ACCORD

A Consortium for COnvection-scale modelling Research and Development

IRM

2021 Joint LACE Data Assimilation & DAsKIT Working Days,
Ljubljana, 22-24 September 2021

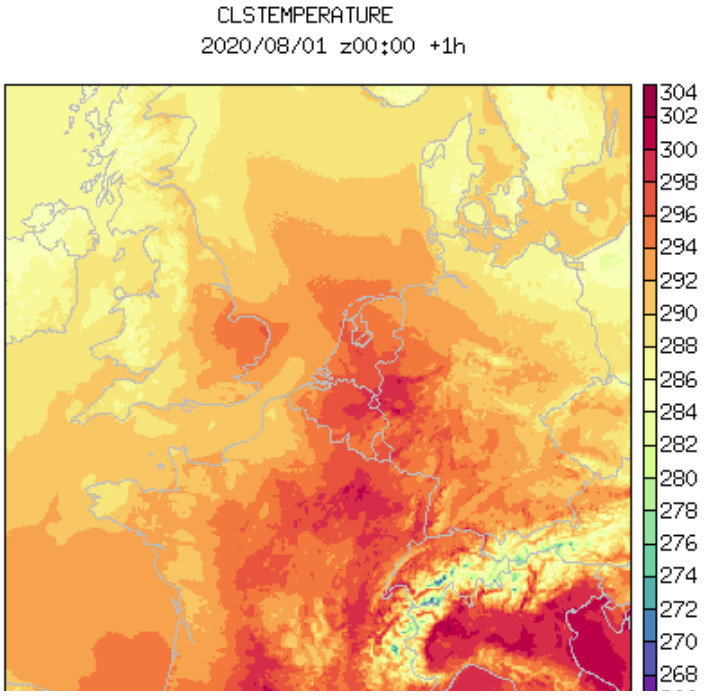
DAsKit progress at RMI (Belgium)

Presented by
Idir DEHMOUS

Operational Forecast models

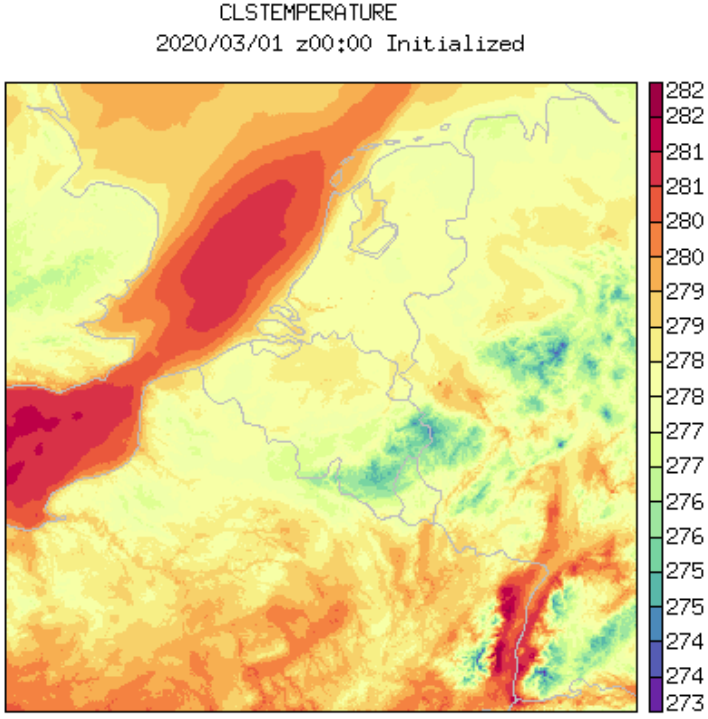
ALARO cy43t2

Resolution	4km , 432x432 grid points
Number of levels	87
Time step	180 s
Coupling model	ARPEGE
Coupling frequency	1 hour
Forecast range	60h at 00, 06, 12, 18h
Initialisation	First ARPEGE coupling file



ALARO (high resolution) cy43t2

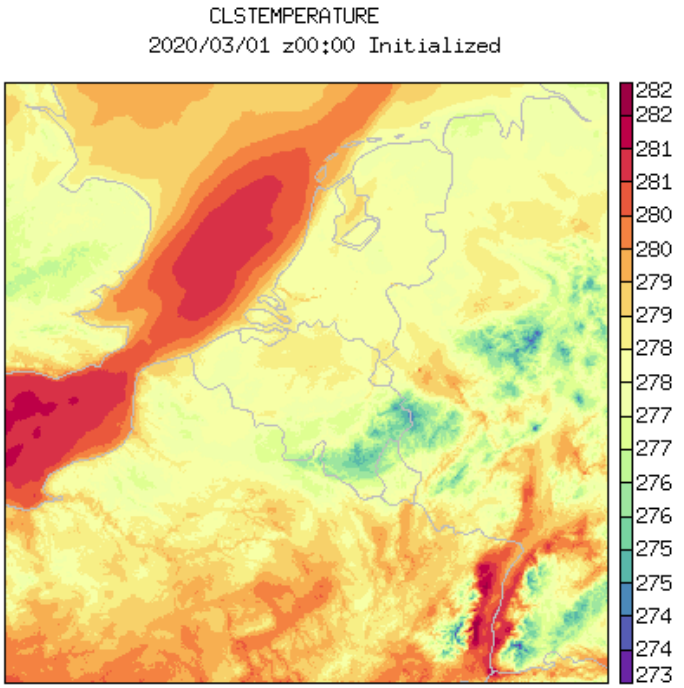
Resolution	1.3km , 576x576 grid points
Number of levels	87
Time step	45 s
Coupling model	ALARO 4km
Coupling frequency	1 hour
Forecast range	36h at 00, 06, 12, 18h
Initialisation	First ALARO coupling file

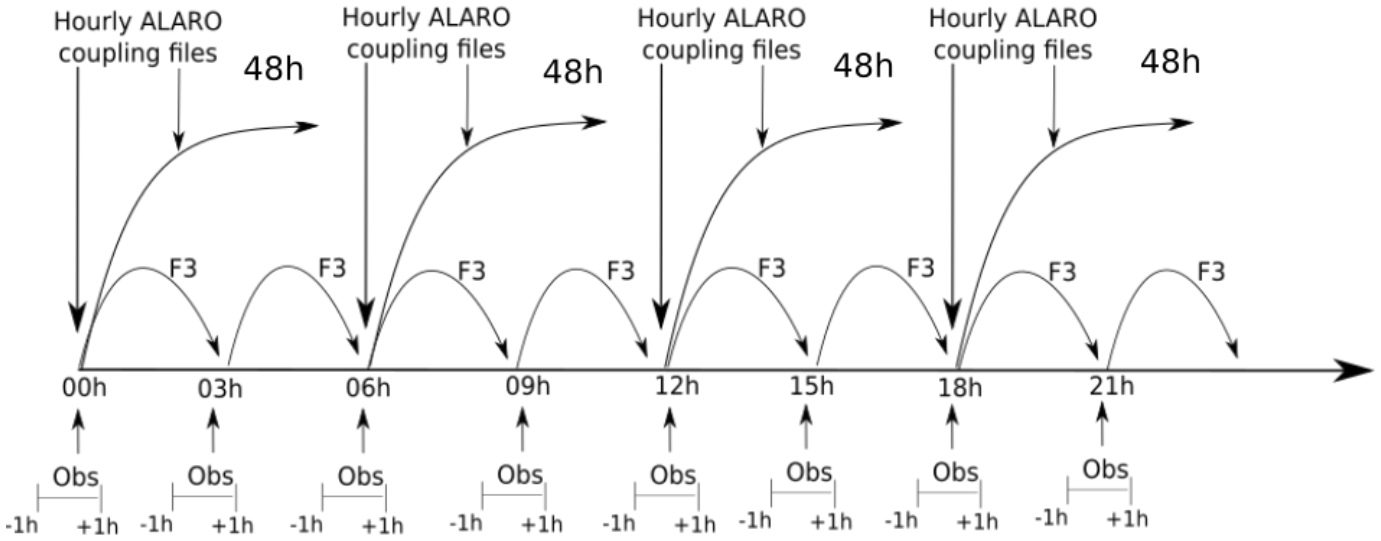


AROME operational setup with surface DA

AROME cy43t2

Resolution	1.3km , 576x576 grid
points	
Number of levels	87
Time step	45 s
Coupling model	Nested with ALARO 4km
Coupling frequency	1 hour
Forecast range	48h at 00, 06, 12, 18h
Initialisation	Surface :
Canari_Oimain	
Upper-air: None	





