MSI Level 1 product verification

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& others from prior CARDINAL team

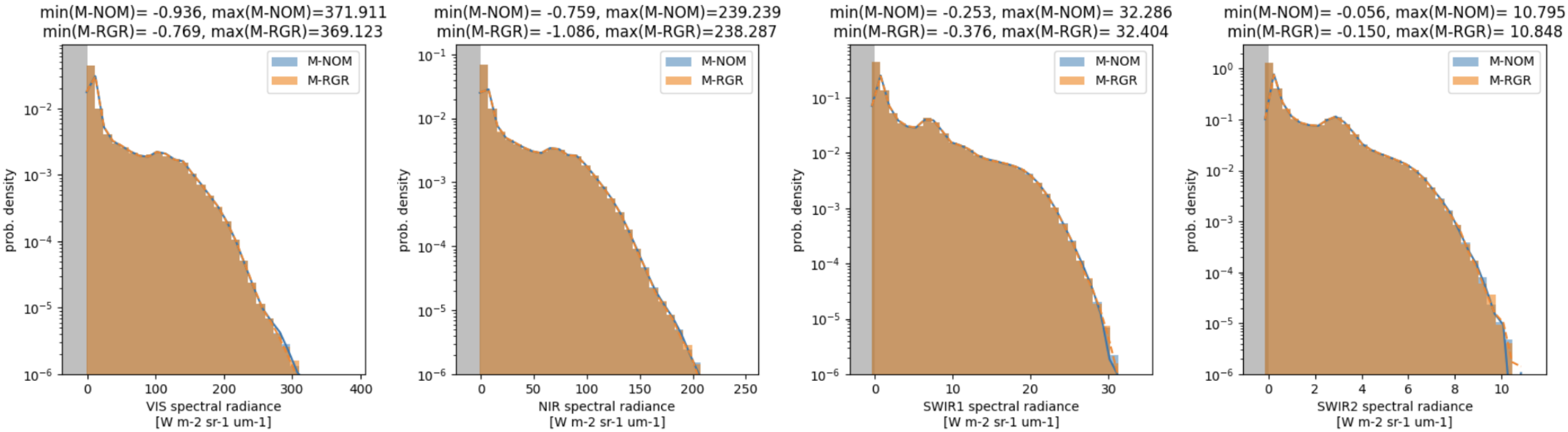
1st ESA-JAXA EarthCARE In-Orbit Validation Workshop

14 – 17 January 2025 | VIRTUAL EVENT

1. L1b/L1c products consistency verification
2. Data flagging, monitoring and statistics
3. MSI L1c products verification, with external data (see presentation of Sebastian Bley)
4. Geolocation & co-registration (see presentation from Edward Baudrez)
5. Final words

L1b/L1c products consistency verification

RGR (**1c**) is a **re-gridded** (using resampling) version of NOM (**1b**) Geometry and radiometry should be unaffected! This is regularly monitored!



Data from 10/Jan/2025

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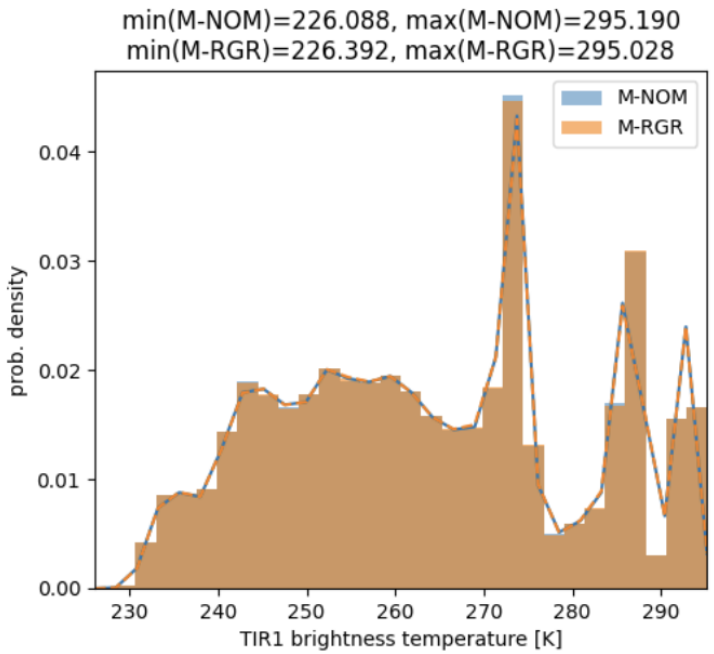

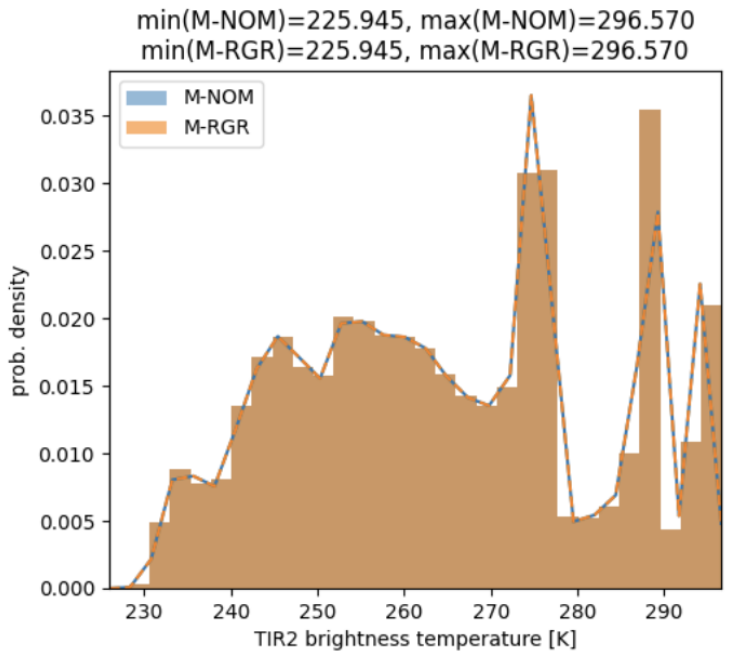

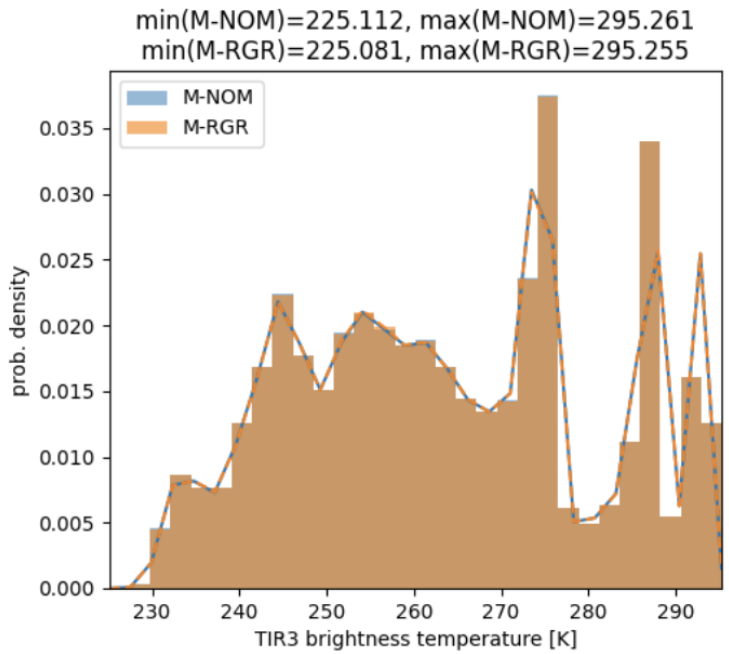

Data from 10/Jan/2025

L1b/L1c products consistency verification

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Radiometry between NOM and RGR is consistent

