

Data QC within the Belgian synoptic and climatological networks: an overview



Cédric Bertrand & Michel Journée

Cedric.Bertrand@meteo.be, Michel.Journee@meteo.be

**Royal Meteorological Institute of Belgium
Climatological and Meteorological Information Service**



RMI observations data base

➤ RMI aims at centralizing most of the Belgian meteorological and climatological data

→ RMI central DB alimented by

- ✓ RMI
- ✓ Belgocontrol
- ✓ MeteoWing
- ✓ Regional services (VMM, HIC, SPW, SBGE)

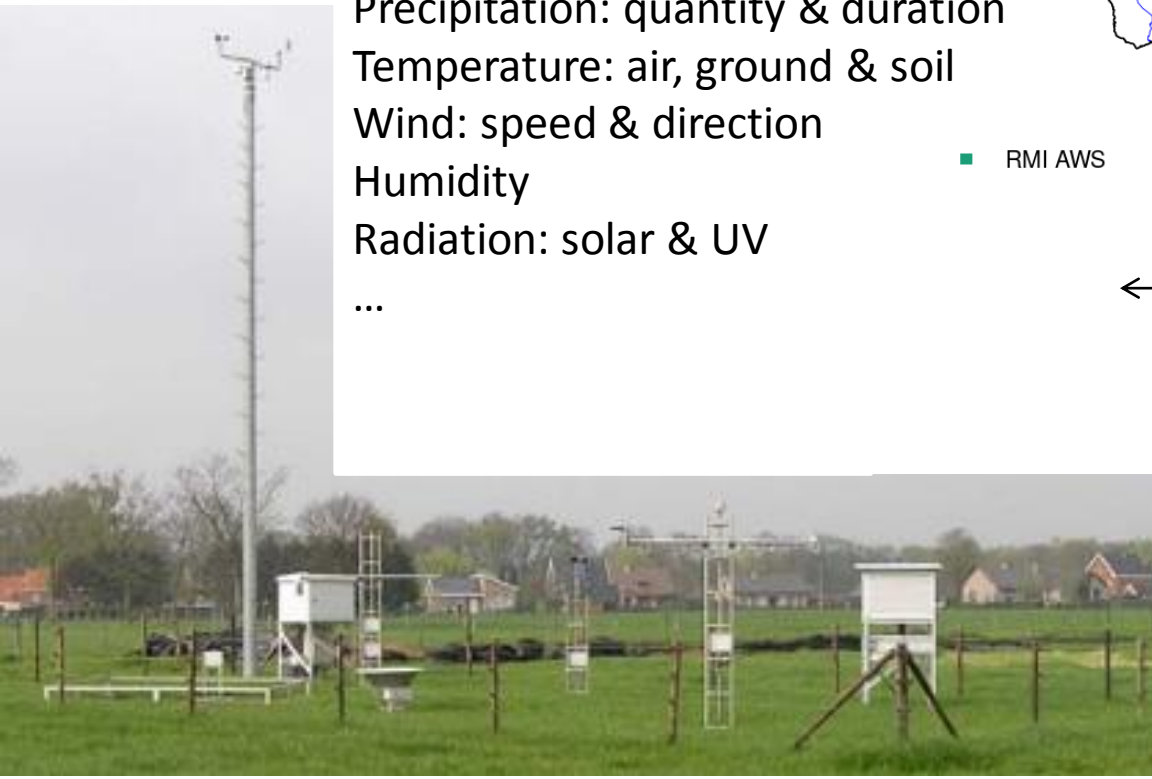
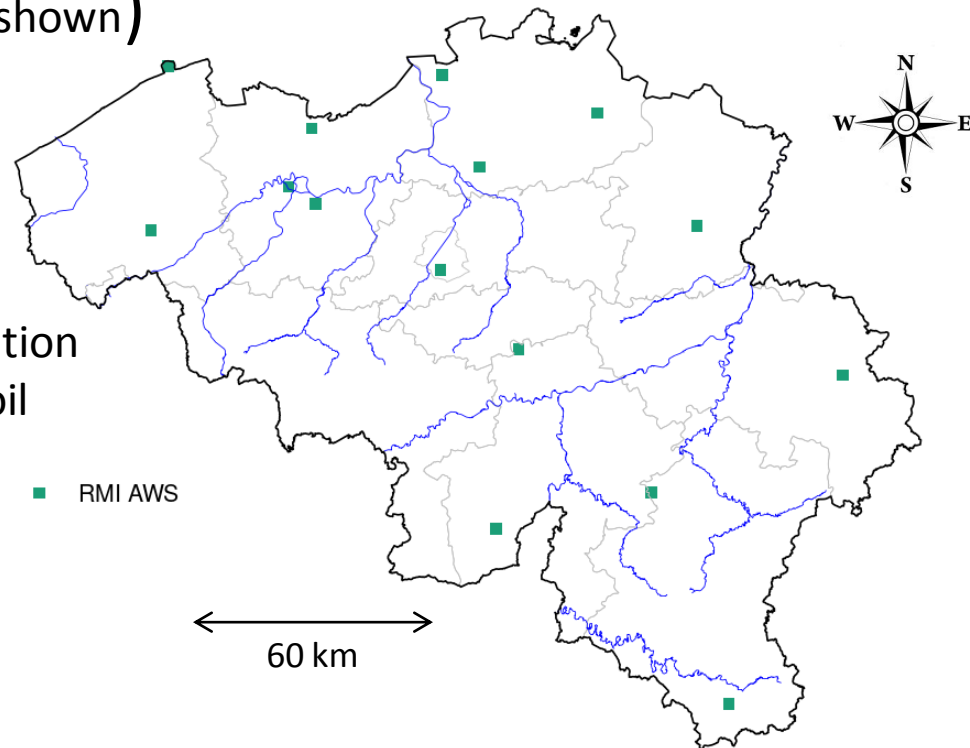
Belgocontrol: the public compagny in charge of the safety of air traffic in the civil airspace

MeteoWing: Meteorological Wing of the Air Component of Defense

RMI automatic weather stations (AWS)

- 15 stations (+ 3 radiometric only not shown)
- (1-min), 5-min, 10-min data
- Large number of variables

Surface pressure
Precipitation: quantity & duration
Temperature: air, ground & soil
Wind: speed & direction
Humidity
Radiation: solar & UV
...

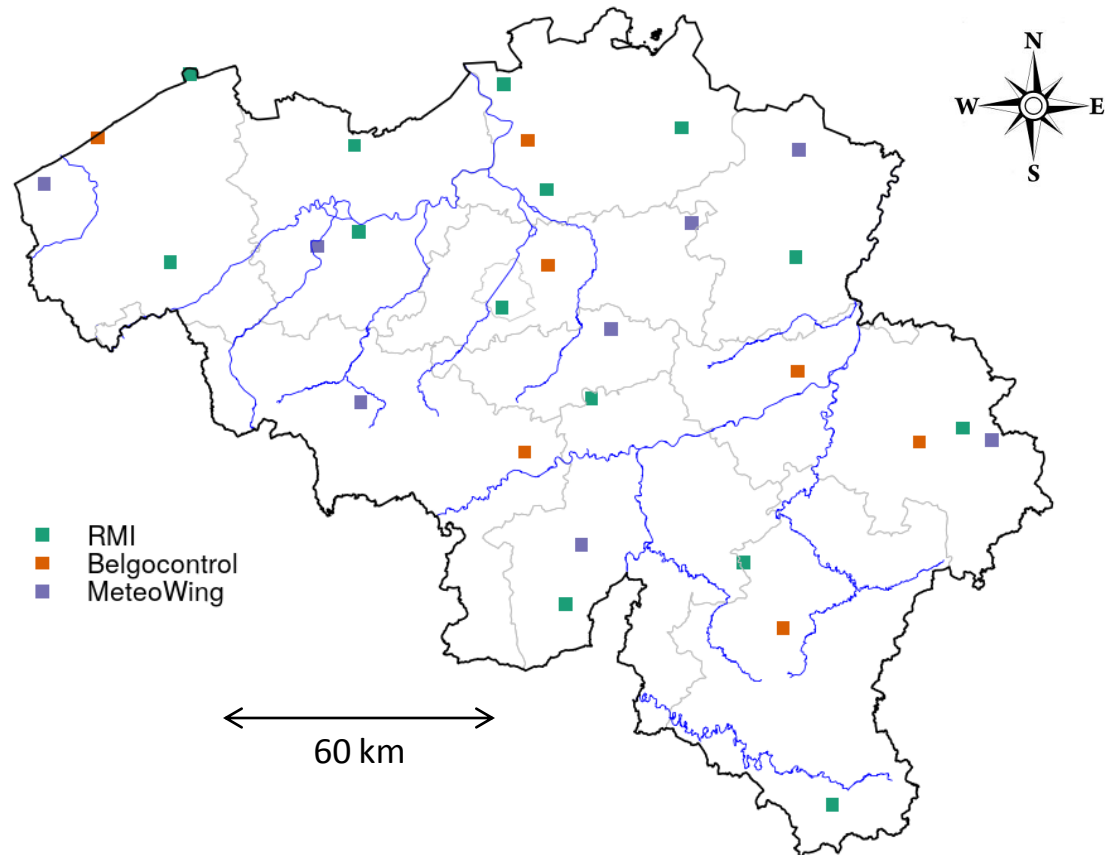


Diepenbeek AWS
(50°54'59"N, 5°27'04"E, alt: 39m)

