

CPR L1B NRT quality monitoring using NWP

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Frame 1888B

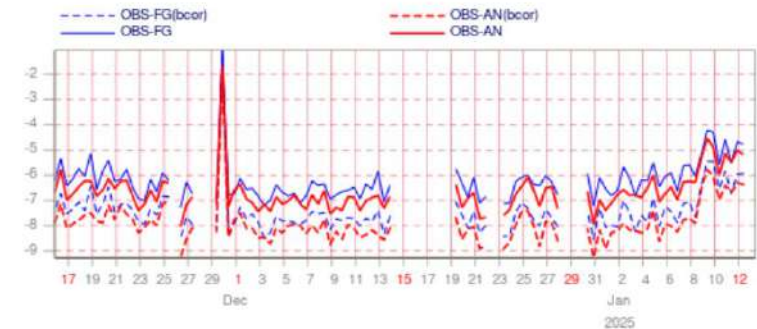
2nd ESA-JAXA EarthCARE
In-Orbit Validation Workshop



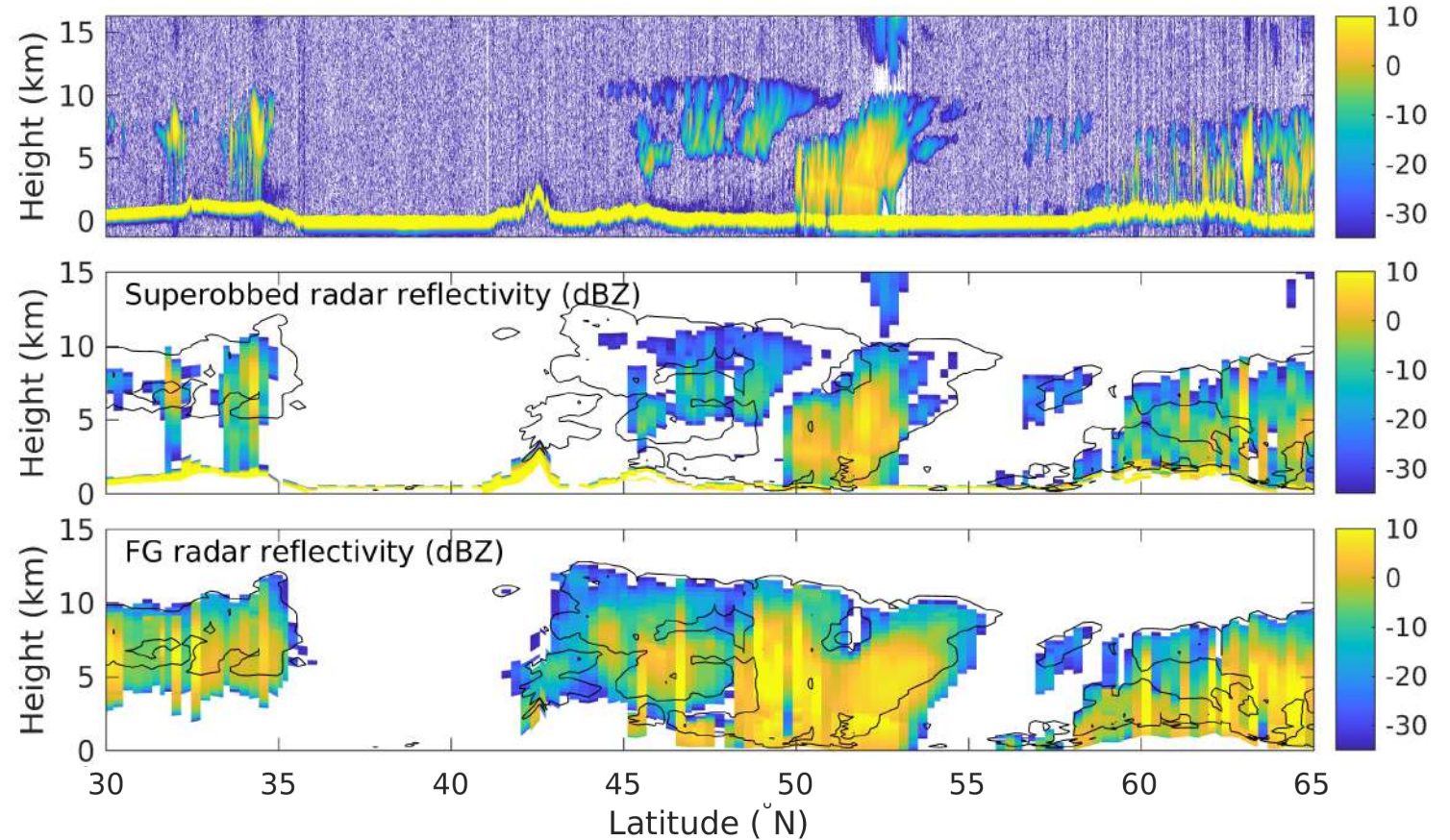
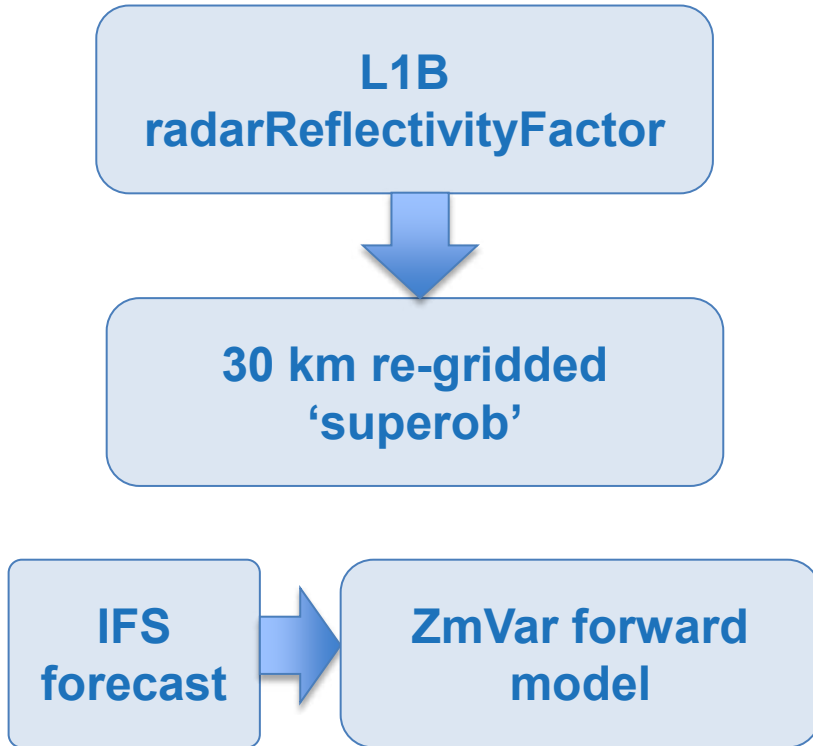
What are the benefits of validating CPR against NWP?

