ATLID L1 NRT quality monitoring using NWP

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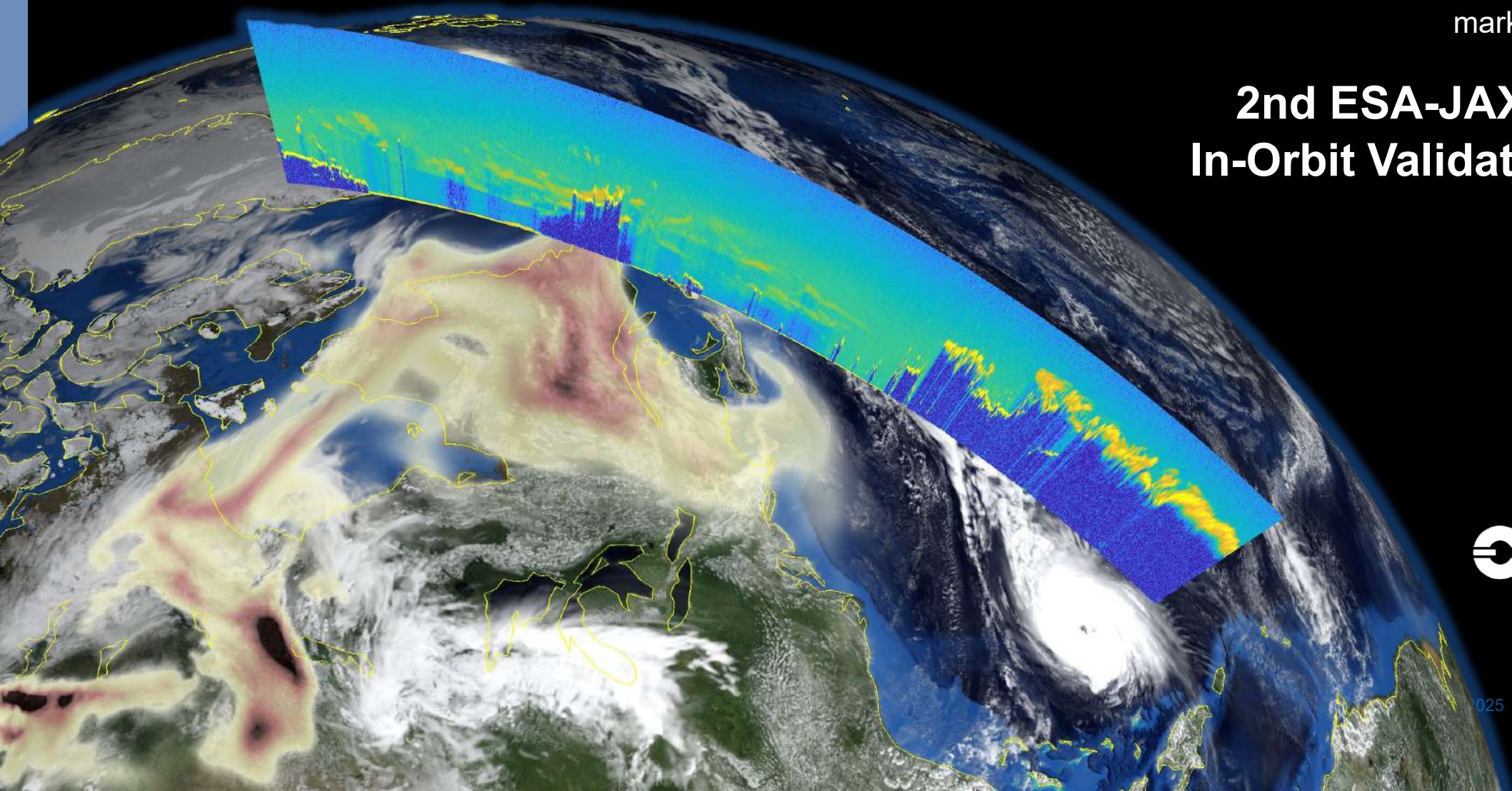
2nd ESA-JAXA EarthCARE
In-Orbit Validation Workshop



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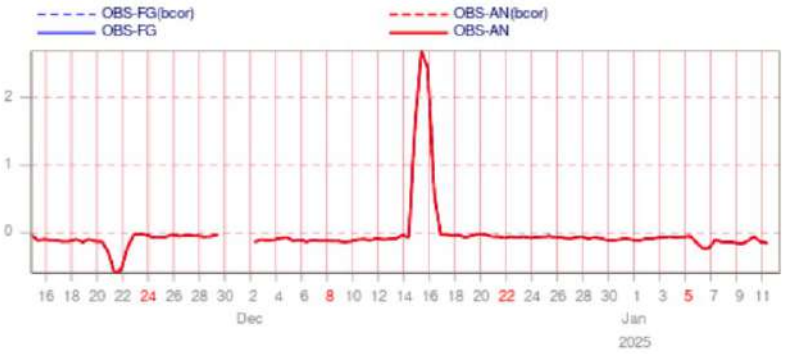
What are the benefits of validating ATLID against NWP?

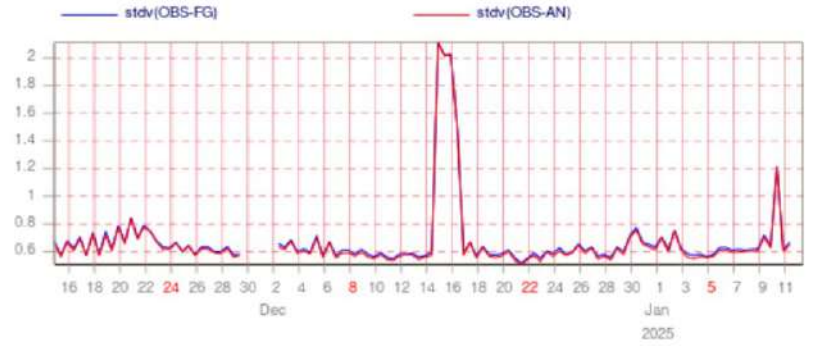
- **Rapid detection** of instrument issues (removes most of day-to-day variability)
- **Continuous evaluation** in space and time
- Platform for **comparison with other instruments**, including historical missions
- Precursor for **data assimilation**

https://charts.ecmwf.int/catalogue/packages/obstat/products/hist_ECare_LRBSC_v3

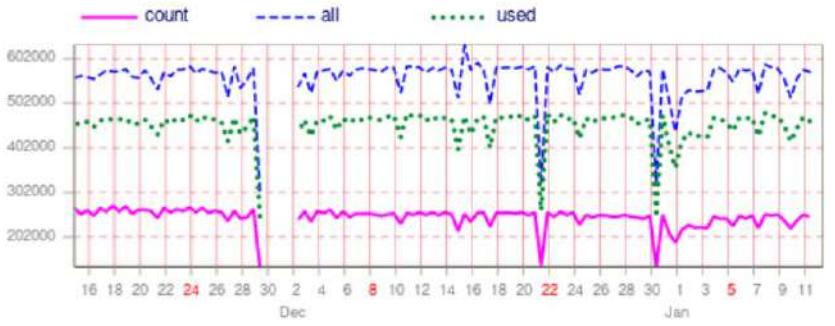
Mean FG



Std. FG

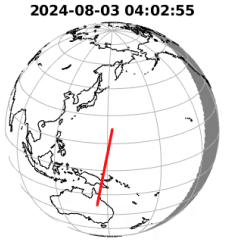


Number of obs.



