Sentinel-3A
Calibration and Validation

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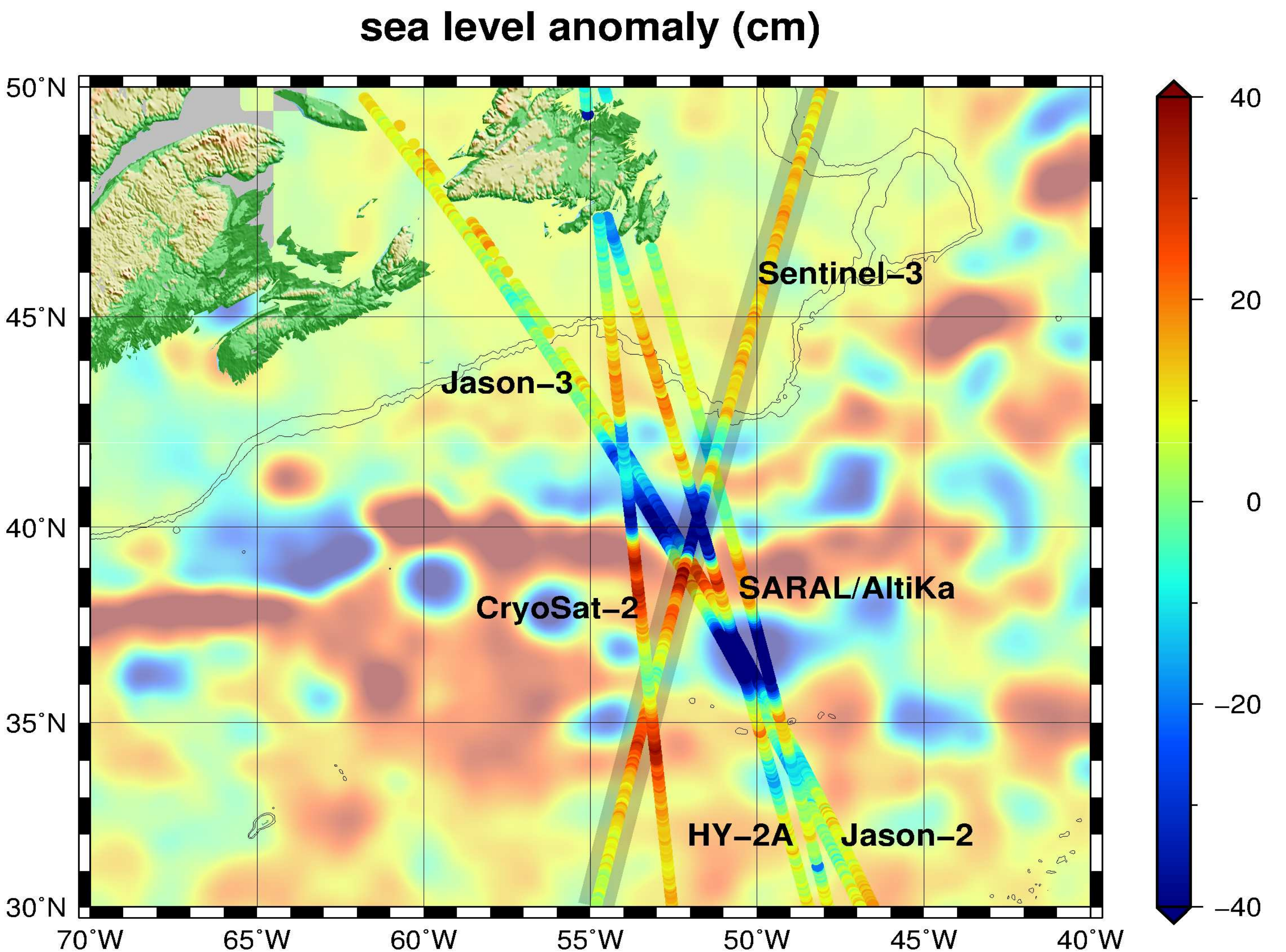
"First Image" 1 March 2016



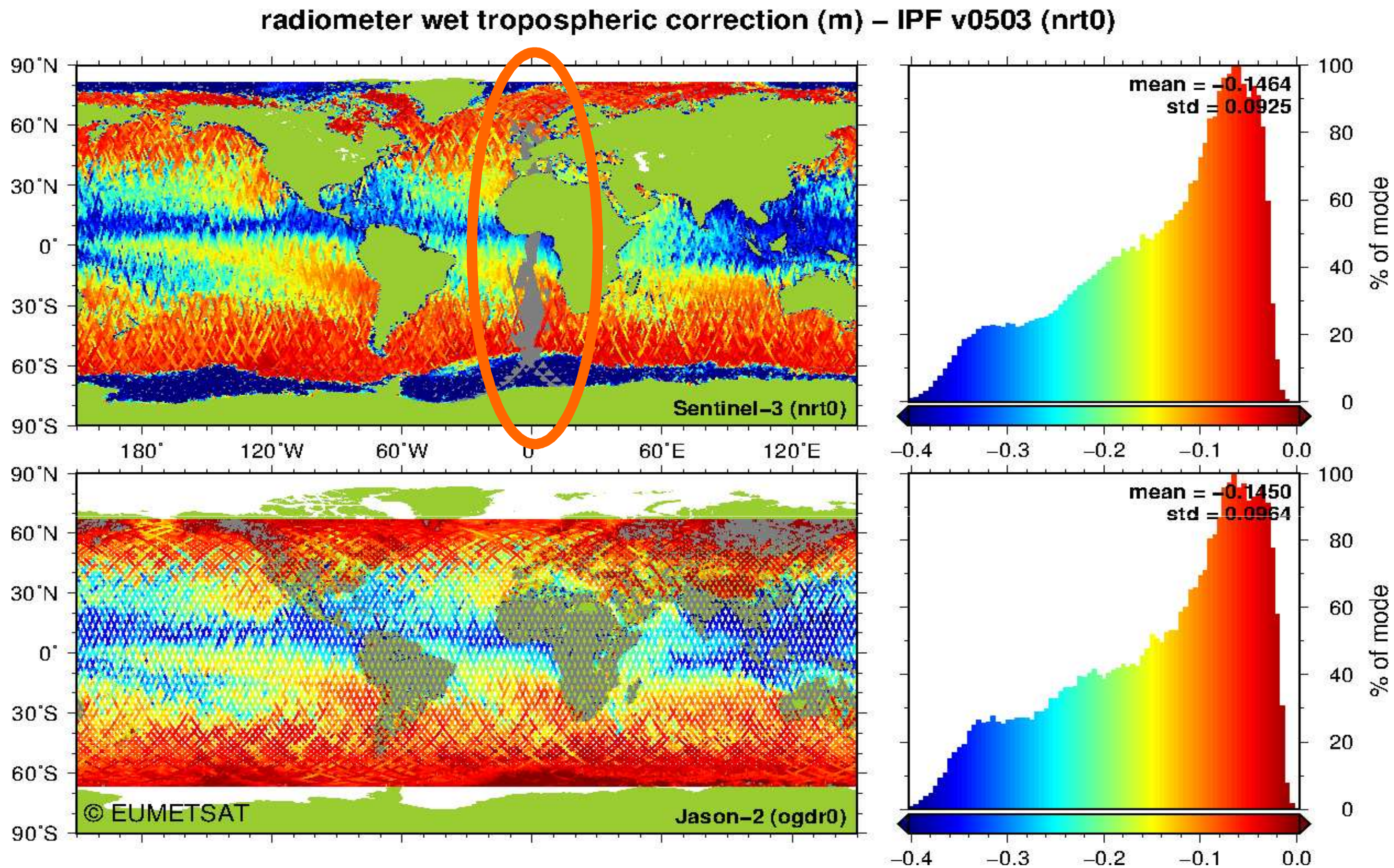
Ground Segment EUMETSAT

- Started production SRAL/MWR Level 2 data
  - After resolving many issues with work flow
  - NRT data: Level 2 production started 23 June 2016 ~ 13:00
- Several IPF versions
  - **v05.03.16** until 12 October
  - **v06.03** thereafter
  - **v06.03** on reference platform since late August
- Release of NRT L1 and L2 data to S3VT
  - Started in July
- Future
  - Evaluating IPF **v06.05** starts next week
  - Operational by last week of November
  - Reprocessing with IPF **v06.05** started, to be released to S3VT in coming weeks
  - Release operational data (NRT and STC) to general public of L1A, L1B, L2 mid December

IPF Update

- Many updates since June
  - biases in sigma0 fixed, hence wind speed, SSB
  - biases in range corrected
  - (static) inverse barometer correction fixed
- Most recent updates (v06.03)
  - adjustment brightness temperatures
  - fix “loss” of radiometer data around Greenwich Meridian
  - properly use multiple meteo files for interpolation
  - backup sigma0 attenuation in case of missing/defaulted radiometer data
- Future updates
  - L1/L2 alignment on number of looks used
  - Look up table for range correction

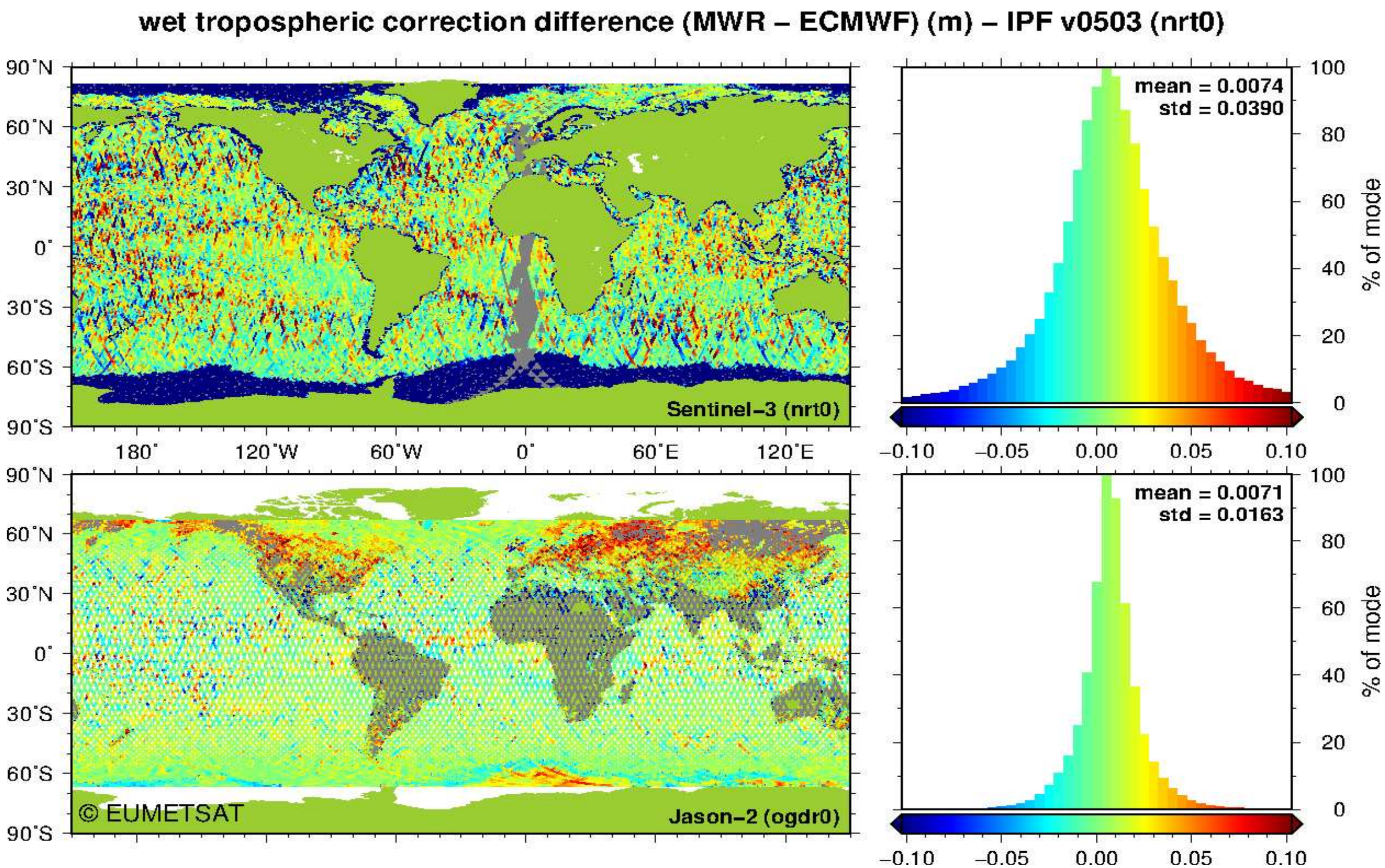
radiometer wet tropo correction



v05.03

- Invalid values for granules crossing Greenwich Meridian
- Otherwise looks reasonable at first glance