- **Rapid detection** of instrument issues
(removes most of day-to-day variability)
- **Continuous evaluation** in space and time
- Platform for **comparison with other instruments**, including historical missions
- Precursor for **data assimilation**

STATISTICS FOR Cloud radar reflectivity FROM EarthCare (Globe)
CHANNEL=400.0_0.0hPa Ice_cloud_used DATA (TIME STEP=12 HOURS)
Area 90.N/-90.S/0.W/360.E (Over all surfaces)
Exp=0001 LAST TIME WINDOW (2025011400)

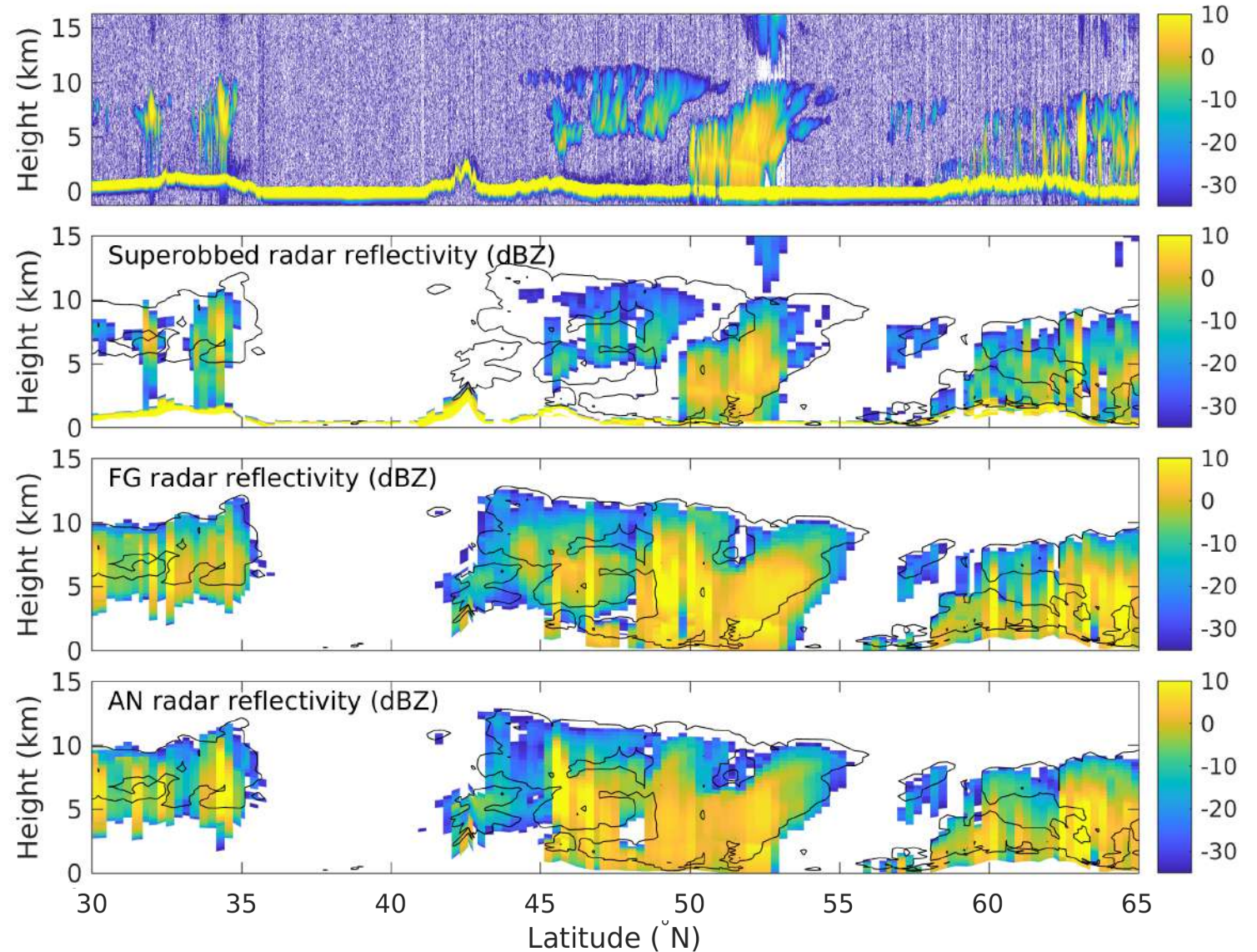
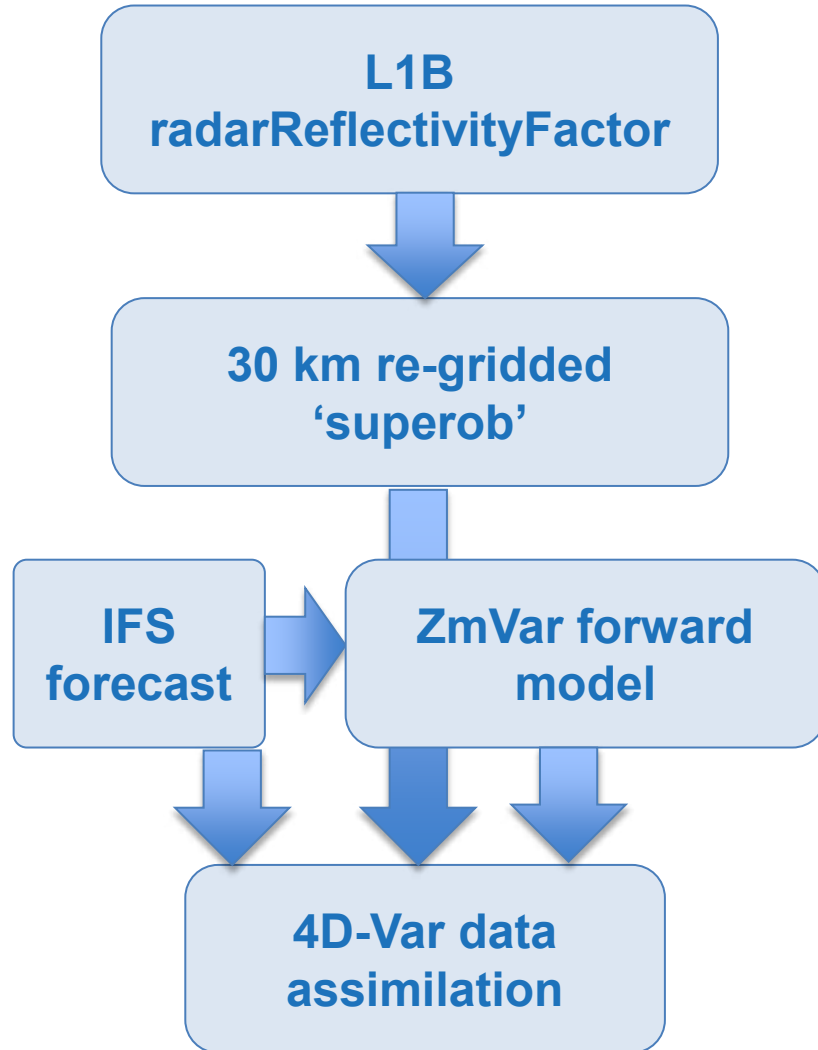


