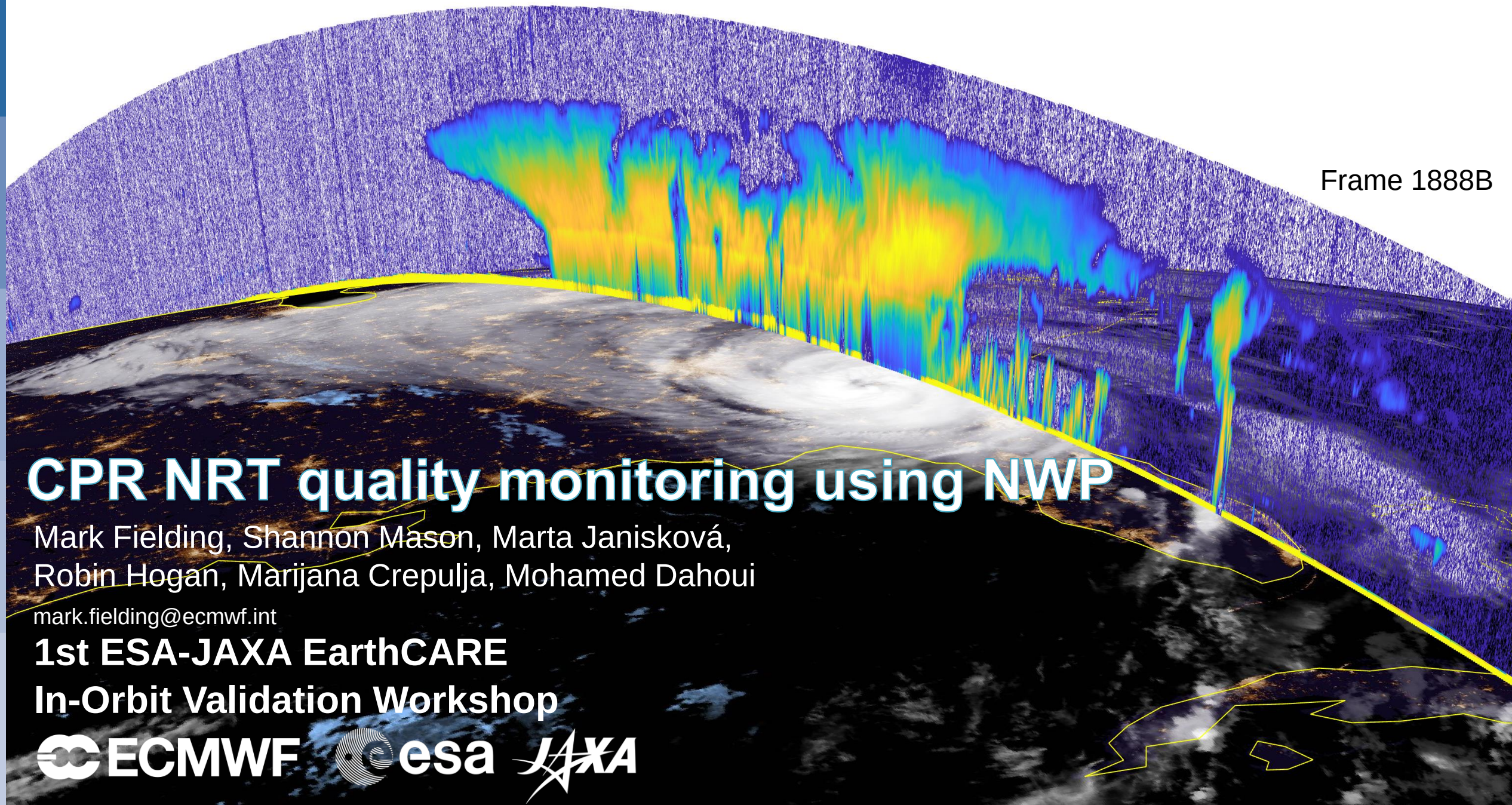

CPR NRT quality monitoring using NWP

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Robin Hogan, Marijana Crepulja, Mohamed Dahoui

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1st ESA-JAXA EarthCARE
In-Orbit Validation Workshop

ECMWF esa JAXA

Observation processing for CPR

Commissioning phase / monitoring

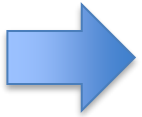
CPR_NOM_1B -> radarReflectivityFactor
-> dopplerVelocity

L2 product monitoring / model evaluation

CPR_FMR_2A -> reflectivity_no_attenuation_correction

CPR__CD_2A -> doppler_velocity_best_estimate

BUFR



Re-gridding to regular model levels and averaging horizontally to TCo319 (~30 km grid spacing), L1B uses basic feature mask from CPRO