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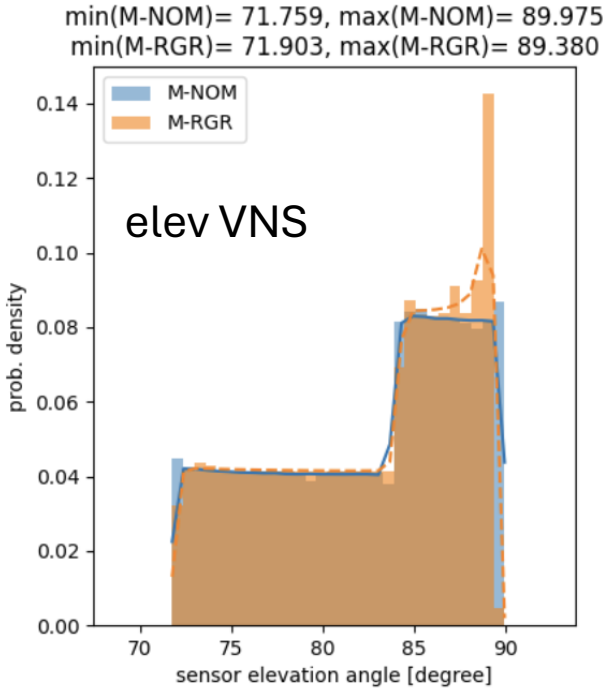

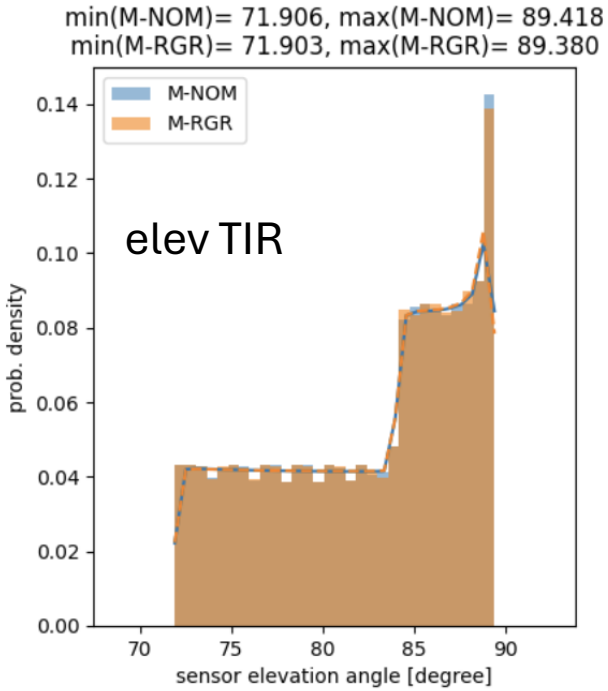

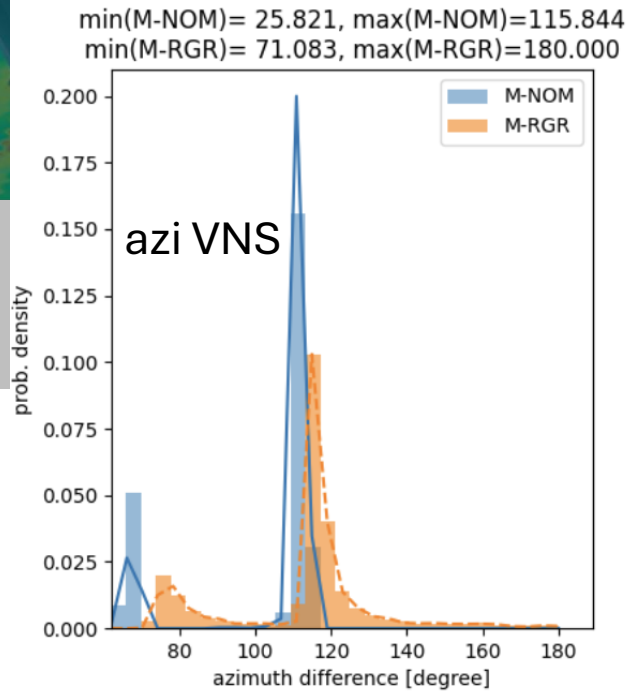

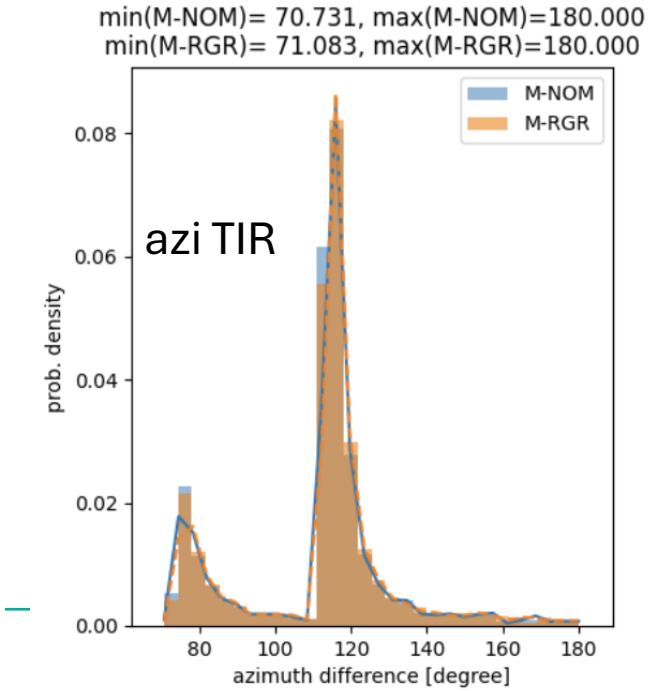

- The geometry (not all angles are shown) for TIR bands is consistent
- The geometry of VNS **is not** consistent:

  ***'Its not a bug, it's a feature'*:** The TIR component was choosen to be the refrence for RGR geometry. In addition, the TIR component has a small twist so that it looks a bit off-Nadir (you see no 90° sensor elevation!) → The geometry in RGR belongs to TIR and only *approximately* to VNS. This could become an issue if features with high sensitivity to geometry will be investigated.