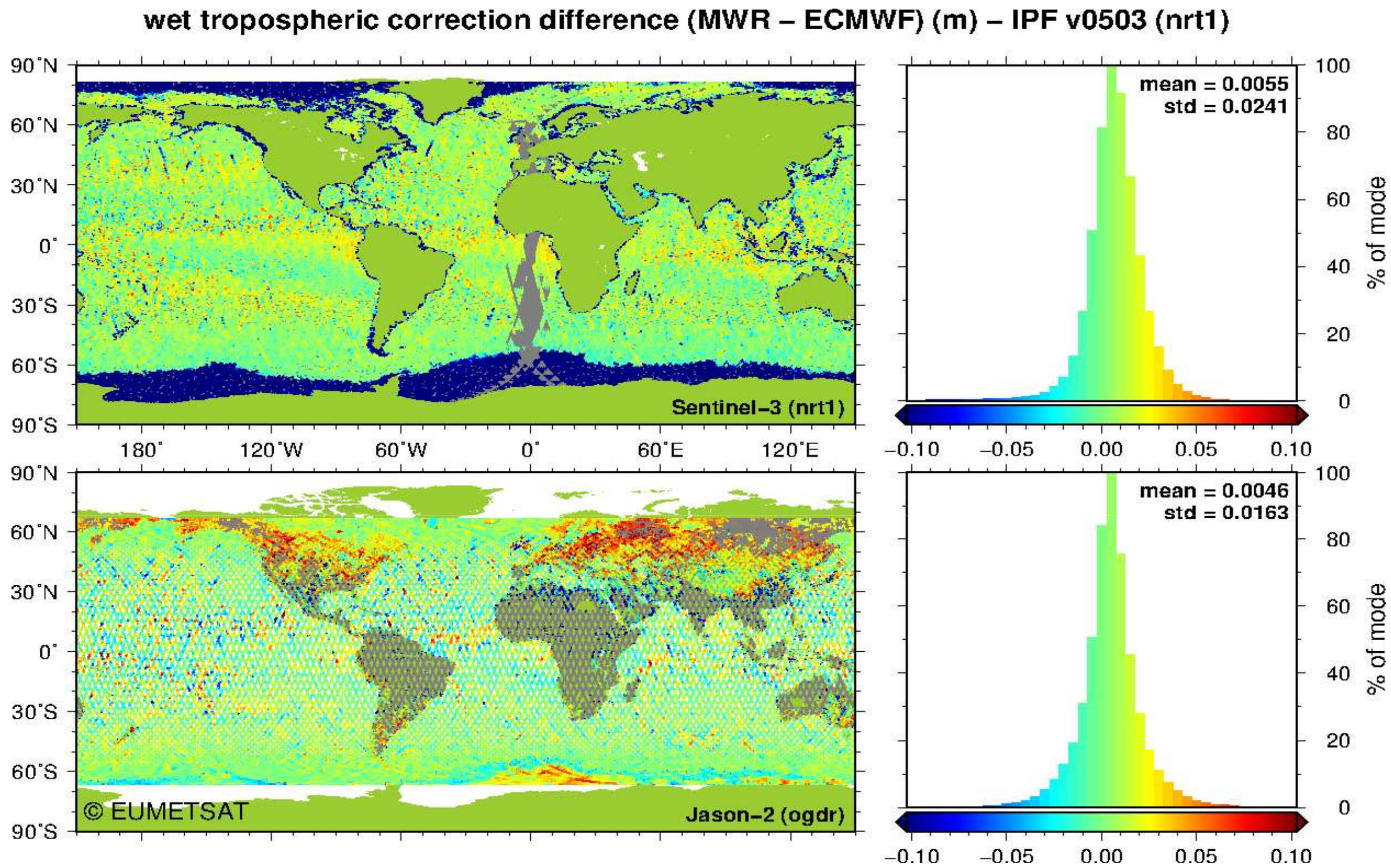
wet tropo (MWR–ECMWF, PDGS)



v05.03

- Looks like MWR wet tropo by far not as good as for AMR
- However …

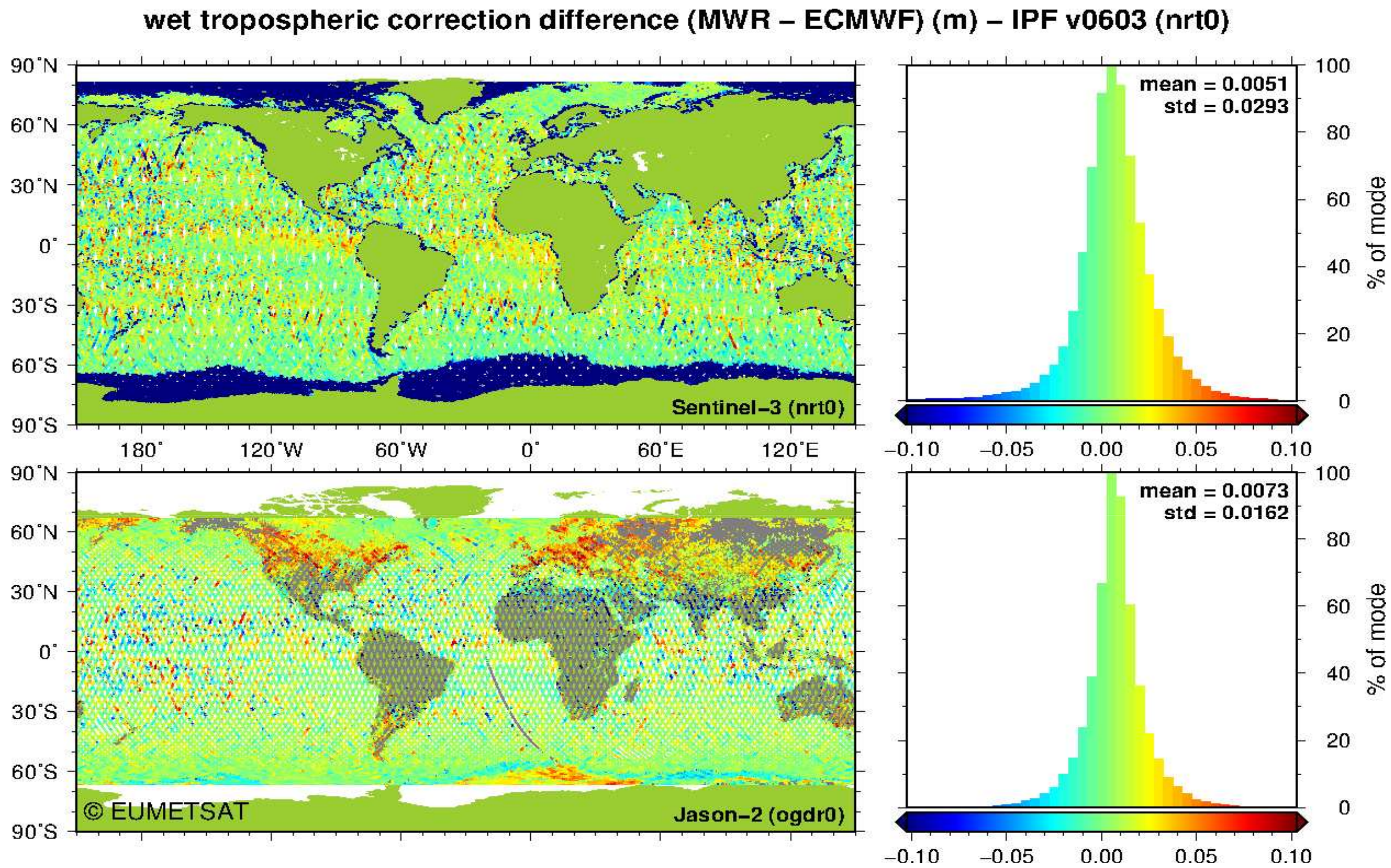
wet tropo (MWR–ECMWF, RADS)



v05.03

- … things look quite different with RADS …
- This is because interpolation of meteo fields only used one grid

wet tropo (MWR–ECMWF, PDGS)



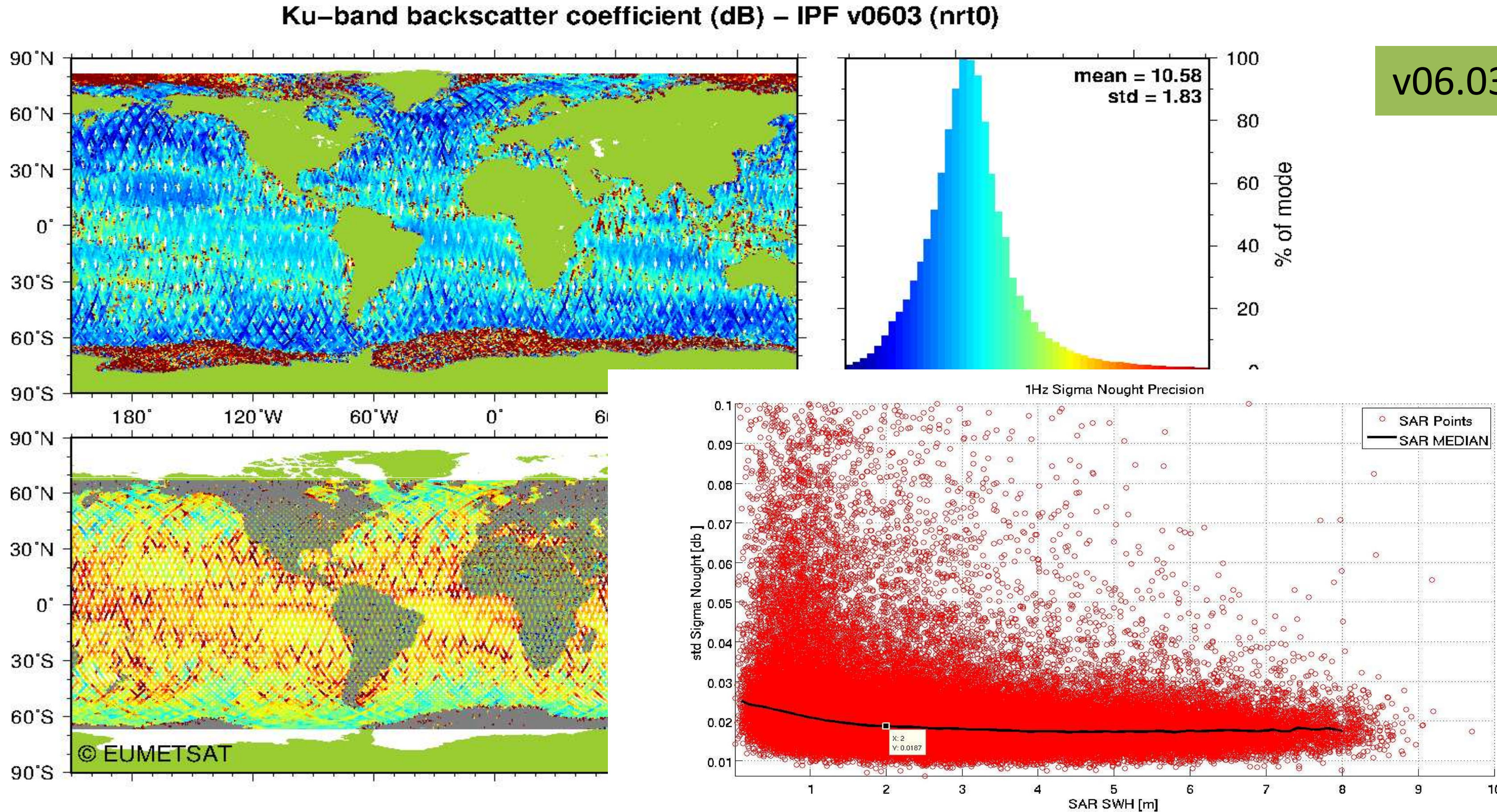
v06.03

- Much better in IPF v06.03
- Still not as accurate as AMR
- TB adjustment needed; NN model can be improved

