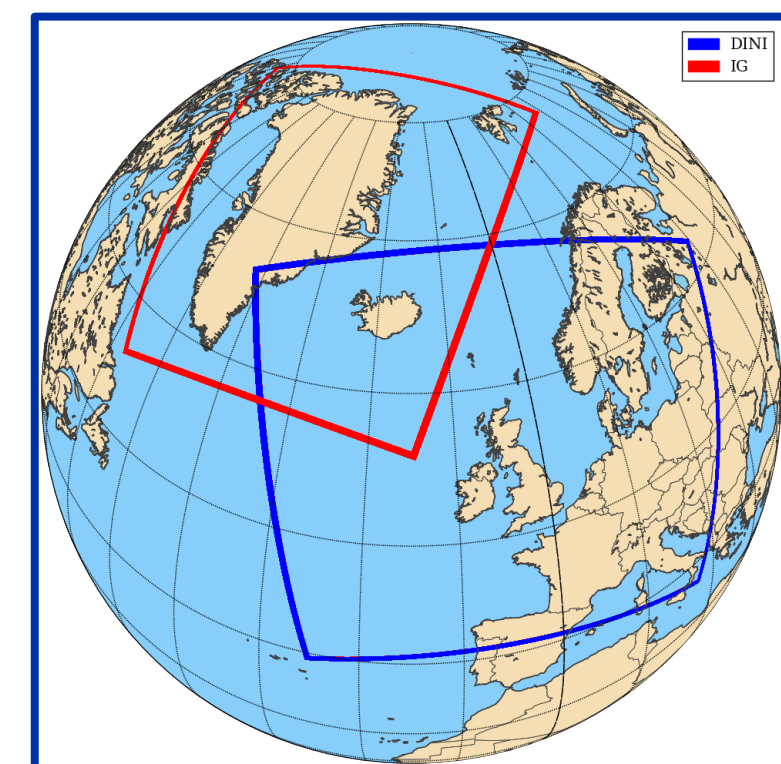# Present and future use of satellite data in United Weather Centres West

Isabel Monteiro (KNMI), Fabrizio Baordo (DMI), Eoin Whelan (Met Éireann), and Mats Dahlbom (DMI)

contact: isabel.monteiro@knmi.nl

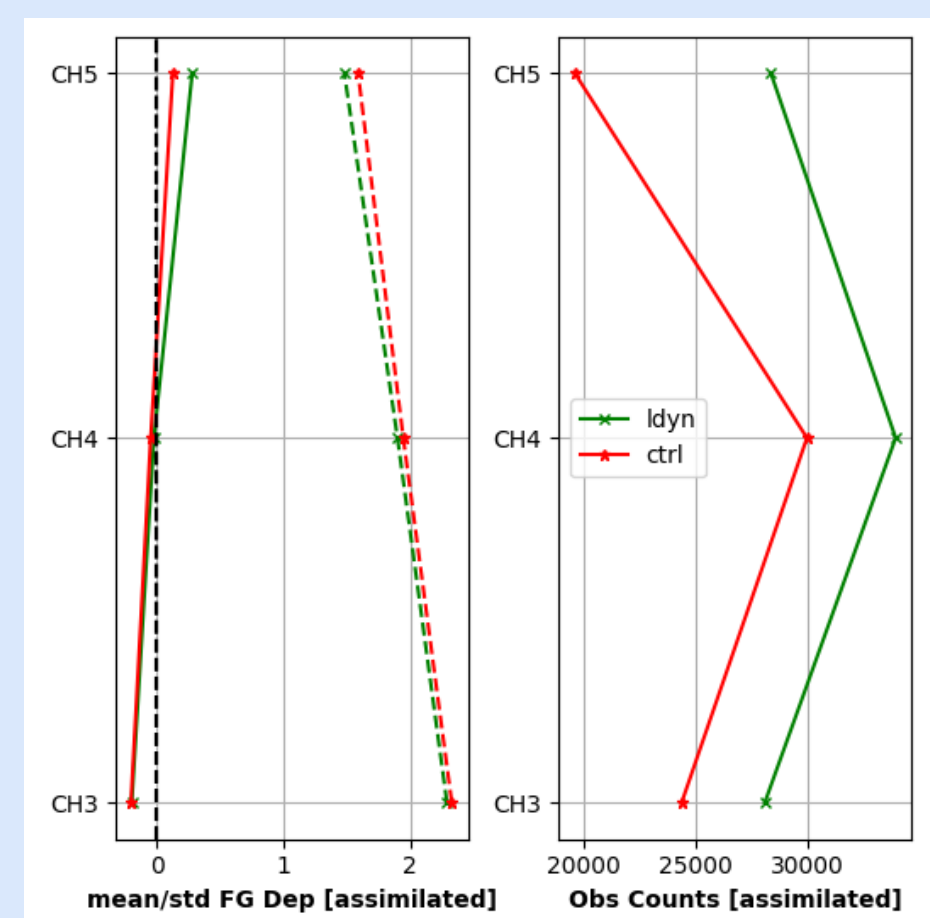## PRESENT STATUS:

Configuration of the NWP

- **Spatial resolution:** 2 km
- **Vertical resolution:** 90 levels up to 10 hPa;
- **Assimilation:** 3D-Var 3h cycling, and static background errors.
  Observations: Conventional, AMVs, RO, ASCAT, and
  MW sounders (AMSUA, MHS, ATMS,MWHS2),
  IR sounders (IASI, CrIs) from 9 different satellites.

- **4D-Var parallel suite**:
  - Obs.window [-2h, +1h] with 10 sub-windows 10 min/20 min.
  - Every 3h;
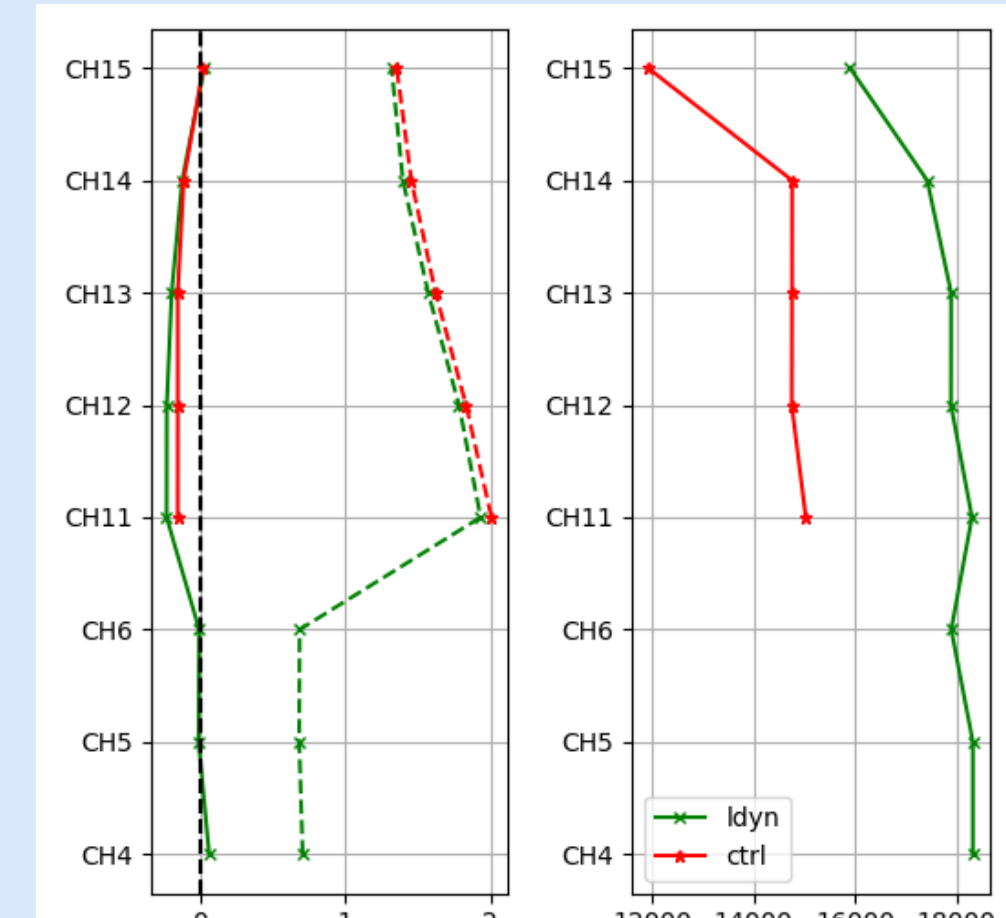 - 2 loops,15 km and 7.5 km;
  - Running since August 2024.

