Report on the GSICS UV/Vis/NIR Spectrometer Session and Plans for the Coming Year

L. Flynn (NOAA Lawrence.E.Flynn@noaa.gov),
R. Lindstrot (EUMETSAT Rasmus.Lindstrot@eumetsat.int),
and Yuan Li (CMA LiYuan@cma.gov.cn)

3 June 2026

4.9 10:25CET 10 minutes

https://gsicsweb.eumetsat.int/web-joint-working-group-meetings-users-workshops/

Disclaimer

"The contents of this presentation are those of the authors and do not necessarily reflect any position of the US Government or the National Oceanic and Atmospheric Administration.“

Discussion Topics at the GSICS Meeting

- Solar Trending and Comparisons
  - Absolute Calibration (TSIS HSRS validated at 1% level)
    - https://lasp.colorado.edu/lisird/data/tsis1_hsrs_p1nm
  - Modelling – solar activity, wavelength shifts, diffuser degradation, throughput degradation
    - Time dependent components can be attributed/explained/estimated at the 0.1% level.
  - Intercomparisons (Mission Time Series – See Survey on Slide 5.)
- Radiance Trending and Comparisons
  - Deep Convective Clouds (DCC)
  - Simultaneous Nadir Overpass (SNO)
  - Ice, Deserts, tropical forests
  - Equatorial Pacific open Ocean
  - Radiative Transfer over dedicated sites (PICS, RadCalNet)
- Level 2 products (Effective Reflectivity, Aerosol Indices, O3, Other trace gases)
  - Deep Convective Clouds (DCC) (effective reflectivity & its wavelength dependence)
  - Simultaneous Nadir Overpass (SNO)
  - Ice, Deserts
  - Equatorial Pacific Ocean

Planned 2026 UVN-Spectrometer Subgroup Activities

- GHG Missions quarterly meetings:
  - OCO-TROPOMI-GOSAT-TEMPO Calibration Team meetings organized by JAXA
  - Latest meeting was held: 12-13UTC, Friday, May 22, 2026
  - Contact Kei Shiomi shiomi.kei@jaxa.jp for information on joining the Team.
- Potential UVN-S Topical Quarterly Meetings (5th Thursday of the month)
  - Solar inter-comparisons and comparisons to TSIS-1 HSRS Version 2.
  - Matchup Inter-comparisons for LEO/GEO, LEO/GEO/Lagrange-1, LEO/LEO (SNO)
    - Geostationary – GEMS, TEMPO and Sentinel 4 UVN
    - Do we have stable instruments to use as long-term transfer standards?
  - Use of Targets and Statistical approaches for reflectivity channels
    - Ice Radiances, Open Ocean, Land (PICS, etc.), Deep Convective Clouds
    - Comparisons of surface reflectivity databases
  - UV Ozone Profiler homogenization methods for Climate Data Records
  - Discussion of Radiative Transfer Model strengths and weaknesses
    - Can we make a recommendation?
- Proposal for NO_2 Retrieval Algorithm Round-Robin (TropoMI Day?)

Quick Survey of Solar Time Series

- NASA NOAA LASP Solar Spectral Irradiance 1 High Resolution (NNLSSI1h) https://lasp.colorado.edu/lisird/data/nrl2_ssi_high_res
- OMI Solar Spectral Irradiance https://lasp.colorado.edu/lisird/data/omi_ssi
- GOME-2 Level 1B Fundamental Data Record Release 3 - Metop-A and –B https://user.eumetsat.int/catalogue/EO:EUM:DAT:0533
- Sentinel-5P TROPOMI Irradiance product UVN module L1B V3 (S5P_L1B_IR_UVN) at GES DISC https://cmr.earthdata.nasa.gov/search/concepts/C3882784324-GES_DISC.html
- SCIAMACHY solar irradiance timeseries https://www.iup.uni-bremen.de/UVSAT/data/solartimeseries/
- TEMPO Version 4 (Does not currently adjust for degradation.) https://asdc.larc.nasa.gov/project/TEMPO/TEMPO_IRR_L1_V04
- OMPS NM and NP Biweekly Solar (No release found)

Overview of presentations

14 talks with over 50 attendees covering most of the operational UV/Vis/NIR spectrometers. The backup material has one-slide summaries of each talk. Full presentations are available at https://wmoomm.sharepoint.com/:f:/s/Collaboration/IgCfehG8zFDTS7dKgRKJp6WbAWMB1gxmyQeERSoi7PQgmI4?e=QHAObo

Topic	Presenter
8 years TROPOMI: Long-term instrument degradation: derivation, validation and lessons learned	Erwin Loots KNMI
GOME-2 in-orbit performance, including end-of-life activities	Rasmus Lindstrot Eumetsat
Sentinel-4 and Sentinel-5 status in the first year after launch	Rasmus Lindstrot Eumetsat
Calibration of the NOAA-20 OMPS instrument for NASA products	Bradford Fisher NASA/STC
V8TOz as a transfer of radiometric calibration	Lawrence Flynn NOAA
Improving Mission-Long Quality Stability of SNPP OMPS NP SDR Data through Solar Activity and Optical Throughput Degradation Adjustments	Steven Buckner NOAA/ERT
Vicarious calibration at Railroad Valley for the operating MISR and upcoming MAIA missions	Graziela Keller Rodrigues NASA
The OCO-2/3 Radiometric Puzzle	Rob Rosenberg NASA

Topic	Presenter
Calibration status of GOSAT and GOSAT-2	Kei Shiomi JAXA
GEMS Status and Calibration Update	Changsuk Lee NIER
Research on the Non-Uniformity Correction Method for FY-3F OMS-N	Jinghua Mao NSSC/CAS
On-Orbit Performance Algorithm Optimization and Global Calibration Consistency Verification of the OMS-L Instrument	Yuan Li NSMC/CMA
On-orbit stripe correction and degradation monitoring and correction for the EMI instrument	Fuqi Si CAS/AIOFM
TEMPO Version 4 Level 1 Products	Heesung Chong SAO

Day 1: 23-Mar-2026 VIS/NIR + Lunar Breakout Session (i) - AUDITORIUM					
Session Chair: Dave Doelling					
Minute Taker: W. Wang					
Meeting Link:	https://teams.microsoft.com/meet/3184732366424?p=5o6Jmo3cl47rzLI1cm				
Presentations:					
Time (EDT)	**Topic**	**Presenter**			
13:30	Investigation into Improving AHI Radiometric Performance Monitoring by Ray-matching Inter-calibration	Tsuguyoshi Toma	2a	In Person	
13:50	Ray-Matching for Calibration Monitoring of MTG-I1 FCI VNIR Channels: An Initial Assessment	Vincent Debaecker	2b	In Person	
14:10	Desert Calibration and Intercalibration: State-of-the-Art Methods and Challenges	Ali Mousivand	2c	In Person	
14:30	Validation of GOES-19 ABI Solar Calibration Performance Using GSICS Approaches	Fangfang Yu	2d	Virtual	
14:50	ABI Solar Channel Pre-Launch Characterization Error and Correction	Fred Wu	2e	Virtual	
15:10	Radiometric Calibration Performance of the VNIR Channels of EUMETSAT Optical Missions	Ali Mousivand	2f	In Person	
15:30	**Break**				
15:50	DCC inflection point statistic and SWIR band empirical BRDFs	David Doelling	2g	Virtual	
16:10	Improving the Deep Convective Cloud (DCC) Method for VIIRS using AI/ML based BRDF Models	Wenhui Wang	2h	Virtual	
16:30	Achieving aerosol retrieval consistency across 3 VIIRS sensors	Rob Levy	2i	Virtual	
16:50	Long-Term Monitoring of AMI VIS/NIR Radiometric Performance and Initial Results from AMI–AHI Inter-Comparison	Hanbyul Lee	2j	Virtual	
17:10	On-orbit radiometric assessment of FY-3G/HAOC and intercalibration utilization for other sensors	Xiuqing Hu	2k	Virtual	

17:30	Initial Radiometric Performance Assessment of FY-3H MERSI-III from In-Orbit Testing	Ling Wang	2l	Virtual	
17:50	discussion		2m	Virtual	
18:10	**End of Day 1**				
18:30	**bus departure to Ice breaker**				

Day 2: 24-Mar-26 VIS/NIR + Lunar Breakout Session (ii) - AUDITORIUM					
Session Chair: Dave Doelling & Tom Stone					
Minute Taker: Shawn Shao					
Meeting Link:	https://teams.microsoft.com/meet/3184732366424?p=5o6Jmo3cl47rzLI1cm				
Presentations:					
Time (EDT)	**Topic**	**Presenter**			
8:00	The hyperspectral EnMAP and DESIS missions: status, processors, calibration and quality control	Martin Bachman	3a	Virtual	
8:20	Harmonization of SPOT-VGT1, SPOT-VGT2, and PROBA-V time series, including per-pixel uncertainty: status of the FDR4VGT project	Sindy Sterckx	3b	Virtual	
8:40	Copernicus Sentinel-2 calibration and inter-calibration activities	Valentina Boccia	3c	Virtual	
9:00	LUNAR SESSION				
9:00	Lunar Acquisitions to Support Inter-band and Inter-polariser calibration of 3MI	Bertrand Fougnie	3d	Virtual	
9:20	Overview of Sentinel-3 vicarious and lunar calibration results	Silvia Scifoni	3e	Virtual	
9:40	Break				
10:00	Monitoring radiometric calibration of satellite instruments using lunar radiance	Fred Wu	3f	Virtual	

10:20	Lunar calibration and status of the missions operated by EUMETSAT	Seb Wagner	3g	In Person	
10:40	Air-LUSI operational campaign 3 and lunar reference measurements	Kevin Turpie	3h	Virtual	
11:00	ARCSTONE mission update	Cindy Young	3i	Virtual	
11:20	Current status of the LIME	Carlos Toledano	3j	In Person	
11:40	LSICS development status and plans for release	Seb Wagner	3k	In Person	
12:00	**Lunch**				

Day 2: 24-Mar-2026 Mini Conference (last talk) - AUDITORIUM					
13:30	WildFireSat	Denis Dufour (CSA)			

Day 2: 24-Mar-26 IR Breakout Session (i) - AUDITORIUM					
Session Chair: Chengli Qi (CMA)					
Minute Taker: Likun Wang (UMD)					
Meeting Link:	https://teams.microsoft.com/meet/3184732366424?p=5o6Jmo3cI47rzLI1cm				
Presentations:					
Time (EDT)	**Topic**	**Presenter**	**Item**		
14:00	Session Introduction	Chengli QI (CMA)	5a	In person	
14:10	FY-3E/HIRAS and FY-4B/GIIRS radiometric and spectral performances analysis using IASI	Dorothee Coppens (EUMETSAT)	5b	In person	
14:40	On orbit performance assessment of HIRAS-II onboard FY-3H satellite	Junwei Wang (CMA)	5c	In person	
15:00	Radiometric Calibration Performance of the IR Channels of EUMETSAT Optical Missions	Ali Mousivand (EUMETSAT)	5d	In person	

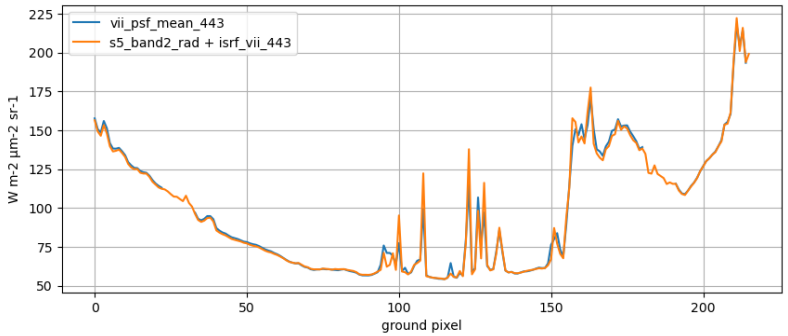
Backup

Proposed Golden Day from TropoMI Version 3 processing – August 2, 2023

- https://search.earthdata.nasa.gov/search?q=S5P_L1B_RA_BD2_1
- https://www.earthdata.nasa.gov/data/catalog/ges-disc-s5p-l1b-ir-uvn-3
  - This is NRT processing. Where are the Version 3 reprocessed records.
  - Should we use something from 2026 as there are more Pandora stations?