(Eventually, it may have been a better decision to use VNS as reference, since TIR does not depend on scattering (there is no 'azimuth' in TIR RTM), or to include both TIR and VNS geometries in RGR)

Monitoring and Statistics

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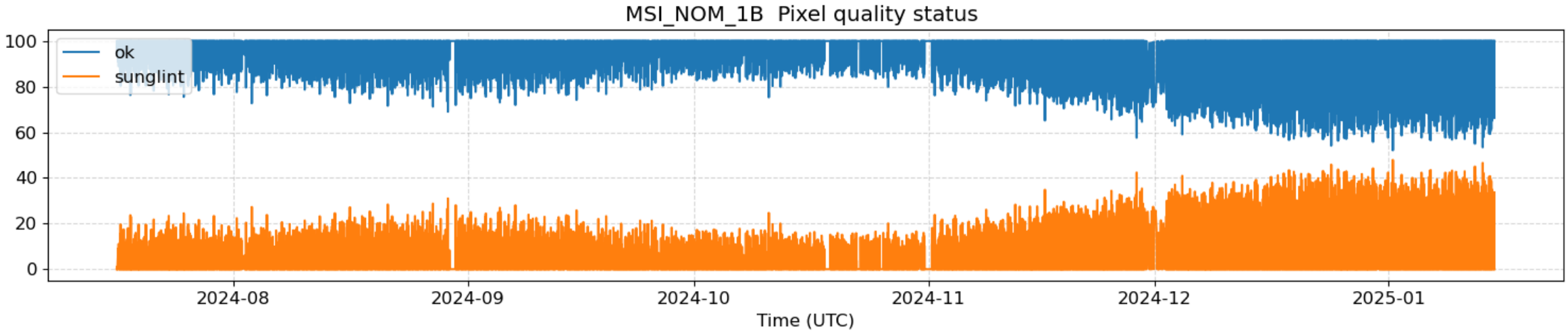
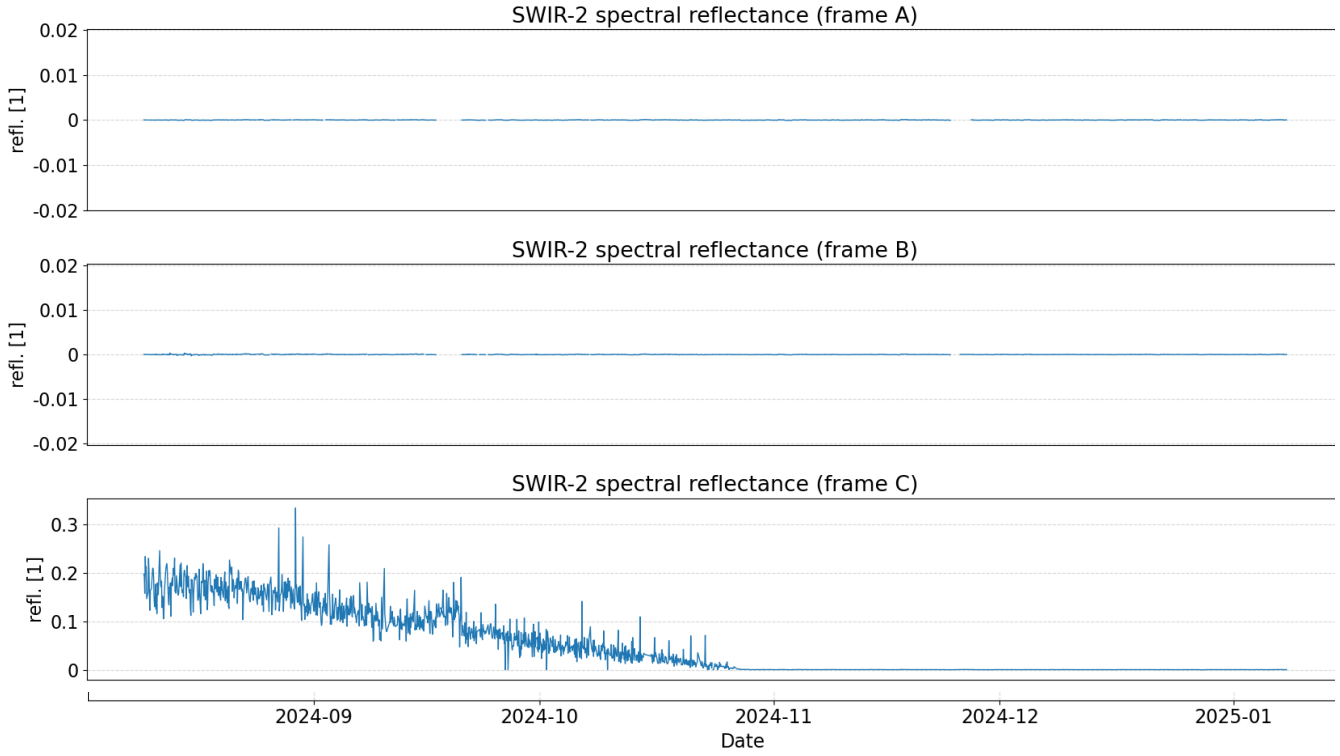
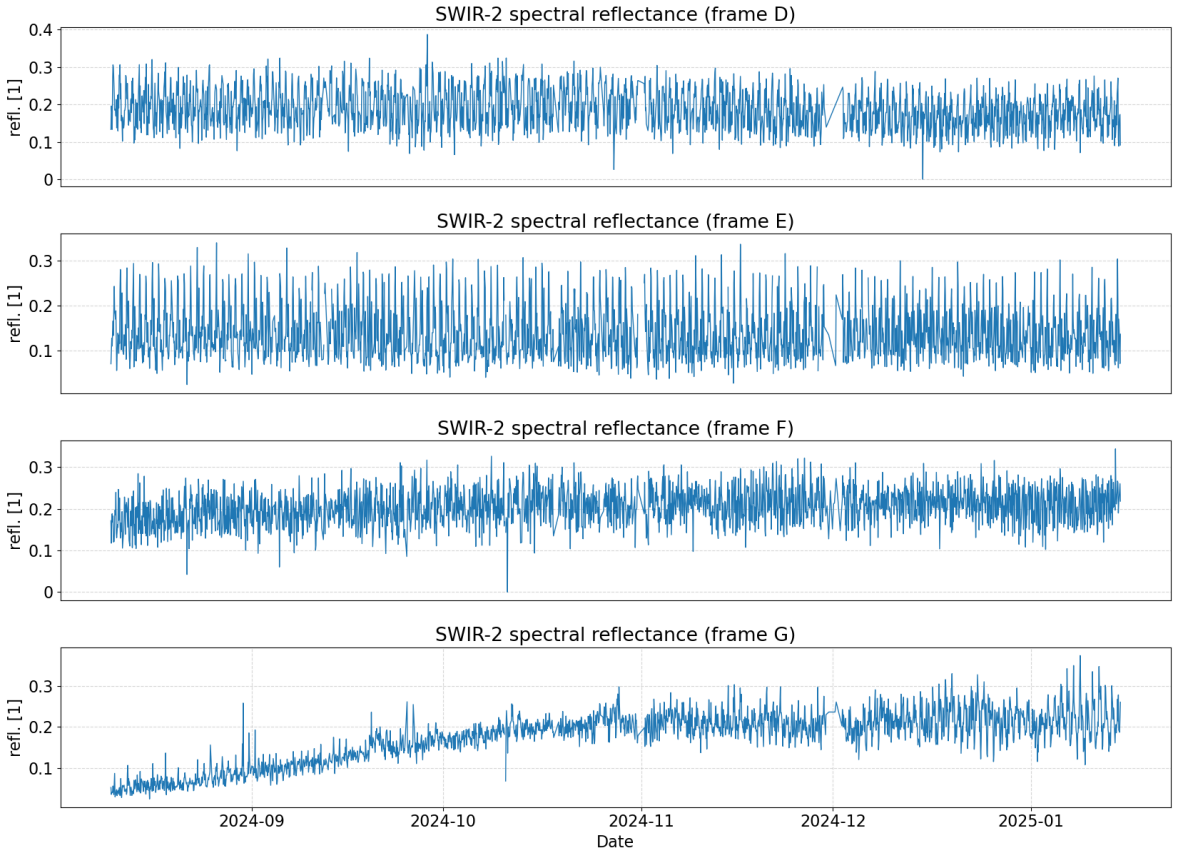


