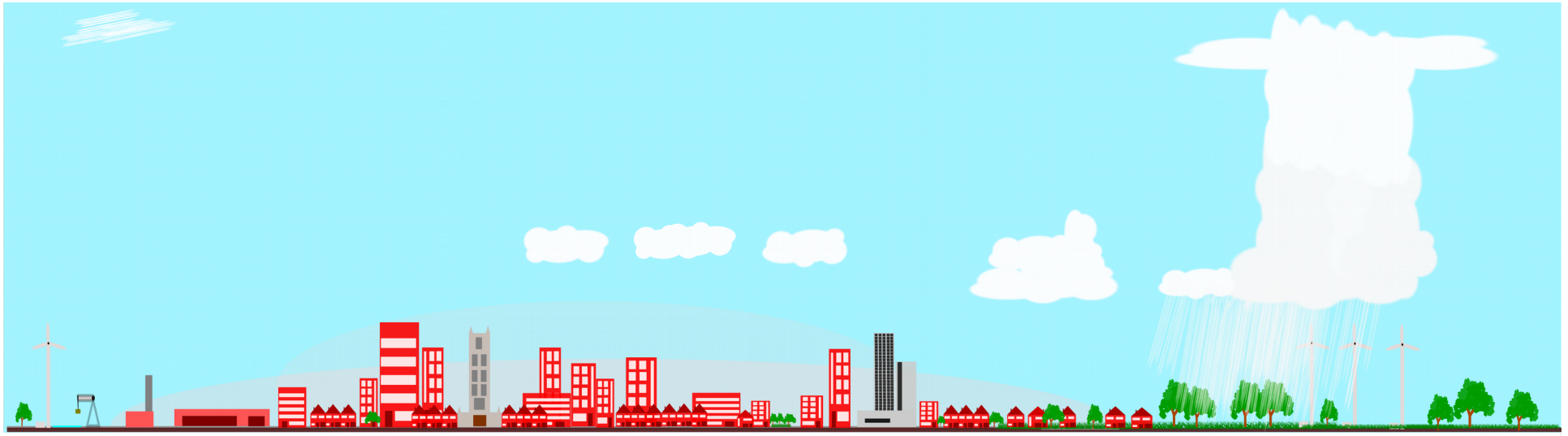
Studying the local microclimate in Gent



Steven Caluwaerts

ALADIN-Hirlam Workshop

UNIVERSITEIT GENT

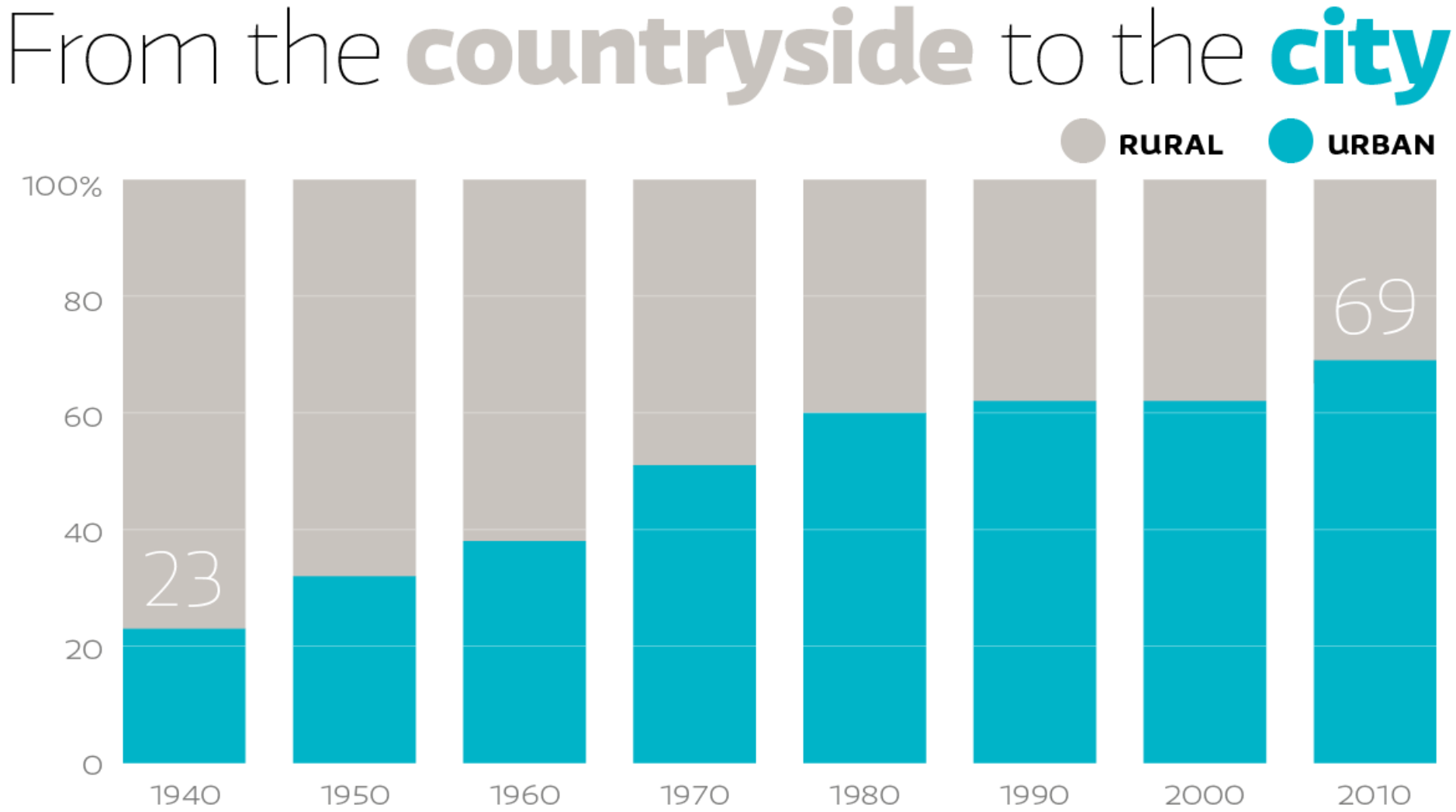
KMI

What to expect?

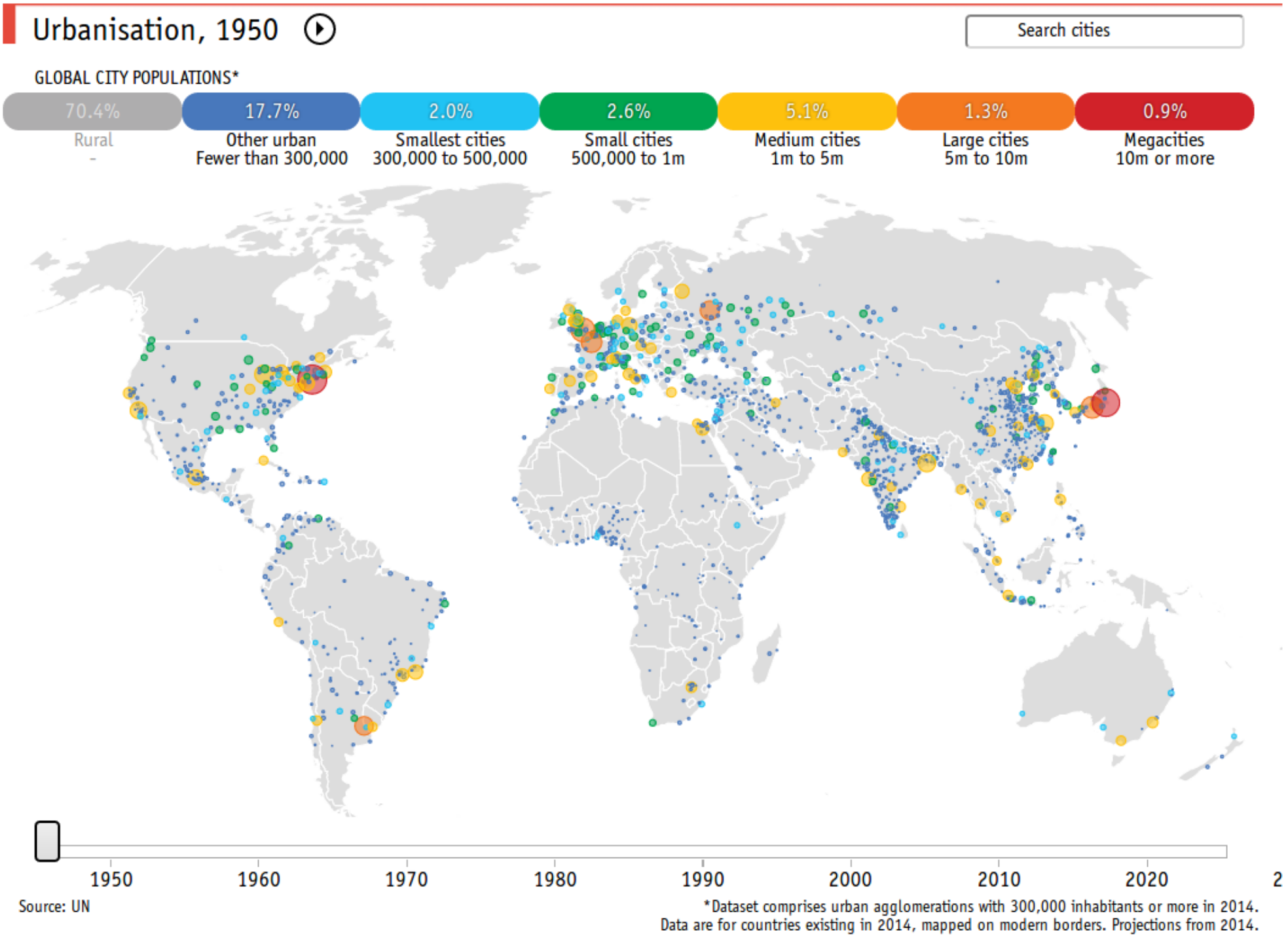
- Introduction urban microclimate
- MOCCA network Gent
- first analysis of MOCCA measurements
- modelling the UHI of Gent

Finland's flight from the country

WATCH HOW FINLAND'S POPULATION FLOWED FROM RURAL AREAS TO THE CITIES



http://yle.fi/uutiset/osasto/news/flight_from_the_country_how_finland_moved_from_rural_areas_to_the_cities/7677896