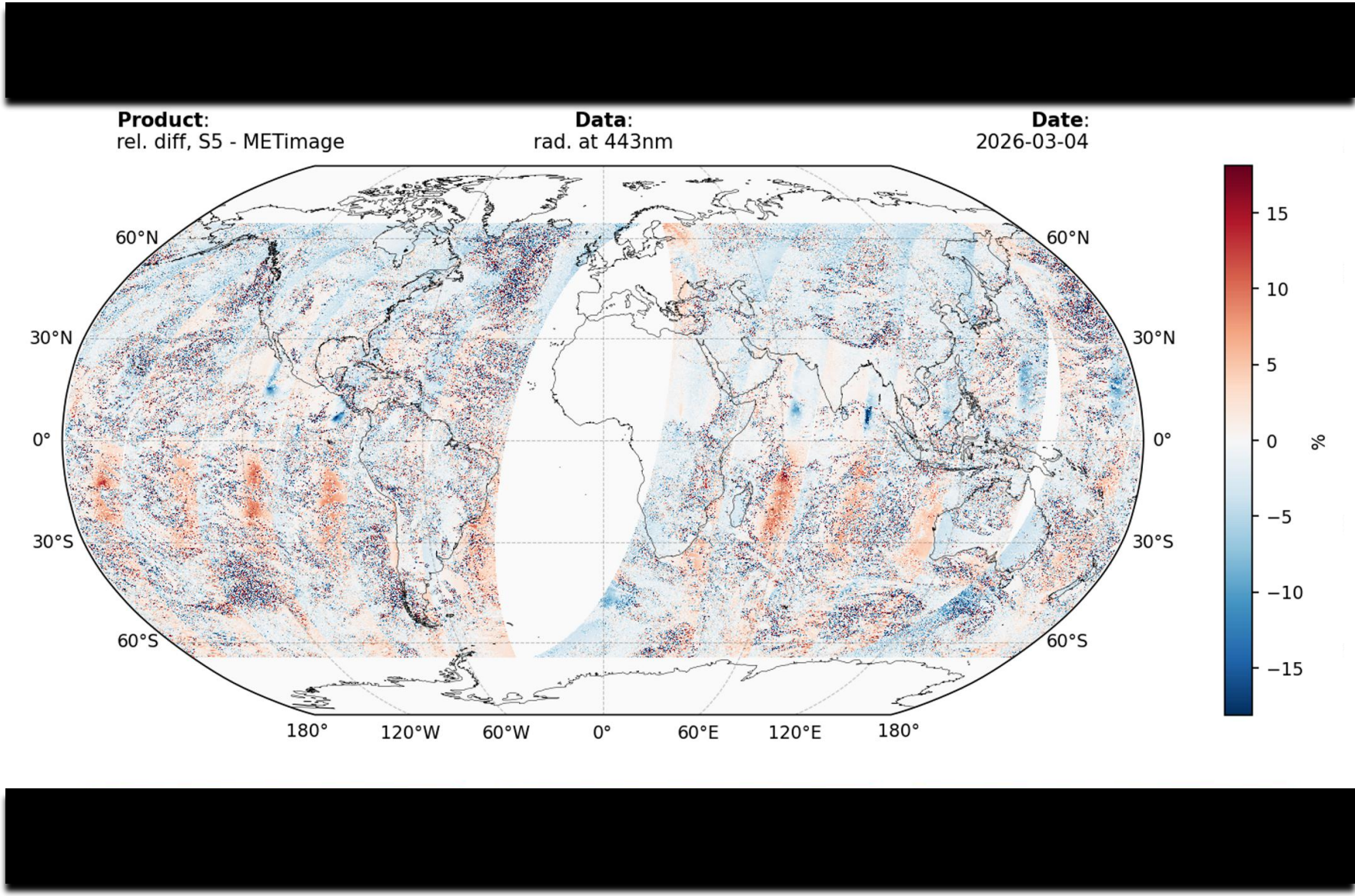
6c. Copernicus Sentinel-4 & -5 – status Rasmus Lindstrot

Sentinel-5/UVNS vs METimage radiances



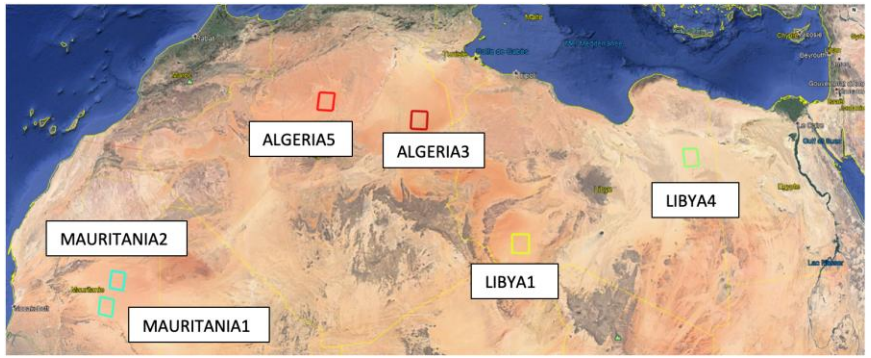
* Both missions in commissioning!
* S5 and METimage radiances in close agreement over homogeneous surfaces.
* Larger deviations observed over cloudy scenes and in regions affected by sun glint.
* Some viewing angle dependent deviations found, flipping sign at the equator.
* Pattern persistently found in all orbits

Disclaimer
- Commissioning ongoing
- Preliminary results, known artefacts
- Not validated
- Not for public distribution



6a. 8 years TROPOMI long-term instrument degradation, Erwin Loots et al.

Validation (2/3): PICS



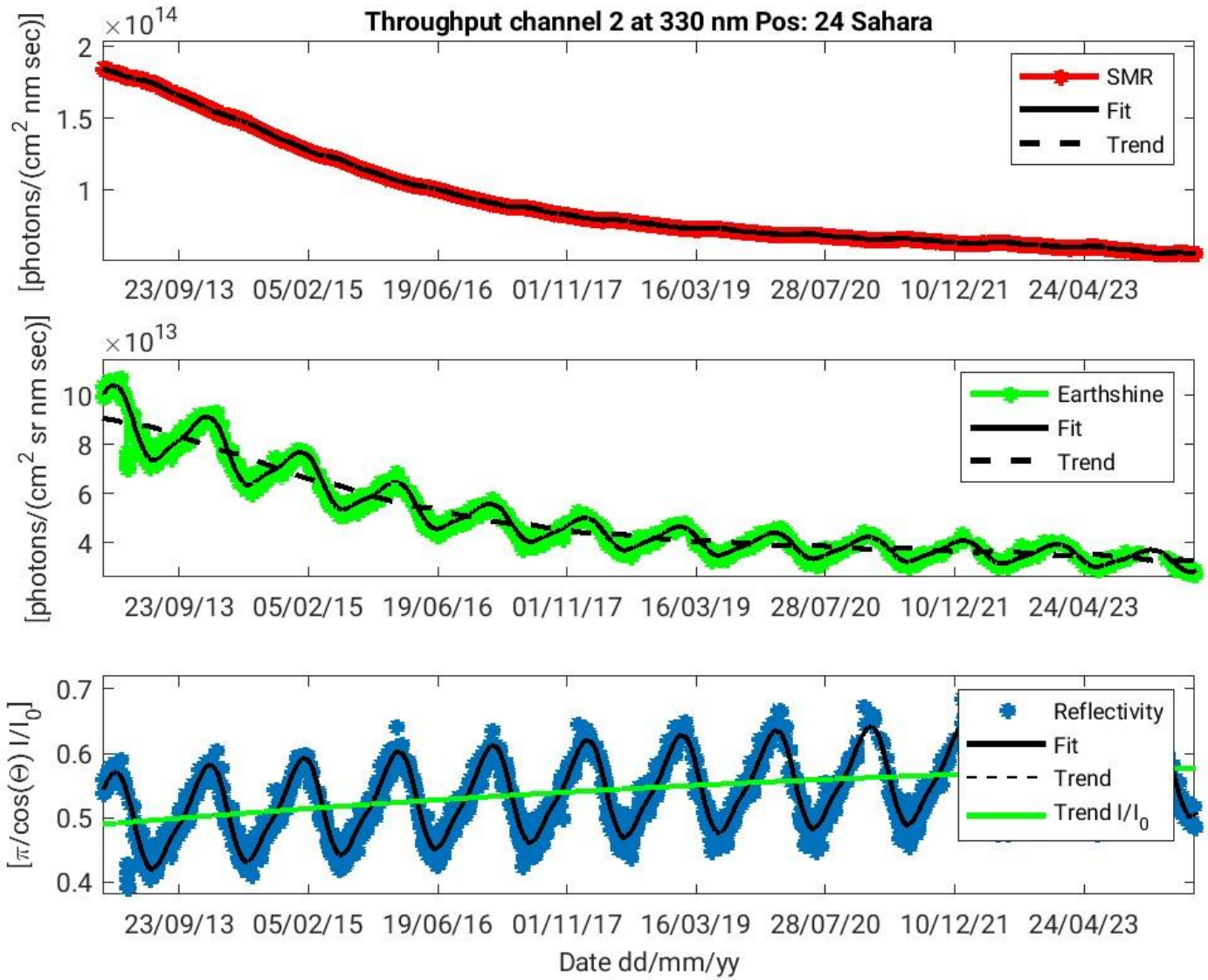
From: https://mpc-vdaf.tropomi.eu

Stability of reflectance (B3,4,6) has been obtained from near cloud-free, near nadir measurements over 20 Pseudo-Invariant Calibration Sites located in the Saharan Desert and the Arabian Peninsula from May 2018 through January 2026. For all bands, the long-term drift is statistically not significant for the bulk of the sites.

6b. GOME-2 in-orbit performance, Pieter Valks, et al.