Belgian synoptic network

- RMI: 14 AWSs
- Belgocontrol: 7 AWSs
- MeteoWing: 10 AWSs

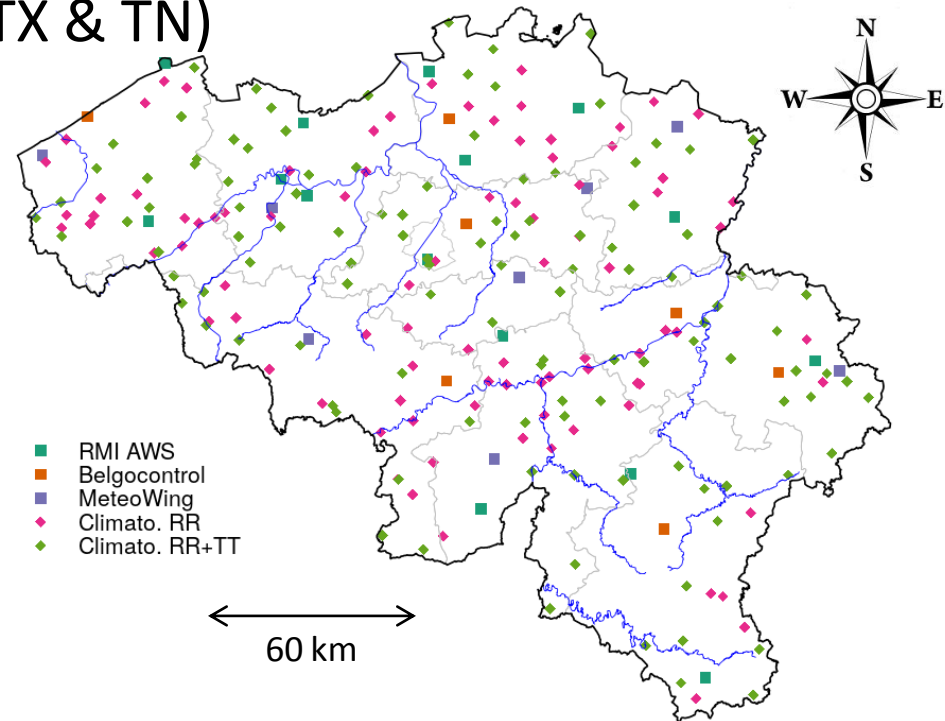
→ **31 stations**



Area: 30 528 km²
Highest point: 694 m (Signal de Botrange)
Lowest point: -3m (De Moeren)

Belgian climatological network

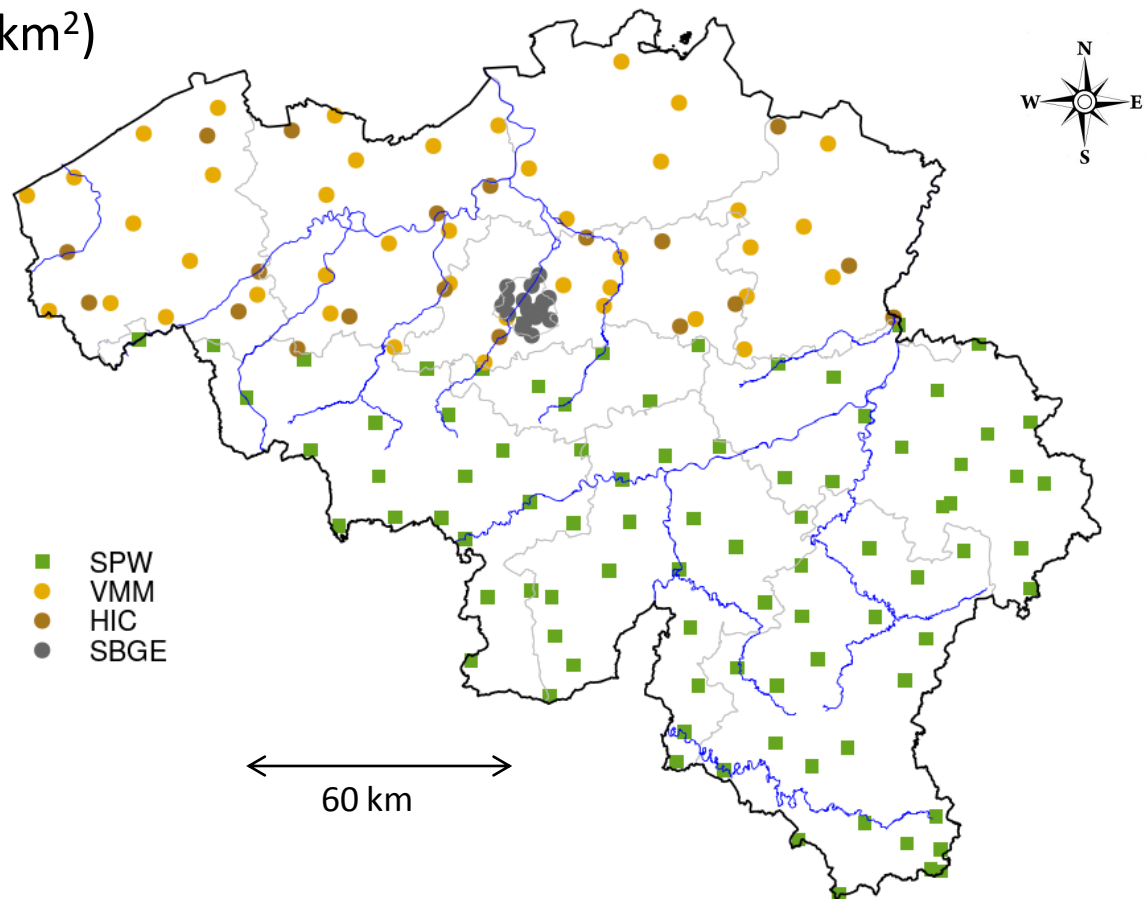
- Daily observations (8:00 am local time) by voluntary observers
 - ✓ **196** pluviometers (RR)
 - ✓ **114** thermometric shelters (TX & TN)



- RMI AWS + Belgocontrol AWS + MeteoWing AWS = **32** AWS

Regional networks of automatic rain gauges

- Brussels Capital (161 km²)
 - **SBGE : 16**
- Wallonia (16 844 km²)
 - **SPW: 92**
- Flanders (13 522 km²)
 - **VMM : 39**
 - **HIC: 18** } **57**

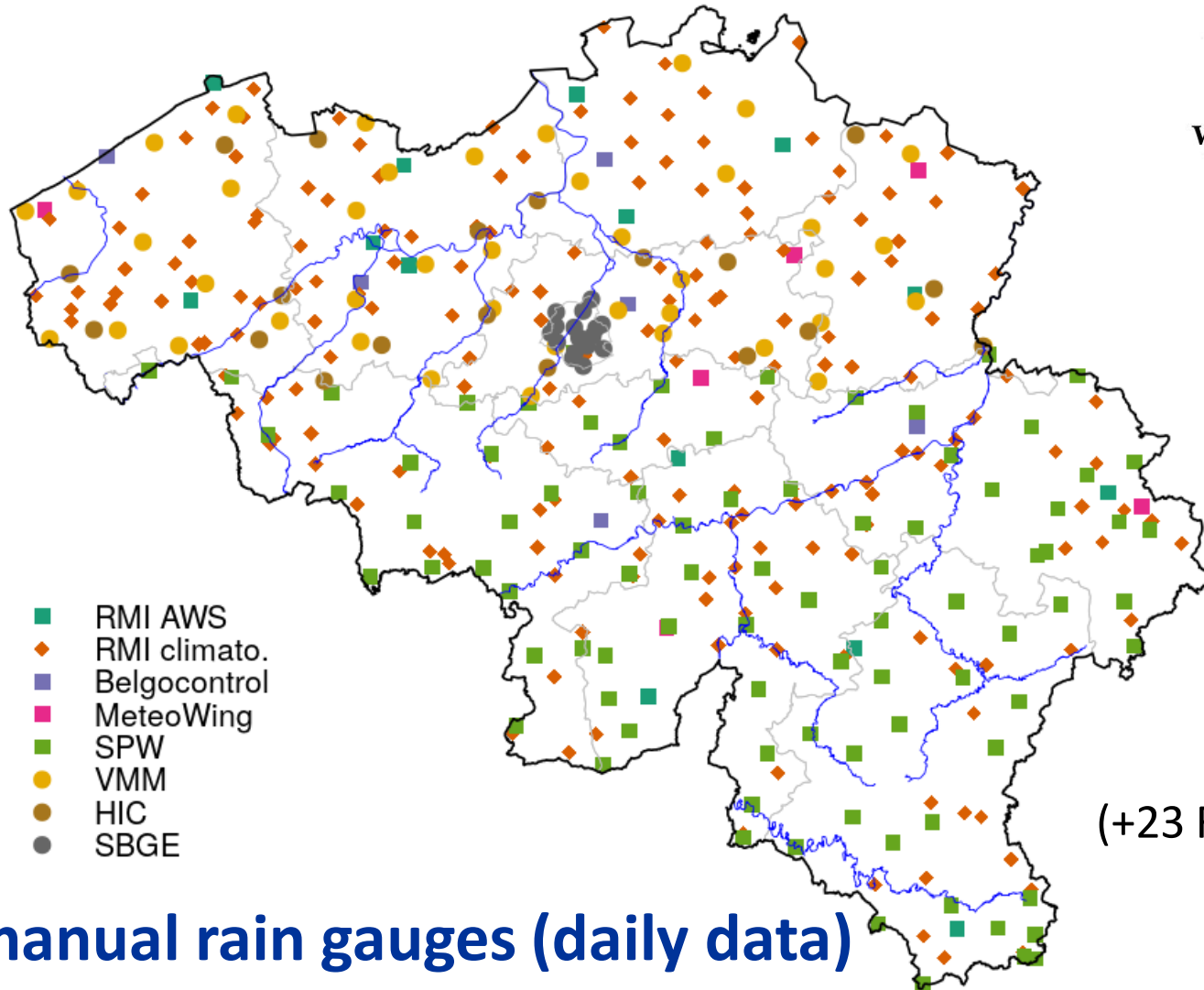


→ **165** weighting (and tipping bucket) rain gauges

- 5-min or 10-min data



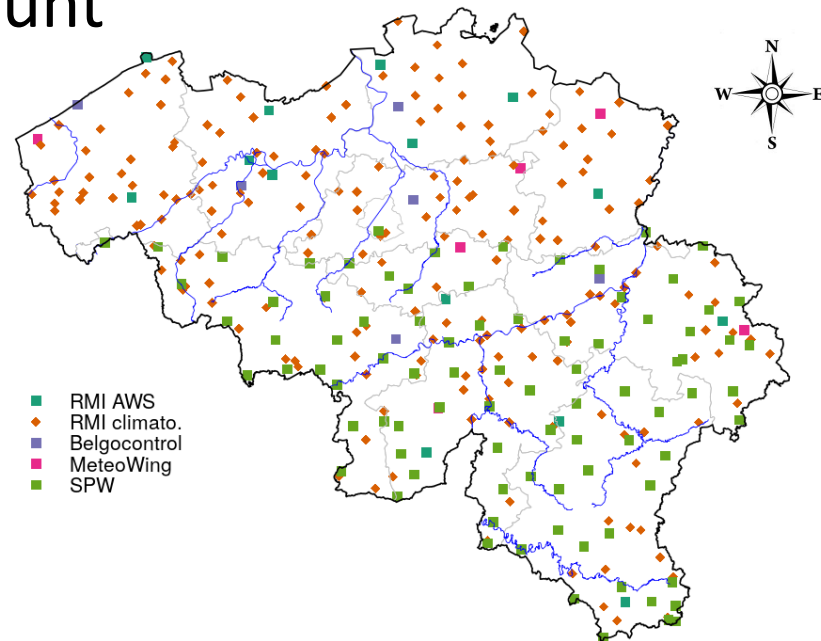
Rain gauges observations across Belgium



- **196 manual rain gauges (daily data)**
- **197 automatic rain gauges (5-min or 10-min data)**

