Provisional Maturity Science Review For V8TOz & V8TOS Total Column Ozone EDR

Presented by L. Flynn
Date: 08/03/2023

JPSS/GOES-R Data Product Validation Maturity Stages - COMMON DEFINITIONS (Nominal Mission)

1. Beta

- Product is minimally validated, and may still contain significant identified and unidentified errors.
- Information/data from validation efforts can be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose.
- Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists.

2. Provisional

- Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
- Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.
- Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
- Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.

3. Validated

- Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
- Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level.
- Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
- Product is ready for operational use based on documented validation findings and user feedback.
- Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

Maturity Review - Entry Criteria

- Product Requirements
- Pre-launch EDR Performance Matrix/Waivers – None
- Provisional Maturity Performance Validation
  - On-orbit instrument performance assessment
    - Identify all of the instrument and product characteristics you have verified/validated as individual bullets
    - Identify pre-launch concerns/waivers, mitigation and evaluation attempts with on-orbit data
- Users/Downstream-Products feedback
- Risks, Actions, Mitigations
  - Potential issues, concerns
- Path forward (to the next maturity stage)
- Summary

Maturity Review - Exit Criteria

- Provisional Maturity Performance is well characterized and meets/exceeds the requirements:
  - On-orbit instrument performance assessment
    - Provide summary for each identified instrument and product characteristic you have validated/verified as part of the entry criteria
    - Provide summary of pre-launch concerns/waivers mitigations/evaluation and address whether any of them are still a concern that raises any risk.
- Updated Maturity Review Slide Package addressing review committee's comments for:
  - Cal/Val Plan and Schedules
  - Product Requirements
  - {Beta/Provisional/Validated} Maturity Performance
  - Risks, Actions, Mitigations
  - Path forward (to the next maturity stage)

PROVISIONAL MATURITY REVIEW MATERIAL

OMPS Ozone Provisional for V8TOz and V8TOS EDRs

https://drive.google.com/drive/u/0/folders/1uePzfr2LR9Bypy7Z6S0qNUcEa38VQE8q

Outline

- Algorithm Cal/Val Team Members
- Product Overview/Requirements
- Evaluation of algorithm performance to specification requirements
  - Algorithm version, processing environment
  - V8TOS Performance and Improvement
  - Evaluation of the effect of required algorithm inputs
  - Soft Calibration Adjustments
  - Quality flag analysis/validation
  - Error Budget
- User Feedback
- Downstream Product Feedback
- Risks, Actions, and Mitigations
- Documentation (Science Maturity Check List)
- Conclusion
- Path Forward

Ozone Cal/Val/Alg Team Membership

EDR	Name	Organization	Task
Lead	Lawrence Flynn	NOAA/NESDIS/STAR	Ozone EDR Team
Sub-Lead	Irina Petropavlovskikh	NOAA/ESRL/CIRES	Ground-based Validation
Sub-Lead	Trevor Beck	NOAA/NESDIS/STAR	Trace Gas Algorithm Development
Member	Jianguo Niu	STAR/IMSG	R&D, trouble shooting, TOAST, V8TOS
Member	Eric Beach	STAR/IMSG	Validation, ICVS/Monitoring, Data Management
Member	Zhihua Zhang	STAR/IMSG	V8 Algorithms implementation & modification
Member	Robert Lindsay	STAR/IMSG	Limb Algorithms implementation
Member	Jeannette Wild	UMD	Applications, CDRs, validation
JAM	Starry Manoharan	JPSS/Aerospace	Coordination
Adjunct	Bigyani Das	STAR/ASSISTT	Deliveries to NDE / NCCF
PAL	Vaishali Kapoor	OSPO	Atmospheric Chemistry Product Area Lead
SDR	Banghua Yan	NOAA/NESDIS/STAR	OMPS SDR Lead

