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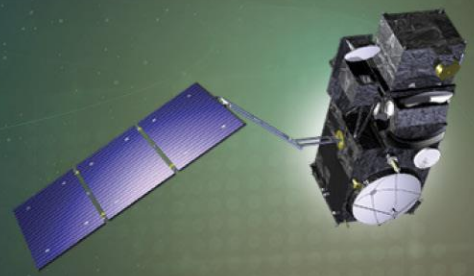

7th Sentinel-3 Validation Team Meeting 2022

18-20 October 2022 | ESA-ESRIN | Frascati (Rm), Italy

Calibration monitoring of SLSTR IR channels based on comparisons with IASI

Tim Hewison, Vincent Debaecker, Alessandro Burini, Ali Mousivand, Igor Tomazic

EUMETSAT

LEO-LEO IR Inter-Calibration Algorithm

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Direct Comparisons with Reference Instrument

- Tie to contemporary reference instrument
- with very small uncertainty
- Algorithm based on GSICS GEO-LEO IR

Collocate in Space, Time, Angle

- Extended Simultaneous Nadir Overpasses (SNOs)
- Match Viewing Zenith Angle – within 1% path difference
- Match Observation Time – within 200 s
- Average all SLSTR pixels within each IASI iFoV

Hyperspectral Reference (IASI)

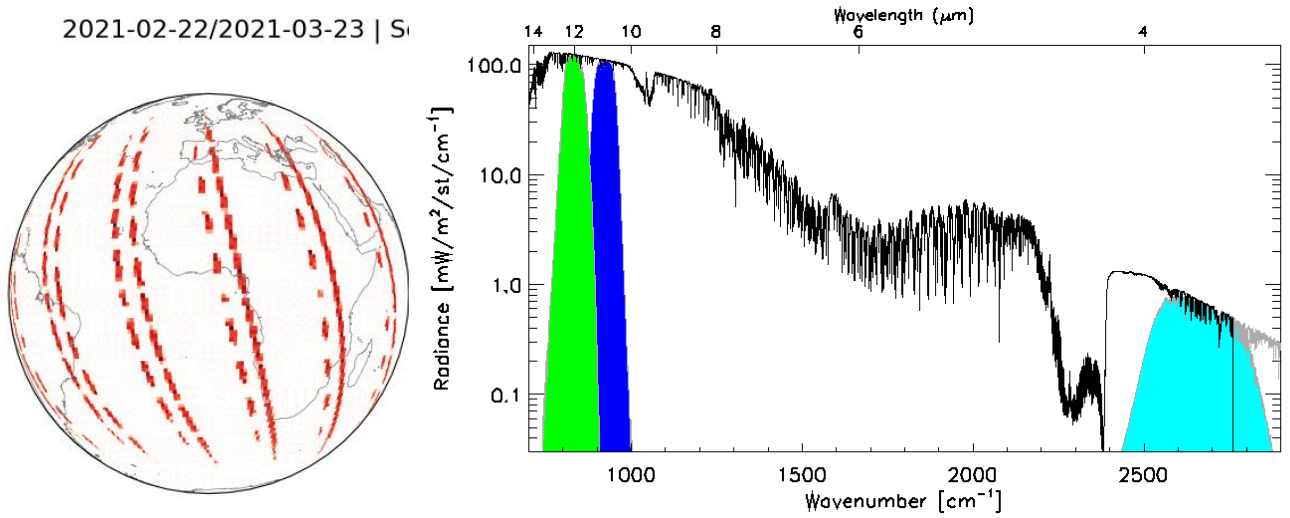
- Gap-filling to extend IASI to cover full S7 band
- Convolve IASI spectrum with SLSTR Spectral Responses
- Could diagnose SRF errors