Monitoring EarthCARE using global NWP



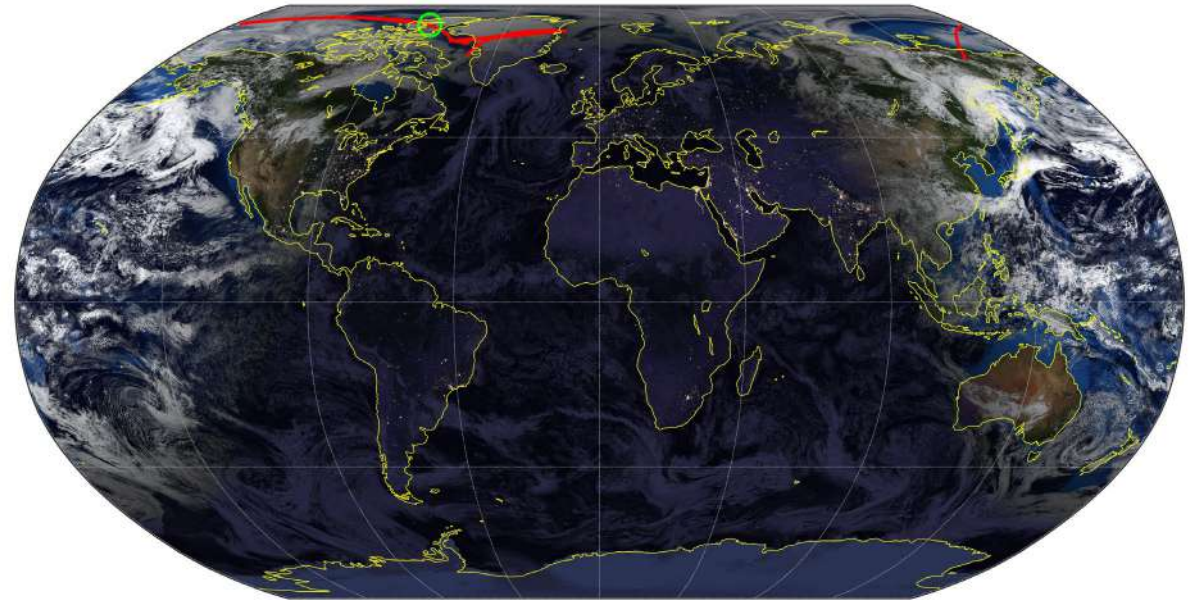
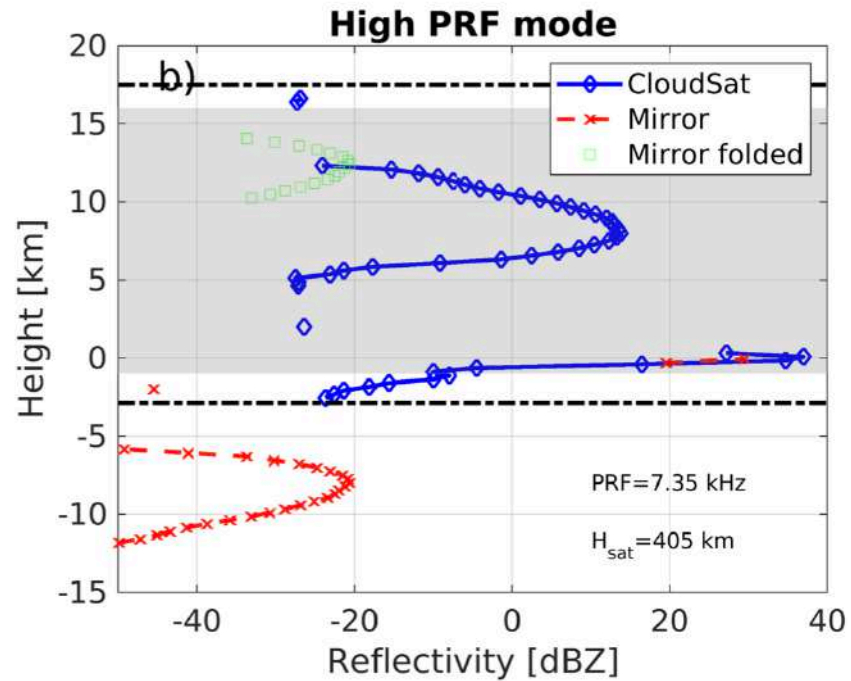
- **Continuous monitoring in space and time** of L1 observations at model-scale to first-guess 'FG' forward modelled observations