OMPS TC EDR Performance Characteristics

	Threshold	Objective
Ozone TC Applicable Conditions 1, 2.		
a. Horizontal Cell Size	50 x 50 km^2 @ nadir	10 x 10 km^2
b. Vertical Cell Size	0 - 60 km	0 - 60 km
c. Mapping Uncertainty, 1 Sigma	5 km at Nadir	5 km
d. Measurement Range	50 - 650 milli-atm-cm	50-650 milli-atm-cm
e. Measurement Precision	.	.
1. X < 0.25 atm-cm	6.0 milli-atm-cm	1.0 milli-atm-cm
2. 0.25 < X < 0.45 atm-cm	7.7 milli-atm-cm	1.0 milli-atm-cm
3. X > 0.45 atm-cm	2.8 milli-atm-cm + 1.1%	1.0 milli-atm-cm
f. Measurement Accuracy	.	.
1. X < 0.25 atm-cm	9.5 milli-atm-cm	5.0 milli-atm-cm
2. 0.25 < X < 0.45 atm-cm	13.0 milli-atm-cm	5.0 milli-atm-cm
3. X > 0.45 atm-cm	16.0 milli-atm-cm	5.0 milli-atm-cm
g. Latency	90 min.	15 min.
h. Refresh	At least 90% coverage of the globe Every 24 hours (monthly average)	24 hrs.
i. Long-term Stability	1% over 7 years	0.5 % over 7 years
1. Threshold requirements only apply under daytime conditions with Solar Zenith Angles (SZA) up to 80 degrees. 2. The EDR shall be delivered for all SZA. 3. SO2 exclusion removed.	1 milli-atm-cm = 1 DU	

Product Overview/Requirements

- Product performance requirements from JPSS L1RD supplement (threshold) versus observed/validated/JERD Vol. II

Attribute	Threshold	Observed/Validated
Geographic coverage	90% Daily Global Earth	SZA < 80° (>90% coverage)
Vertical Coverage	0-60 km	0-60 km (RT tables, physics)
Vertical Cell Size	NA	NA
Horizontal Cell Size	50x50 km^2 at nadir	10x9 km^2 at nadir
Mapping Uncertainty	5 km at nadir	3 km at nadir (SDR Team)
Measurement Range	50 – 650 DU	90-700 DU (algorithm performance and real range)
Measurement Accuracy		
X < 250 DU	9.5 DU	6.0 DU^
250 DU < X < 450 DU	13.0 DU	10.0 DU^
X > 450 DU	16.0 DU	12.0 DU^
Measurement Precision	for 50x50 km^2 product	for 10x9 km^2 product (Broadband)
X < 250 DU	6.0 DU	1 DU* +0.5%
250 DU < X < 450 DU	7.7 DU	1 DU* +0.5%
X > 450 DU	2.8 DU + 1.1%	1 DU* +0.5%

^Versus NPP V8TOz for latitude bands

*SDR contribution from Double-Double Difference

+ Straylight Error

Evaluation of algorithm performance to specification requirements

- Findings/Issues from Beta Review
- Improvements since Beta Review
  - Algorithm Improvements
  - LUT / PCT updates
- Algorithm performance evaluation
  - Validation data sets (type, periods, coverage)
  - Validation strategies / methods
  - Validation results
  - Long term monitoring readiness
- Inter-sensor comparison
  - Compare with S-NPP and NOAA-20
  - Compare with other satellite product

Notes since Beta Review

- SDR
  - Stray Light Update but no OOB on June 26, 2023.
  - Solar and wavelength shift reviewed and 1 AU adjustment
  - Second N21 Reference diffuser solar measurement planned for August 25, 2023
  - Intra-orbit wavelength scale changes (smaller than NPP or N20).
  - Precision for SDR and EDR.
- Soft Calibration – PRNU and absolute accuracy
  - Before / after Ref, AI, Ozone with soft calibration adjustments.
  - Maps of all three and error codes
- Latitude Dependence of Zonal means changed but still present
- V8TOS
  - Good for correcting for volcanic events.
  - New code needed for error flag handing.
- Comparison of NPP to Dobson stations
  - https://gml.noaa.gov/ozwv/dobson/plots/index.php?sta=ldr
- Smaller FOV considerations. Recover SNR?

Processing Environment and Algorithms

- Description of processing environment and algorithms used to achieve the maturity stage:
  - Algorithm version: NDE I&T V8TOz v4r2
    STAR Offline V8TOz v4r3
    NCCF V8TOz v4r3
  - Version of LUTs used: Revised instrument radiative transfer table 04/15/2023
    Soft Calibration Adjustment Table 05/10/2023
    Second Soft Calibration Adjustment Table 8/XX/2023
  - Effective date: 8/XX/2023,
    As the SDR matures, new adjustment tables will be devised and delivered.

