GEMS L1B Status and Update

Myoung-Hwan (MH) Ahn[1], Mina Kang[1], Mijin Eo[1], Yeeun Lee[1], Kyung-Jung Moon[2], Dai Ho Ko[3], Jhoon Kim[4], Dongwon Lee[2]

Ewha Womans University[1], National Institute of Environmental Research[2], Korea Aerospace Research Institute[3], Yonsei University[4]
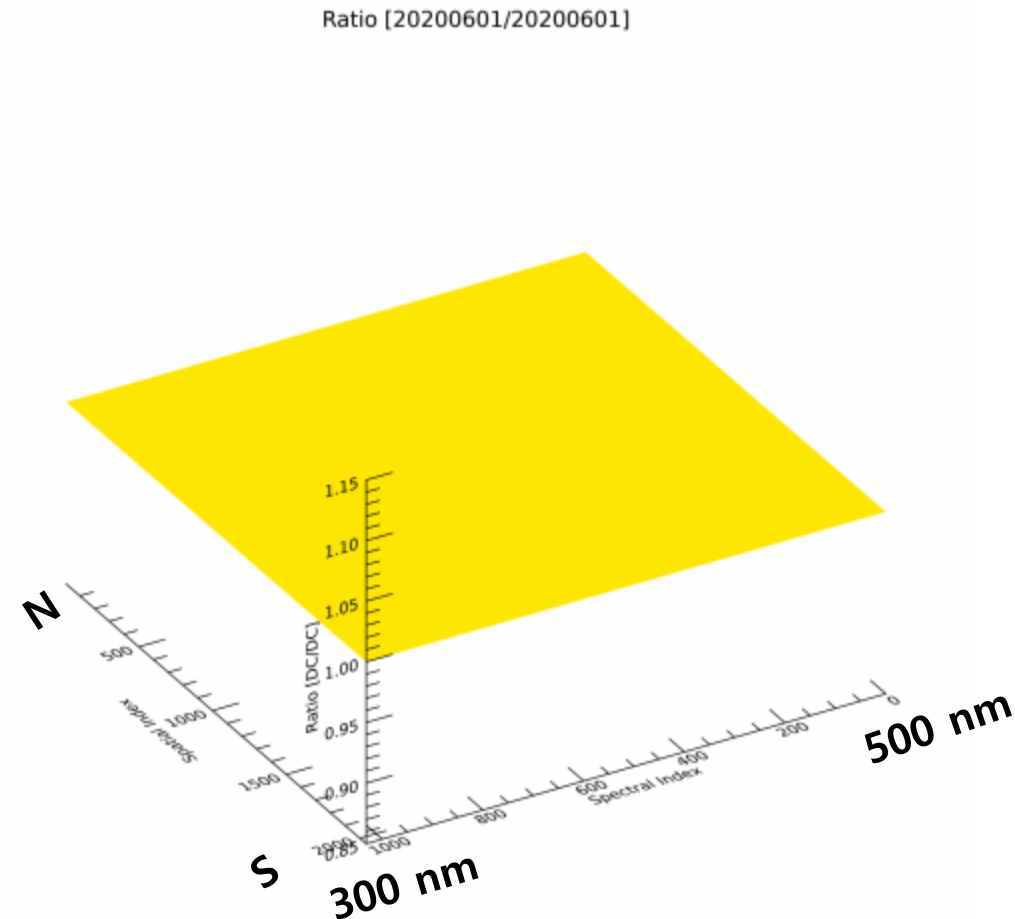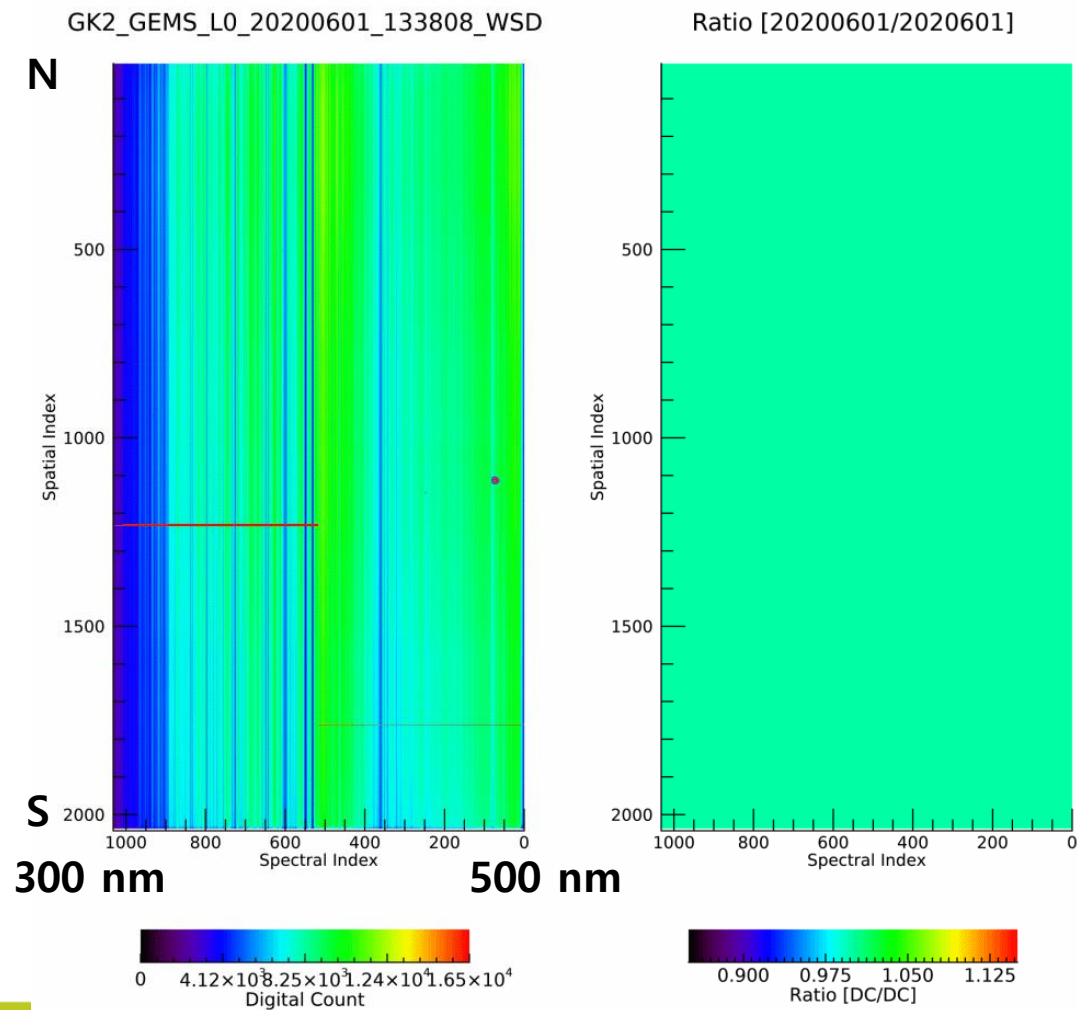
23.06.21