Assimilating EarthCARE using global NWP



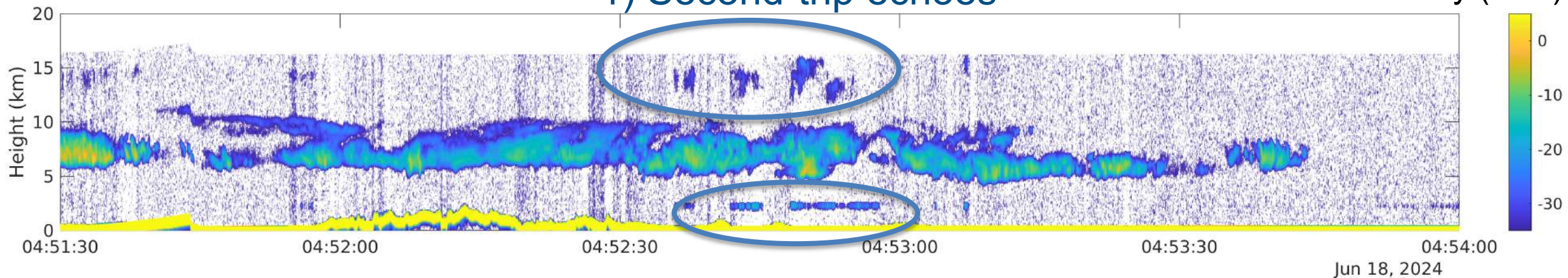
Known CPR radar reflectivity data quality issues and their impact on monitoring

As predicted by Battaglia 2021



1) Second-trip echoes

Radar reflectivity (dBZ)

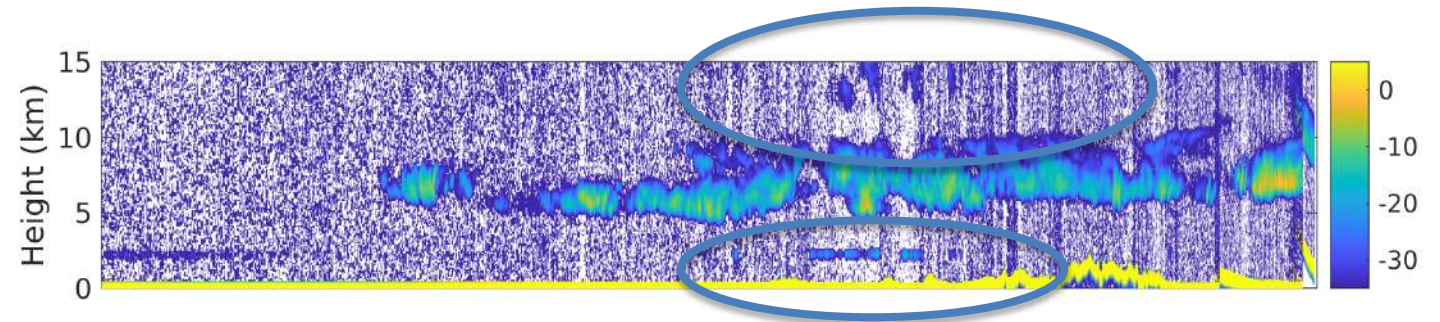


2) Receiver appears to saturate over highly reflective surfaces at 2.5 km

Most issues are removed in screening

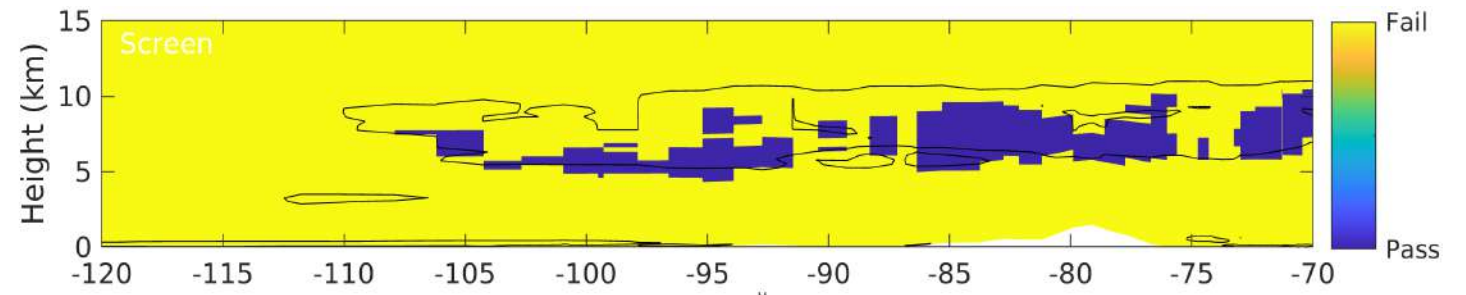
EarthCARE radar reflectivity
observations

1) Second-trip echoes



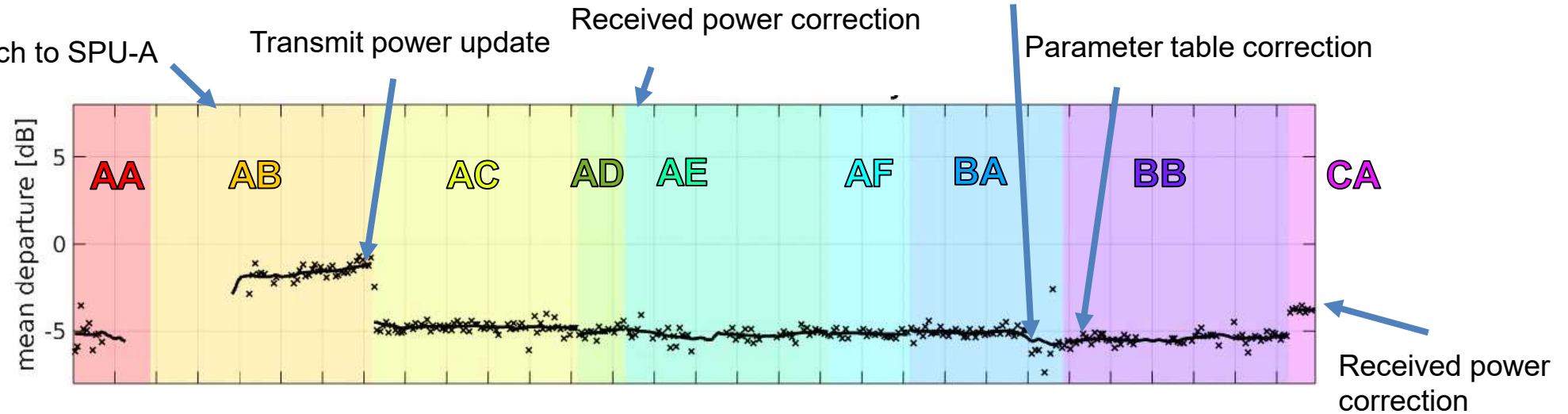
2) Receiver appears to saturate over highly reflective surfaces at 2.5 km