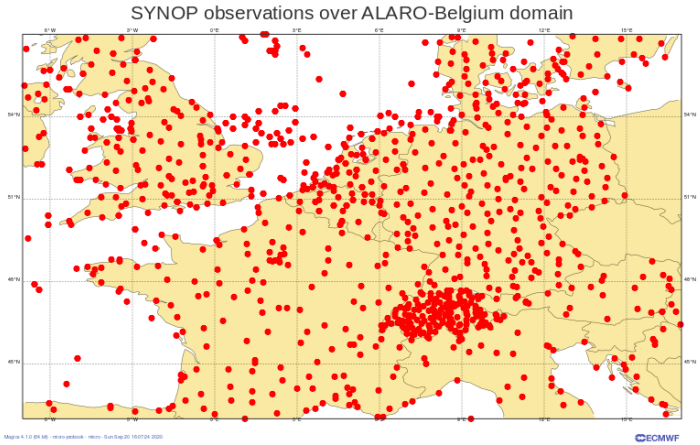
Testing configurations

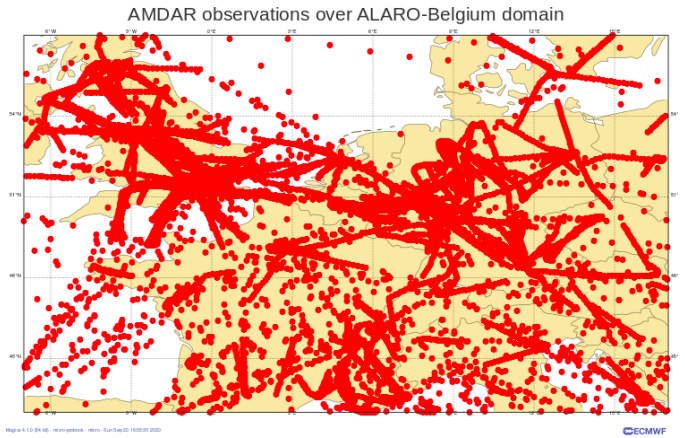
Local set-up and configurations	Status
Cycle used	Cy43t2
Assimilation frequency	3 hours (for all configurations)
B Matrix computation with EDA	On going (The B matrix from AEARP in spin-up mode done)
Surface DA (CANARI_Oimain AROME 1.3km) + SYNOP	Operational
3DVar + CANARI_Oimain for AROME 1.3km (Tested with AMDAR , TEMP ,GNSS , Mode-S and RADAR)	Testing
3Dvar + CANARI for ALARO 1.3 km	Testing
Scripting and suites environnement	-Ecflow version 4.14.0 -NodeRunner (local tool for the suites creation)

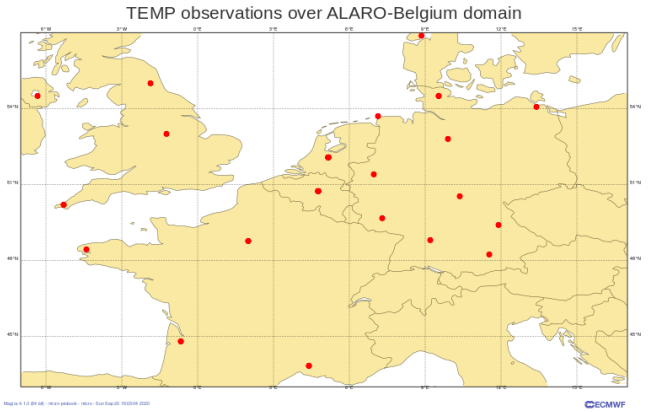
Observations (conventional)

- The conventional observations are assimilated after removing duplications and adding amendements using local python scripts (POP_RMI)

Observation type	Source	Format	Status
SYNOP	GTS	BUFR	Assimilated (Operational)
AMDAR	GTS	BUFR	Assimilated (Testing suites)
TEMP	GTS	BUFR	Assimilated (Testing suites)







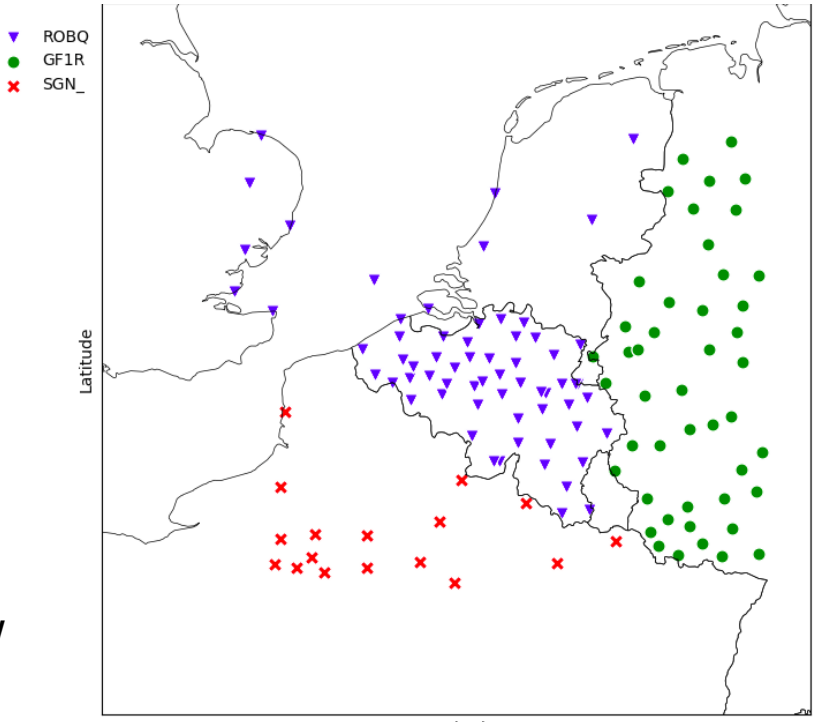
Observations (non-conventional)

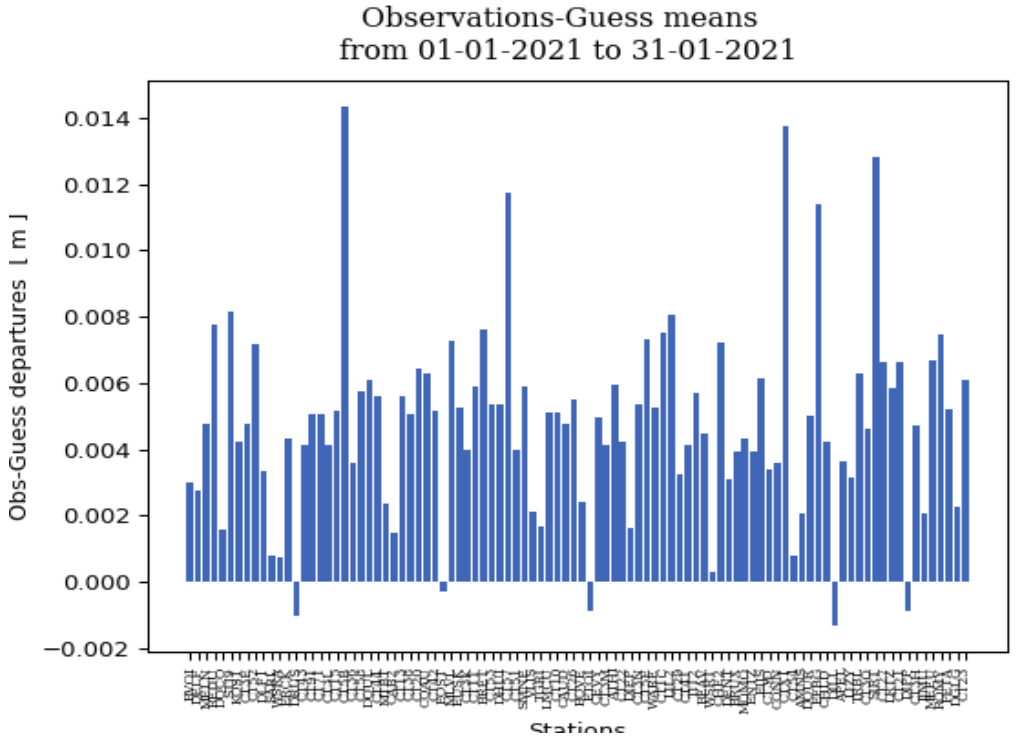
- New observation types are under validation at RMI.