Contents

❖**GEMS L1B update issues**

❖**BTDF update**

❖**Near term activities**

❖**Summary**

Radiometric characteristics

❖ **Daily variation of the L0 digital counts**

Radiometric characteristics

❖**Radiometric calibration does not remove L0 issue**

- Even the L1 irradiance shows a clear spatio-spectral variation
- The oscillating feature is in synchronous with temporal variation of solar azimuthal angle at the solar Cal measurement
- The least variations are shown at nadir and the spring/autumn equinox (when the solar geometry is close to that of conditions used for the ground diffuser BTDF characterization)
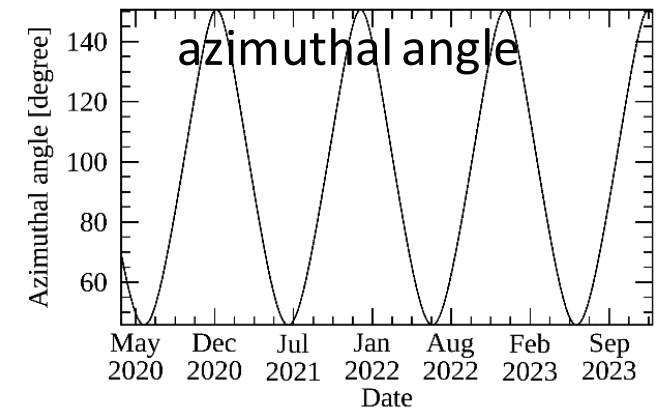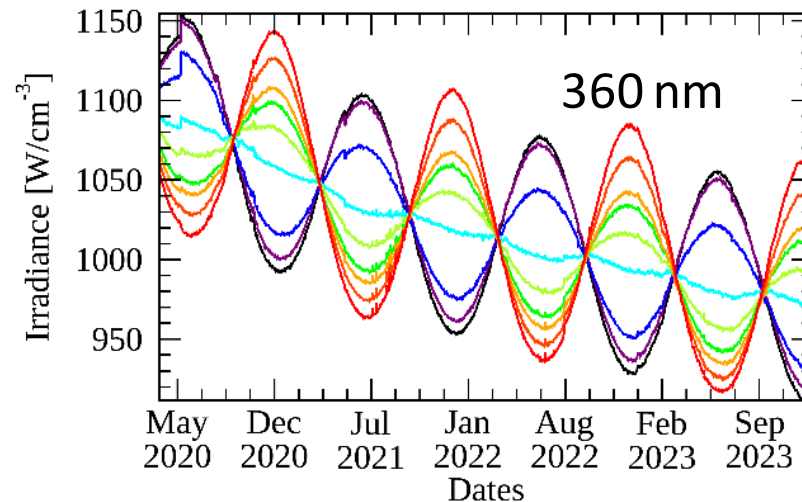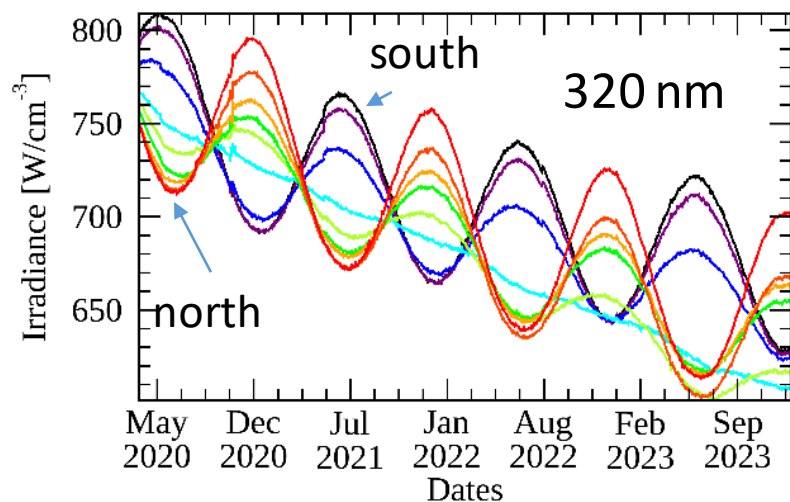
BTDF Correction

