Validation of MSI and BBR by high altitude airborne measurements on HALO

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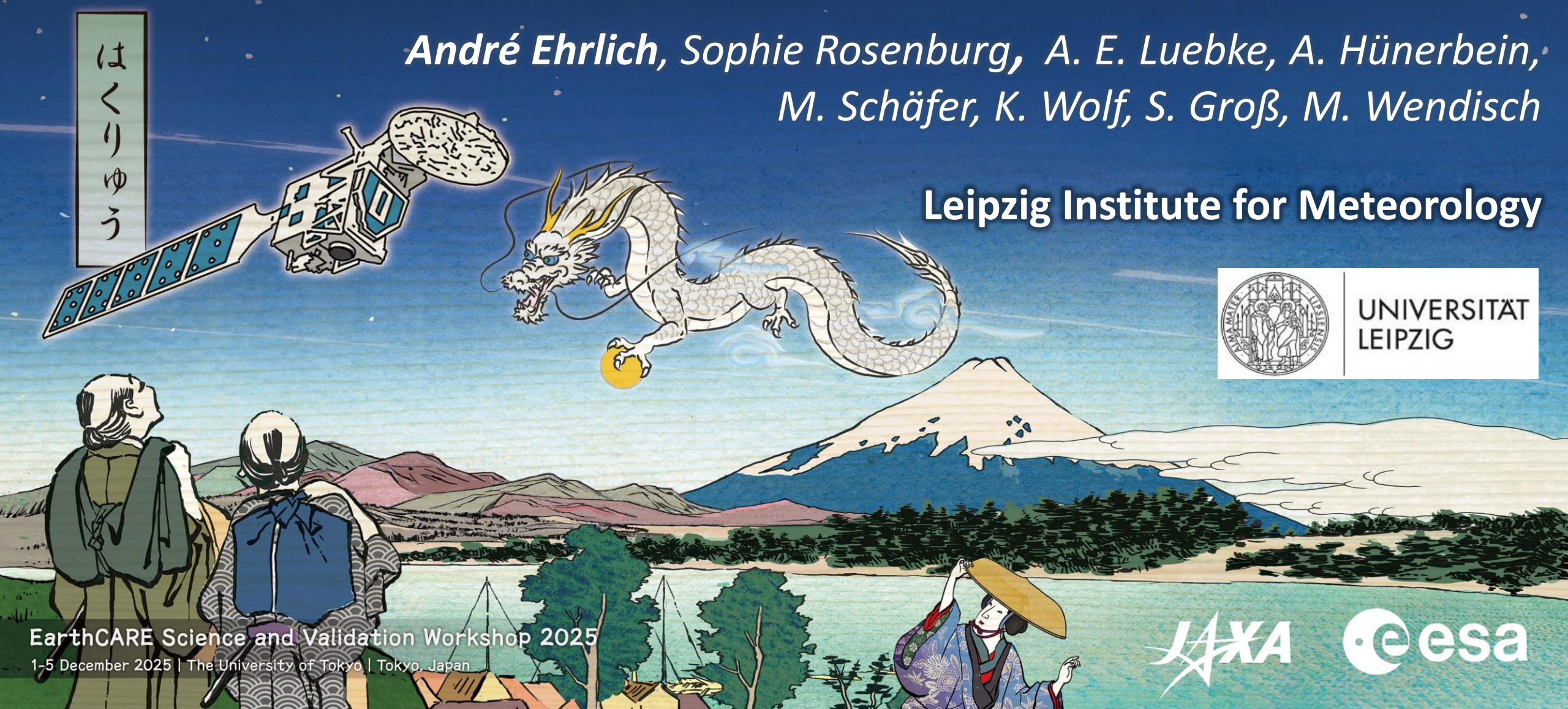

EarthCARE Science and Validation Workshop 2025
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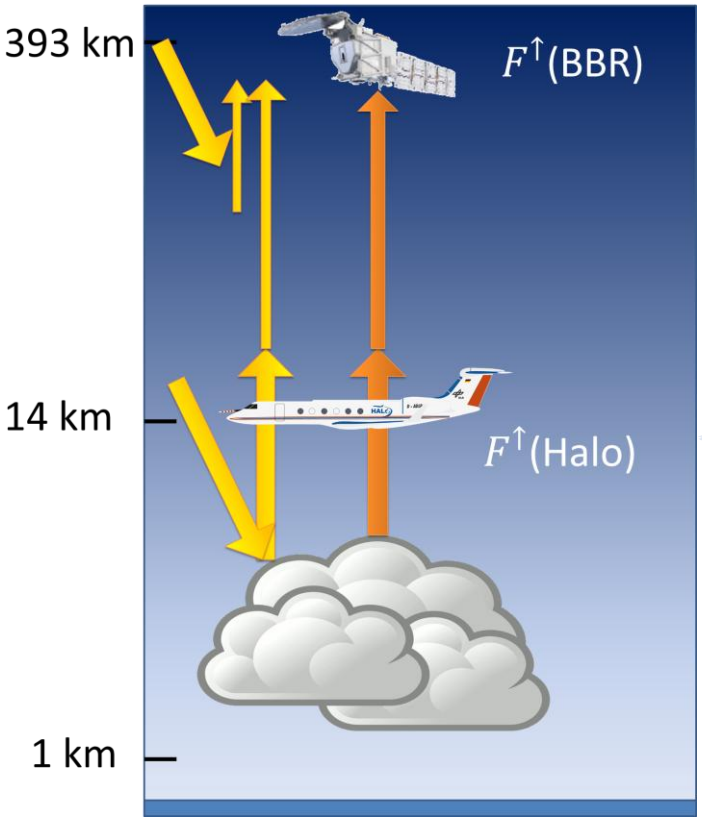
JAXA esa

Measurements and Corrections



BBR
Broad-Band Radiometer

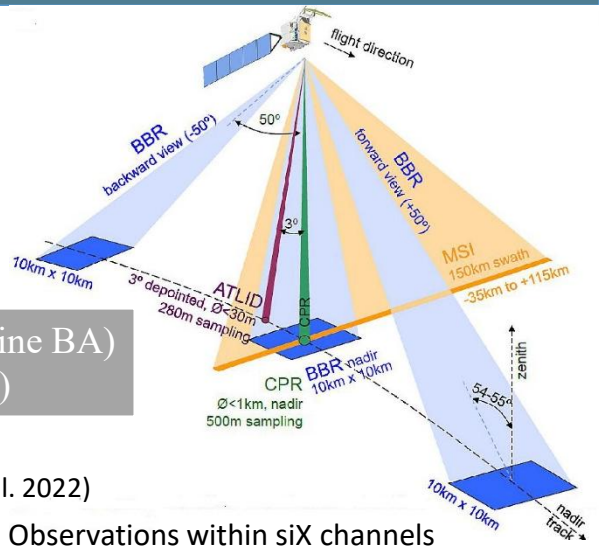
- Solar and TIR upward irradiance
- 10 km x 10 km FOV (stand. resolution)

BMA_FLX_2B Product (Baseline BA)
(Velázquez Blázquez et al., 2024)

MSI
Multi-Spectral Imager

- 3x TIR channels
- 500 m pixel size

MSI RGR 1C (Baseline BA)
(Eisinger et al., 2024)