SH summer 👍

Monitoring and Statistics

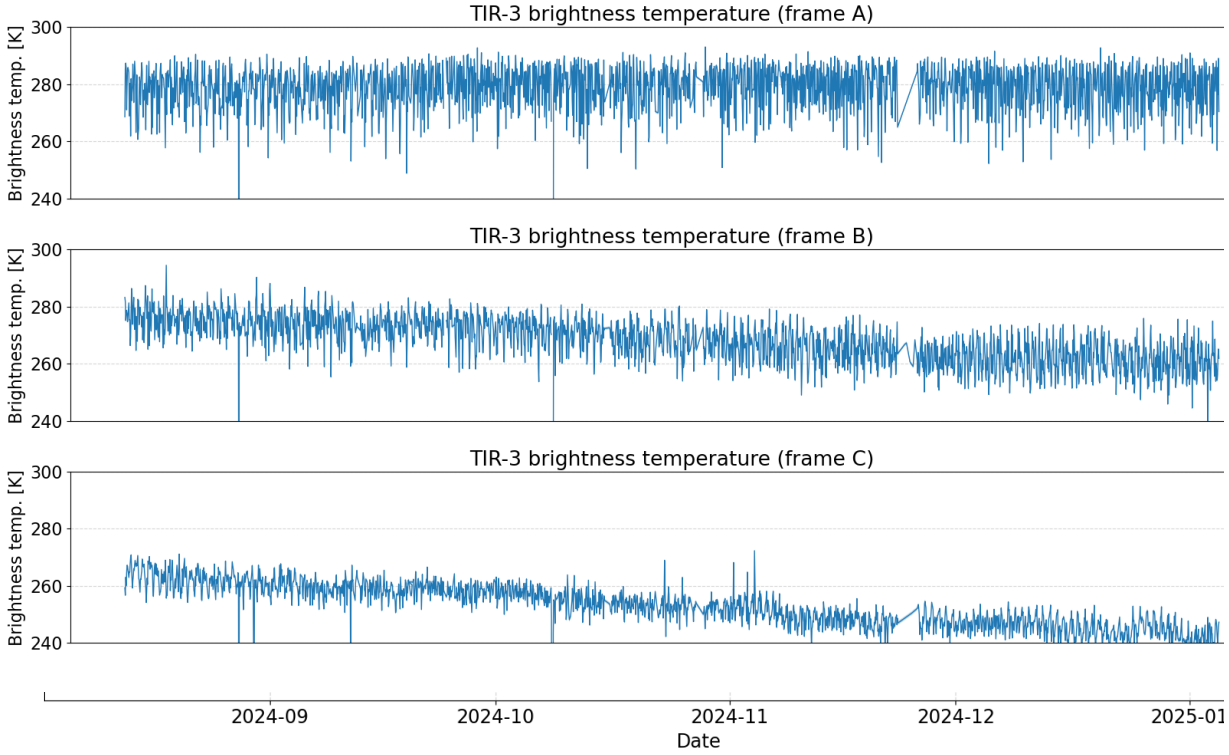


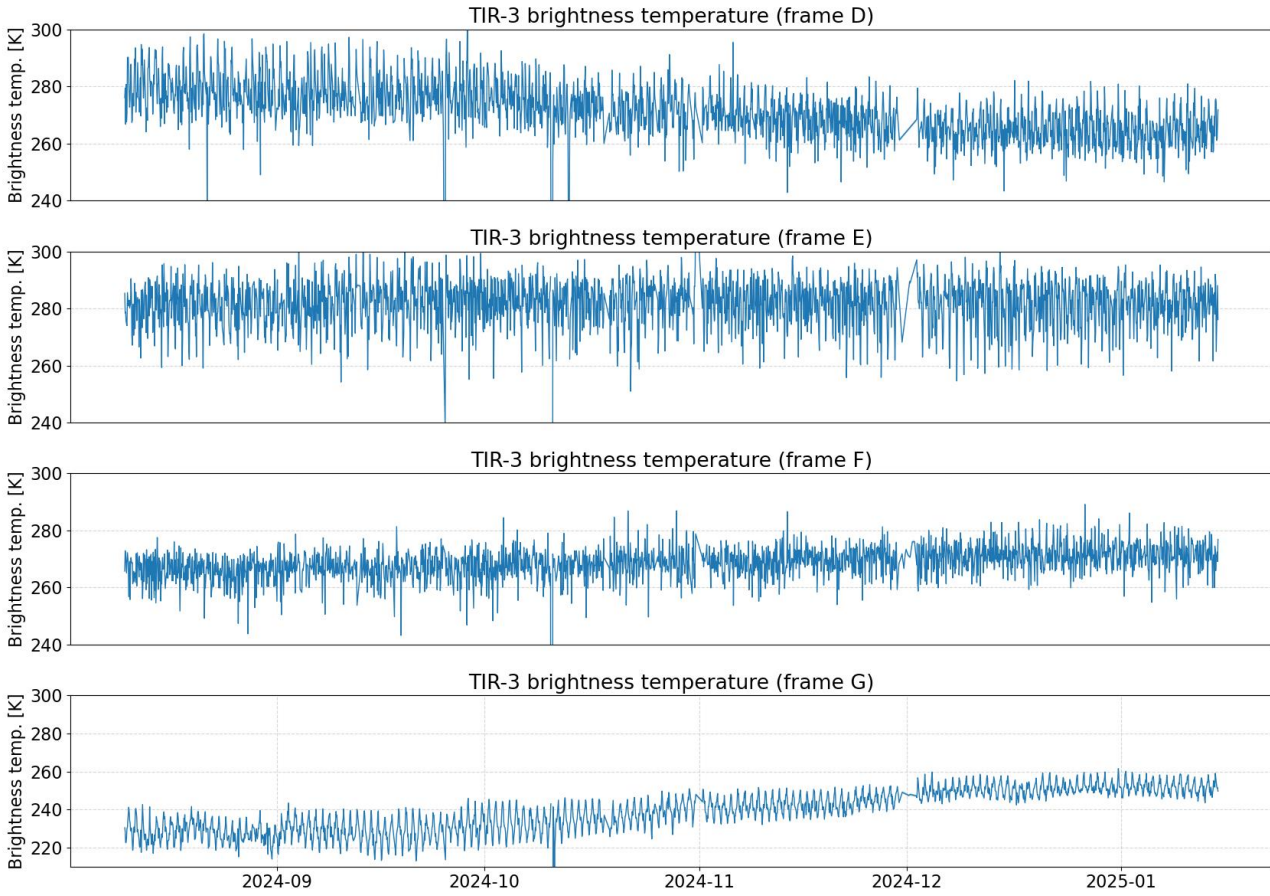
SWIR-2



SH summer & NH Winter 👍

Monitoring and Statistics