Impact missing MWR data

- Missing radiometer data
  - Missing brightness temperatures
  - Most granules that cross the Greenwich Meridian
  - Likely bug in MWR data interpolation across 0º longitude
- As a consequence also missing
  - radiometer wet tropospheric correction
  - water vapour and liquid water content
  - atmospheric attenuation of backscatter
  - wind speed
  - sea state bias
  - ionospheric correction
  - sea level anomaly
- Solution
  - Fix included in IPF v06.03
  - Also implemented backup solution for atmospheric attenuation

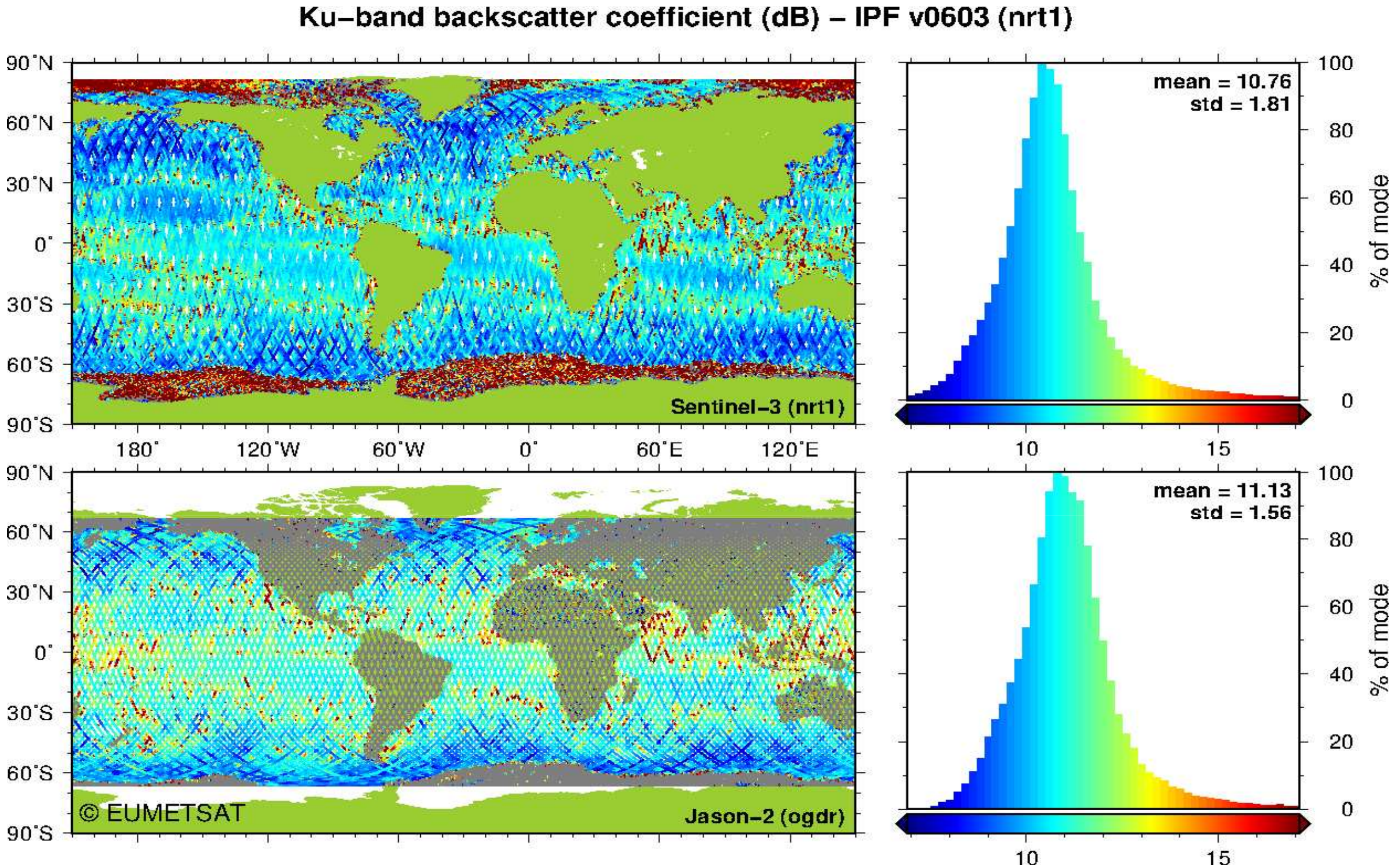
backscatter



v06.03

- Backscatter around 11 dB (not corrected for attenuation); close to Envisat/Geosat standard
- 1-Hz precision ~0.02 dB

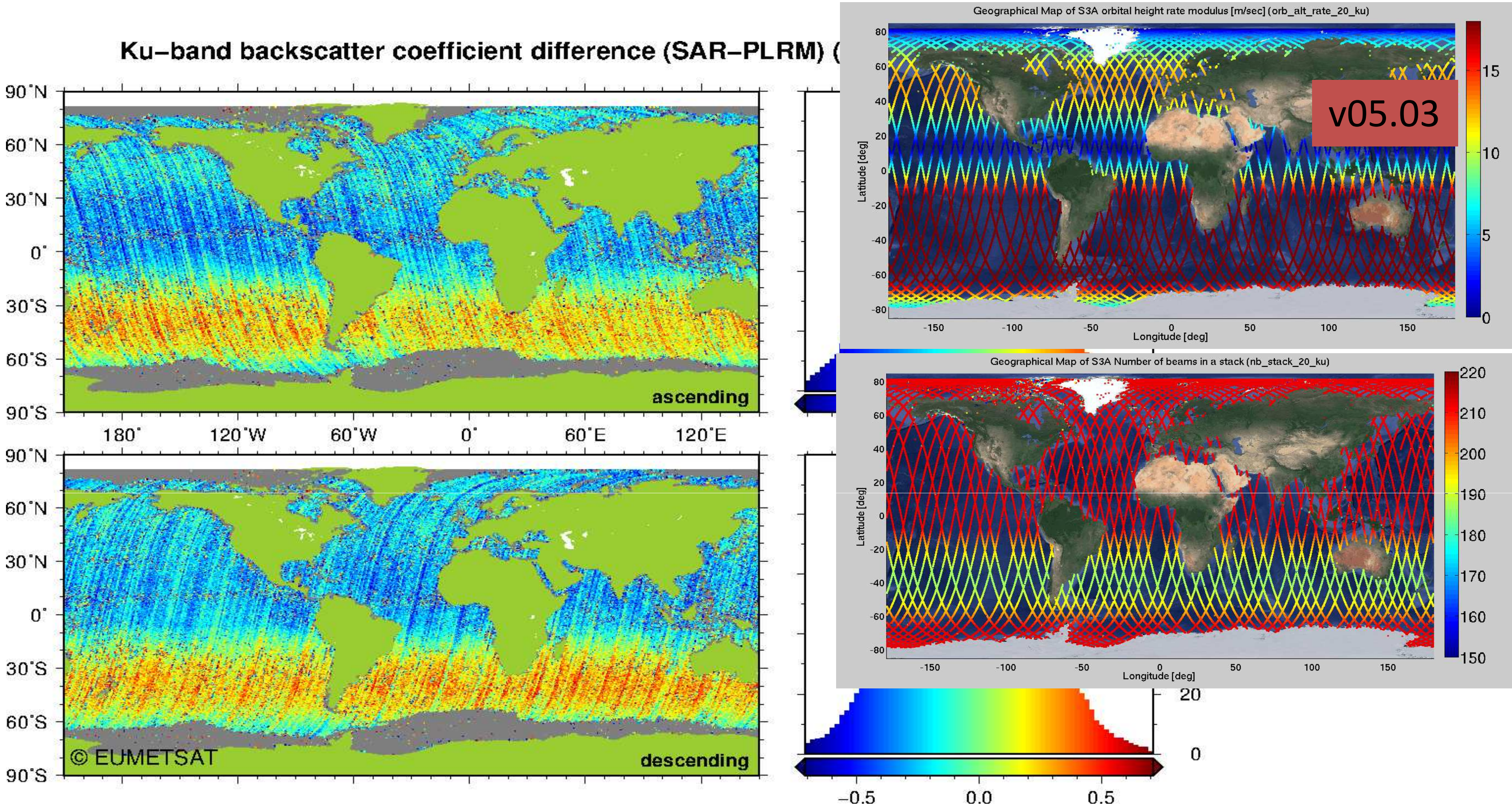
backscatter (patched)



v06.03

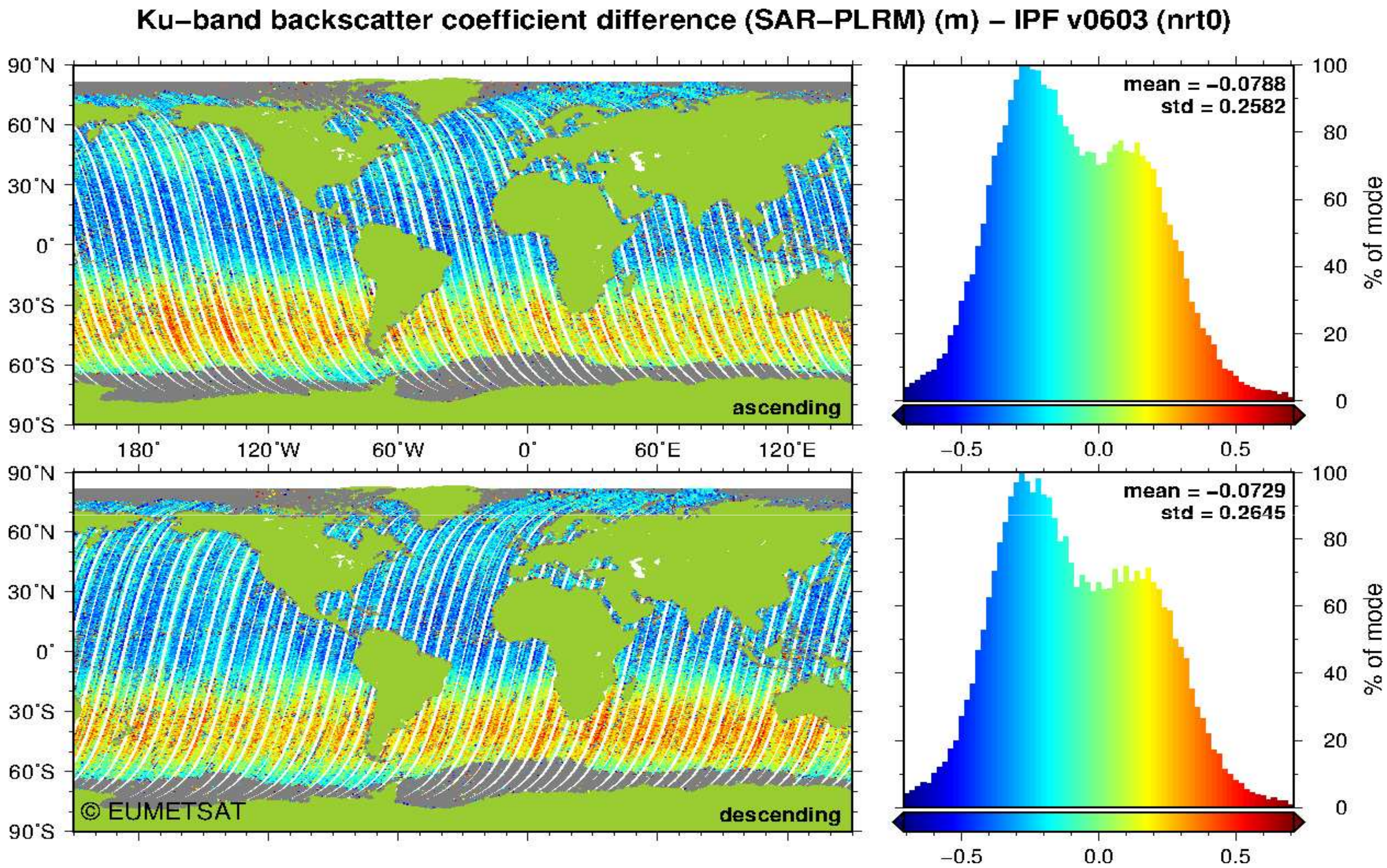
- Now backscatter corrected for attenuation
- ~0.3 dB bias with Jason-2 (aligned with Envisat) -> impacts wind speed

