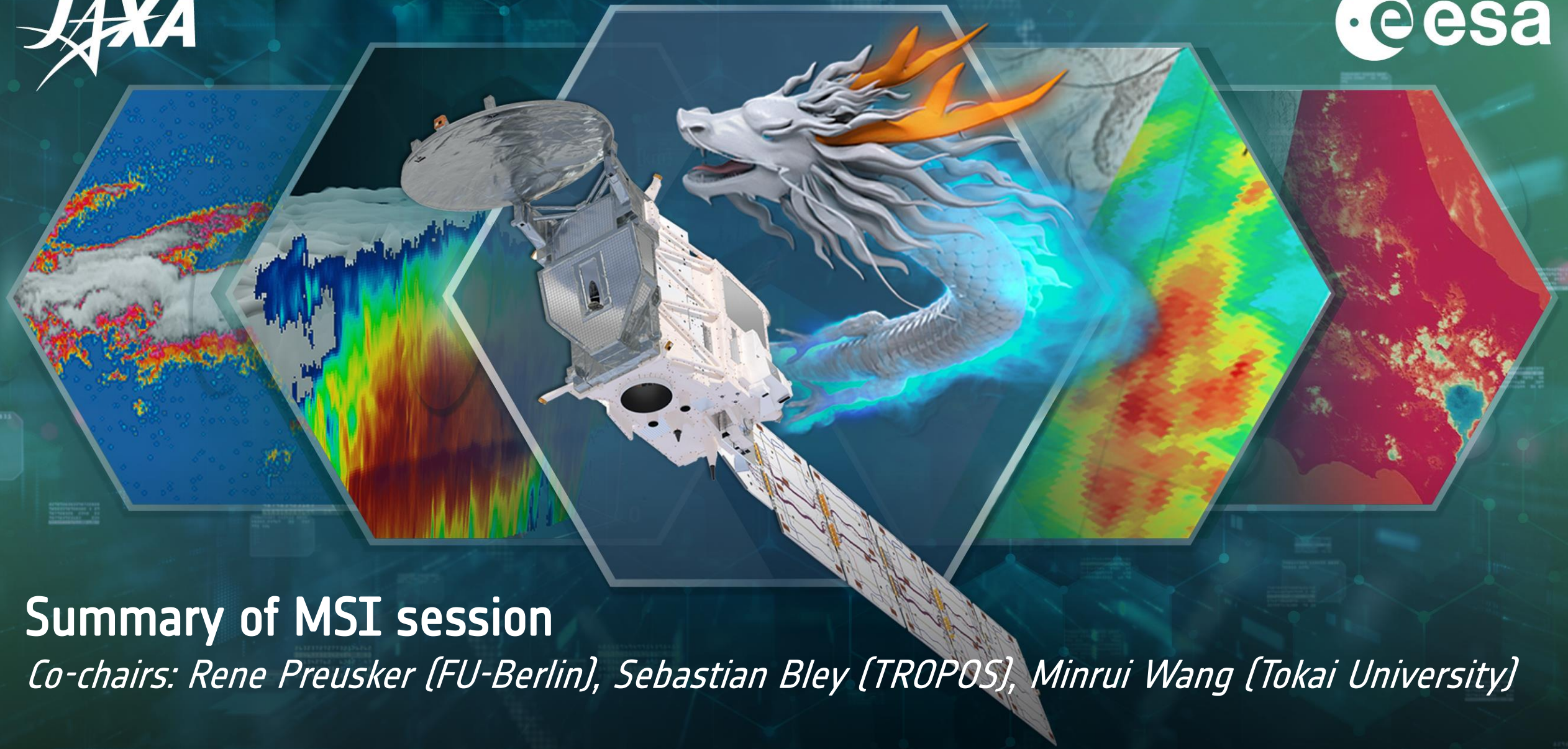


Summary of MSI session

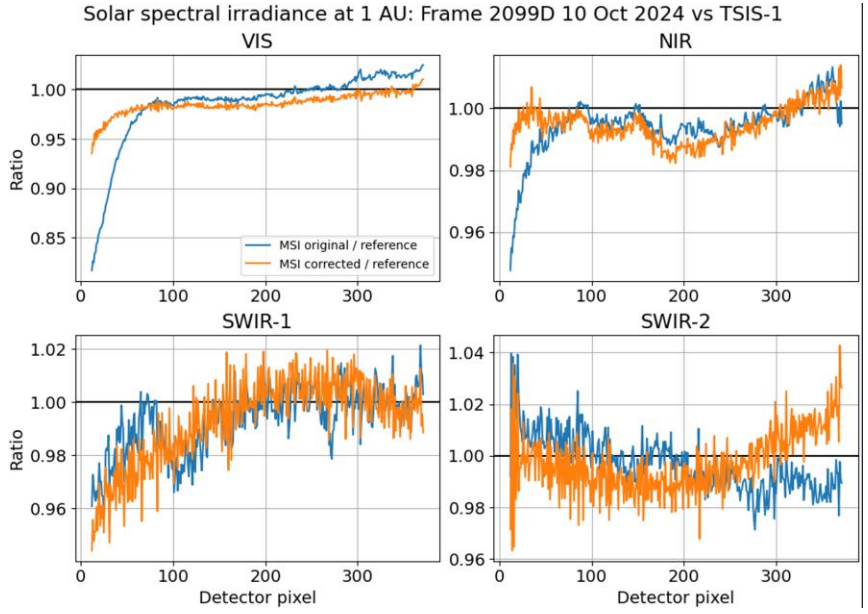
Co-chairs: Rene Preusker (FU-Berlin), Sebastian Bley (TROPOS), Minrui Wang (Tokai University)