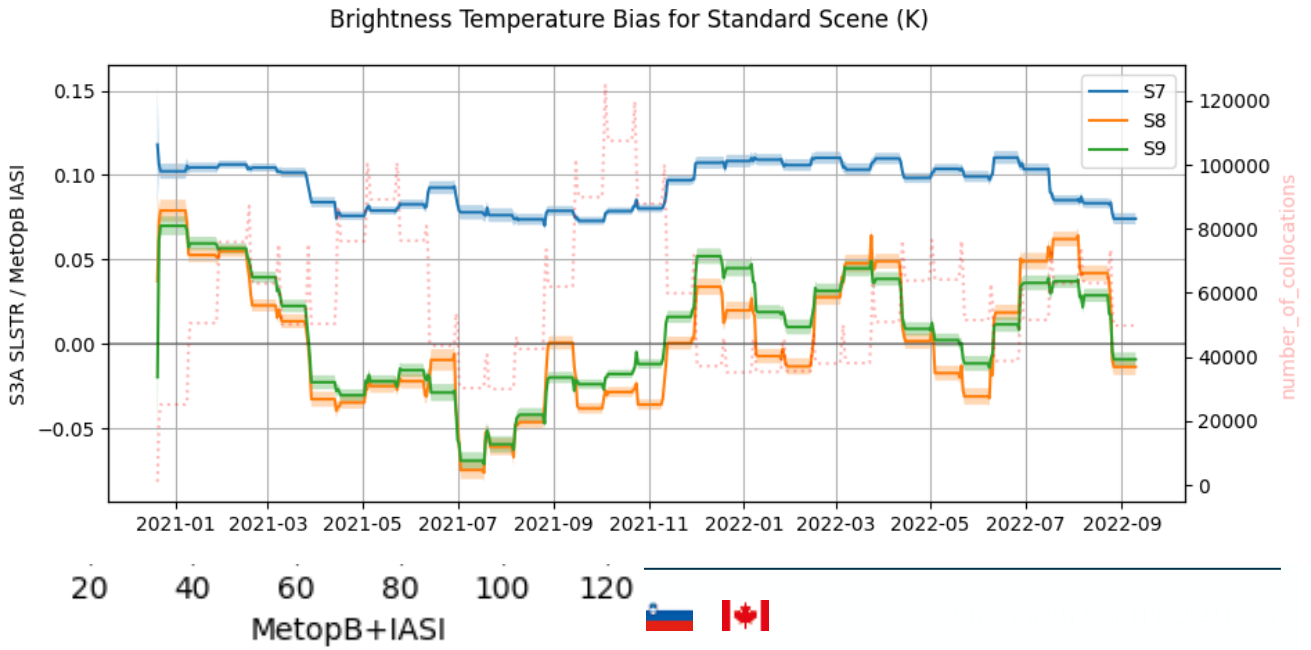
Compare

- Apply weighted regression to collocated radiances
- Evaluate uncertainties

Evaluate & Monitor Bias

- Check long-term stability & Decontamination



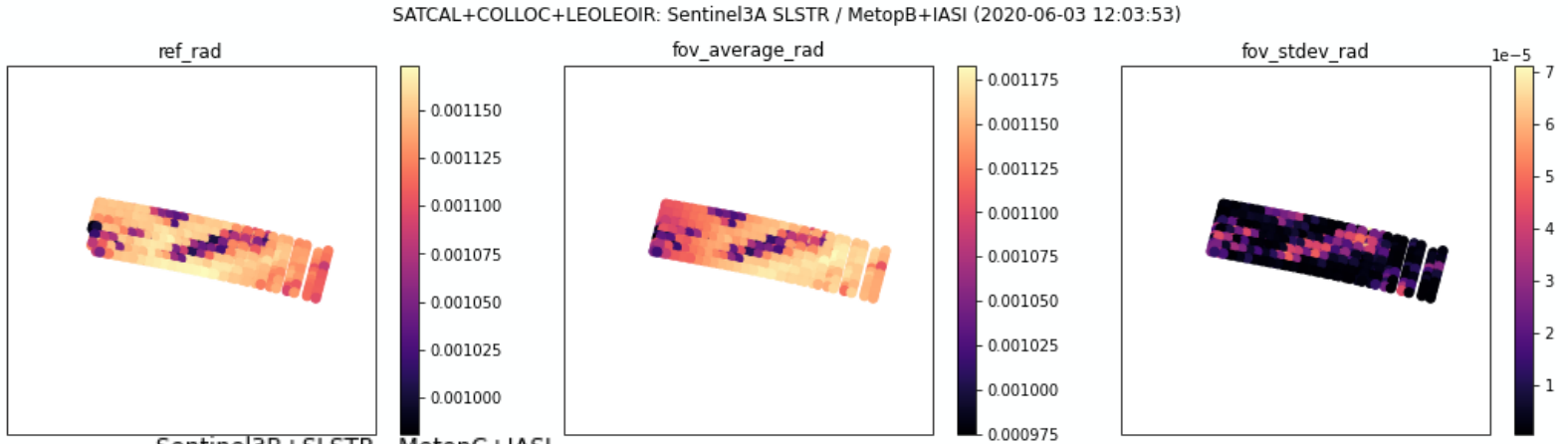


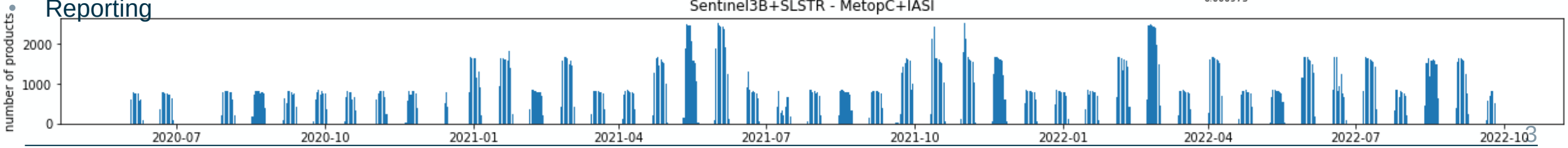
Implementation in MICMICS

- Routine daily processing
- Pre-Collocation
  - Select granules with >10% overlap
  - Time difference <1200s