backscatter (SAR–PLRM)



- Difference (SAR – PLRM) backscatter reveals error as function of (absolute) height rate
- Due to inconsistency in nr of beams used in L1 and specified in L2 retracker

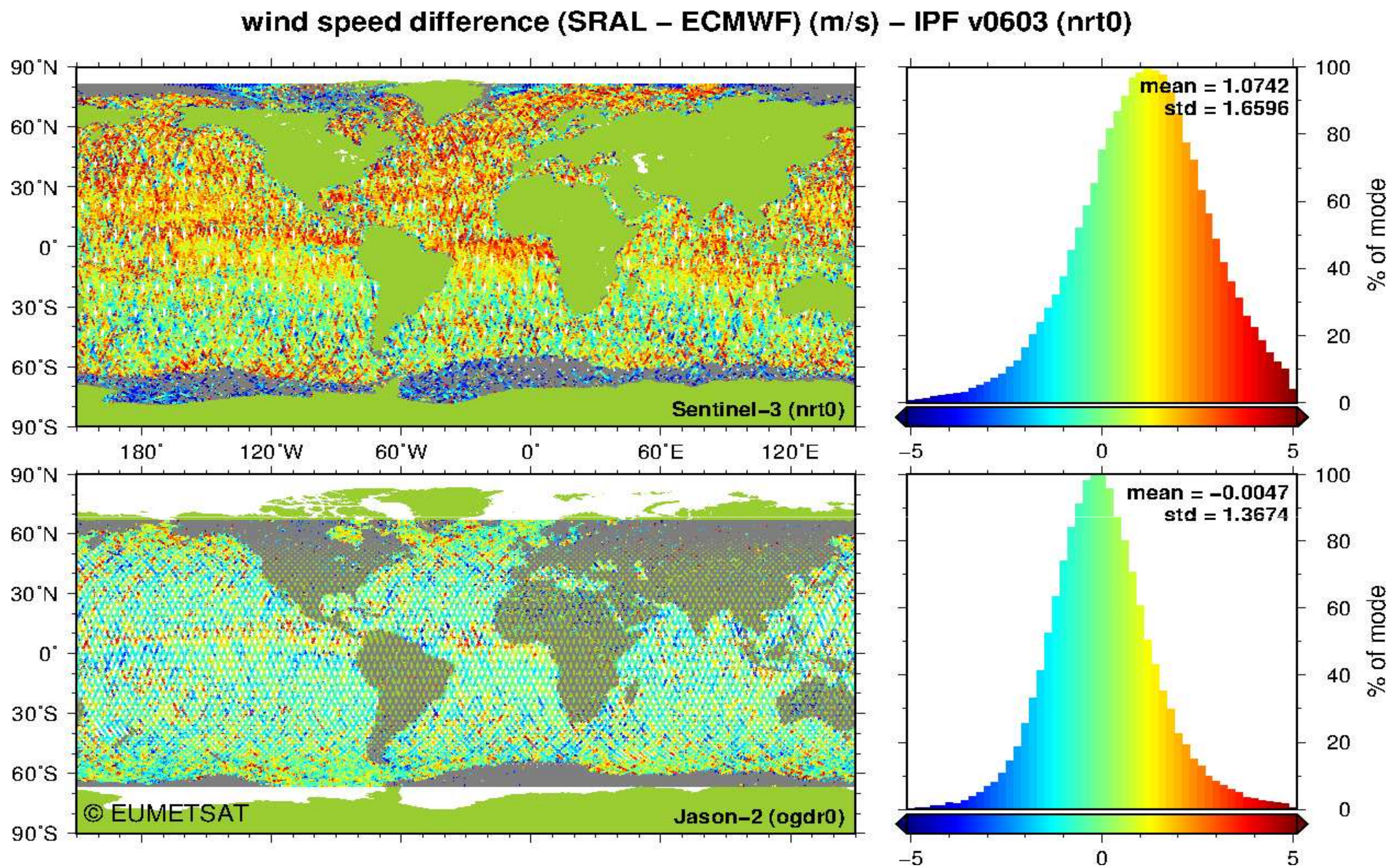
backscatter (SAR–PLRM)



v06.03

- Fix not yet in IPF v06.03, but expected in IPF v06.05
- Part of reprocessing and delivery to S3VT

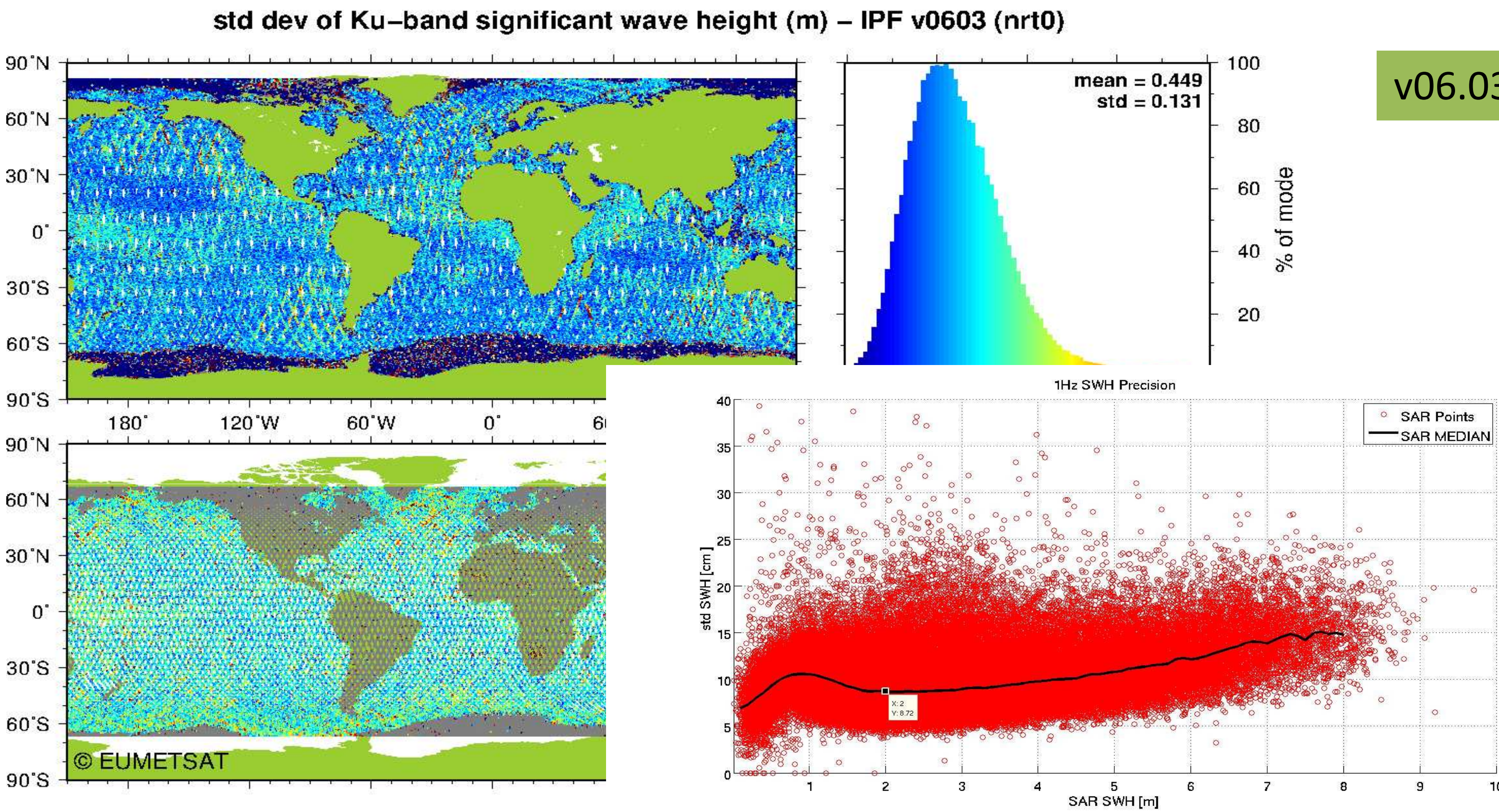
wind speed (SRAL–ECMWF)



v06.03

- Large bias (1.04 m/s) and high std dev (1.66 m/s) with respect to ECWMF model
- Outside requirement; calibration of sigma0 needed