https://charts.ecmwf.int/catalogue/packages/obstat/products/hist_ECare_LRBSC_v3

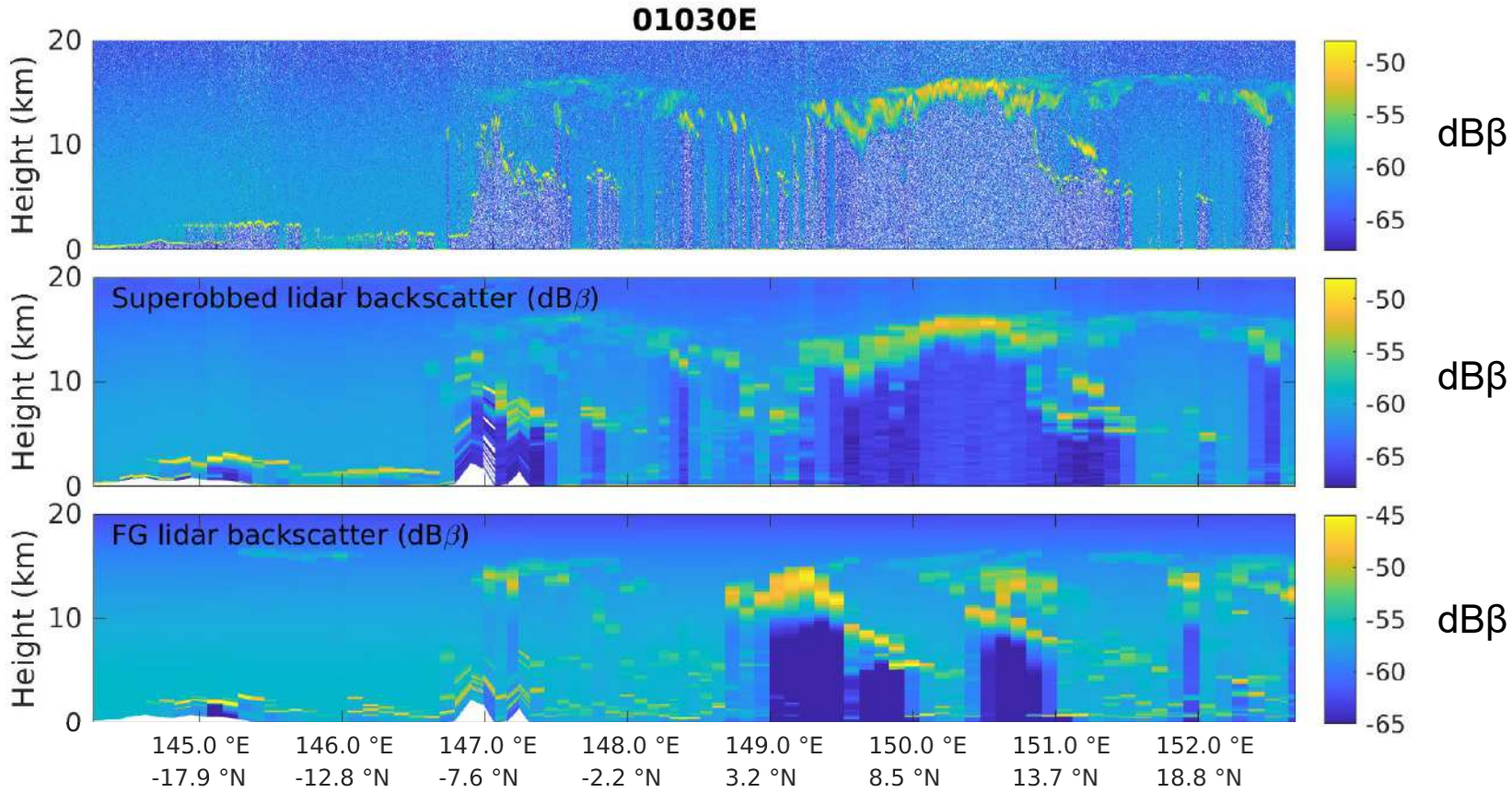
Monitoring EarthCARE using global NWP



EarthCARE ATLID total attenuated backscatter

ATLID averaged to model scale

IFS total attenuated backscatter (FG)