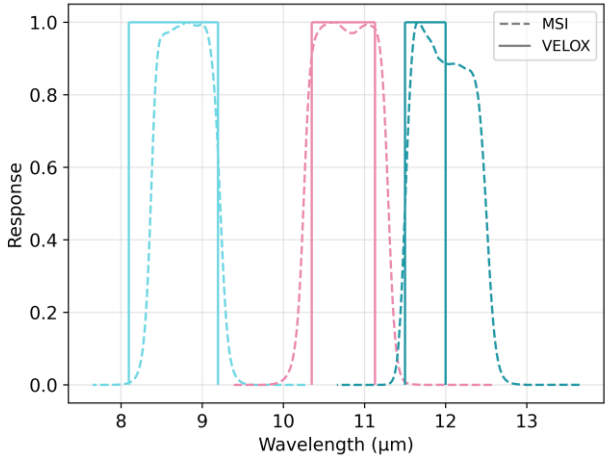
BACARDI (Ehrlich et al. 2023)
Broadband AirCrAft RaDiometer Instrumentation

2x Pyranometer
2x Pyrgeometer
- Hemispherical FOV

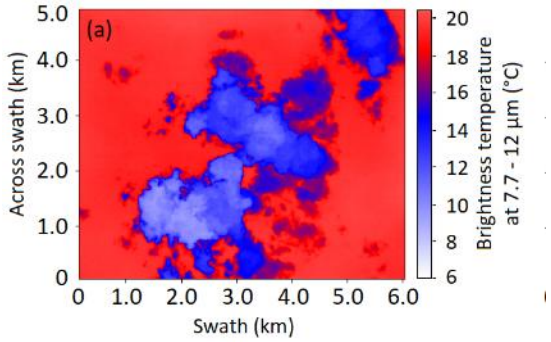
- solar 0.2 – 3.6 µm
  (0.2 – 3 µm)
- TIR 4.5 – 42.0 µm
  (3 – 100 µm)

VELOX (Schäfer et al. 2022)
Video airbornE Longwave Observations within siX channels

Thermal-IR Imager
- 7.7 – 12.0 µm (6 ch)
- 36° x 29° FOV
- 10 m pixel size

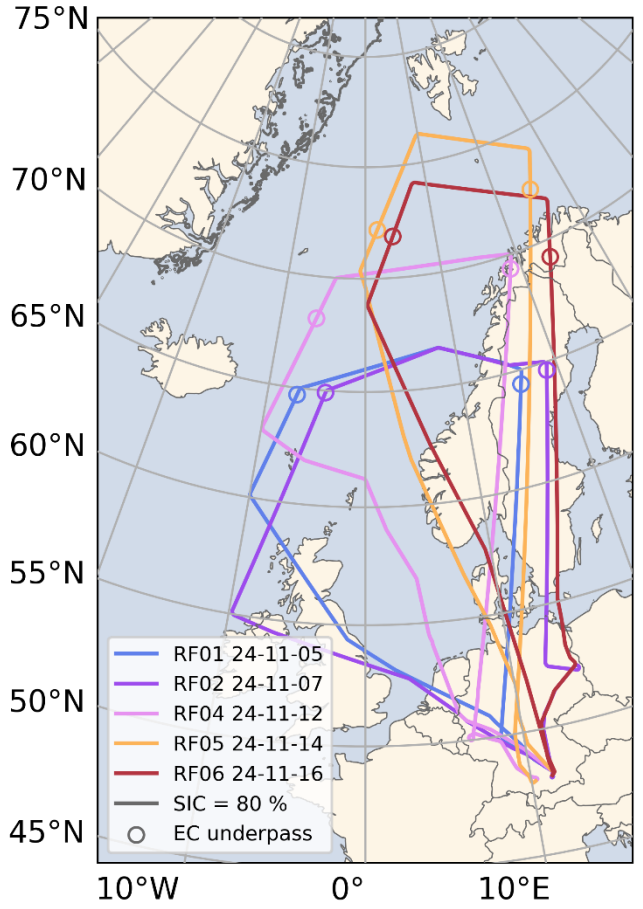


Brightness temperature

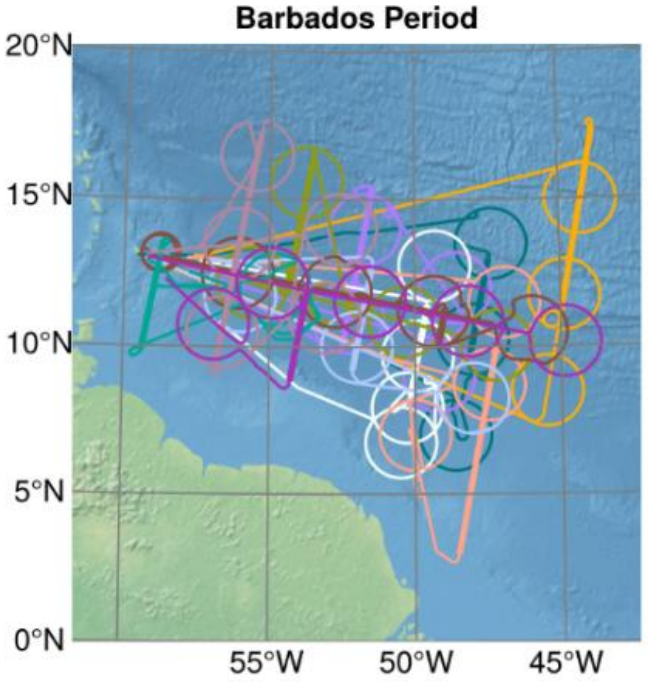


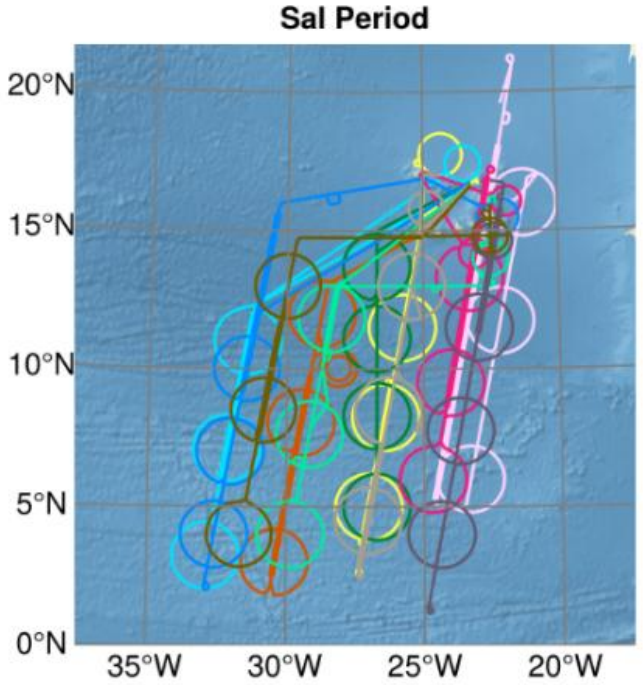
Measurements and Corrections

Filtering of data → no clouds above HALO
→ ± 7.5 min overpass time



TROPICS (17 orbits)





High Latitudes (8 orbits)