  - Average SLSTR pixels to IASI iFOV
  - Spectral Convolution
  - Generate collocation files
- Filtering
  - Apply collocation criteria
  - |d(secθ)/secθ|<0.01, |dt|<200s
- Analysis
  - Weighted linear regression
  - Calculate biases
  - Store results in database
- Reporting

MICMICS

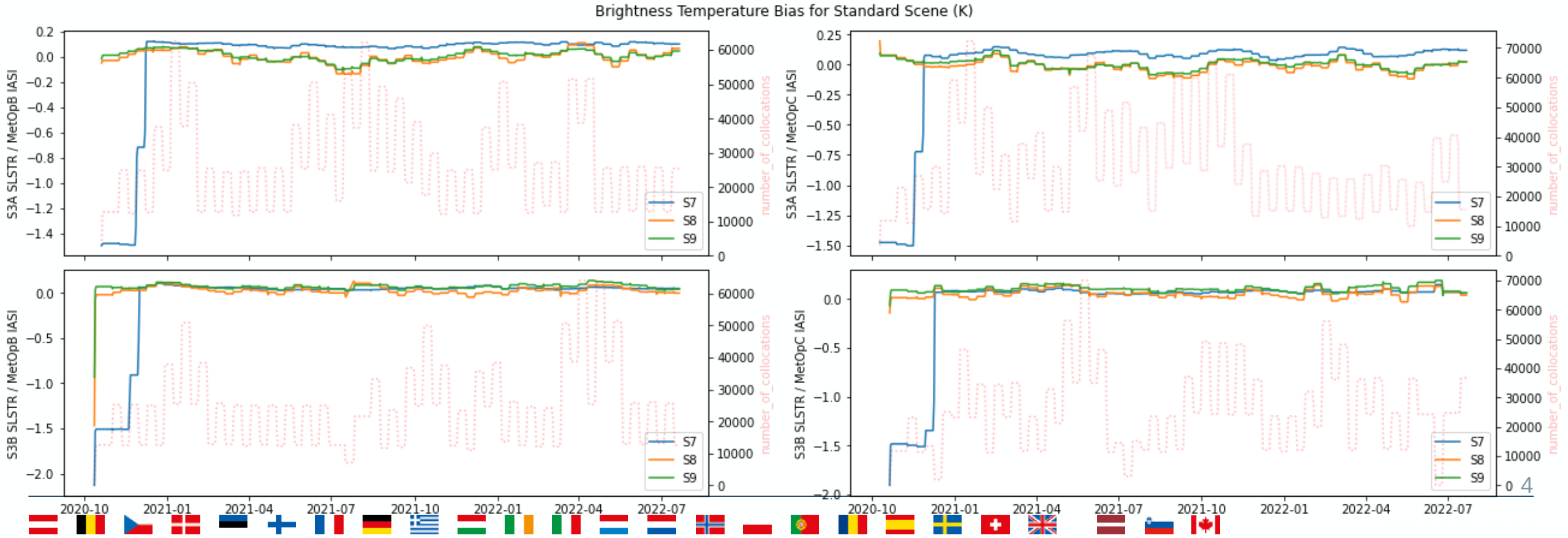
Mission Integrated Calibration Monitoring & Inter-Calibration System