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

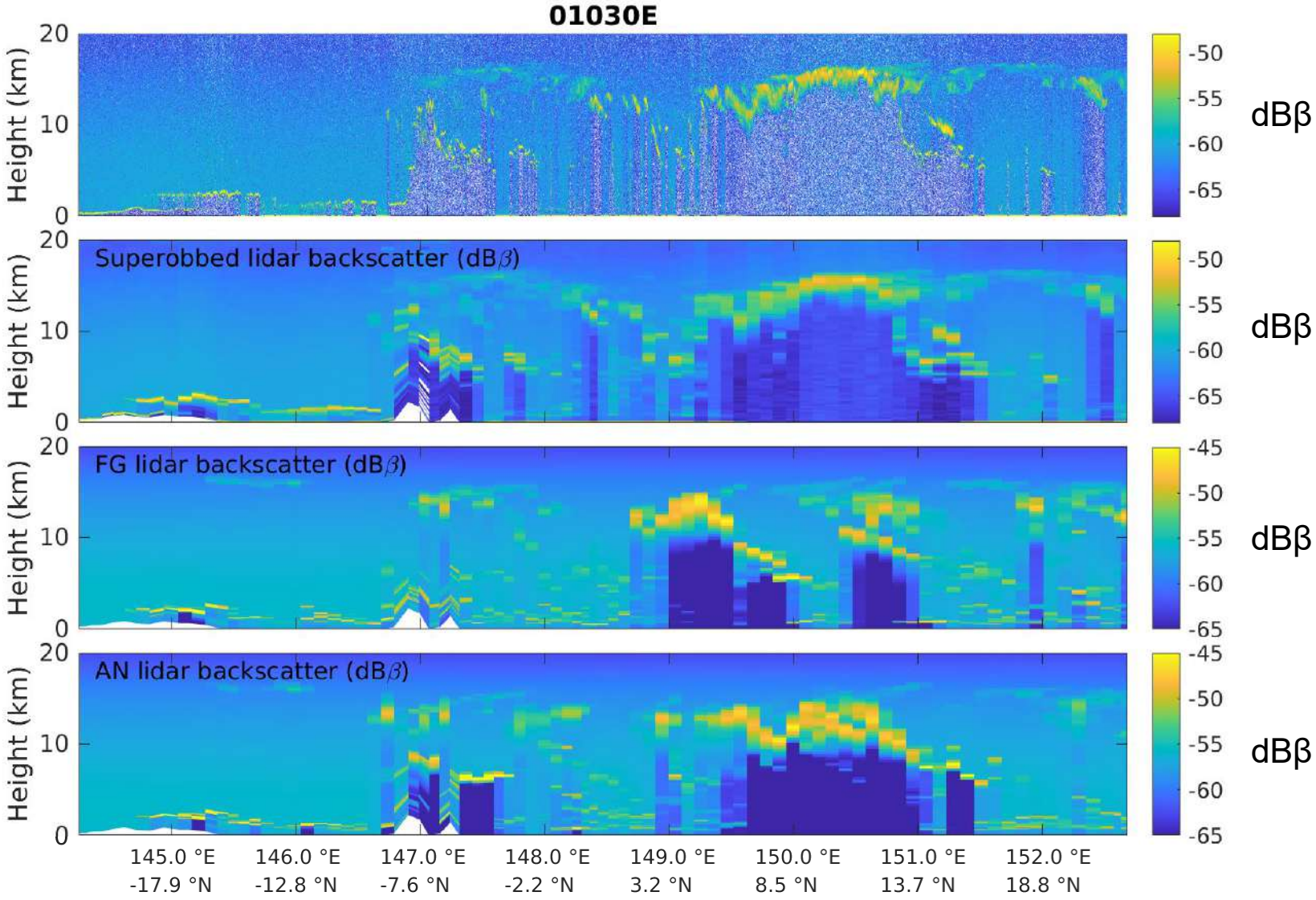
Comparison of model with observations

EarthCARE ATLID total attenuated backscatter

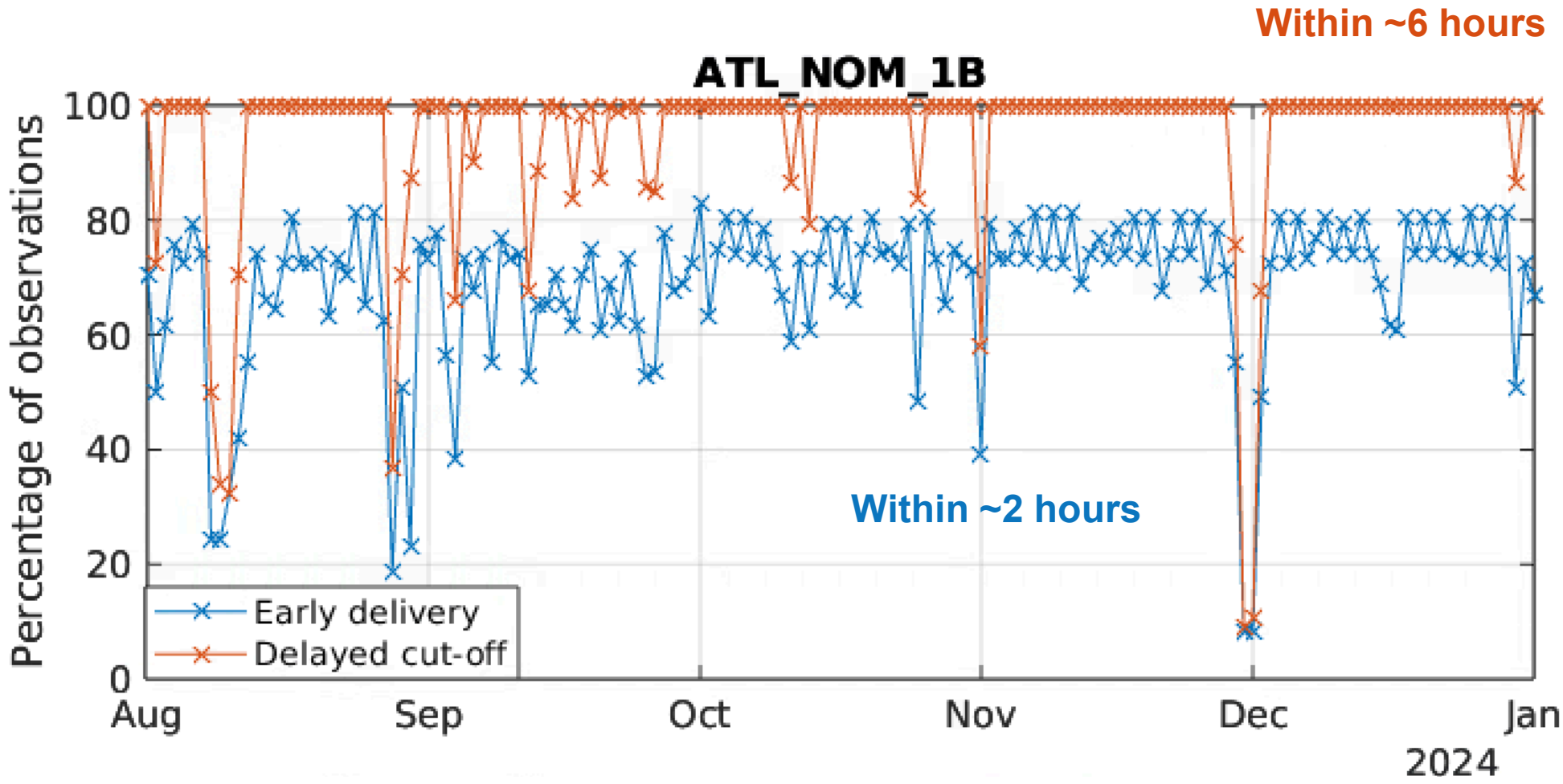
ATLID averaged to model scale

IFS total attenuated backscatter (FG)

IFS total attenuated backscatter (after assimilation; AN)



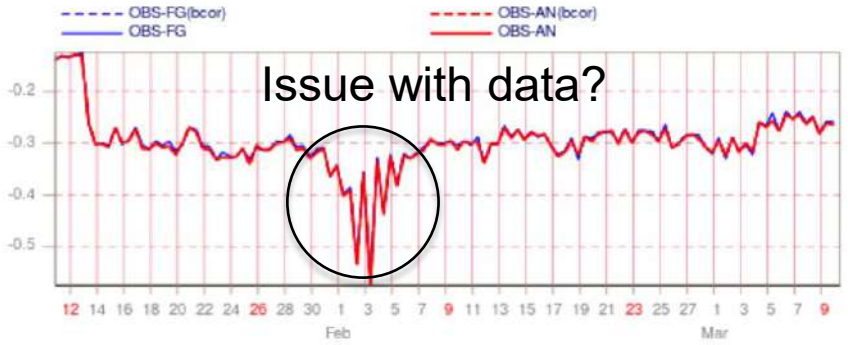
Observation availability for data assimilation



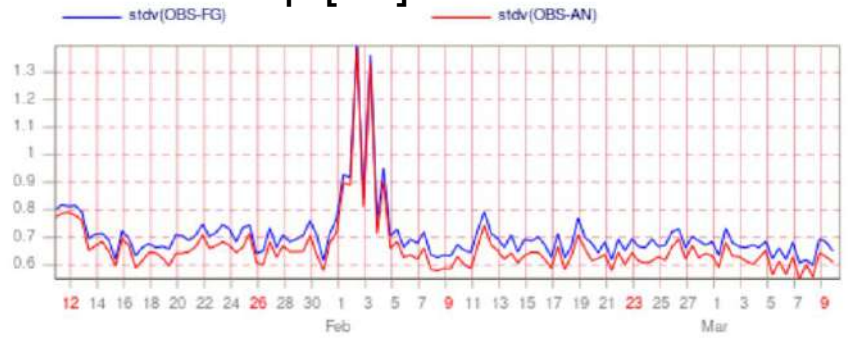
Thanks CPF!

Routine monitoring examples – Rayleigh channel

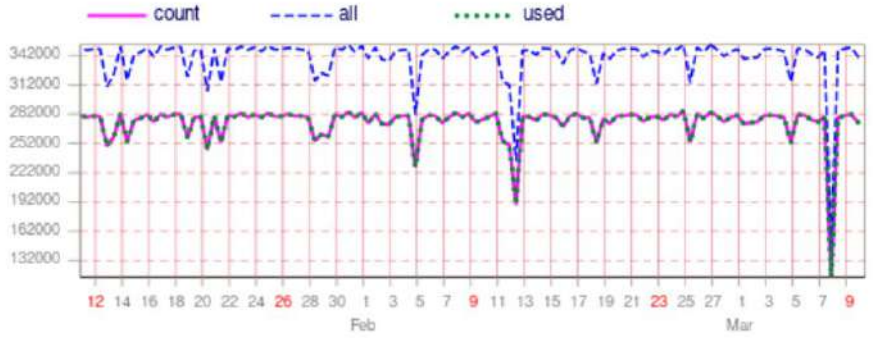
STATISTICS FOR Lidar Rayleigh backscatter FROM EarthCare/Earthcare (Globe)
CHANNEL=400@0_0@0hPa Used DATA (TIME STEP=12 HOURS)
Area 90.N/-90.S/0.W/360.E (Over all surfaces)
Exp=0001 LAST TIME WINDOW (2025031100)