GOME-2 L1B - Throughput 330 nm (Ch. 2) scan pos 24 (west)

GOME-2 FM2
Metop-B



SMR

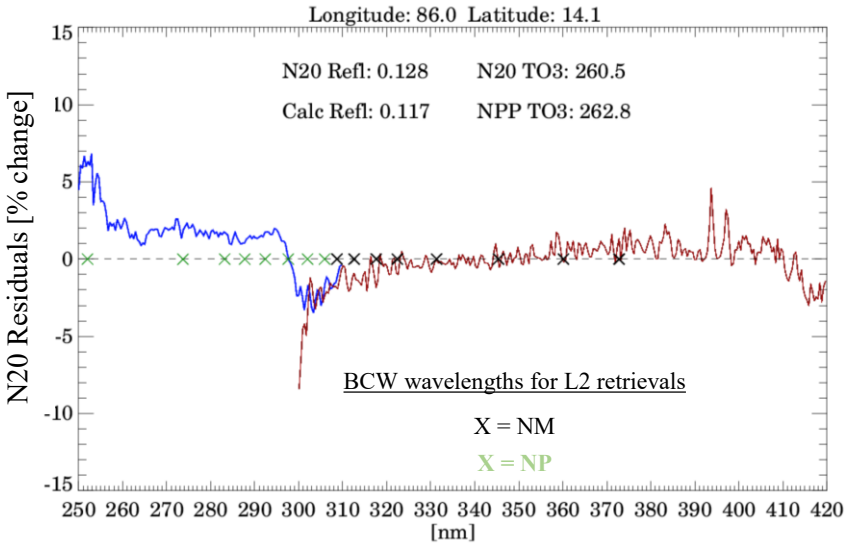
Earthshine (Sahara)

Reflectivity (Sahara)

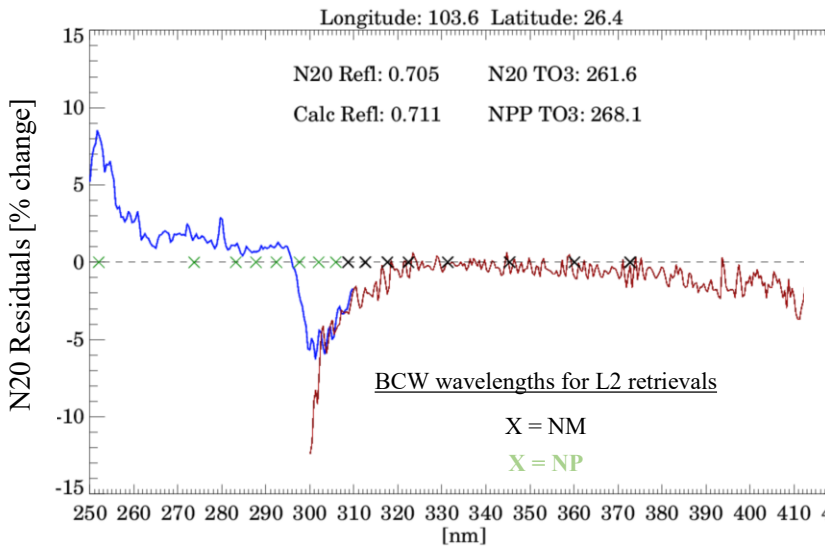
6d. Calibration of the NOAA-20 OMPS Instrument for NASA Products, Brad Fisher

RTM Assessment of OMPS NOAA-20 Performance for Clear and Cloudy Conditions using OMPS-NPP Ozone

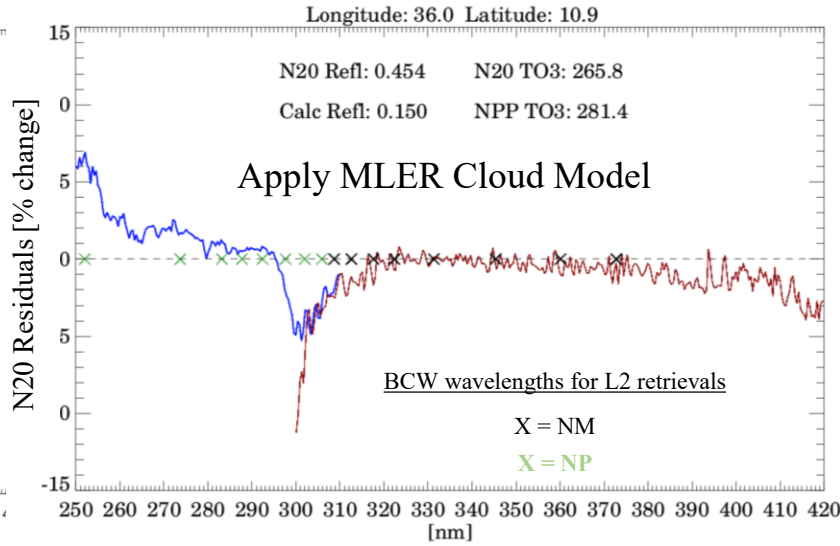
Clear Sky Case (REF < 0.15)



DC Case (ECF >=0.8)

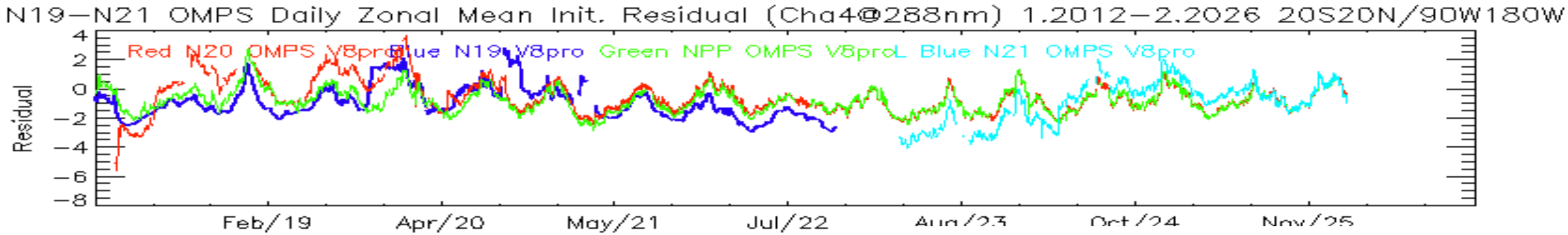


PC Case (0.3 < ECF < 0.5)

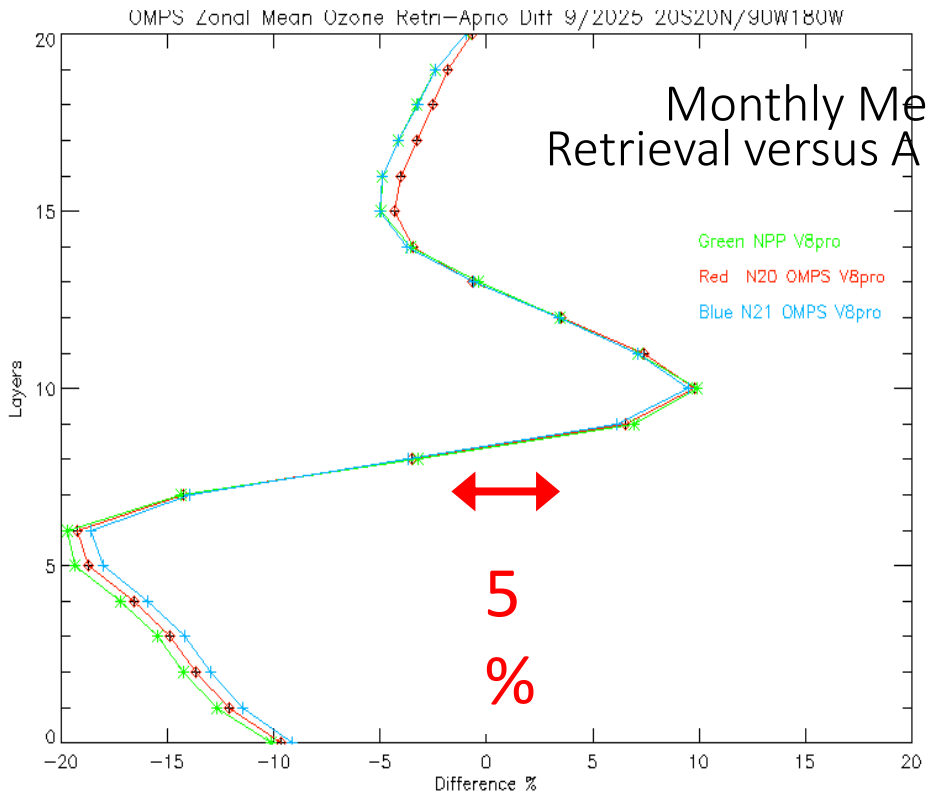


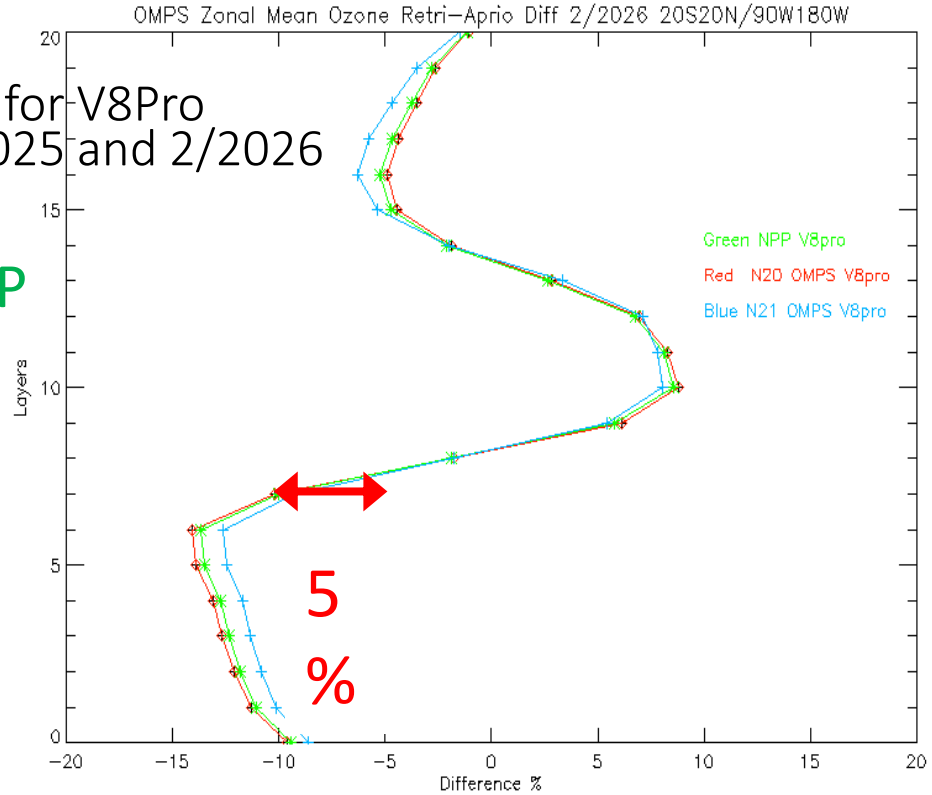
- NPP and N20 fly in parallel orbits at the same latitude separate by 12º longitude
- A Radiative Transfer Model is used to assess performance based on OMPS-NPP Ozone profile and OMPS-N20 viewing conditions (geometry, surface, and cloud conditions)
- For Clear and DC cases: The RTM is run and then the NOAA-20 reflectivity is recalculated before computing normalized radiances for Clear and Deep Convections (DC) cases.
- For partly cloudy (PC) skies: Apply MLER cloud model and then run RTM twice for clear (REF = 0.15) and cloudy (REF = 0.8). Use the 331 residual to adjust the whole NP and NM wavelength spectrum