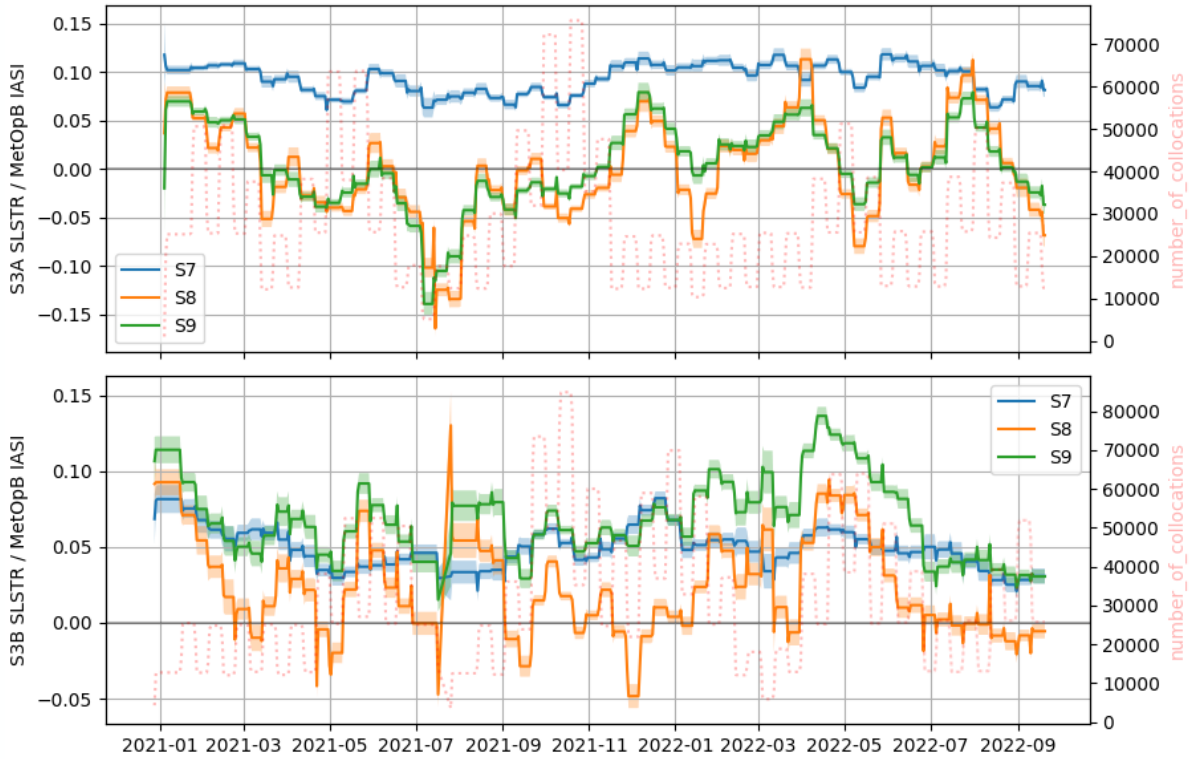
Results – Nadir Views

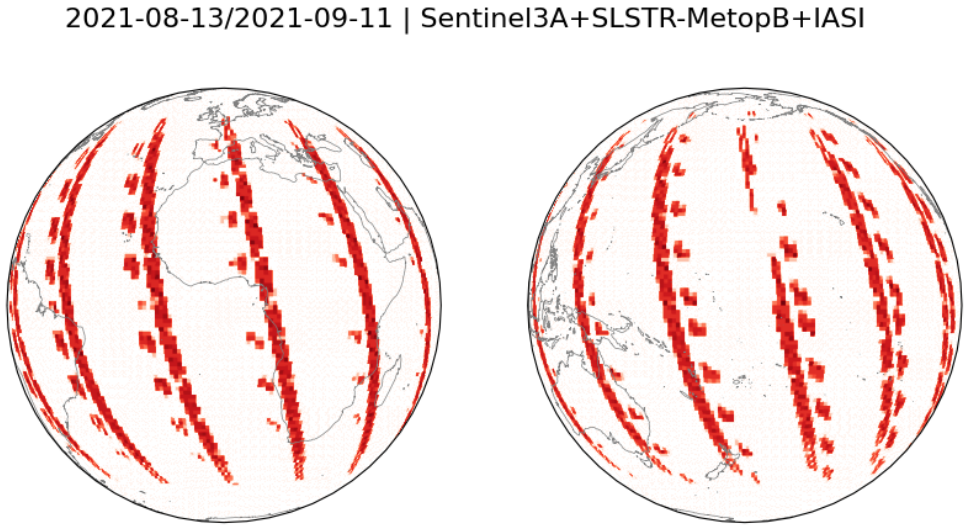
- Bias for Standard Scenes
  - small biases in all channels: S7 ~+0.1K, others ~0.0K
- Stable for all channels – since new gap-filling correction 2020-11
  - For both SLSTR-A and –B – with both IASI-B and –C (and –A)