Std. dev. FG dep [dB]



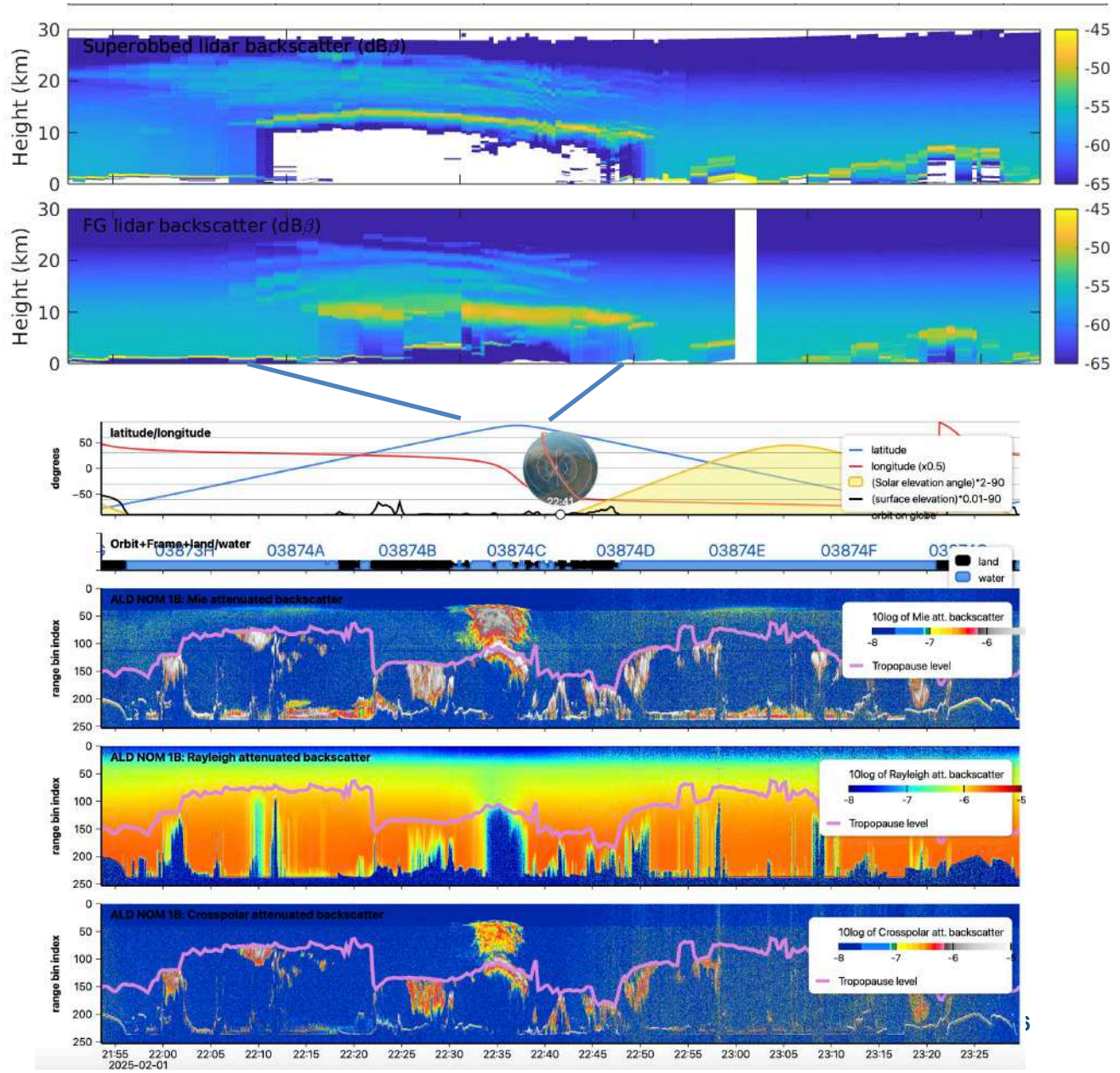
Number of obs



No… PSC missing in model!