6e. Monitoring of Measurements for S-NPP, NOAA-20 & -21 OMPS and Metop-C GOME-2 for 2023 to 2025 by using V8TOZ and Global Statistics



Monthly Mean Difference for V8Pro Retrieval versus A Priori for 9/2025 and 2/2026





Retrieval Layers, #

Green NPP

Red N20

Blue N21

5 %

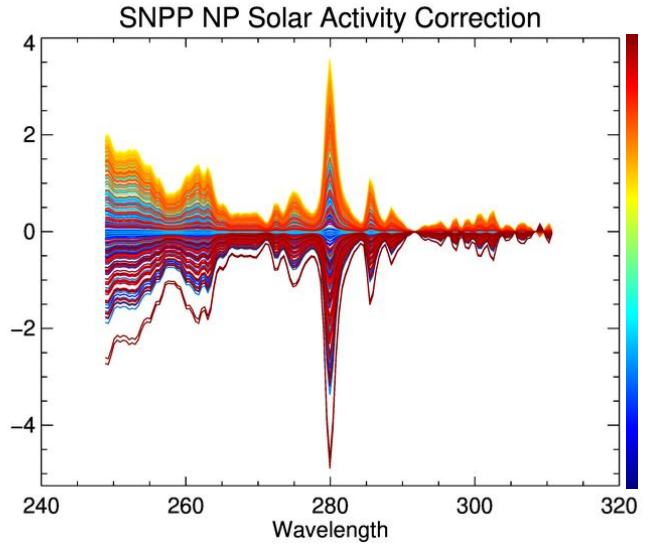
5 %

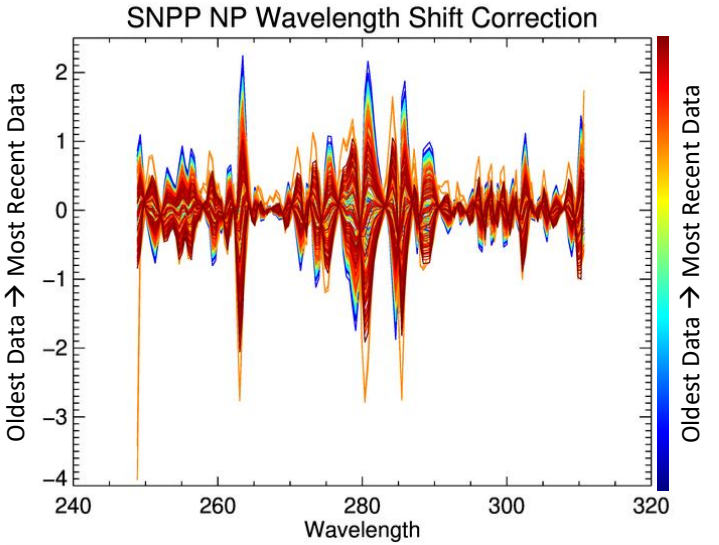
Layer Difference, %

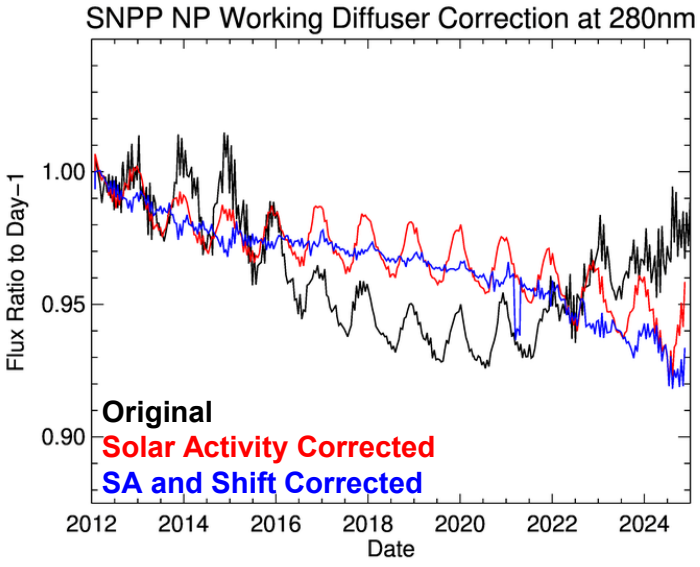
6f. Improving Mission-Long Quality Stability of SNPP OMPS NP SDR Data through Solar Activity and Optical Throughput Degradation Adjustments, Steven Buckner et al.

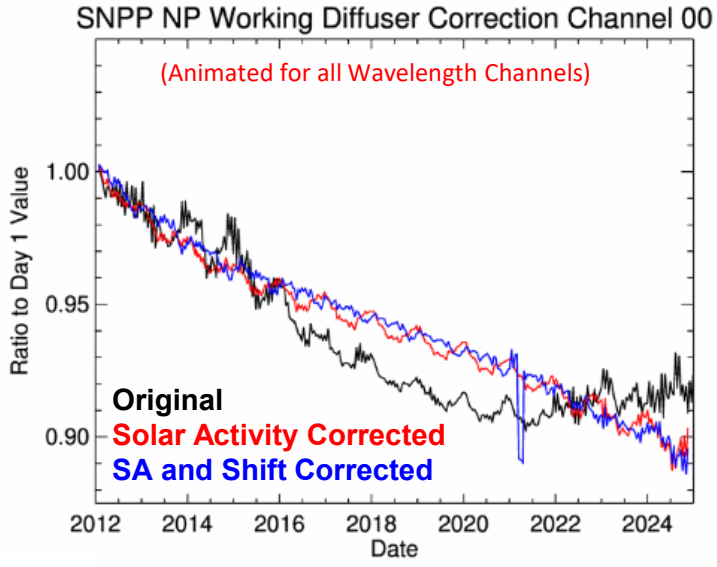
Applying Both Corrections to the Data

- To determine the amount of correction that needs to be applied to each solar measurement, scale factors are multiplied by the percent change in Mg-II Index compared to the day-1 measurement
  - For example, if the scale factor value is 0.5 and the change in Mg-II Index from day-1 is 4%, then the total impact from solar activity would be 2%
- Wavelength shift adjustments are also made relative to day-1
  - Shift adjustments are made to the data following adjustments for solar activity
- Corrections have been calculated for the lifetime of each of the three NP sensors





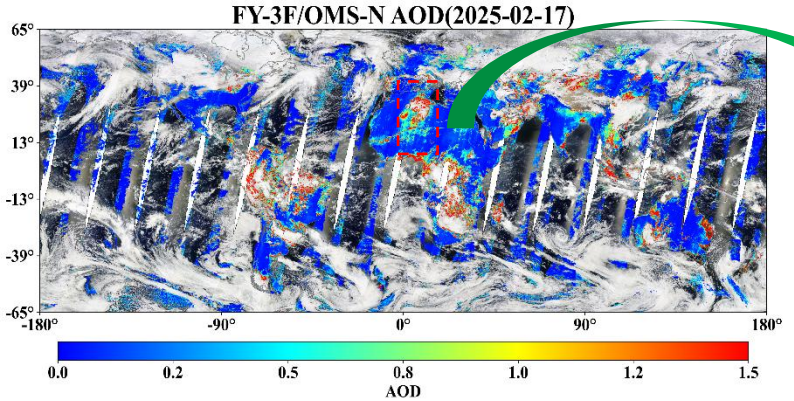




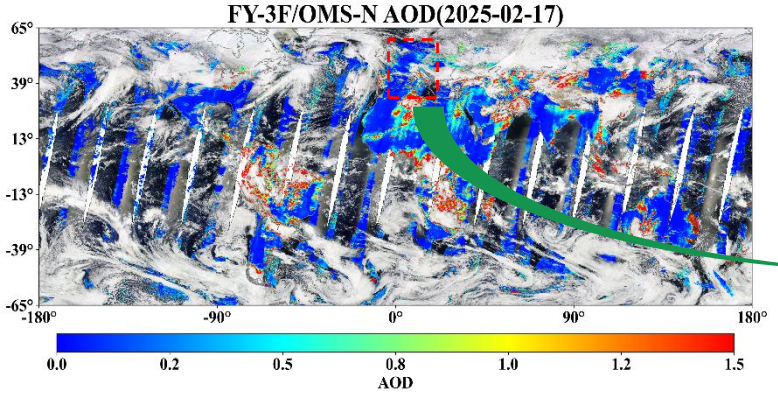
6k. Research on the Non-Uniformity Correction Method for FY-3F OMS-N, Mao Jinghua et al.