Our findings

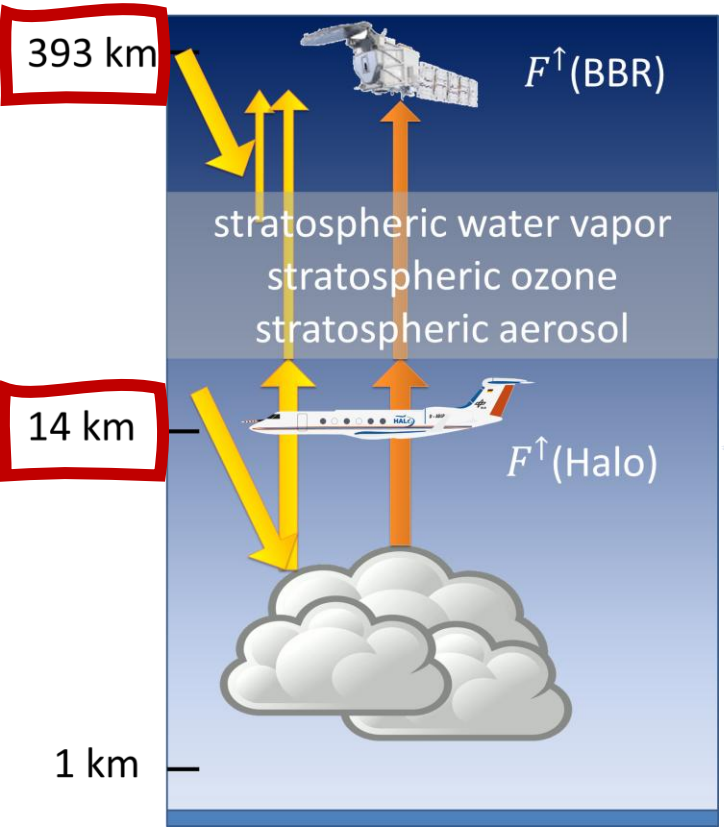
Atmospheric correction:

- MSI/VELOX: → high latitudes small effect
  → tropics correction is needed
- BBR/BACARDI: → correction is needed
  → implemented by RT simulations

Comparison:

- MSI/VELOX: → TIR brightness temperature OK (one case in high latitudes)
- BBR/BACARDI: → Solar fluxes OK (only tropics)
  → TIR fluxes show differences (warm targets)