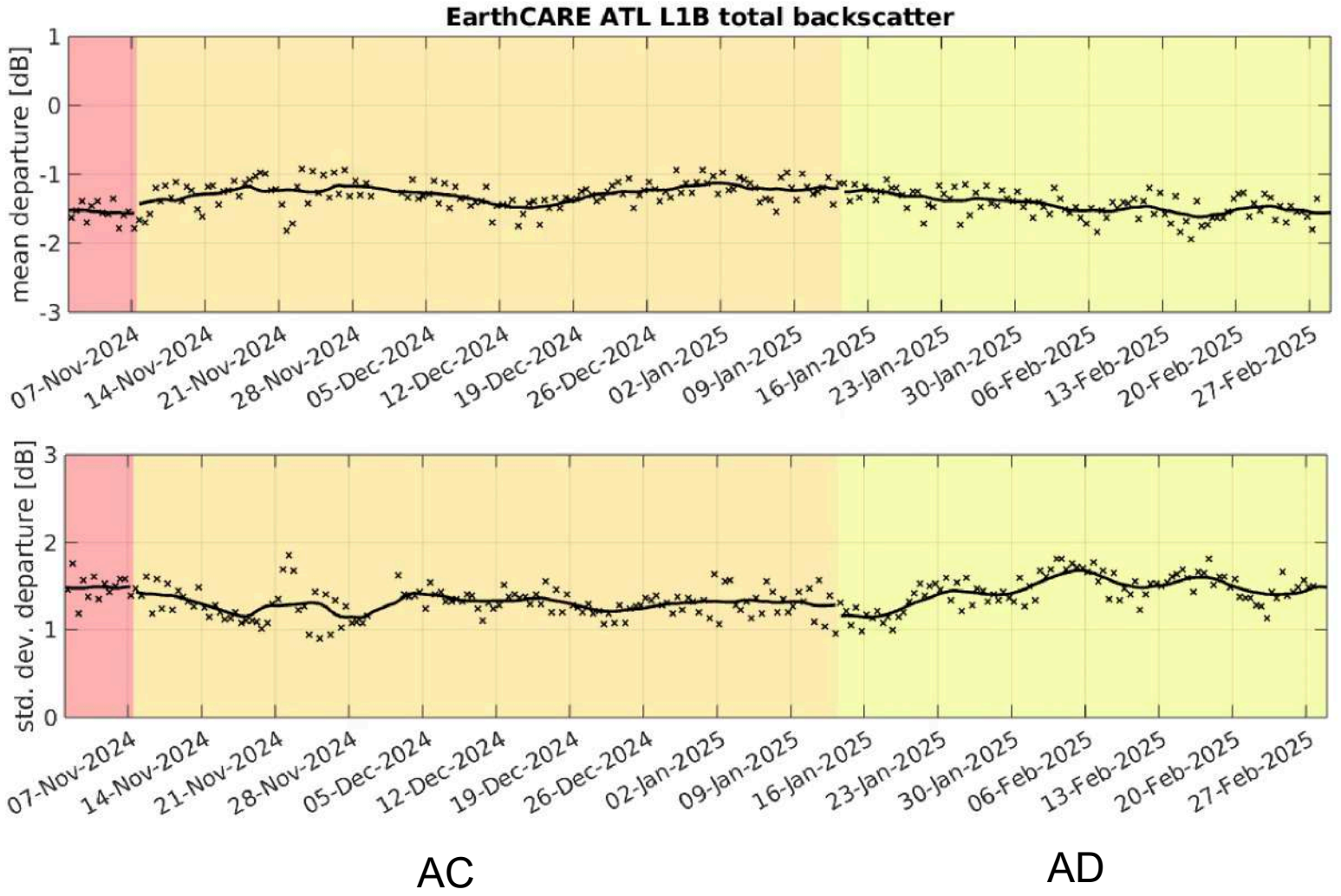
ATLID

IFS

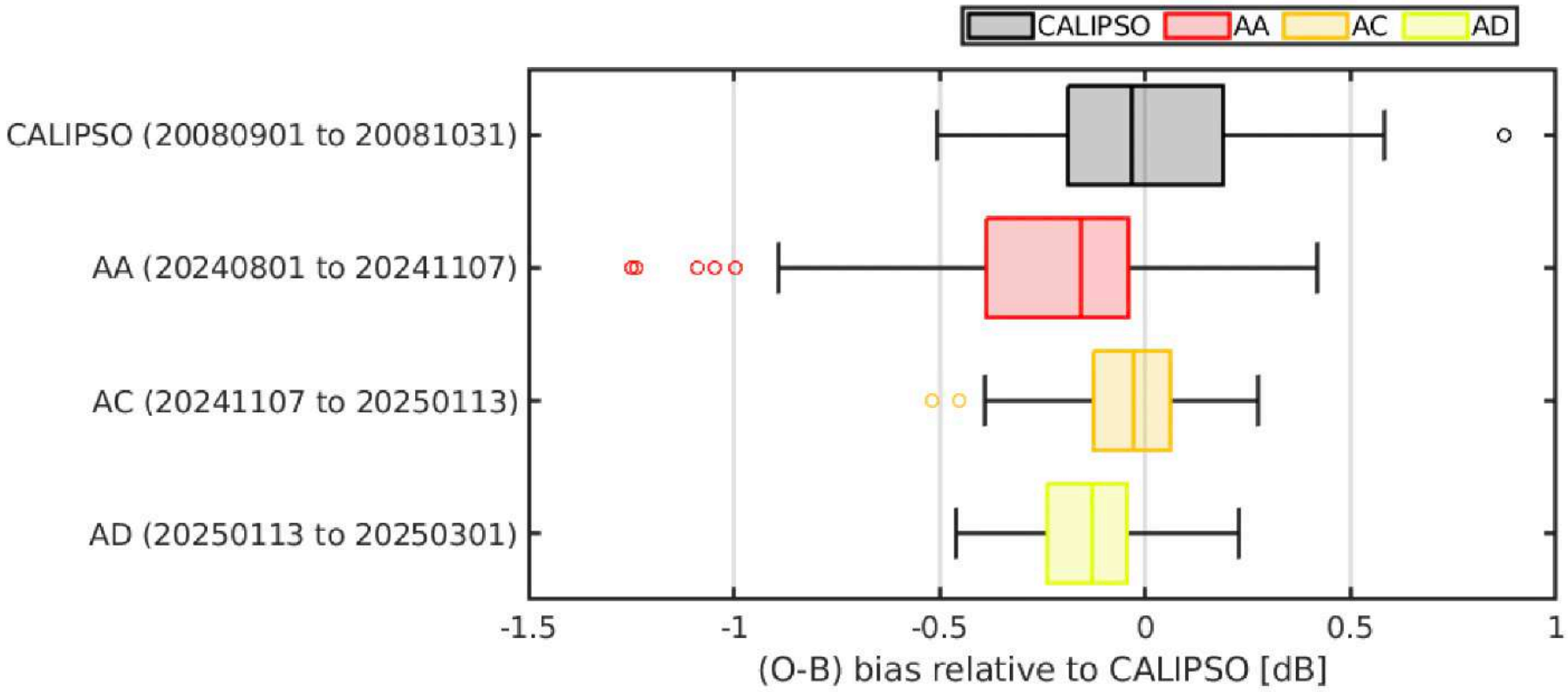


Monitoring total attenuated backscatter in ice cloud

- Monitoring of signal in ice-cloud reduces impact of attenuation of lidar signal and multiple scattering.
  - Remove incidence of liquid water cloud by restricting observations to where
    T < 233 K and using a cloud threshold
    of – 56 dBβ
- Monitoring shows ATLID cloud detection stable since lidar switch-on
- Some bias compared to model is expected - model clouds not perfect!



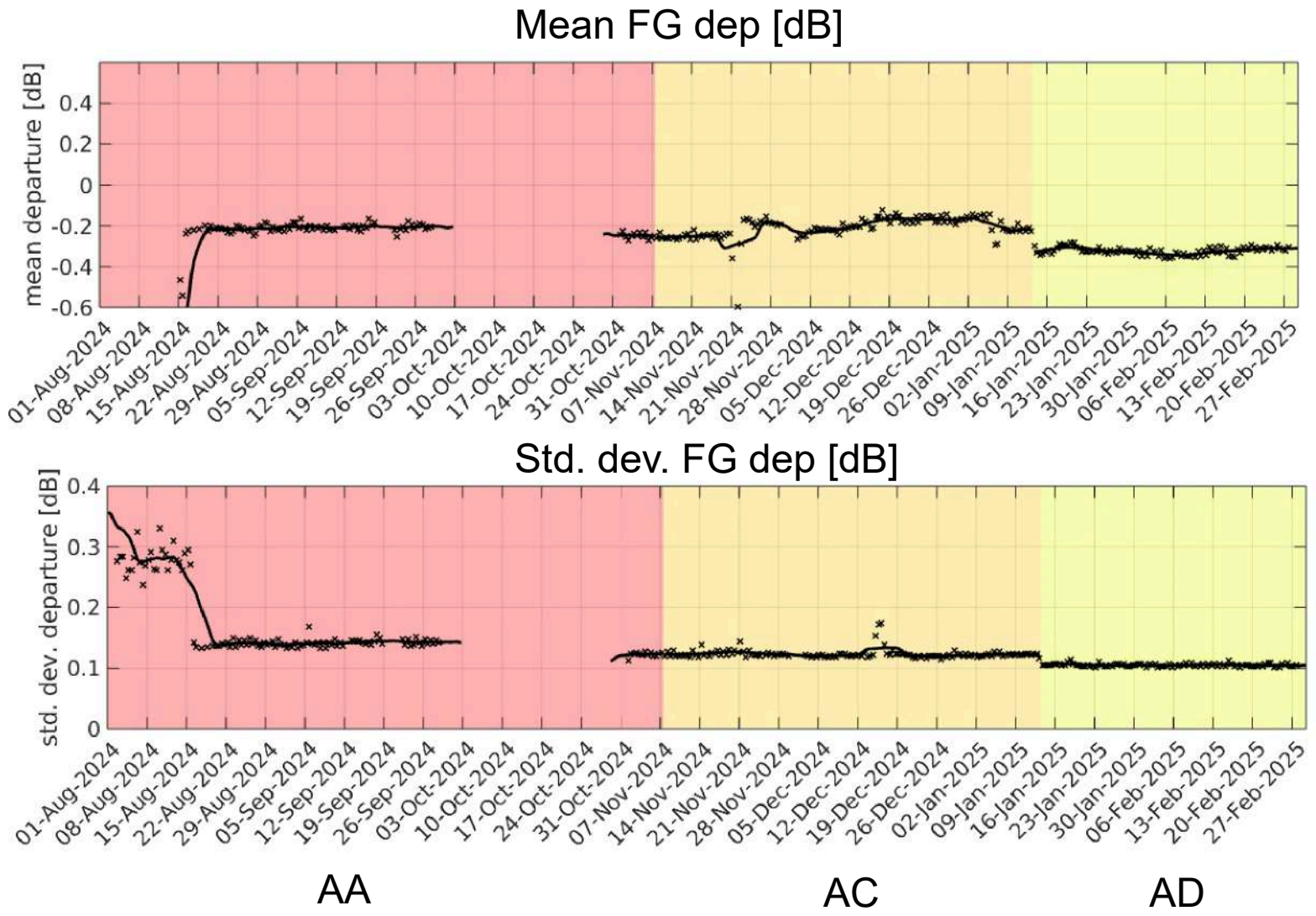
Comparison of ATLID and CALISPO in ice cloud (12-hour global mean samples)



- Can sanity check ATLID observations to CALIPSO by using model as ‘stepping stone’.
- Same processing applied to both CALIPSO and ATLID.
- AC processing agrees well with CALIPSO in global mean.

