(selected) SURFEX activities

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on behalf of R. Hamdi

http://www.cnrm.meteo.fr/aladin/

EWGLAM meeting, 2017, 2-5 October 2017, ECMWF

- SURFEX in ALARO
- Using SURFEX for urban modeling
- Work on EKF in Belgium and Austria

Preliminary tests of the CMC ALARO-1 coupled to SURFEX-8 using CY43T2 over Belgium

ALARO-1 Working days

September 2016, Brussels

"*It was decided that the current code in* ***cy43t2*** *is a base for further developments and tunings, also for the coupling with* ***SURFEXV8****.*"

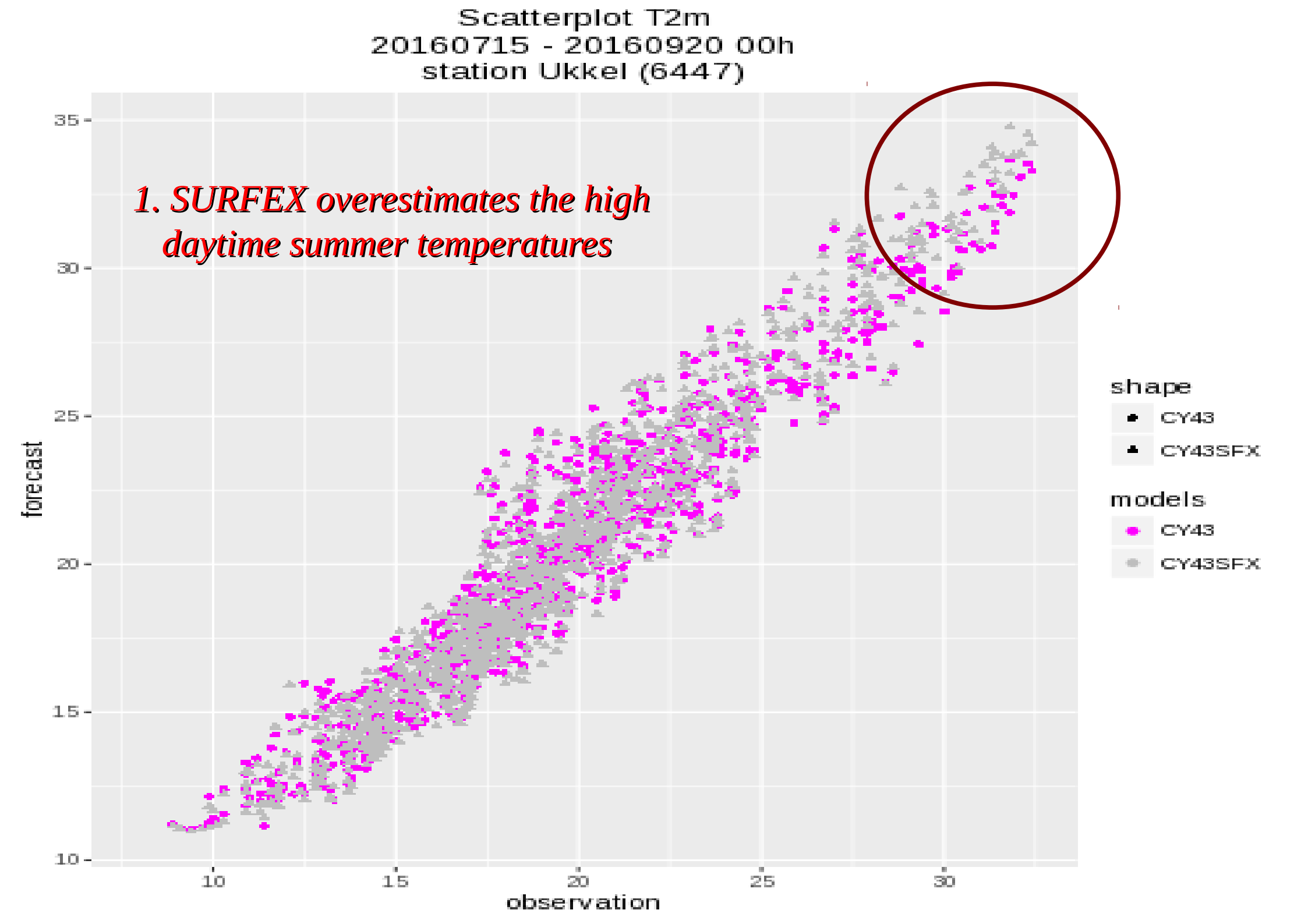
Task: To develop a Canonical version of ALARO1 with SURFEXV8