Screening (blue is pass)

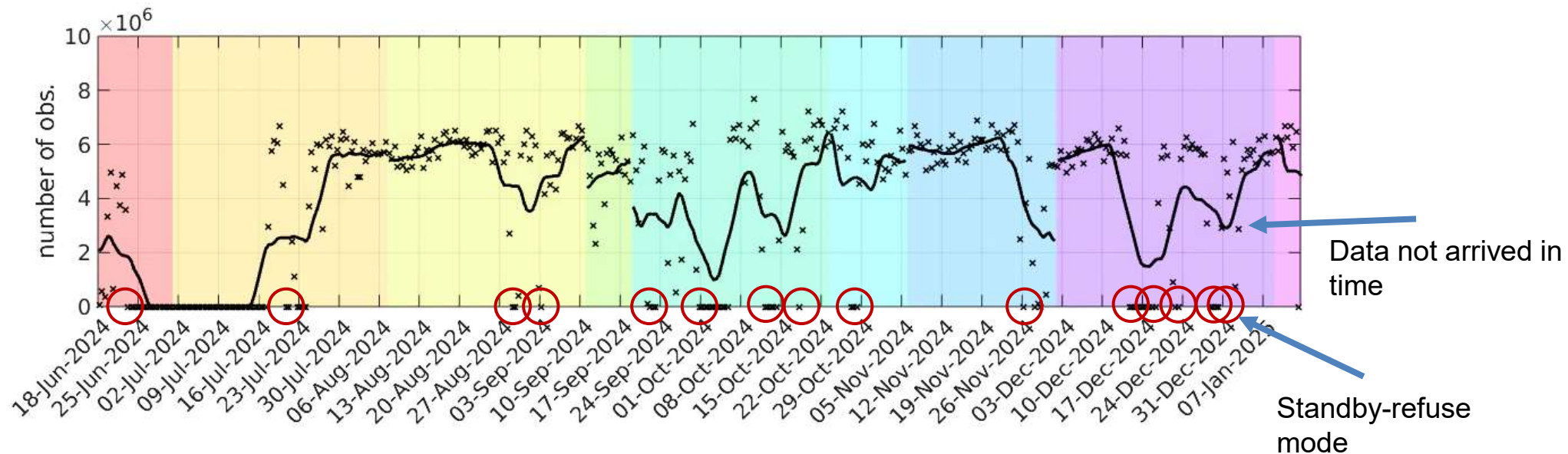


CPR NRT quality monitoring

Global 12-hour mean FG dep [dB]



Number of obs passing screening



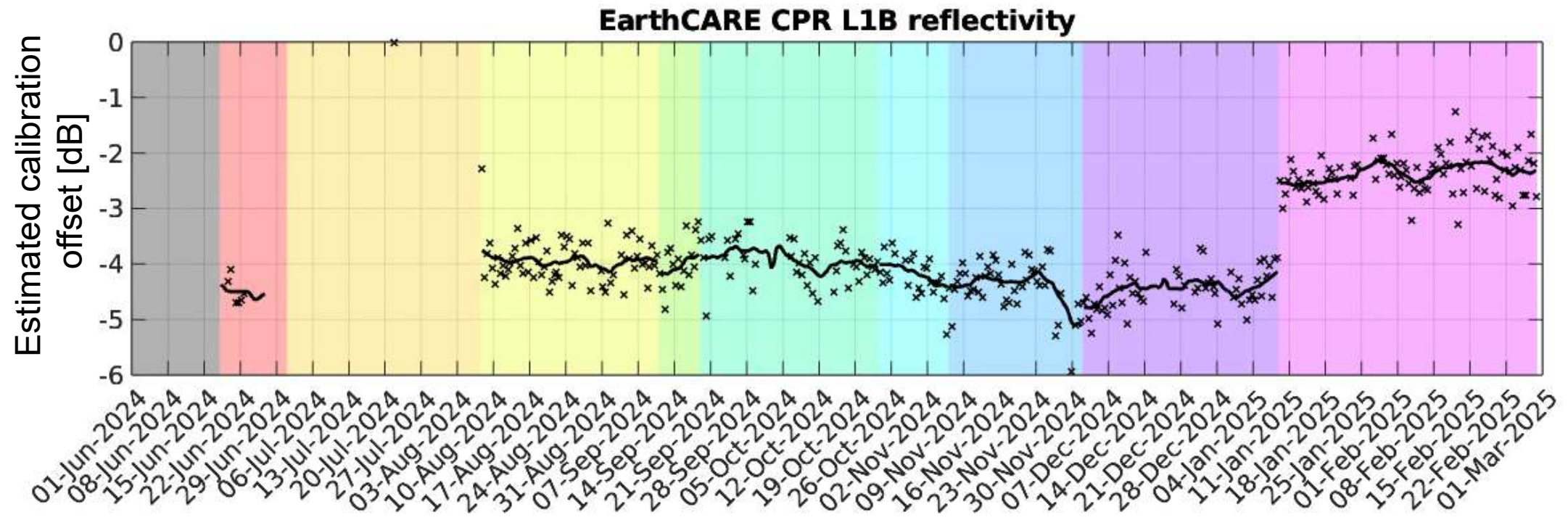
CPR quantifying relative calibration with CloudSat using ice cloud

Global 12-hour mean bias compared to model for ice cloud relative to CloudSat.