ODB

Binary data format used at operational NWP centres

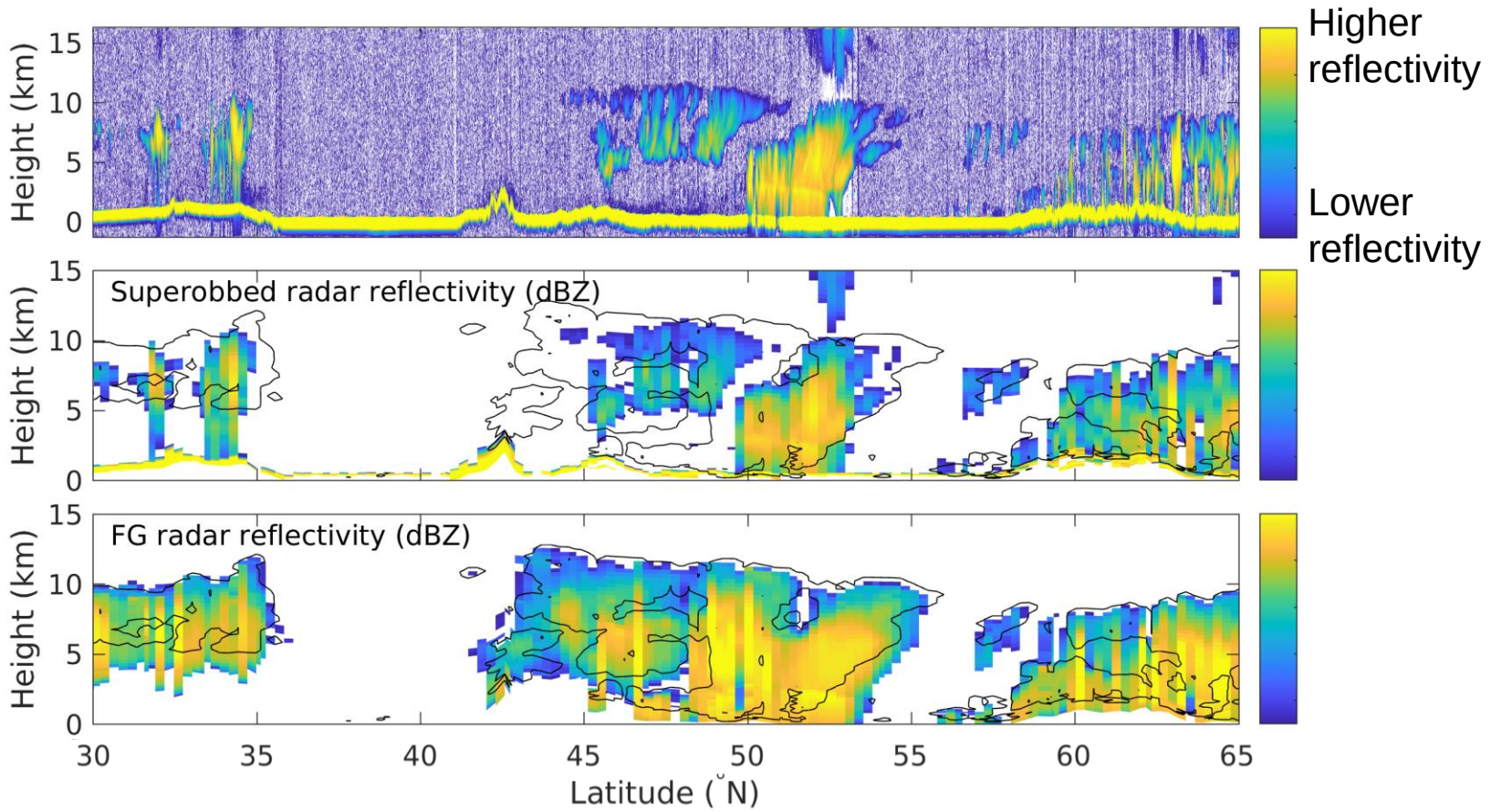
In-house observation database, ready for comparison with model