❖**Empirical correction of geometry dependence of BTDF**

- Using the nadir measurement, azimuthal dependence is isolated in the measured solar irradiance
- The 3rd order polynomial correction function as a function of azimuthal angle is derived (example for 480 nm)
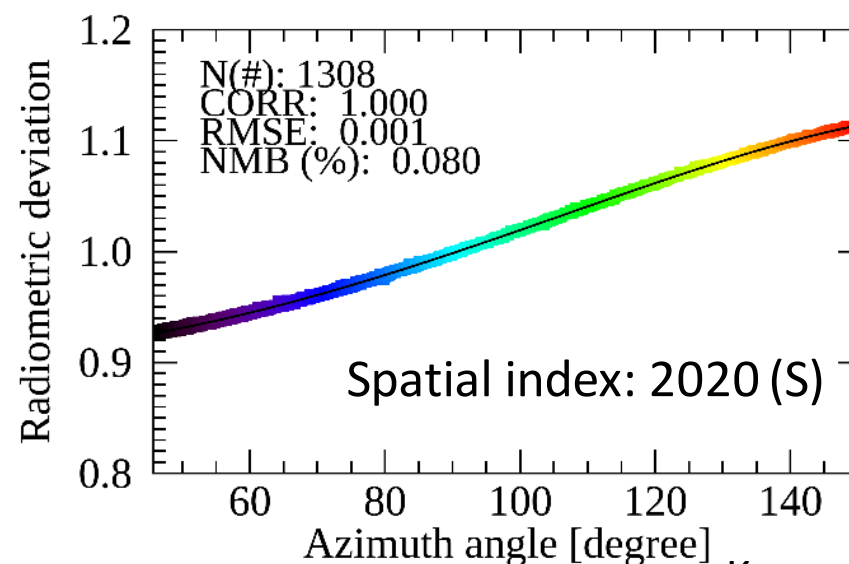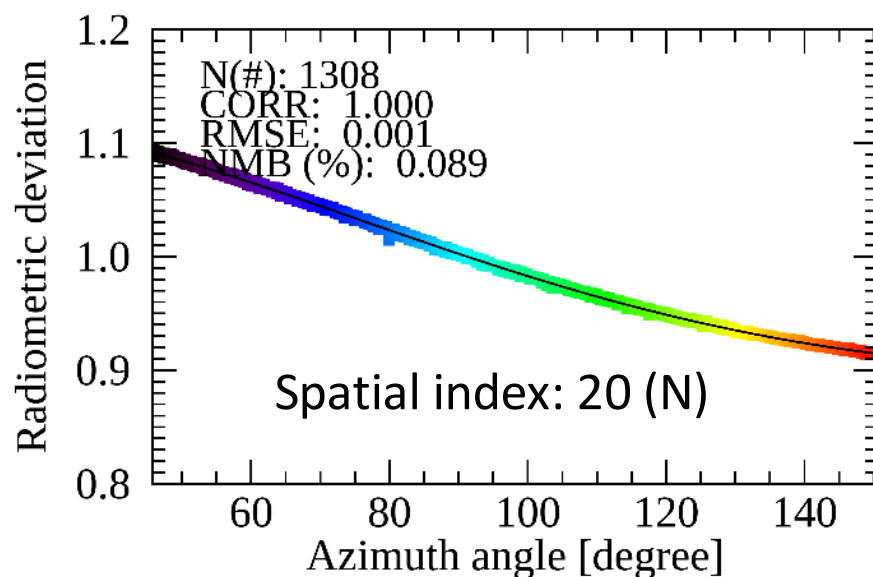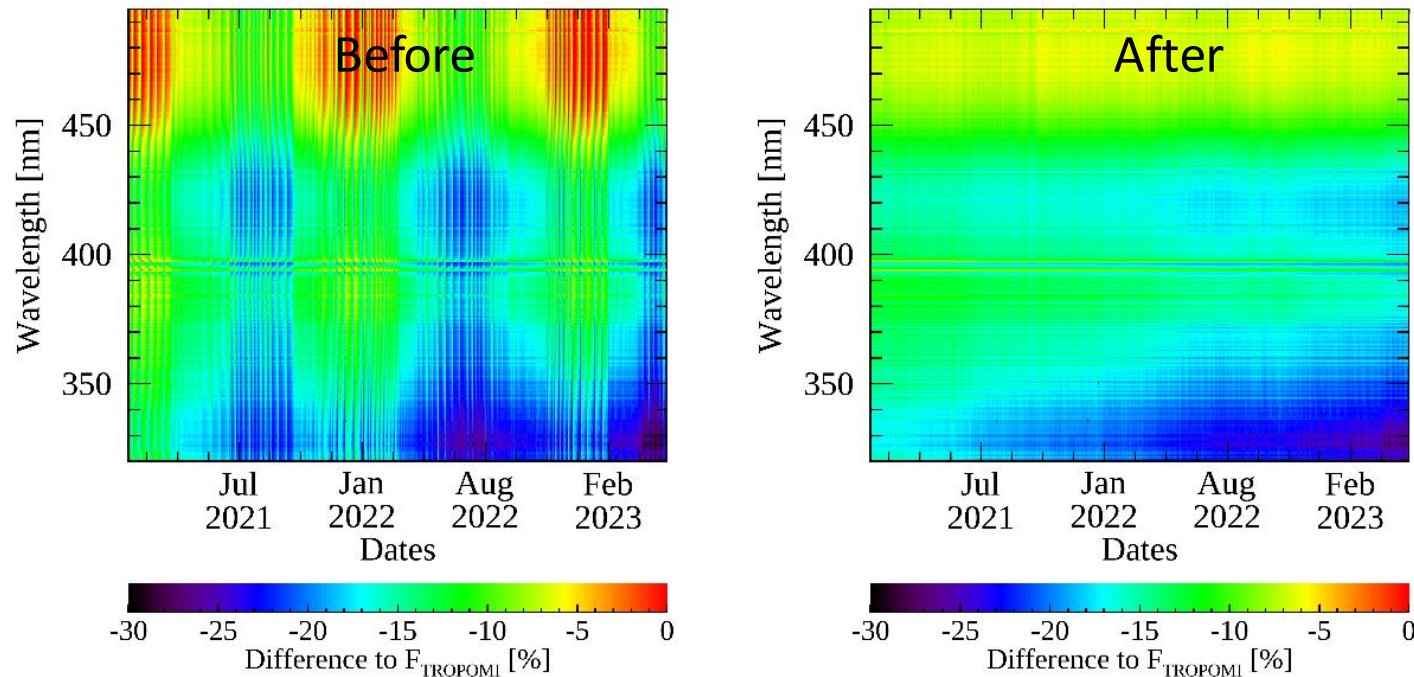

Kang et al. (TGRS submitted)

BTDF Correction

❖Validation

- Comparison with the TROPPOMI solar irradiance
  - ✓Disappeared spatio-temporal variation of the different pattern
  - ✓Difference in irradiance as a function of wavelength
  - ✓Increased discrepancy with time at the shorter wavelength (degradation issue)

BTDF Correction

❖**Validation**

- Time series of RSD (reference solar diffuser)

  ✓ Time series of infrequently used RSD clearly shows discontinuity when measurements are made summer and winter period (upper half panel)