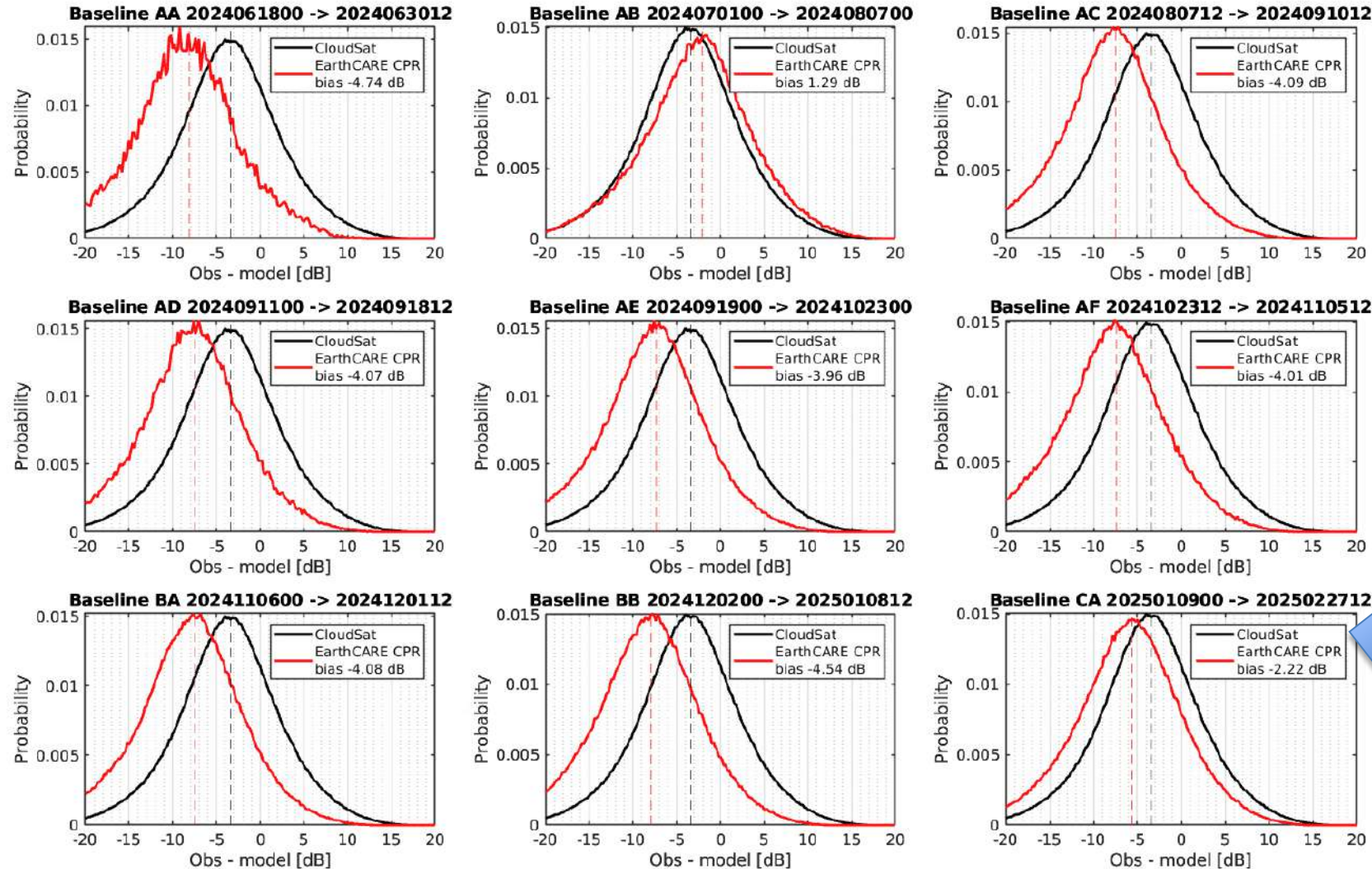
Conditional on:

model radar reflectivity > -20 dBZ; **Obs radar reflectivity** > -20 dBZ; **model temperature** < 260 K;
altitude > 3km; **Max(Z)** < 0 dBZ