Comparsion of model with observations

EarthCARE CPR radar reflectivity

CPR averaged to model scale

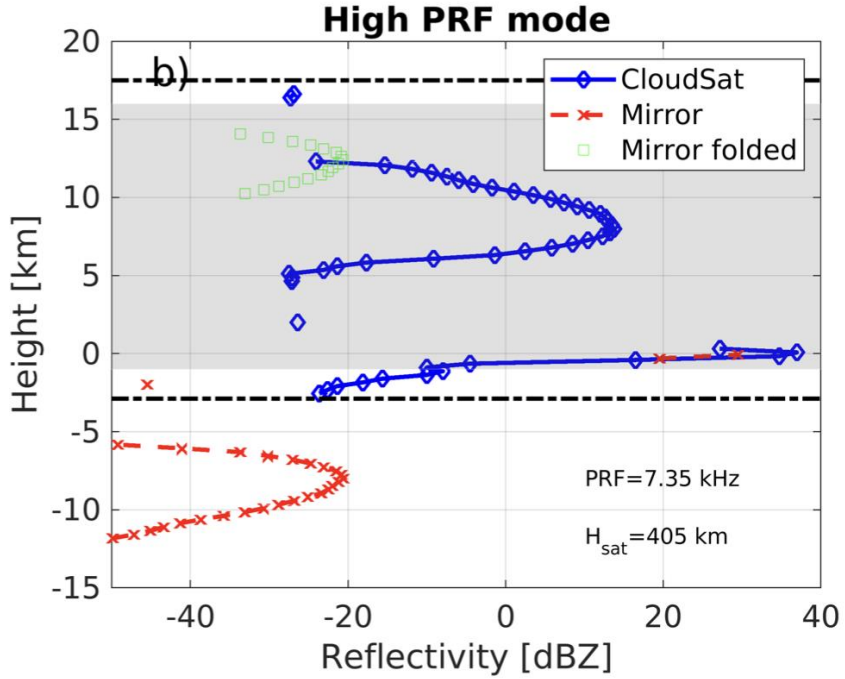
ECMWF model radar reflectivity

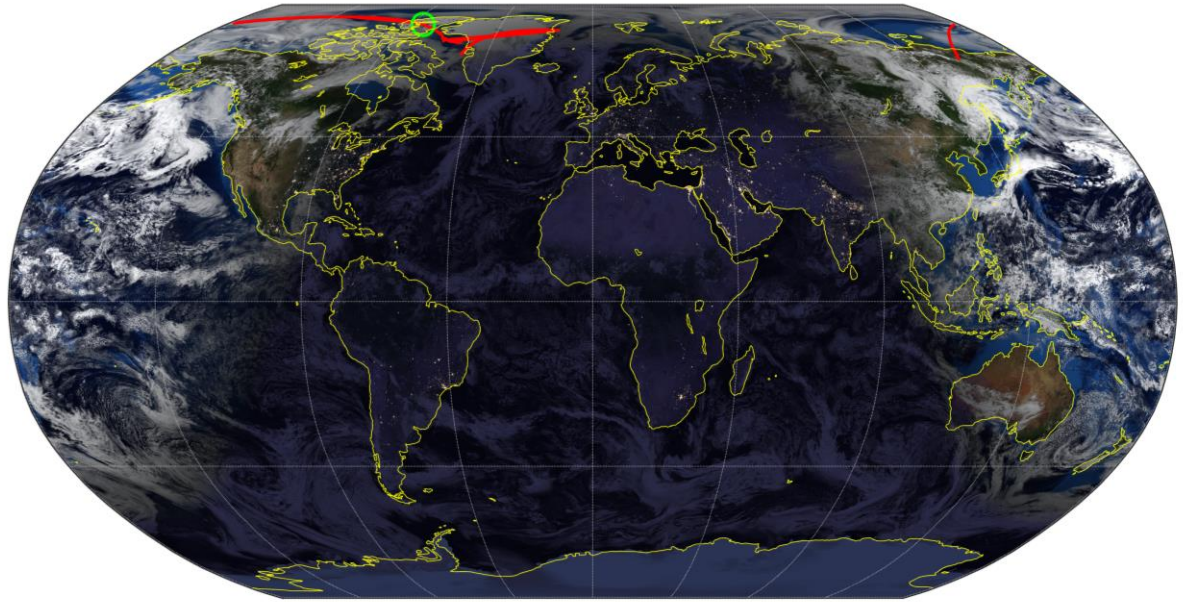


-> Monitor ‘FG depatures’ (obs minus model) with various screening criteria

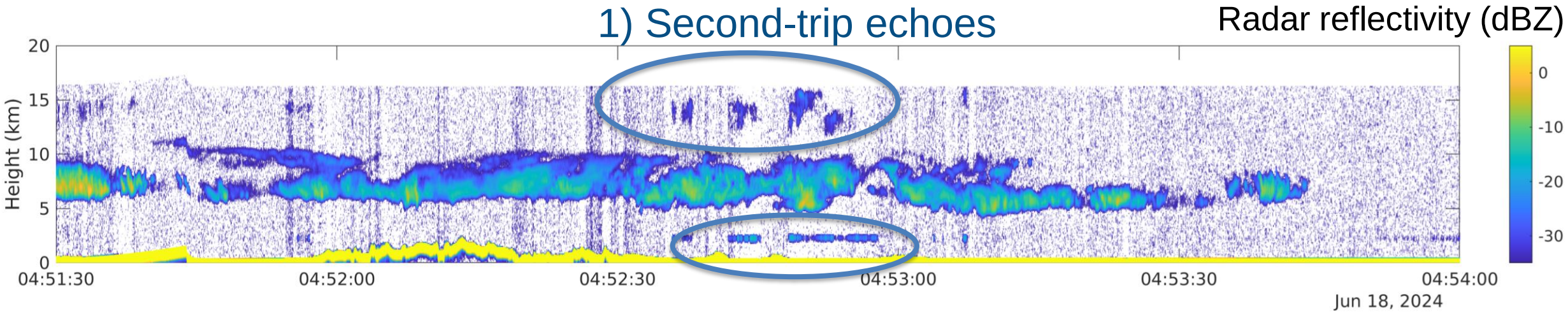
Known CPR radar reflectivity data quality issues and their impact on monitoring

As predicted by Battaglia 2021





1) Second-trip echoes

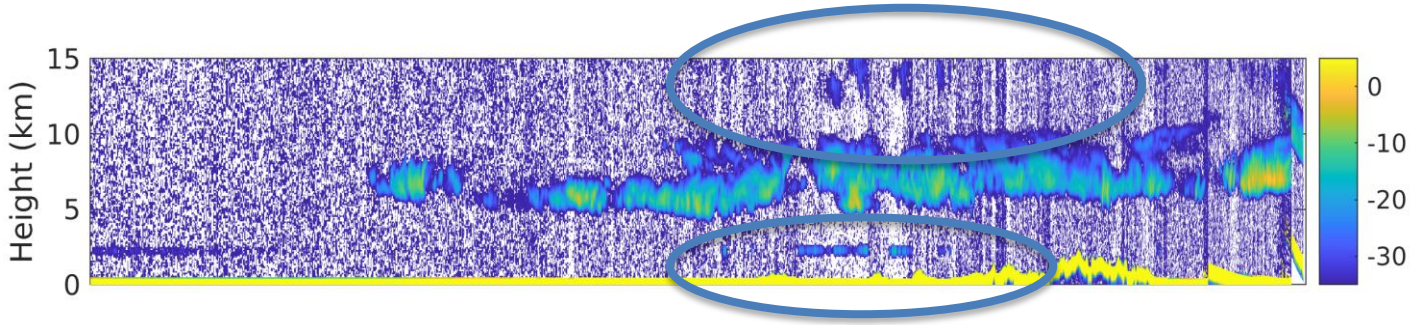


2) Receiver appears to saturate over highly reflective surfaces at 2.5 km

Most issues are removed in screening

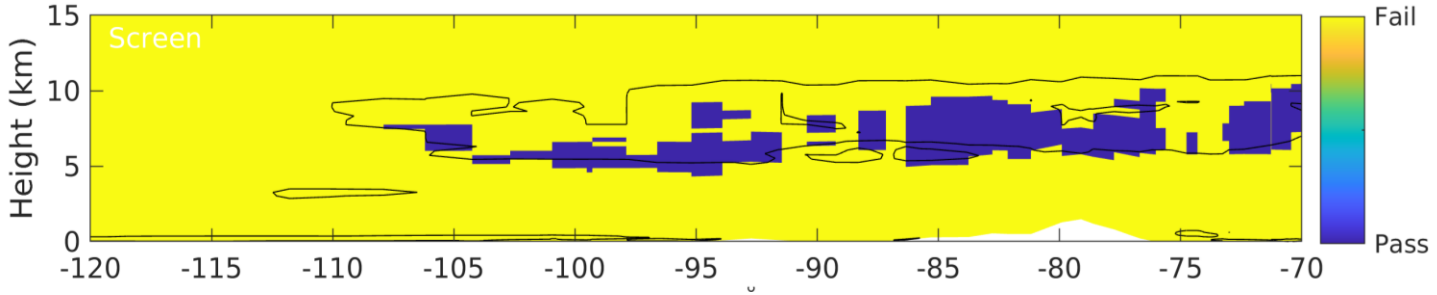
1) Second-trip echoes

EarthCARE radar reflectivity **observations**



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

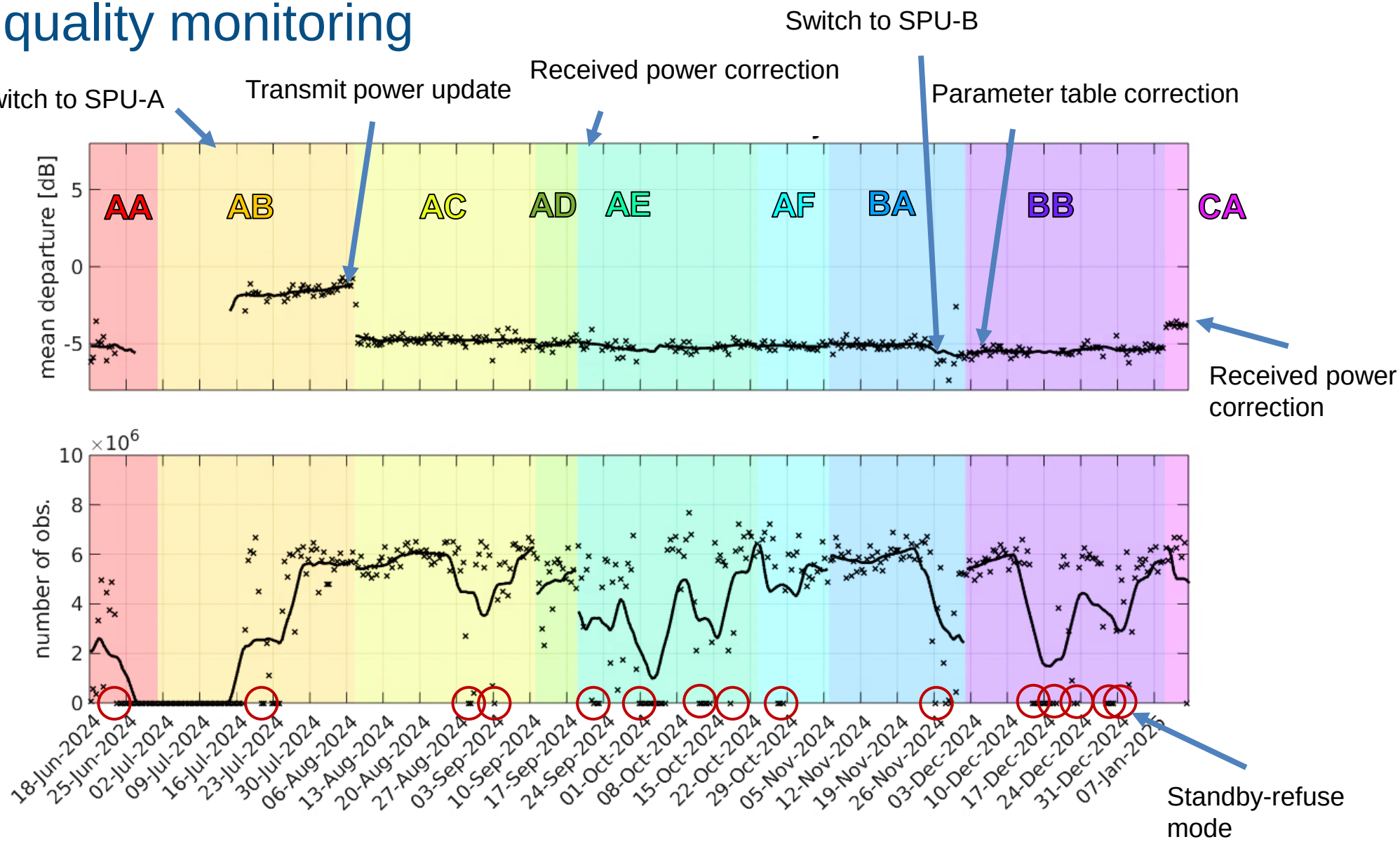
Screening (blue is pass)