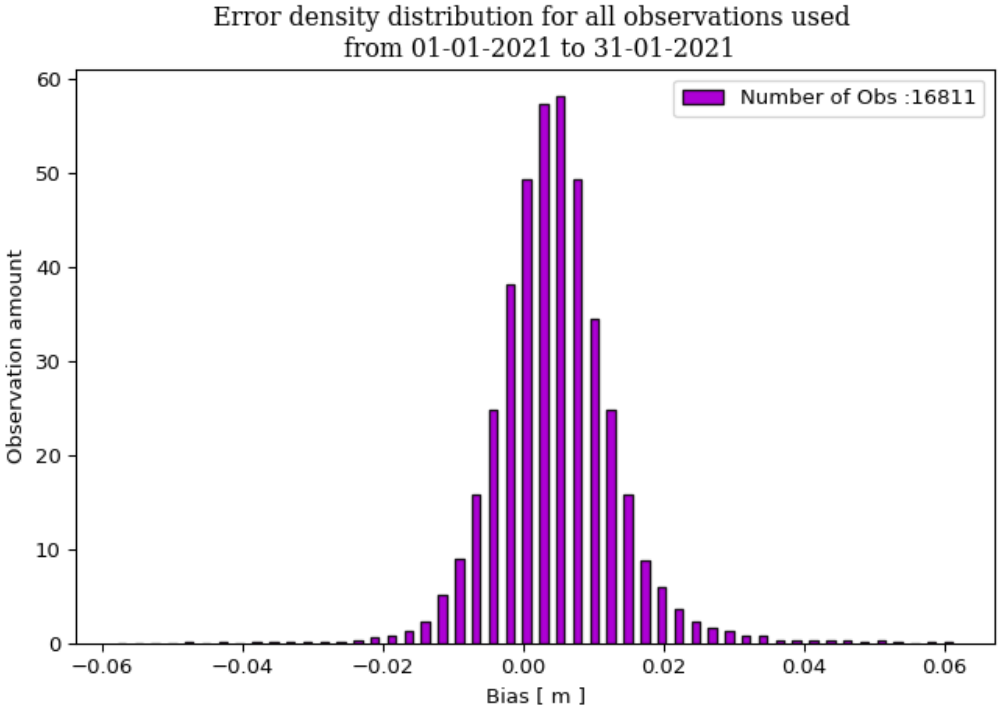
Observation type	Source	Format	Status
Ground based GNSS	GTS	BUFR	Monitored and assimilated
MODE-S EHS	KNMI server	BUFR	Monitored and tested
RADAR (DBZH)	RMI	HDF5	Tested (no quality control)

GNSS Monitoring

- Around 128 stations are selected and monitored from 3 different processing centers (ROBQ, GF1R, SGN1)
- Collected each 3 hours , 15’ sampling
-
- The ZTD static bias of each station is evaluated using 1-month period (arround 16811 observations)
-
- Update of the list_gpssol for AROME by adding the new monitored stations

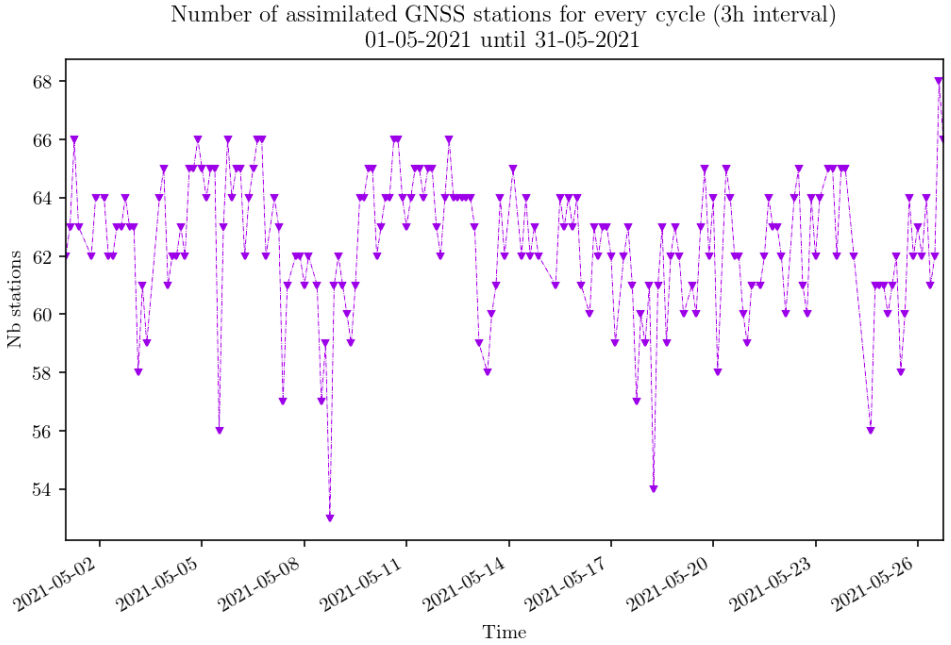


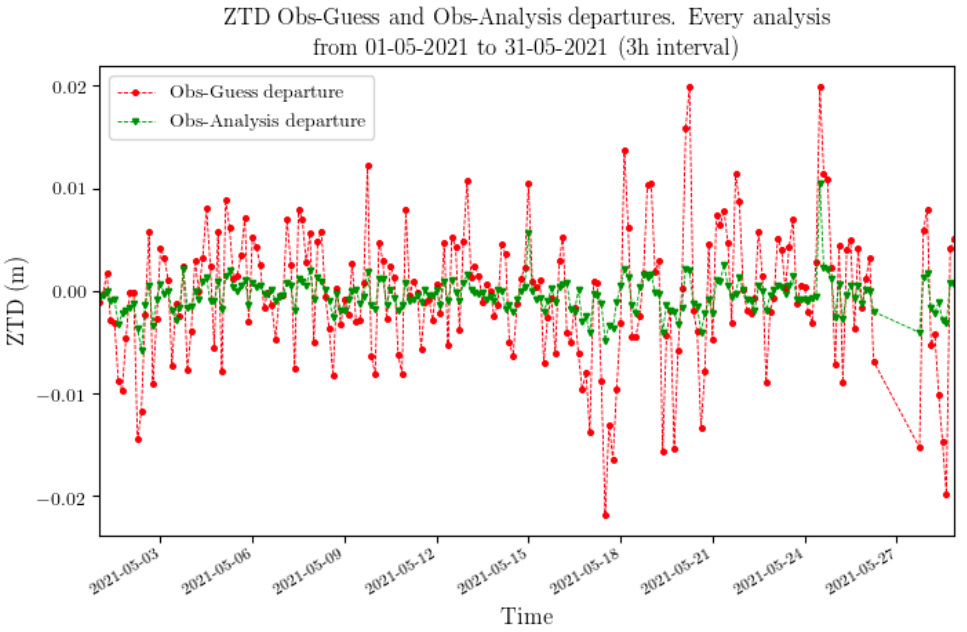


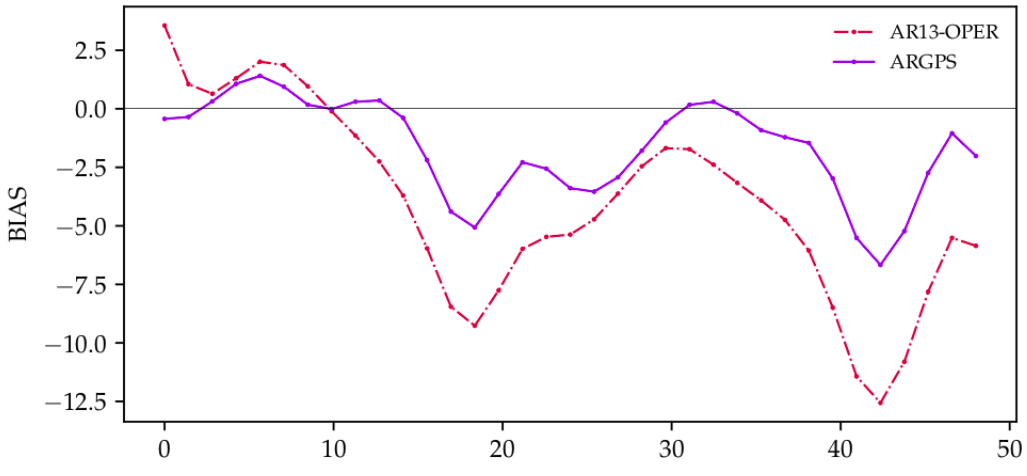


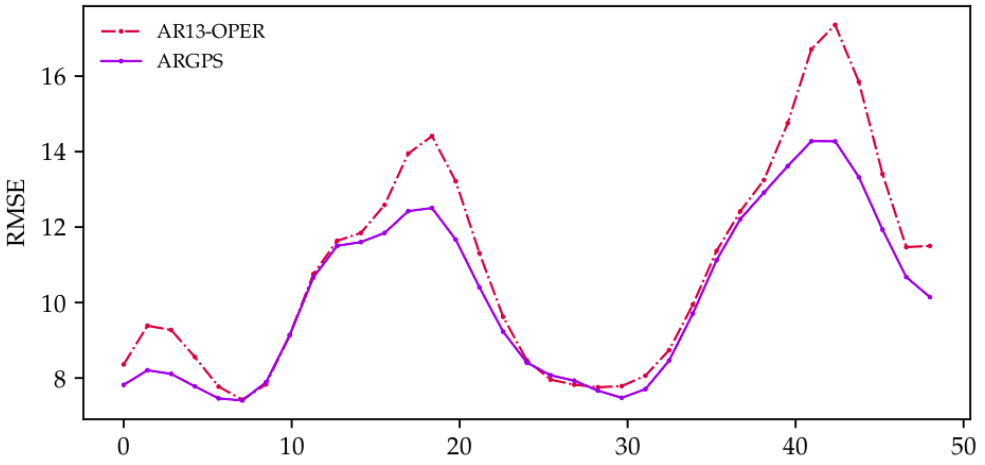
GNSS assimilation first results

- The GNSS are tested for one month period 01-05-2021 until 31-05-2021
-
- In AROME CANARI + 3DVAR 3hour RUC configuration