  ✓ After the BTDF correction, such spatial and temporal variation are disappeared
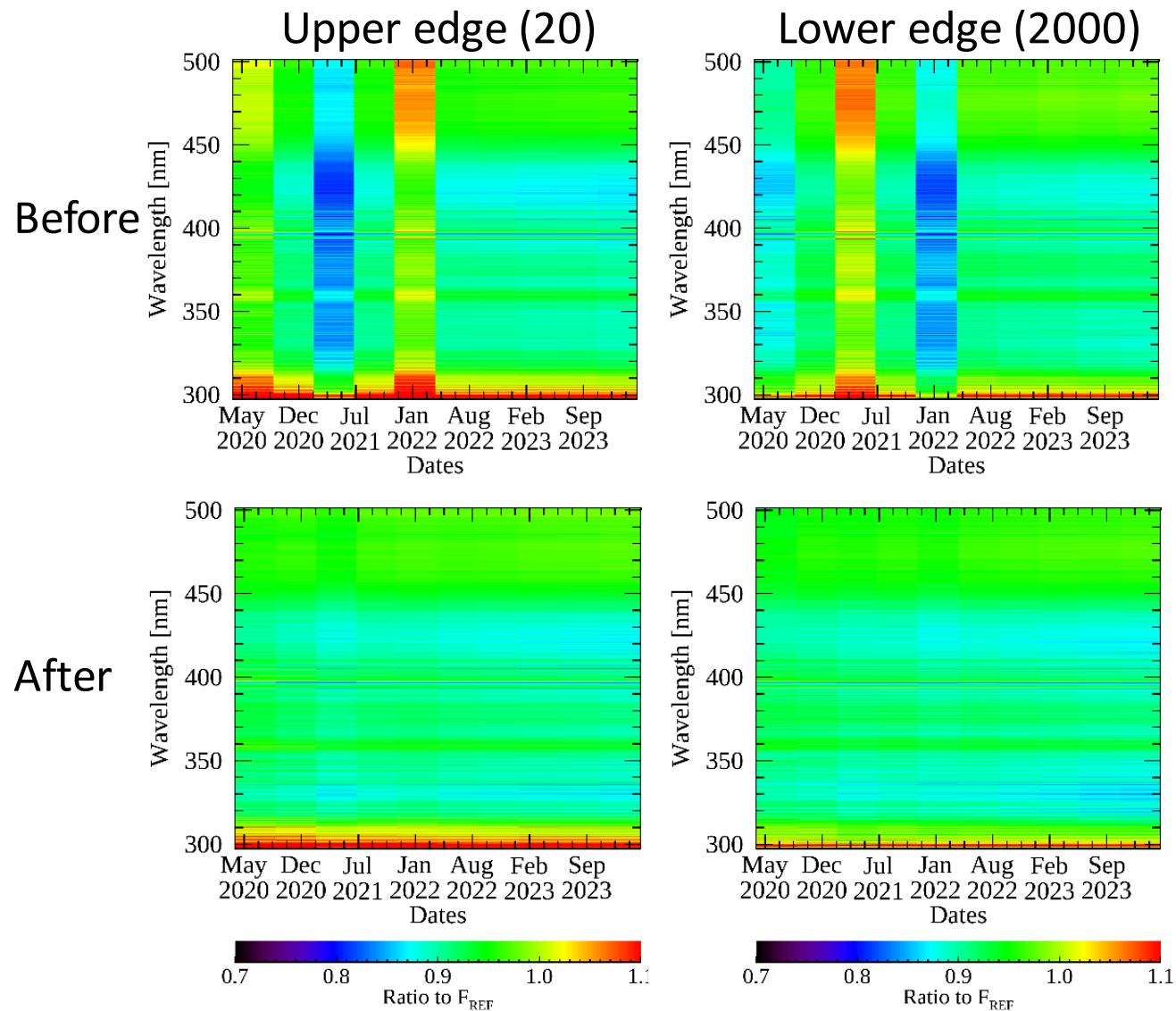
BTDF Correction

❖**Validation**

- Comparison with the GK2B/AMI data
  - ✓ Two co-located twin GEO satellites (within 0.05°)
  - ✓ One Vis Ch. of AMI overlaps with GEMS
  - ✓ Two data are collocated in terms of observation time, target, geometry as well as wavelength
  - ✓ No clear spatial dependency in the radiance data
  - ✓ However, in the reflectivity, clear N-S as well as the seasonal variations (Jan. vs. Jul.) before the correction (left column) are disappeared after the correction (right column)
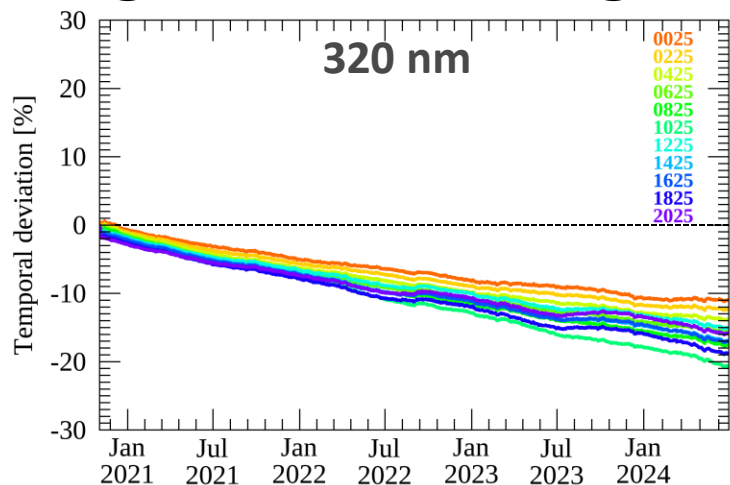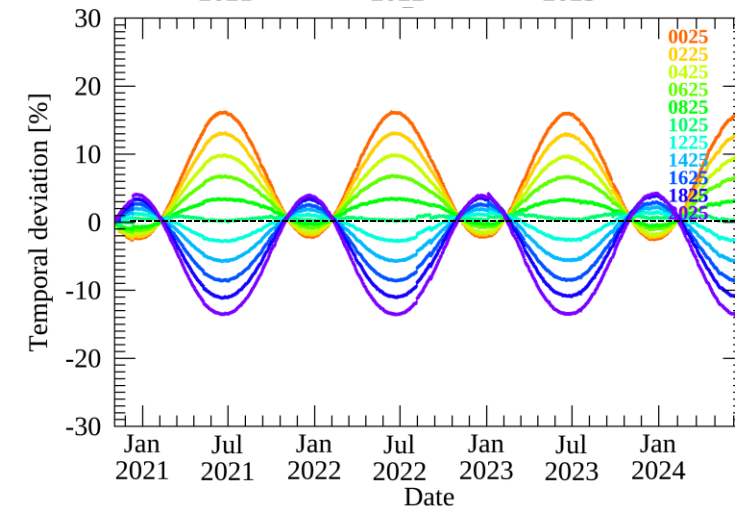