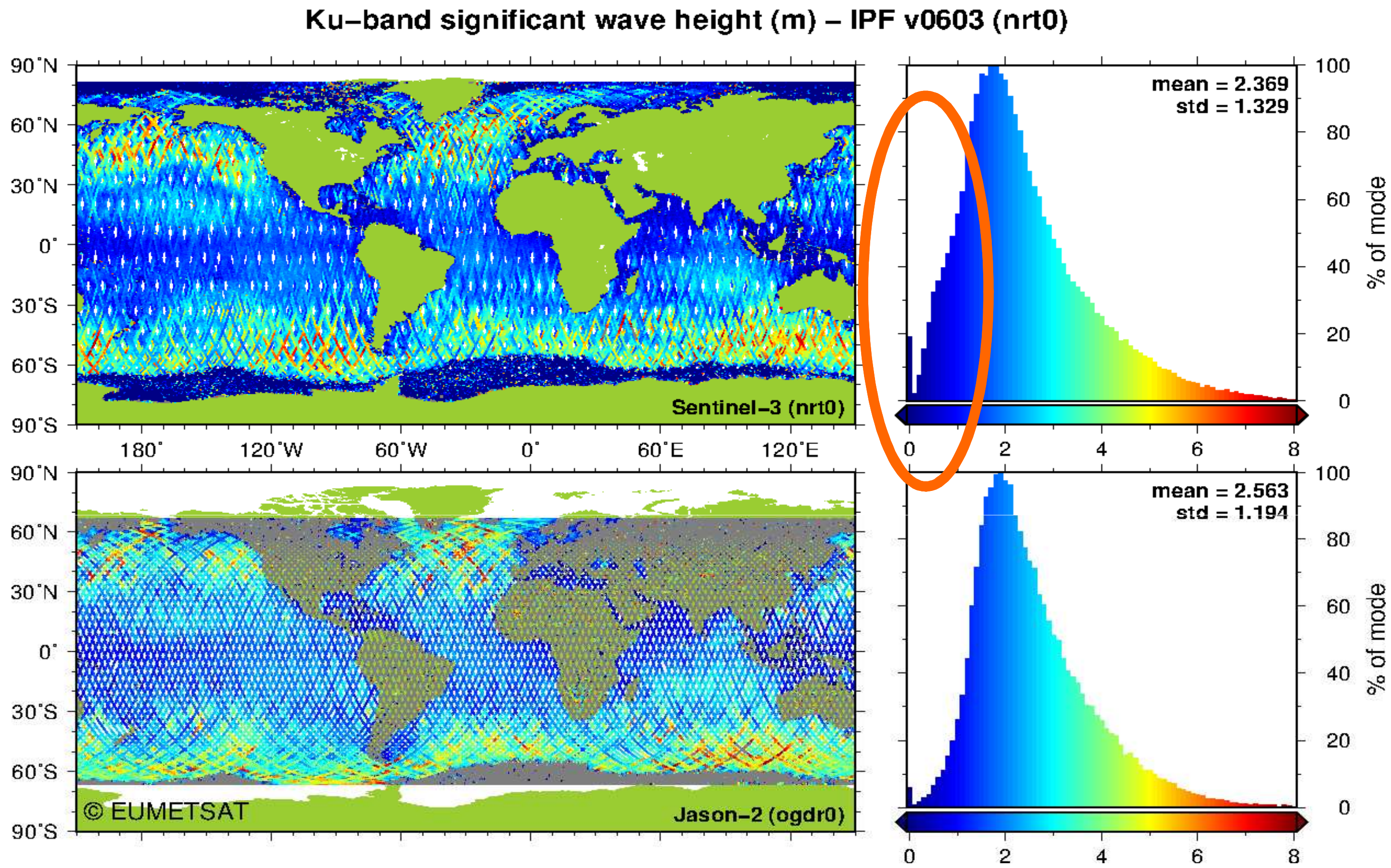
std dev significant wave height



v06.03

- Std dev significantly lower than for Jason-2
- 1-Hz precision at 2 m is around 9 cm, within requirement
- Some sign of increased std dev in swell-rich areas