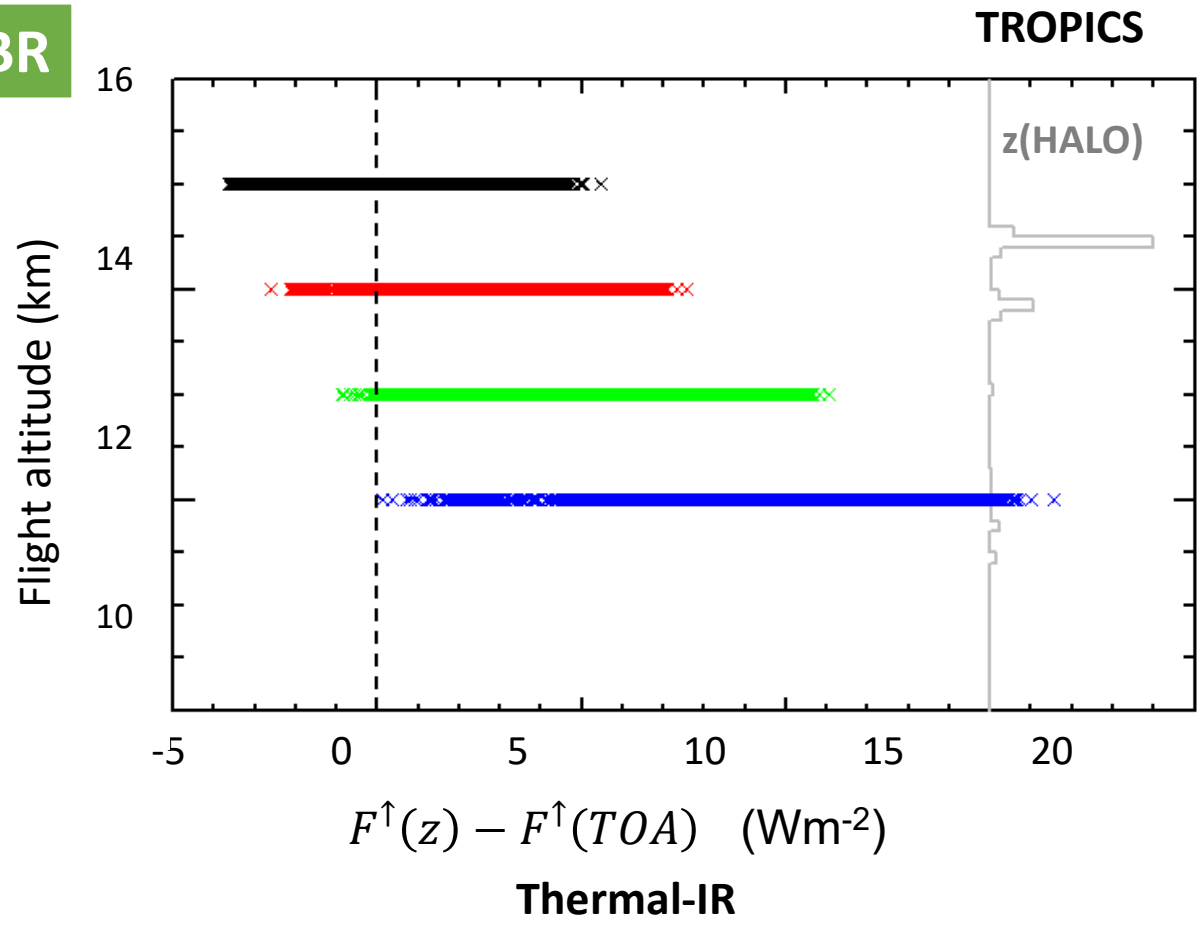
Atmospheric Correction: BACARDI - BBR



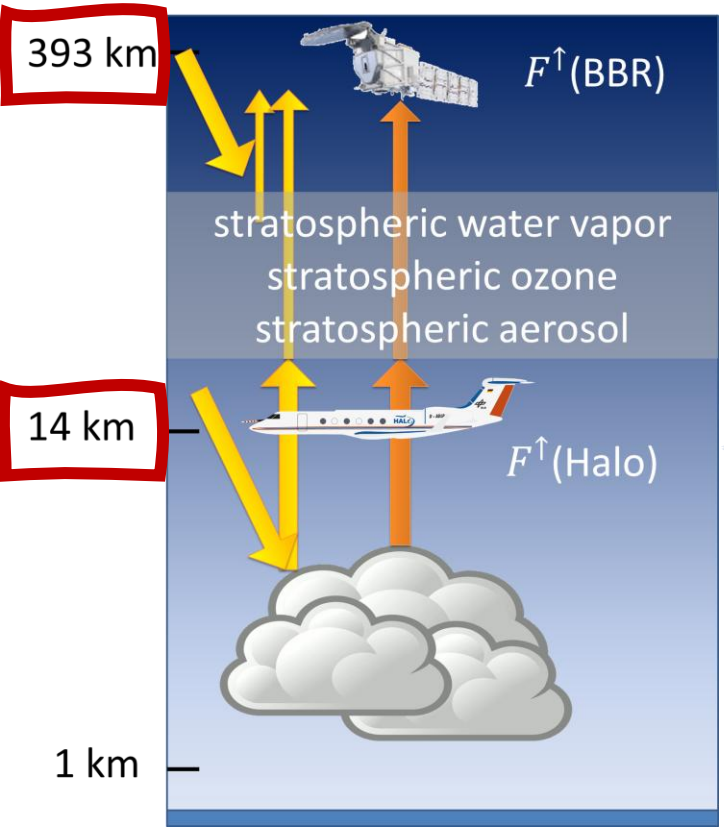
BACARDI vs. BBR

Radiative transfer

simulations



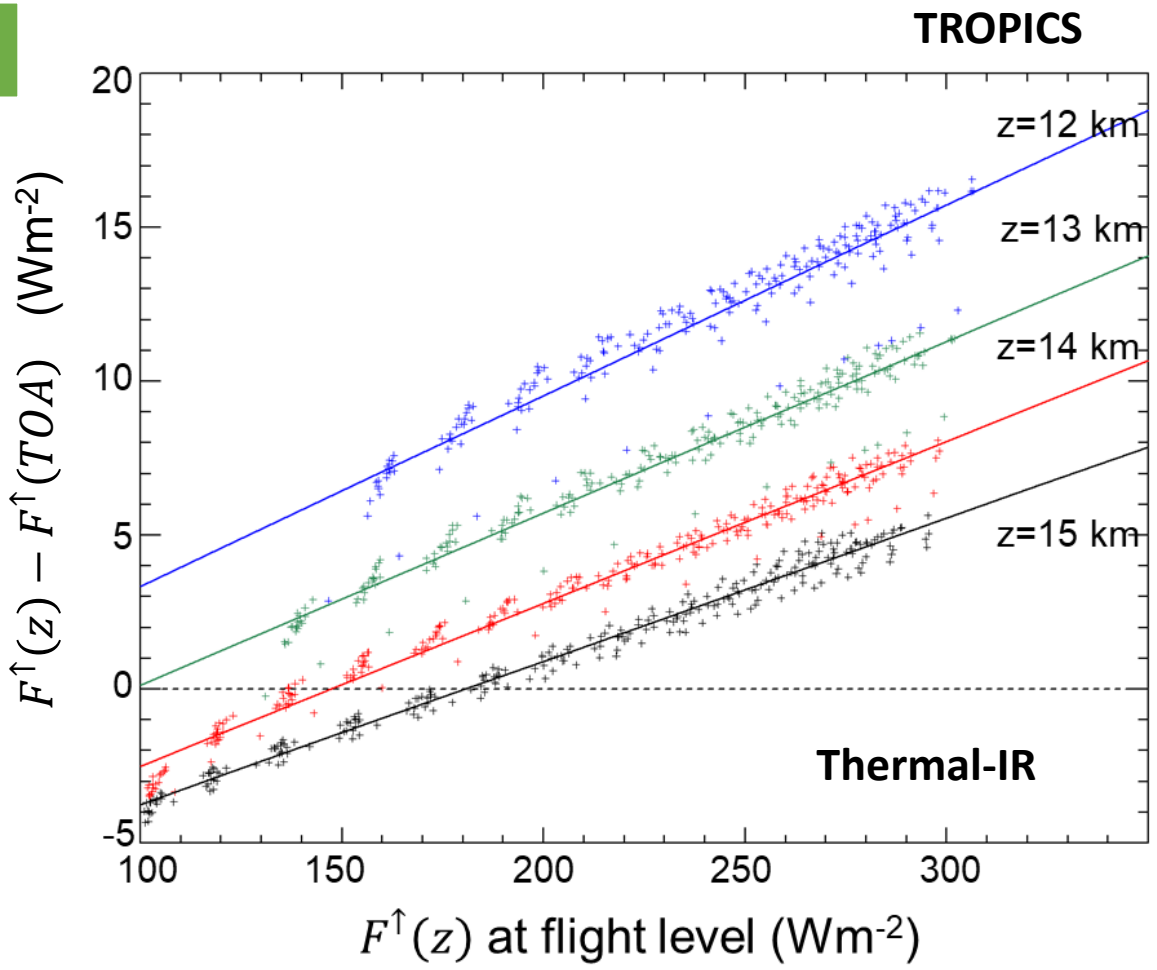
Atmospheric Correction: BACARDI - BBR



BACARDI vs. BBR

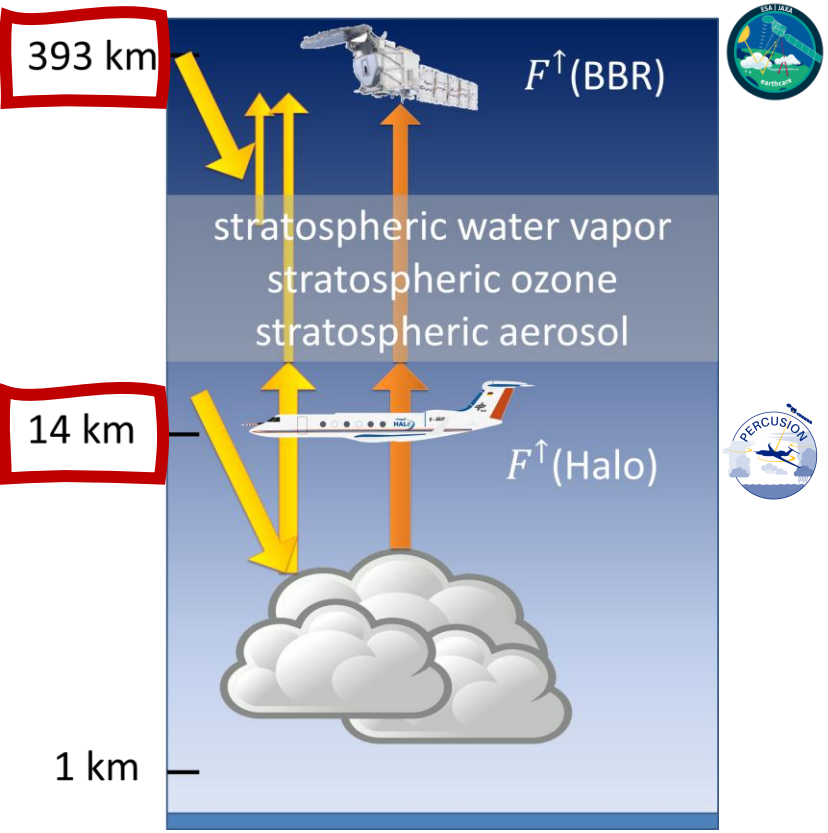
Radiative transfer simulations

based on X-MET data



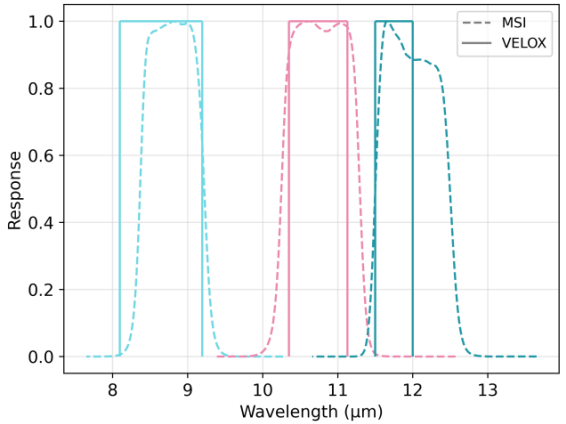