Before   After
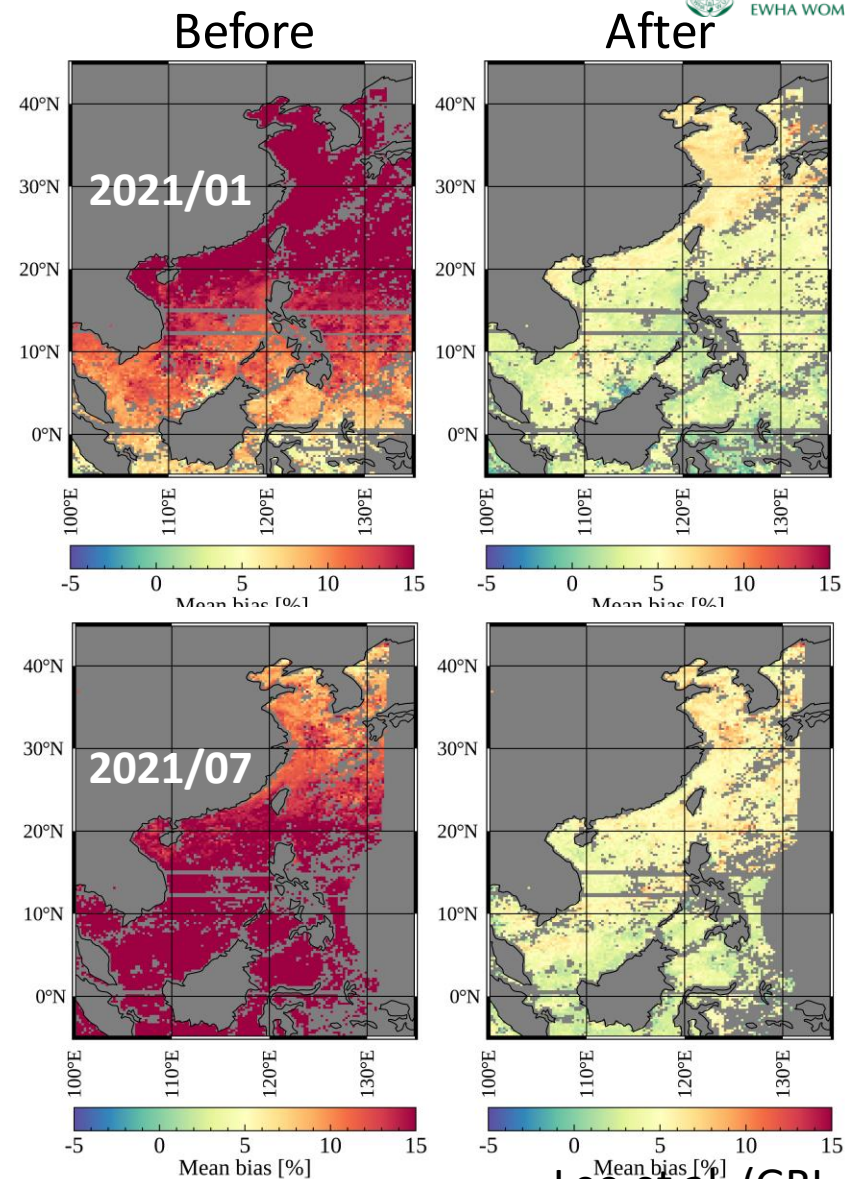
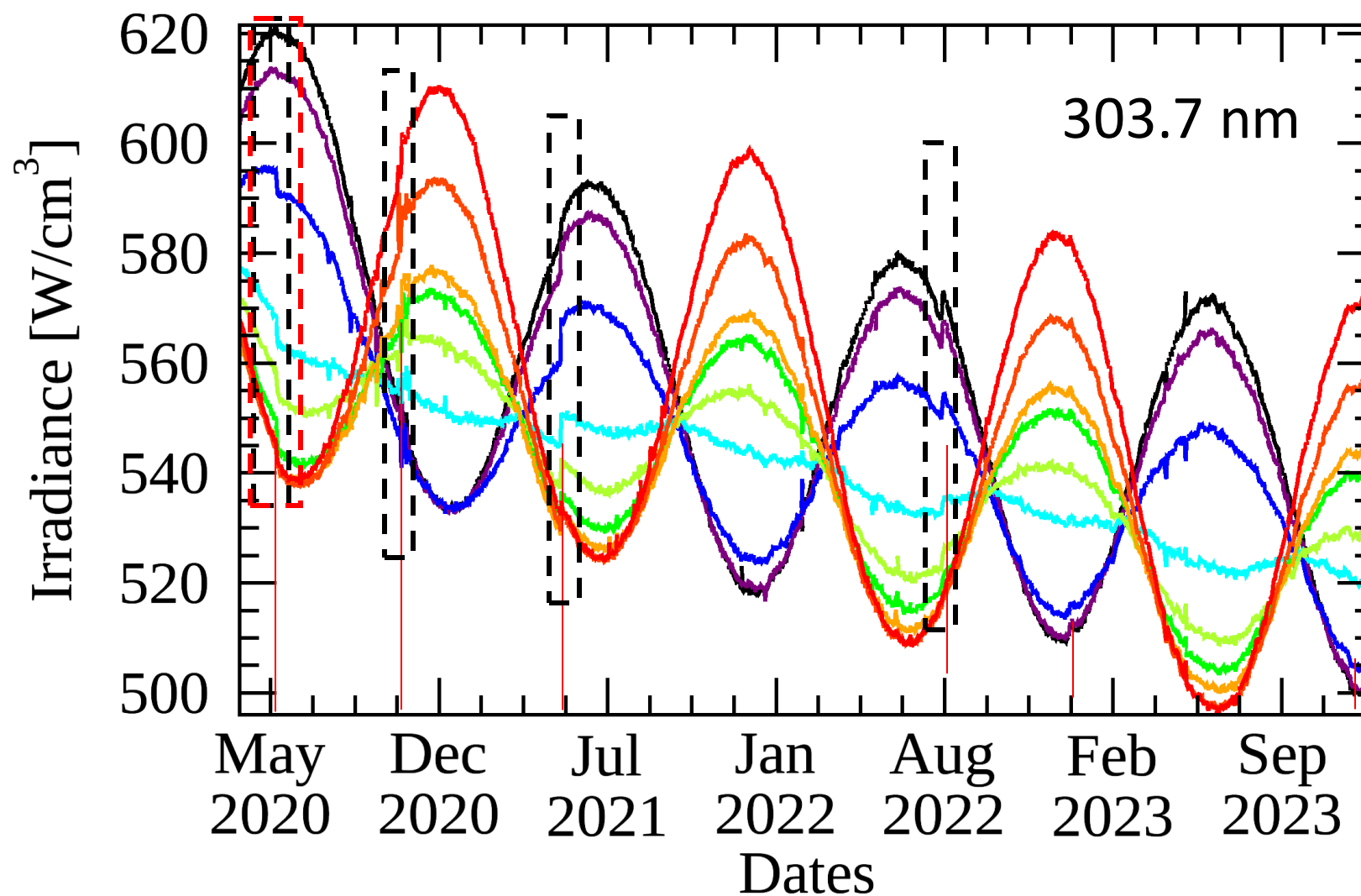Lee et al. (GRL 2024)