Working on the interface: SURFEX <-> ALARO + TOUCANS

- ALARO with very high resolution (1~2km) requires new sophisticated turbulence/shallow convection scheme TOUCANS.
- TOUCANS calculates also third order moment terms (TOM), which interact strongly with surface fluxes (from SURFEX/ISBA), but since surface should stay externalised (Best et al.) → conflict
- Linking of the two schemes is needed without dramatic increase of complexity and numerical costs but keeping consistency

Working on the interface: SURFEX <-> ALARO + TOUCANS

- When increasing the horizontal resolution, it was found quite important to pay special attention to the way turbulence is triggered between the surface and lower model layer.
- Use tiling of the surface scheme in the turbulence scheme: some fraction of rough surfaces (urban areas) might start important turbulent behavior which would be escalated in the consecutive vertical developement.
- Either do multiple solving for each tile (expensive) or to have an average lower boundary condition for a single solving.


Scatterplot T2m
20160715 - 20160920 00h
station Ukkel (6447)
1. SURFEX overestimates the high daytime summer temperatures
forecast
observation
10
15
20
25
30
35
shape
CY43
CY43SFX
models
CY43
CY43SFX

- Provincie and St Bavo are close to each other in the densely built city centre of Ghent

- Plantentuin is situated in a small park

- Honda is situated in the port, north of the city center

- Wondelgem represents a typical suburban neighborhood (detached housing with large green spaces in between) at the northwestern border of the city