Quality control (QC) of precipitation data

- 15 RMI AWSs : 5-min amount & 10-min duration
 - next business day
- 92 SPW rain gauges: 5-min amount
 - next business day
- 228 RMI climato: daily amount
 - next business day for 35 stations
 - ~2 months delay for all other stations

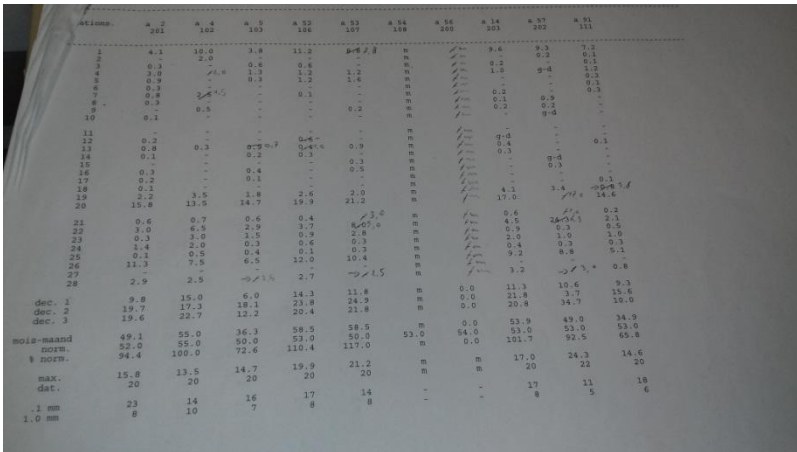


➔ **Minimum of about 33 000 data/day to be controlled !**

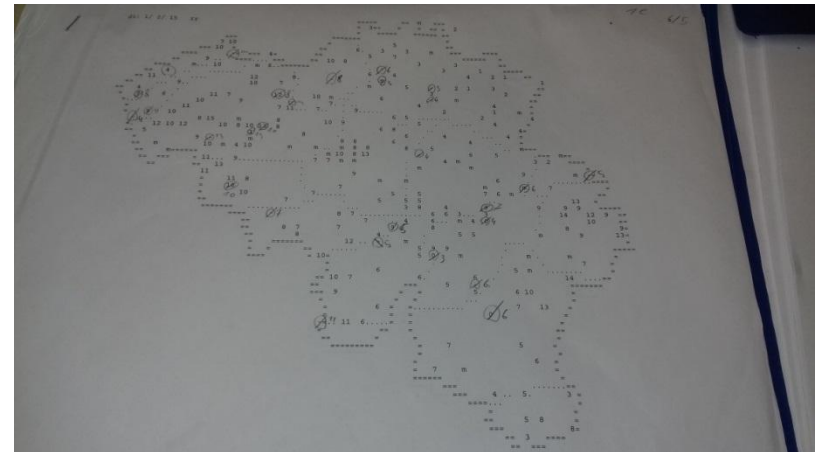
- ✓ Further 5-min data & networks could be included in the QC protocol

Old fashioned QC

Manual inspection on a monthly non-real time basis by well-trained operators to identify inconsistencies or anomalies



station	h. 2	h. 4	h. 5	h. 52	h. 53	h. 54	h. 55	h. 56	h. 57	h. 58
1	4.1	10.0	1.8	11.2	9.8	8.6	9.3	7.2		
2	0.3	2.0	0.6	0.6	-	0.2	0.2	0.1		
3	0.9	-	1.3	1.2	1.2	1.8	0.4	0.2		
4	0.9	-	0.3	1.2	1.4	-	-	0.2		
5	0.8	-	-	0.1	-	-	-	0.2		
6	0.2	-	-	-	-	-	-	0.2		
7	0.2	-	-	-	-	-	-	0.2		
8	0.2	-	-	-	-	-	-	0.2		
9	0.2	-	-	-	-	-	-	0.2		
10	0.2	-	-	-	-	-	-	0.2		
11	-	-	-	-	-	-	-	-		
12	0.2	-	-	-	-	-	-	-		
13	0.4	0.3	0.7	0.4	0.9	0.4	-	0.1		
14	0.1	-	0.2	0.3	-	0.3	-	-		
15	-	-	-	-	-	-	-	-		
16	0.3	-	0.4	-	0.5	-	-	-		
17	0.2	-	0.1	-	-	-	-	0.3		
18	0.2	-	-	-	-	-	-	0.1		
19	2.2	3.5	1.8	2.6	2.0	4.1	3.4	1.6		
20	15.8	13.5	14.7	19.9	21.2	17.0	14.6	-		
21	0.6	0.7	0.6	0.4	0.3	0.6	0.2	-		
22	3.0	4.5	2.9	3.7	4.0	4.5	2.6	2.1		
23	0.3	2.0	1.5	0.9	2.8	0.9	1.3	1.9		
24	1.4	2.0	0.3	0.4	0.3	2.9	1.0	0.3		
25	0.1	0.5	0.4	0.1	0.3	5.4	0.3	0.3		
26	11.3	7.5	6.5	12.0	10.4	9.2	8.8	5.1		
27	-	-	-	-	-	-	-	-		
28	2.9	2.5	2.7	2.7	1.5	3.2	3.3	0.8		
dec. 1	9.8	18.0	6.0	14.3	11.8	0.0	11.3	10.6	9.3	
dec. 2	19.7	17.3	18.1	23.8	24.9	0.0	21.8	3.7	15.4	
dec. 3	19.6	22.7	12.2	20.4	21.8	0.0	20.8	34.7	18.0	
mois-maand	49.1	55.0	36.3	58.5	58.5	0.0	53.9	49.0	34.9	
norm.	52.0	55.0	50.0	50.0	53.0	0.0	53.0	53.0	53.0	
% norm.	94.4	100.0	72.6	110.4	117.0	0.0	101.7	92.5	65.8	
max.	15.8	13.5	14.7	19.9	21.2	m	17.0	24.3	14.6	
dat.	20	20	20	20	20	m	20	22	20	
1 mm	23	14	16	17	14	-	8	5	4	
1.0 mm	8	10	7	8	8	-	-	-	-	



→ slow, laborious and expensive in terms of staff time



Automated QC Tests

- Existence:

- ✓ Missing data

5-min, 1 hour and 1 day time scales

- Physical limits:

- ✓ Non-negative value
- ✓ Upper limit

- Spatial consistency:

- ✓ Comparison against a spatial interpolation of neighboring stations' values
- ✓ Comparison against estimate from the closest meteorological radar
- ✓ Special tests for isolated precipitation, isolated dryness and maintenance operations

- Internal consistency:

- ✓ Quantities ↔ Durations

➔ **QC flags (“v”, “s” or “e”) + estimations for all data**

Jabbeke
RMI
2012



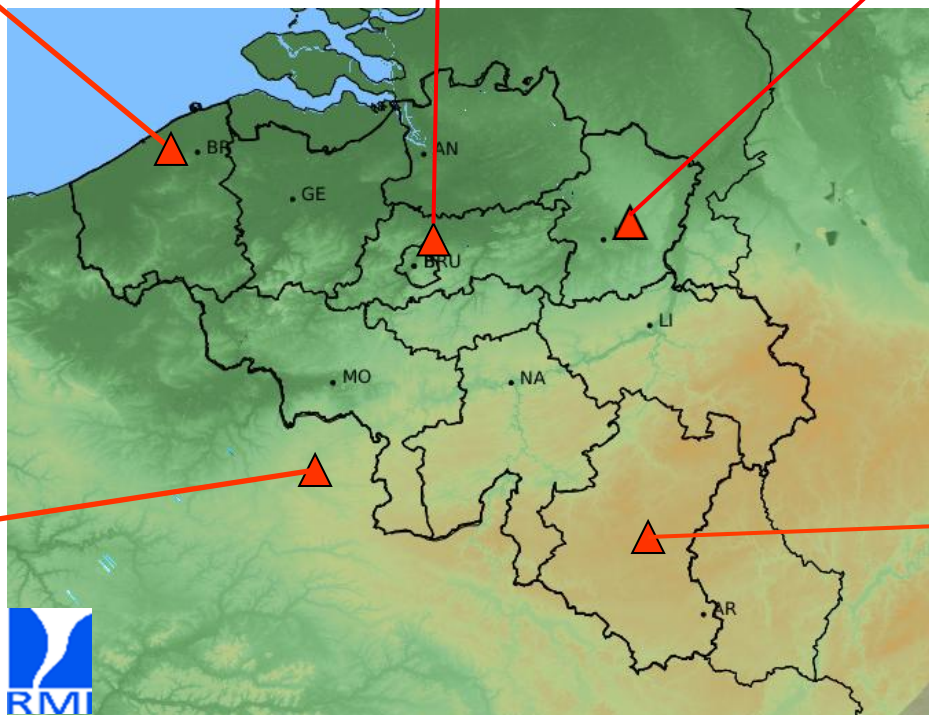
Zaventem
Belgocontrol
2003



Houthalen-Helchteren
VMM
2016

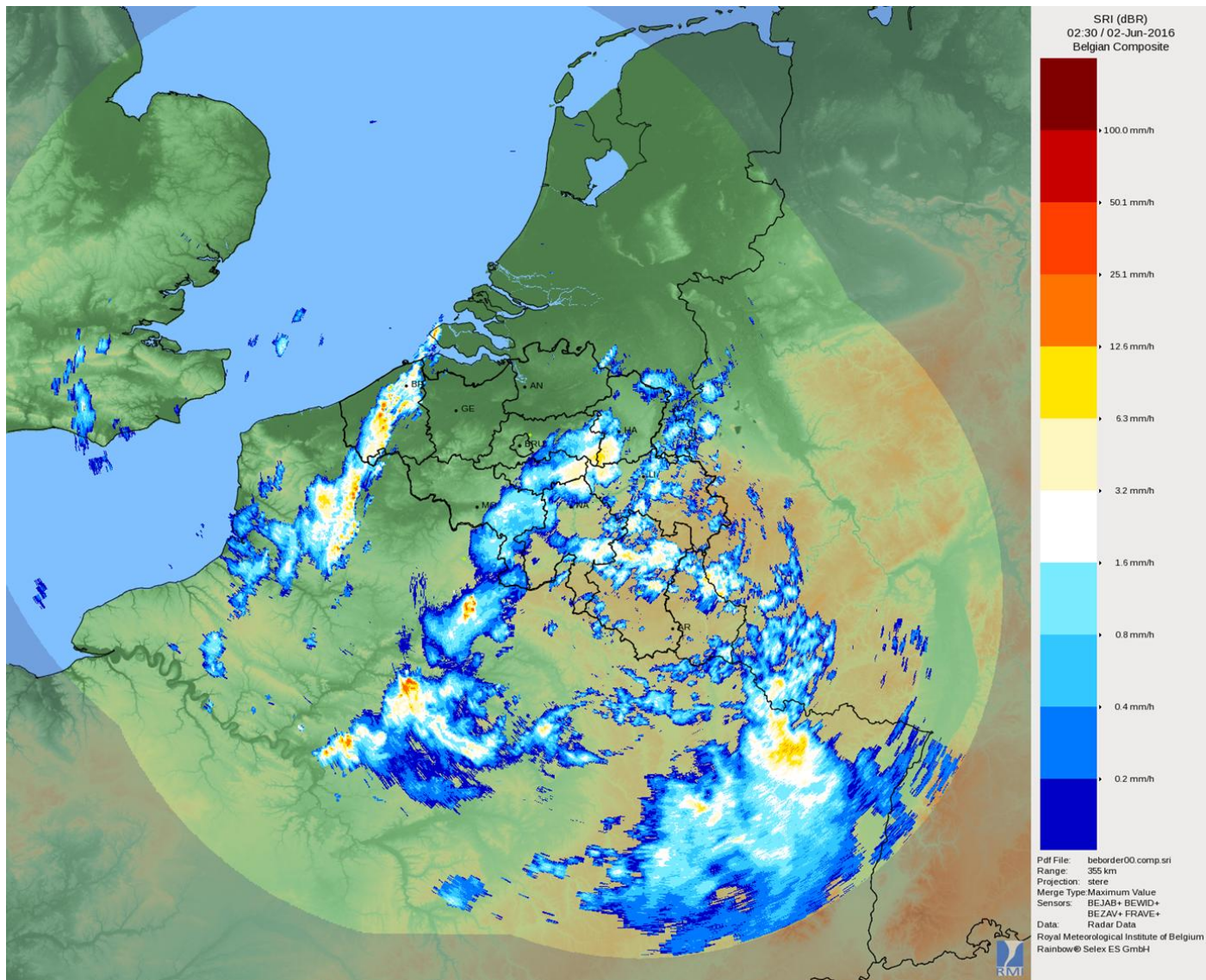


Avesnois
Météo-France
2005



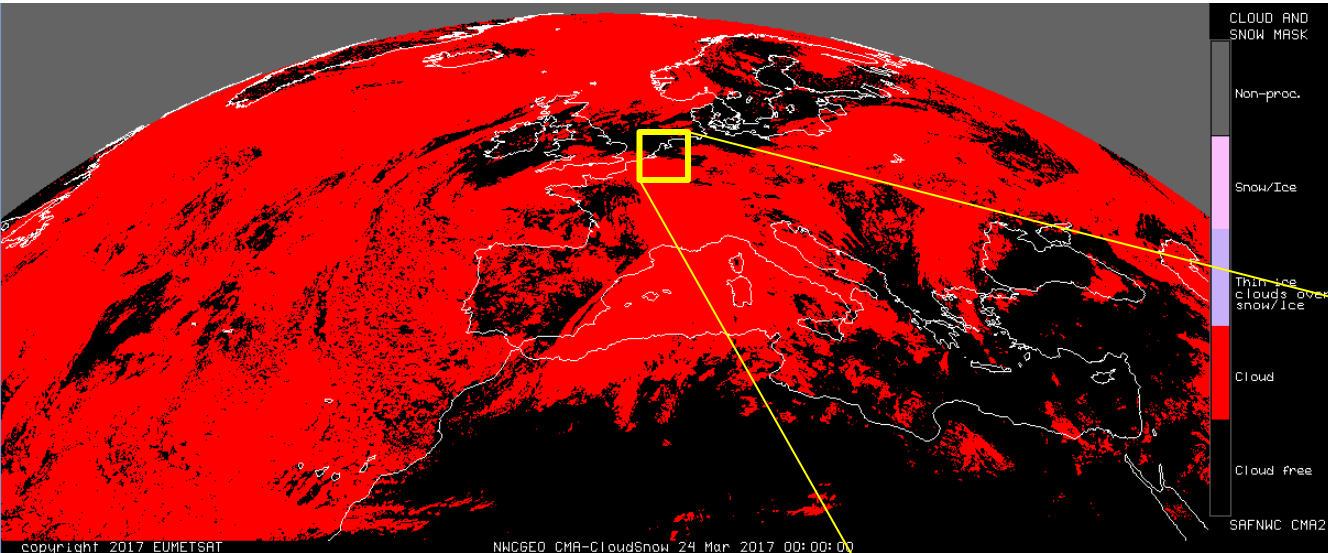
Wideumont
RMI
2001





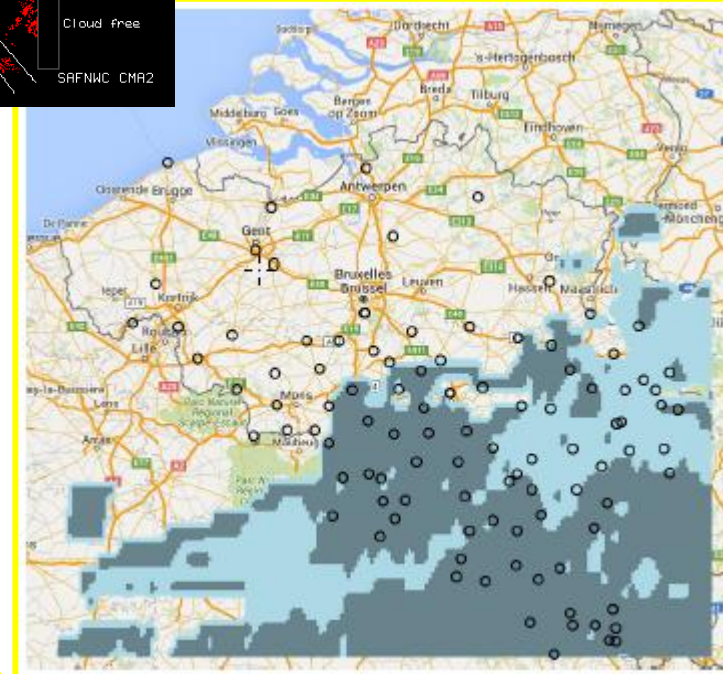
→ Computation of 1-h & 24-h accumulations from each radars data at 1 km x 1 km spatial resolution

SAFNWC/MSG: CMA product



Cloud and snow mask:

- Non-proc
- Snow/Ice
- Thin ice clouds over S/I
- Cloud
- Cloud free



➤ MSG cloud-free index

- Hourly and daily composites
- SEVIRI pixel size: 6km \updownarrow x 3.3 km \leftrightarrow



“Cross-networks” QC interface

PRECIPITATION

Automatic QC

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Preliminary tasks

Radar data extraction Done for 336 stations

Automatic QC Done on 2017-03-10 11:45:12 (only daily)

Detected erroneous/suspicious/missing data

NETWORK	CODE	NAME	PARAMETER	DAILY DATA	AUTO QC_FLAGS	# 1-H DATA	# 5-MIN DATA
CLIMATO	602	VALK	RR		m		
CLIMATO	1004	POPERINGE	RR		m		
CLIMATO	1012	KEMMEL	RR		m		
CLIMATO	1016	GENT STERRE	RR		m		
CLIMATO	1715	KAIN	RR		m		
CLIMATO	1912	LIER	RR		m		
CLIMATO	2808	Elingen	RR		m		
CLIMATO	3205	MARBAIS	RR		m		
SETHY	36470015	Rouveroy	RR	10.3	s	1	
SETHY	69670015	Butgenbach	RR	17.7	s	2	
SETHY	69670115	Butgenbach	RR	19.8	s	2	
SETHY	73350015	Mornimont-cluse	RR	15.4	s	1	

RESSOURCES

- web interface
- Google maps API
- Oracle and SQLite databases
- R+ package (gstat, rgdat, etc.)