Correction: individual for each orbit

Atmospheric Correction: VELOX - MSI



VELOX vs. MSI

+ Spectral response functions

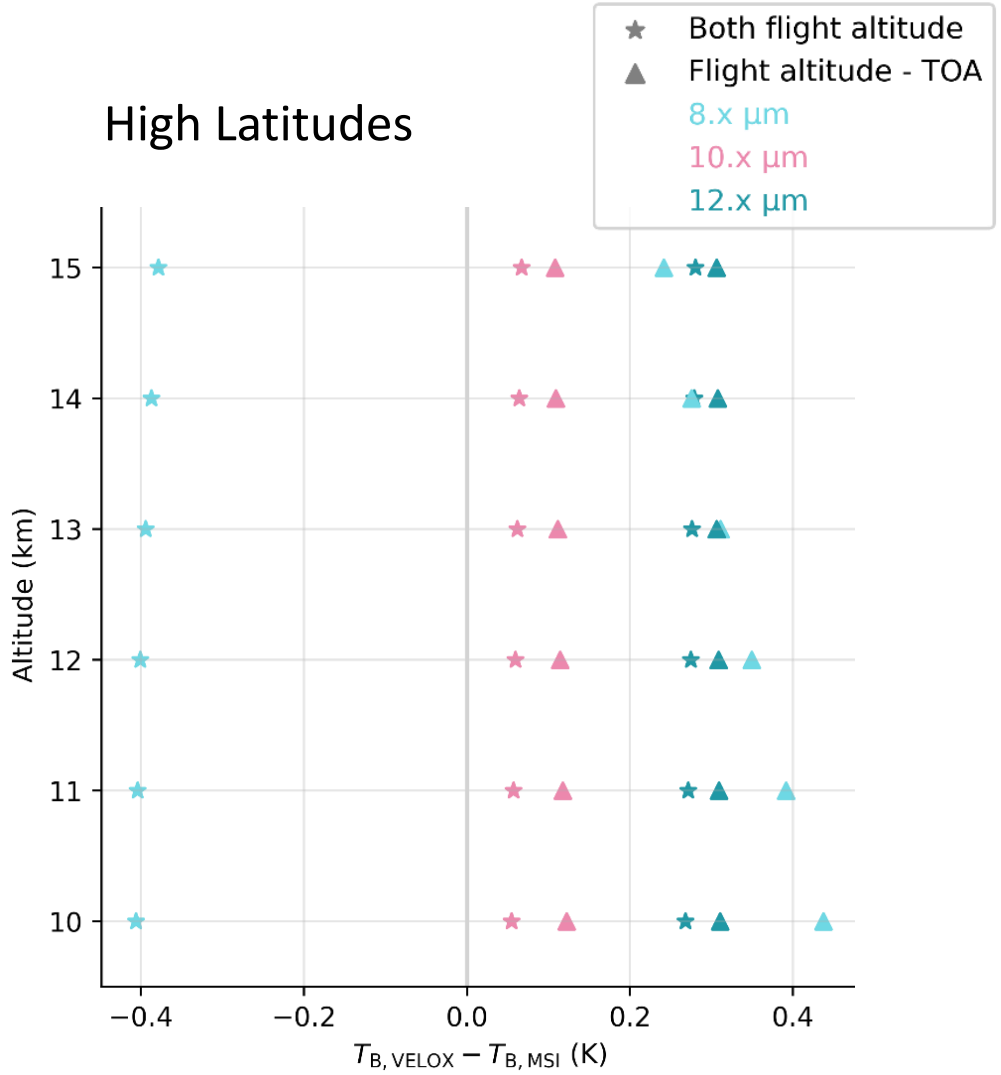


Radiative transfer simulations

☆ Only spectral differences

△ Spectral & altitude differences

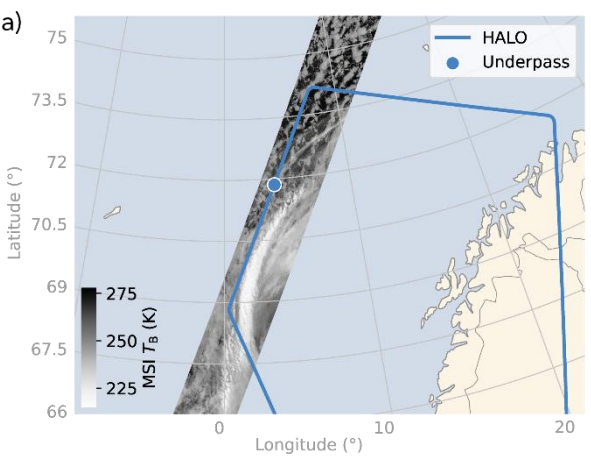
High Latitudes

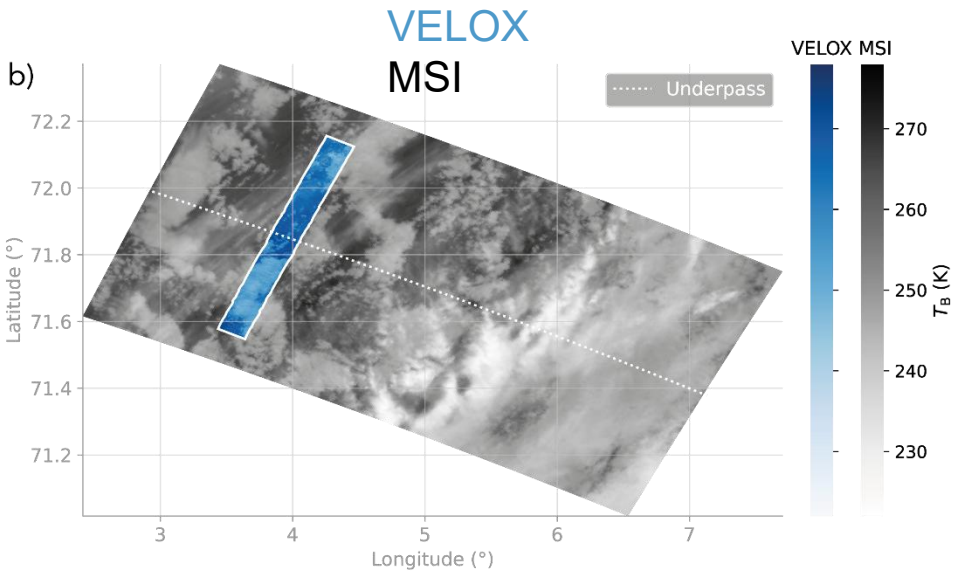


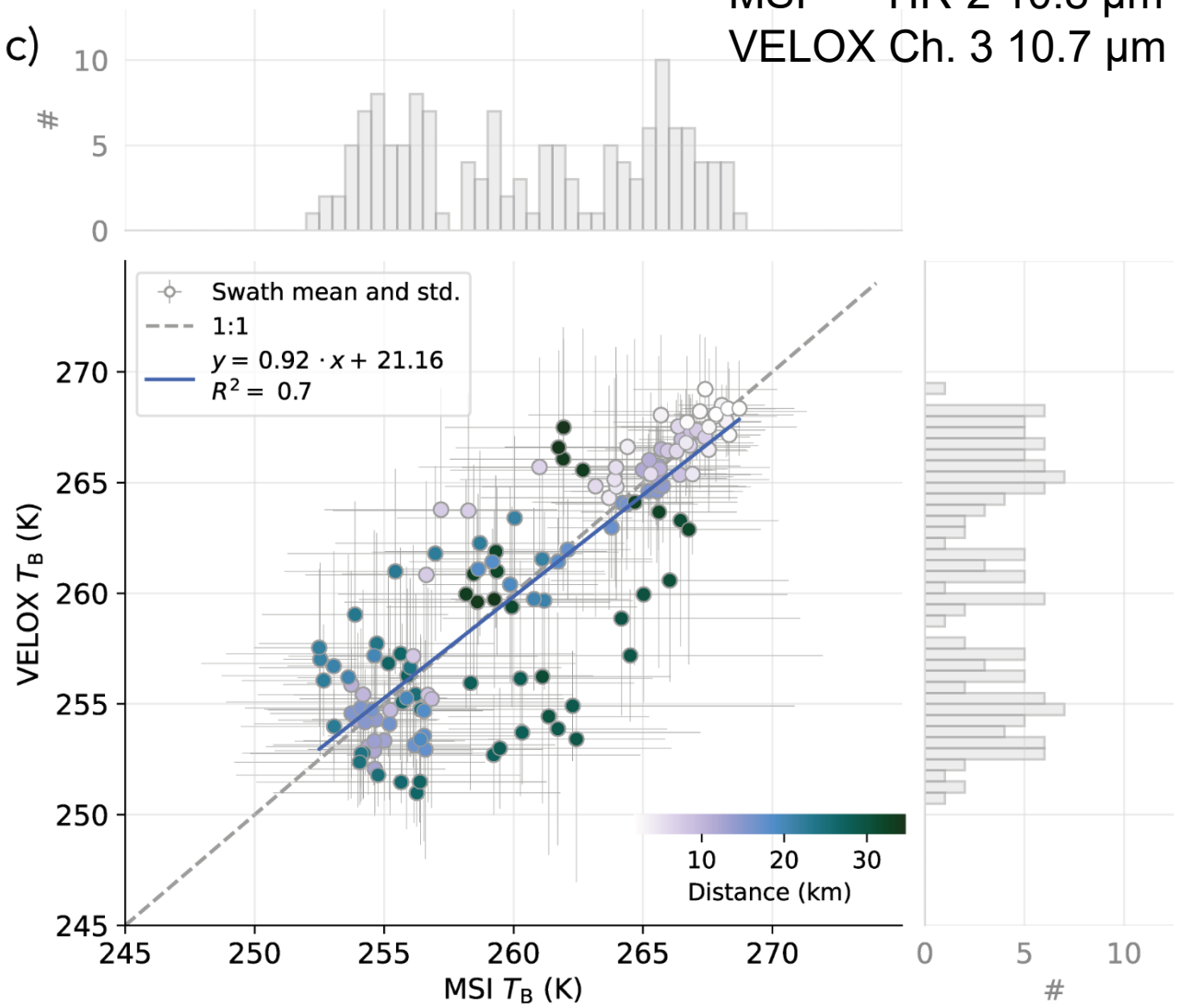
- Indication for water vapor and ozone absorption