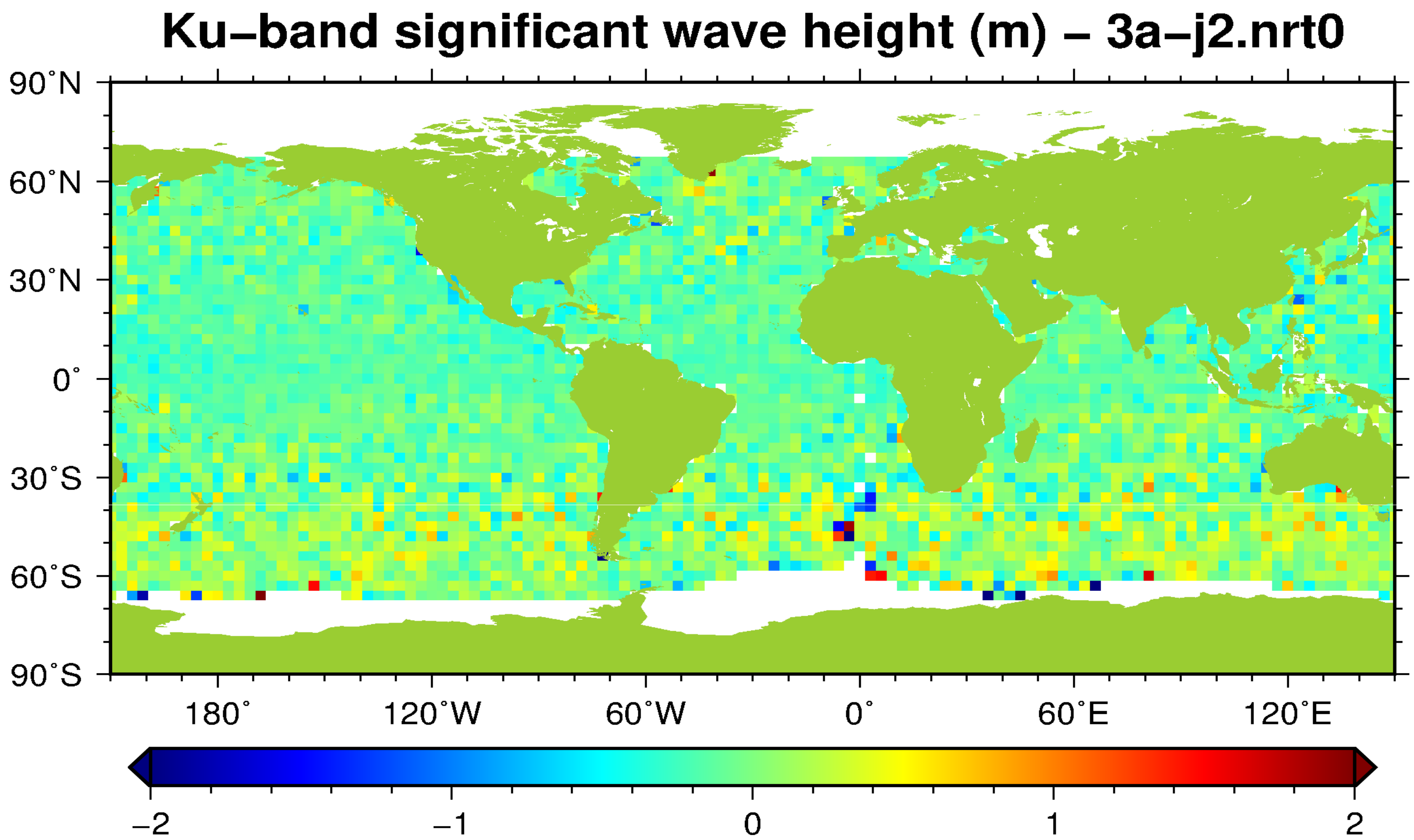
significant wave height



v06.03

- Mean SWH somewhat lower than Jason-2
- Probably due to polar data

significant wave height

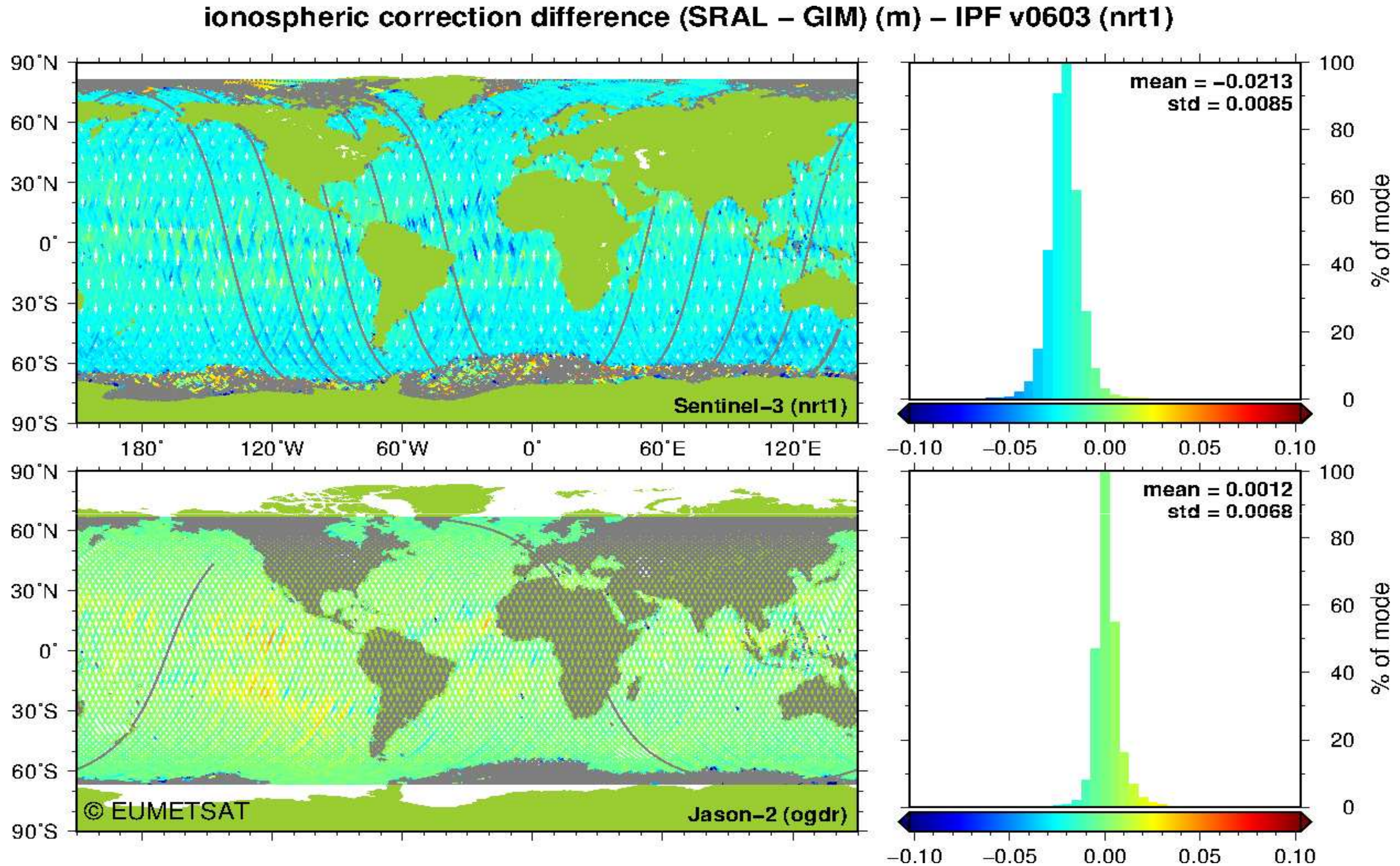


v05.03

- Mean SWH difference on Sentinel-3/Jason-2 xovers
- No clear signal to be seen

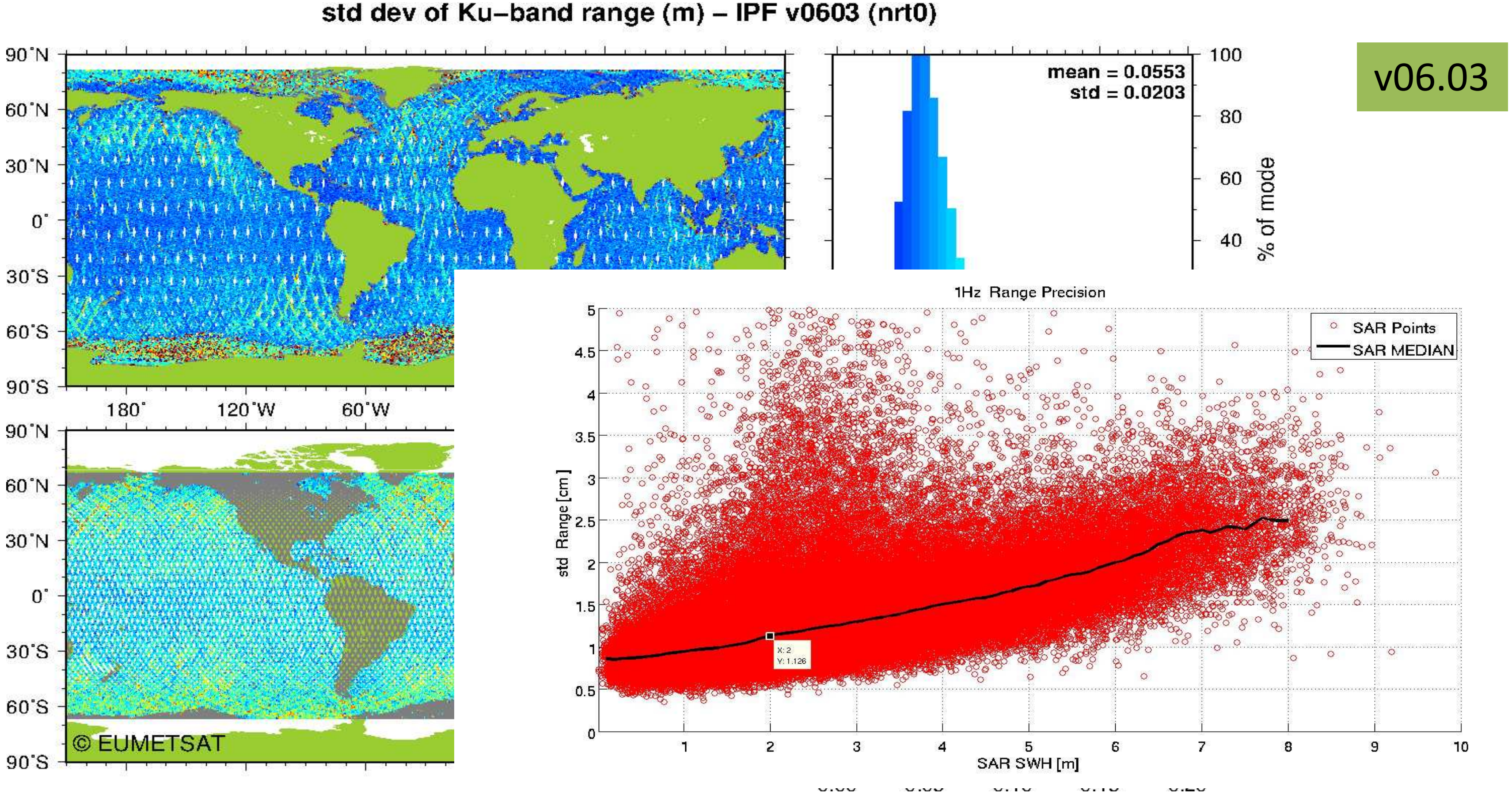
ionospheric correction (SRAL–GIM)

v06.03



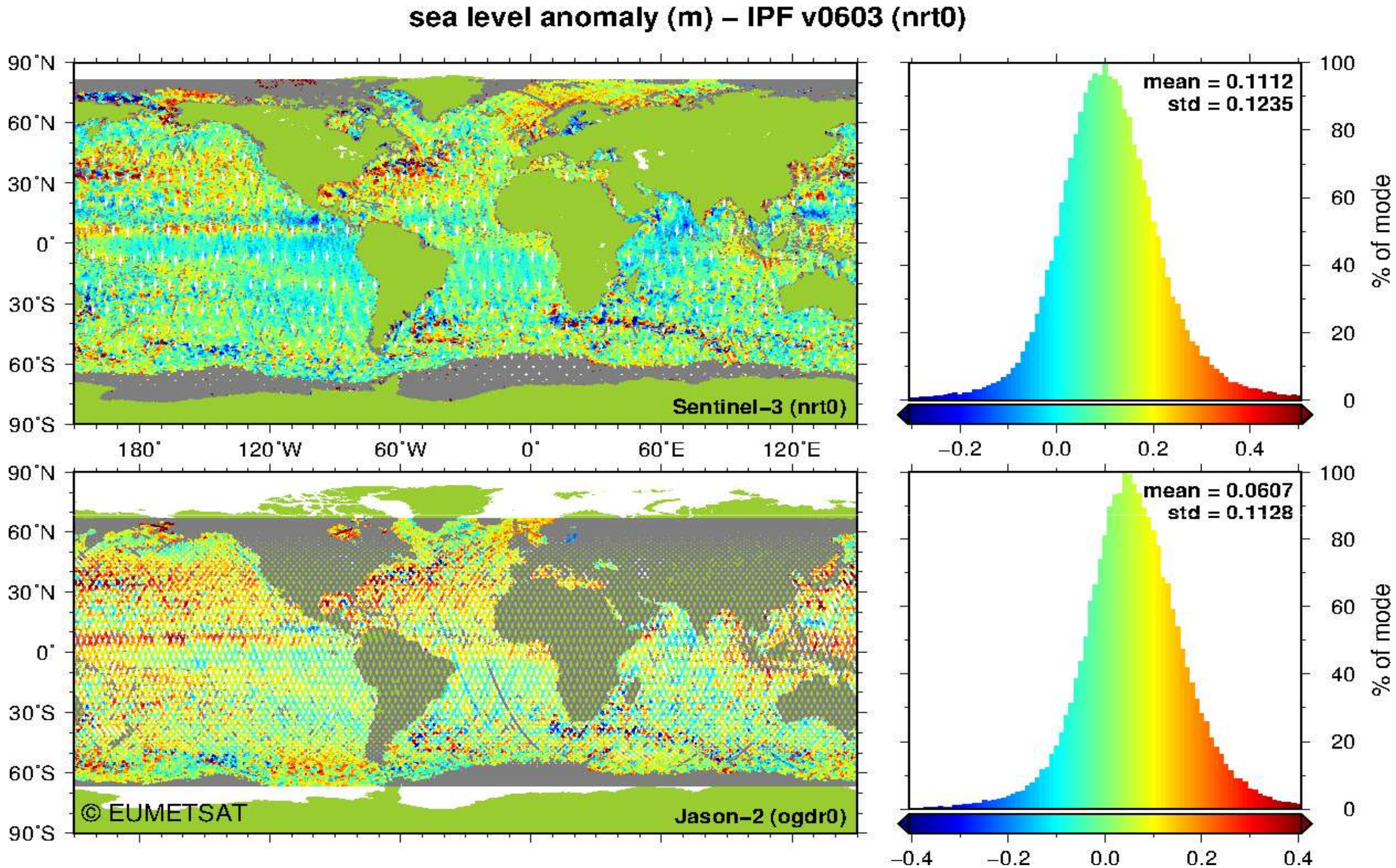
- Difference between dual-frequency and model iono shows bias and larger rms difference than Jason-2.
- Requires investigation

std dev range



- Std dev of 20-Hz range (mean of 5.5 cm) significantly lower than Jason-2 (mean of 7.8 cm)
- Within requirement

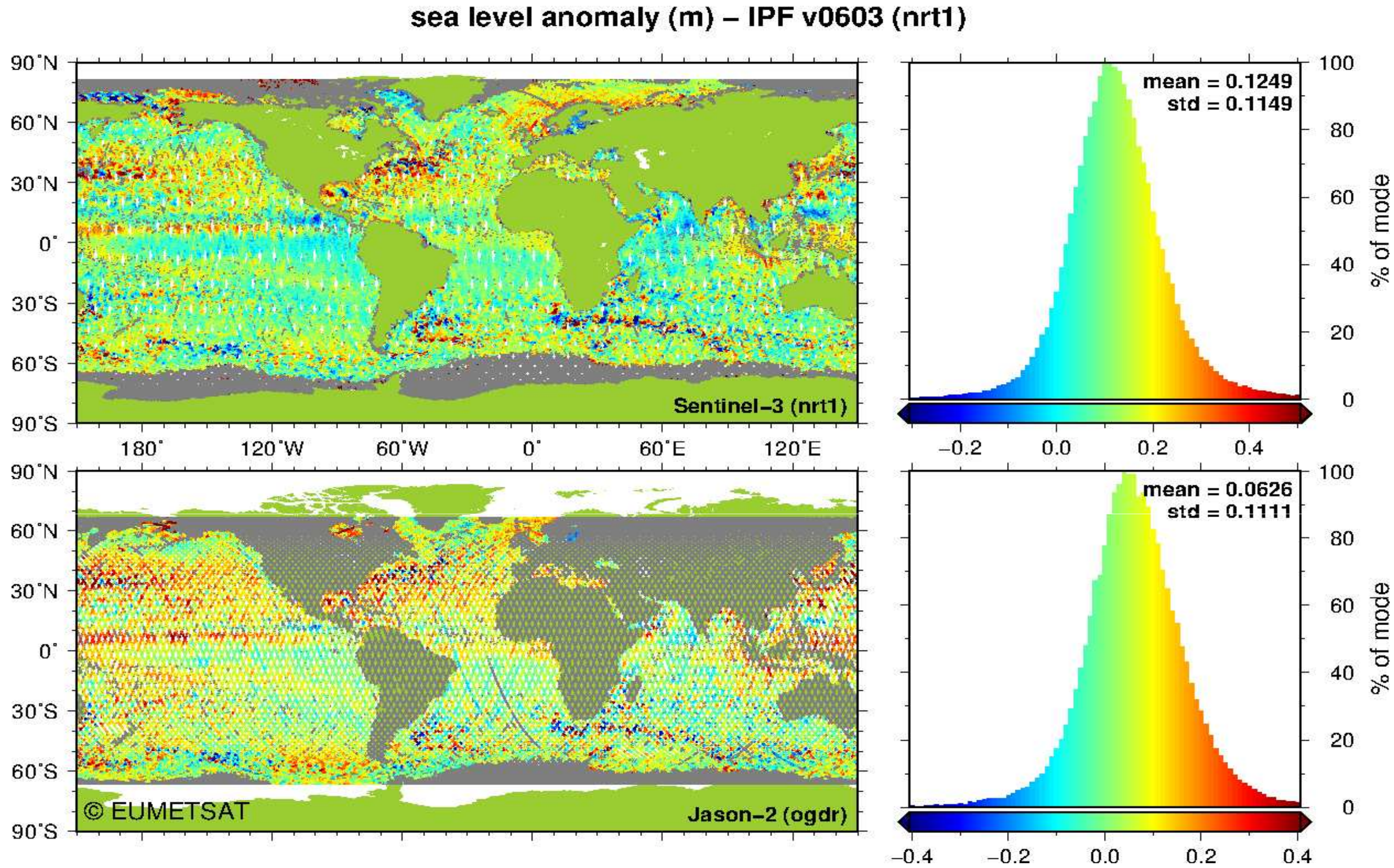
sea level anomaly (PDGS)



v06.03

- Only small bias with Jason-2 (5–6 cm)
- Std dev IPF v06.03 (12.3 cm), higher than Jason-2 (11.3 cm)
- Further improvement expected in v06.05

sea level anomaly (RADS)