Precipitation data: manual QC

PRECIPITATION

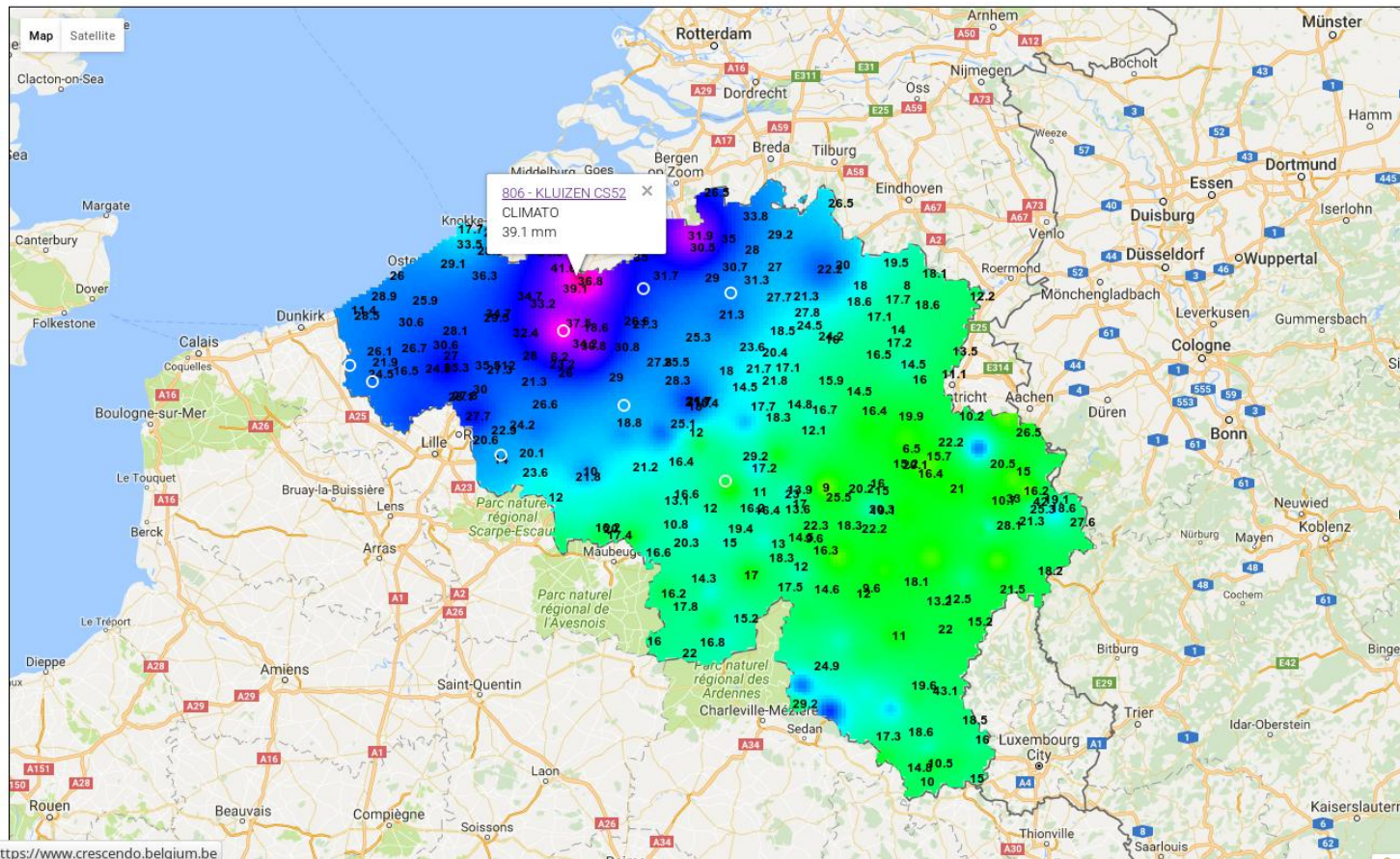
Maps

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- Google maps overlays (daily) Done on 2017-02-28 11:26:27
- Google maps overlays (hourly) Not done



Opacity: 100%

Networks

- AWS
- SETHY
- SAWS
- VMM
- HIC
- CLIMATO

Overlays (to refresh: CTRL+F5)

- AWS
- SETHY
- AWS+SAWS+SETHY
- CLIMATO
- CLIMATO+SETHY
- Wideumont
- Jabbeke
- Avesnois
- Zaventem
- CLIMATO+SETHY vs Wideumont
- CLIMATO+SETHY vs Jabbeke
- CLIMATO+SETHY vs Avesnois
- CLIMATO+SETHY vs Zaventem
- CLIMATO_30DAYS_SUM
- CLIMATO_30DAYS_MAX
- TX
- TN

2017-01-08

2017-01-09

2017-01-10

2017-01-11

2017-01-12

2017-01-13

2017-01-14

2017-01-15

2017-01-16

2017-02-28 10:26

PRECIPITATION

KLUIZEN CS52

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PRECIP 806 | Alt m | [Google map](#)

Begin 1951-01-01 | End

Wideumont 187km | **Jabbeke 47km**

Avesnois 115km | Zaventem 58km

[Go to TEMP 319](#)

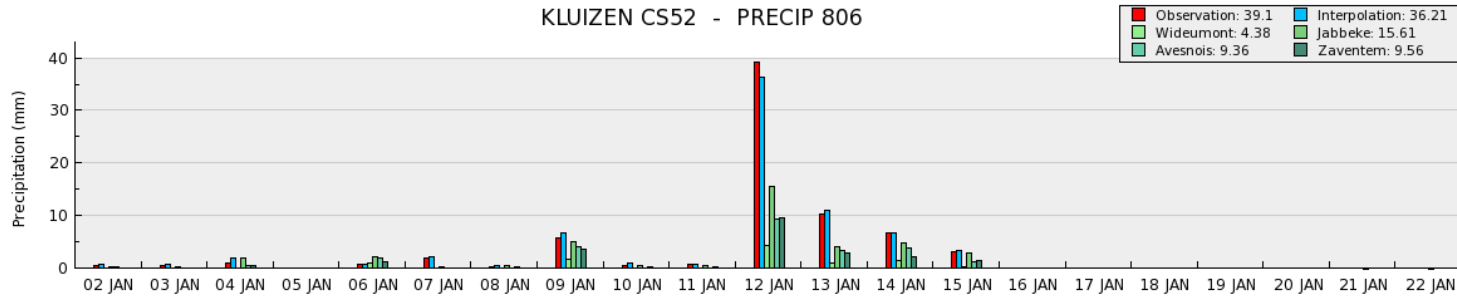
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DISTANCE	NETWORK	CODE	NAME	DAILY PRECIP. QUANTITY
2.3 km	VMM	63	Ertvelde_P	37.15
6 km	PRECIP	1009	ZELZATE AWS	36.8
6 km	AWS	6431	ZELZATE (SIDMAR GENT)	36.8
8.5 km	PRECIP	301	BASSEVELDE	41.6
9.4 km	VMM	5	Vinderhoutte	36.64
12.4 km	PRECIP	808	GENTBRUGGE	
12.6 km	VMM	17	Boekhoutte	32.24
12.9 km	PRECIP	1006	ZOMERGEM	33.2
15.1 km	PRECIP	1016	GENT STERRE	
15.1 km	AWS	106430	GENT STERRE	34.8
15.5 km	PRECIP	1022	LAARNE	
16 km	PRECIP	309	WATERLAND-OUDEMAN	
16.2 km	HIC	42	Sint-Laureins	37.1
16.3 km	PRECIP	1021	URSEL	

[Graph \(daily, current data\)](#)

[Graph \(daily, original data\)](#)

[Closest stations' values](#)



	02 JAN	03 JAN	04 JAN	05 JAN	06 JAN	07 JAN	08 JAN	09 JAN	10 JAN	11 JAN	12 JAN	13 JAN	14 JAN	15 JAN	16 JAN	17 JAN	18 JAN	19 JAN	20 JAN	21 JAN	22 JAN	
RR current (mm)	.4	.4	1	0	.7	1.8	.3	5.8	.5	.6	39.1	10.2	6.6	3.2	0	0	0	0	0	0	0	RR current (mm)
RR current QC flag	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	RR current QC flag
RR raw (mm)	0.4	0.4	1	0	0.7	1.8	0.3	5.8	0.5	0.6	39.1	10.2	6.6	3.2	0	0	0	0	0	0	0	RR raw (mm)
Interpolation (mm)	0.68	0.68	1.97	0.06	0.81	2.19	0.43	6.58	0.87	0.81	36.21	11.01	6.69	3.46	0	0	0	0	0.06	0	0	Interpolation (mm)
Wideumont (mm)	0.03	0	0.02	0	0.91	0	0	1.65	0	0.05	4.38	0.96	1.46	0.22	0	0	0	0	0	0	0	Wideumont (mm)
Jabbeke (mm)	0.19	0.2	1.81	0	2.15	0.23	0.56	4.98	0.58	0.4	15.61	3.96	4.85	2.94	0	0	0	0	0	-	-	Jabbeke (mm)
Avesnois (mm)	0.18	0.04	0.58	0	1.99	0	0.11	4.03	0.06	0.06	9.36	3.46	3.78	1.12	0	0	0	0.01	0	0.02	0	Avesnois (mm)
Zaventem (mm)	0.09	0.06	0.39	0	1.14	0.07	0.28	3.64	0.27	0.18	9.56	2.96	2.17	1.43	0	0	0	0	0	0	0	Zaventem (mm)
RR auto QC flag	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	RR auto QC flag
RR final QC flag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RR final QC flag
RR correction (mm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RR correction (mm)

[Save 1-day corrections](#)

[Reset to original values \(2017-01-12\)](#)



PRECIPITATION

Sugny PM

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SETHY 96170015 | Alt 373m | [Google map](#)

Begin 1997-01-01 | End

Wideumont 45km | Jabbeke 202km

Avesnois 86km | Zaventem 126km

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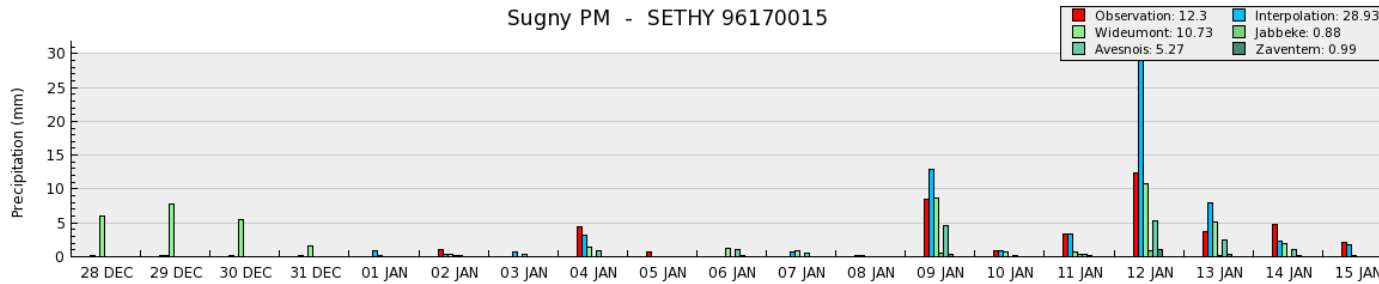
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Sugny PM - SETHY 96170015



[RR + interpolation + radars \(1-hour\)](#)

[RR + interpolation + radars \(daily, original data\)](#)