CPR NRT quality monitoring

Global 12-hour mean FG dep [dB]

Number of obs passing screening

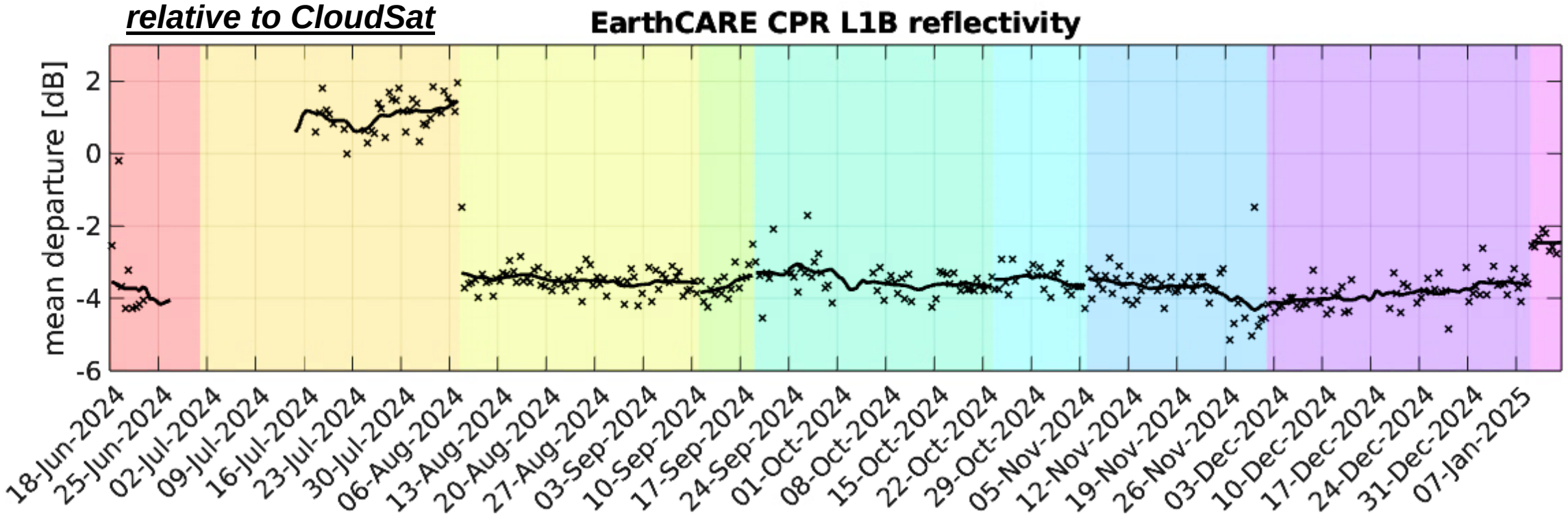


CPR quantifying relative calibration with CloudSat

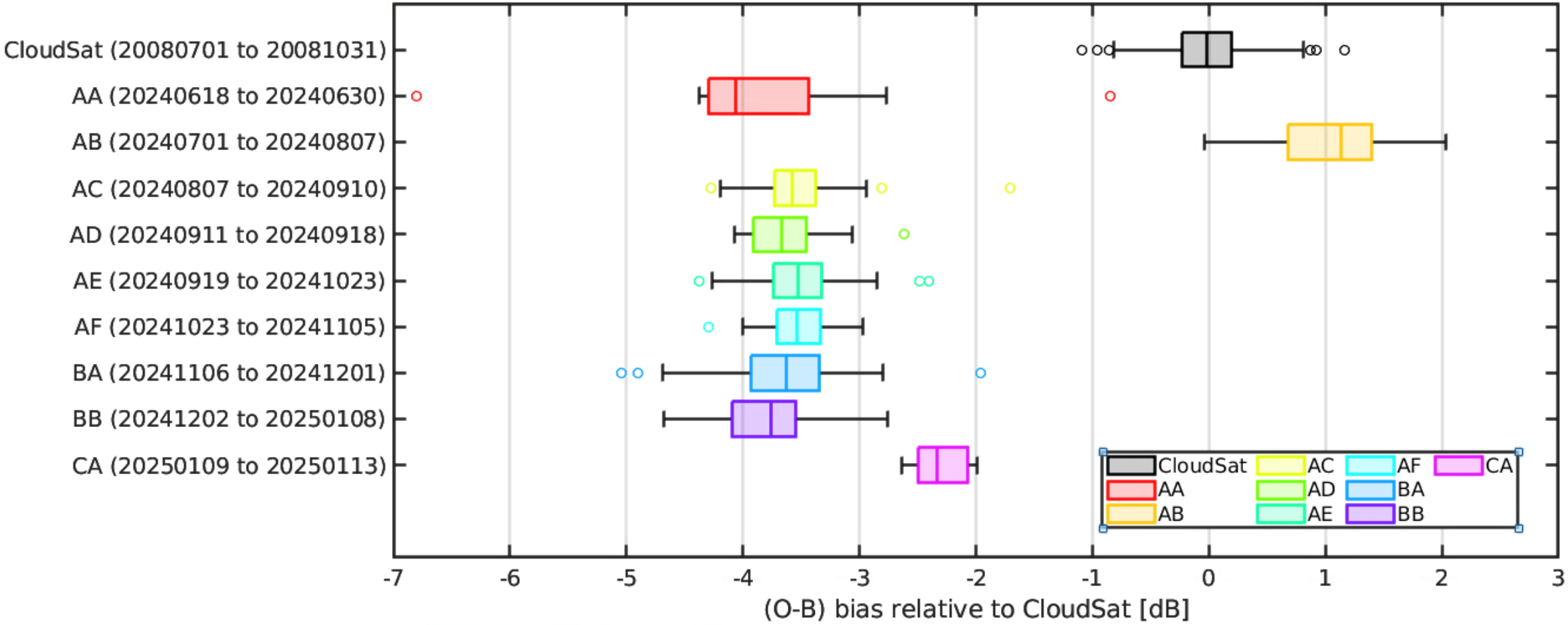
Global 12-hour mean bias compared to model for ice cloud relative to CloudSat.