- Differences do not exceed measurement uncertainties

VELOX vs. MSI

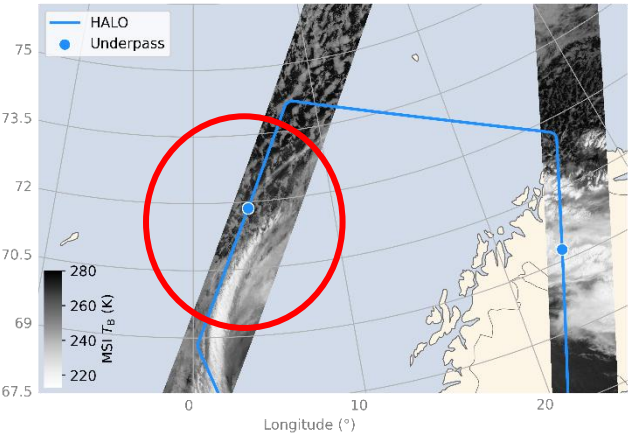
16. November 2024
Orbit 02671C
Baseline BA







BACARDI vs. BBR



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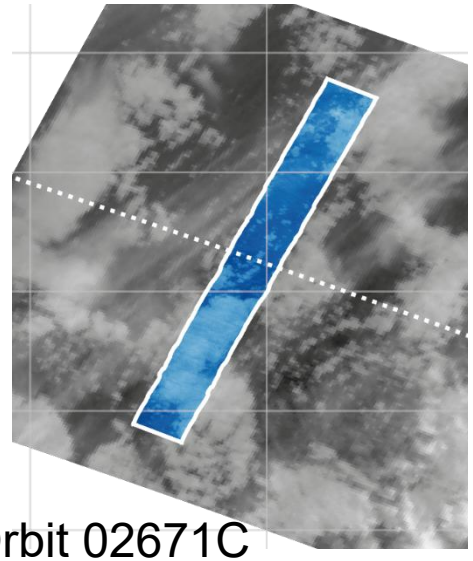

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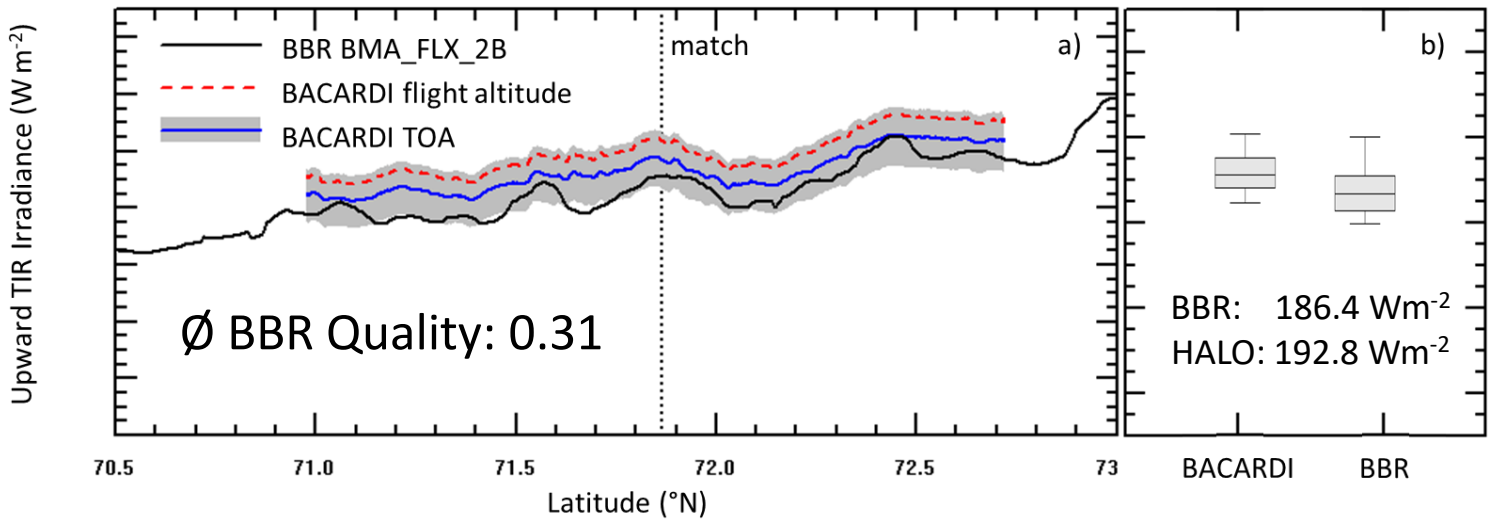
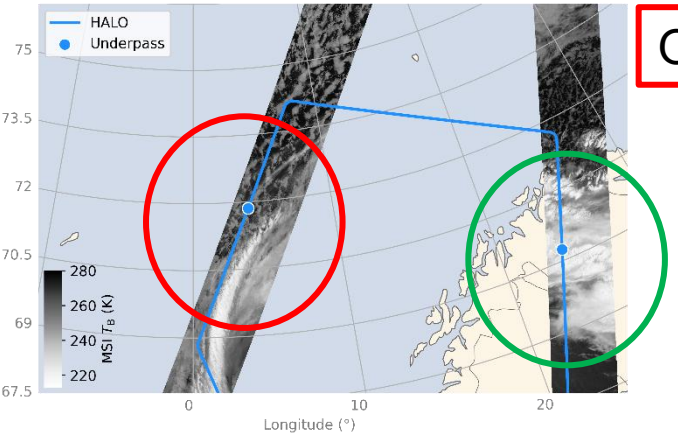