- Melle is located southeast of Ghent in a rural environment

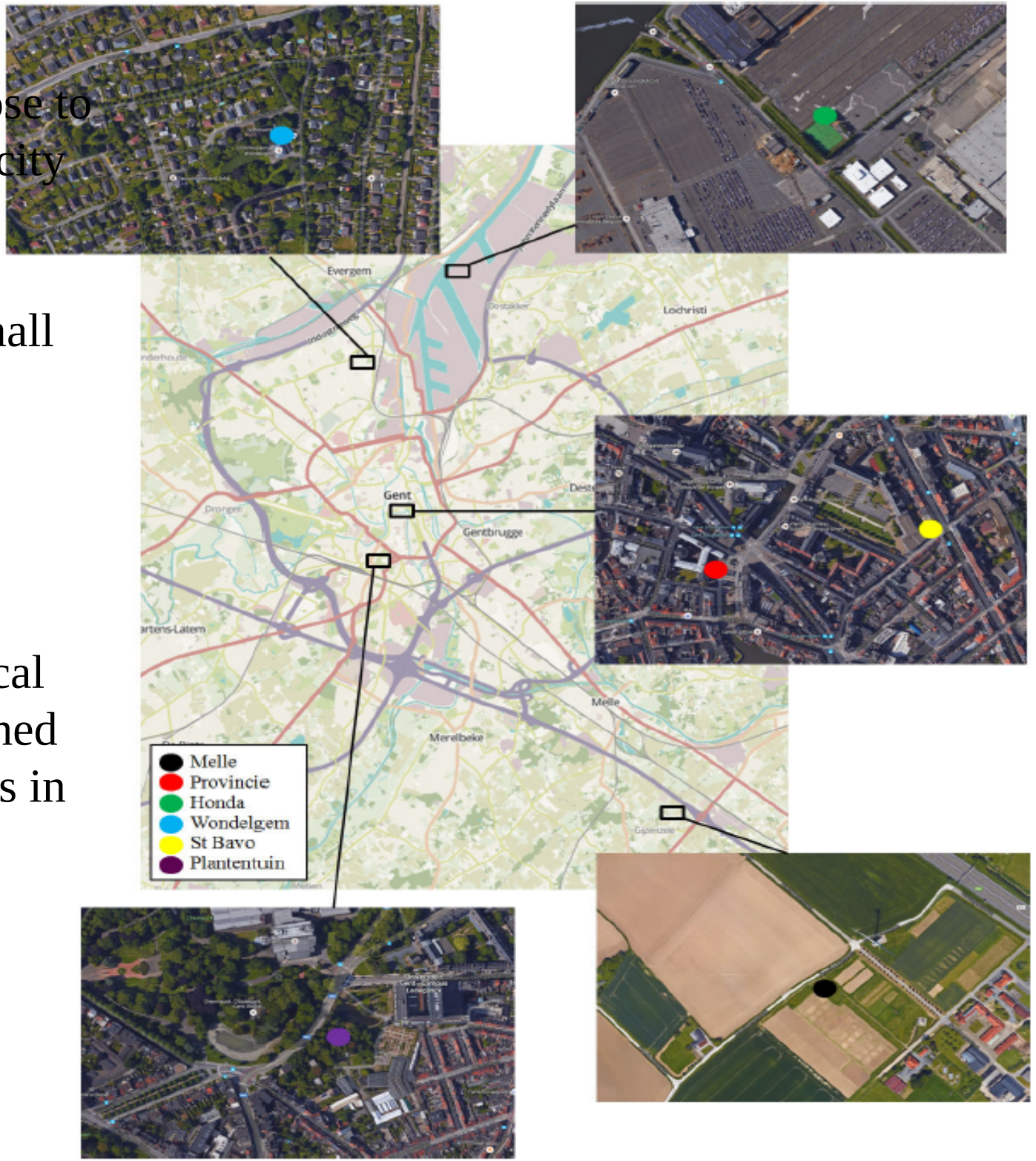
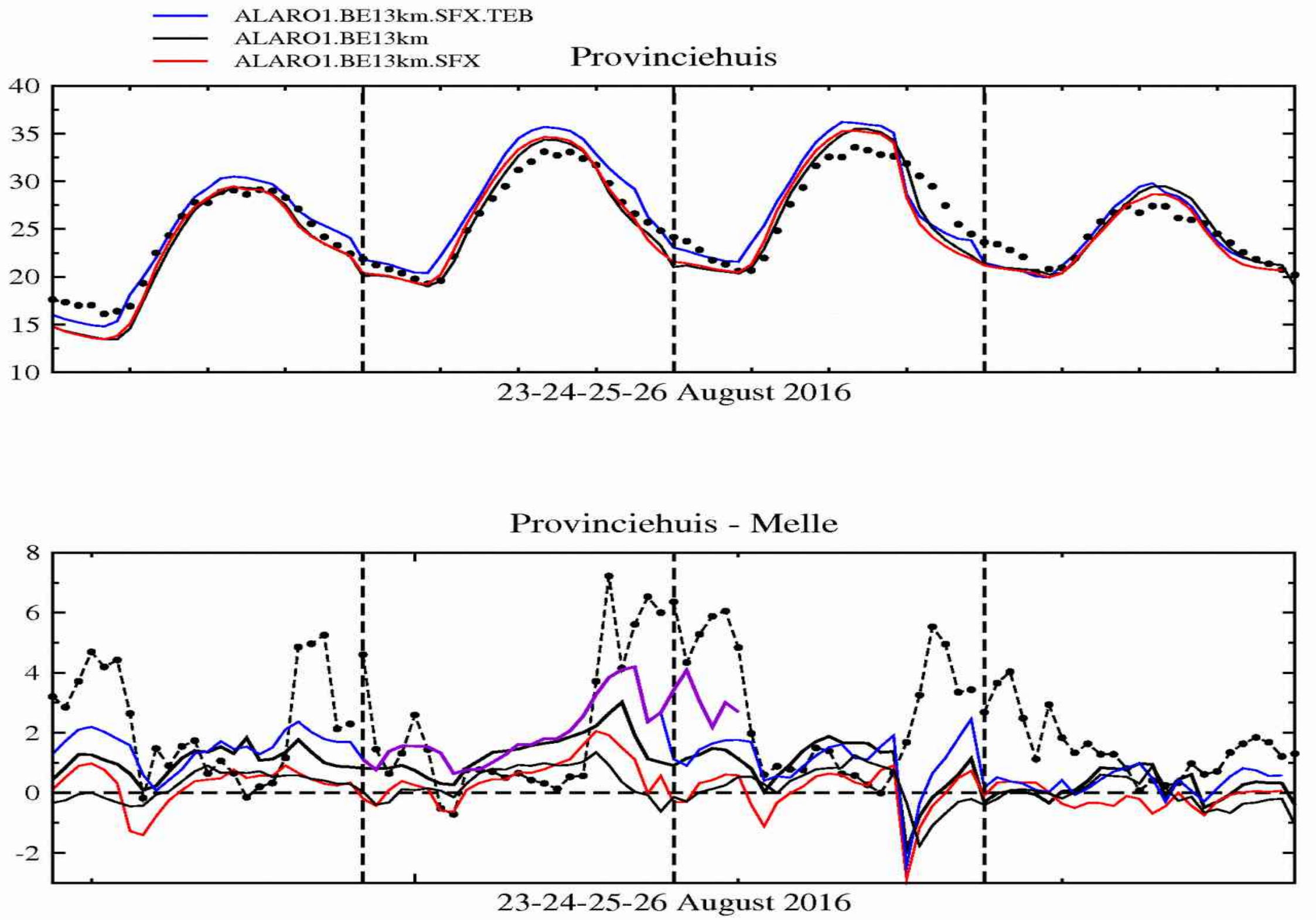