After subtracting model bias compared to CloudSat



CPR quantifying relative calibration with CloudSat

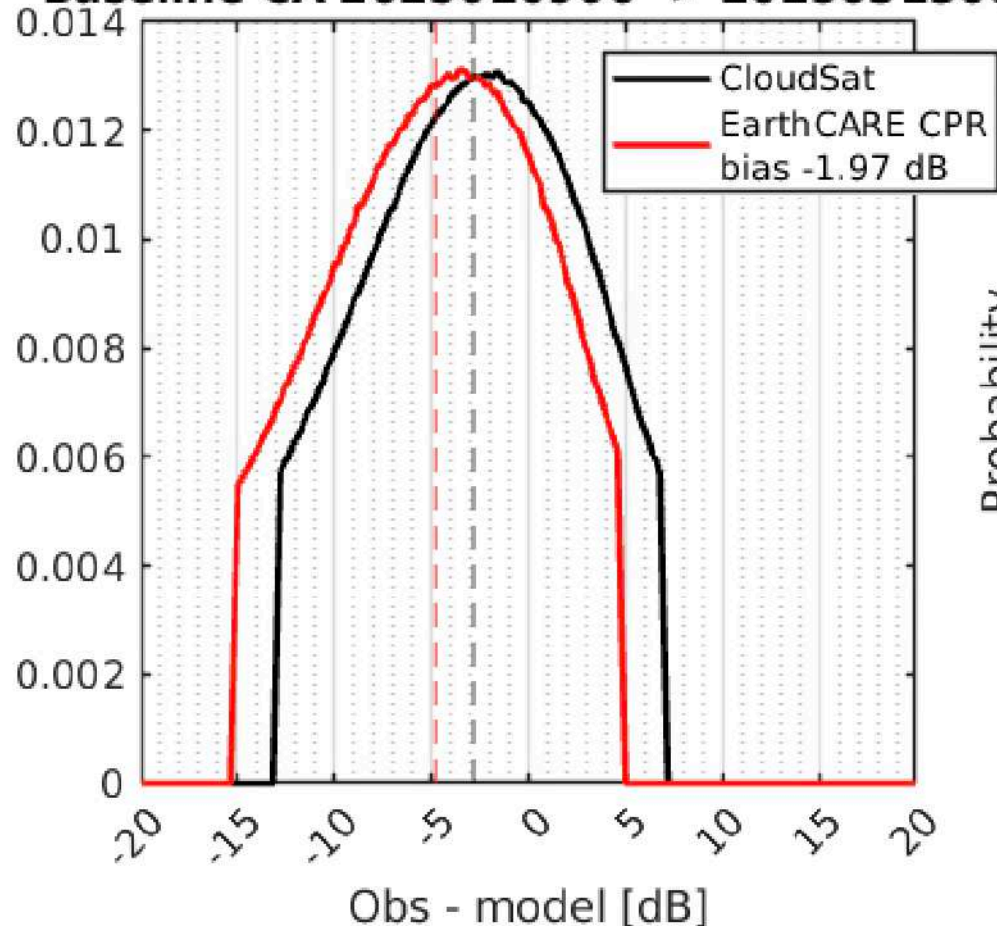


Great agreement
with McGill sea
surface calibration
and JAXA direct
calibration
measurement!

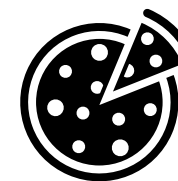
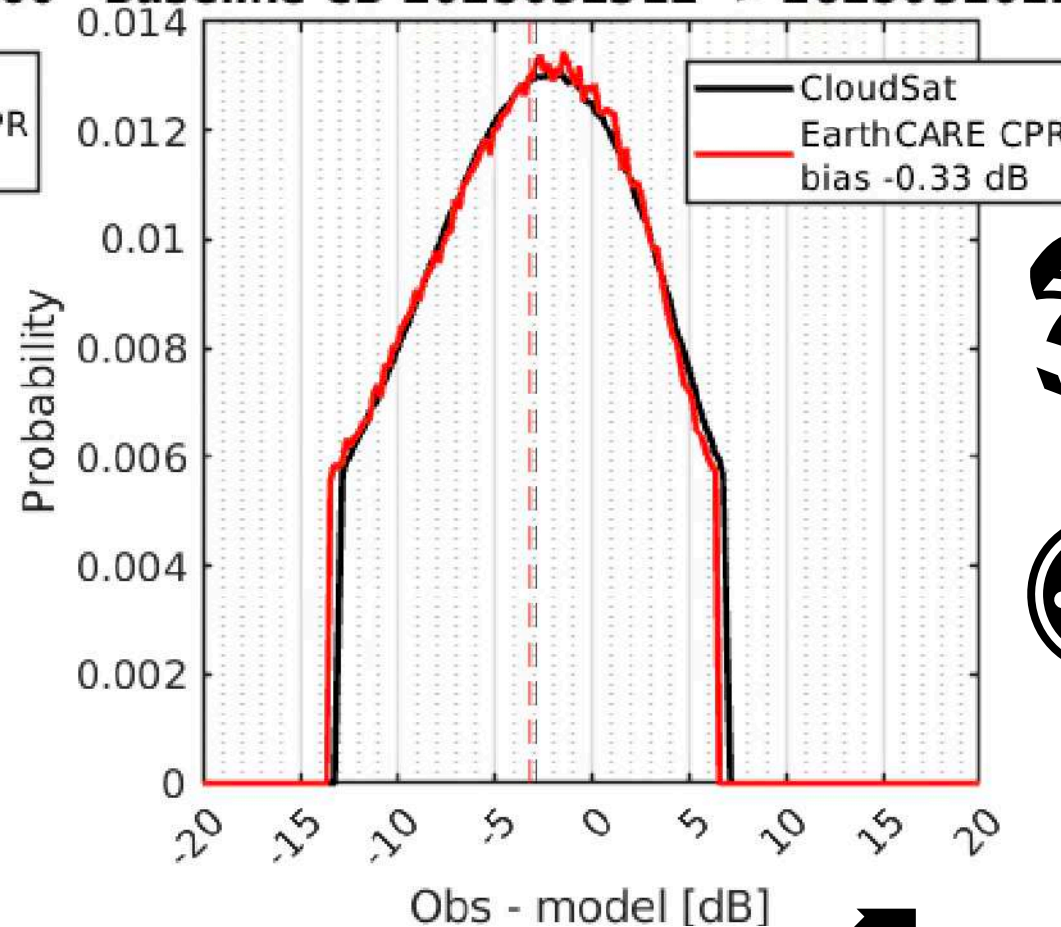
Processor version CB - 2dB or not 2dB?