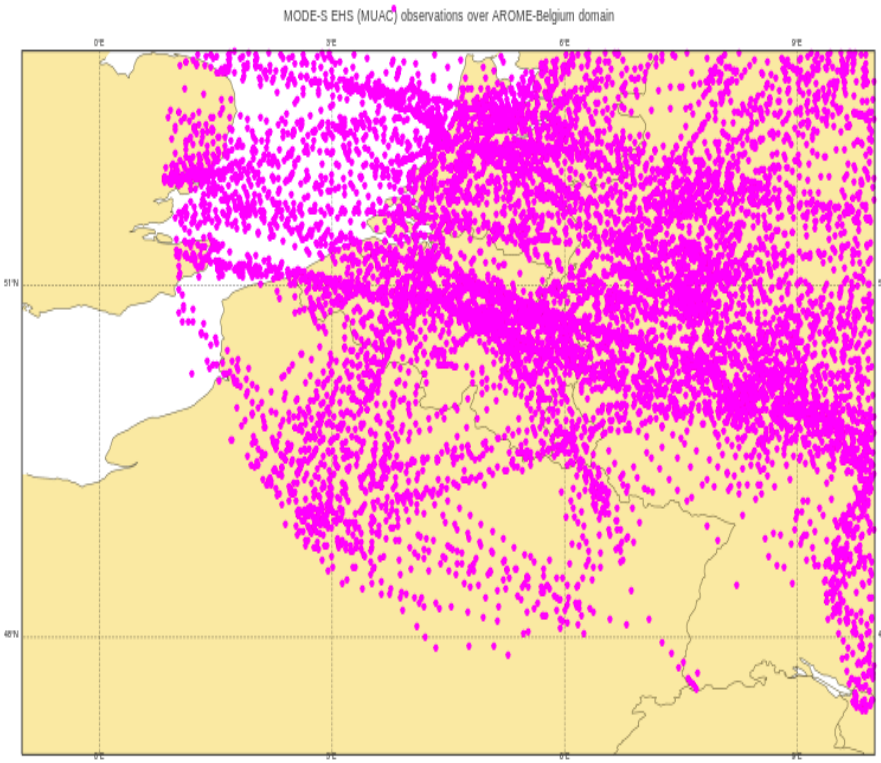


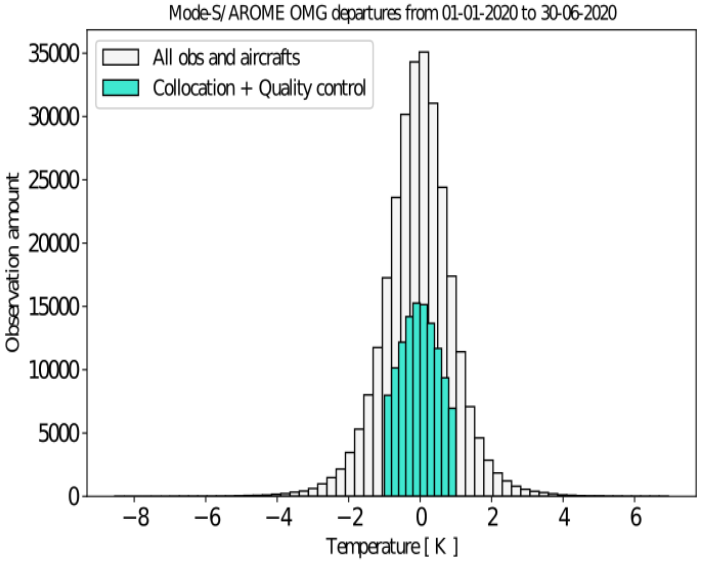


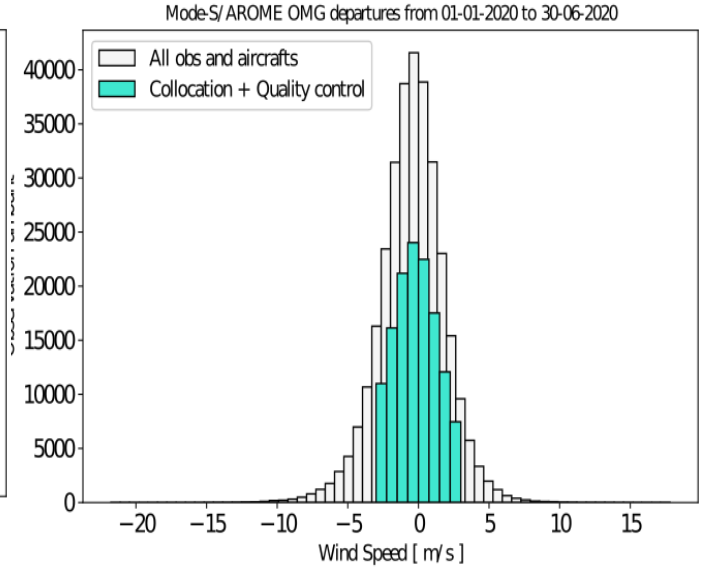


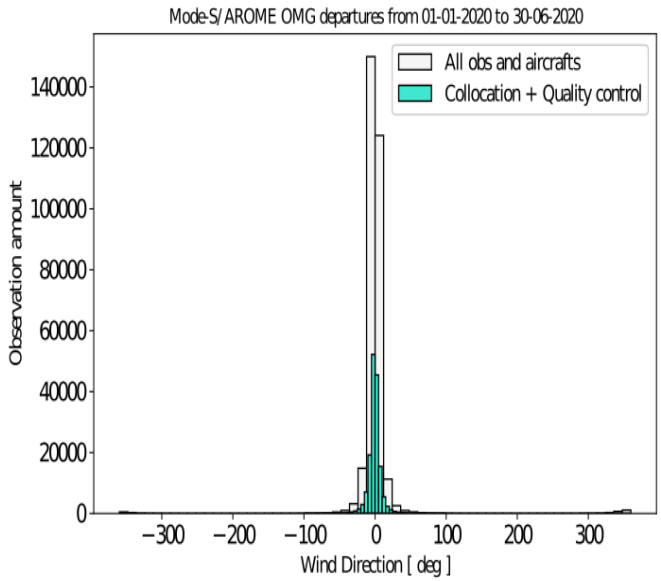
MODE-S EHS Monitoring

- The data are collected by **MUAC** (Maastricht Upper Area Control Centre) and processed by the **KNMI**.
-
- Monitored paramters : Upper-air temperature , wind speed and direction
-
- Monitoring period : 01-01-2020 to 30-06-2020 (around 300.000 observations)
-
- The data are monitored against the AMDAR and AROME NWP
-
- Generation of a whitelist containing around 420 aircrafts to be used in active assimilation









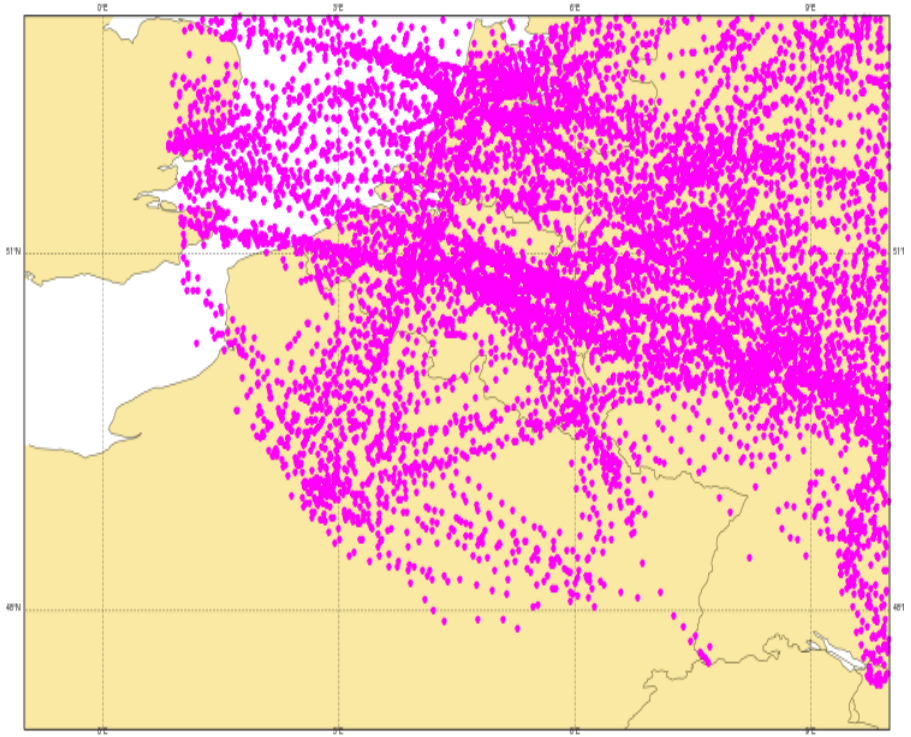
MODE-S EHS Monitoring

- Switch to the EMADDC Mode-S data .