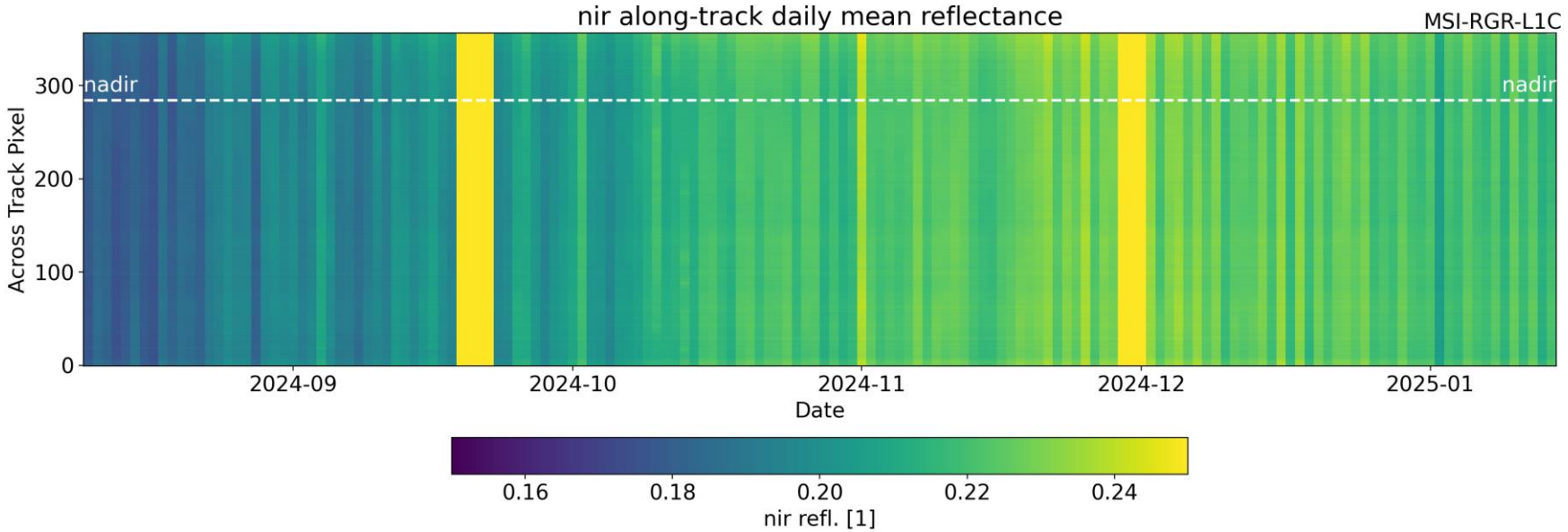


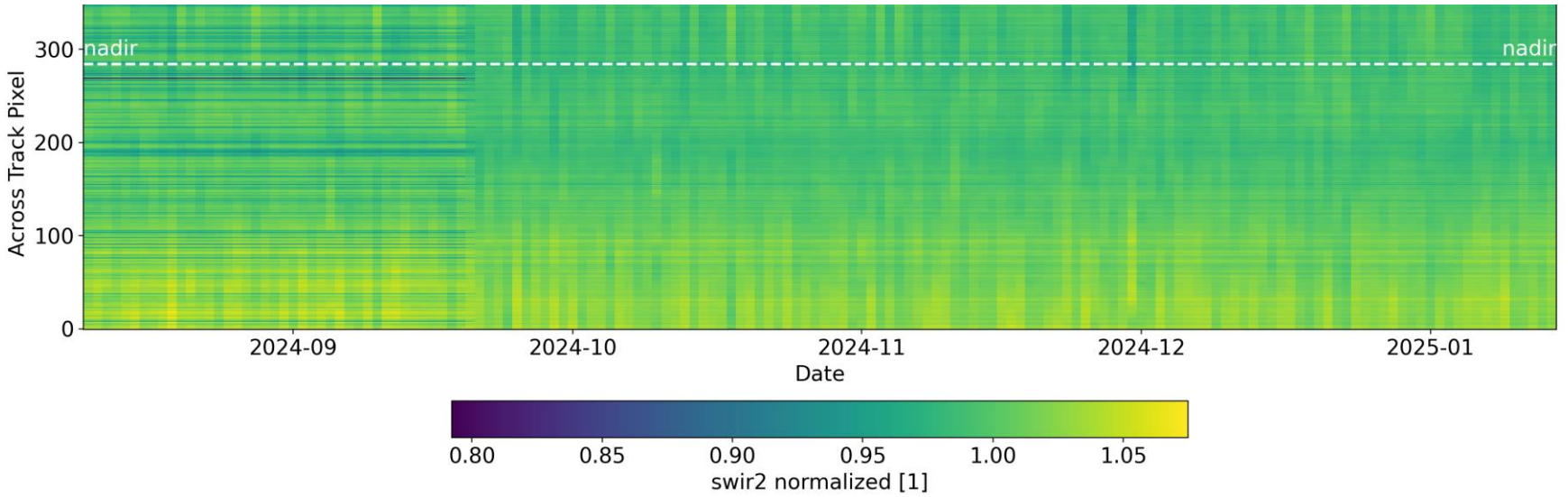


TIR-3

SH summer & NH Winter 👍

Monitoring and Statistics

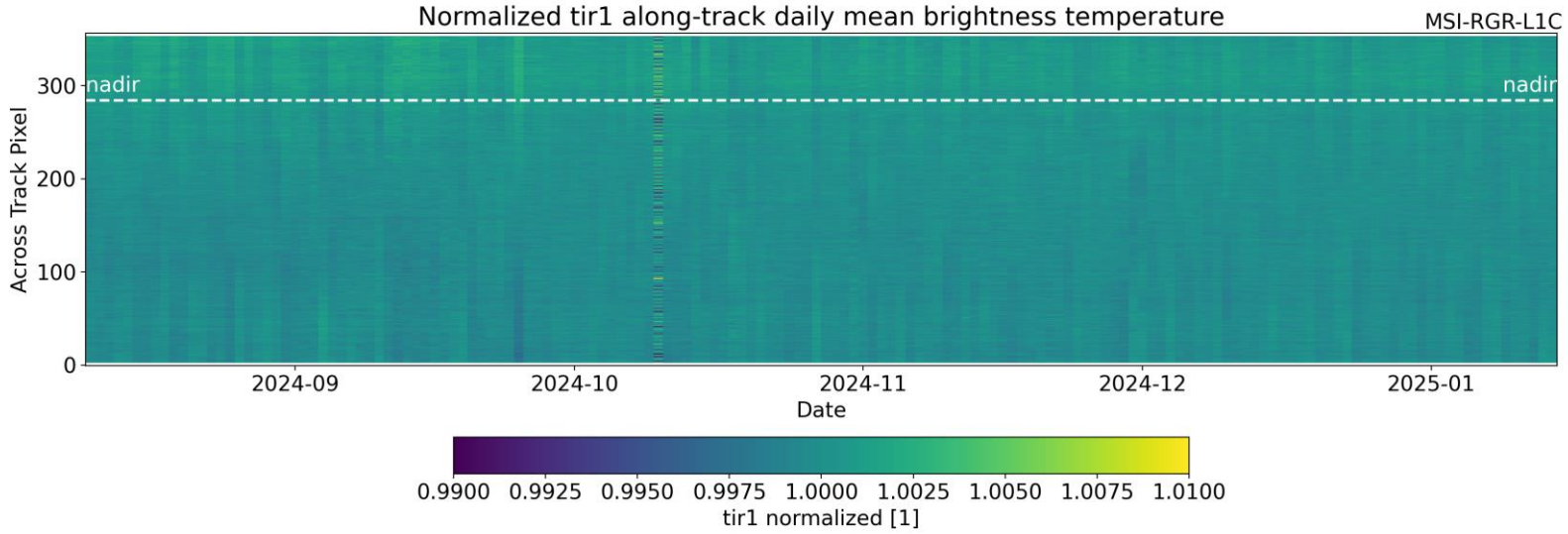


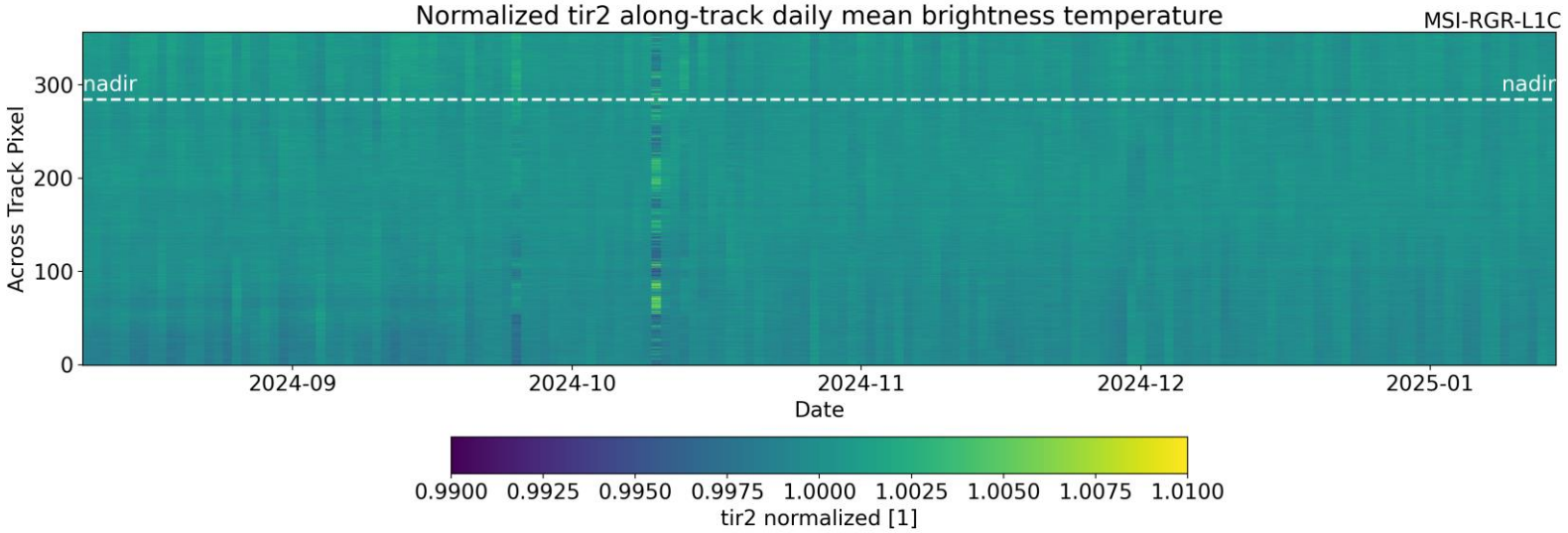