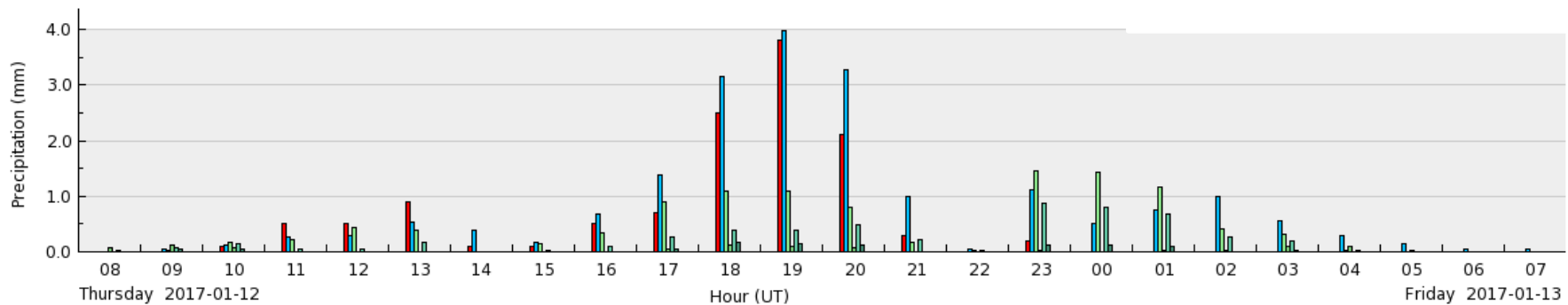
[RR + interpolation + radars \(daily, current data\)](#)

[Closest stations' values](#)



DISTANCE	NETWORK	CODE	NAME	DAILY PRECIP. QUANTITY
1 km	PRECIP	6600	SUGNY	
7.7 km	SETHY	94360015	Vresse	21.4
12.4 km	SETHY	94690015	Bouillon/Dohan	23.6
16.8 km	PRECIP	6302	BIEVRE	24.9
20 km	SETHY	86770015	Gedinne	13.3

Sugny PM - SETHY 96170015



PRECIPITATION

Sugny PM

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SETHY 96170015 | Alt 373m | [Google map](#)

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2017-01-12	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	DAILY	2017-01-13
RR current (mm)	0	0	0.1	0.5	0.5	0.9	0.1	0.1	0.5	0.7	2.5	3.8	2.1	0.3	0	0.2	0	0	0	0	0	0	0	0	12.3	RR current (mm)
RR current QC flag	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	RR current QC flag
RR raw (mm)	0	0	0.1	0.5	0.5	0.9	0.1	0.1	0.5	0.7	2.5	3.8	2.1	0.3	0	0.2	0	0	0	0	0	0	0	0	12.3	RR raw (mm)
Wideumont (mm)	0	0.03	0.18	0.21	0.44	0.38	0	0.15	0.34	0.89	1.1	1.09	0.81	0.16	0.02	1.45	1.43	1.17	0.41	0.31	0.02	0	0	0	10.59	Wideumont (mm)
Jabbeke (mm)	0.07	0.11	0.07	0	-	-	0	0	0	0.04	0.13	0.1	0.08	0	0	0.02	0	0.02	0.02	0.1	0.09	0.03	0.01	0	0.89	Jabbeke (mm)
Avesnois (mm)	0	0.07	0.14	0.04	0.06	0.17	0	0.03	0.1	0.27	0.38	0.4	0.48	0.21	0.02	0.87	0.8	0.69	0.27	0.19	0	0	0	0	5.19	Avesnois (mm)
Zaventem (mm)	0.03	0.04	0.05	0	0	0	0	0	0	0.05	0.16	0.14	0.13	0	0	0.12	0.13	0.1	0	0.03	0.02	0	0	0	1	Zaventem (mm)
Interp. hourly (mm)	0	0.05	0.13	0.26	0.3	0.54	0.4	0.17	0.68	1.38	3.15	3.97	3.27	1	0.06	1.12	0.51	0.76	1	0.56	0.29	0.15	0.05	0.05	19.85	Interp. hourly (mm)
Interp. daily (mm)	0	0.07	0.19	0.37	0.43	0.79	0.58	0.25	0.99	2.02	4.59	5.79	4.76	1.45	0.09	1.63	0.74	1.1	1.46	0.82	0.42	0.22	0.08	0.08	28.92	Interp. daily (mm)
RR auto QC flag	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	RR auto QC flag
RR final QC flag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RR final QC flag
RR correction (mm)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	RR correction (mm)

18h - 19h	18:05	18:10	18:15	18:20	18:25	18:30	18:35	18:40	18:45	18:50	18:55	19:00	18h - 19h
RR current (mm)	0.3	0.3	0.3	0.3	0.4	0.2	0.3	0.3	0.2	0.4	0.4	0.4	RR current (mm)
RR current QC flag	v	v	v	v	v	v	v	v	v	v	v	v	RR current QC flag
RR raw (mm)	0.3	0.3	0.3	0.3	0.4	0.2	0.3	0.3	0.2	0.4	0.4	0.4	RR raw (mm)
RR final QC flag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	RR final QC flag
RR correction (mm)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	RR correction (mm)



Quality control of air temperature data

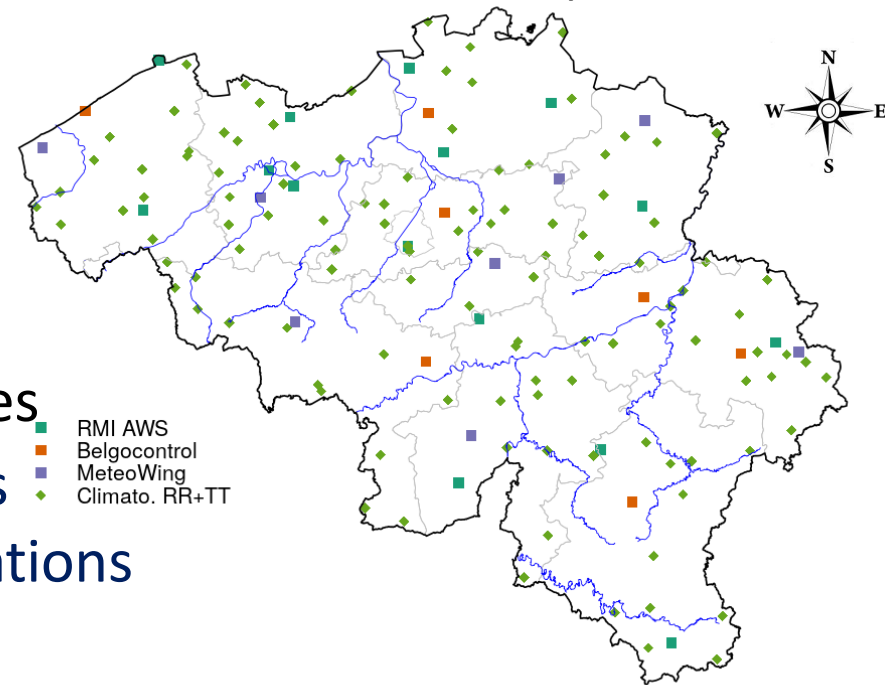
- 15 AWS RMI:
 - 10-min data
 - up to 4 recording heights (1.5, 2.0, 10.0 & 30.0 m)
 - Tdry & Twet : 1.5 m

➤ next business day

- 146 RMI climato:
 - daily extremes temperatures

➤ next business day for 35 stations

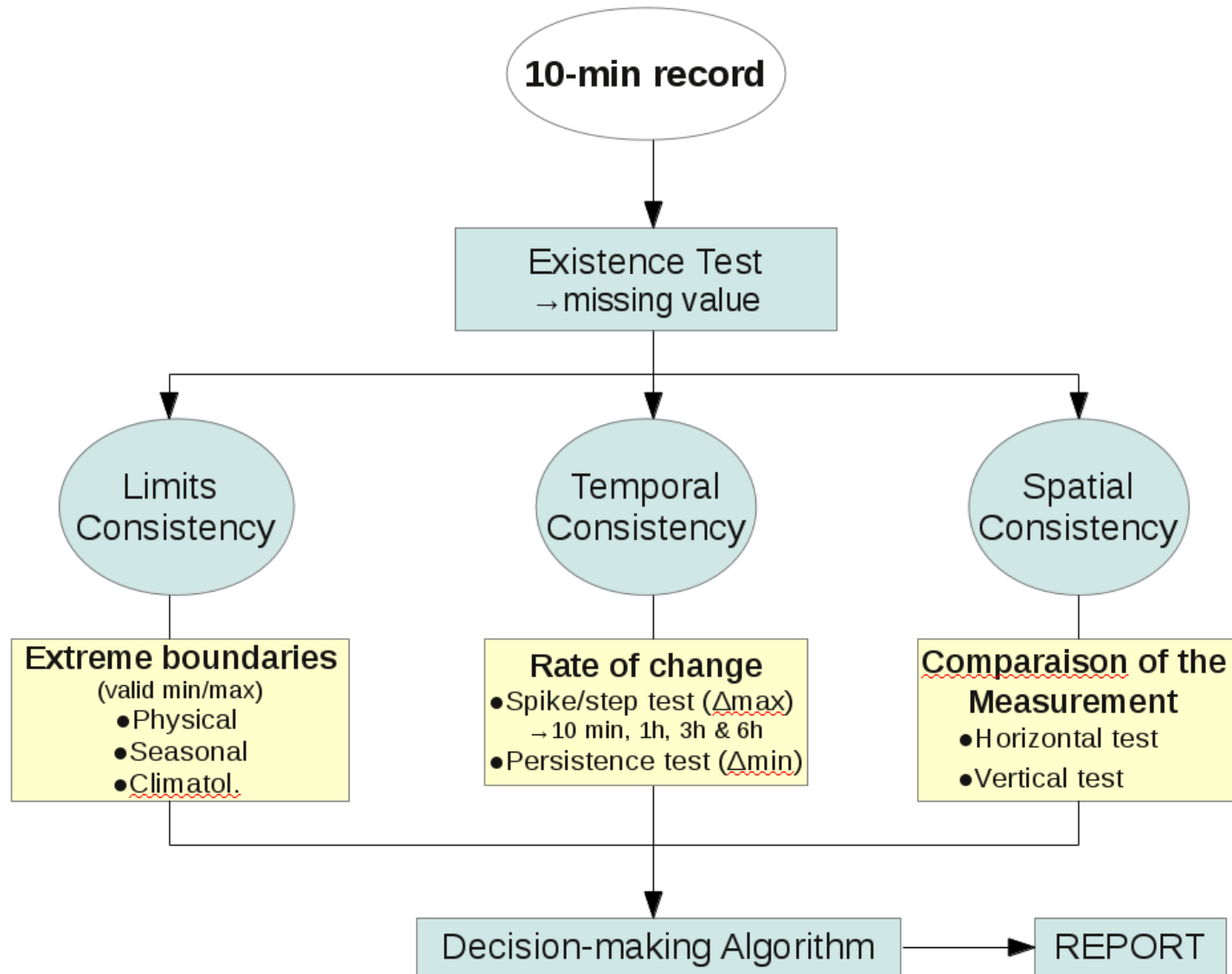
➤ ~2 months delay for all other stations