Level 2 Product Validation

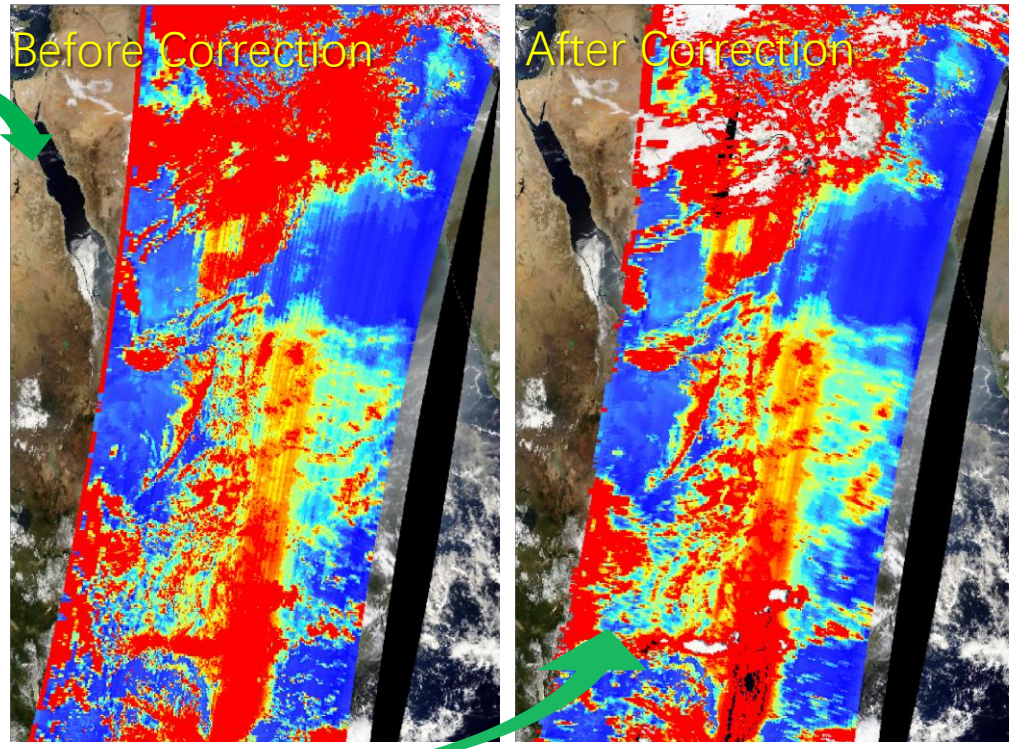
Aerosol Optical Dep

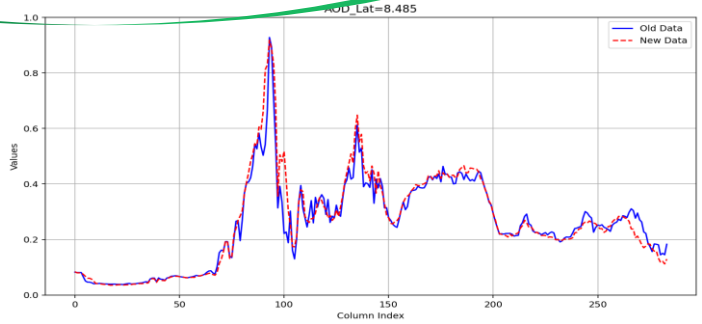


(a) Original L1



(b) L1 after PRNU correction





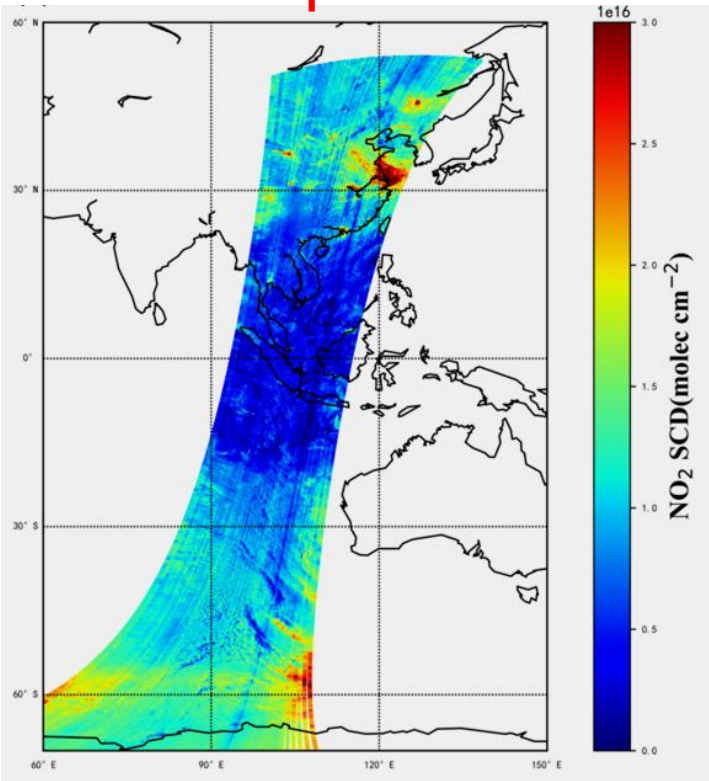
Fine striping artifacts are significantly improved

6m. EMI Stripe Error Correction Method and Results, Zhao Minjie et al.

Stripe Error Correction using Average Solar Spectra

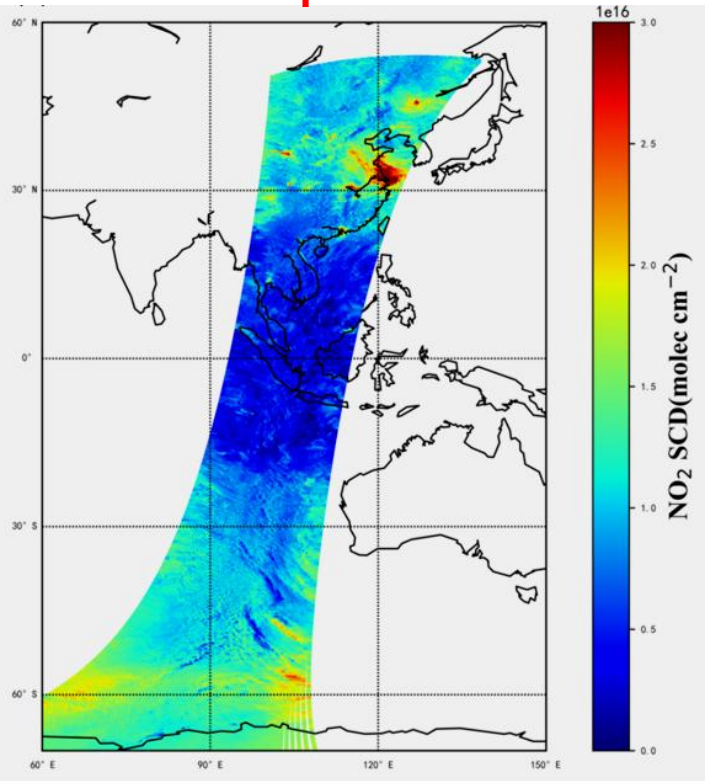
NO_2 SCD retrieval results

Before stripe correction

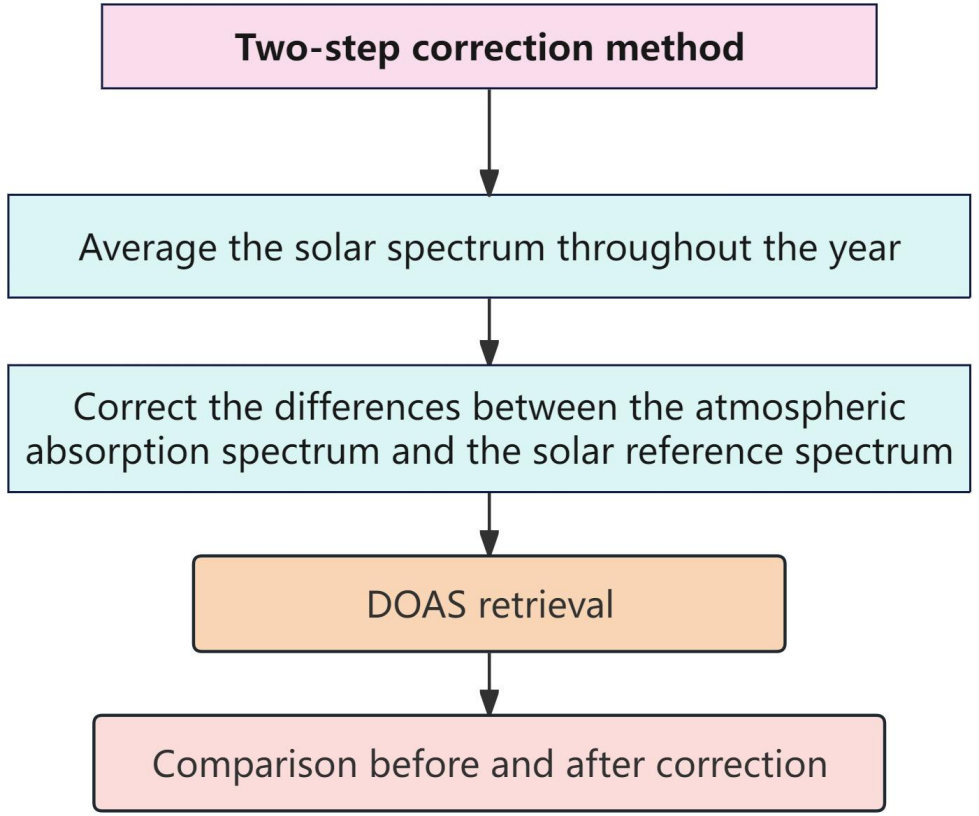


RMS± 6×10^{15} molec/cm^2

After stripe correction



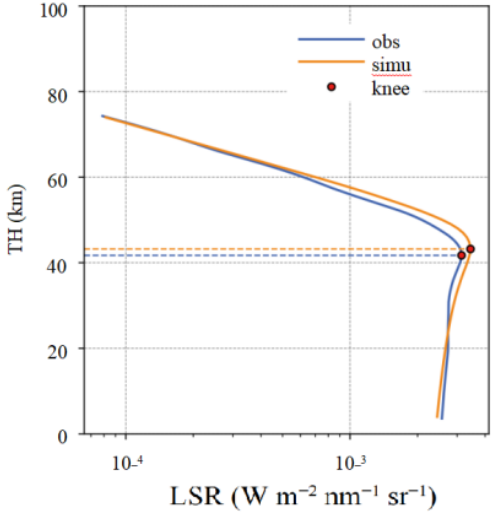
RMS± 0.8×10^{15} molec/cm^2



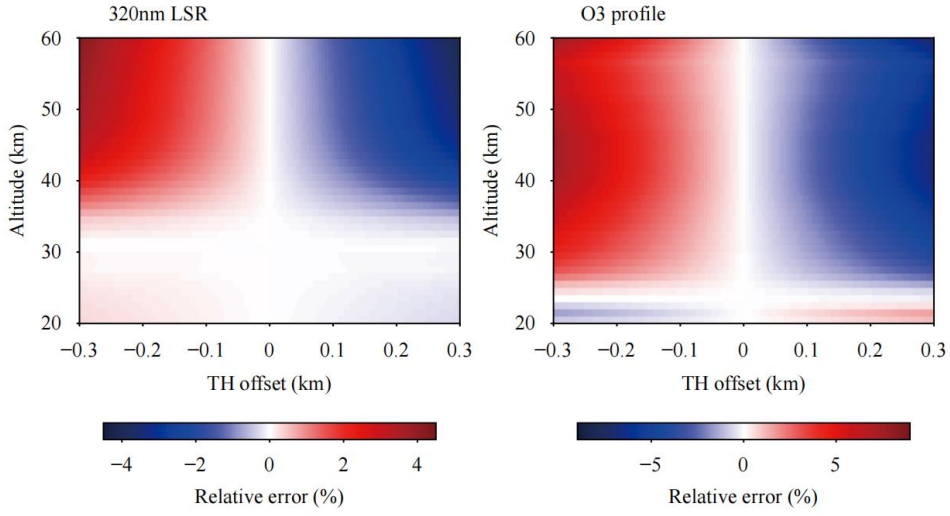
6l. On-Orbit Performance Algorithm Optimization and Global Calibration Consistency Verification of the OMS-L Instrument, Li Yuan et al.

Tangent Height Correction via Knee Point Method (Liu Song)

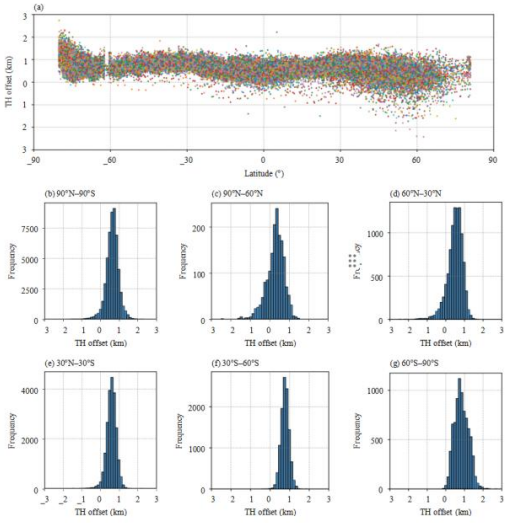
- Aiming at the problem that OMS-L has no star tracker and cannot directly verify the tangent height, an on-orbit tangent height verification and correction algorithm (KB algorithm) based on the knee point of the 305 nm ultraviolet limb scattered radiance (LSR) profile is proposed. After correction by this algorithm, the correlation coefficient between the simulated radiance and the observed spectrum reaches 0.973, which verifies the reliability of the algorithm and provides key support for improving the OMS-L data quality and retrieving ozone products.