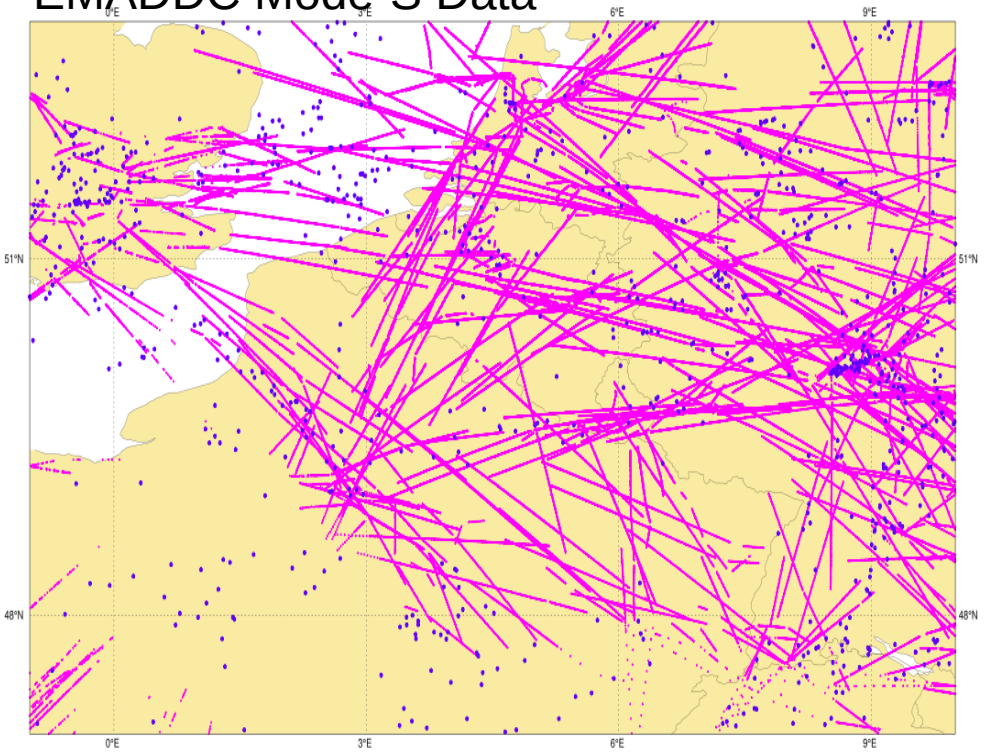
Collaboration with the EUMETNET: Observations Programme Capability Area (Obs-CA)

-
- Use of the recently revised temperature at KNMI
-
- More extended area coverage compared to MUAC data
-
- Data are denser over time (every 4 seconds)
-

MUAC Mode-S Data



EMADDC Mode-S Data



First trial of the RADAR DA (reflectivities)

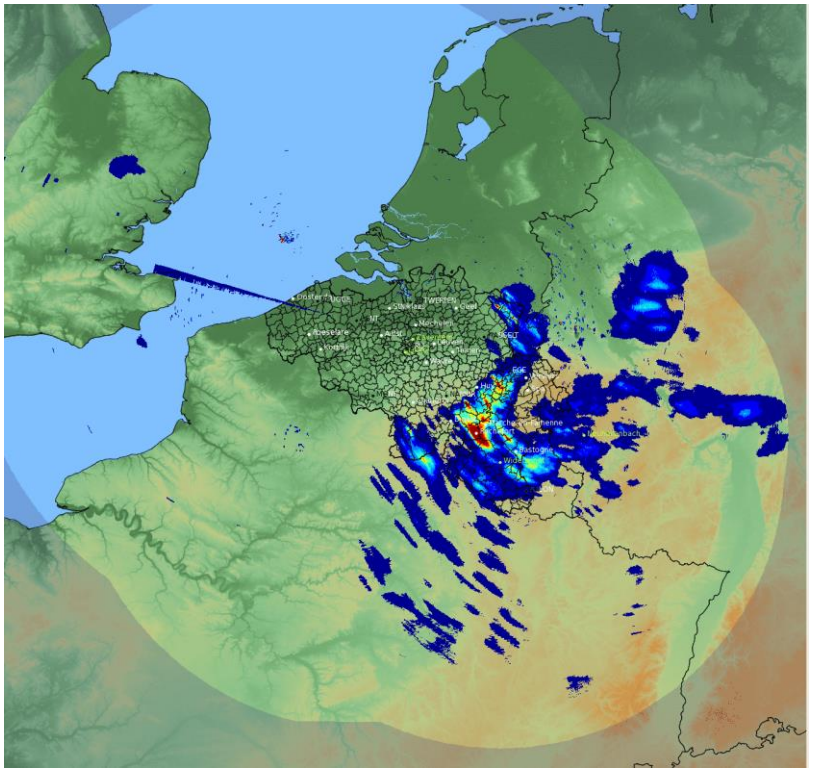
- The radar data are provided by the RMI in HDF5 format
- The files are compatible with OPERA ODIM V2.2 structure , but were modified to match the structure expected by BATOR program

- Old HDF5 structure

```
/
/dataset[X]
/          /data[n]
/          /      /data
/          /      /what
/          /data[n]/quality[Y]
/          /          /data

/          /          /what

/           /what
/           /where
/what
/where
/how
```

- New HDF5 structure

```
/ Conventions
/dataset[X]
/          /data[n]
/          /      /data
/          /      /what
/          /data[n]/quality[Y]:Task
/          /          /data

/          /          /what

/           /what
/           /where
/           /how
/what
/where
/how
```

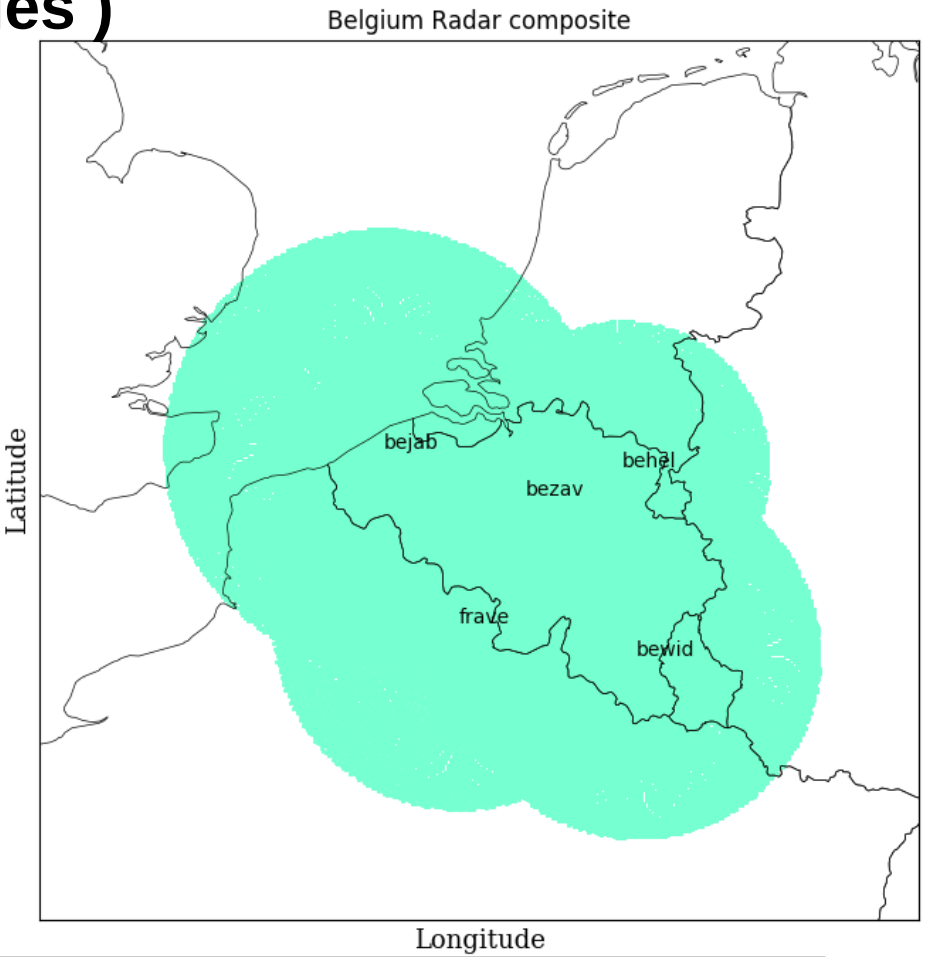


- The routine bator_decodhdf5_mod.F90 was modified to read the quality flags one level deeper
- Local version of BATOR is used to handle either the local RADAR files or those from OPERA.