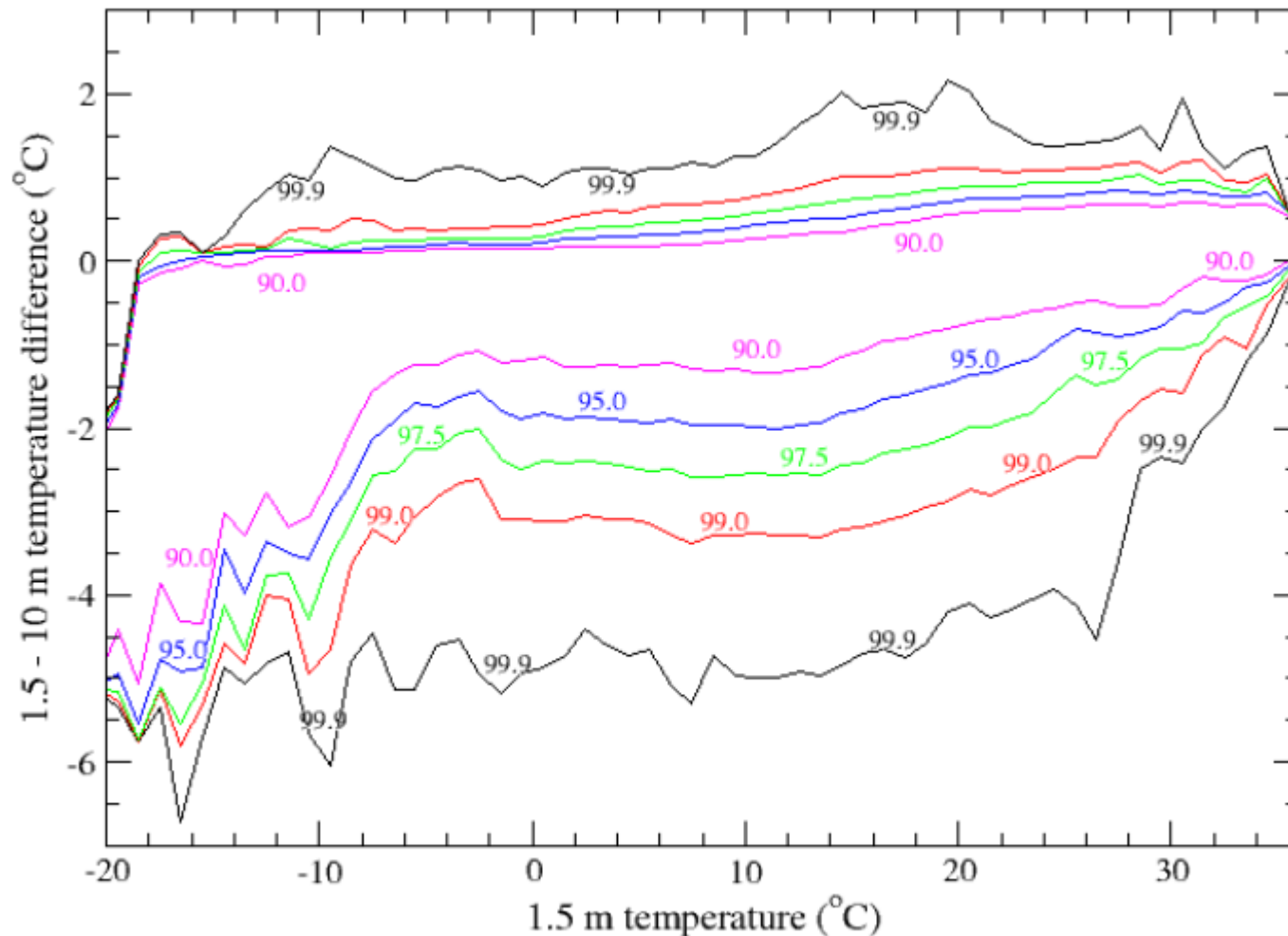
✓ Further 10-min data could be included in the QC protocol



10-min air temperature: automated QC



Vertical check



Percentiles of the joint probability density determined from several years of screened data

- Require consistency among the vertical temperature profile as well as consistency with historical data
- Minimum of 3 recording heights to identify a problematic level



10-min air temperature: Interactive manual QC

ADD A CONSTANT VALUE

Before=RED After=GREEN X-axis position 175,4
Y-axis position 4,135

— Before
— After

Temperature
Time

× 1E0

Would you like to correct ONLY 1 parameter data ? [1=yes, 0=no]
0
Would you like to introduce any correction in the TEMP_DRY_SHELTER_AVG data (RED)
0
Would you like to validate the TEMP_DRY_SHELTER_AVG data (RED curve) time series
0
Would you like to introduce any correction in the TEMP_WET_SHELTER_AVG data (GRAY)
1

There are different ways to correct the data:
1 = set the data value to NULL
2 = temporal interpolation - missing value -
3 = temporal interpolation - erroneous value -
4 = vertical interpolation - erroneous value -
5 = least squares fitting
6 = replace the erroneous value by the value of another parameter
7 = replace the erroneous value by the value recorded in another AWS
8 = add a constant value to the data
9 = smooth the time serie - running average procedure -
10 = manual correction
11 = noon heating reduction (option 1)
12 = noon heating reduction (option 2)
13 = extra cooling reduction (option 1)
14 = extra cooling reduction (option 2)
15 = spatial (horizontal) interpolation
Enter your selection (i.e., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15)
8
ADD A CONSTANT VALUE TO THE DATA
Enter the constant value to add
-2.
Would you like to use the new values to correct the data ? [1 = yes, 0 = No]

HUMAIN

BEFORE CORRECTION

Temperature
Time

× 1E0

X position 164
Y position -5,803

- 1,5 m (Tdry)
- 10 m
- 2 m
- 30 m
- Vaisala (1,5 m)
- 1,5 m (Twet)
- E/S
- E/S
- E/S
- E/S

Would you like to correct ONLY 1 parameter data ? [1=yes, 0=no]
0
Would you like to introduce any correction in the TEMP_DRY_SHELTER_AVG data (RED)
0
Would you like to validate the TEMP_DRY_SHELTER_AVG data (RED curve) time series
0
Would you like to introduce any correction in the TEMP_WET_SHELTER_AVG data (GRAY)
1

There are different ways to correct the data:
1 = set the data value to NULL
2 = temporal interpolation - missing value -
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15 = spatial (horizontal) interpolation
Enter your selection (i.e., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15)
8
ADD A CONSTANT VALUE TO THE DATA
Enter the constant value to add
-2.
Would you like to use the new values to correct the data ? [1 = yes, 0 = No]

TEMP WET SHELTER AVG

Constant Value Added X-axis position 0,5639
Y-axis position 23,83

Temperature
Time

× 1E0

- 1,5 m
- 10 m
- 2 m
- 30 m
- Vaisa
- 1,5 m

Would you like to correct ONLY 1 parameter data ? [1=yes, 0=no]
0
Would you like to introduce any correction in the TEMP_DRY_SHELTER_AVG data (RED)
0
Would you like to validate the TEMP_DRY_SHELTER_AVG data (RED curve) time series
0
Would you like to introduce any correction in the TEMP_WET_SHELTER_AVG data (GRAY)
1

There are different ways to correct the data:
1 = set the data value to NULL
2 = temporal interpolation - missing value -
3 = temporal interpolation - erroneous value -
4 = vertical interpolation - erroneous value -
5 = least squares fitting
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13 = extra cooling reduction (option 1)
14 = extra cooling reduction (option 2)
15 = spatial (horizontal) interpolation
Enter your selection (i.e., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15)
8
ADD A CONSTANT VALUE TO THE DATA
Enter the constant value to add
-2.
Would you like to use the new values to correct the data ? [1 = yes, 0 = No]



Daily extreme temperatures : automated data QC

TEMPERATURE

Automatic QC

[Overview](#)

[Maps](#)

[Automatic QC](#)

[Near stations](#)

[All stations](#)

Thursday 12-13 Jan 2017

[« previous](#) | [next »](#)

Preliminary tasks

Automatic QC Done on 2017-03-02 02:01:23

Detected erroneous/suspicious/missing data

CODE	NAME	TN	TN AUTO QC_FLAGS	TX	TX AUTO QC_FLAGS
1014	UCCLE VIVAQUA	-3.4	e	6.2	v
1405	ROCHEFORT	-1.4	e	6.2	v
1207	LIEGE-MONSIN		m	7.5	c
318	KEMMEL		m		m
321	GENT STERRE		m		m
718	LIER		m		m
919	ELINGEN		m		m
1618	SOURBRODT		m		m
1206	ANGLEUR	4.7	s	7.5	v
1404	CRUPET	-0.4	s	4.6	v
1708	SAINT-HUBERT	-0.2	v	2.2	e
1620	ELSENBORN	-1	v	4.2	s

- Existence test
- Limit consistency
- Internal consistency
- Spatial consistency