Conditional on:

model radar reflectivity > -30 dBZ,;**Obs radar reflectivity >** -30 dBZ; **model temperature** < 260 K; **altitude** > 3km; **Max(Z)** < 0 dBZ



CPR quantifying relative calibration with CloudSat

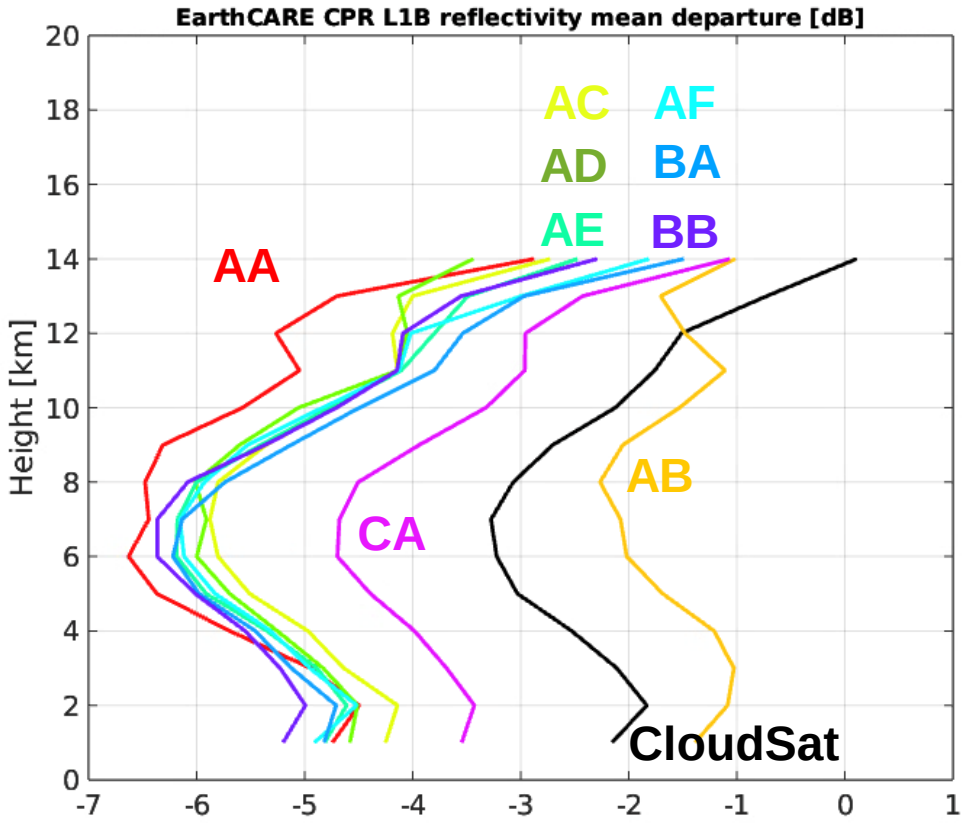


- Strong agreement in AC-BB 3.5-4 dB correction required, 2-2.5 dB from CA onwards

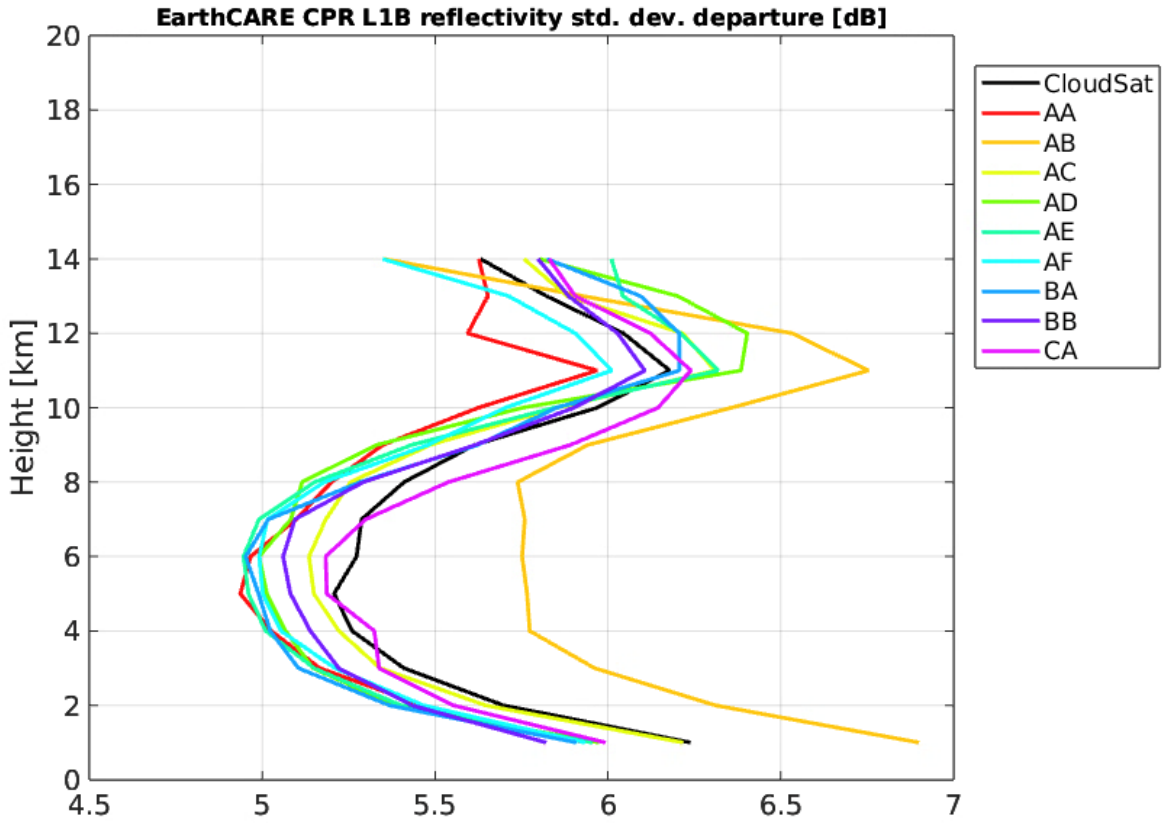
CPR preliminary quality monitoring

Global 12-hour mean bias and standard deviation compared to model for all targets passing screening for different processing periods, including relative comparison with CloudSat from July 2008.