First trial with RADAR DA (reflectivities)

- The Dataset and coverage
- Contains the corrected reflectivities DBZH
- The quality flags groups

be.rmib.clutter.rainbow
be.rmib.clutter.cloudtype
be.rmib.clutter.vertical_gradient
be.rmib.clutter.texture



Station	Latitude	Longitude	Elevation (m)	Location	Country	Radar type & Polarisation
bejab	51.19	5.40	50	Jabbekke	Belgium	C band , Dual
bezav	50.12	3.06	90	Zaventem	Belgium	C band ,single
behel	51.07	5.40	144	Helchteren	Belgium	C band ,Dual
bewid	49.91	5.50	590	Wideumont	Belgium	C band, single
frave	50.12	3.81	208	Avenois	France	C band , Dual

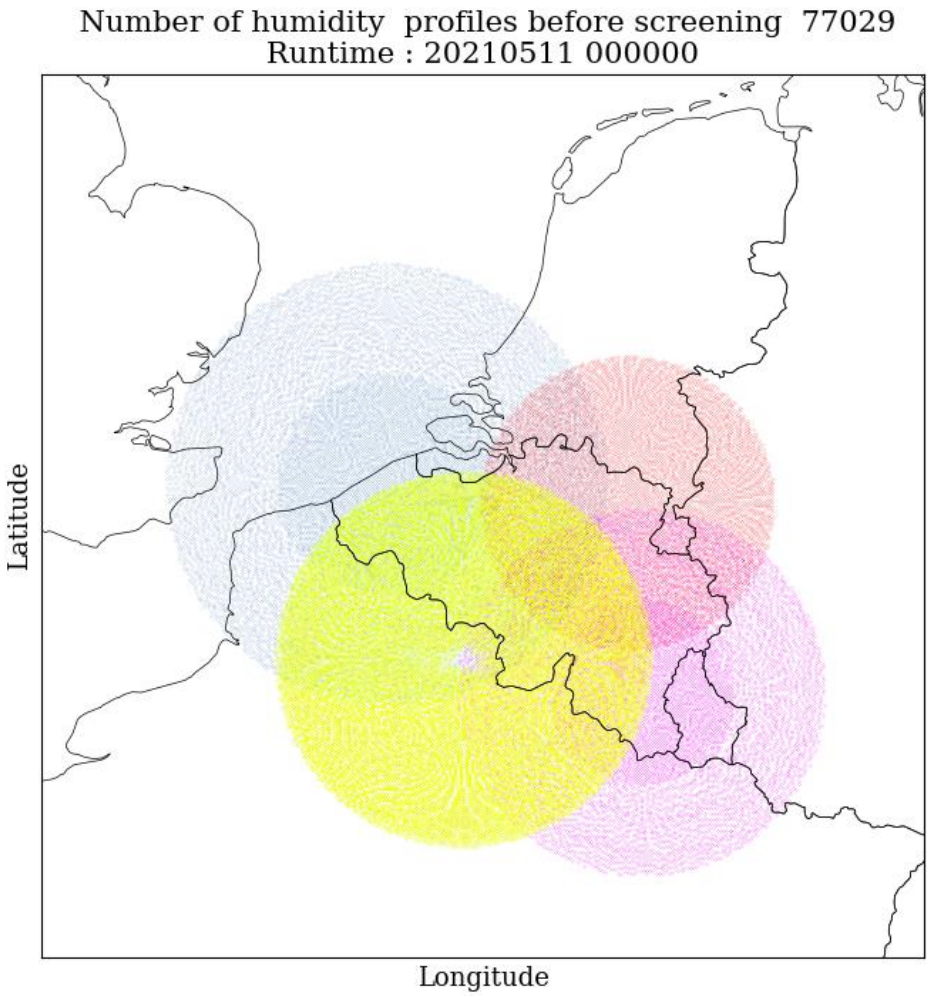
First trial with RADAR DA (reflectivities)

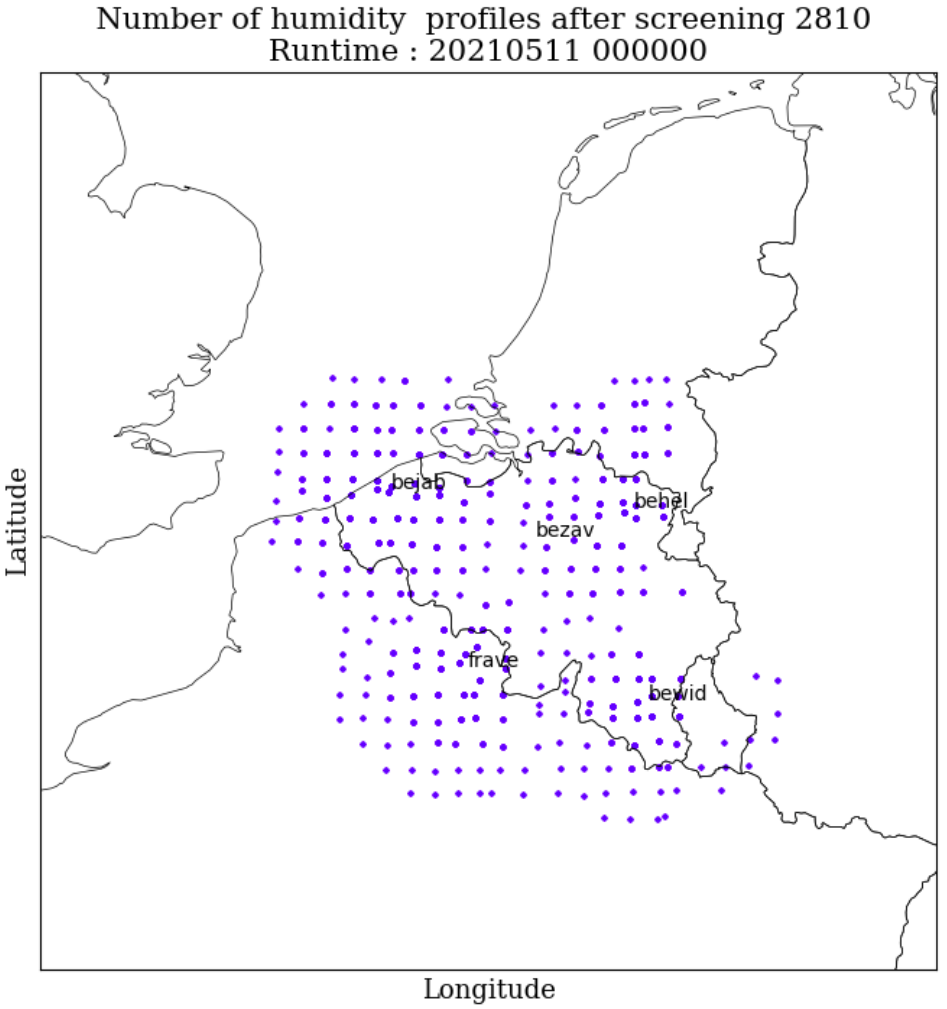
Main namelists setting

namelist	Namelist bloc setting	Description
namel_bator	**&HDF5** ODIM%Sample = 2000 ODIM%Resolustion =4000 ODIM%Choosentask= « be.rmib.clutter.texture »	-Data sampling and final resolution -Quality flag to be used for reflectivity
Screening (e002)	**&NAMSCC** RFIND_RADAR = 16000. RMIND_RADAR= 8000.	-Box size of Radar data selection -Average distance between two radar data
Minimisation (e131)	**&NAMCOSJO** NOTVAR=(1,13)=-1,-1,-1,-1,0,-1,0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,0-1,-1,-1,-1,-1,-1,-1	-Take only upper-air humidity , temperature and geopotential in the observation operator

First trial of the RADAR DA(reflectivities)