Evaluation of the effect of required algorithm inputs

- Required Algorithm Inputs
  - OMPS Nadir Mapper SDR and GEO
  - Instrument Radiative Transfer Tables
  - Soft Calibration Adjustment Tables
- No changes yet to the V8TOz or V8TOS EDR algorithms – Table updates only.
  - Revised instrument radiative transfer table 04/15/2023
  - Soft Calibration Adjustment Table #1 05/10/2023
  - Soft Calibration Adjustment Table #2 August 2023 Delivery

Table A summary of the delivered and upcoming NOAA-21 OMPS NM and NP SDR LUTs as of 04/25/2023

#Delivery	Date of Used Working Diffuser Solar Data	Delivered LUTs	Affected Sensor	Main Purpose	Operational Date
1st	02/09/2023	OSOL and Wavelength LUTs (NM: -0.13nm; NP: -0.09nm)	NM and NP	Wavelength shifts from ground to flight; Fixing the NM radiance 3-pixel-shift-error	03/09/2023
2nd	03/19/2023	OSOL and wavelength LUTs	NP	Fixing the NP 12-pixel-error; wavelength shift since 02/09/2023	03/23/2023
3rd	02/09/2023	Sample table, OSOL and wavelength LUTs	NM	Fixing the 85th cross-track wavelength shift discrepancy	04/13/2023
4th	04/16/2023	OSOL and wavelength LUTs	NP	Applied SED correction; doppler shift correction; wavelength shift	04/20/2023
5rd	Target: 04/27/2023 to ASSISTT	OSOL LUT	NM	Applied SED correction;	Target: 05/04/2023

OMPS NM SDR Changes or Findings since SDR Provisional

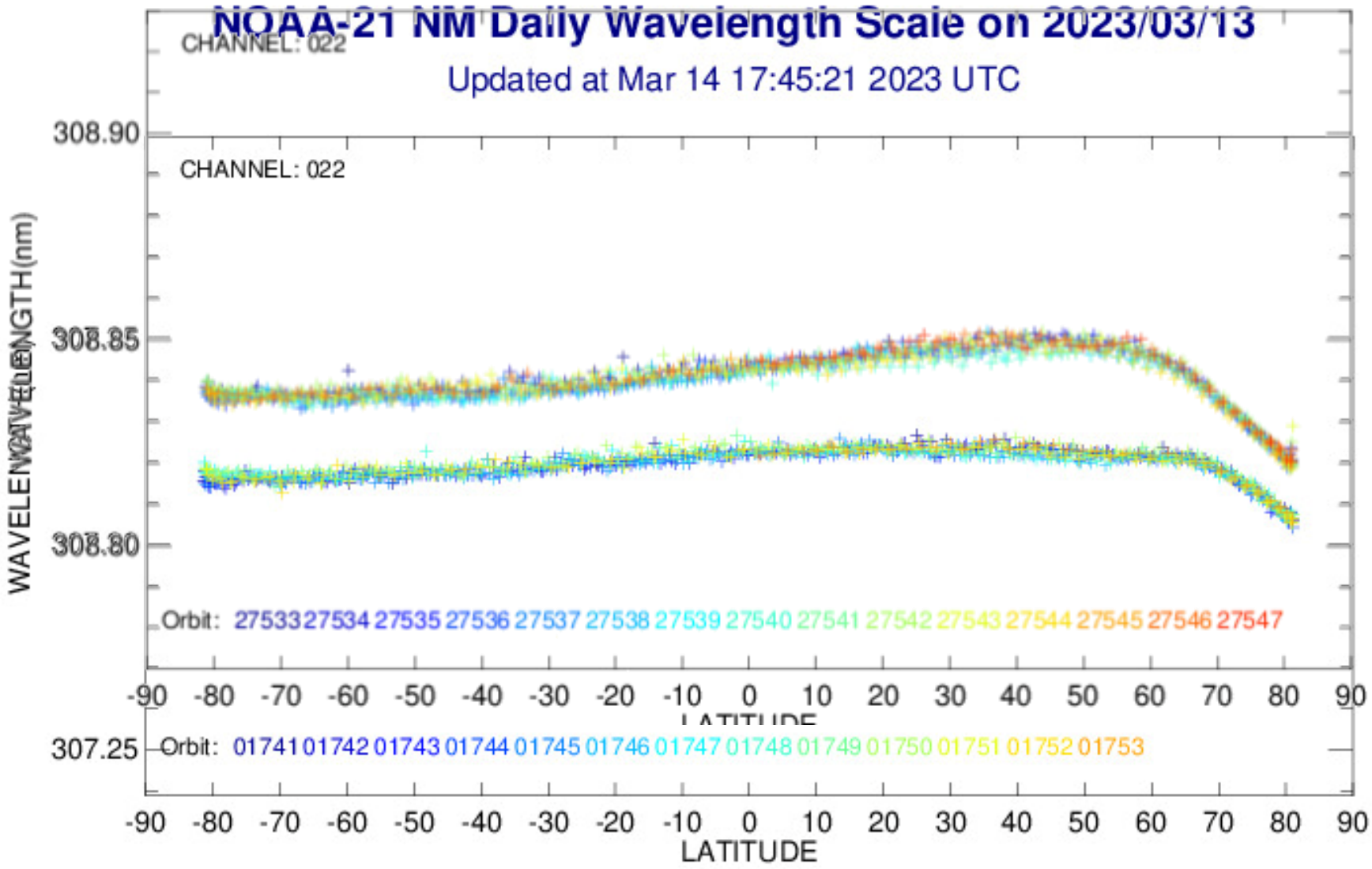
- The OMPS NM Solar Irradiance Spectra were adjusted to 1 AU.
  - This created a change of ~2.5% in the radiance / irradiance ratios.