Different variability → Field of view (FOV)

BACARDI: – FOV depends on cloud altitude
– High clouds = smaller footprint (1 km above = 6 km)
– Surface = larger footprint (14 km = 80 km)

BACARDI vs. BBR



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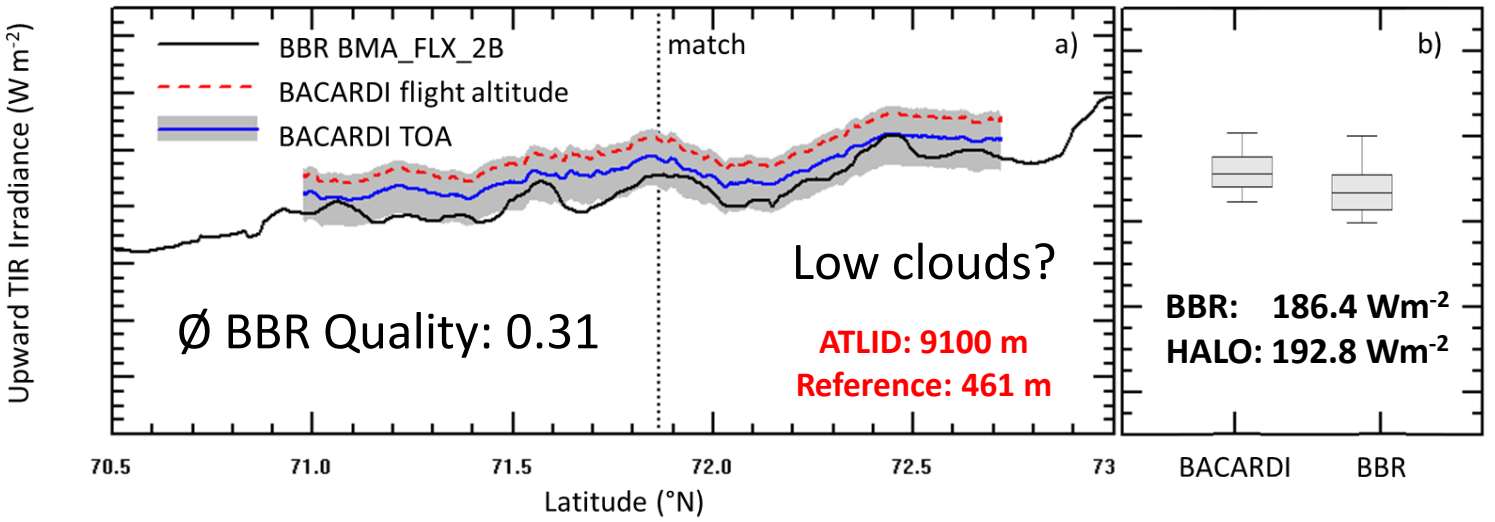
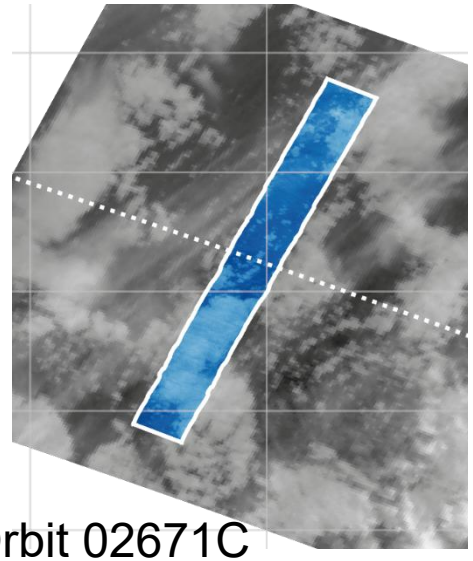
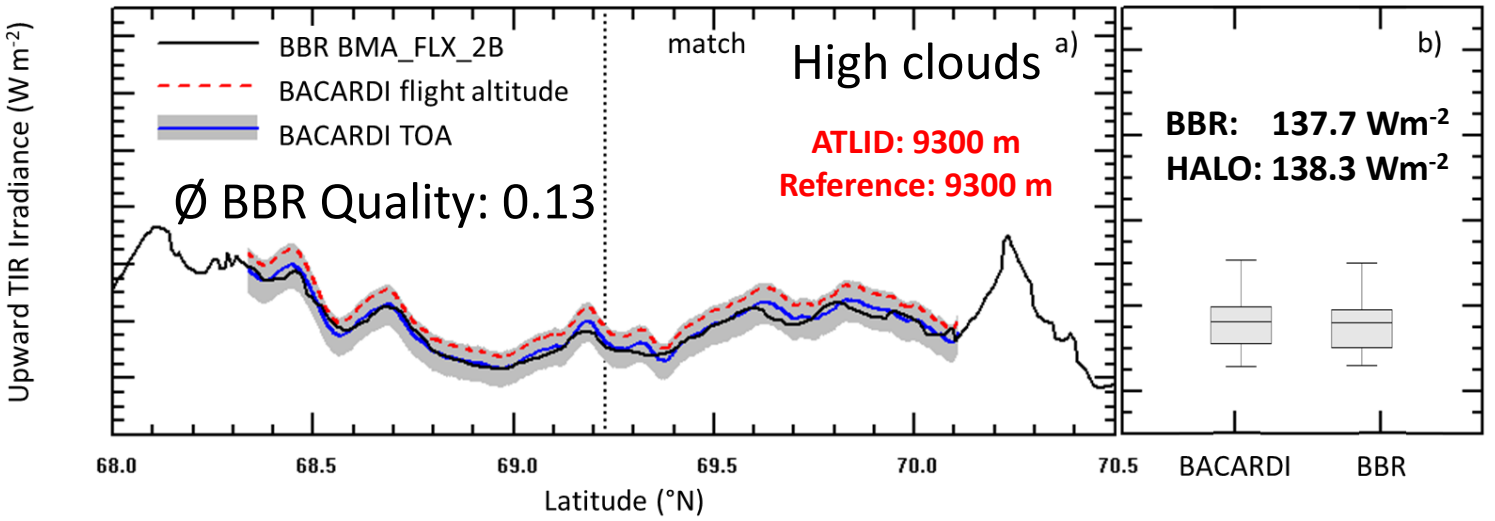