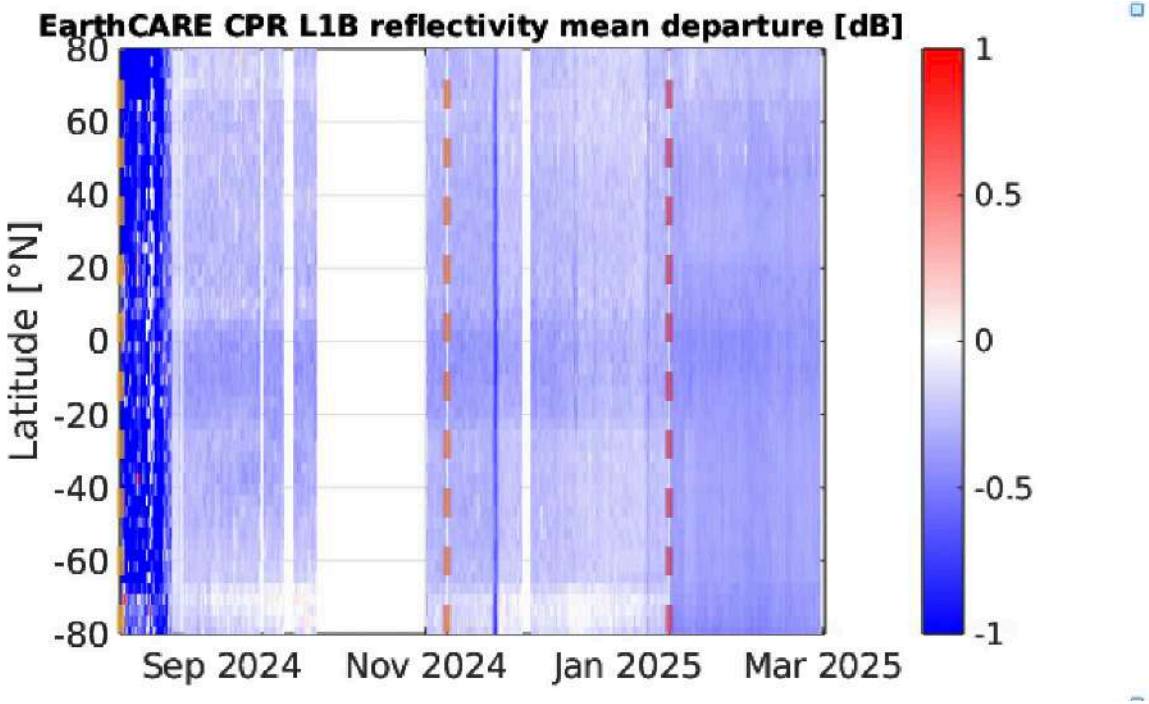
Monitoring total cloud backscatter for clear-sky only pixels

- Select clear-sky only
  - Remove incidence of clouds using a threshold of – 56 dBβ
  - Screen when Mie > 2*Rayleigh
- Bias compared to model is expected (attenuation from aerosols not represented)

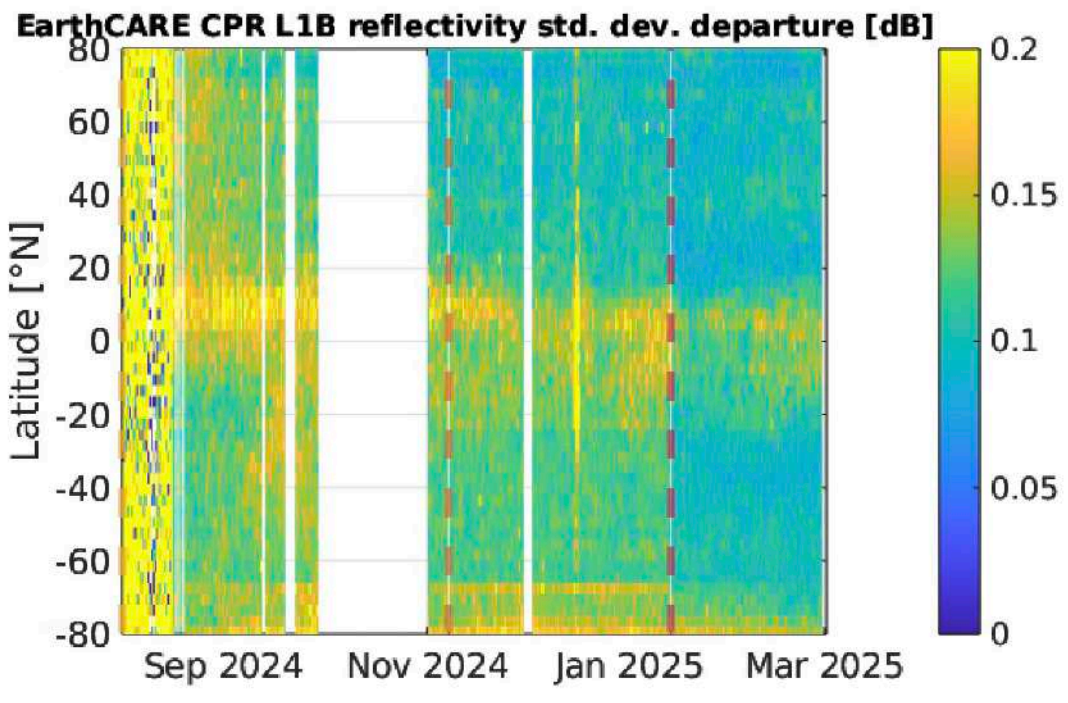


Bias in Rayleigh backscatter changing over Antarctic?

Mean bias [dB]



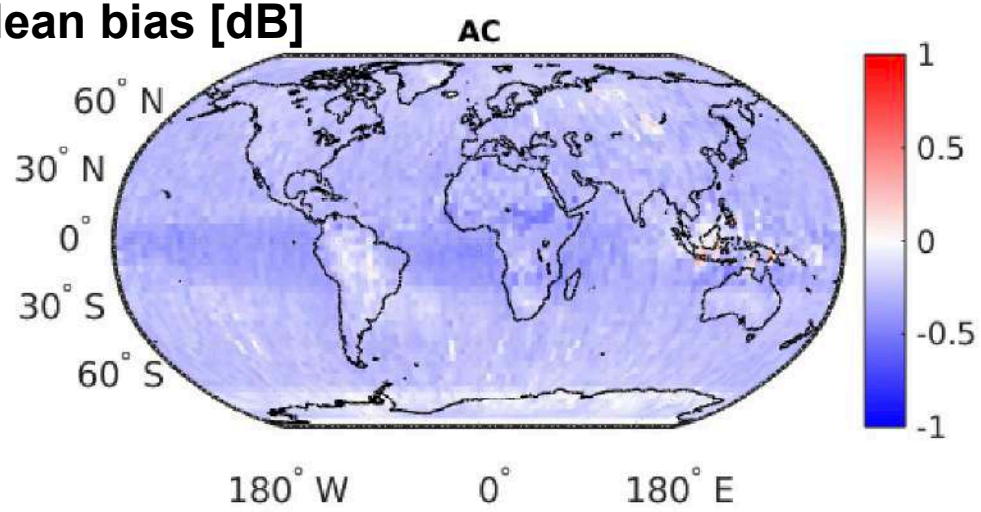
Mean std. dev. [dB]