Bias

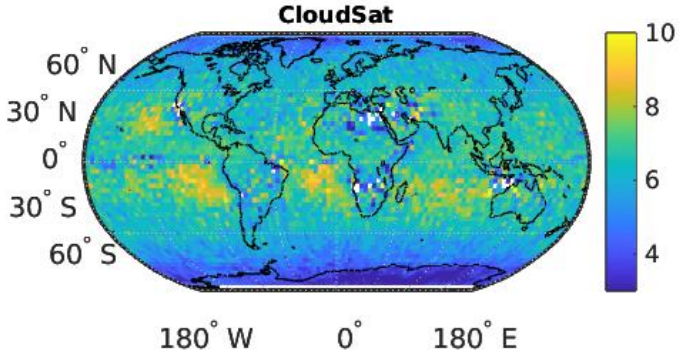


Std. dev.

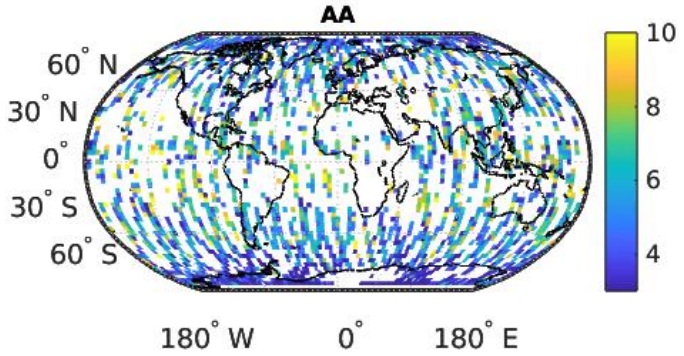


Column-average standard deviation in radar reflectivity FG departures (dB)