- The OMPS NM SDR Straylight correction was too small by a factor of ~10.
  - This produces a latitude-dependent (SZA, SVA, reflectivity and ozone dependent) bias in the radiances. The bias in the radiances may be partially responsible for a latitude-dependent bias in the total ozone of 2% seen at Beta Maturity.
  - The improved straylight correction (in operations since June 26, 2023) changes the biases in the tropics where the V8TOz soft calibration adjustments are developed.

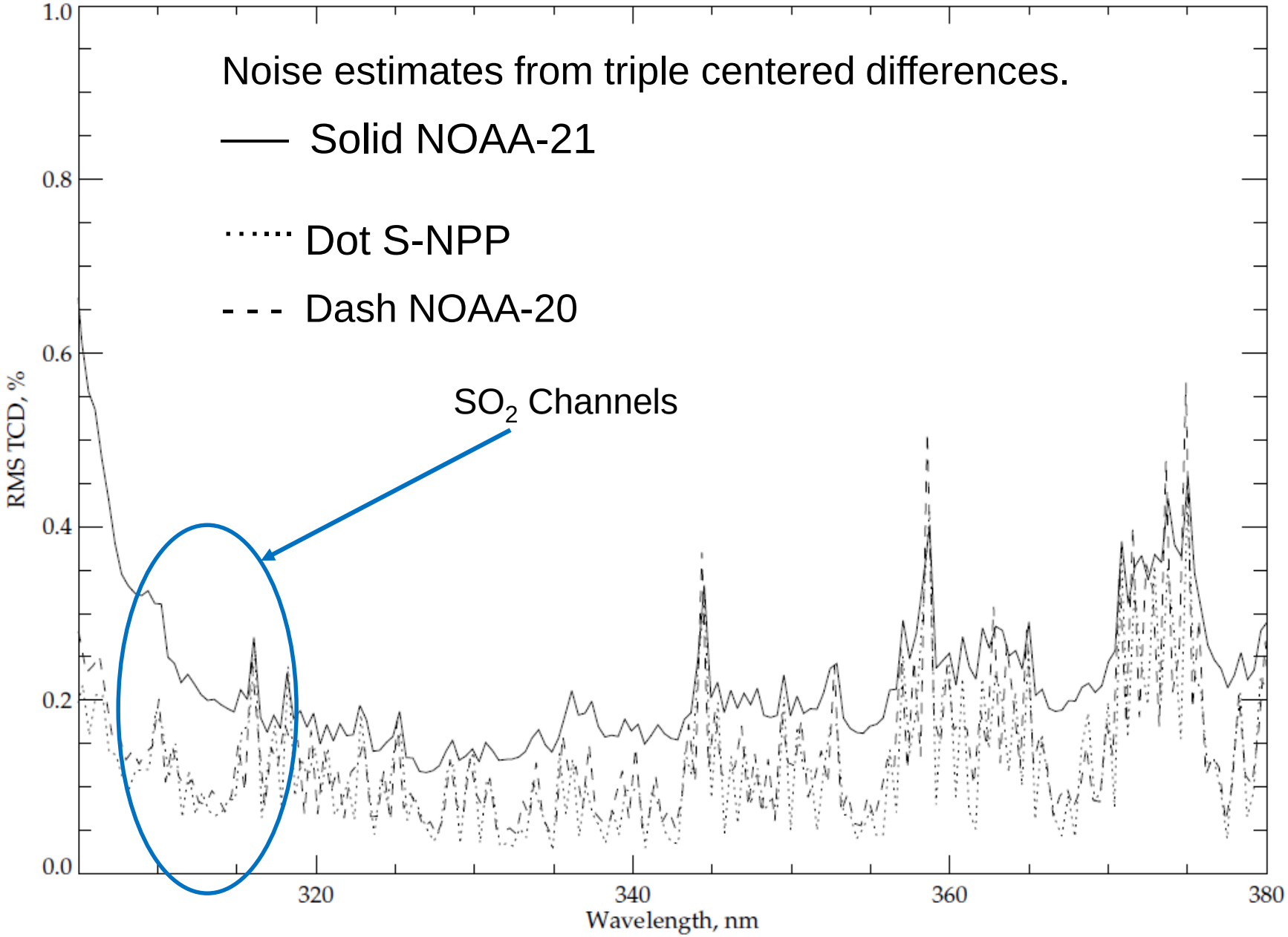
Major changes since Launch / Beta

- Regular weekly dark table and biweekly Solar and wavelength table updates for both SDRs. The dual diffuser system is working well.
- Solar and wavelength updates for ground-to-orbit wavelength shifts based on first solar measurements for both OMPS NM (-0.14nm) and NP SDRs (-0.09nm).
- Solar and wavelength updates for three pixel offset error for OMPS NM SDR.
- Minor solar and wavelength updates for nadir macro-pixels, 4/7/2023.
- Minor sample table update for macro-pixel #177 is in Mx 8, July 13, 2023.
- Correction to OMPS NM SDR Solar Tables to 1 AU June 13, 2023.
- Better Jacobian for OMPS NM Straylight Corrections.
  - ADR 10360 has been opened for the OMPS NM SDR Straylight correction. A new table was implement on 6/26/2023. It improves performance but does not include the contributions from radiances longward of 380 nm.

NOAA-21 OMPS NM has a smaller intra-orbital wavelength scale variation than NOAA-20 OMPS NM. Both are well-characterized by the granule-level adjustments in the SDR processing, the adjustments are good.