Dynamic emissivity   contact: fab@dmi.dk

- Active MW data over land and sea ice from 01 to 28 Dec 2024
- It will be included in the next o-suite

MHS Metop B/C; NOAA 19   MWHS2FY-3D
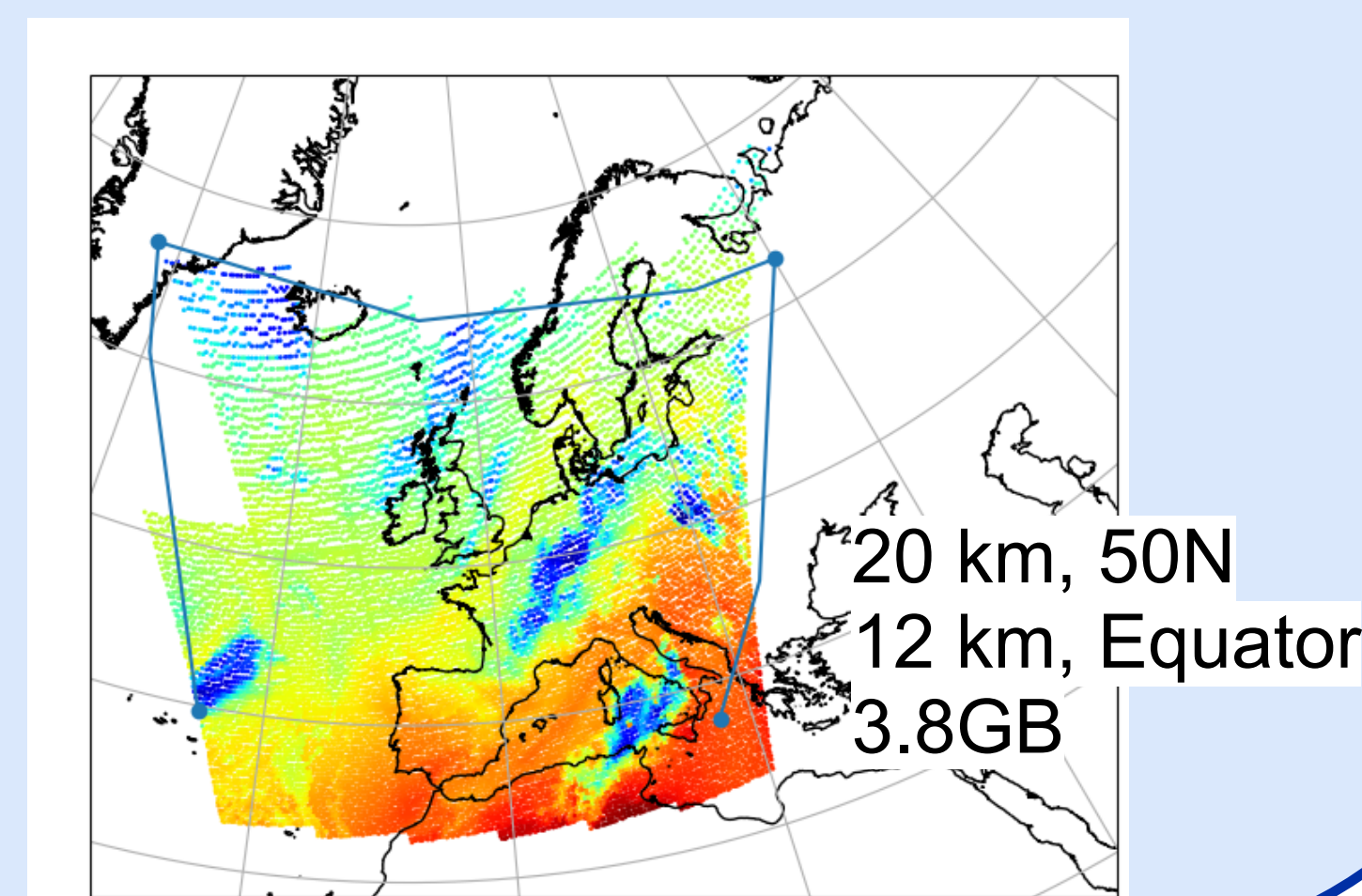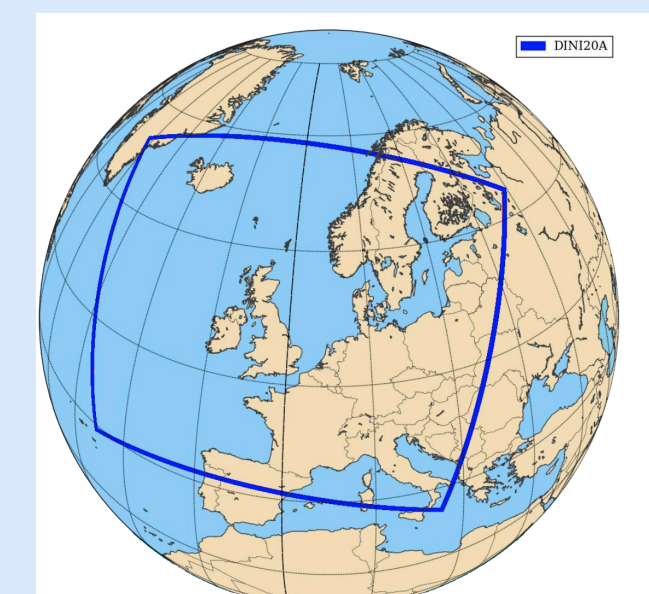
PREPARATION FOR MTG-IRS:

HARMONIE-AROME 4D-Var to take full advantage of time frequency

Data reception and pre-processing:

- Only LAC4 and selected dwells (31 to 39,46 to 53, and 57 to 63) are processed.
- IRSPP (NWPSAF-MO-UD-053-IRSPP_User_Manual.pdf) used to obtain MTG-IRS reconstructed radiances.
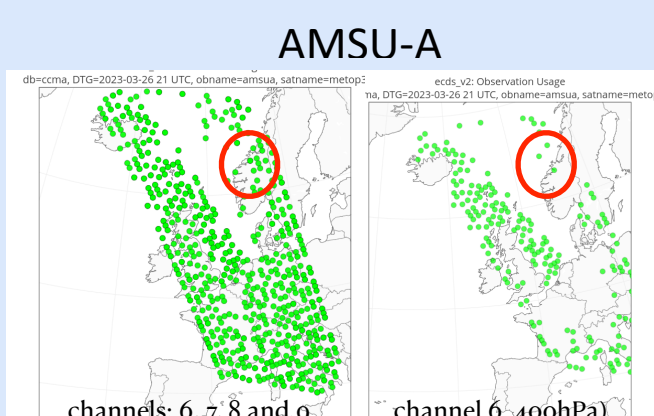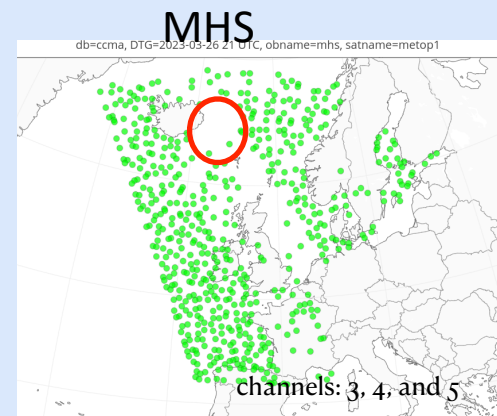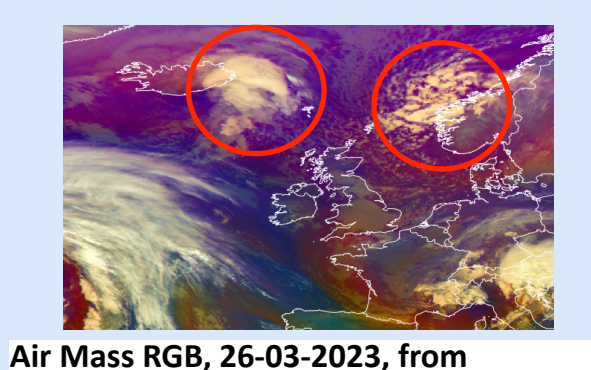- Data volumes reduced by channel selection and thinning at IRSPP level.
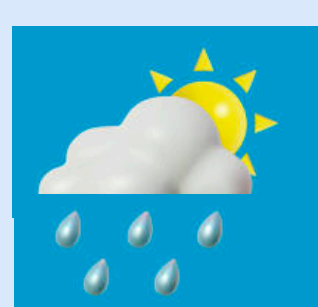
Data reception and pre-processing:

- Channel selection, thinning strategy and observations errors - collaboration with Météo-France.
- Code developments are technically ready (collaboration with ACCORD consortium).
- Cloud detection - based on the McNally & Watts scheme (using the LWIR band).