Near term activity

❖ **Mitigate diffuser degradation**

BTDF 2024 — 320 nm, 412 nm, 470 nm

NIER L1C — 320 nm, 412 nm, 470 nm
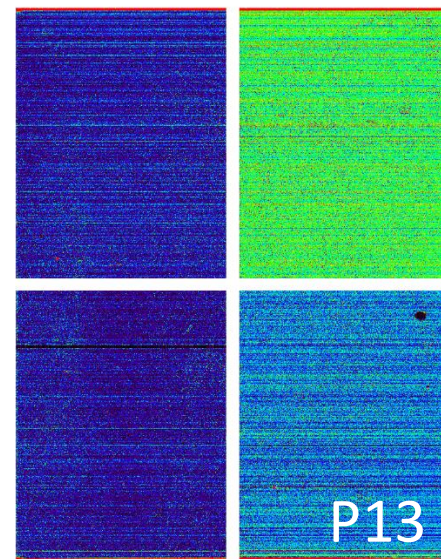
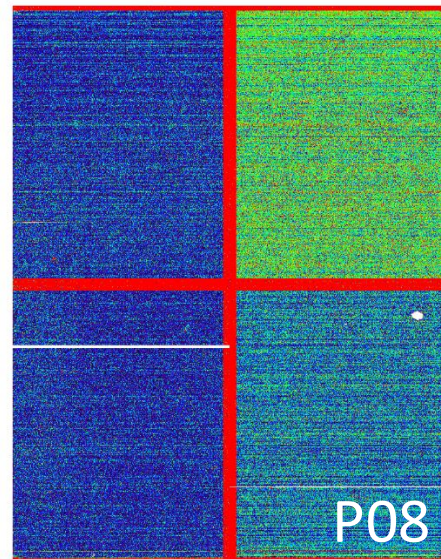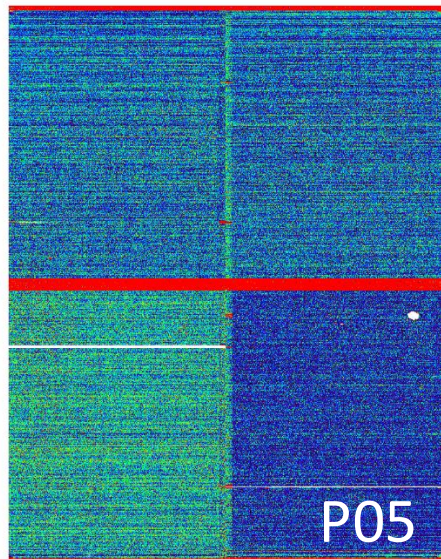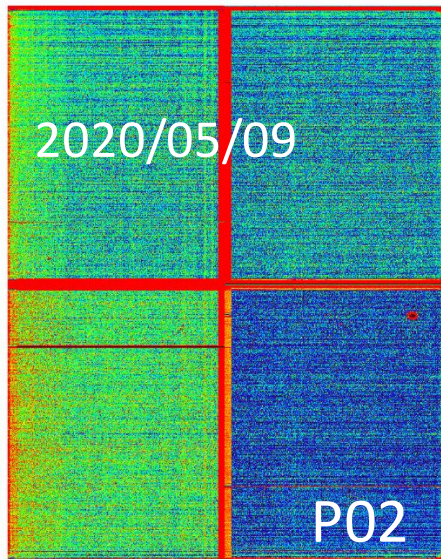# Near term activity

303.7 nm
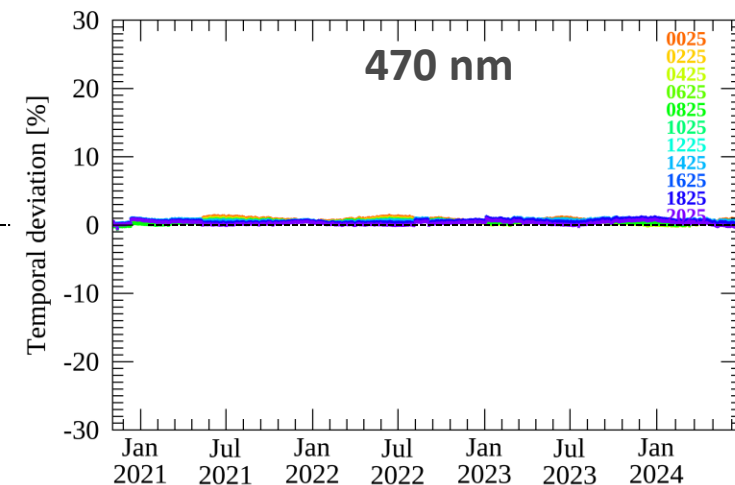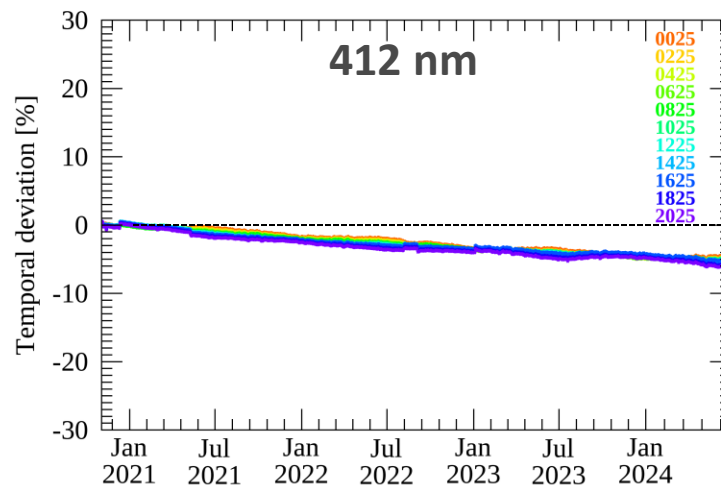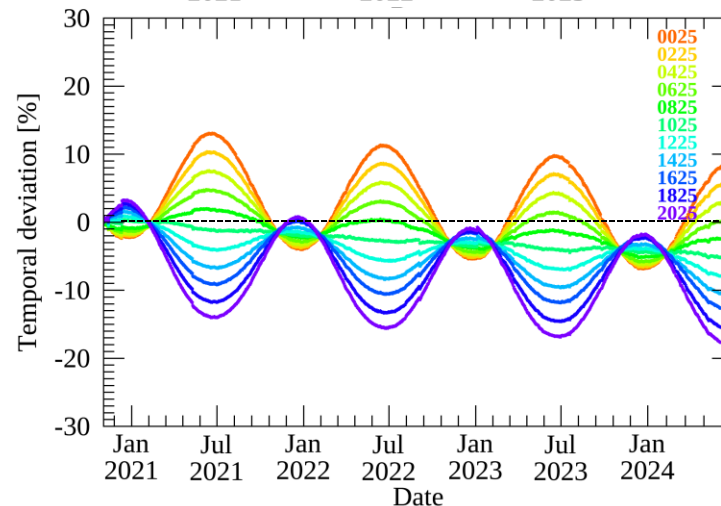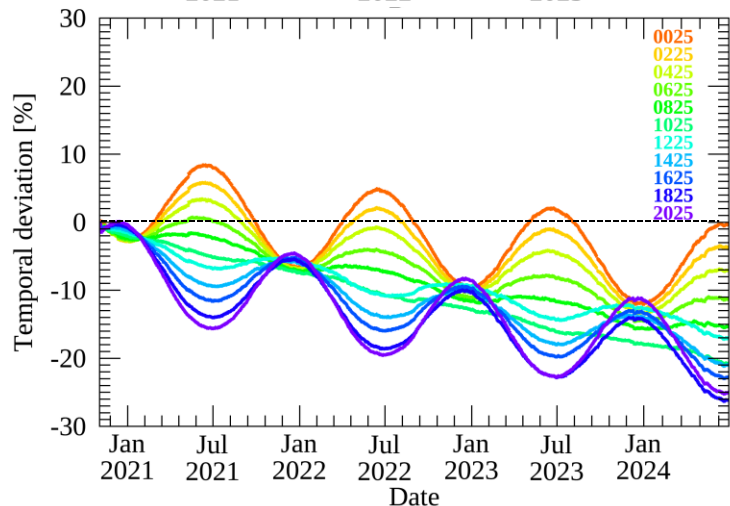
Diff btw odd and even_02_210509   Diff btw odd and even_05_210509   Diff btw odd and even_08_210509   Diff btw odd and even_13_210509   Diff btw odd and even_16_210509