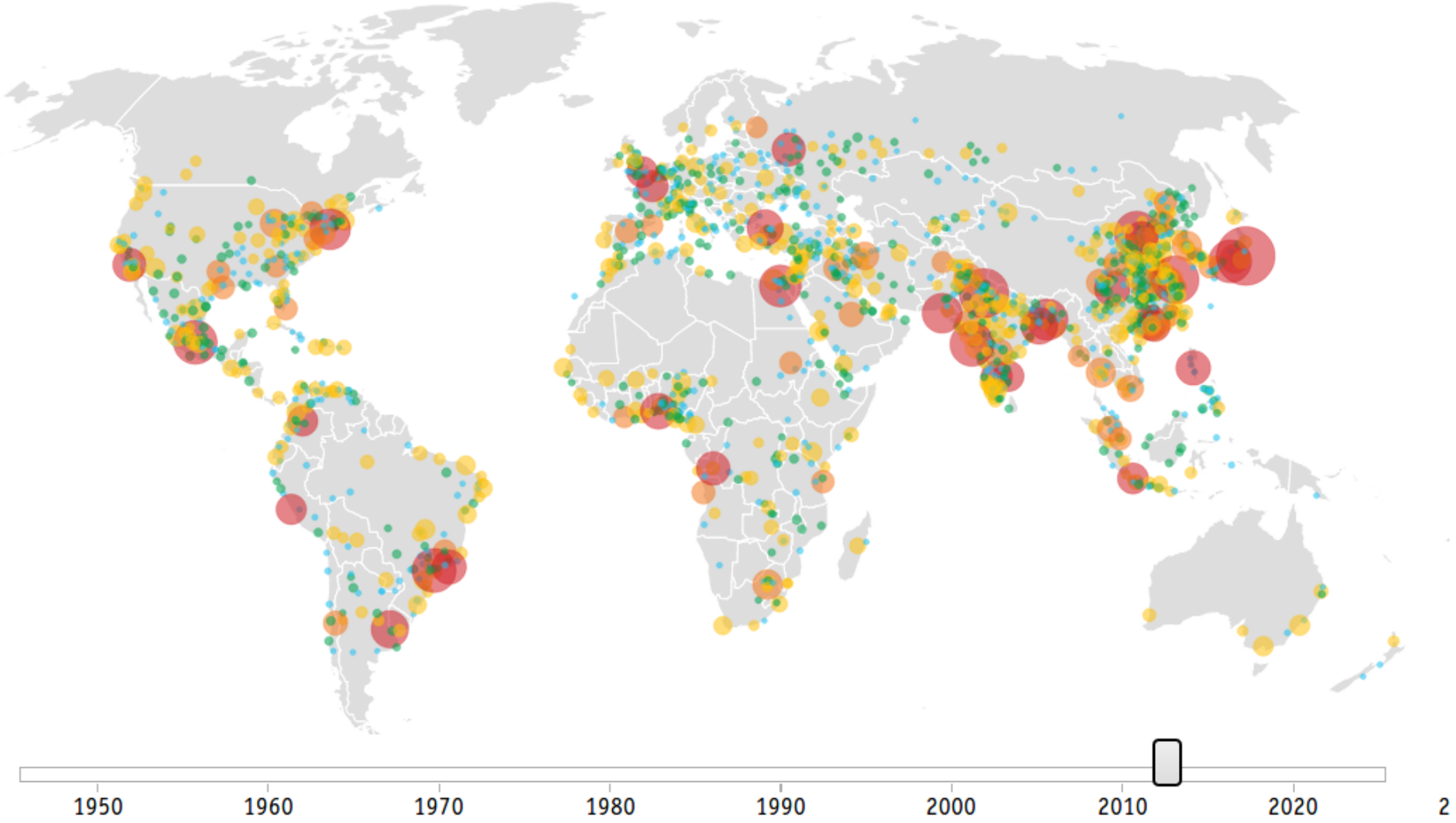
http://www.economist.com/node/21642053?fsrc=scn/tw/te/dc/brightlightsbigcities

Urbanisation, 2017

Search cities

GLOBAL CITY POPULATIONS*

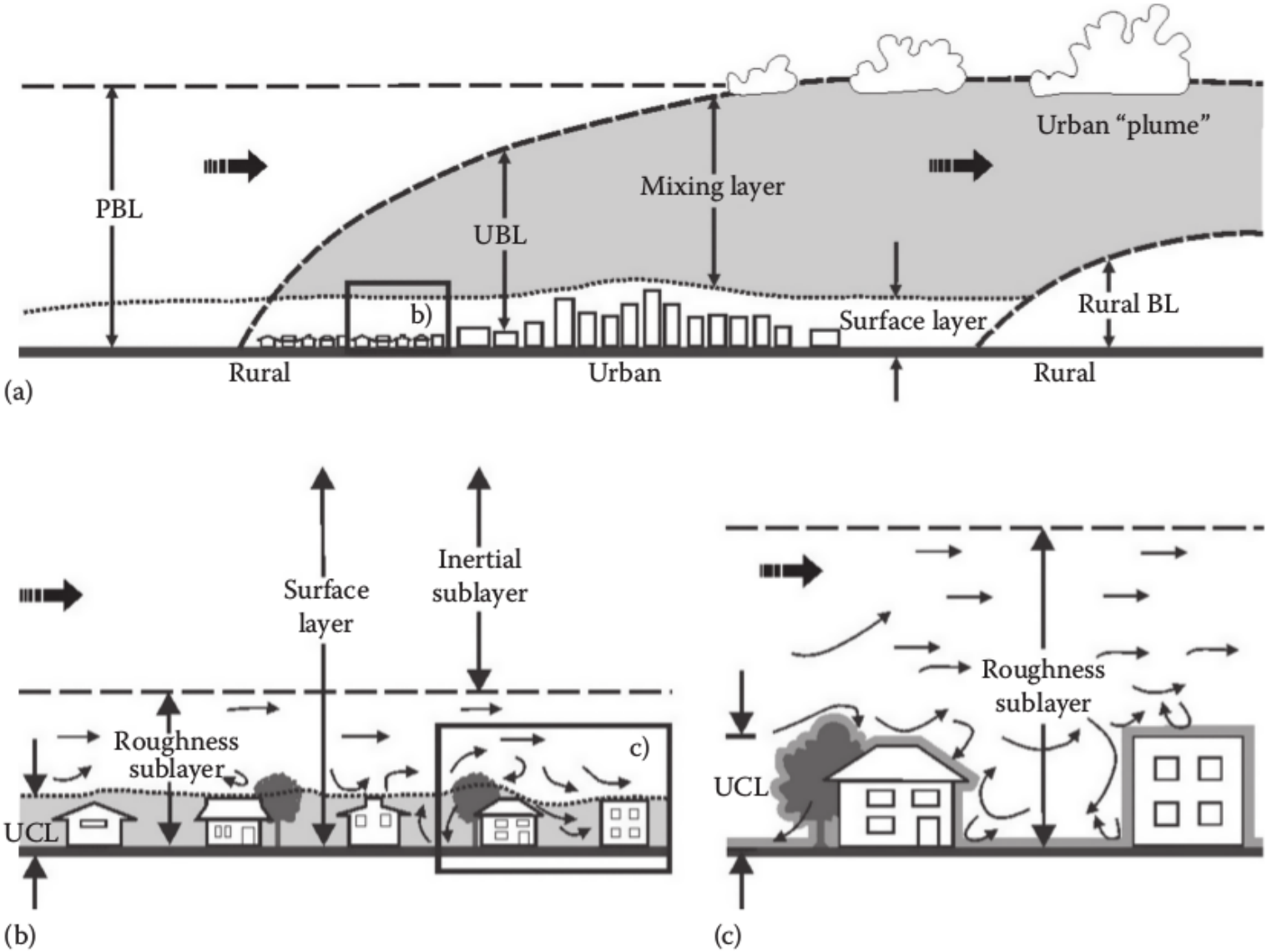
46.0%	23.2%	3.6%	5.1%	11.6%	4.2%	6.4%
Rural	Other urban Fewer than 300,000	Smallest cities 300,000 to 500,000	Small cities 500,000 to 1m	Medium cities 1m to 5m	Large cities 5m to 10m	Megacities 10m or more



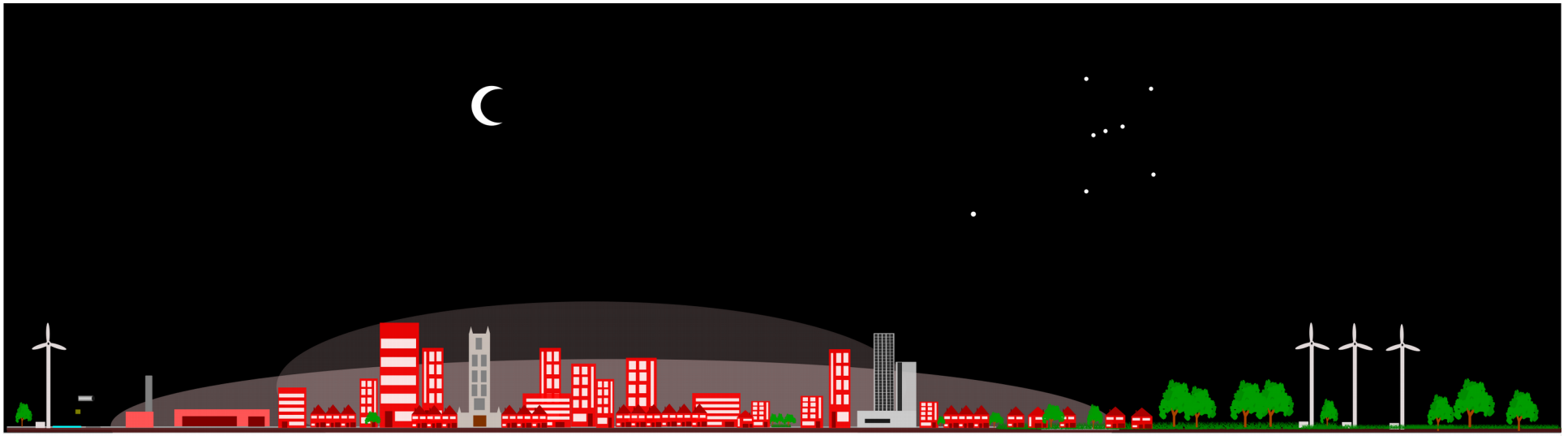
Source: UN

*Dataset comprises urban agglomerations with 300,000 inhabitants or more in 2014.
Data are for countries existing in 2014, mapped on modern borders. Projections from 2014.

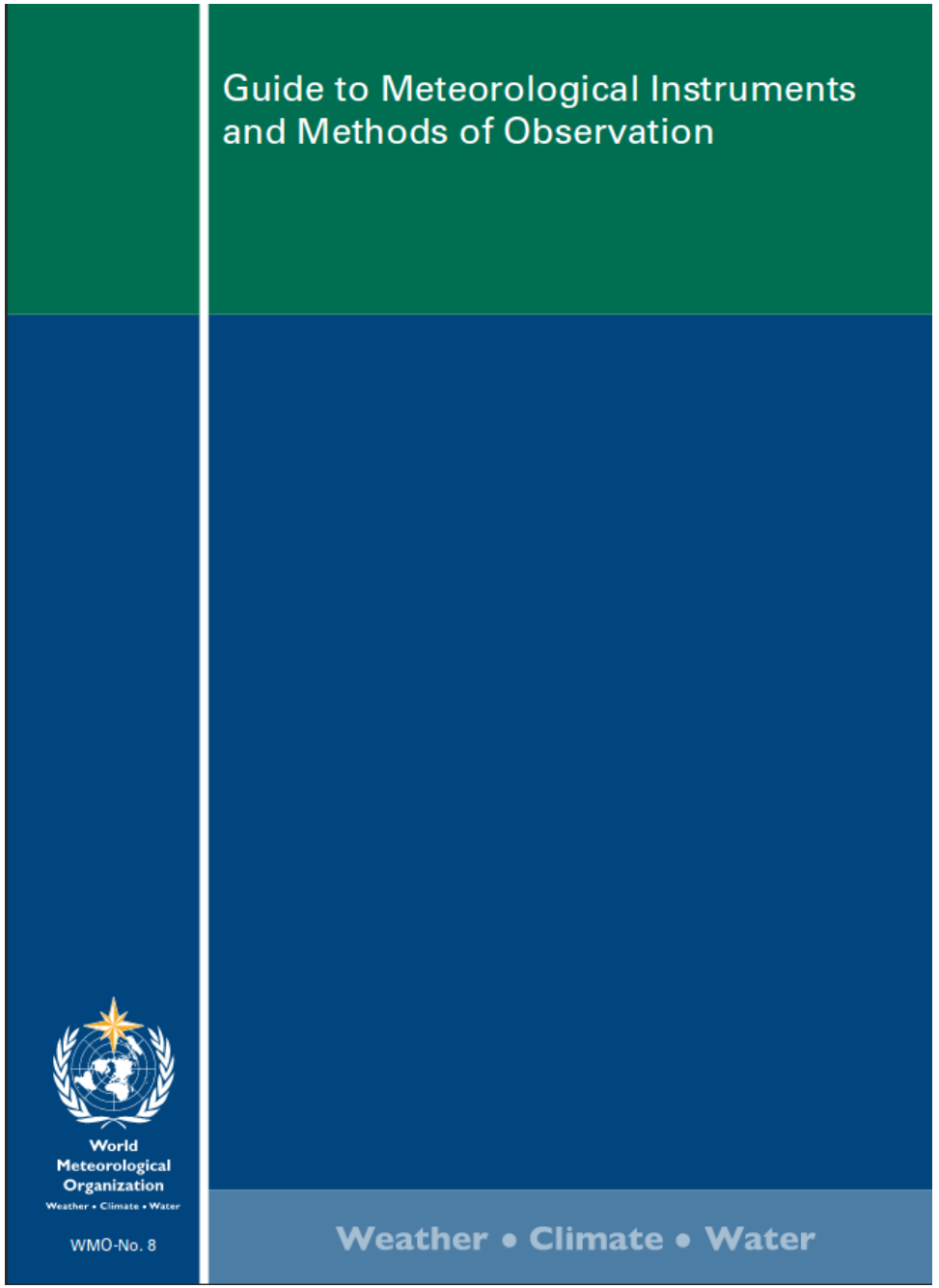
Cities interact with the atmosphere on multiple scales.