NIR behaves well,

SWIR-2 striping greatly (not perfect) reduced

Monitoring and Statistics

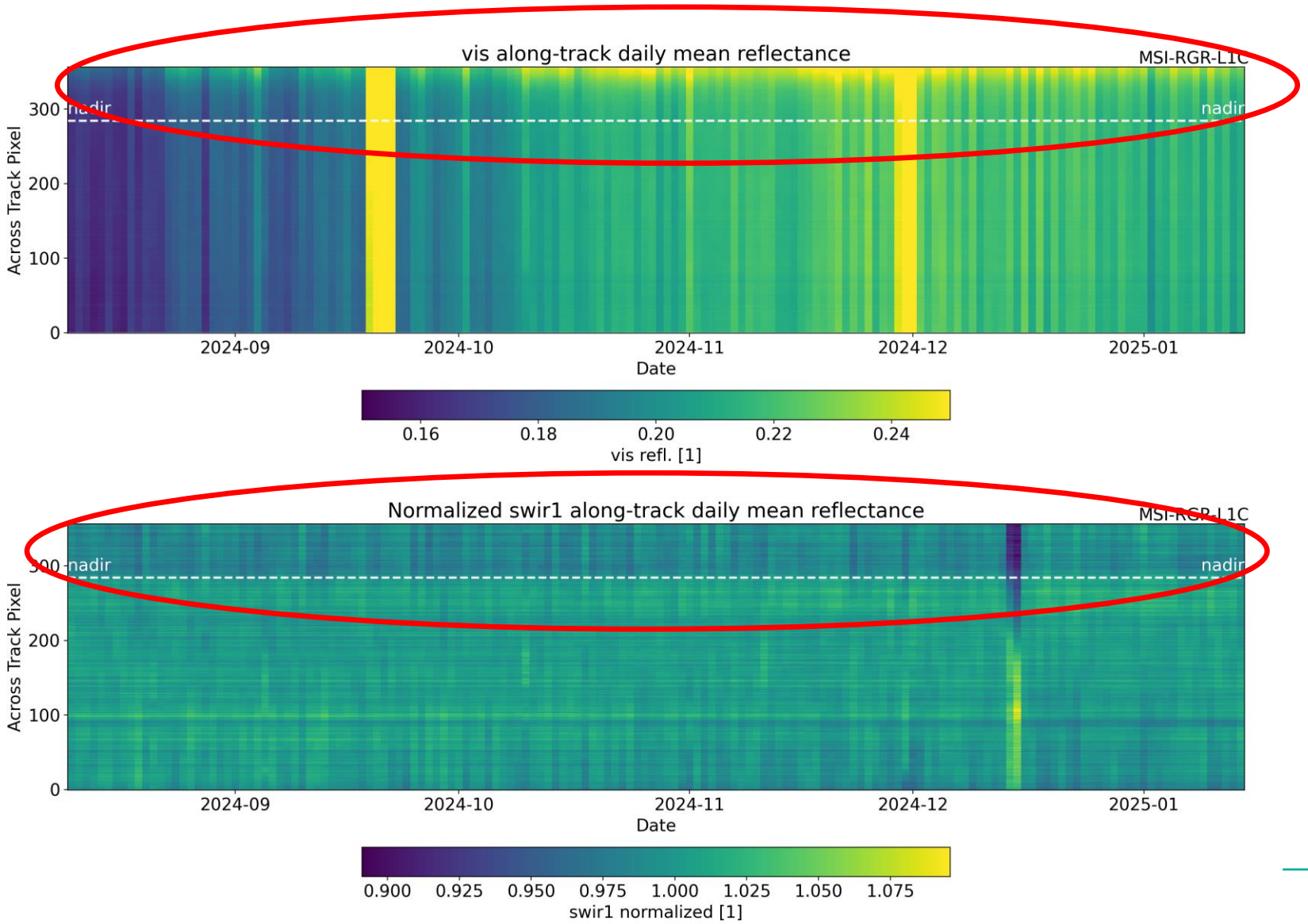




TIR1/2 almost no striping
TIR 3 (not shown) too.