Figure 4. Detailed view of the sensors at one of the weather stations: actively ventilated radiation shield (1) with temperature sensor, rain gauge (2), passively ventilated shield (3) with temperature and relative humidity measurement, and sonic anemometer (4).


ALARO1.BE13km.SFX.TEB
ALARO1.BE13km
ALARO1.BE13km.SFX
Provinciehuis
40
35
30
25
20
15
10
23-24-25-26 August 2016
Provinciehuis - Melle
8
6
4
2
0
-2
23-24-25-26 August 2016

URCLIM

Urban CLIMate services

Starting date: 01/09/2017

Duration: 36 months

Overall budget of the project: 4 315 656€

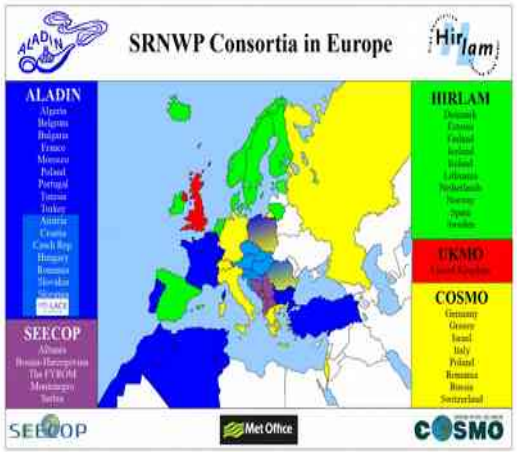
The partnership

National meteorological services:
- Météo France / CNRS
- IRM
- FMI
- KNMI
- METEO-RO

mapping agency
- IGN

Laboratory of geomaticians
- Lab-STICC

- All are part of the ALADIN-HIRLAM Consortium
- They use the same suite of atmospheric models: ALADIN/ALARO – AROME-HARMONIE



URCLIM OBJECTIVES

4 main objectives have been defined:

1) A methodology for the creation of High resolution urban maps for climate studies

2) Downscaling methods from regional climate models to city scale
& assessment of uncertainties

3) multi-criteria impacts and evaluation of adaptation strategies
(Urban Heat Island & heat waves, precipitation, snow cover, economy, ...)

4) Urban Climate Services (defined with stakeholders)
& co-visualization of urban/climatic data

WP4: Case studies

Toulouse

Gent & Brussels

The Randstad

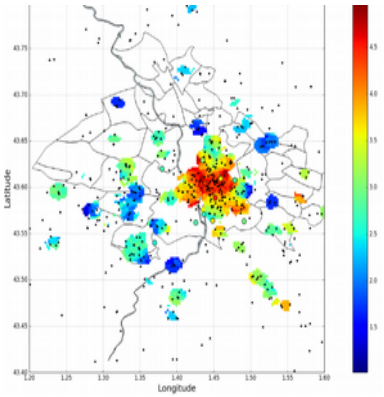
Helsinki

Bucarest

5 case studies:

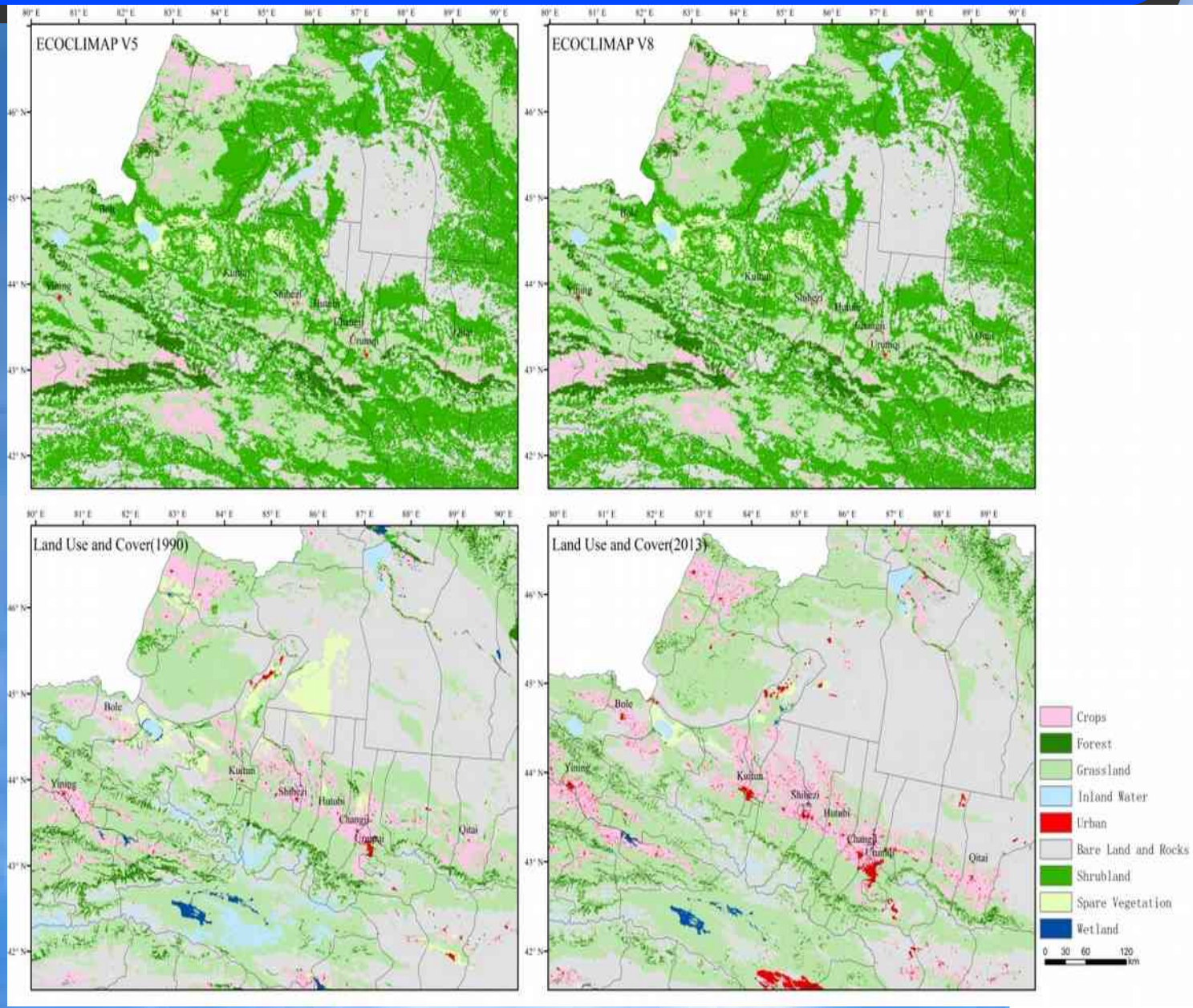
- Involvement of urban users
- Case study selection
- Repository
- Collection of high resolution data
- Data fusion