The urban heat island.



For the city of Gent we measure differences up to 7 °C.



Urban observations are difficult but needed.

WORLD METEOROLOGICAL ORGANIZATION

INSTRUMENTS AND OBSERVING METHODS
REPORT No. 81

INITIAL GUIDANCE TO OBTAIN REPRESENTATIVE METEOROLOGICAL OBSERVATIONS AT URBAN SITES

Tim R. Oke (Canada)

WMO/TD-No. 1250
2006

INTERNATIONAL JOURNAL OF CLIMATOLOGY
Int. J. Climatol. **31**: 200–217 (2011)
Published online 15 April 2010 in Wiley Online Library
(wileyonlinelibrary.com) DOI: 10.1002/joc.2141

RMetS
Royal Meteorological Society

A systematic review and scientific critique of methodology in modern urban heat island literature

I. D. Stewart*
Department of Geography, University of British Columbia, Vancouver, BC Canada

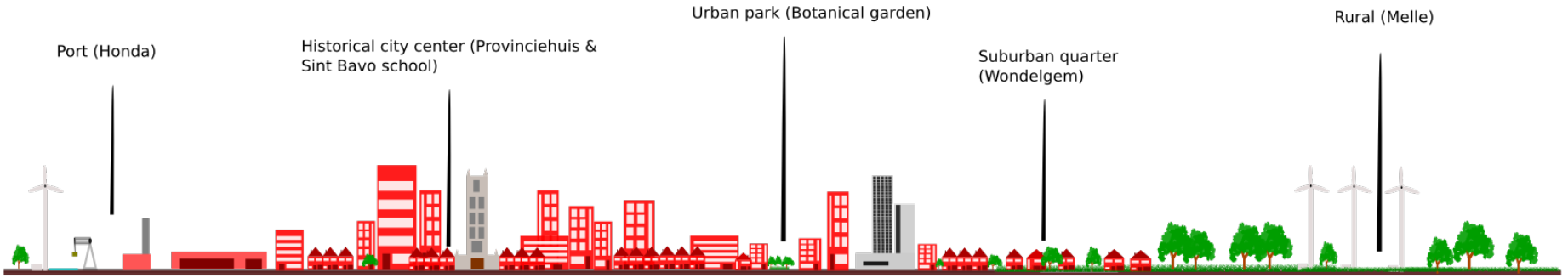
ABSTRACT: In the modern era of urban climatology, much emphasis has been placed on observing and documenting heat island magnitudes in cities around the world. Urban climate literature consequently boasts a remarkable accumulation of observational heat island studies. Through time, however, methodologists have raised concerns about the authenticity of these studies, especially regarding the measurement, definition and reporting of heat island magnitudes. This paper substantiates these concerns through a systematic review and scientific critique of heat island literature from the period 1950–2007. The review uses nine criteria of experimental design and communication to critically assess methodological quality in a sample of 190 heat island studies. Results of this assessment are discouraging: the mean quality score of the sample is just 50 percent, and nearly half of all urban heat island magnitudes reported in the sample are judged to be scientifically indefensible. Two areas of universal weakness in the literature sample are *controlled measurement* and *openness of method*: one-half of the sample studies fail to sufficiently control the confounding effects of weather, relief or time on reported 'urban' heat island magnitudes, and three-quarters fail to communicate basic metadata regarding instrumentation and field site characteristics. A large proportion of observational heat island literature is therefore compromised by poor scientific practice. This paper concludes with recommendations for improving method and communication in heat island studies through better scrutiny of findings and more rigorous reporting of primary research.

MOCCA

(MOnitoring the City's Climate and Atmosphere)