2020/05/09   P02   P05   P08   P13   P16

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
difference(%)
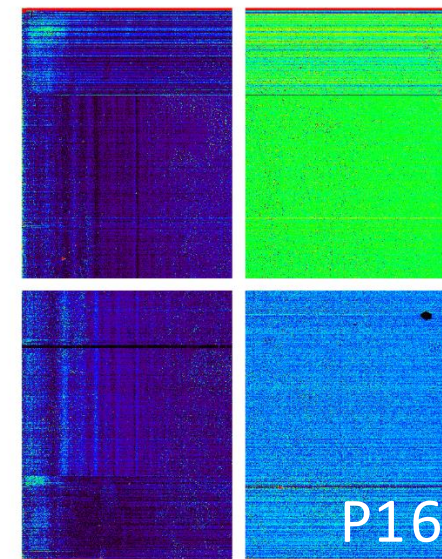
Diff btw odd and even_02_210510   Diff btw odd and even_05_210510   Diff btw odd and even_08_210510   Diff btw odd and even_13_210510   Diff btw odd and even_16_210510
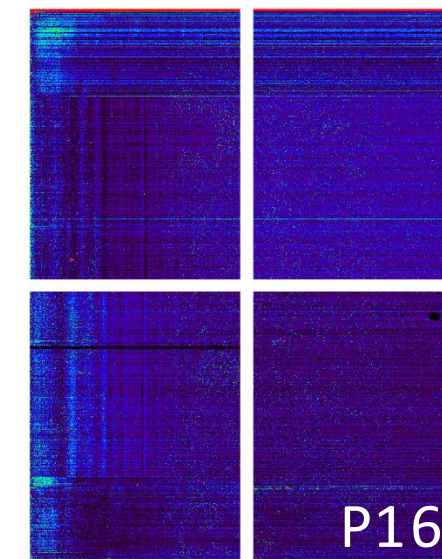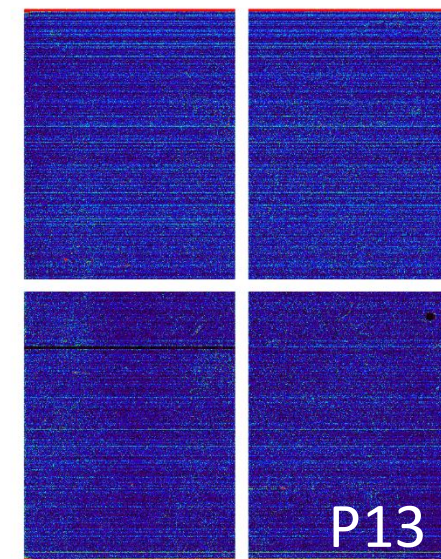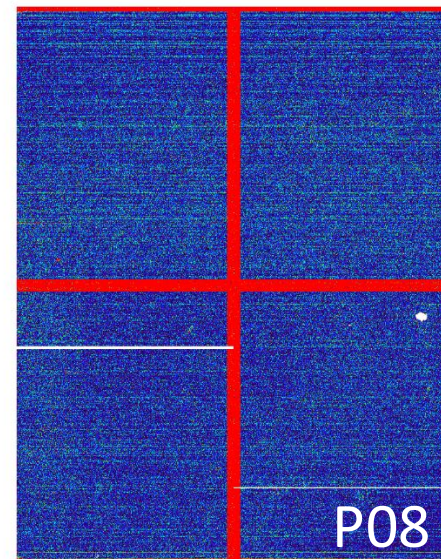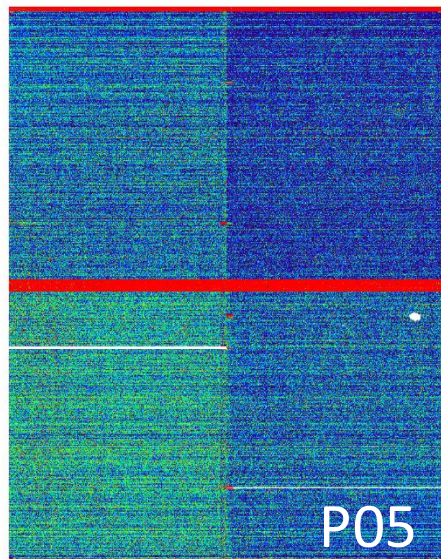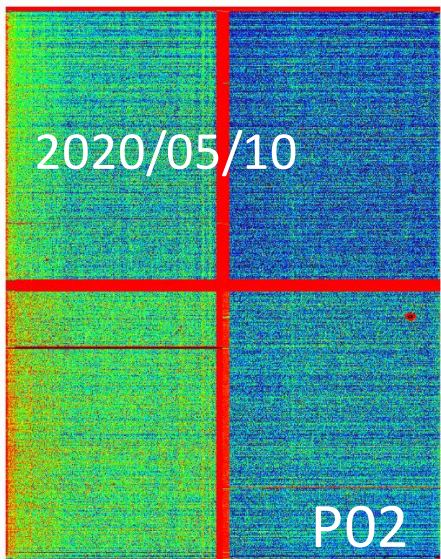
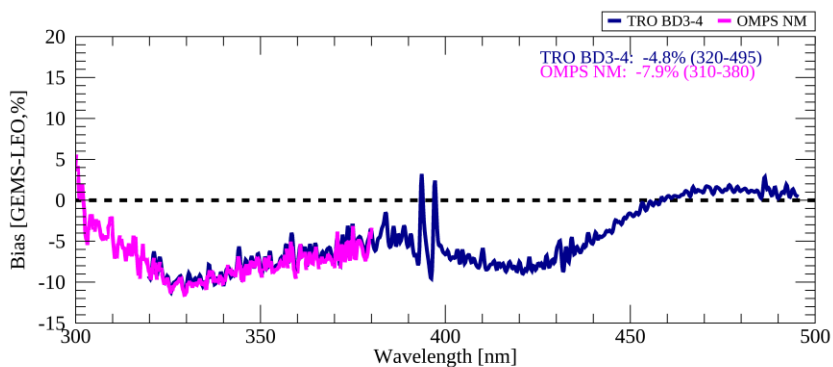2020/05/10   P02   P05   P08   P13   P16