20 km, 50N
12 km, Equator
3.8GB

FUTURE DEVELOPMENTS:

4D-Var ⟷ All-sky

Air Mass RGB, 26-03-2023, from

MHS   AMSU-A
channels 3, 4, and 5   channels 6, 7, 8 and 9   channel 6 400hPa)

Implement All-sky in HARMONIE-AROME 4D-Var:

In **4D-Var** a forecast is run in the minimisation (unlike 3D-Var).

The **forecast** relates cloudy radiances with temperature, humidity and winds.

The **analysis** can be updated with cloud information.

- **Cloud and precipitation i**nformation can be transmitted to the **analysis**.
- Use **MW imagers** in the DA system.

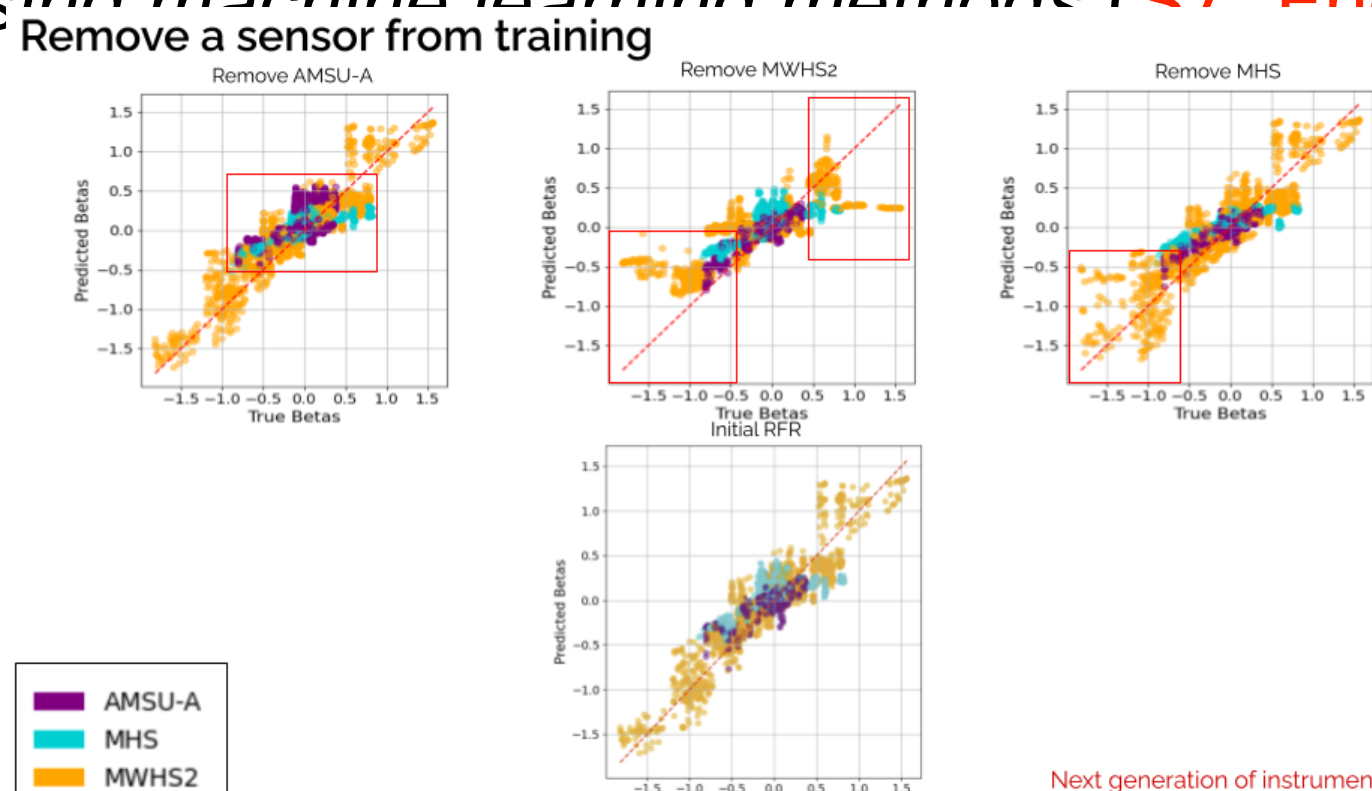## Research activities on satellite data assimilation at KNMI:

Royal Netherlands
Meteorological Institute
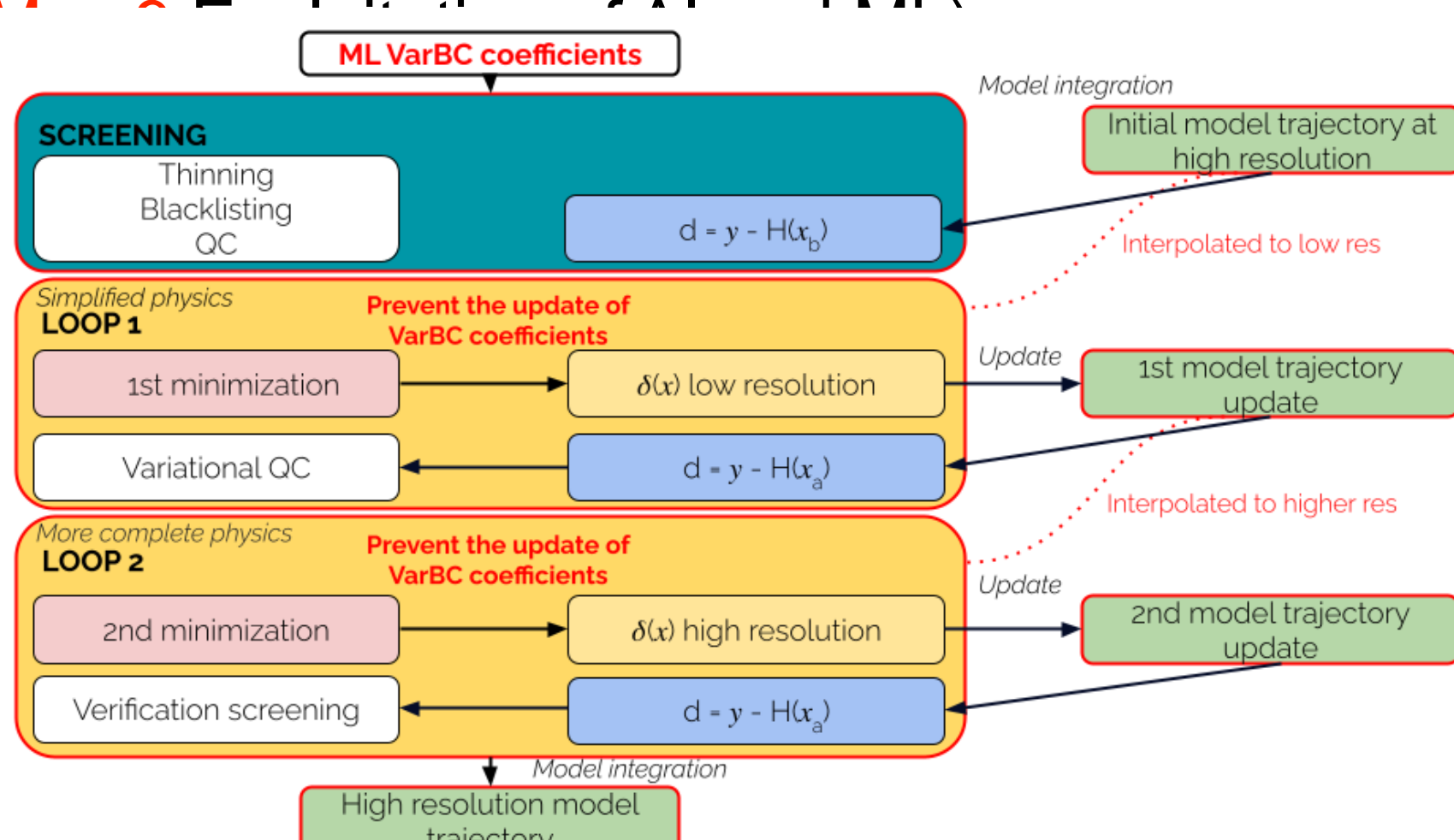Ministry of Infrastructure
and Water Management