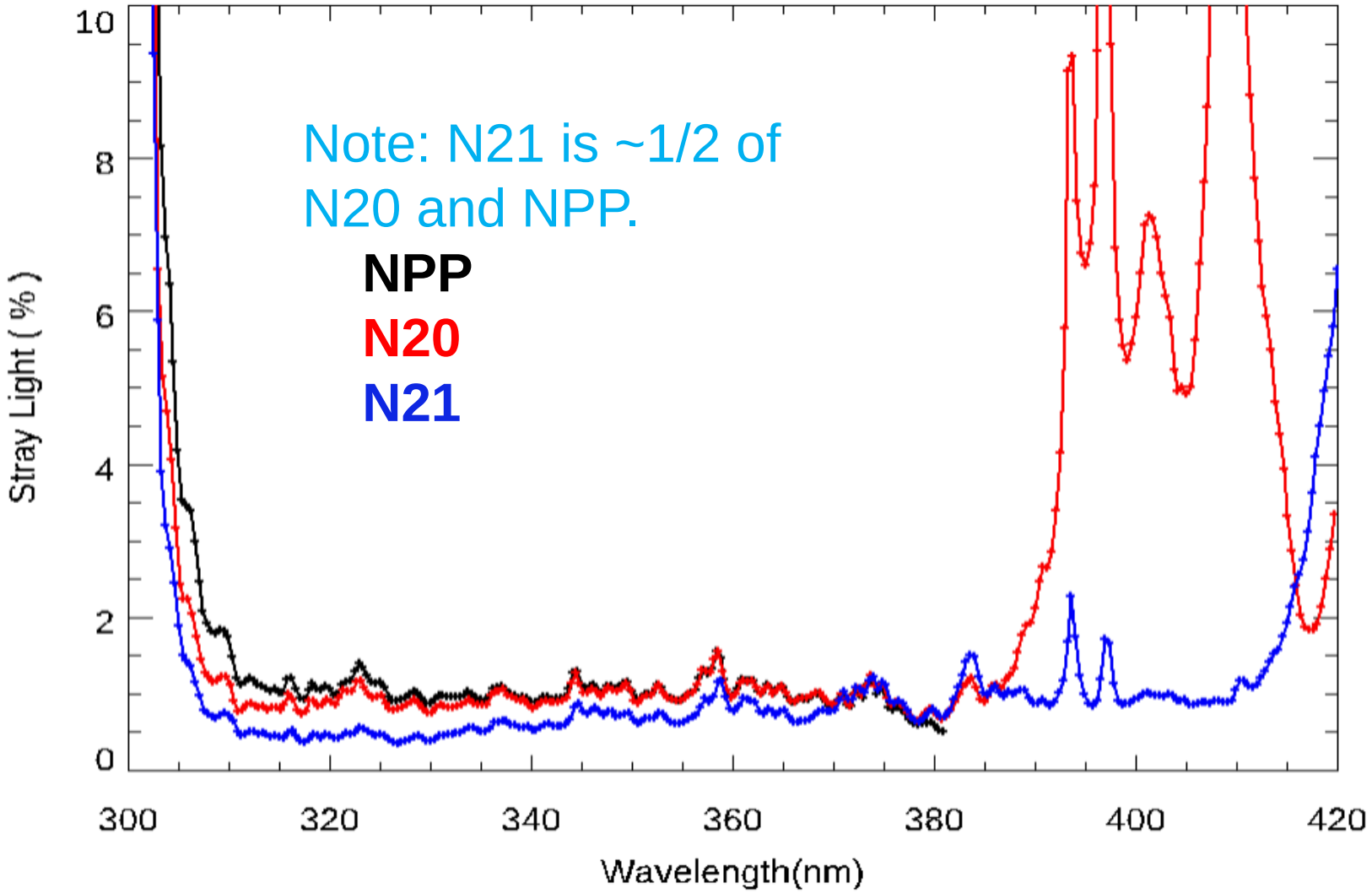


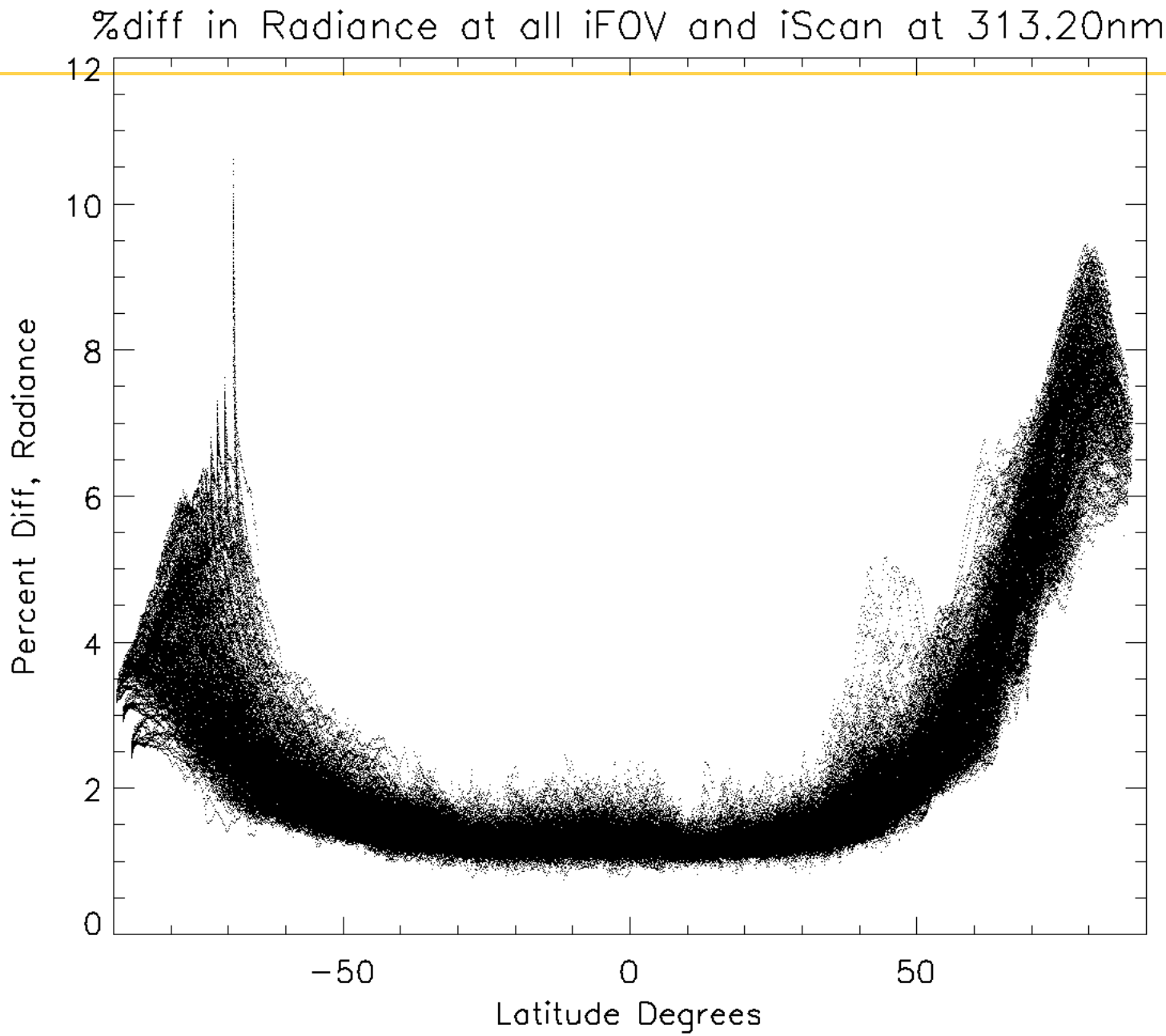
Smaller FOV have noisier measurements as expected