Source: CNRM

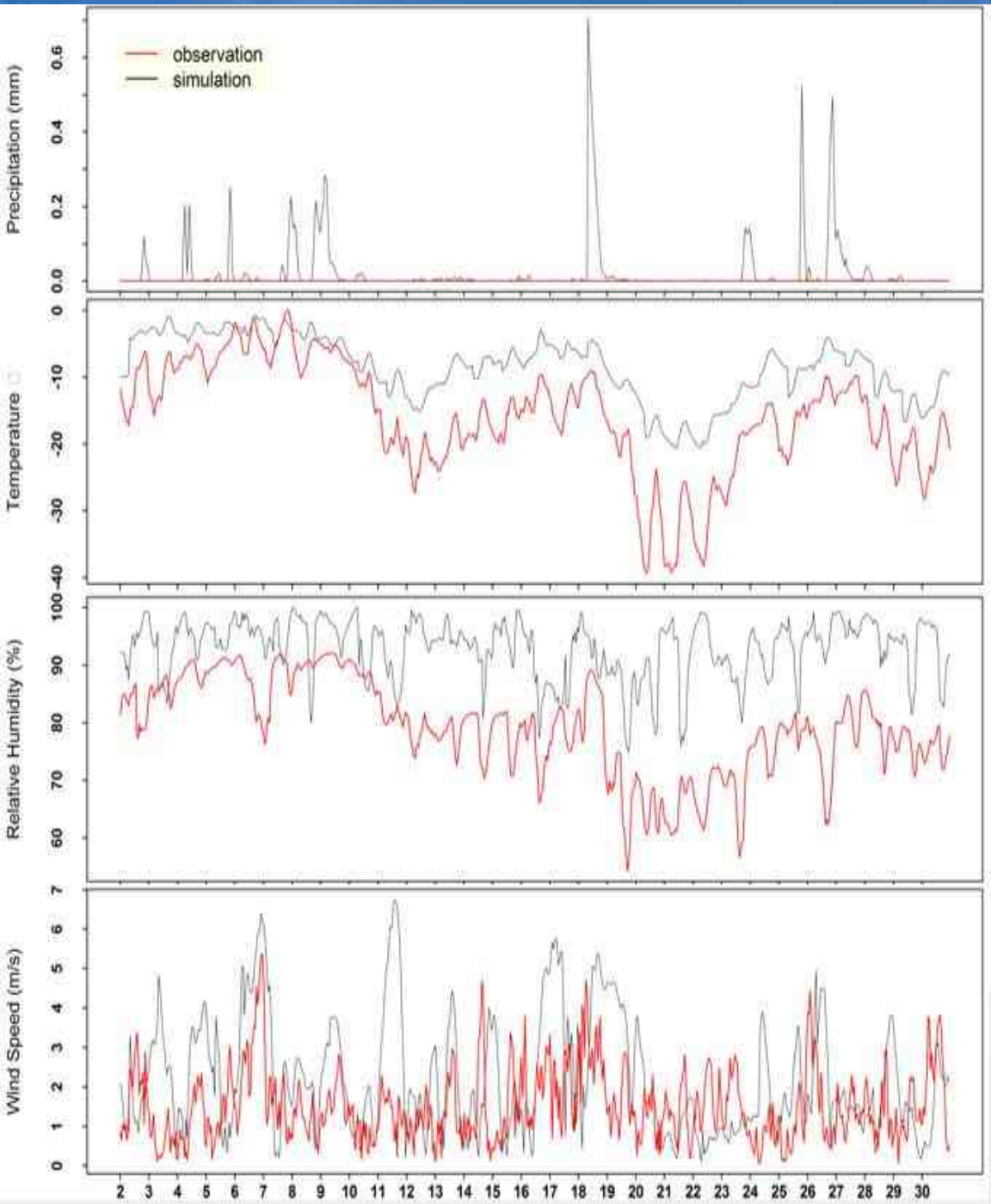


Example of data: *https://weathermap.netatmo.com/*

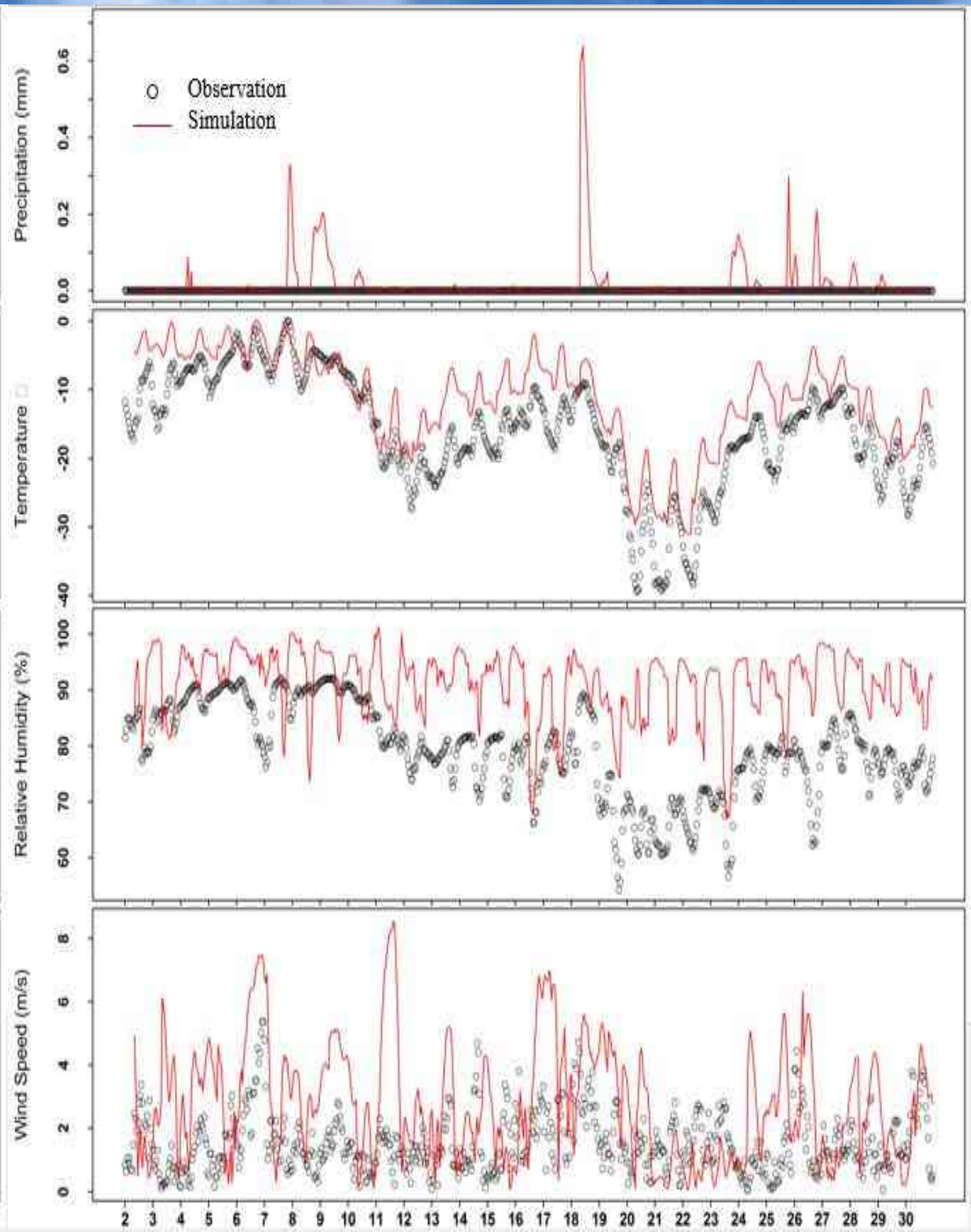
Preliminary test of ALARO-SFX over Xinjiang (China)



ALARO coupled to ERA-Interim, January 2010



ALARO coupled to SURFEX



Surface data assimilation

Belgium

Combining an EKF soil analysis with a 3D-Var upper-air assimilation in a limited area NWP-model

Duerinckx et al., QJRMS, 2017 in press.

	Initial Conditions	
	Atmosphere	Soil
Open Loop (OL)	ARPEGE analysis	ARPEGE analysis
Optimum Interpolation (OI)	ARPEGE analysis	OI
Extended Kalman Filter (EKF)	ARPEGE analysis	EKF
3dVar+OL	3dVar	ARPEGE analysis
3dVar+Free run	3dVar	6h fc. from prev. run
3dVar+OI	3dVar	OI
3dVar+EKF	3dVar	EKF
3dVar+OI/EKF	3dVar	OI(soil temp.) + EKF(soil moisture)

- **The surface assimilation using EKF has a positive effect on the humidity scores that is able to produce similar or improved scores compared to the current operational Open Loop set-up.**

- **For temperature the benefits of the surface assimilation are less pronounced, but still manage to get similar scores as the Open Loop in most cases.**

- **The potential benefits of the combination of upper-air and surface assimilation is shown in the soil moisture and screen-level relative humidity verification.**

EKF activities at ZAMG

SWI assimilation - Modifications in SURFEX / AROME

CY40T1 (SURFEX 7.3) for AROME

- add modifications from HIRLAM to use ISBA diffusion scheme

SURFEX 8.0 for soil data assimilation

- add soil moisture assimilation for layers 3-6 in OFFLINE & SODA (Observations and control variables)