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0
difference(%)
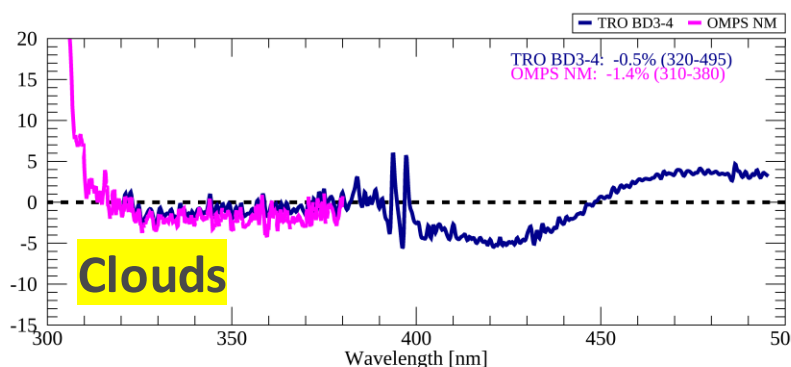
EWHA

Near term activity

❖**Update of absolute radiometric calibration**
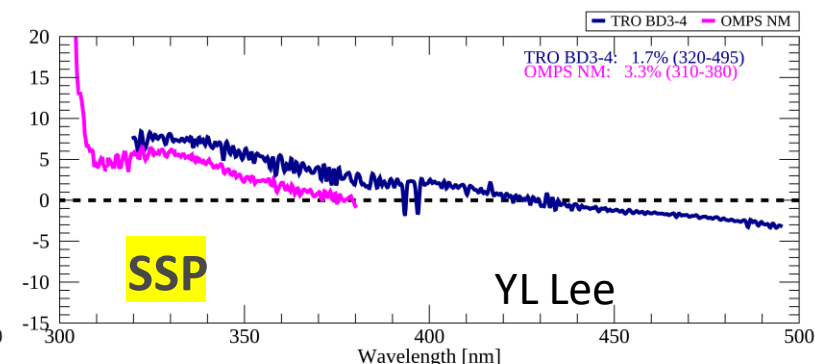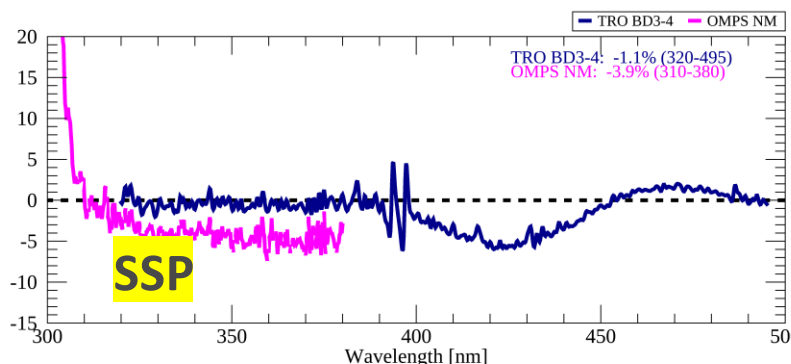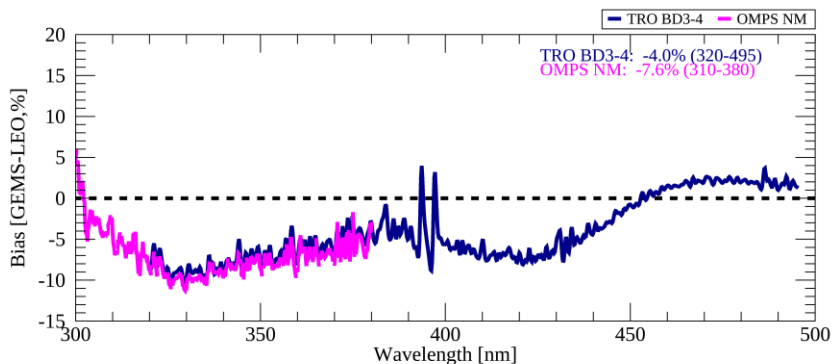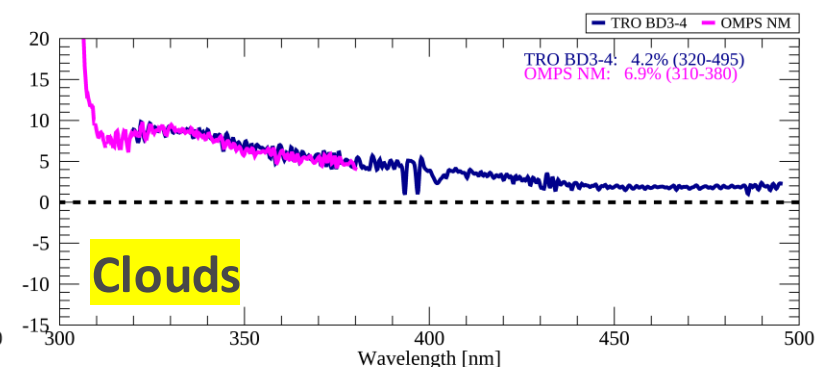- TROPOMI (2021.01-2021.12, 5 days) & OMPS (2021.01-2021.12, every day)

Irradiance | Radiance | Reflectance

Summary and future works

Issues	Level 1B Products			Effect	NIER L1C V2.0	EOSRL 2024
	IRR (F)	RAD (I)	REF (R)			
Diffuser N-S dependence	O	X	O (I/F)	Systematic bias along the N-S direction	+	Reduced (<2%, REF)
Diffuser BTDF	O	X	O (I/F)	Negative bias in IRR	+	10%↑
Diffuser degradation	O	X	O (I/F)	Higher degradation in ~300 nm	+	+
Optics degradation	O	O	X	Systematic decrease in overall signal	+	+
Radiometric cal. coefficient	O	O	X	Systematic bias depending on WV	+	+
Stripping pattern	O	O	X	Artificial patterns (~2%)	+	+
Stray light	-	O	O	Higher signals @~300 nm	+	In process
Discontinuity	O	?	?	Bias, stripping	+	In process

Thank you