Daily extremes temperatures: manual QC

TEMPERATURE

Maps

Overview

Maps

Automatic QC

Near stations

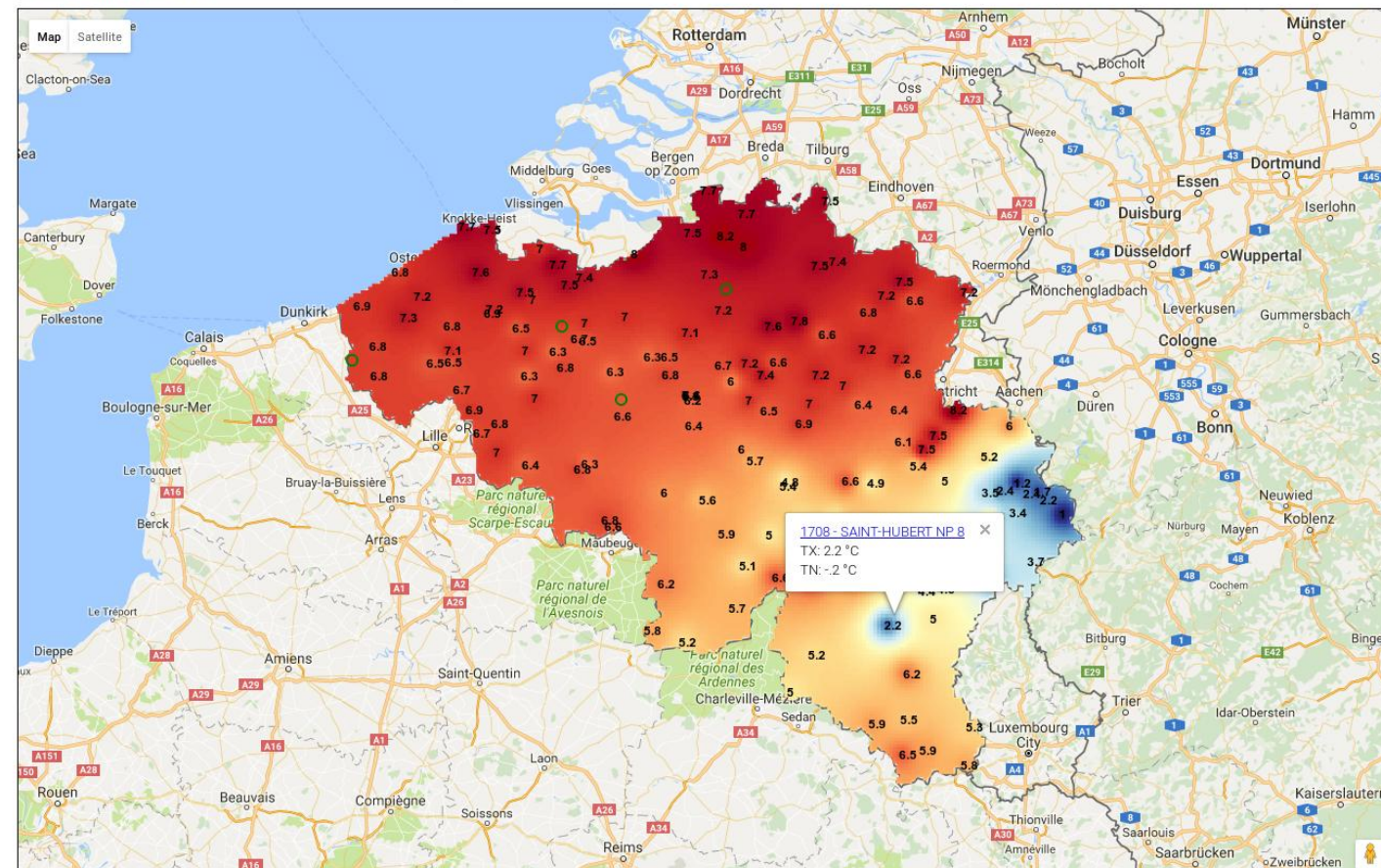
All stations

Home

Thursday 12-13 Jan 2017

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Google maps overlays Done on 2017-03-08 14:11:22



Opacity: 100%

Networks

- CLIMATO
- No values
- TX
- TN

Overlays (to refresh: CTRL+F5)

- TX
- TN
- TX-TN
- TX(D)-TX(D-1)
- TN(D)-TN(D-1)

2017-01-08

2017-01-09

2017-01-10

2017-01-11

2017-01-12

2017-01-13

2017-01-14

2017-01-15

2017-01-16

2017-03-08 13:11

TEMPERATURE

SAINT-HUBERT NP 8

Thursday 12-13 Jan 2017

TEMP 1708 | Alt 557m | [Google map](#)

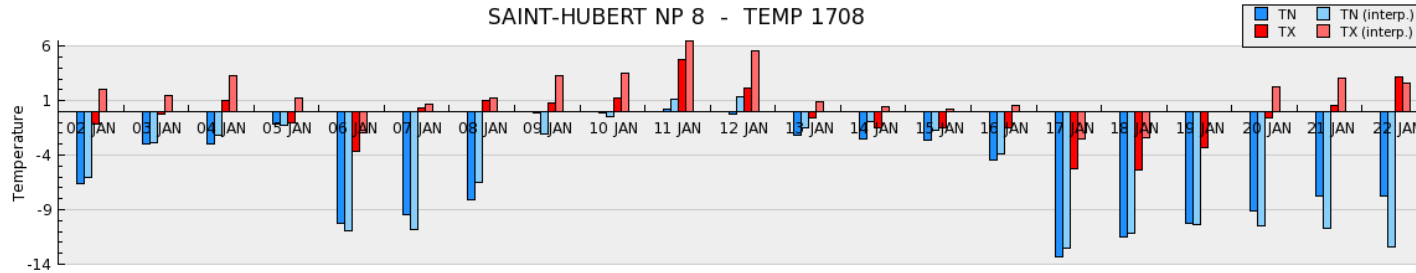
[« previous](#) | [next »](#)

Begin 1953-12-01 | End

[Go to PRECIP 6304](#)

[Overview](#) | [Maps](#) | [Automatic QC](#) | [Near stations](#)

DISTANCE	CODE	NAME	TX	TN
17.1 km	1717	GIVRY	5	1.5
17.9 km	1701	HIVES	4.4	1.6
19.3 km	1719	MASSUL	6.2	-0.1
19.9 km	1405	ROCHEFORT	6.2	-1.4



[Graph \(daily, current data\)](#)

[Graph \(daily, original data\)](#)

[Closest stations' values](#)

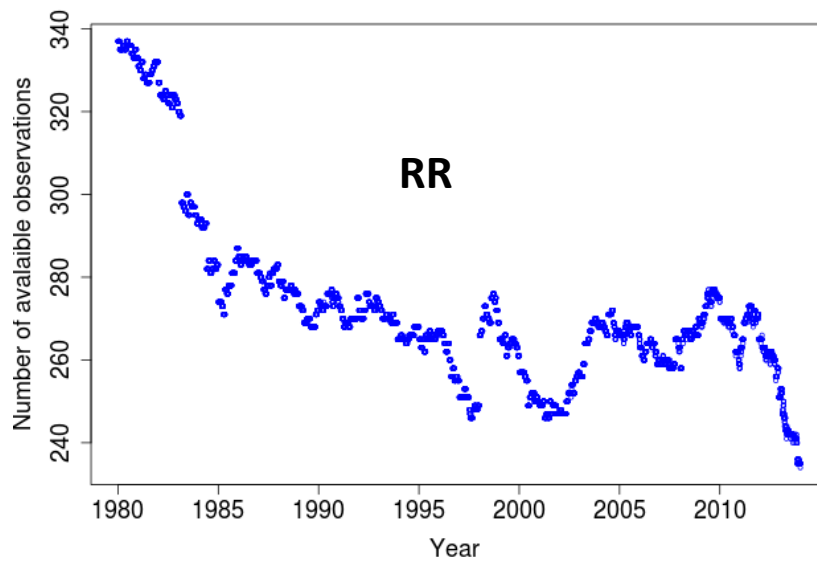


	02 JAN	03 JAN	04 JAN	05 JAN	06 JAN	07 JAN	08 JAN	09 JAN	10 JAN	11 JAN	12 JAN	13 JAN	14 JAN	15 JAN	16 JAN	17 JAN	18 JAN	19 JAN	20 JAN	21 JAN	22 JAN	
TX current	-1.1	-2	1	-1	-3.6	.3	1	.8	1.2	4.8	2.2	-6	-1.5	-1.5	-1.5	-5.3	-5.4	-3.3	-6	.6	3.2	TX current
TX current QC flag	v	v	v	v	v	v	v	v	v	v	v	v	c	v	v	c	v	c	v	v	v	TX current QC flag
TX raw	-1.1	-2	1	-1	-3.6	.3	1	.8	1.2	4.8	2.2	-6	-	-1.5	-1.5	-	-5.4	-	-6	.6	3.2	TX raw
TX interpolation	2.01	1.42	3.31	1.28	-1.95	0.62	1.21	3.3	3.5	6.47	5.54	0.92	0.41	0.16	0.56	-2.53	-2.43	0.01	2.25	3.07	2.62	TX interpolation
TX auto QC flag	e	v	s	s	v	v	v	s	s	v	e	v	m	v	s	m	s	m	s	s	v	TX auto QC flag
TX final QC flag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TX final QC flag
TX correction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TX correction
TN current	-6.6	-3	-3	-1.2	-10.3	-9.4	-8.1	-1	-1	.2	-2	-2.2	-2.5	-2.6	-4.4	-13.3	-11.5	-10.2	-9.1	-7.8	-7.7	TN current
TN current QC flag	v	v	v	v	v	v	v	v	v	v	v	v	v	c	v	v	c	v	c	v	v	TN current QC flag
TN raw	-6.6	-3	-3	-1.2	-10.3	-9.4	-8.1	-1	-1	.2	-2	-2.2	-2.5	-	-4.4	-13.3	-	-10.2	-	-7.8	-7.7	TN raw
TN interpolation	-6.02	-2.8	-2.14	-1.27	-10.9	-10.81	-6.55	-2.11	-0.45	1.09	1.38	-1.54	-0.92	-1.68	-3.89	-12.5	-11.12	-10.32	-10.47	-10.69	-12.36	TN interpolation
TN auto QC flag	v	v	v	v	v	v	v	s	v	v	v	v	v	m	v	v	m	v	m	s	e	TN auto QC flag
TN final QC flag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TN final QC flag

Conclusions

- To cope with the observation networks automation and the staff reduction the RMI data quality control processes are being revisited to support the QC staff in their work
 - ✓ Automated QC tests
 - ✓ New QC interactive interfaces
 - ✓ ...
- **Next step**: investigate the benefit of using Stochastic Neural Networks (SNNs) for data QC, outlier detection and estimation/reconstruction of missing/erroneous records

Evolution of the number of available precipitation observations



Evolution of the number of available temperature observations