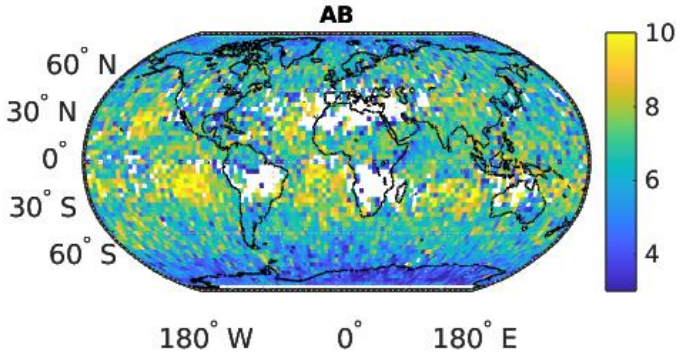
CloudSat



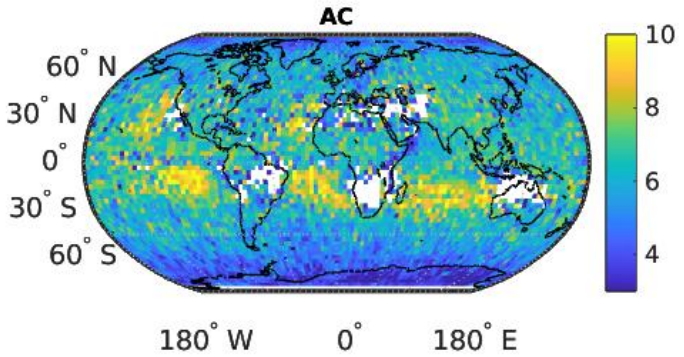
AA



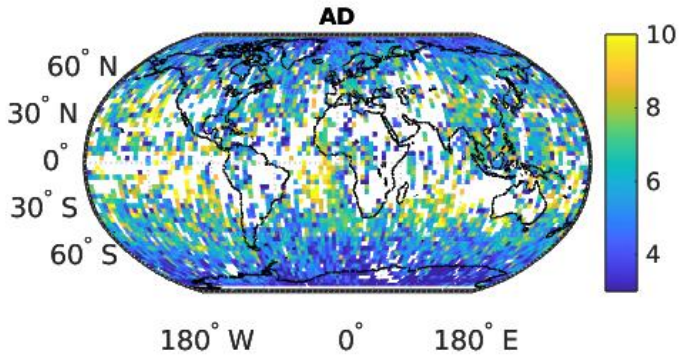
AB



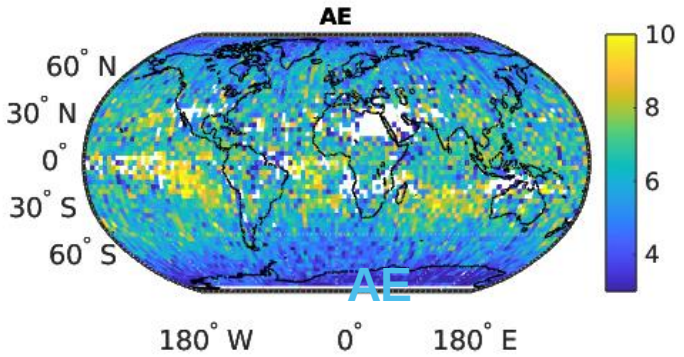
AC



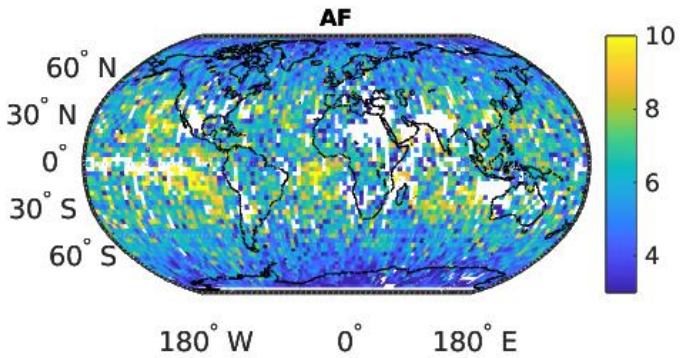
AD



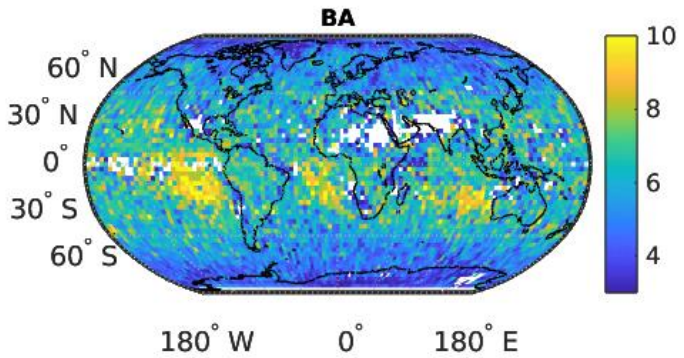
AE



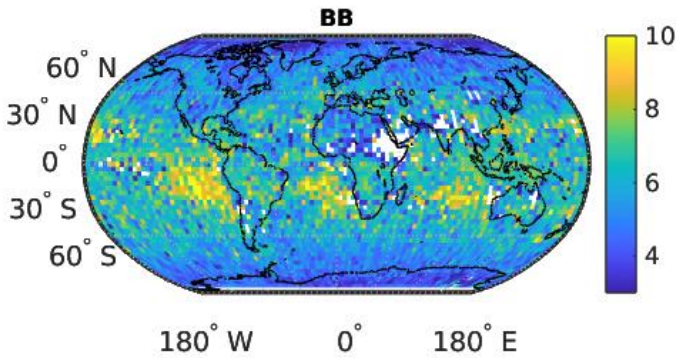
AF



BA

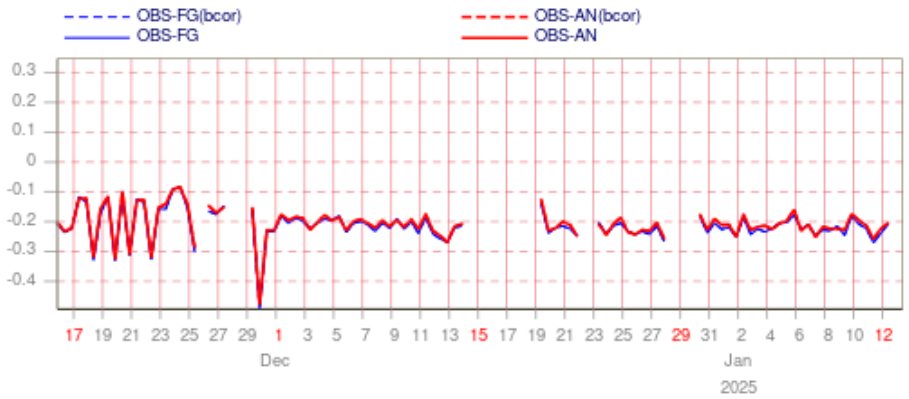


BB

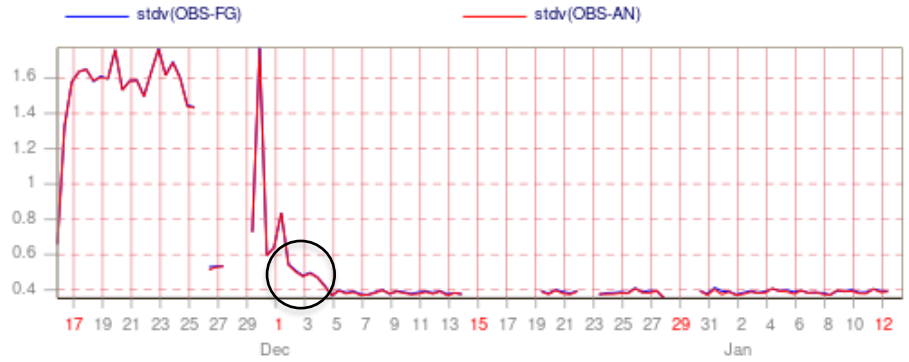


Routine monitoring – Doppler velocity

Mean
FG dep [dB]

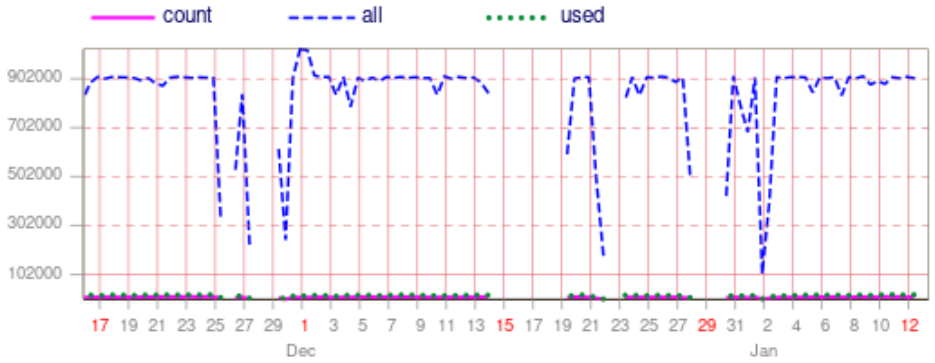


Std. dev.
FG dep [dB]