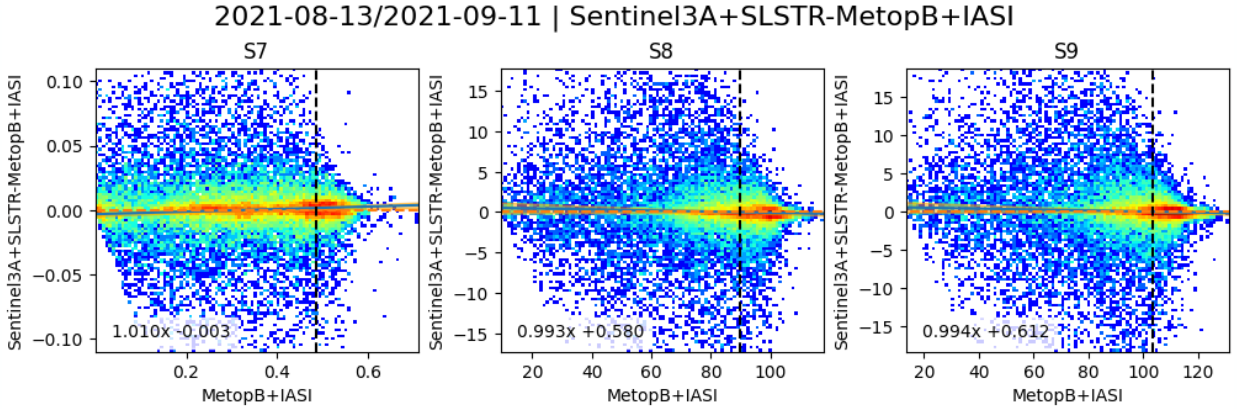


Results – Oblique Views

- Bias for Standard Scenes
  - small bias in S7 ~+0.1K, others ~0.0K
- Stable for all channels
  - For SLSTR-A (above) and –B (below)