Comparison of the 305 nm LSR profile observed by OMS-L with the corresponding simulated profile



Sensitivity analysis shows that the theoretical accuracy of the algorithm is ±300 m, and its error impacts on the 320 nm radiance simulation and ozone profile retrieval are within ±4% and ±8%, respectively.



The results from November 2024 to March 2025 show that the overall tangent height deviation is within ±1 km.

Citation: Liu, S., Y. Li, N. Xu, et al., 2026: Validation and correction of in-orbit tangent height for the ozone monitoring suite-limb onboard . J. Meteor. Res., 40(2), 1-9, doi: https://doi.org/10.1007/s13351-026-5189-3

6g. JPL Vicarious Calibration at the Railroad Valley Playa, Graziela Keller et al.

- The JPL Viccal Team's measurements of the RRV Playa currently support calibration efforts by various missions: OCO-2, OCO-3, MISR, MAIA.
- Our unique calibration approach, in which we take ASD measurements of a Spectralon Panel, provides surface reflectances that are independent of solar and atmospheric models.
- Our measurements, framework, and existing software can be adapted for other missions.
- We are currently extending our capabilities to include UV in-situ measurements and angle matching measurements.
- The JPL Viccal Team would like to find new missions to support with, not only in-situ measurements, but also data analysis, in an effort to expand our activities at the RRV Playa.
- JPL Viccal Team: Graziela R. Keller, Carol Bruegge, Thomas Pongetti, Dejian Fu, Rob Rosenberg, Emily Payne, Edwin Sarkissian, Richard Lee.

Spectralon panel intercomparison

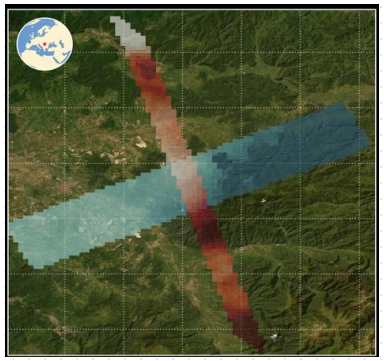
6h. The OCO-2 / 3 Radiometric Puzzle, Robert Rosenberg et al.

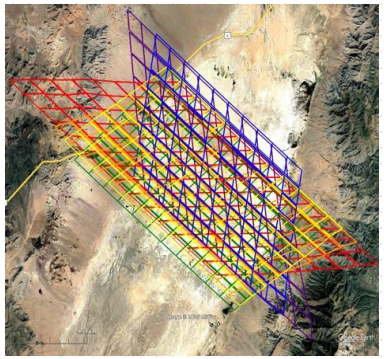
Combining Knowledge

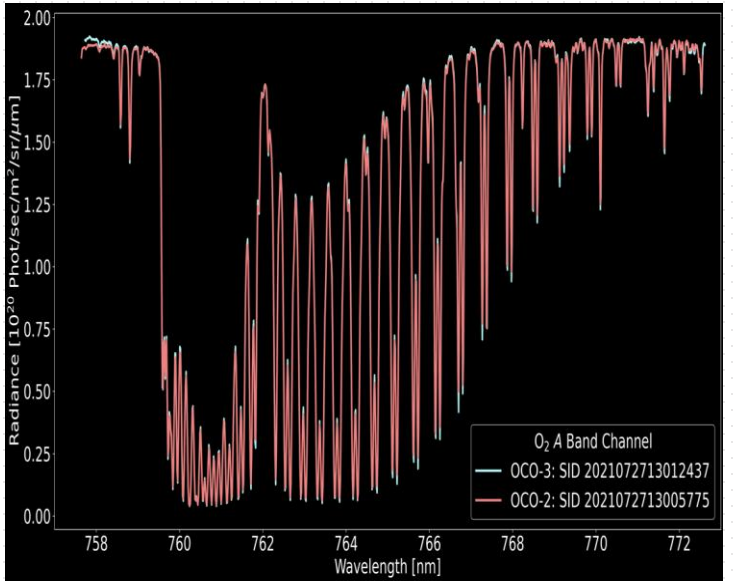
1. Based on Lunar, estimate a drift in OCO2 from Feb 2022 onward and apply to SNOs

2. SNOs estimate OCO2/OCO3 =
1.033, 1.048, 1.022
(constant in time)
and validate OCO-3 B11 Lamp Aging assumption

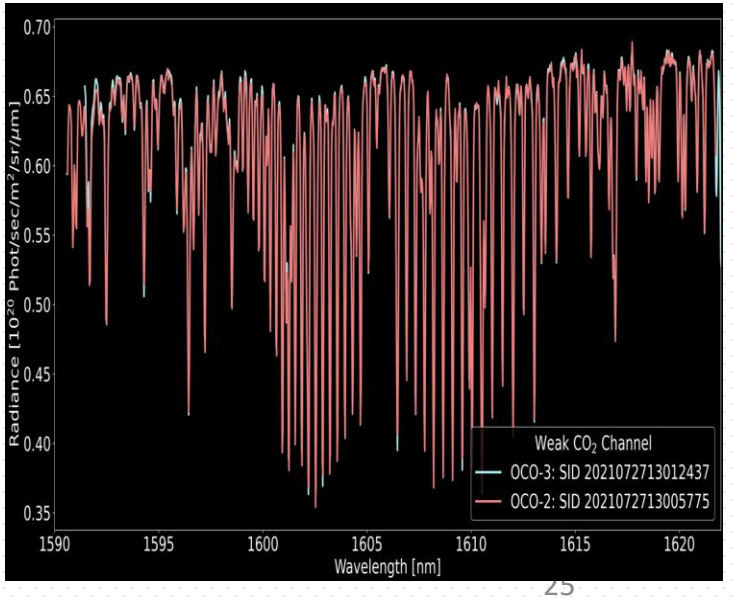
3. RRV estimates match well if OCO3 = 1.0
1.020, 1.057, 1.043
(constant in time)







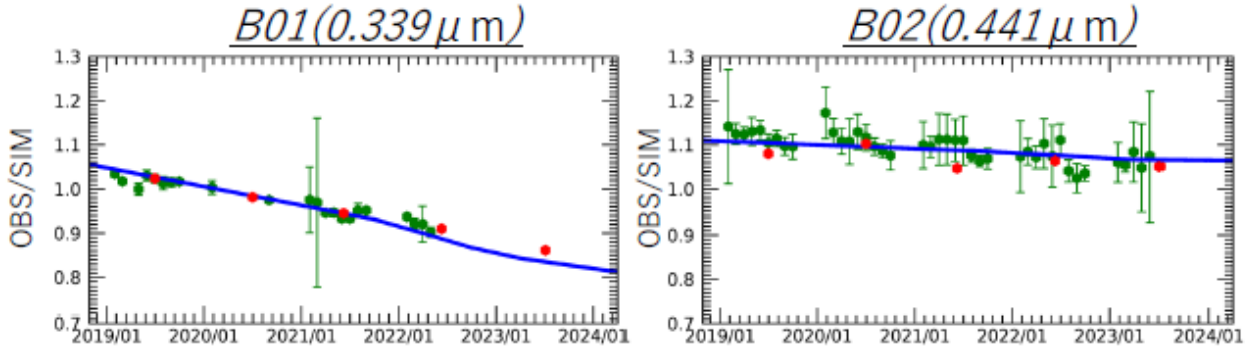
Individual OCO-2 and OCO-3 Band 1 & 2 Radiance Spectra
(from a SNO 25 sec apart)



6i. Calibration status of GOSATandGOSAT-2, Kei SHIOMI and GOSAT Team

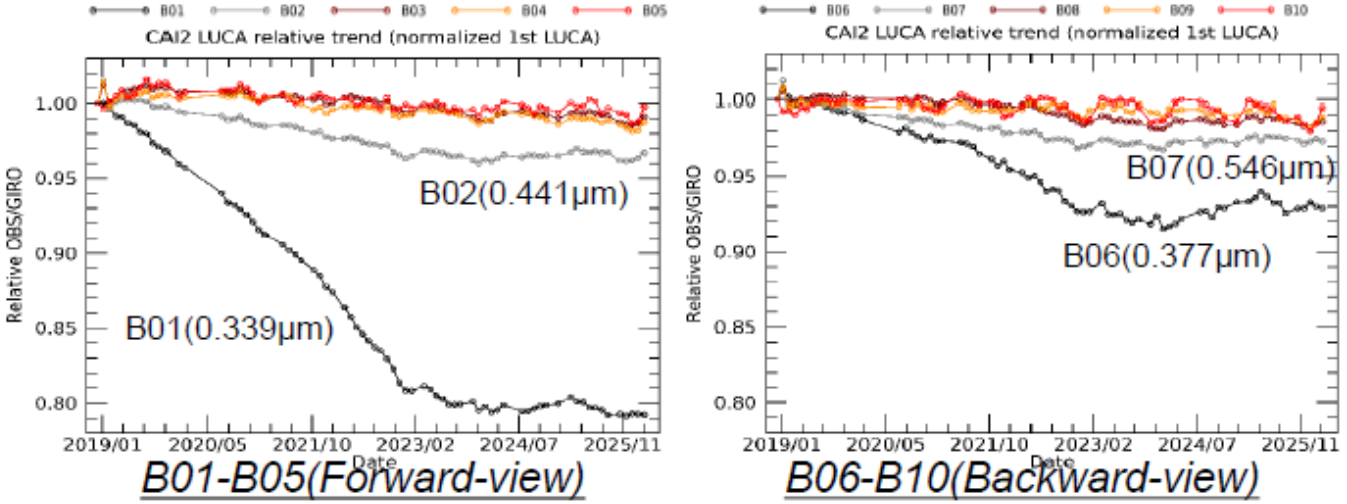
GOSAT-2/CAI-2 radiometric degradation from lunar calibration combined with vicarious methods

■Radiance degradation factor combined with Lunar calibration and Vicarious calibrations



① Vicarious calibration results that evaluated at the Railroad Valley, USA
② Cross-calibration results using other satellite data (ex. VIIRS)
③ Degradation curve estimated from Lunar Calibration results

■Radiance degradation curve estimated from Lunar calibration



- The shorter wavelength bands have larger degradation.
- After Jan. 2023, the degradation curve has changed and became slowly.
- The changing looks the same between forward-view and backward-view bands. B1/B6 use the common before-optics as well as B2/B7.