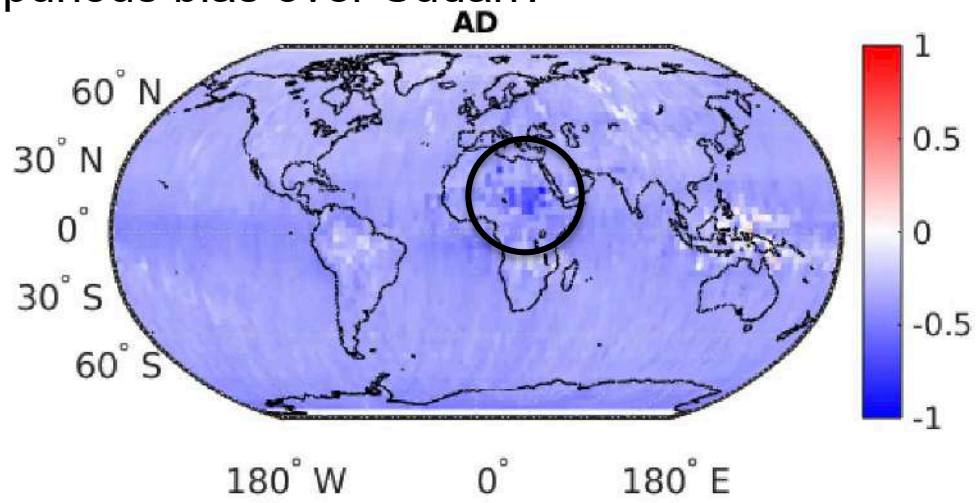
- AD update appears to have removed issue

Mean bias and Std. dev. of cloud-free ATLID Rayleigh backscatter departures

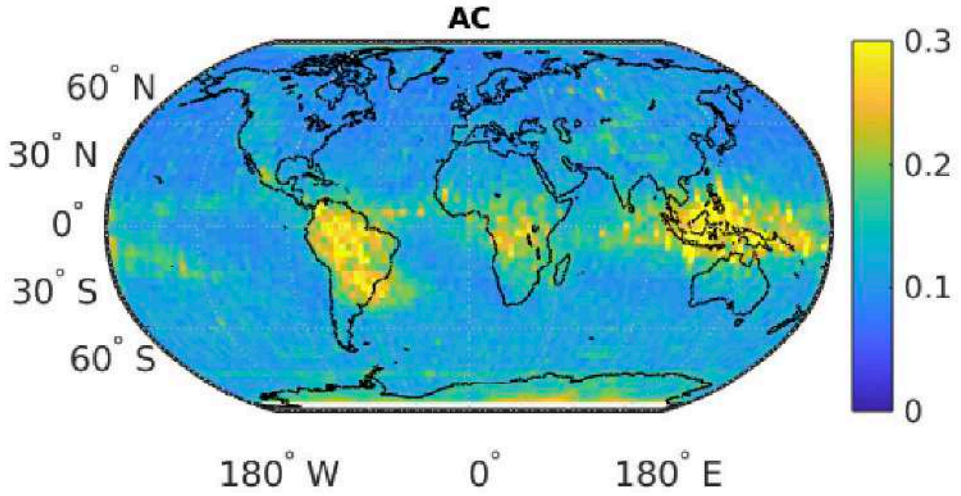
Mean bias [dB]



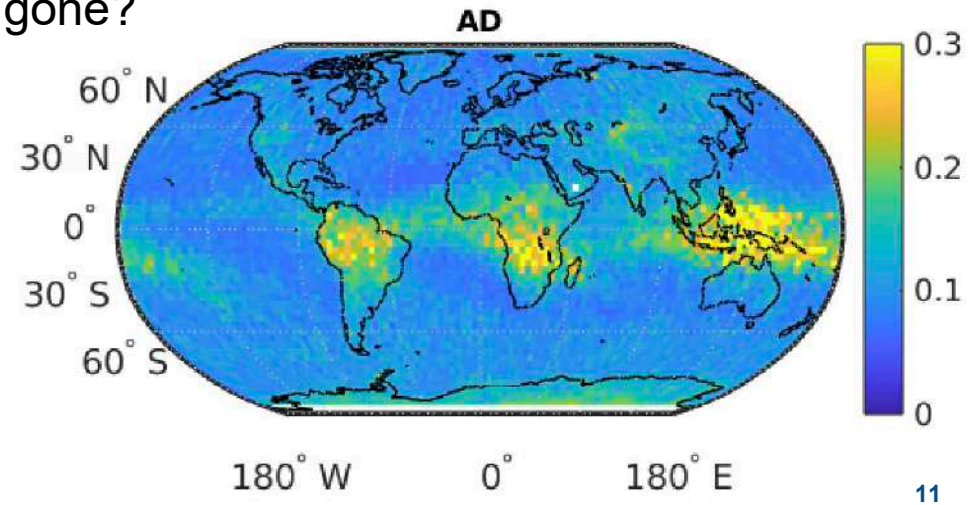
Spurious bias over Sudan?



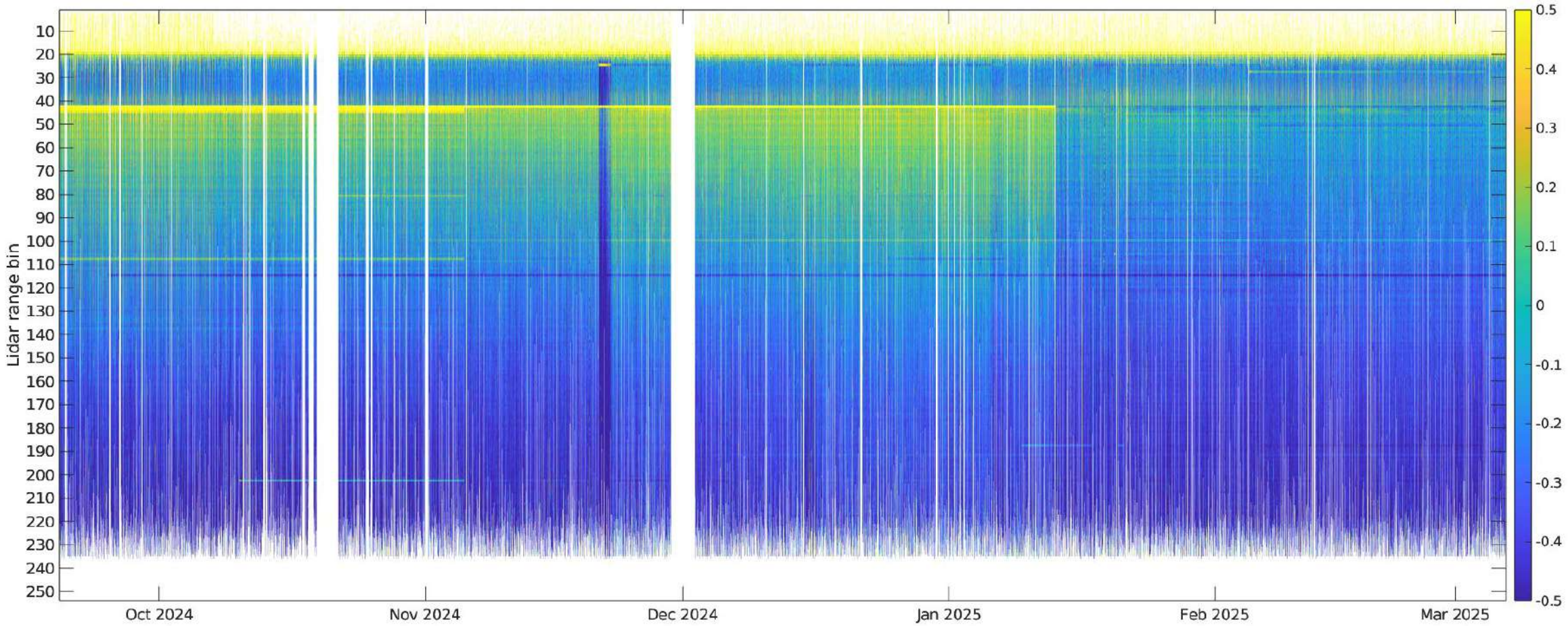
Mean std. dev. [dB]