Gent;
about 250 000 inhabitants; no orography

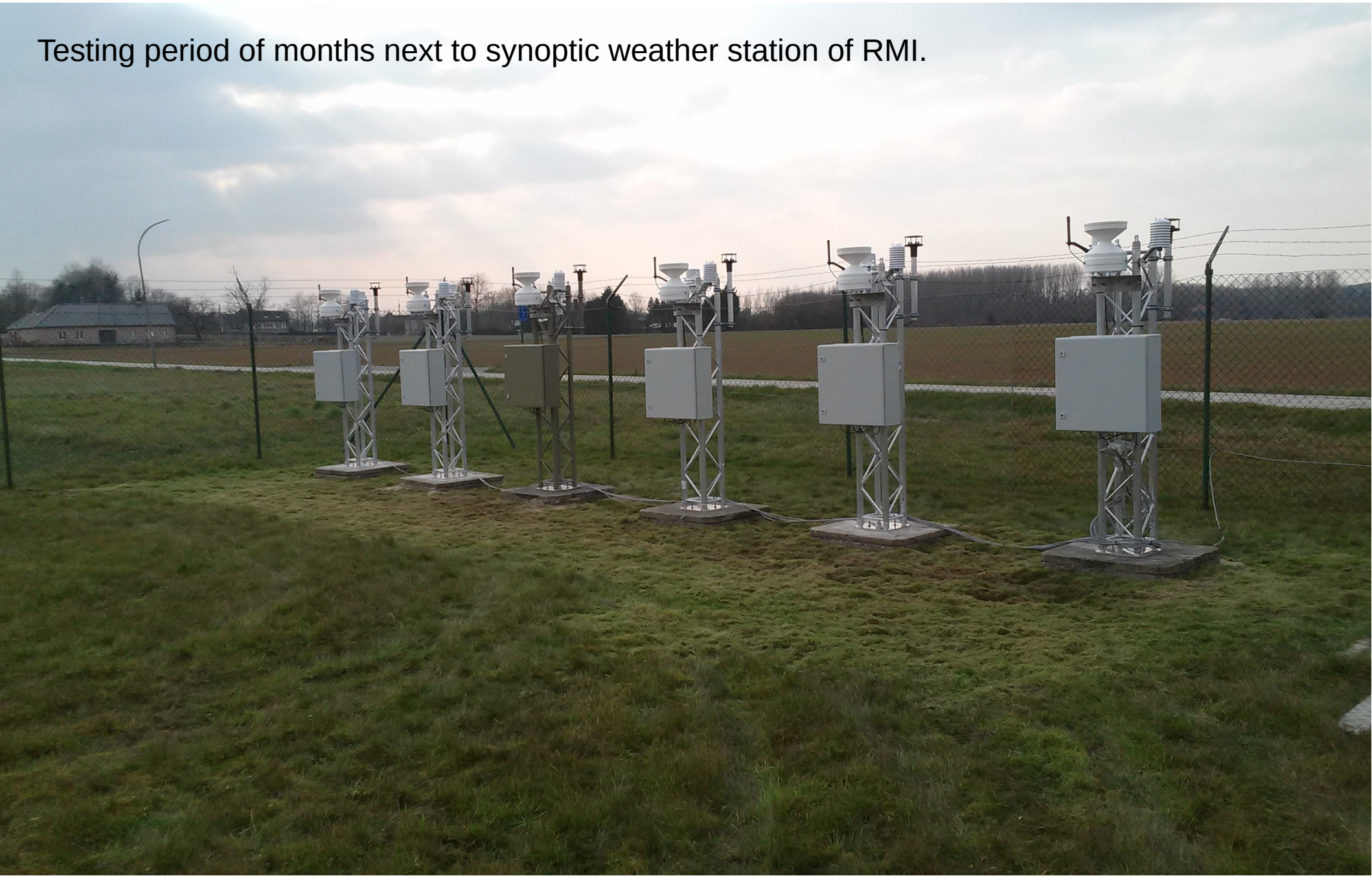
Study local climate zones in Gent



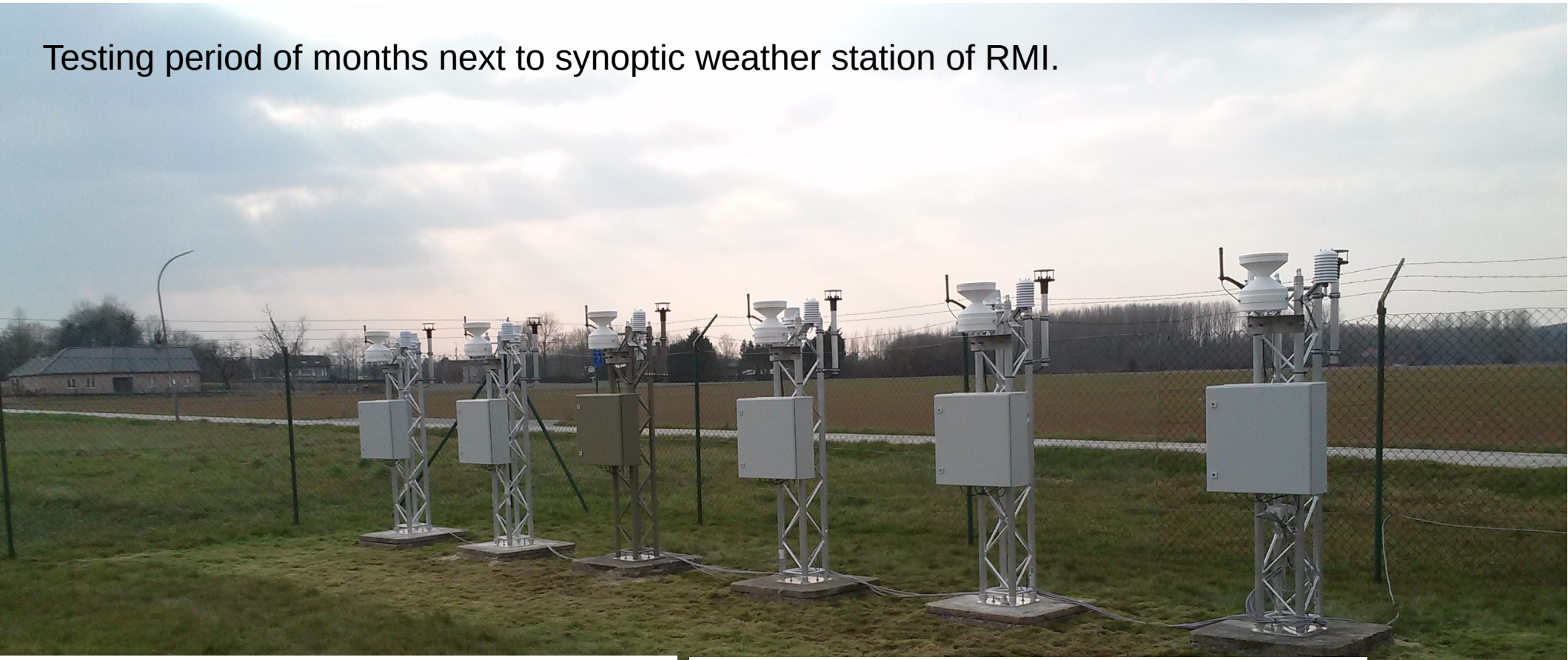
UNIVERSITEIT GENT
KMI
FARYS
vito

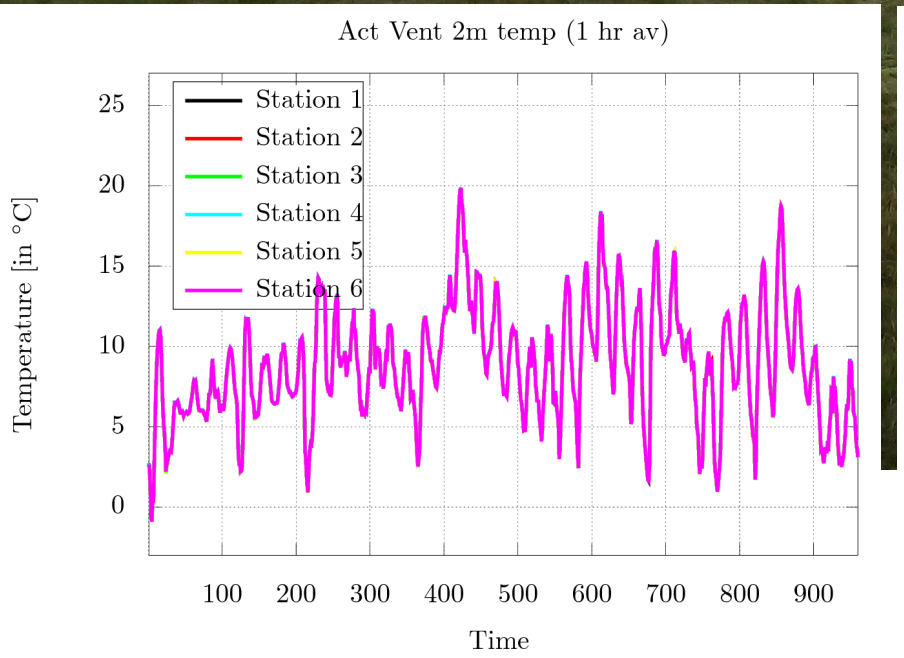
MOCCA sensors

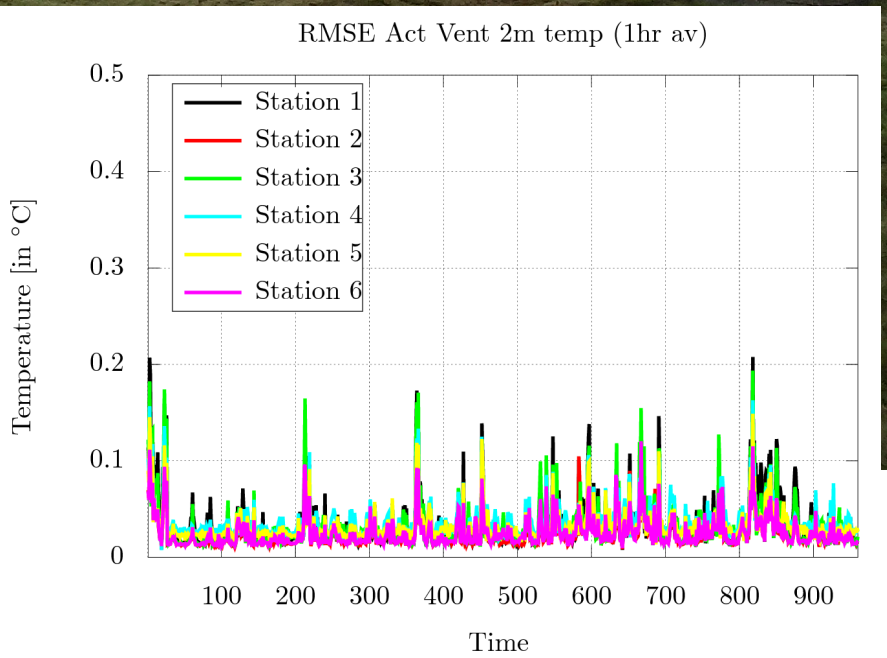
Testing period of months next to synoptic weather station of RMI.



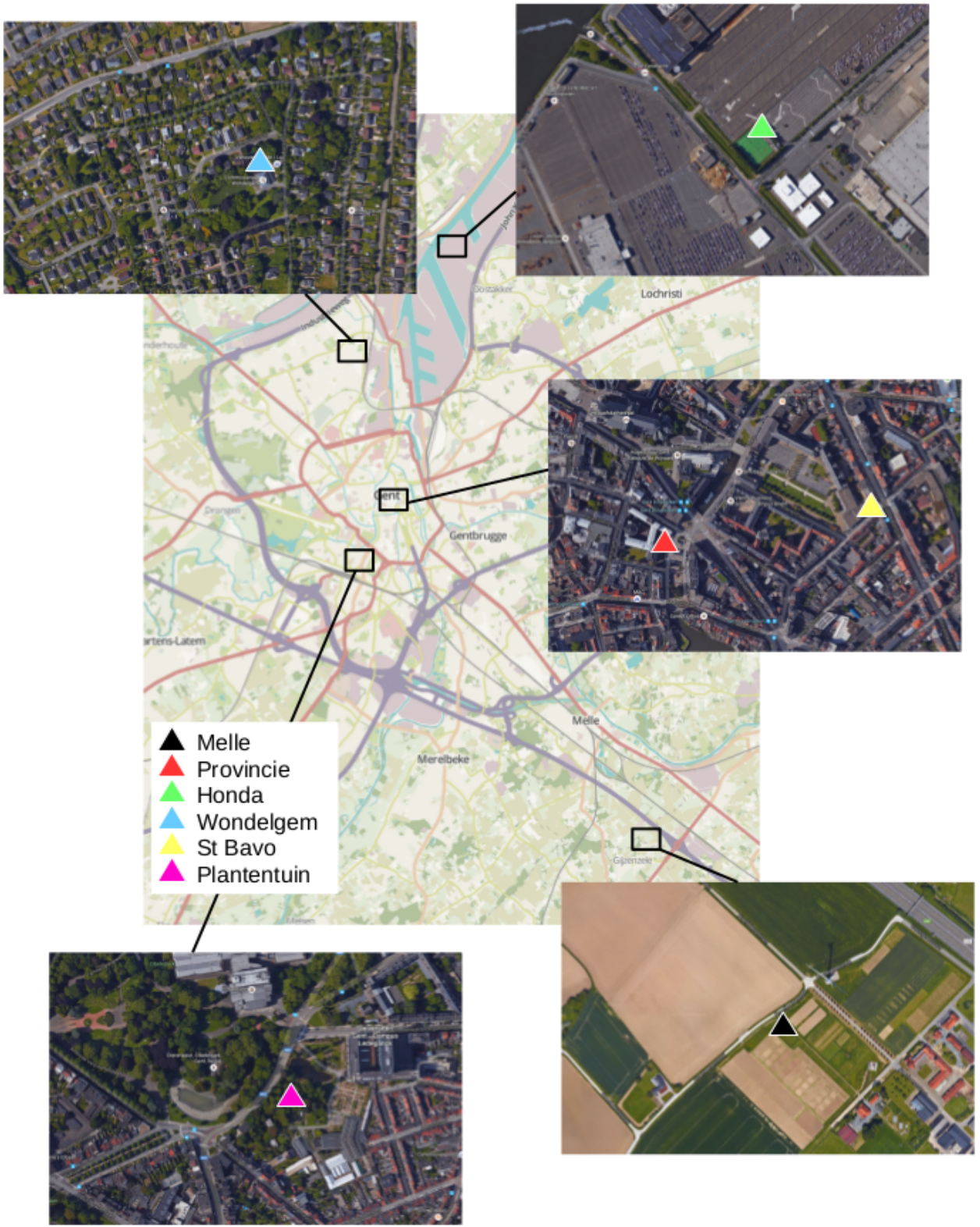
Testing period of months next to synoptic weather station of RMI.