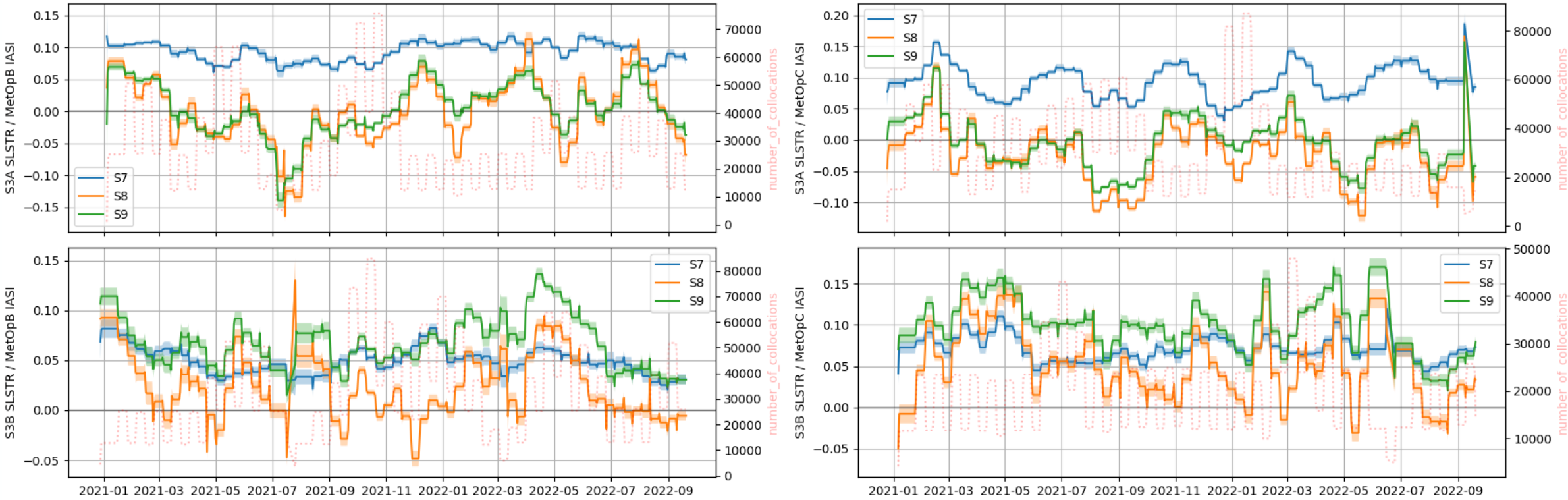






Results – Oblique Views: IASI-A/B

- Bias for Standard Scenes
  - For SLSTR-A (above) and –B (below)
  - Based on inter-calibration with IASI-B (left) and IASI-C (right)
  - No correlation in time series variations ➔ SLSTR calibration is stable



Bias at Standard Scenes 2021-2022

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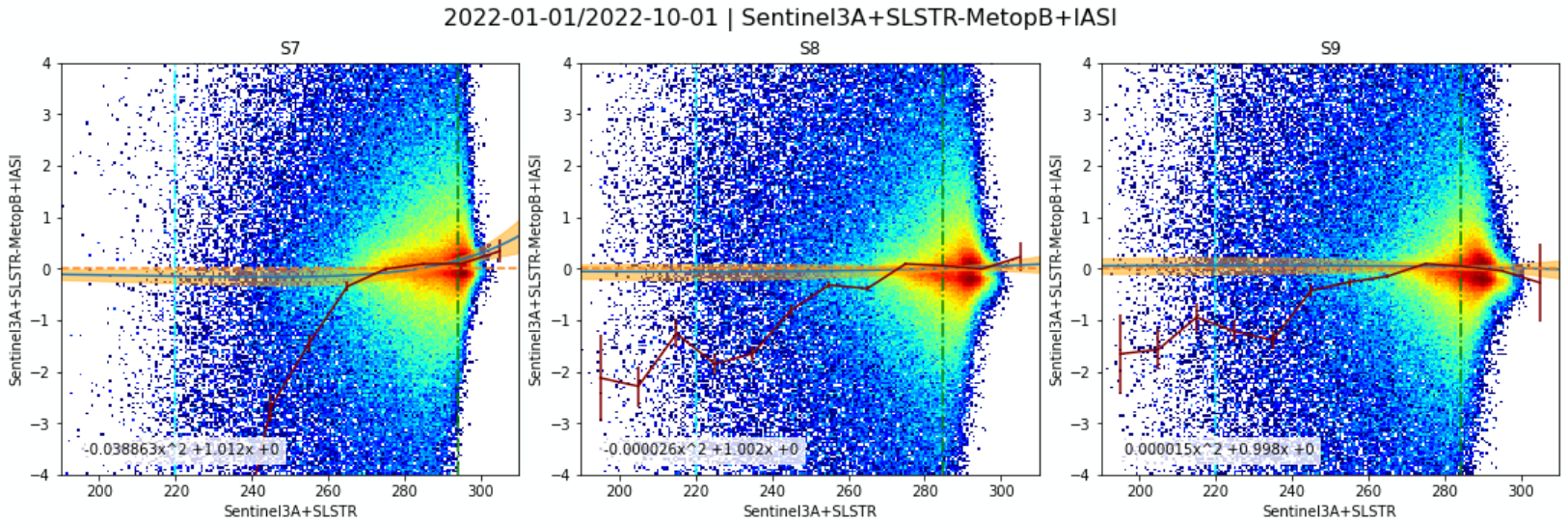
- Bias at Standard Scene
  - Tb ~285K
  - 2020-12-01 to 2022-10-15
  - Small bias in S7 (S3A+B)
    - Gap-filling?
  - Small bias in S3B S9
  - Nadir and Oblique very similar
- Radiance-dependent Bias
  - Small Biases 270-300K:
    - <0.1K in all channels
  - Larger biases in cold scenes
  - Hot land excluded
  - Analysis ongoing
  - Full uncertainty analysis needed