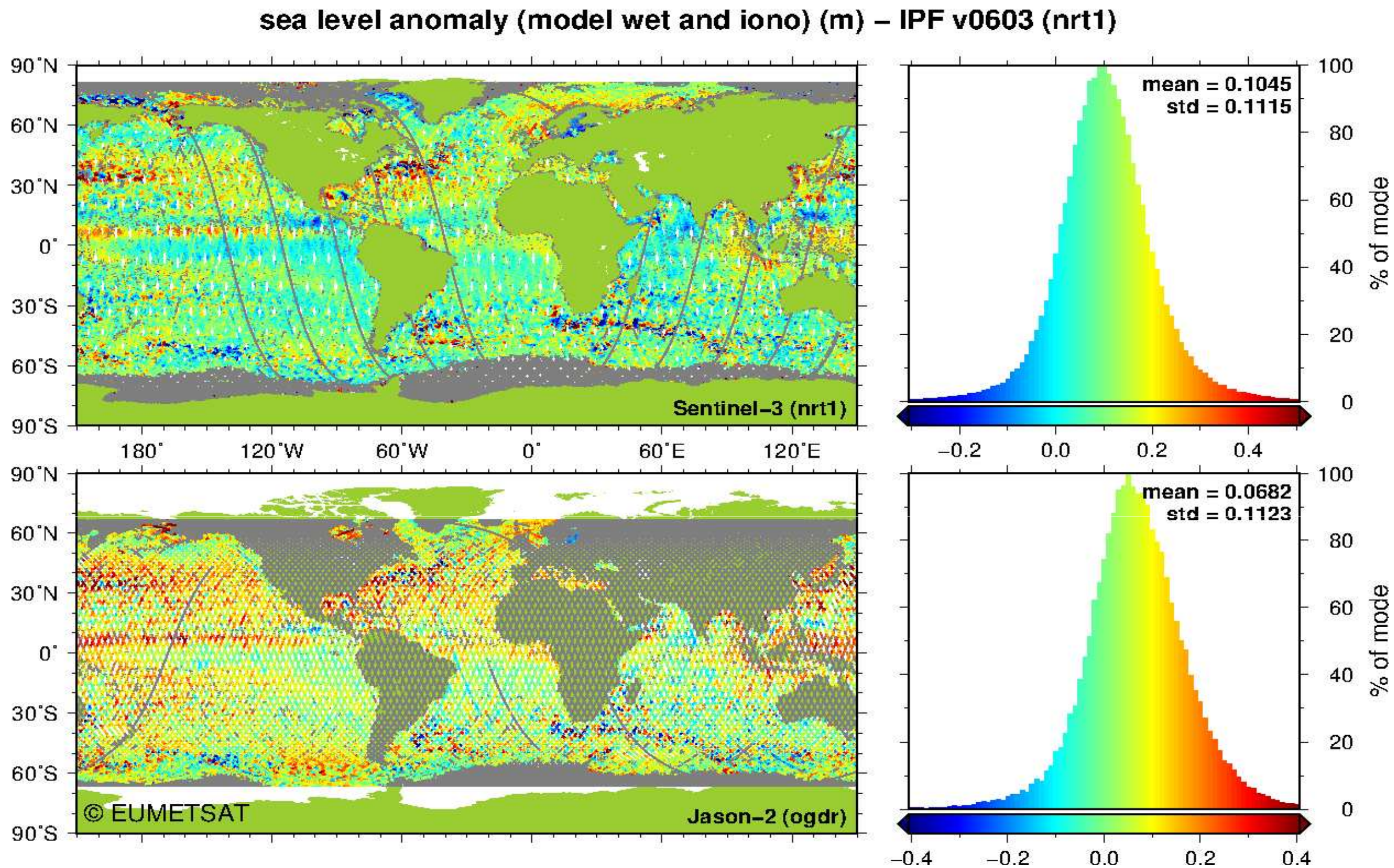


v06.03

- Std dev improved to 11.5 cm, compared to 11.1 cm for J2
- Smoothing ionosphere correction (not in PDGS product)
- Geophysical corrections recomputed

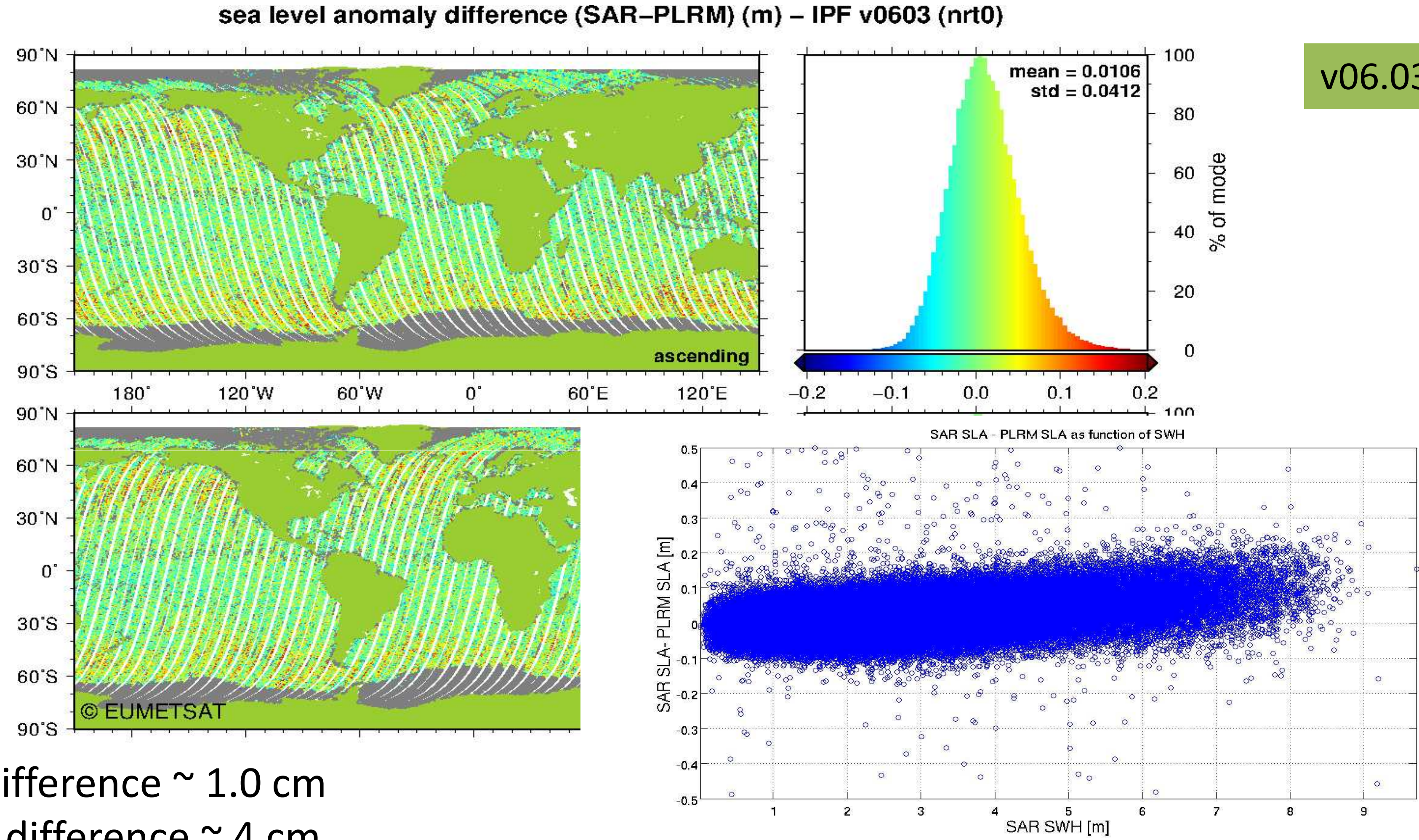
sea level anomaly (model wet/iono)

v06.03



- Corrected with model wet tropo and iono corrections
- Std dev is now the same as Jason-2 (11.2 cm)
- Requires investigation

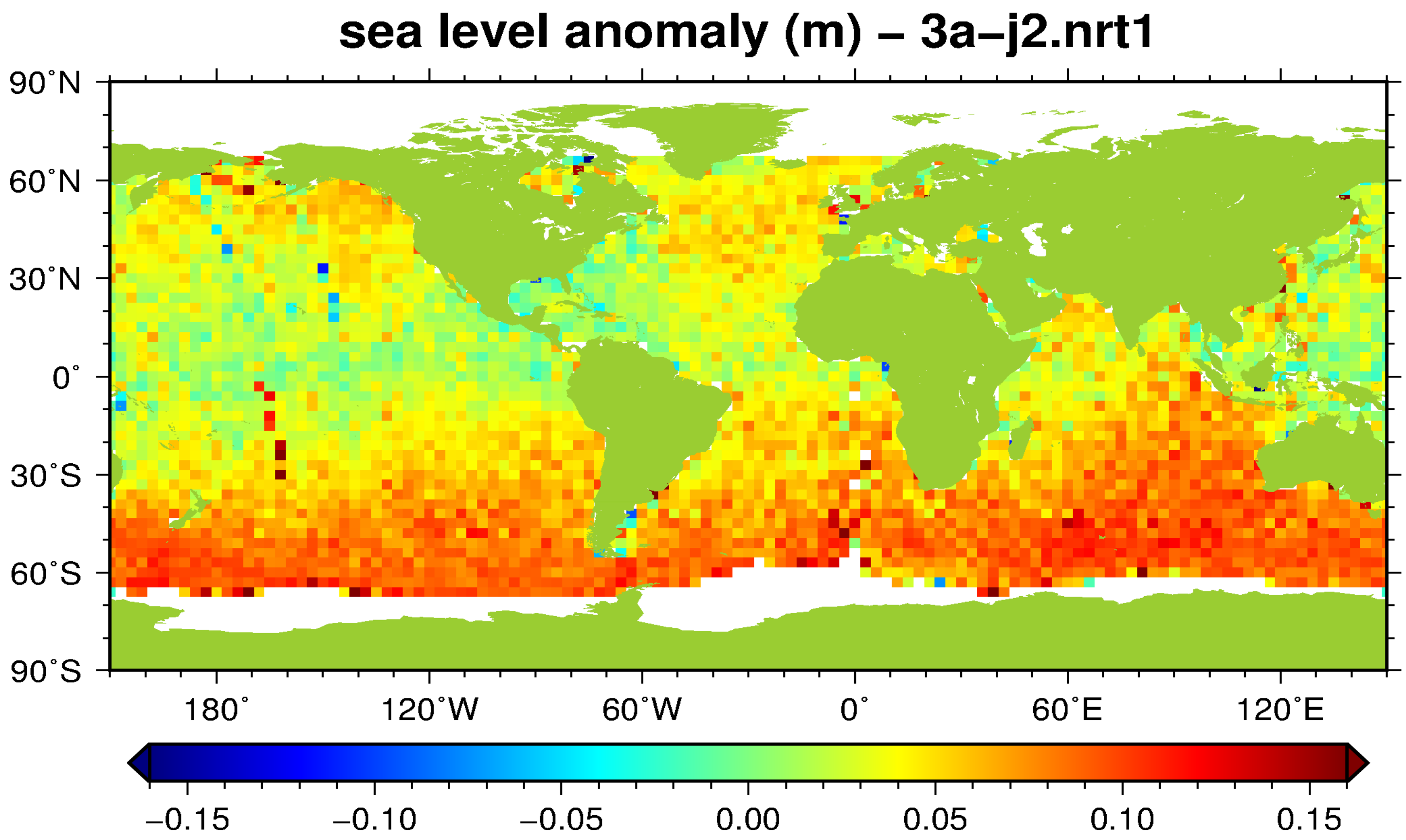
sea level anomaly (SAR–PLRM)



v06.03

- mean difference ~ 1.0 cm
- std dev difference ~ 4 cm
- Difference is more or less linear with SWH (0 difference at 0 SWH)
- Partly lack of LUT, partly L1/L2 inconsistency (reported earlier)