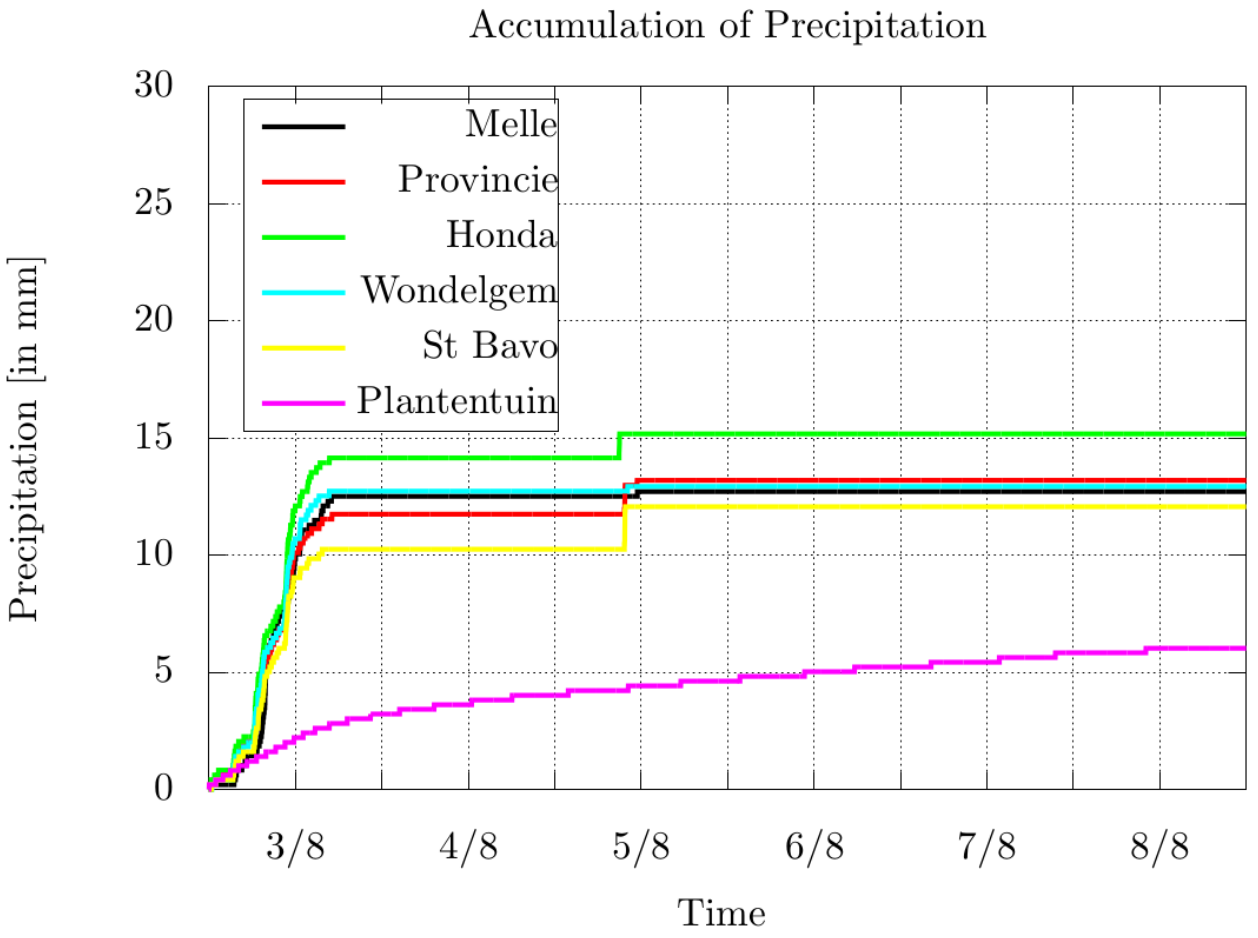




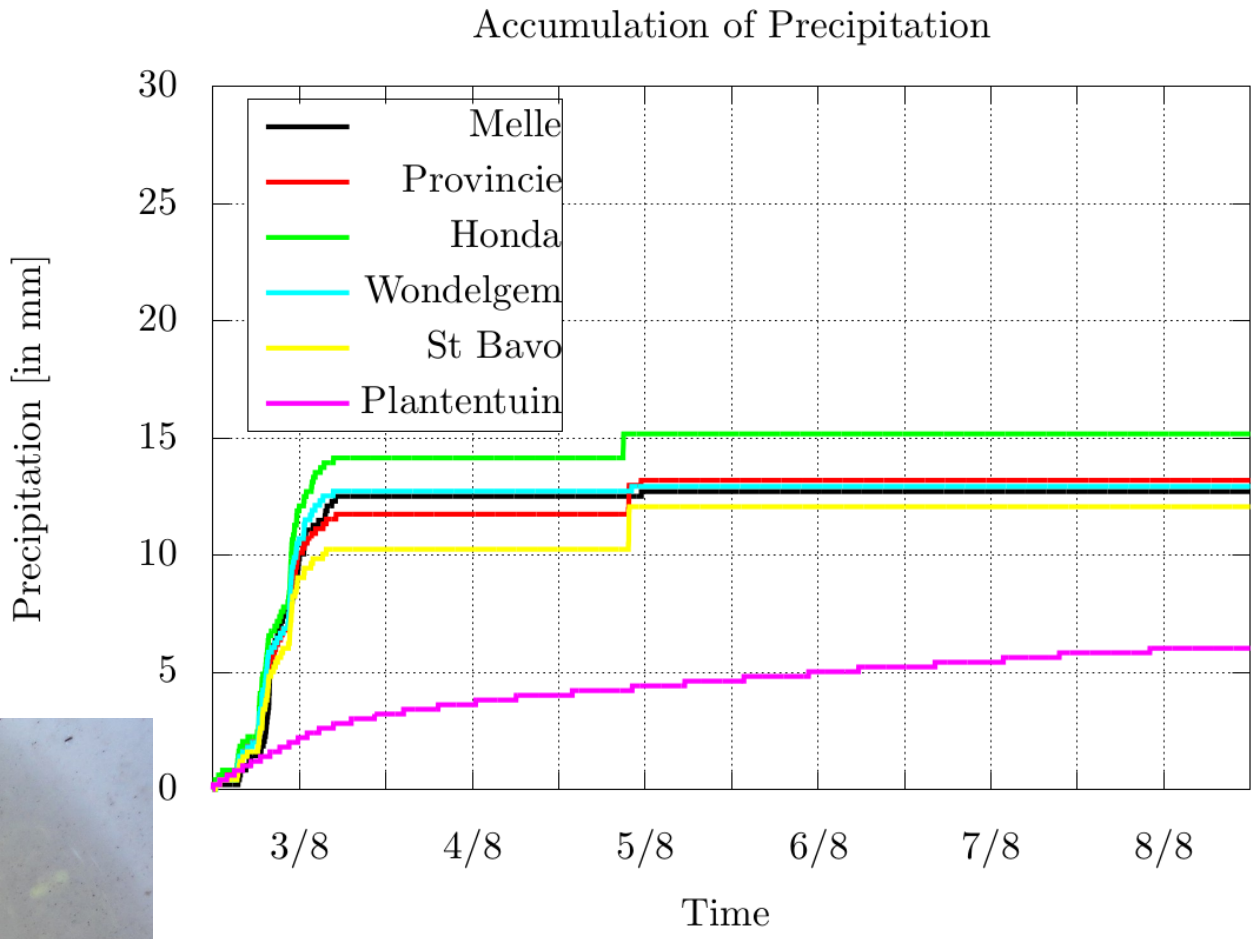
From July 2016 on 6 stations are located in different local climate zones.

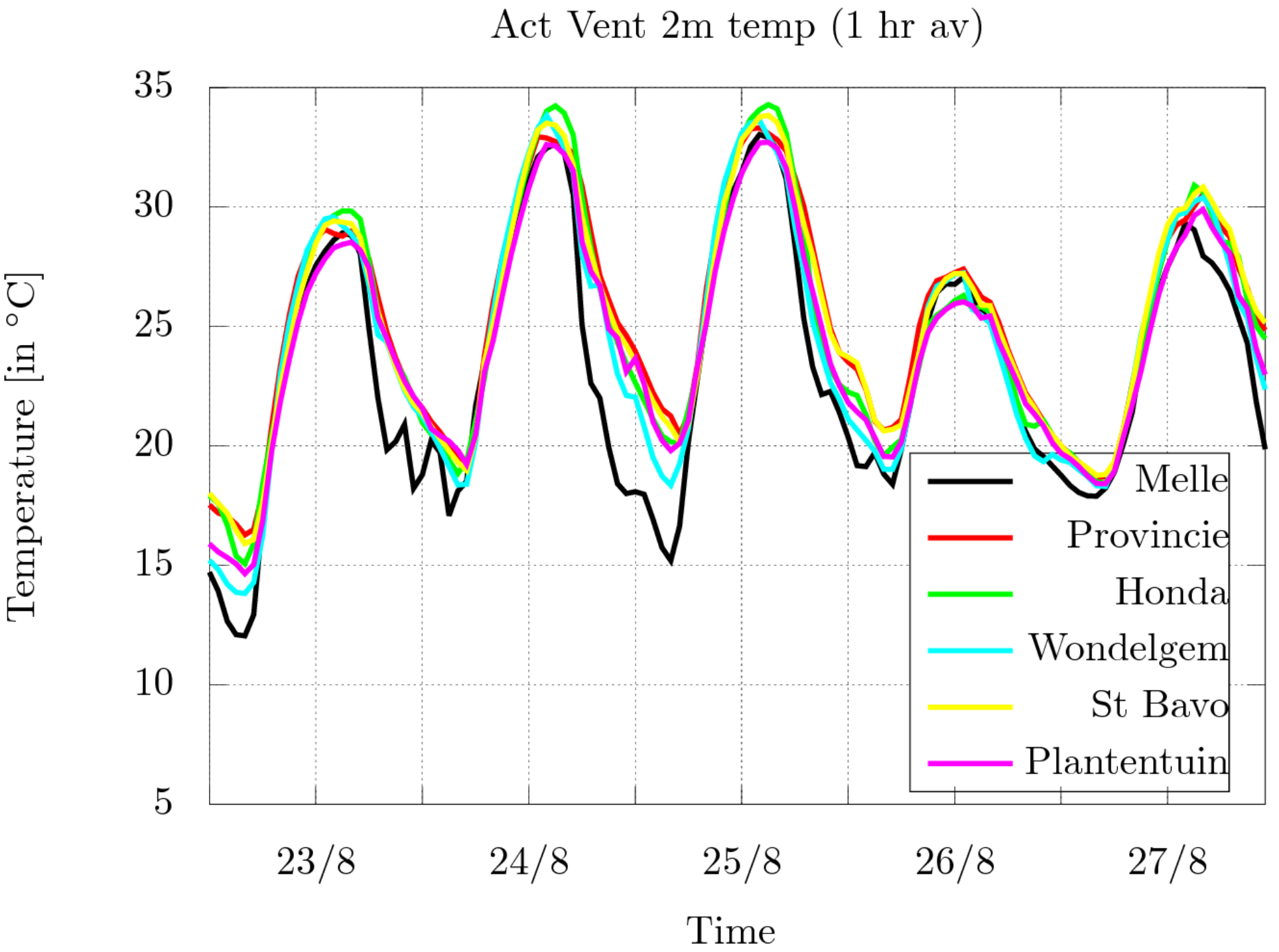


First conclusion: be careful with observations!

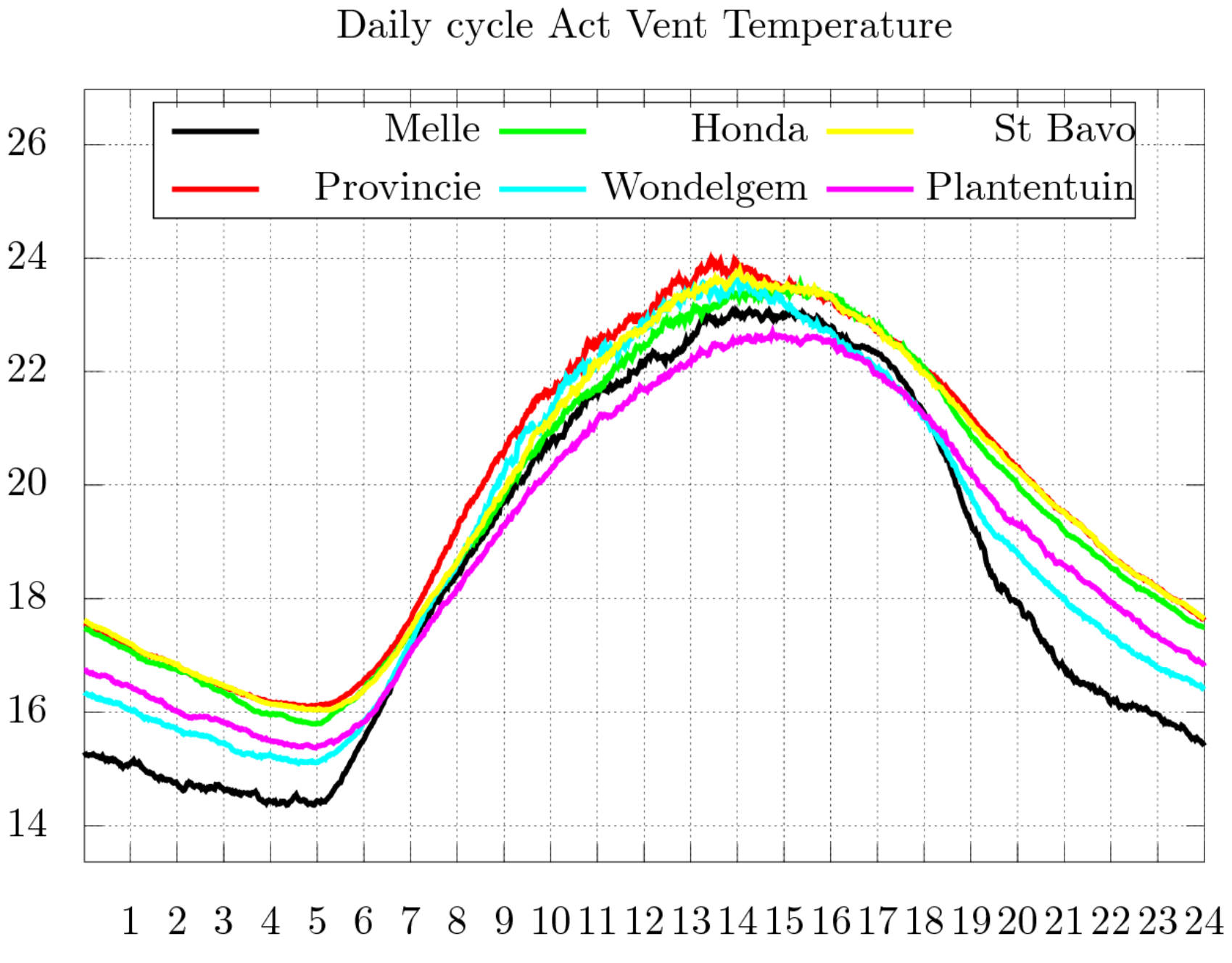


First conclusion: be careful with observations!