Screening example





Number of obs before screening=77029

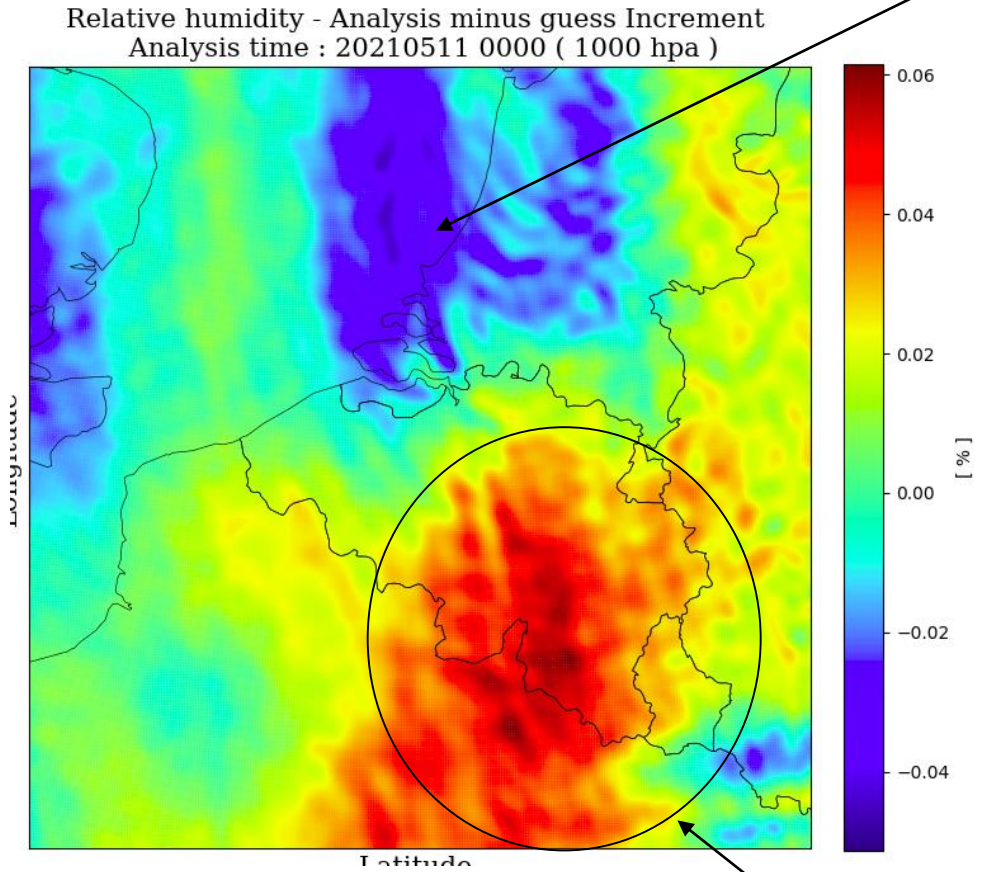
Number of obs after thinning=2810

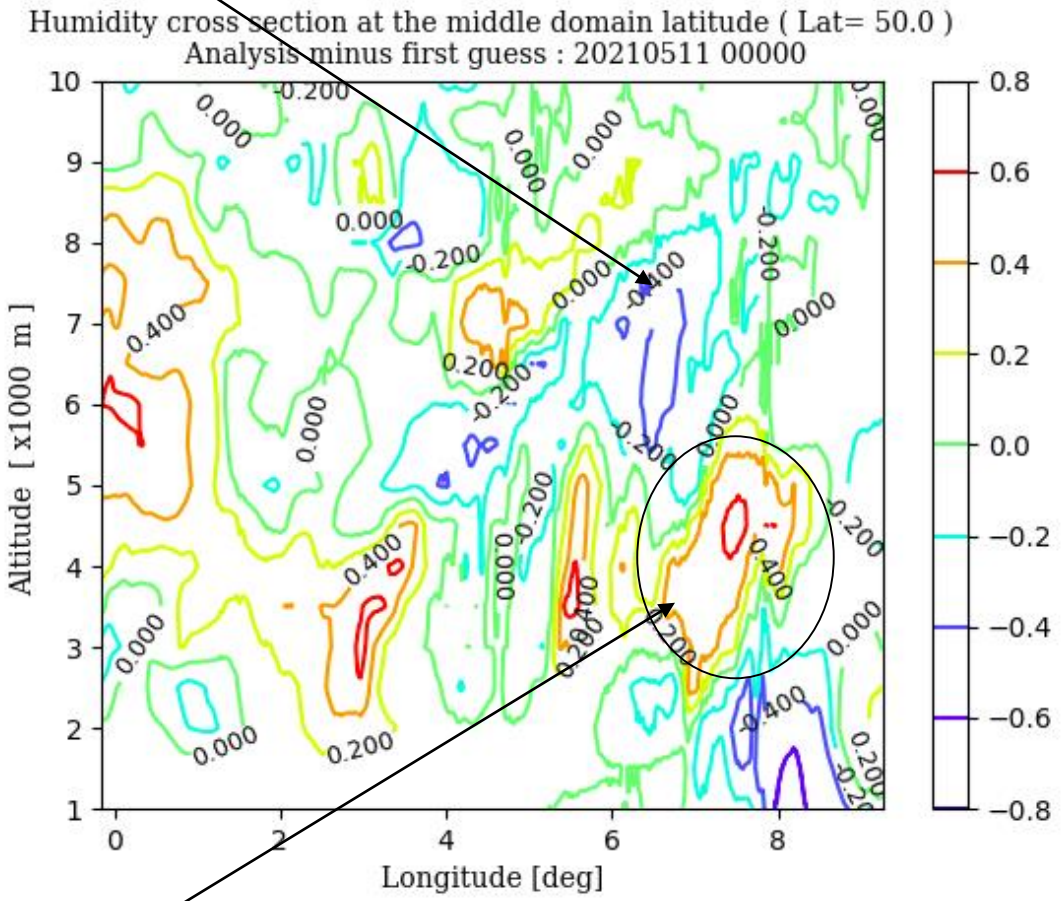
- Only ~3.5 % from the whole data in the ODB are selected for minimisation

First trial of the RADAR DA(reflectivities)

Example of analysis RH2m increment

- Drying

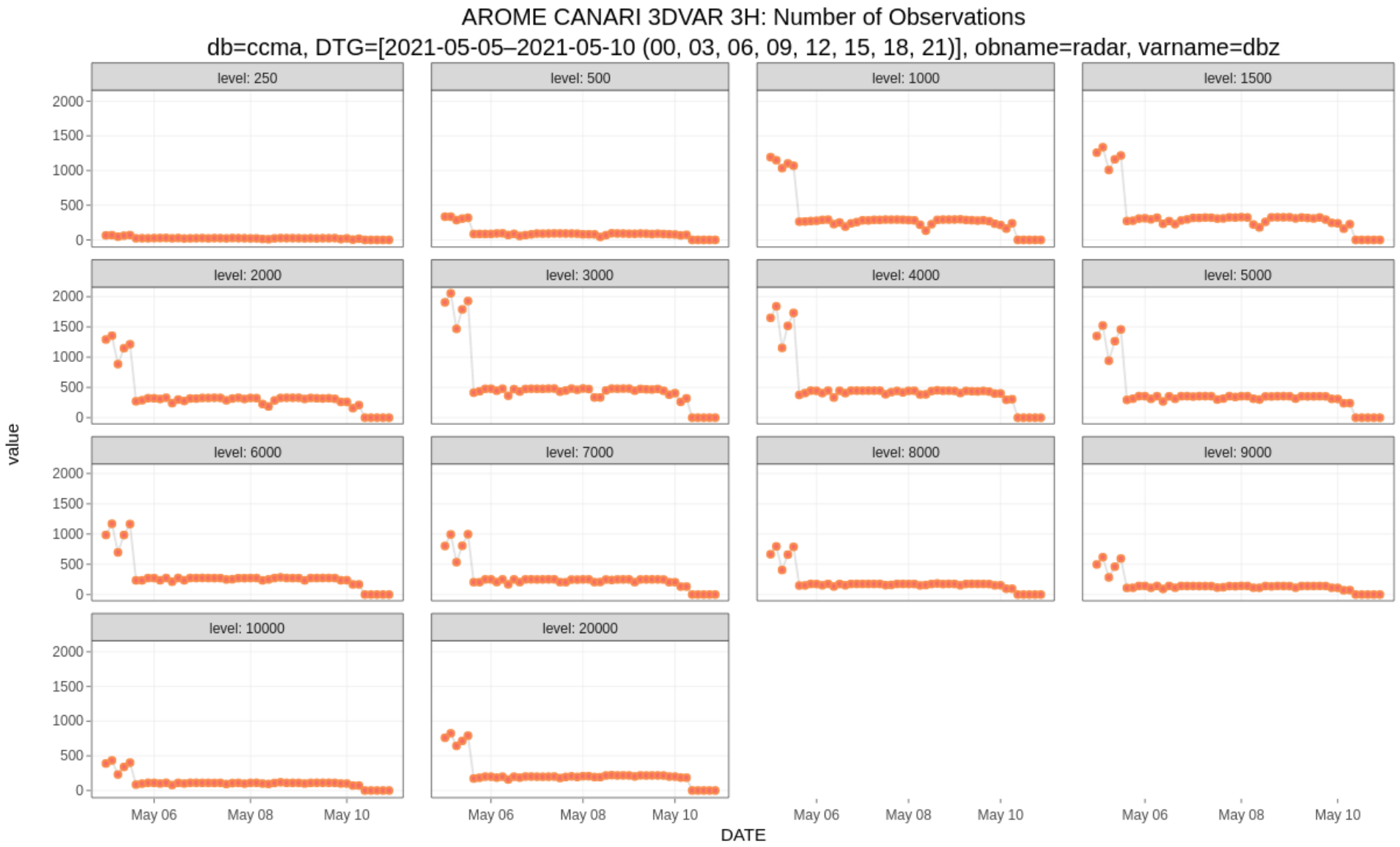




- Analysis Increment (Analysis minus First guess)
- Humidity Vertical cross section Latitude=50.0
- Moistening