👍

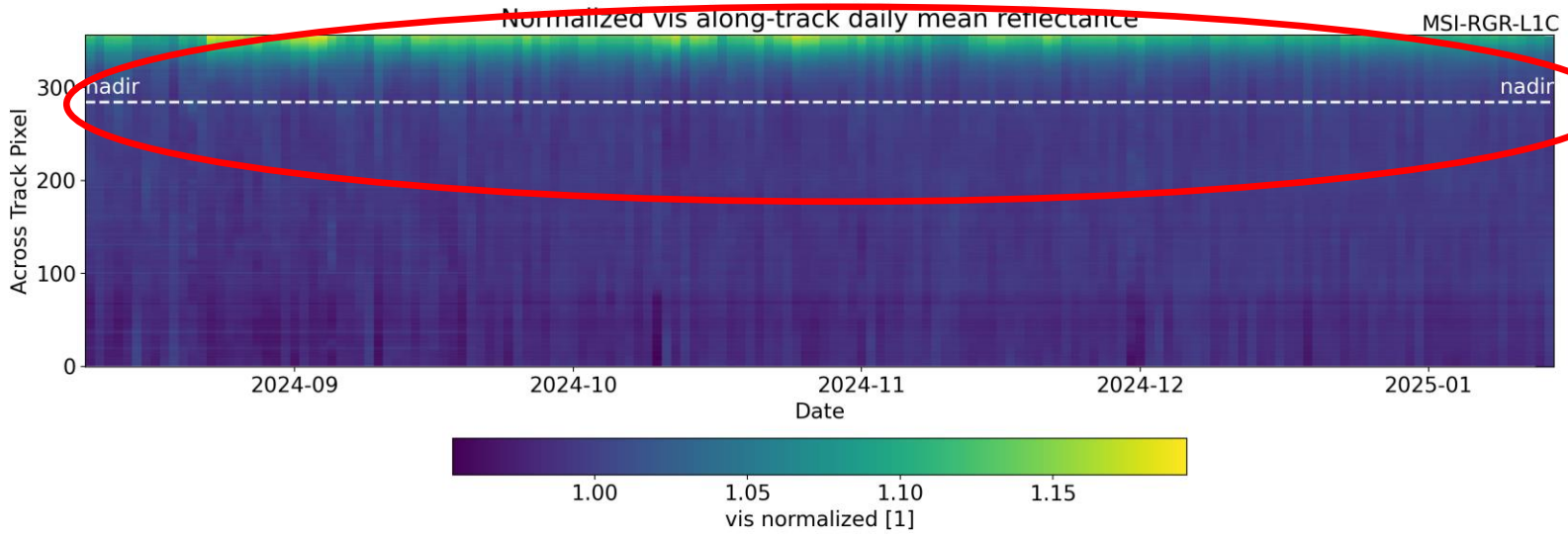
Monitoring and Statistics



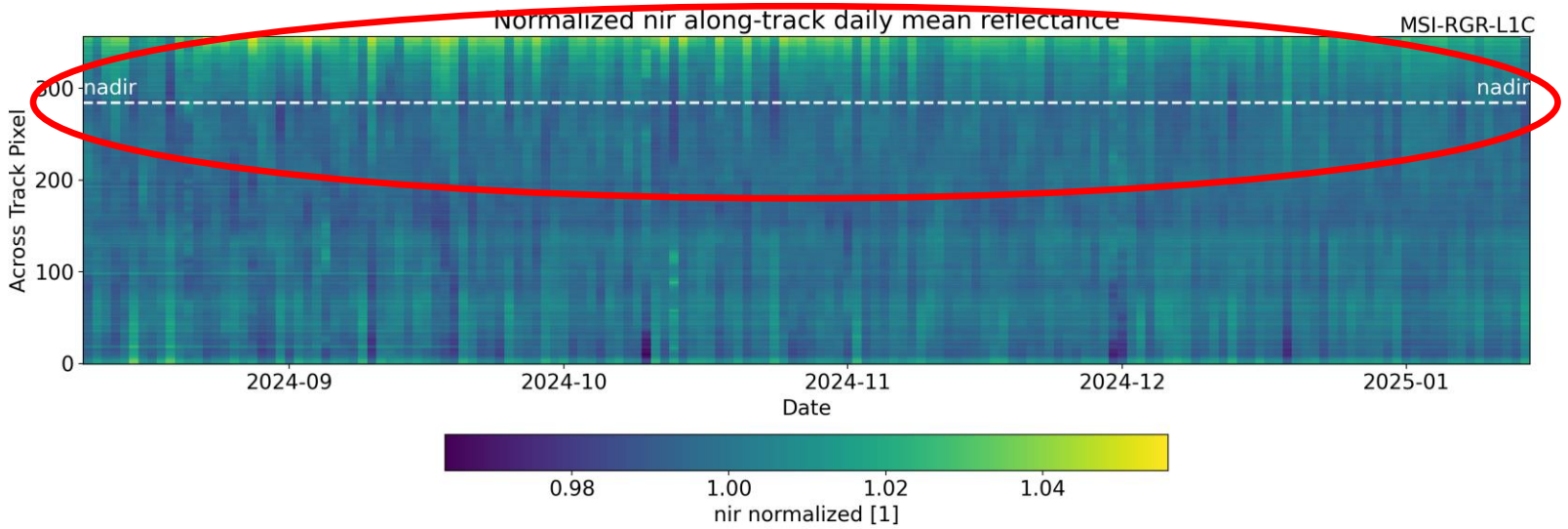
VIS brightening 👎

SWIR1 darkening & striping 👎

Monitoring and Statistics

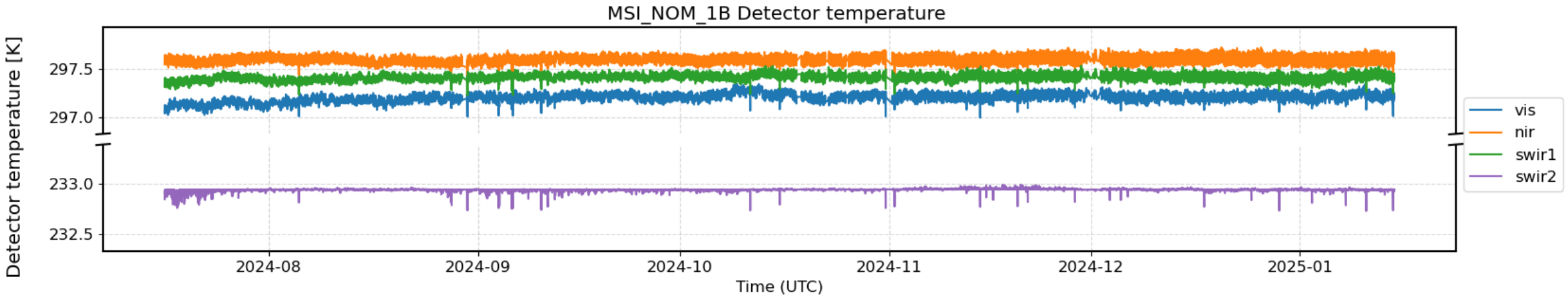


VIS brightening(15%)
&
striping (1%)
👎



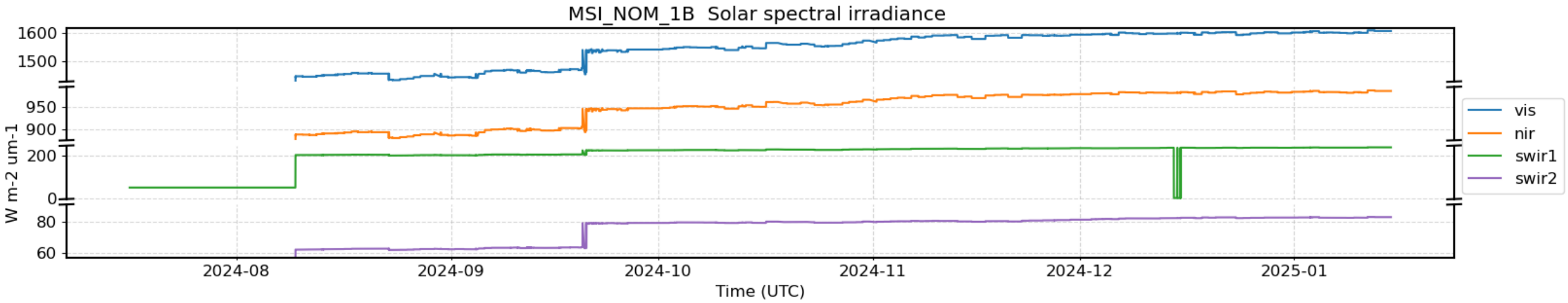
NIR
brightening (3%)
&
striping (1%)
👎

Monitoring and Statistics



Few (<30) temperature drops (~0.1K), that are small but correlated (why and how?). I think (but don't know), that 0.1K is insignificant. To be put under observation…!

Monitoring and Statistics



- This is not what we would expect, some adaptions have been done during commissioning….
- Note: Solar irradiance is used as an *auxiliary value* in radiometric calibration. It is not a product!
- Eventually: irradiance should follow solar orbit (max at 4t of Jan). To be contd.

MSI Geolocation and Co-registration

see presentation of Edward Baudrez

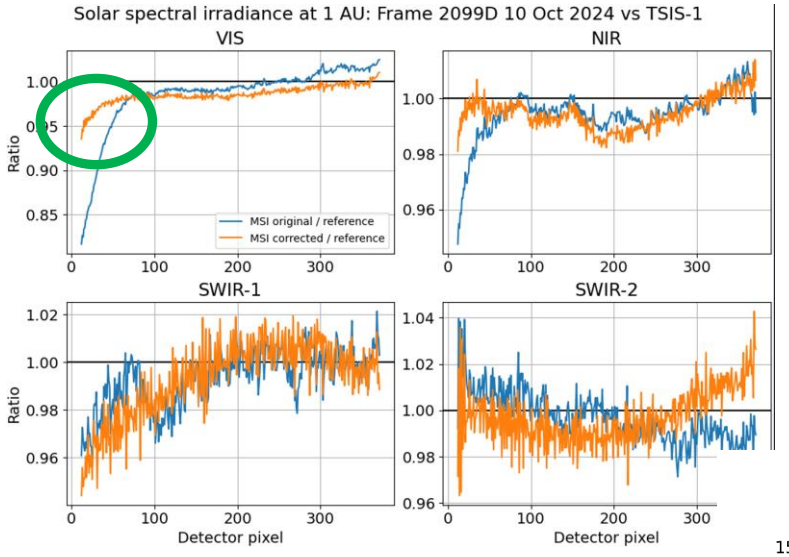
L1c products verification, with external data

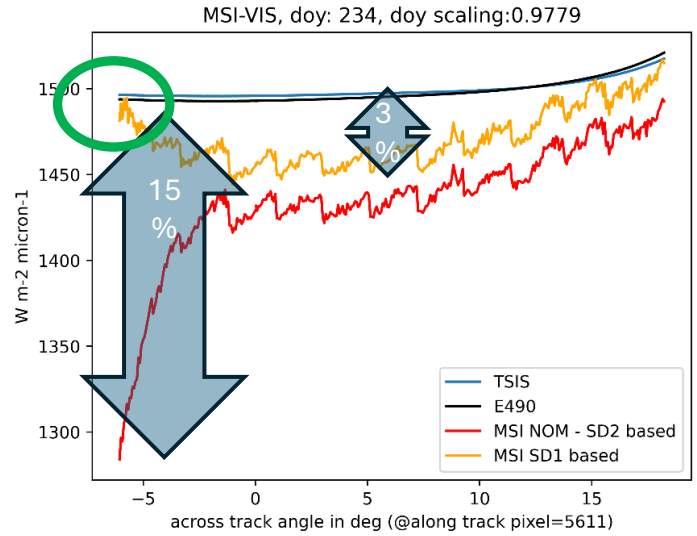
see presentation of Sebastian Bley

MSI – Final Words for VNS (1/3)

VNS Radiometric Calibration suffers from severe deficits in Ground Characterisation !

"After application of the ESA VNS Calibration Maintenance Gains, and the update of the diffuser BSDF using the (external) TSIS-2 solar irradiance spectrum and ***empirical correction*** *factors as a reference, the accuracy is improved. The signals across track are within* ***10%*** *to the theoretical value. However, at* ***the first 100 pixels*** *of the VIS band the solar irradiance varies* ***more than expected*** *between solar calibrations."*