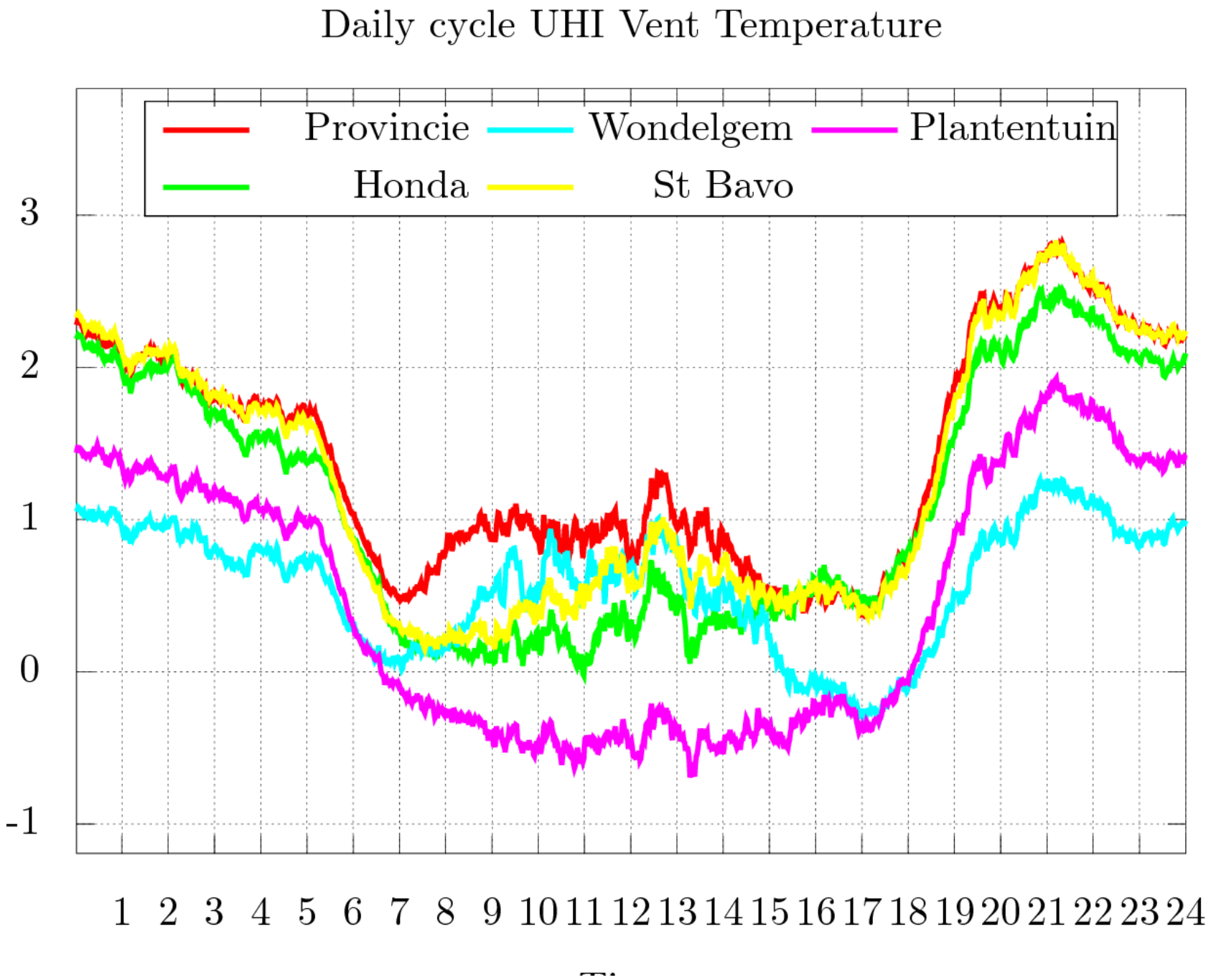



Act Vent 2m temp (1 hr av)
Temperature [in °C]
35
30
25
20
15
10
5
23/8
24/8
25/8
26/8
27/8
Time
Melle
Provincie
Honda
Wondelgem
St Bavo
Plantentuin

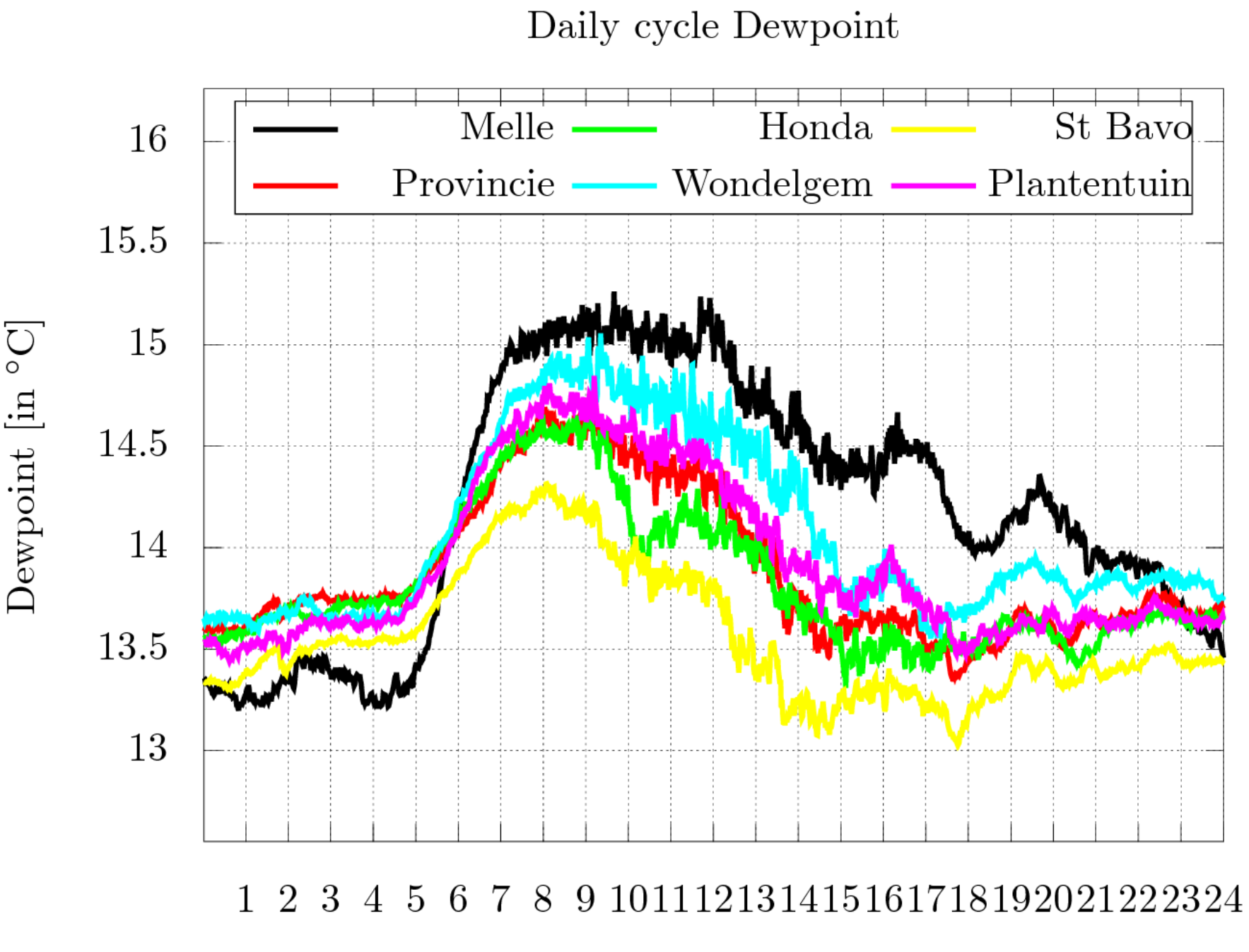
Average daily cycle temperature in August 2016