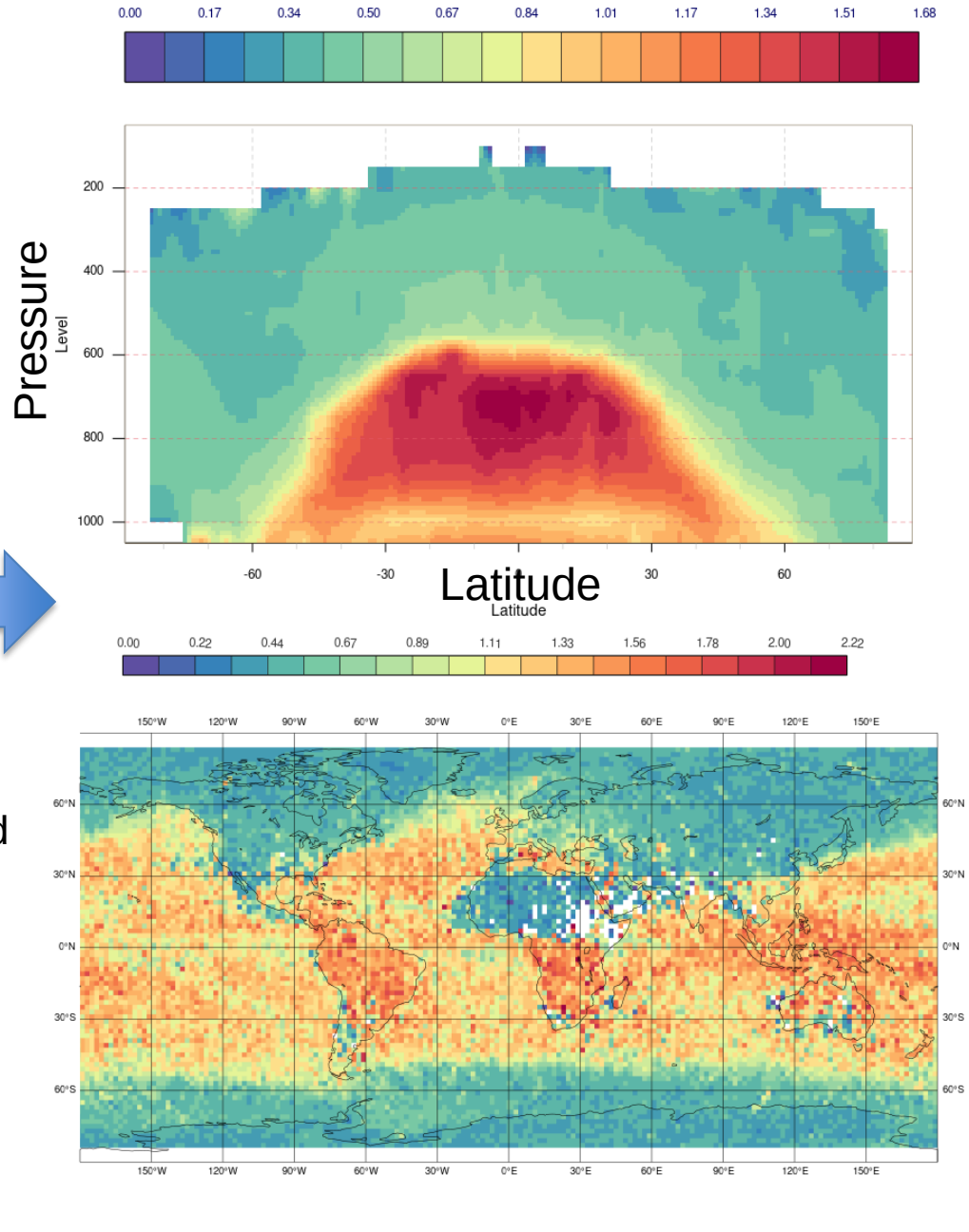


IQ offset values and reference temperatures were updated

Number
of obs



Standard deviation of FG departures



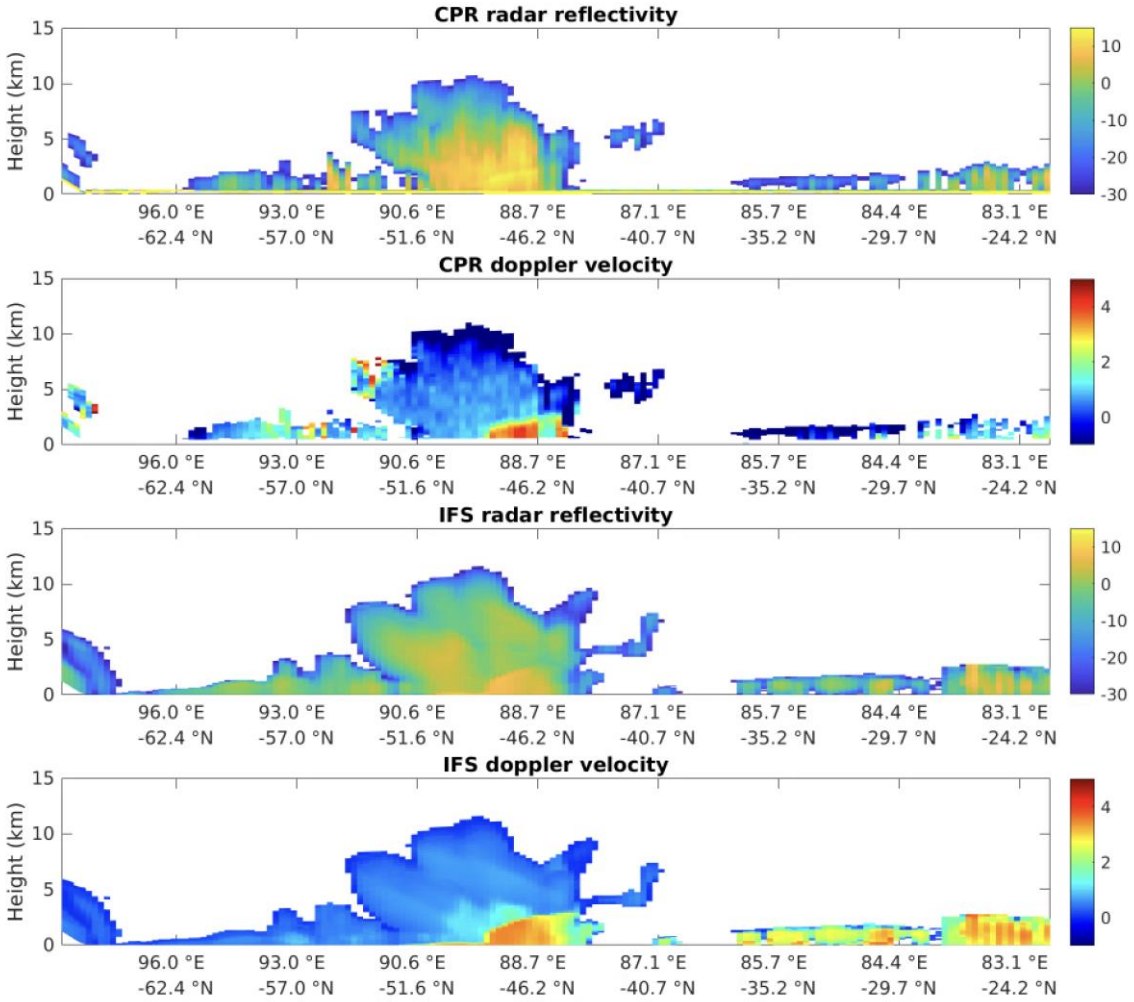
Key points

- CPR L1B NRT quality monitoring is live:

  https://charts.ecmwf.int/catalogue/packages/obstat/products/hist_ECare_CRREF_v3

- Quality and stability of CPR radar reflectivity observations are excellent when compared to ECMWF model with a few well-documented artefacts.
- 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 3.5-4 dB correction required, 2.5-2 dB from CA onwards
- Fantastic Doppler from 4 December onwards.

Frame 1787H



Lots of exciting science to do!