SAA gone?



Bin-by-bin monitoring of total attenuated backscatter in clear-sky conditions

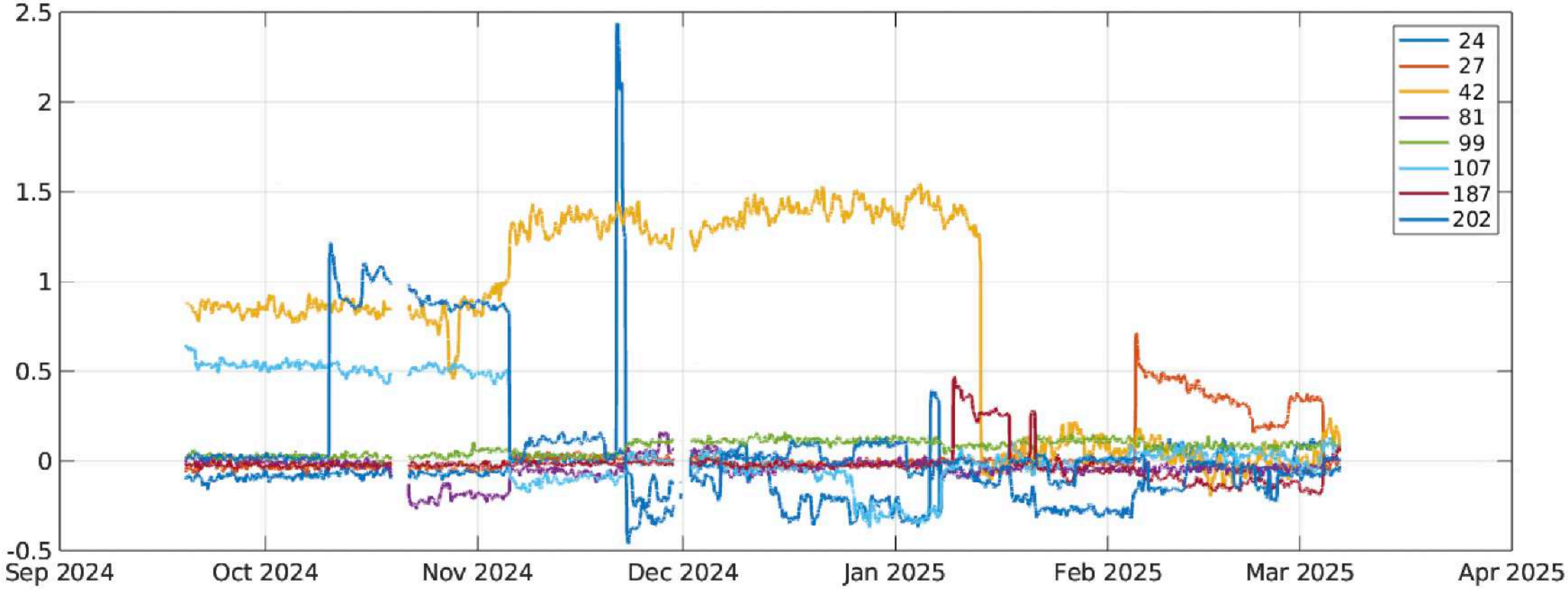


Tracking hot pixels using FG departures

Hot

‘Hotness’ [dB]

Cold



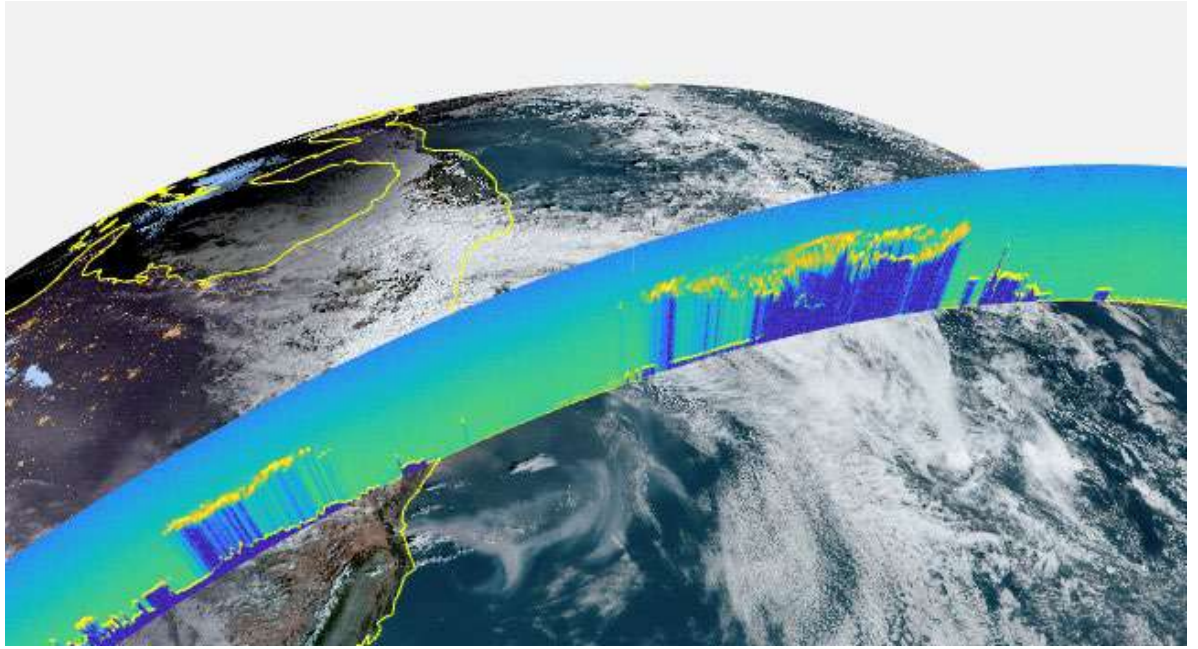
Key points

- ATLID L1B NRT quality monitoring is live:

  https://charts.ecmwf.int/catalogue/packages/obstat/products/hist_ECare_LRBSC_v3

- Data quality appears excellent when compared to ECMWF model data, particularly from AD onwards..
- Hot/cold pixel monitoring is ongoing, but routine dark current map updates have been effective at minimizing impact.
- Monitoring of L2A products will commence in the next few months as part of DISC activities

ATLID L1B 3500D/E + GOES VIS 08-01-25 2200 Z



ECMWF IFS lidar backscatter + CAMS 2200 Z