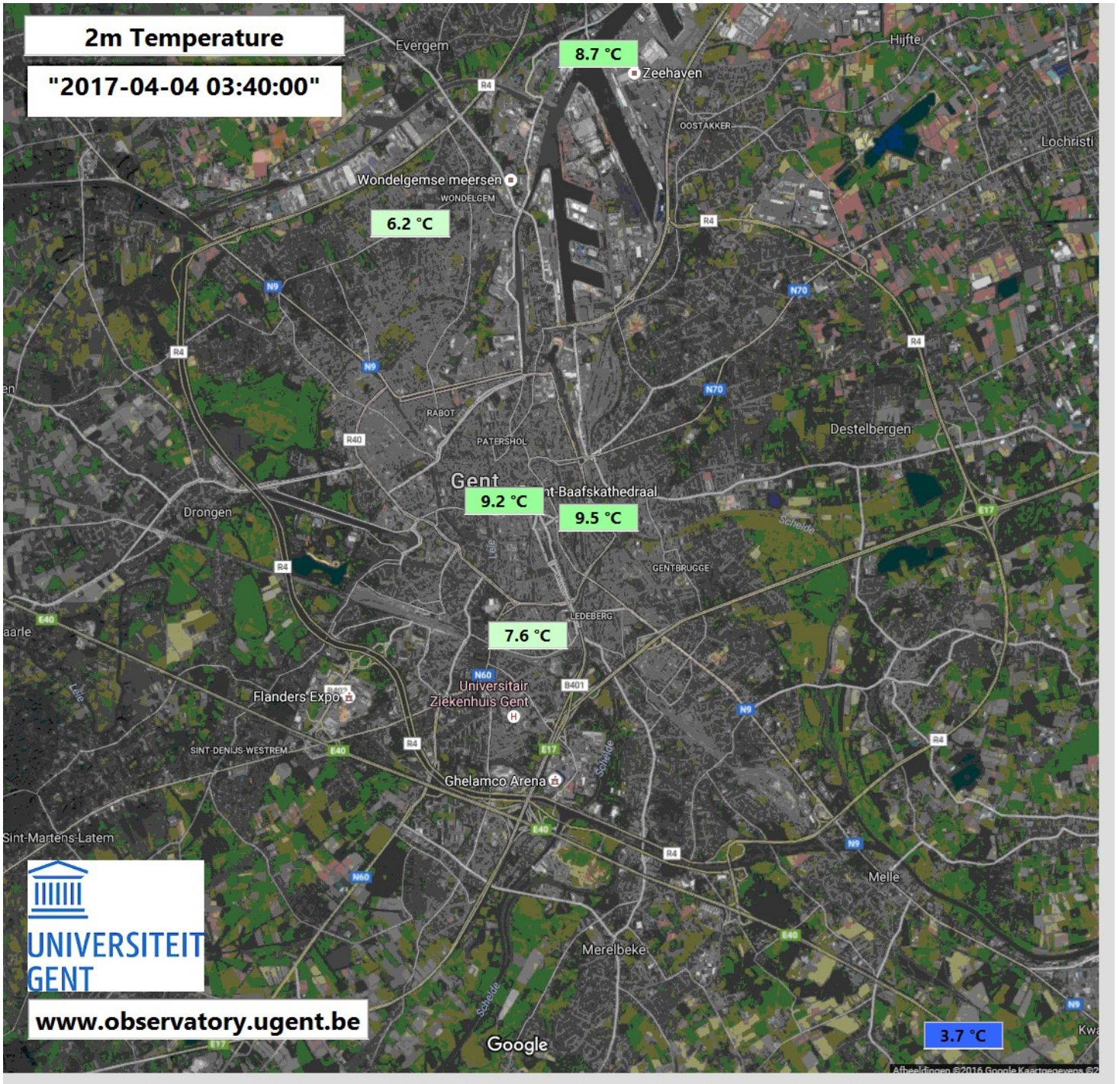
Average daily cycle UHI in August 2016



Average daily cycle dewpoint temperature in August 2016

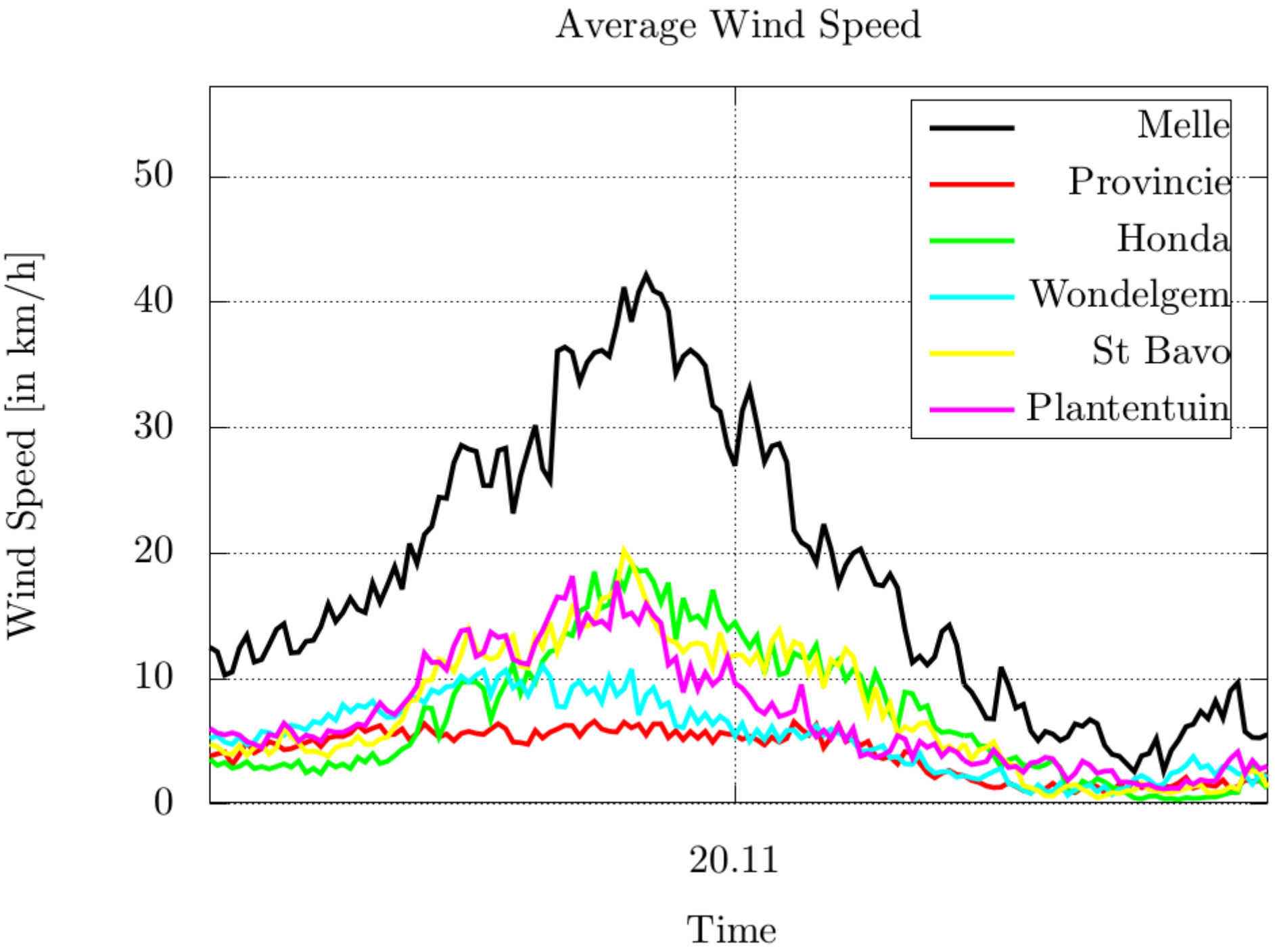


Urban heat island in spring



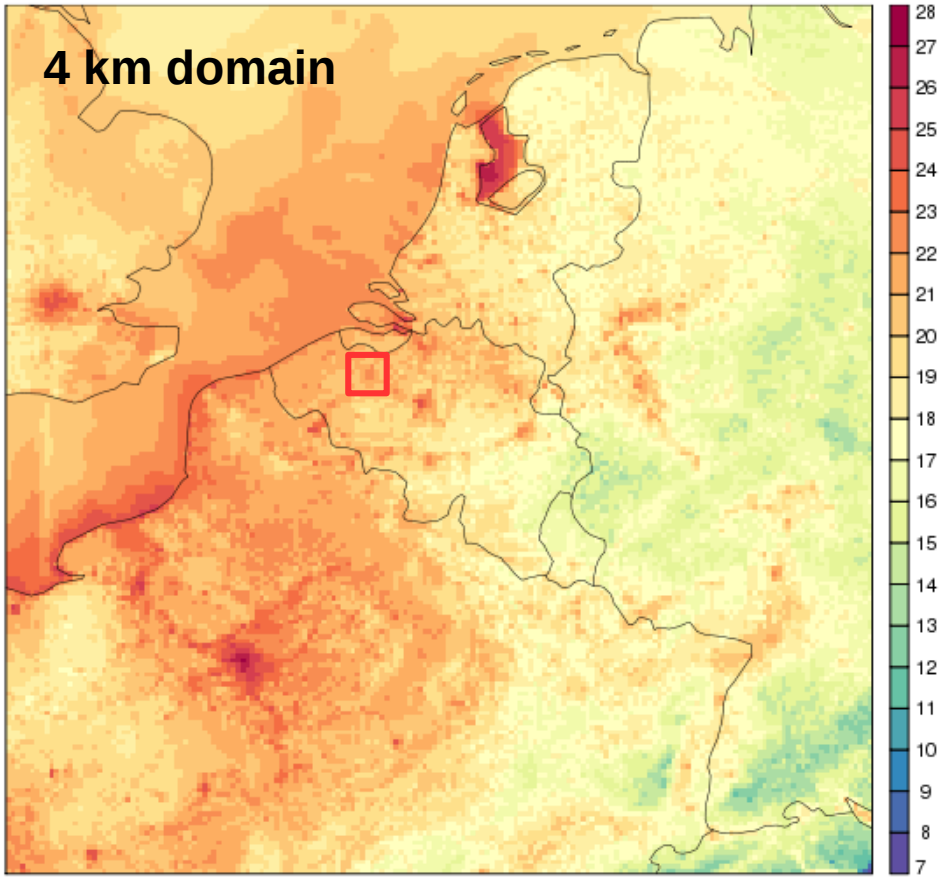
This morning in Gent...

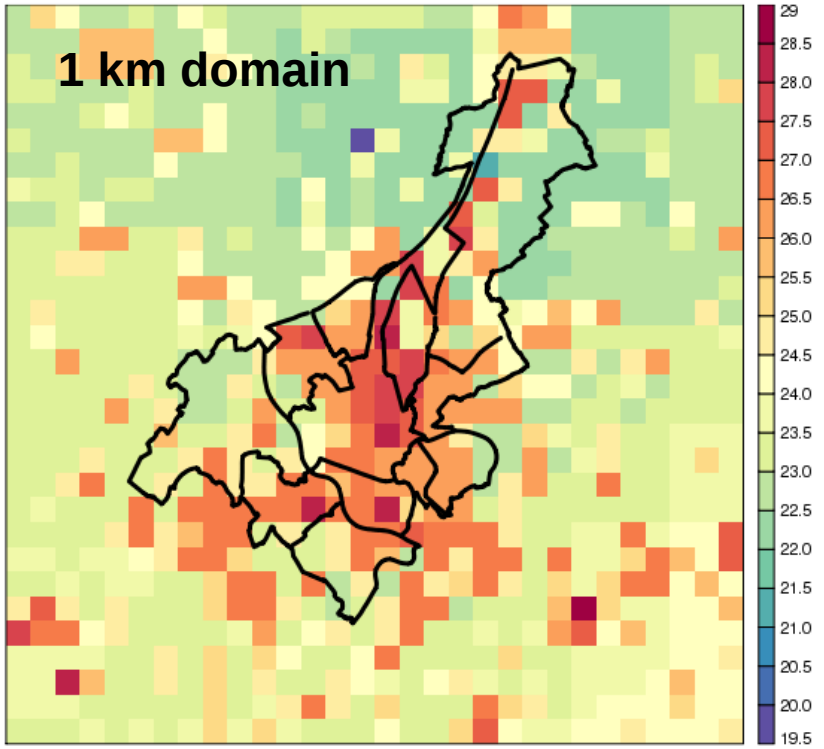
On a windy day...



Modelling the urban heat island.

ERA-INTERIM data → 20 km West-Europe → 4 km ALARO-**0** SURFEX in line (incl TEB)
→ use lowest model level (17m) to force SURFEX off-line at 1km over Gent



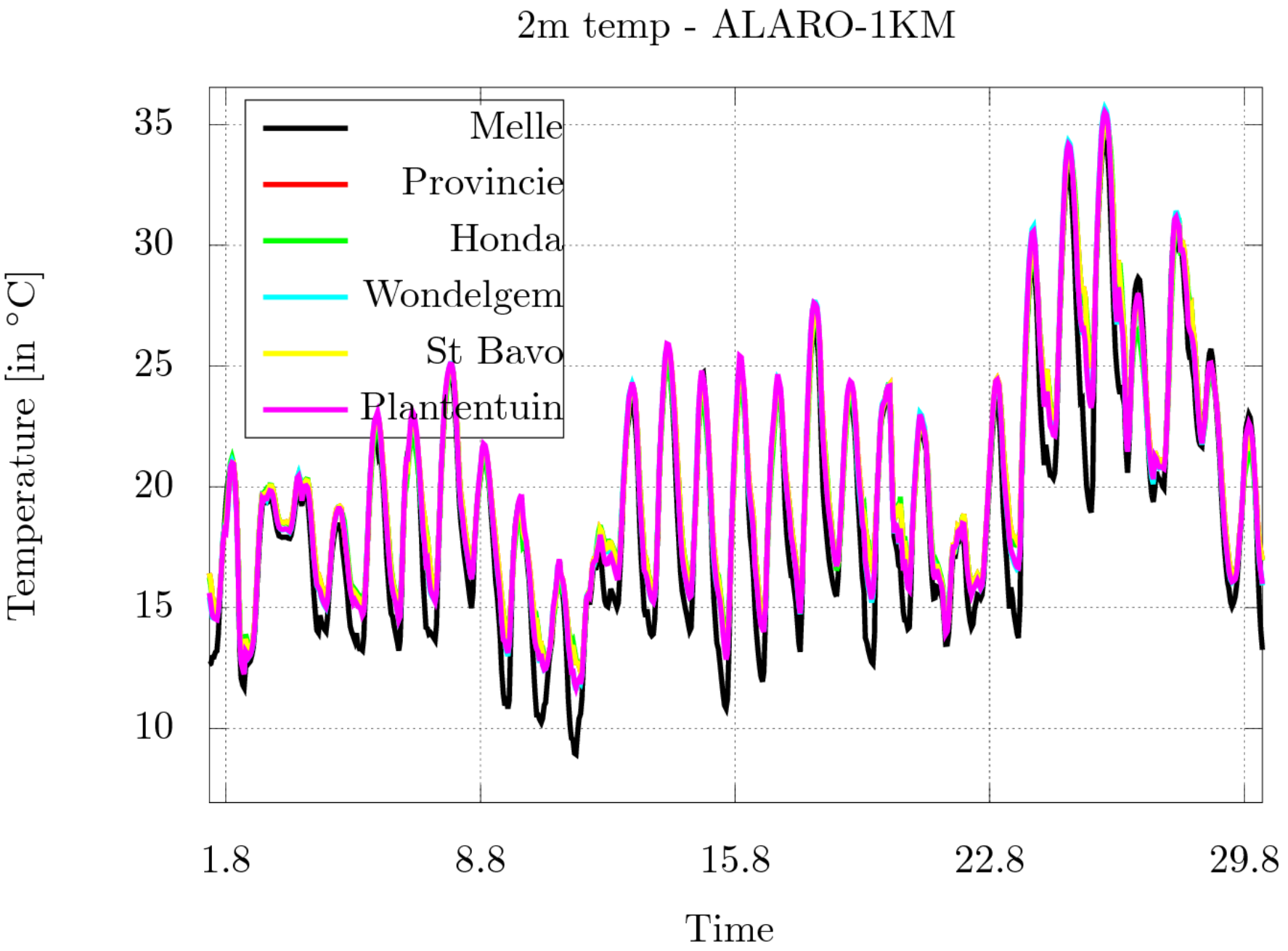


Daily reinitialization – spin-up of 24 hr (12hr at 20km, 12hr at 4km))