Baseline CA 2025010900 -> 2025031300



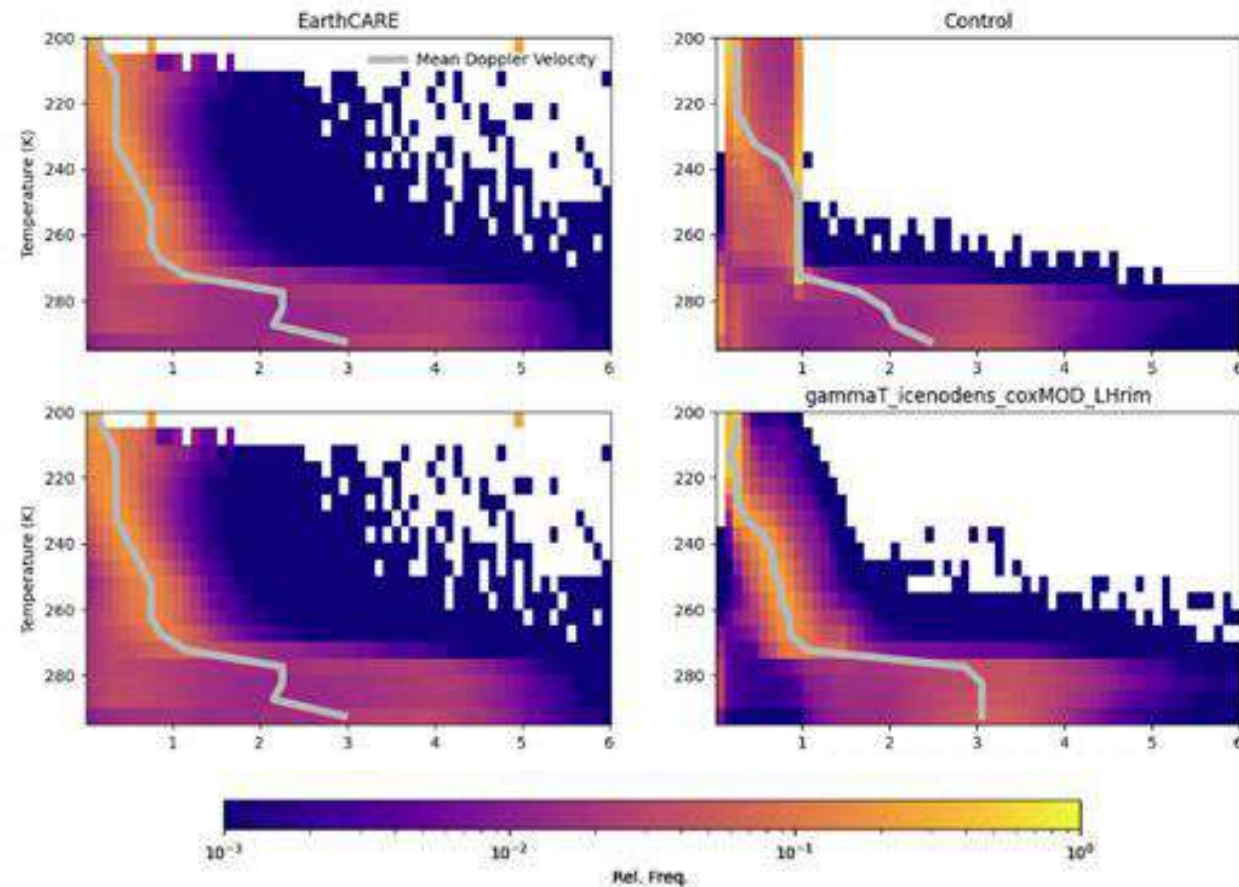
Baseline CB 2025031312 -> 2025031612



Key points

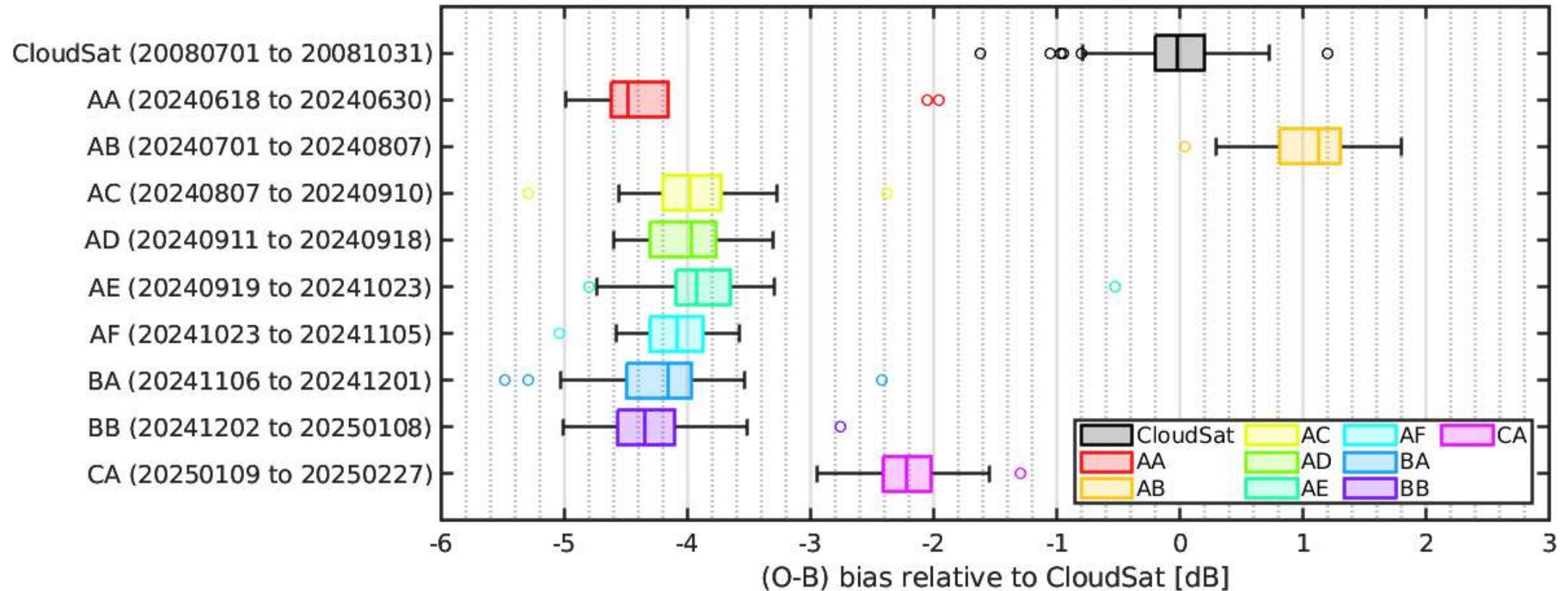
- CPR L1B NRT quality monitoring is live:
https://charts.ecmwf.int/catalogue/packages/obstat/products/hist_ECare_CRREF_v3
- Quality and stability of L1B CPR radar reflectivity observations are excellent when compared to ECMWF model.
- CPR radar reflectivity shows strong consistency with CloudSat - similar height and regional biases compared to model.
- Radar calibration contains offset compared to CloudSat. Strong agreement in AC-BB 4 dB correction required, 2 dB from CA, ~0.4(?) dB from CB onwards

Using EarthCARE to improve the representation of ice and snow fall speeds in the IFS



Thanks: Rebecca Murray-Watson

CPR quantifying relative calibration with CloudSat



- Strong agreement in AC-BB ~ 4 dB correction required, ~2 dB from CA onwards