Sentinel-3 SLSTR/Ch	Std Bias [K] at Nadir wrt IASI-B+C	Std Bias [K] Oblique wrt IASI-B+C	Random Uncertainty (k=2) [K]	Gap-Filling RMSE [K]
S3A/S7	+0.09	+0.09	0.01	0.08
S3A/S8	-0.00	-0.01	0.02	0
S3A/S9	+0.01	+0.00	0.02	0
S3B/S7	+0.06	+0.06	0.01	0.08
S3B/S8	+0.05	+0.04	0.02	0
S3B/S9	+0.09	+0.08	0.02	0



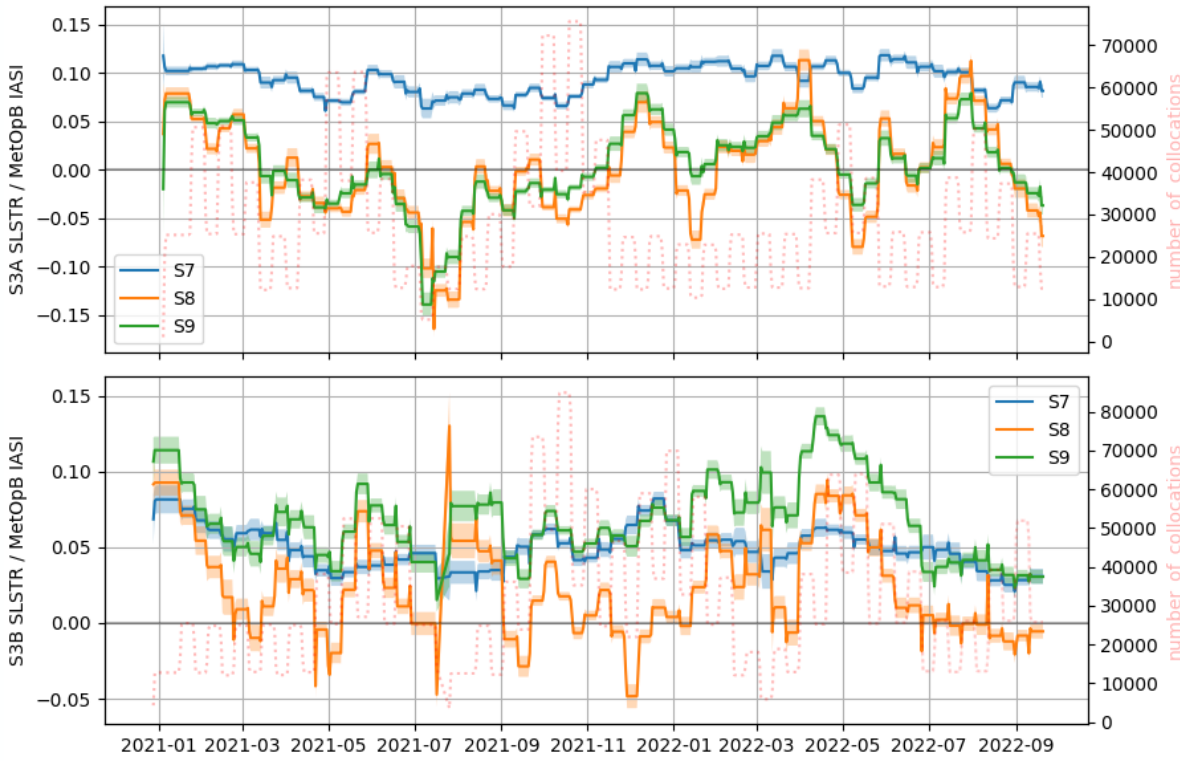
Conclusions

- Extension of previous work by Igor Tomazic to include:

- Routine monitoring of SLSTR IR channel calibration at EUMETSAT
  - Since 2020-12-01
  - Based on inter-comparison with IASI-B and -C
  - For Sentinel-3A and -3B, S7, S8 + S9, Nadir + Oblique
  - Public access to reports from 2024

- Results so far
  - Confirmed good calibration for warm scenes (SST)
    - <0.1K Bias in all channels 270-300K
  - Possible biases for colder scenes
  - Stable over 2021-2022

- Algorithm Development
  - Ongoing tuning
  - Issue over hot land surfaces
    - night-time results so far – extend dynamic range
    - Potential application to Fire Channels



Thank you!

Your Comments and

Questions are welcome