Cycle 36T1 - SURFEX v5

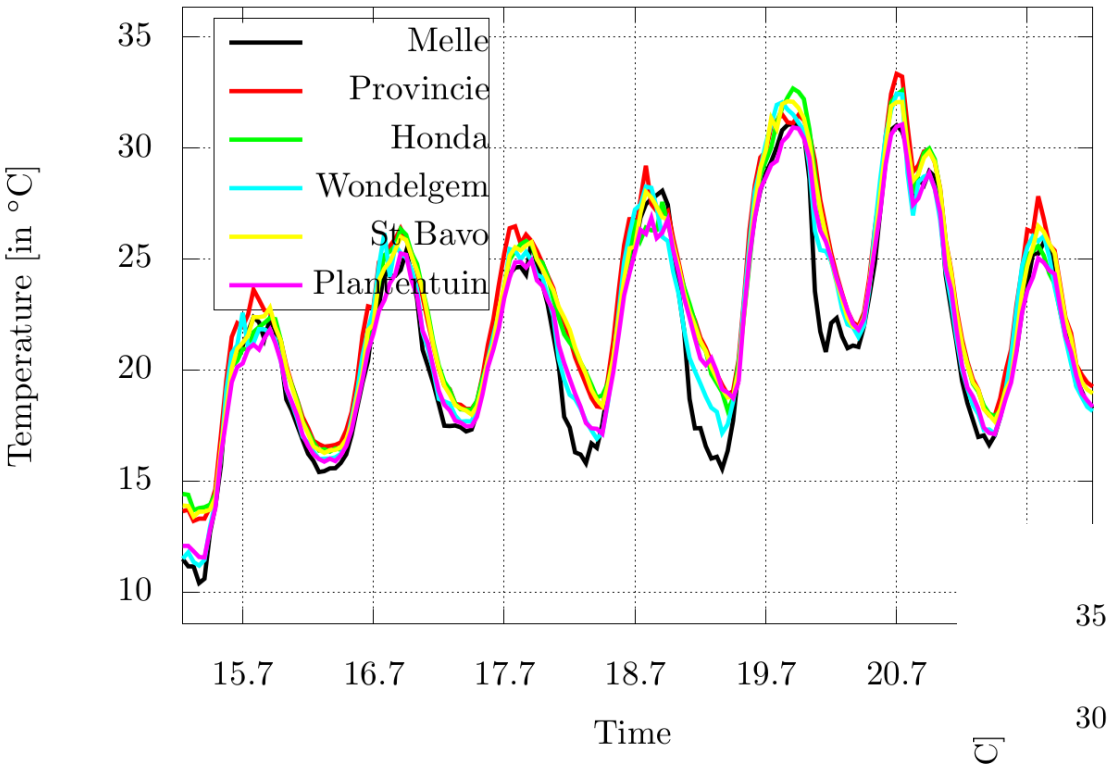
for off-line at 1km the CANOPY was turned on (RAFIQ)

Model results for August 2016.

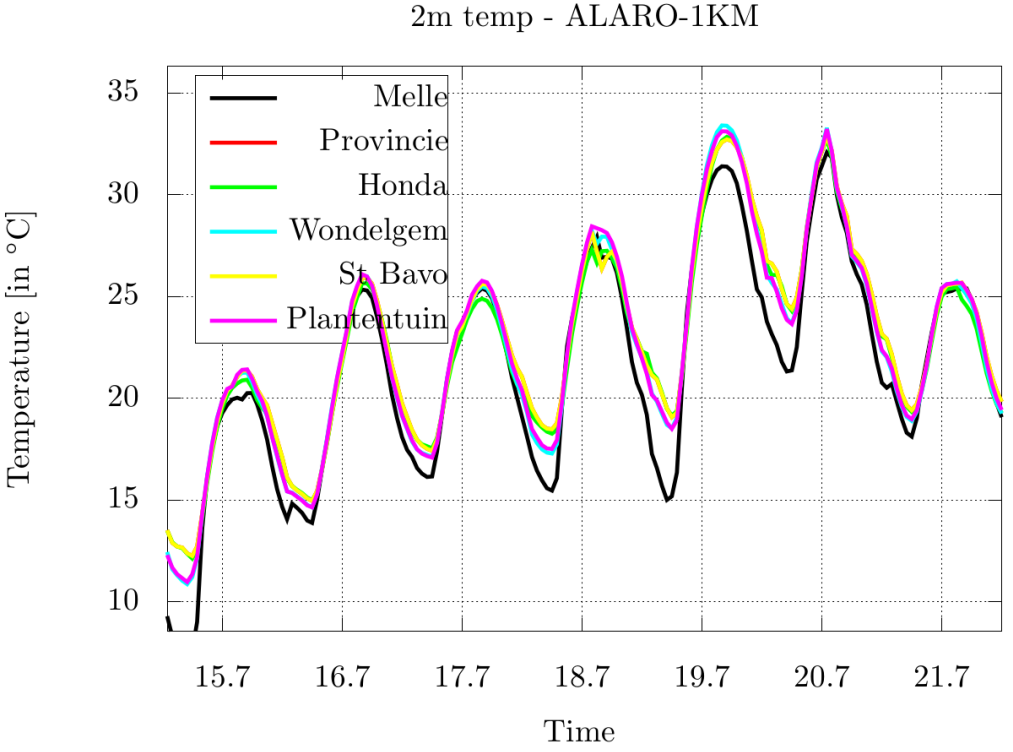


Zoom in on heatwave August 2016

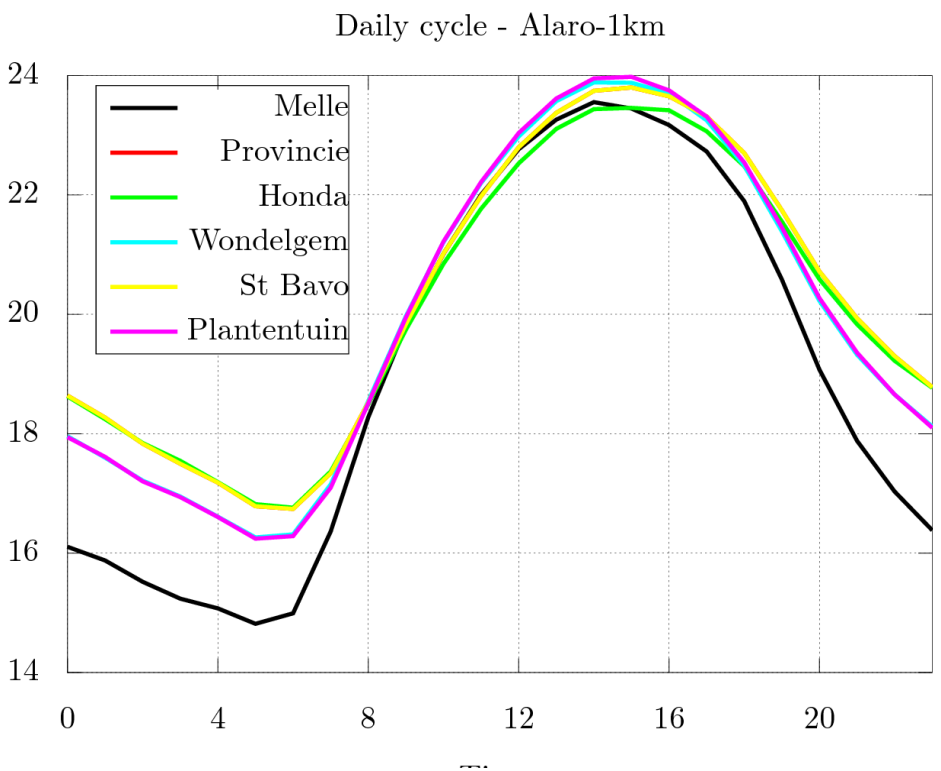
OBSERVATIONS



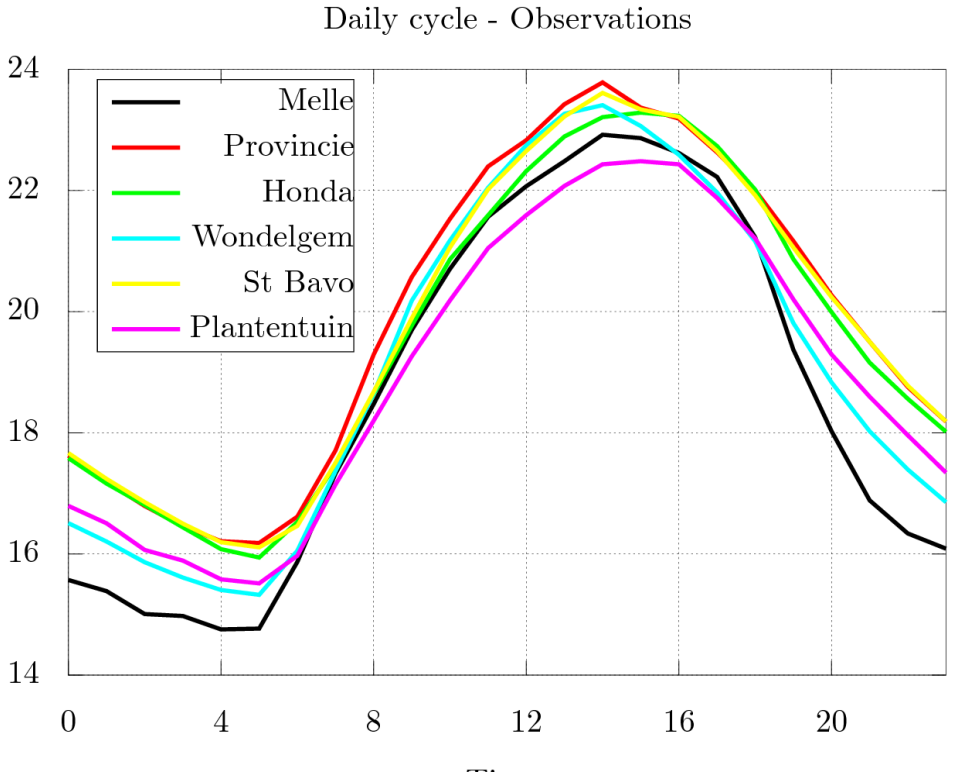
MODEL



MODEL



OBSERVATIONS



Not perfect but same trends in observations and model output.

Future plans

Keeping the MOCCA network up and running

Analysis of seasonal variations urban microclimate

High-resolution model validation over Gent

Build flexible weather stations that can be used for specific, short measurement campaigns

More information and realtime measurements on **www.observatory.ugent.be** or contact me via steven.caluwaerts@ugent.be.

The urban heat island.

Less latent heat release, more sensible heat. And extra heat source: antropogenic activities.

Melle, rural station MOCCA

Provinciehuis, urban station MOCCA