SFXTOOLS CY40T1

- modify I/O to convert LFI-files from 7.3 to 8.0 and back again

GL

- add SURFEX output fields for GRIB conversion

SWI assimilation - Results

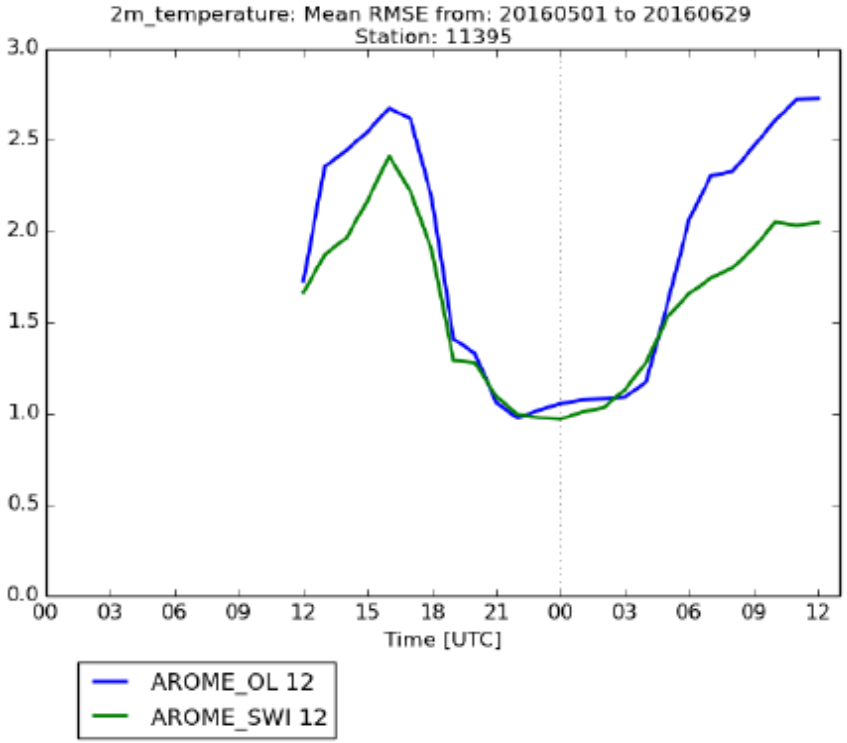
2015 (Jan-Dec) is used as training data set for bias correction
2016 (Jan-June) is used for assimilation experiments:

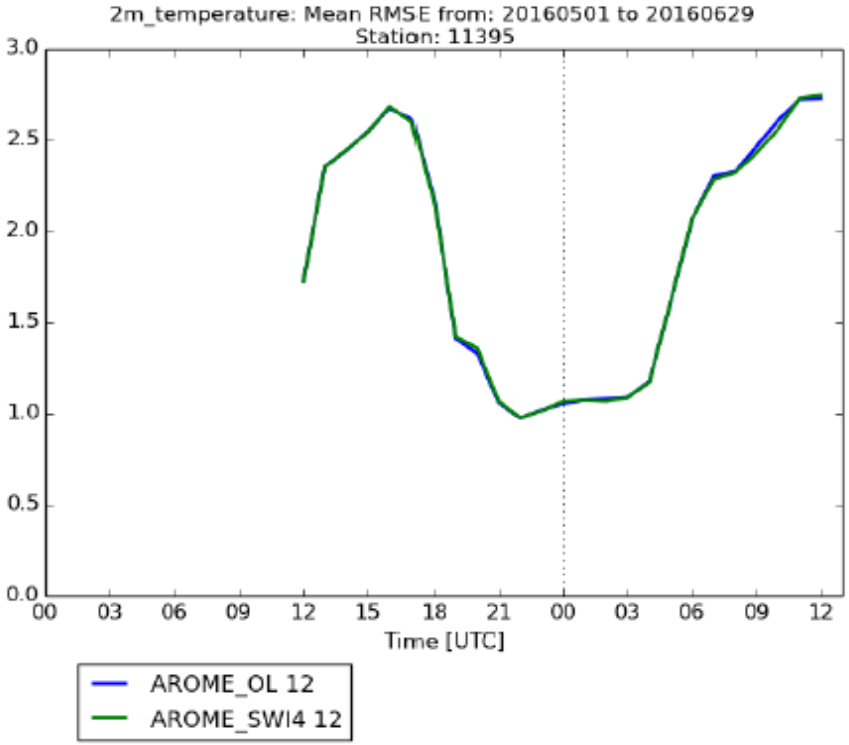
OBS	CTRL	EXPERIMENT
none	none	RR
SWI 1-6	WG 1-6	EXP 3
SWI 1	WG 1	EXP 4
SWI 2-4	WG 2-4	EXP 5
SWI 6	WG 6	EXP 6

validation against Austrian TAWES stations – because we have no in-situ soil moisture measurements

ZAMG
Zentralanstalt für Meteorologie und Geodynamik

SWI assimilation - Results





RMSE for T2M
for the SYNOP station Andau (Burgenland)
RR = blue (both figures), EXP3 = green (left) and EXP4 = green (right)

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Thank you for your attention!