1st ESA-JAXA EarthCARE In-Orbit Validation Workshop
14 – 17 January 2025 | VIRTUAL EVENT

MSI L1 status

Olivier Defaucy (MSI Integrated Commissioning):

- MSI L1 data in general compliant to the requirements
- Radiometric precision compliant for TIR channels
- For VNS channels, radiometric calibration not fully compliant for full across-track range
- Apart from 100 pixels of VIS band, across track signals are within 10% → too low requirement in order to derive aerosol properties
- Preliminary correction through update of diffuser BSDF using normalized daily across-track statistics



Rene Preusker (L1 product verification):

- L1b/L1c regridding for the VNS bands works very well
- Instrument and sun geometry of VNS L1B and L1c is not consistent. → Recommendation: Reference should be VNS, not TIR, because TIR has no azimuth angle
- L1 monitoring shows expected seasonal features (e.g. sunglint increase during SH summer)
- SWIR-2 striping greatly reduced in EXAD
- **VNS radiometric calibration suffers from severe deficits in ground characterisation → need to perform vicarious calibration!**

MSI L1 status

Edward Baudrez (L1 Geolocation and Co-registration):

- 900 scenes were used to assess the M-NOM geolocation and M-RGR co-registration accuracy
- M-NOM geolocation accuracy excellent for VNS, but out-of-spec for TIR bands → will be solved in v14 processor update
- Known issues with SWIR-1 M-RGR co-registration → will be also solved in current processor update → interpret product geolocation with care until this is communicated
- **Recommendation by Rene: Analyse impact of latitude or frame ID on co-registration accuracy**

Conclusion

→ **Latest MSI L1 processor update (CCDB v14) includes update of diffuser BSDF ('cosmetic correction') and coregistration parameters and will replace the recent baseline version soon (not yet in the released EXAD L1 version)**

→ **To reach VNS compliance, a full year in-orbit characterization including further BSDF updates will be required and additional vicarious calibration using reference instruments on other satellite platforms (e.g. FCI onboard MTG)**

MSI L1 validation

Sebastian Bley (L1 cross-satellite validation using data from MSG SEVIRI)

- Cross-satellite validation and calibration proven to be very useful (e.g. SEVIRI, FCI, Modis, AVHRR)
- Comparison to SEVIRI shows that TIR calibration has been improved with baseline EXAD which has been publicly released this week
- VIS and NIR reflectances seem too high (12-20 %) in comparison to SEVIRI for cloudy scenes. Both bands reach many values above 1 even above 1.2, which is unrealistic and causes gaps in the cloud products
- Differences found depending on surface type → Radiative transfer calculation needed to account for differences in filter functions
- For vicarious calibration, focus on FCI onboard MTG with much better spatial resolution than SEVIRI

Bernhard Mayer (First comparison of MSI and specMACS observations during PERCUSION)

- specMACS VNS radiances have been compared to collocated MSI radiances (only nadir pixels) during the PERCUSION campaign – approx. 20 available under flights
- First comparison of two underflights looks very promising (one case study excellent agreement, one flight with 5% deviation)
- Interested in comparison of cloud products (e.g. cloud top height, droplet size)
- Comment Bastiaan van Diedenhoven: PACE-PAX data are available and can be used for validation. His team doesn't have dedicated funding for that, so they will not be doing any analysis

MSI L2 status

Anja Hünerbein (MSI early Level 2 product validation results)

- In comparison to MODIS and SEVIRI cloud products, MSI M-CM and M-COP products and their features look very promising → However still issues with VNS values exceeding 1 and the L1 across-track variations which influence L2
- Also M-AOT compared to Modis and looks promising
- Collocated data between Modis and MSI has 30 min difference, however for surface or aerosol validation suitable
- No statistical validation on L2 yet because there are still issues at L1 that need to first be fixed to not have their effect in the L2.