EUMETSAT

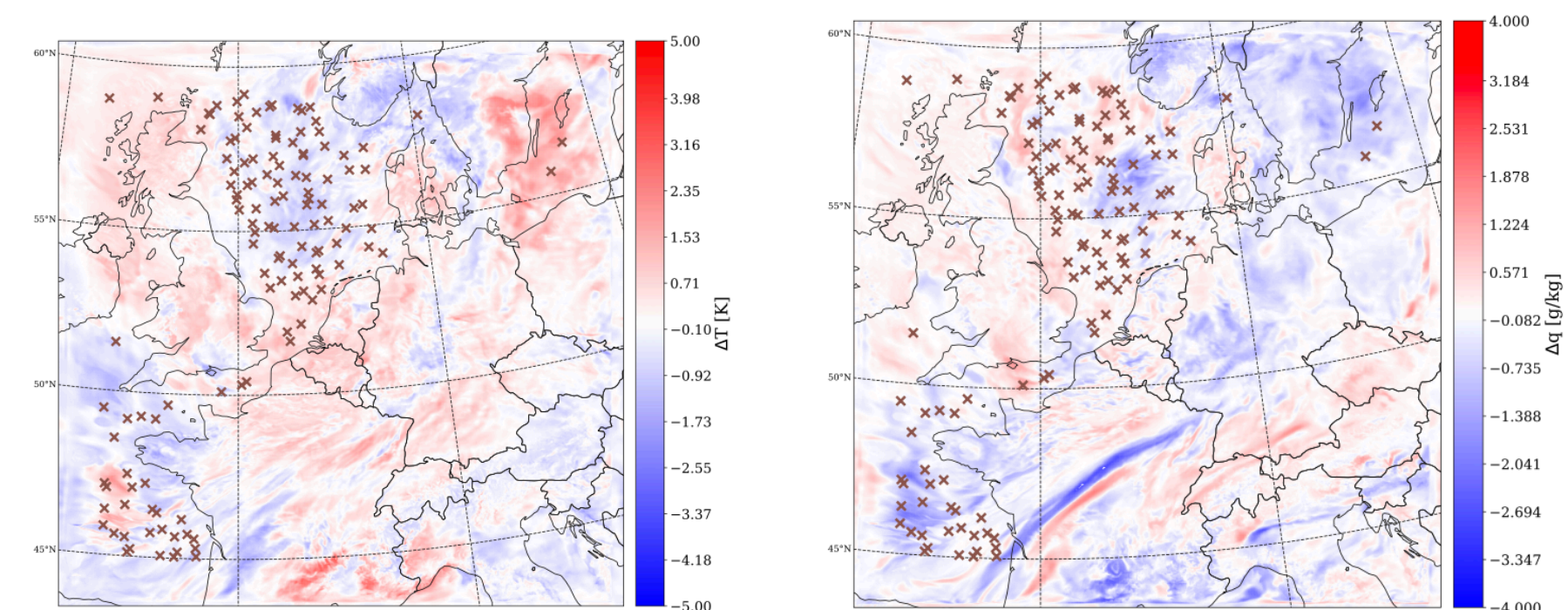**Alice Abramowicz,** *Prototype for bias-correction of microwave radiance observations using machine learning methods (S7, Friday May 9, Exploitation of Aeolus Mk)*

Remove a sensor from training

AMSU-A
MHS
MWHS2

Next generation of instruments?

ML VarBC coefficients

SCREENING
Thinning
Blacklisting
QC

$d = y - H(x_b)$

Initial model trajectory at high resolution

Interpolated to low res

Simplified physics
LOOP 1
1st minimization   Prevent the update of VarBC coefficients $\delta(x)$ low resolution   Update   1st model trajectory update

Variational QC $d = y - H(x_g)$ Model integration

Interpolated to higher res

More complete physics
LOOP 2
2nd minimization   Prevent the update of VarBC coefficients $\delta(x)$ high resolution   Update   2nd model trajectory update

Verification screening $d = y - H(x_g)$

High resolution model trajectory

Sensitivity analysis on the impact of the impact removing observations from the training data set.

Schematics of the emulation of VarBC in HARMONIE-AROME 4D-Var.

Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

EUMETSAT
NWP SAF

Erik Dedding: *Towards a full exploitation of satellite radiance information using transformed retrievals in HARMONIE-AROME 4D-Var*
Poster 17p.01

Analysis increments (single cycle) of temperatures (left) and humidity (right) at ~ 880 hPa. TR-observations used during assimilation are marked by brown crosses.