6j. GEMS Status and Calibration Update, Changsuk Lee

Analysis of Radiometric correction

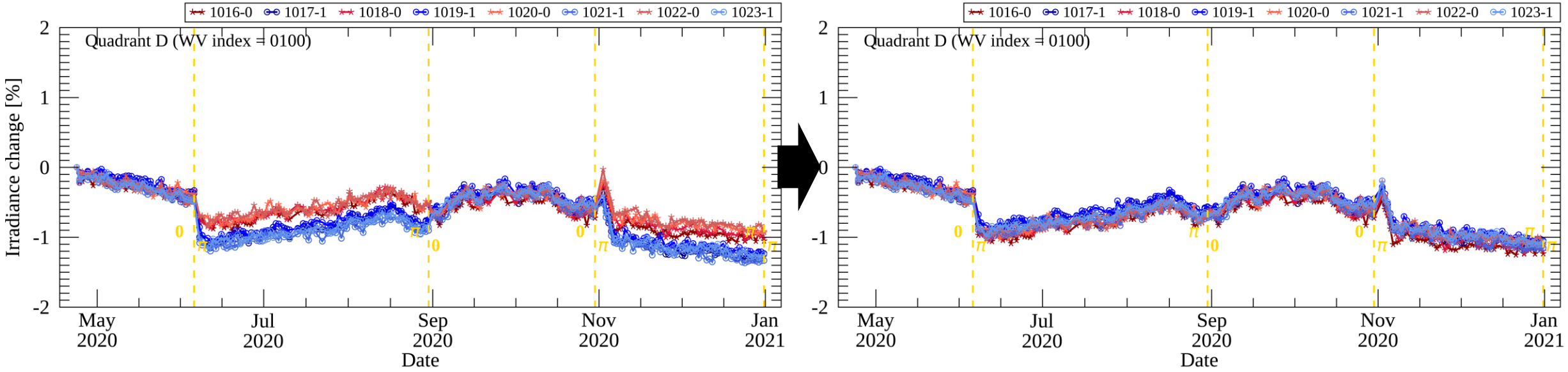
- **Unusual stripe pattern(N-S direction) on CCD**

Correction is performed using the error ratio by gain of the radiometric correction

Abnormal differences between adjacent pixels during time series analysis are reduced after correction.
→ Earth and solar observation each need to be applied

Quadrant D (WV index = 100)

before **After Gain & Radiometric calibration coeff.**

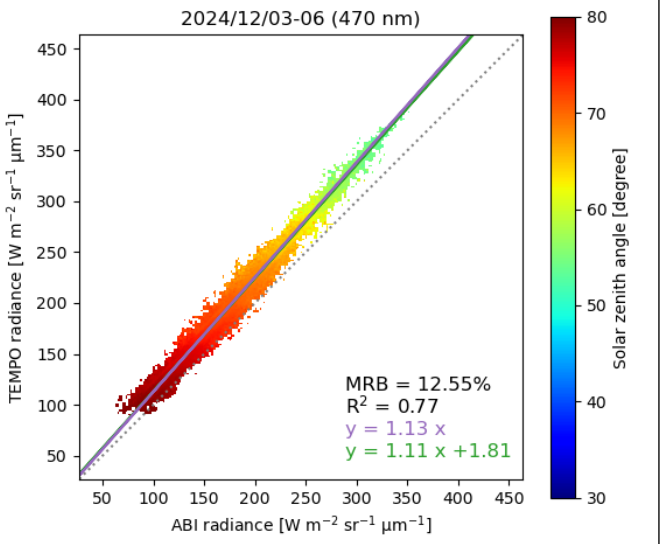


6n. TEMPO Level 1 Status, Heesung Choi et al.

Absolute calibration after solar calibration correction

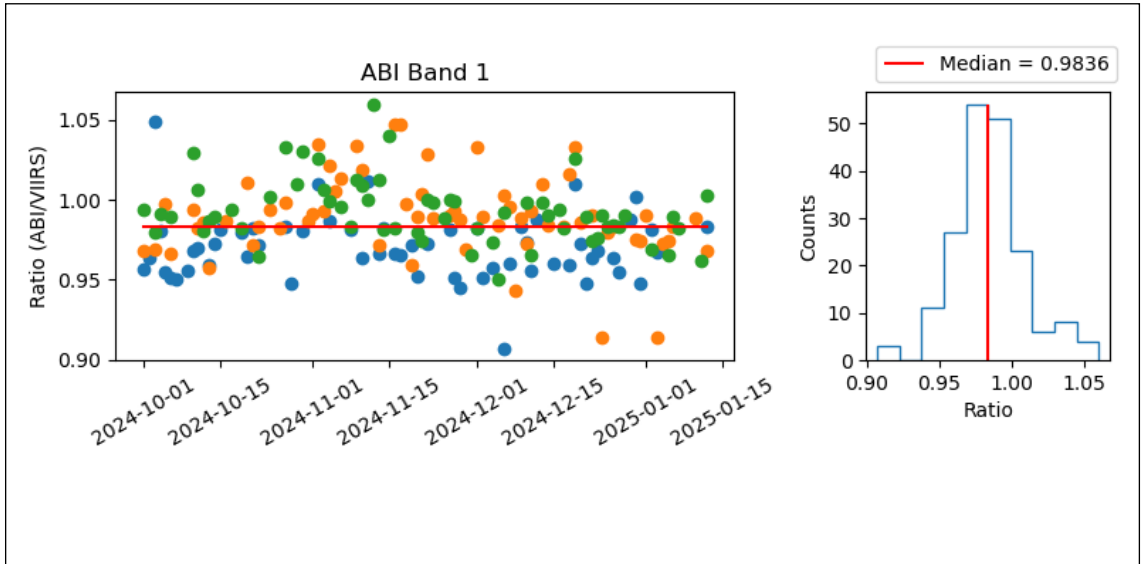
Earth radiance intercomparison (TEMPO V03 vs. ABI vs. VIIRS)

Example: 470 nm (UV), GOES-19



$$\frac{TEMPO}{ABI} = 1.1255$$

$\times$



$$\frac{ABI}{VIIRS} = 0.9836$$

$$\rightarrow \frac{\boldsymbol{TEMPO}}{\boldsymbol{VIIRS}} = \mathbf{1.1070}$$

In Version 4, the UV and visible calibration coefficients have been reduced by 11% and 7%, respectively.

Future Plans for UVN Spectrometer Subgroup

Discussion

Topics

- Solar Trending and Comparisons
  - Absolute Calibration (TSIS HSRS validated at 1% level)
    - https://lasp.colorado.edu/lisird/data/tsis1_hsrs_p1nm
  - Modelling – solar activity, wavelength shifts, diffuser degradation, throughput degradation
    - Time dependent components can be attributed/explained/estimated at the 0.1% level.
  - Intercomparisons
- Radiance Trending and Comparisons
  - Deep Convective Clouds (DCC)
  - Simultaneous Nadir Overpass (SNO)
  - Ice, Deserts, tropical forests
  - Equatorial Pacific Ocean
  - Radiative Transfer over dedicated sites (PICS, RadCalNet)
- Level 2 products (Effective Reflectivity, Aerosol Indices, O3, Other trace gases)
  - Deep Convective Clouds (DCC) (effective reflectivity & its wavelength dependence)
  - Simultaneous Nadir Overpass (SNO)
  - Ice, Deserts
  - Equatorial Pacific Ocean

(a) Six years of NOAA-20 OMPS NP bi-weekly Working Diffuser Soar measurements compared to their average.

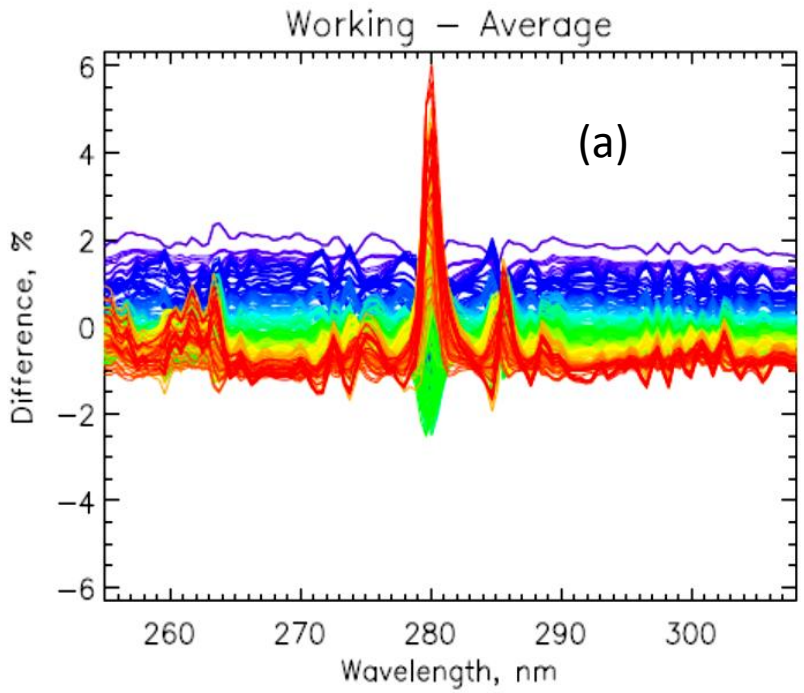
(b) Wavelength Shift Patterns. Wavelength shifts track optical bench annual thermal variations.

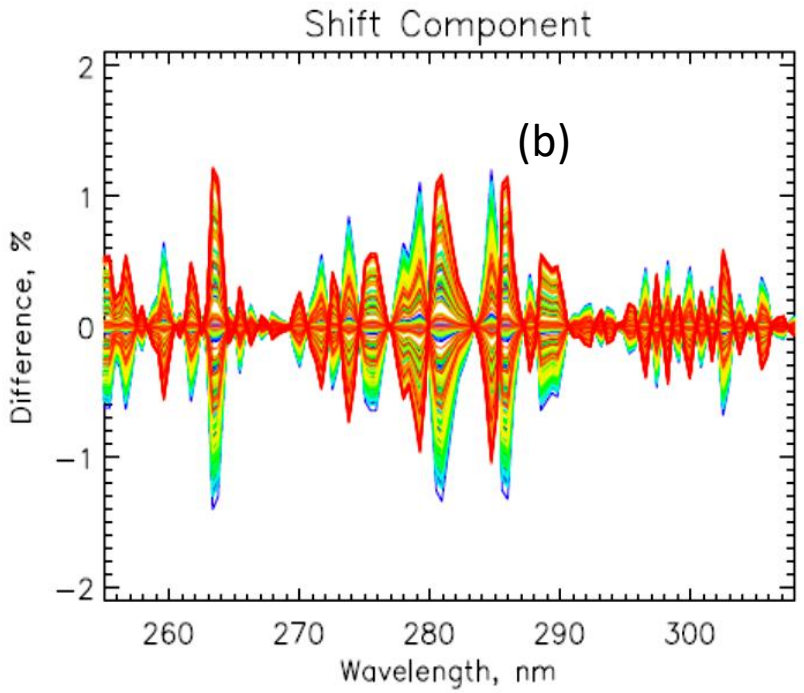
(c) Solar Activity Patterns. Patterns are Mg II scale factors and track Solar activity.