First trial of the RADAR DA(reflectivities)

The radar DBZH were cycled in AROME 3DVAR+CANARI 3hours RUC from 01-05-2021 until 15-05-2021



First trial of the RADAR DA(reflectivities)

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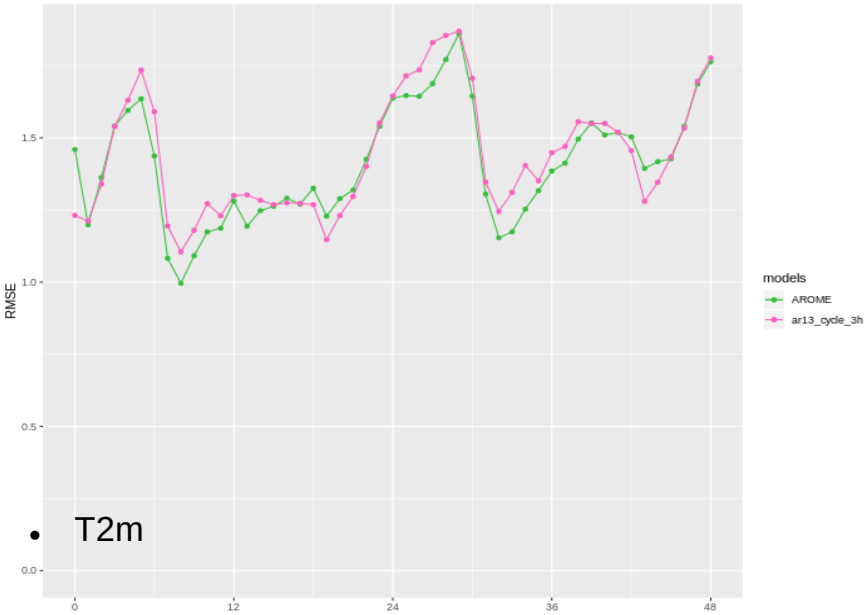
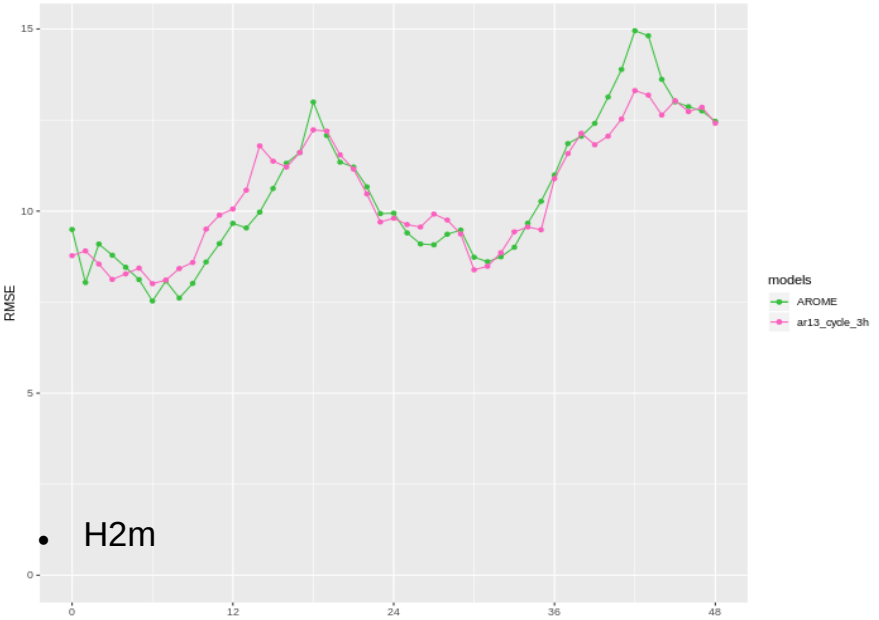
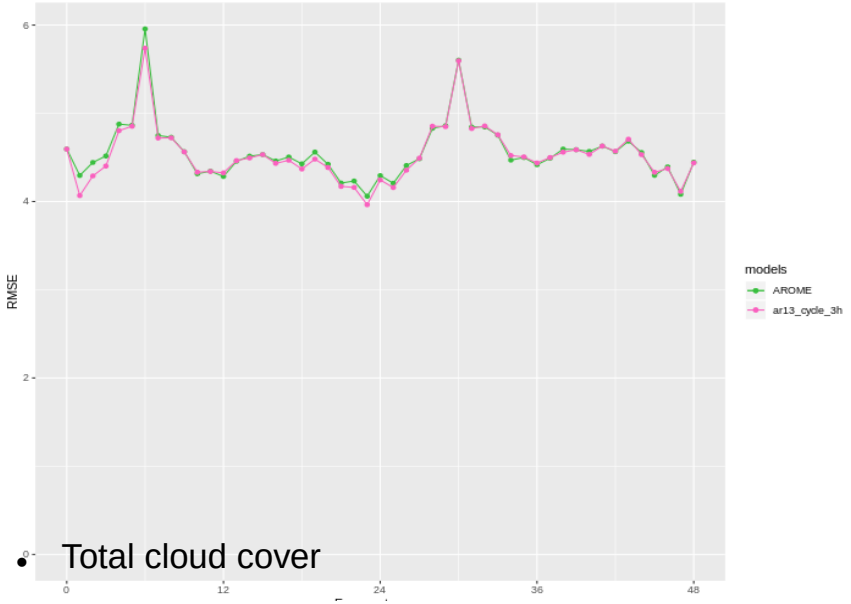


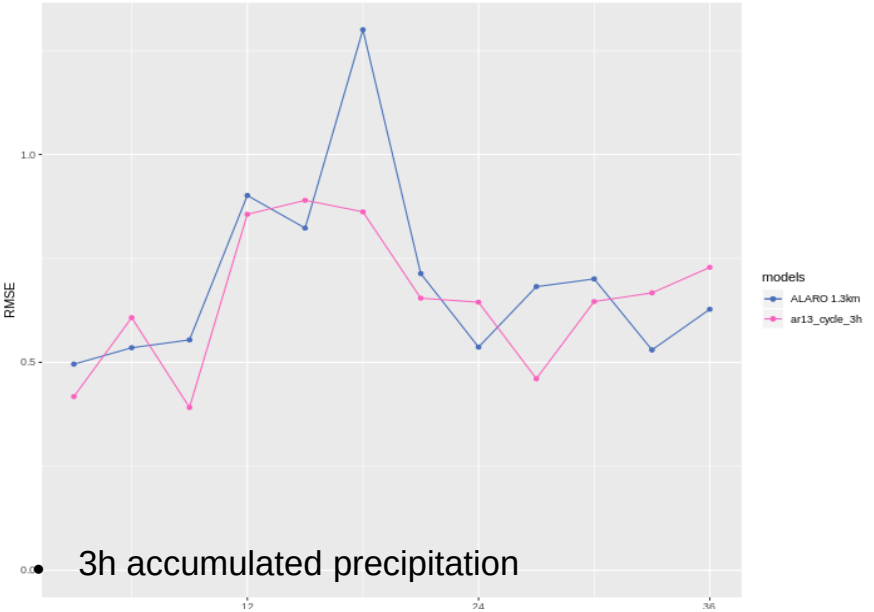
- T2m



- H2m



- Total cloud cover



- 3h accumulated precipitation

Perspectives

- Validation of AROME 3Dvar + CANARI with SYNOP , AMDAR and TEMP + GNSS

- Tuning the VarBC for the GNSS.
-
- Assessement of the impact of Mode-S and RADAR data assimilation
-
- Replace the NMC B matrix by the AEARP (on going)
-
- Build a mini-eps with both high resolution models AROME and ALARO1.3 (part of seamless and FULLKOST project at RMI)
-
- Increase the assimilation frequency to 1 hour for nowcasting
-
- Implementation of DFS (Degree of Fredom for Signal) and evaluation of each observation type contribution to the analysis.
-