- There have been several empirical corrections:
  - Chainsaw features
  - Absolute agreement of the solar irradiance measurement (**via diffusor** 1|2)
  - striping

MSI – Final Words for VNS (2/3)

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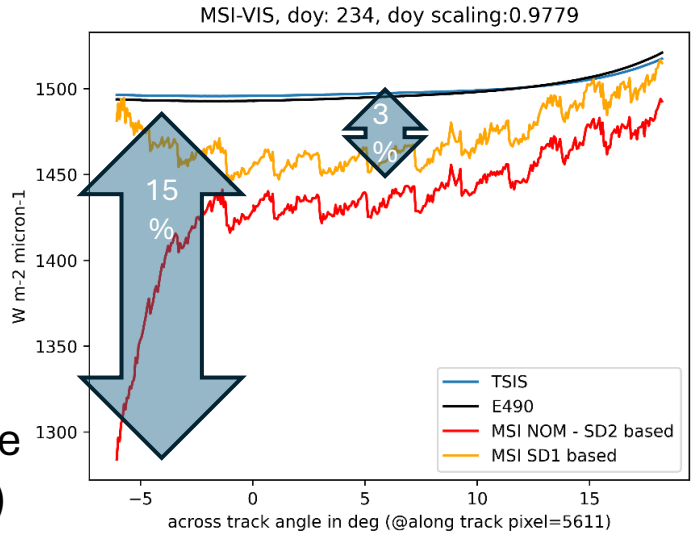

Frankly:

- The empirical calibration correction based on the diffusor view is only cosmetic!
- Currently we don't have a **reference**, that can be used for radiometric calibration. (We know the sun, but we can not look at the sun without diffusors, which have '***features***')
- Currently we can use the diffusor views only to monitor stability. (Don't forget: MSI's earth-view is **without** diffusor. Thus, if we look at Earth, we can not know wether or not the assumed calibration gain is correct!)

→ We have to perform a ***vicarious calibration***! (See presentation of Sebastian Bley)

MSI – Final Words for VNS (3/3)

Last JMAG (43) we gave recommendation with respect to verification. This now evolves into **vicarious radiometric calibration**:

“”””

Since end of last year MTG - FCI data is released. Commissioning phase for FCI took more than a year because of mechanical problems that encumber radiometric calibration. However:

- The bands are close to MSI VNS
- The spatial resolution is high (0.5km -2km depending on band and mode)
- The temporal resolution is high (2.5 -10 min)
- EUMETSAT evolved their vicarious calibration capabilities. There potential for **mutual support**. EC can provide vertical information, EUM has a great database (MICMICS) and corresponding tools + mechanics of PICS (=pseudo invariant calibration sites) data.

“”””