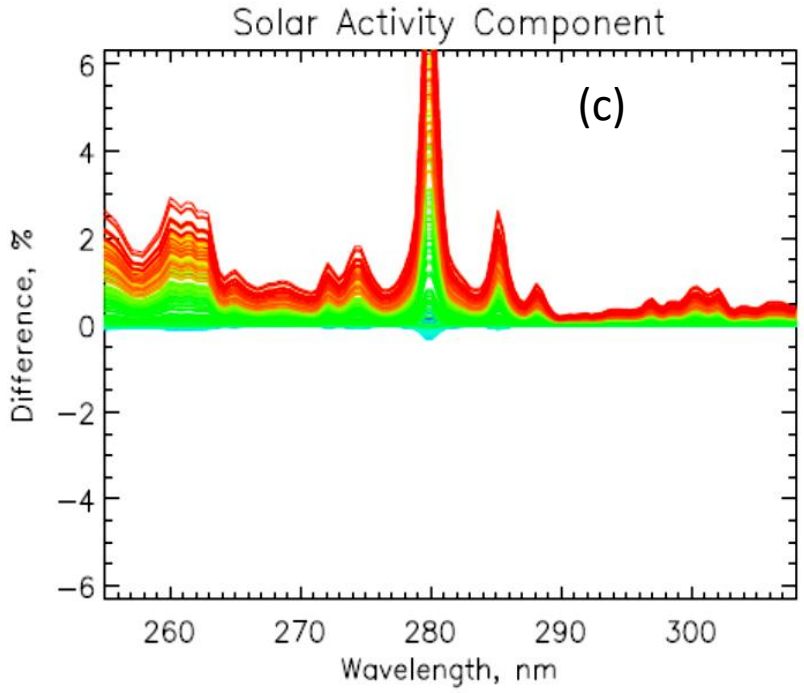
(d) Differences after subtracting the shift and activity patterns. This shows the combined degradation of the reference diffuser and the instrument's optical throughput.

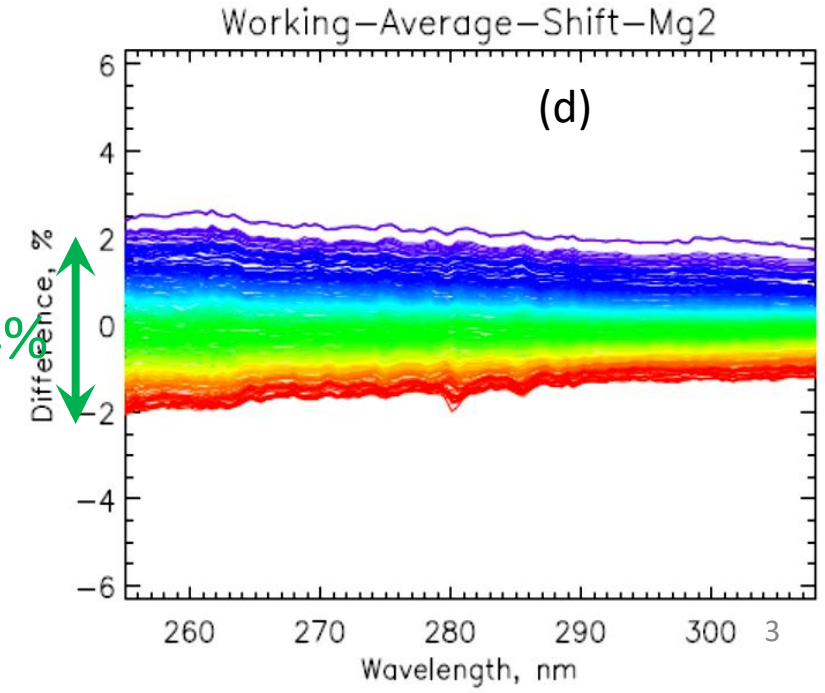
Note: The working diffuser's exposure is deployed every two weeks.

Time dependent components can be attributed/explained/estimated at the 0.1% level



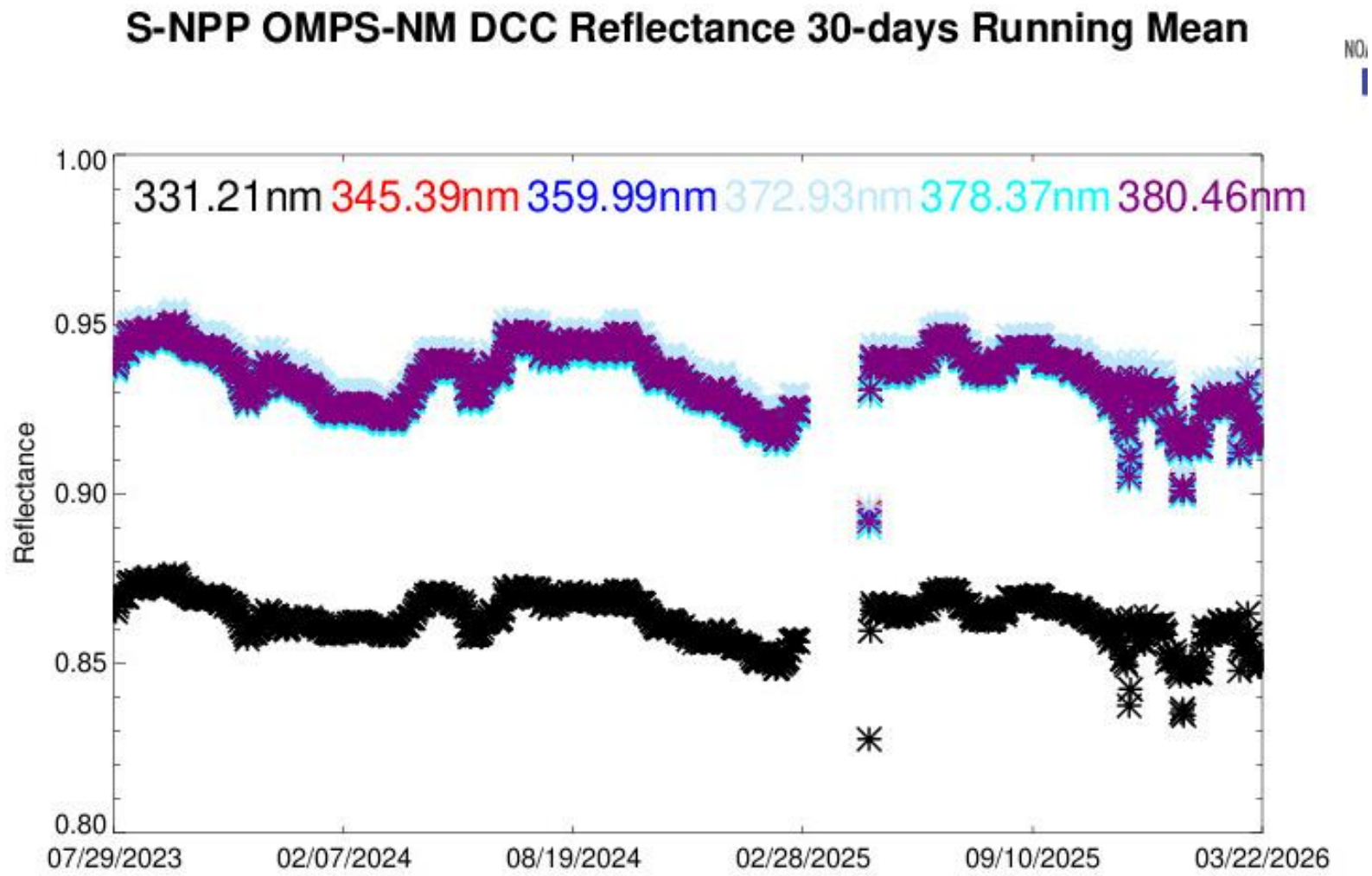






Deep Convective Cloud (DCC) Monitoring at NOAA Integrated Cal/Val System (ICVS)

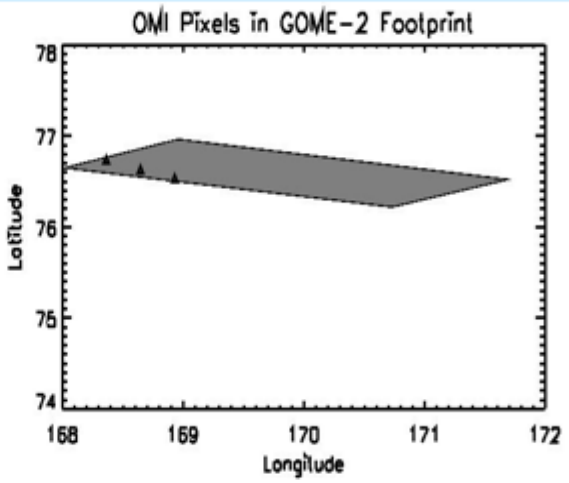
https://www.star.nesdis.noaa.gov/icvs/status_N21_OMPS_NM.php

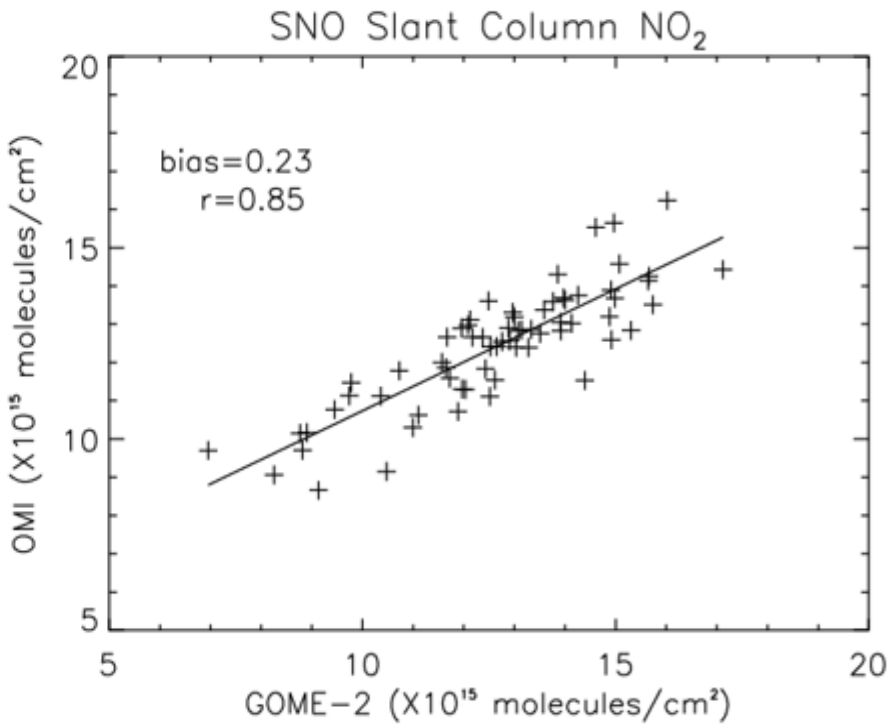


Before doing science applications with the data, we ran the same algorithm on both OMI and GOME-2 and compared the two NO_2 products

Simultaneous Nadir Overpass (SNO) Analysis of GOME-2 vs OMI Slant Column NO_2

- 15 months of GOME-2 and OMI slant column NO2 data (2008-2009) were intercompared using SNO analysis. Number of matchups for this analysis were 77.
- SNO matchup criteria
  - » ± 2 minutes overpass
  - » Solar zenith angles less than 80°
  - » View zenith angles less than 4° (nadir)
  - » OMI row anomaly flag used
- Results
  - » Mean bias is 0.23 (~ 2%)
  - » Correlation coefficient is 0.85





Slide from talk by S. Kondragunta (NOAA)

Agenda for Topical Meeting on Solar Analysis and Comparisons on June 2, 2024

- OMI and TropoMI Solar Activity Time Series by Matt Deland et al.
- TEMPO Solar Measurements by Heesung Chong et al.
- TropoMI Solar Measurements by Erwin Loots et al.
- Bremen Composite Mg II Index by Mark Weber et al.
- Analysis of OMPS Solar Measurements by Larry Flynn et al.