Conclusion

→ **L1c TIR bands look good, but VNS too high**
→ **We need vicarious calibtation, focus here will be on FCI onboard MTG**
→ **SpecMACS onboard HALO aircraft very useful for MSI validation (soon also VELOX analysed at LIM, Leipzig)**
→ **It would be very useful if SpecMACS would measure diagonal to cover all MSI across-track angles (other airbone MSI-like instruments which could contribute here?)**
→ **Airborne instruments are very valuable for MSI L1 and L2a validation! Would be very useful to involve PACE-PAX campaign and/or PICARD / AVIRIS-NG team (currently, many ongoing activities, but no resources to analyse the data with respect to MSI validation)**
→ **There are crossings between PACE and EarthCARE (opposite to each other - one satellite is ascending and the other is descending). OCI (the imager on PACE) has a large swath which makes feasible good comparison cases with MSI.**

Backup for discussion - MSI L2 validation needs

Usage of all types of reference data, e.g.,

- ground-based measurements (AERONET, ACTRIS, ARM etc)
- satellite-based (e.g., MTG-FCI, Sentinel-2 MSI, MODIS, VIIRS, PACE, etc.)
- airborne-based

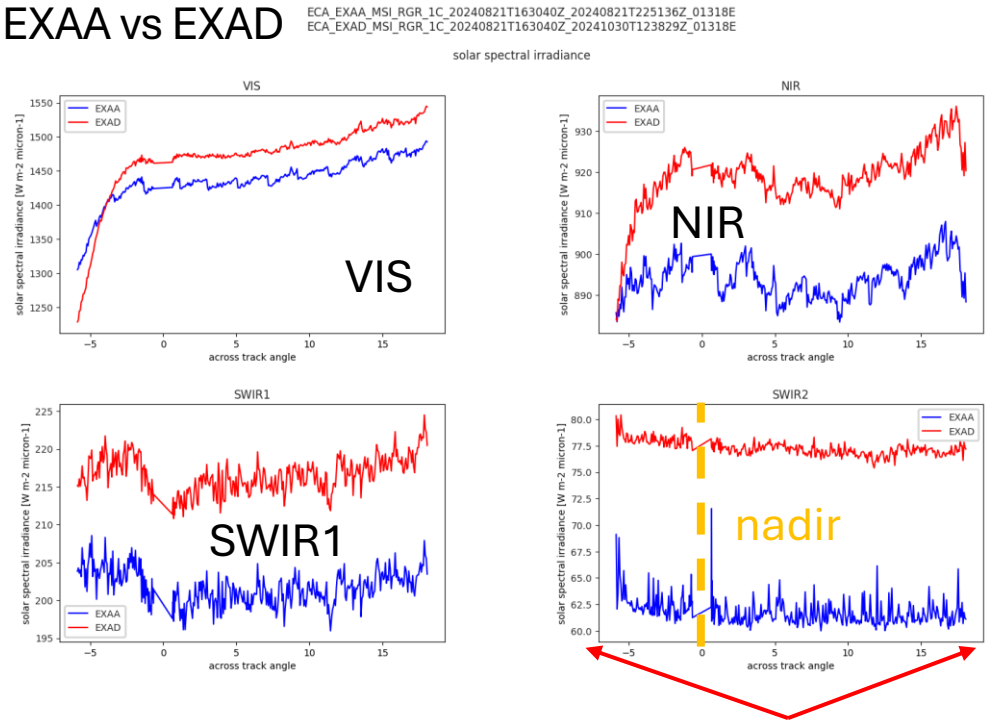
Separation of validation results with respect to geophysical conditions, e.g.,

- cloudiness
- surface type (different biomes: ocean, vegetated land, desert, ice, snow, etc.)
- day-night
- (e.g., frame-based)
- etc.

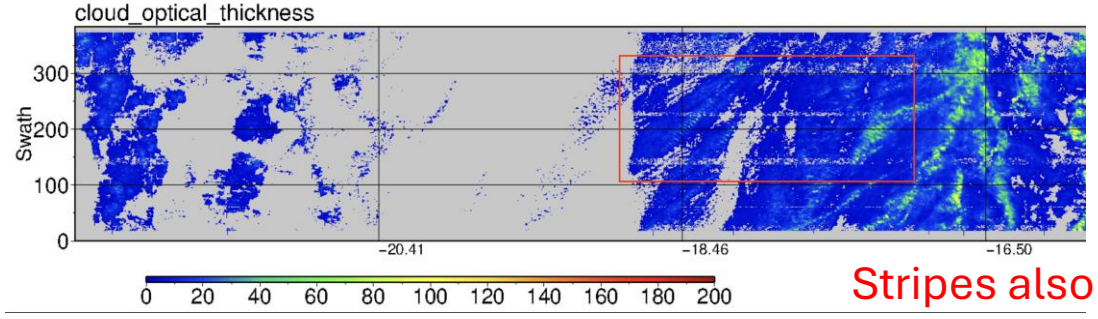
Consideration of the across-track dependency wherever possible, due to effects caused by

- MSI diffuser dependency of the spectral solar irradiance
- Stripes on both L1NOM and L2 data
- MSI smile (Docter et al. 2024)

EXAA vs EXAD



MSI across track



Stripes also in L2a

TROPOS