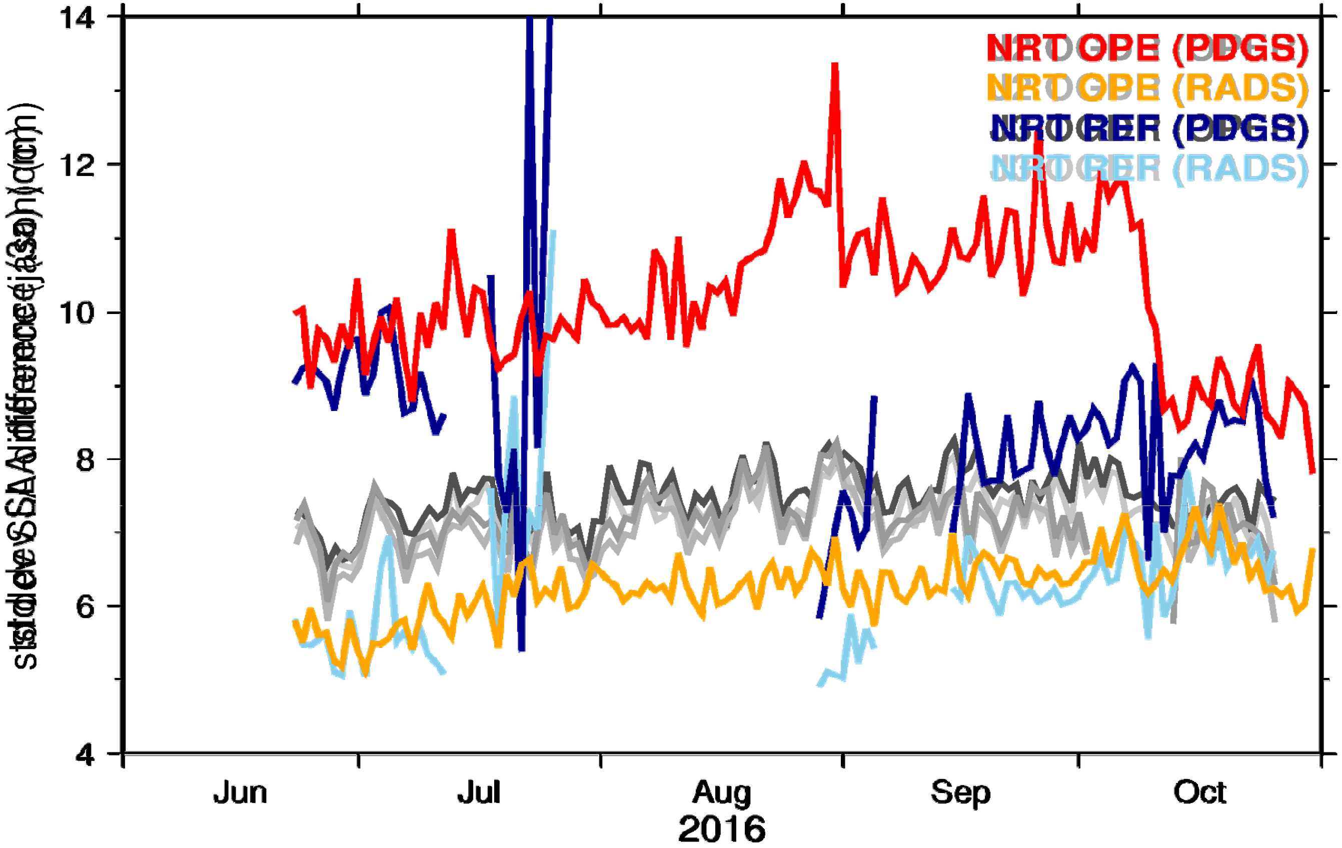
sea level anomaly (xovers)



v05.03

- Mean xover difference Sentinel-3/Jason-2
- Part bias, part SSB

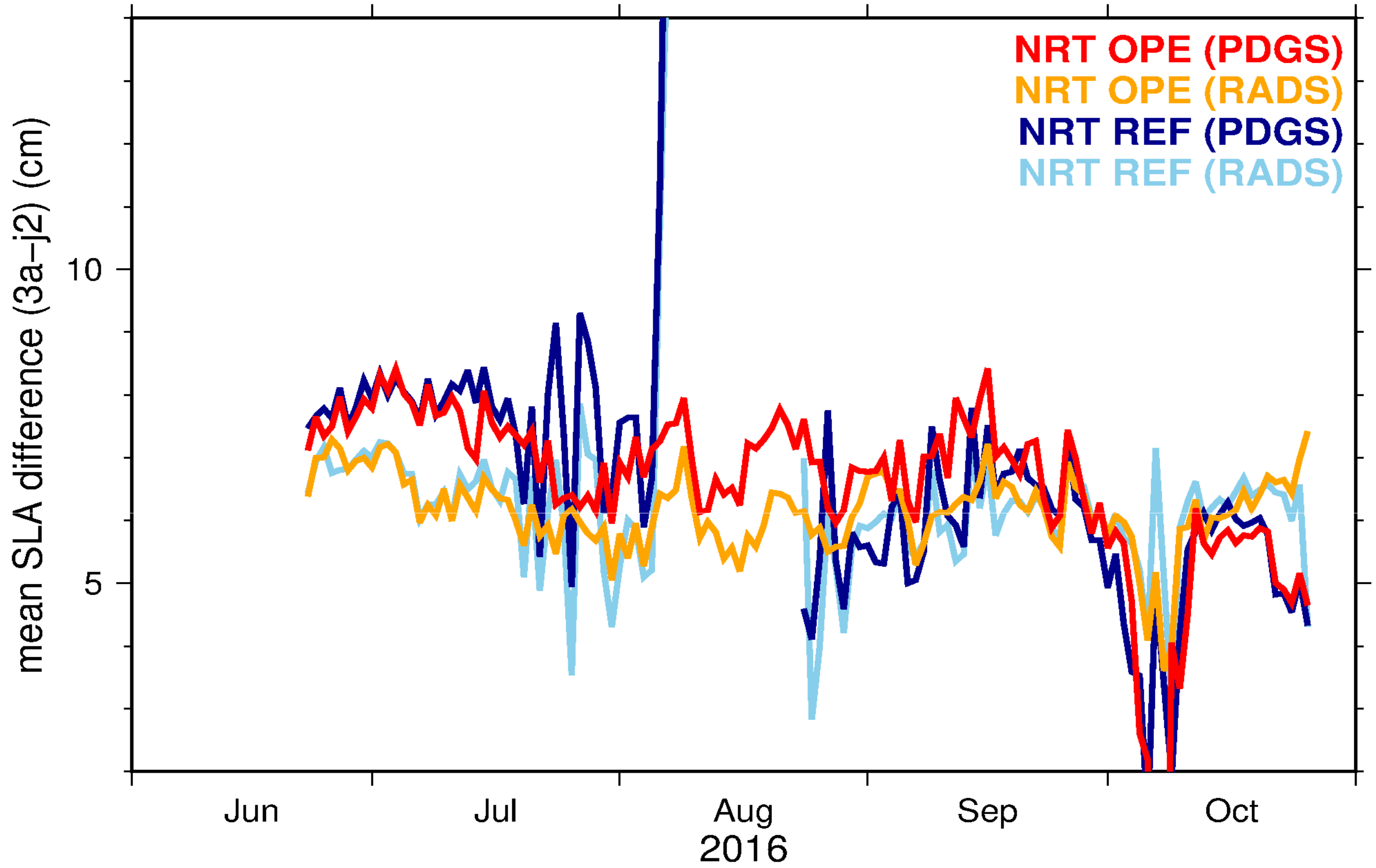
sea level anomaly (xovers)



v05.03

- RADS std dev is harmonious
- Beats even Jason-2/3 xover RMS

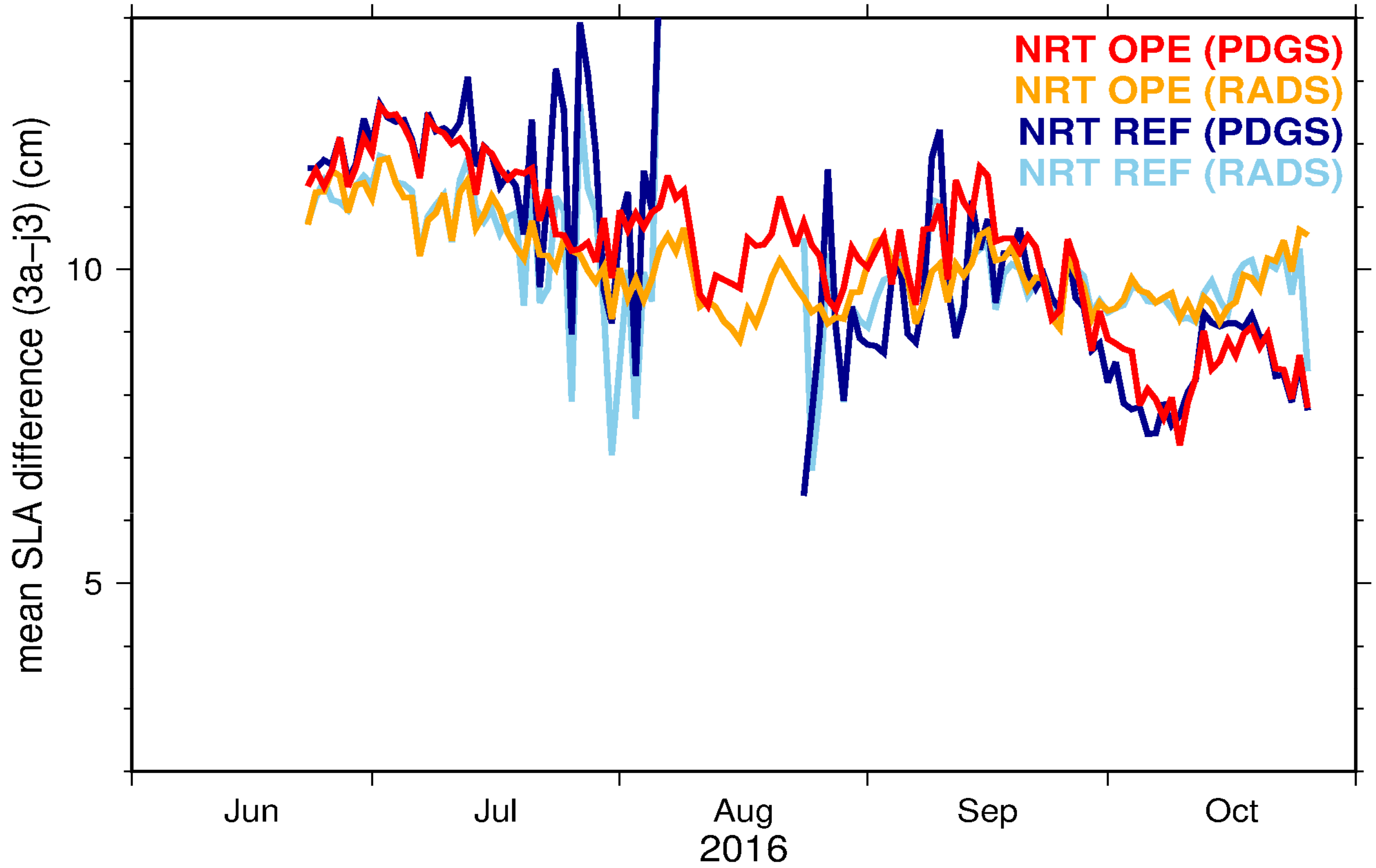
sea level anomaly (xovers)



v05.03

- Small drift between Sentinel-3 and Jason-2

sea level anomaly (xovers)



v05.03

- Small drift between Sentinel-3 and Jason-2
- Also between Sentinel-3 and Jason-3

Concerns, evolutions

- Radiometer data missing on granules crossing Greenwich Meridian
  - Fixed in IPF version 06.03
- Radiometer wet tropospheric correction does not perform nearly as well as J2
  - TBs may be (linearly) adjusted
  - Future evolution possible in retrieval algorithm
- Backscatter coefficient error as function of height rate
  - Fix expected in IPF version 06.05
- Missing radiometer data should not have such cascading effect
  - "Backup solution" for atmospheric attenuation implemented in IPF v06.03
- Ionospheric correction not as accurate and bias for Jason-2 values
  - Due to remaining bias in Ku- and C-band range and SSB models?
- SLA performing close to Jason-2 when using RADSified S3A data
  - Analysis of difference with OPErational data underway
- Drift in SLA with respect to J2 and J3 to be investigated
- Overall:
  SRAL of very good quality