16. November 2024
Baseline BA

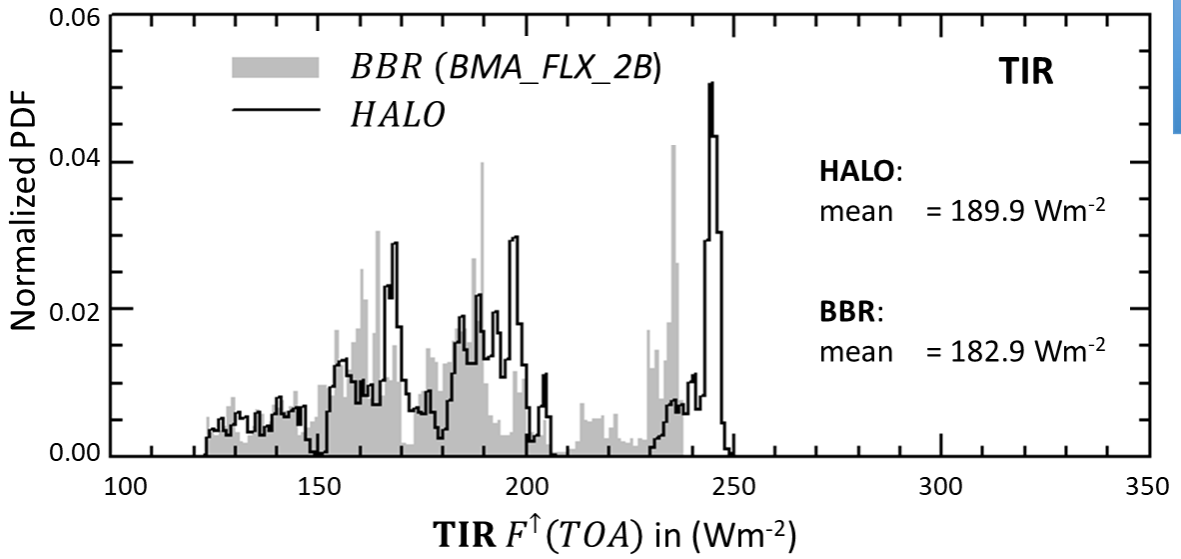
Orbit 02670C



Orbit 02671C



BACARDI vs. BBR



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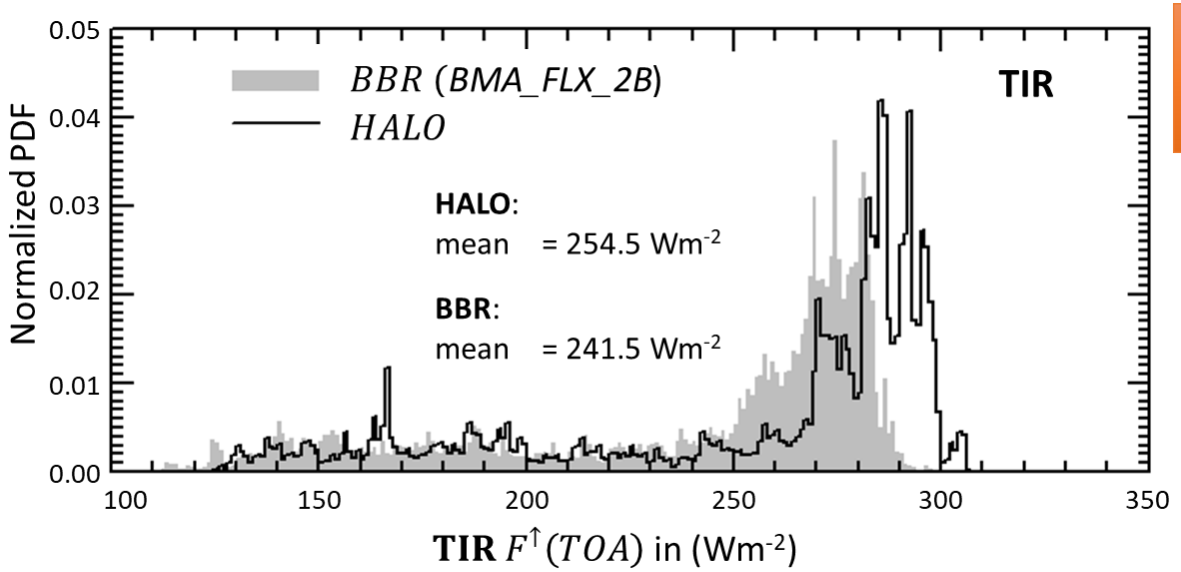

TROPICS
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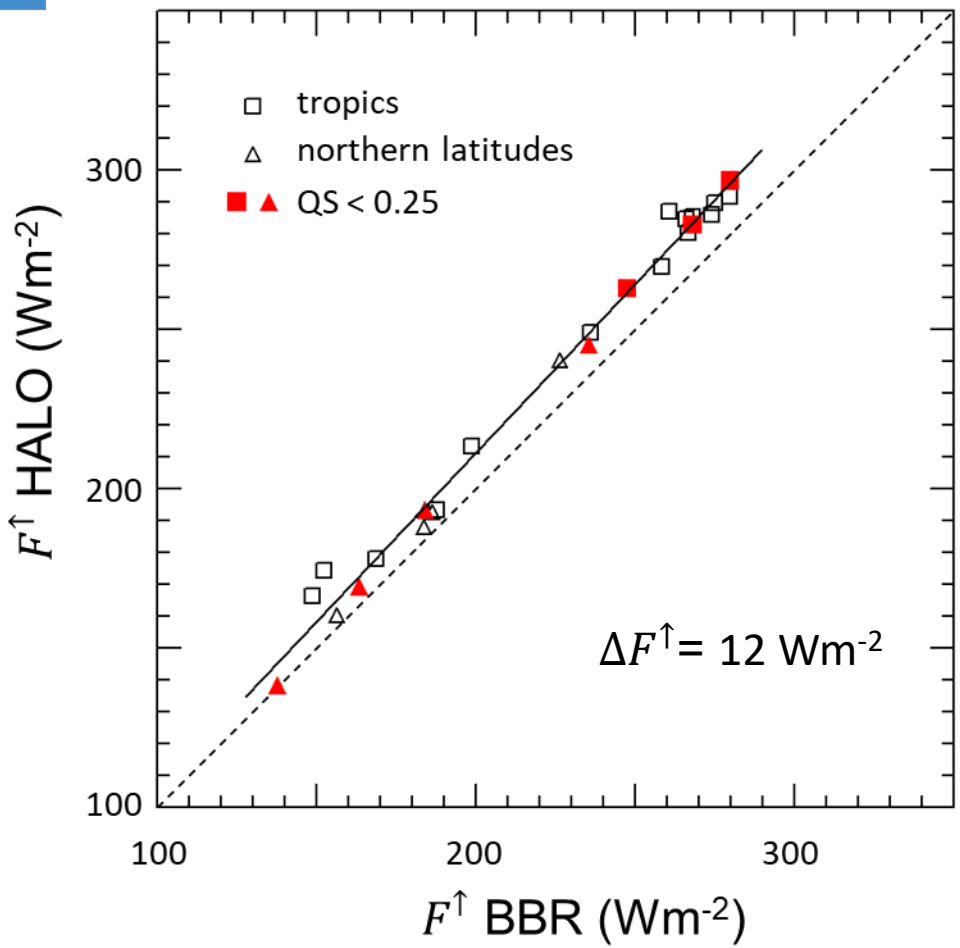

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