NASA estimates of the spectral dependence of the straylight components for OMPS NM SDRs

10%

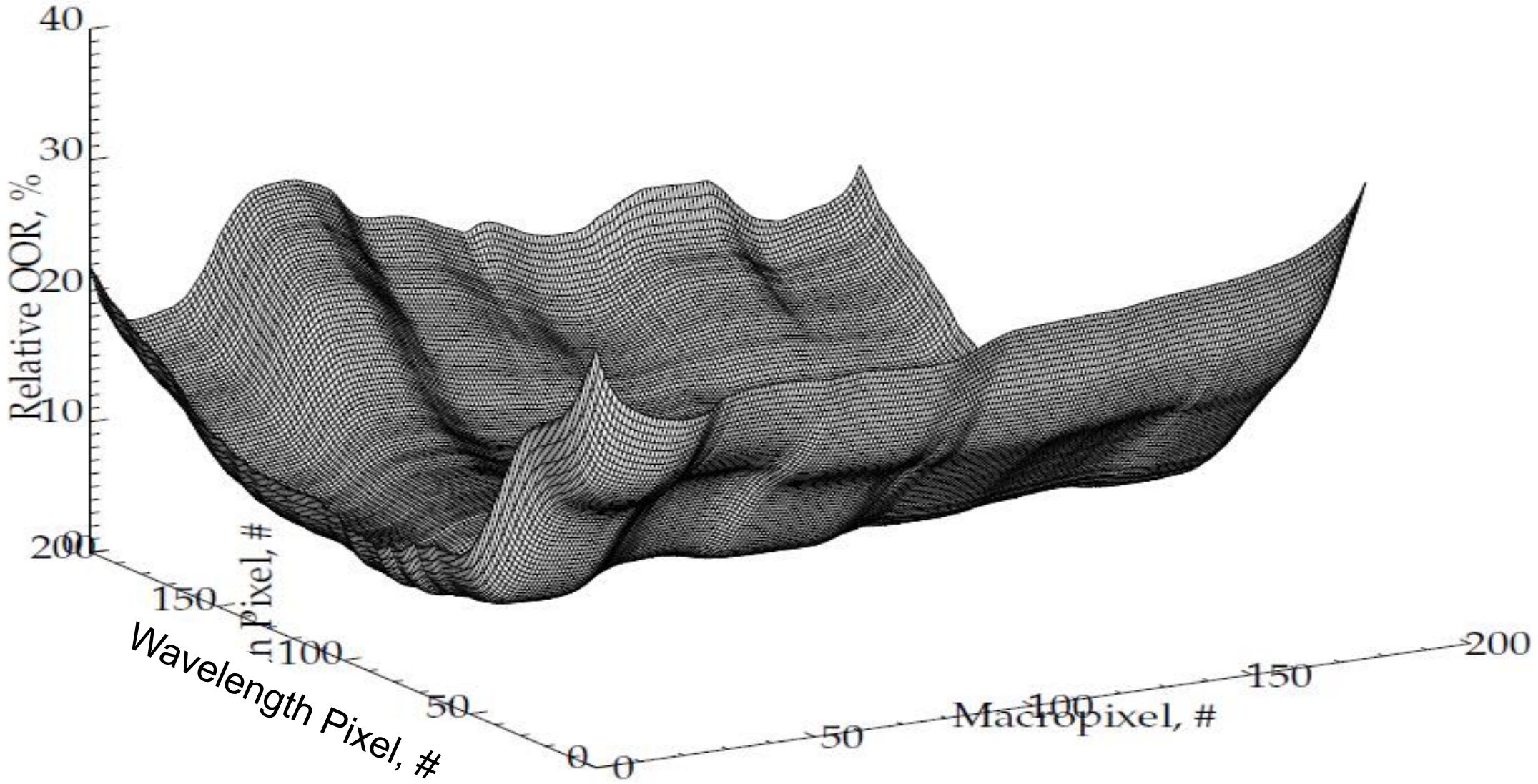


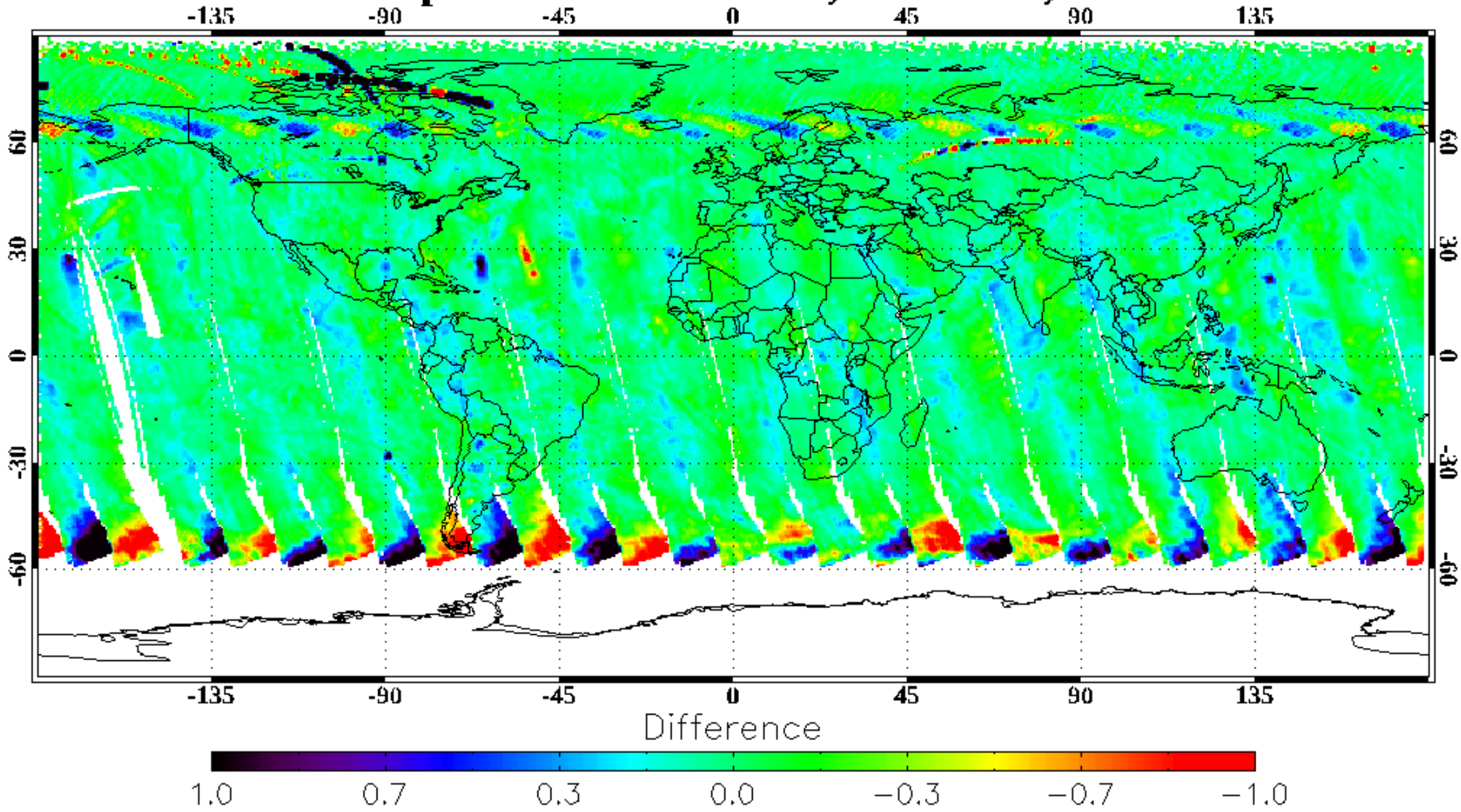


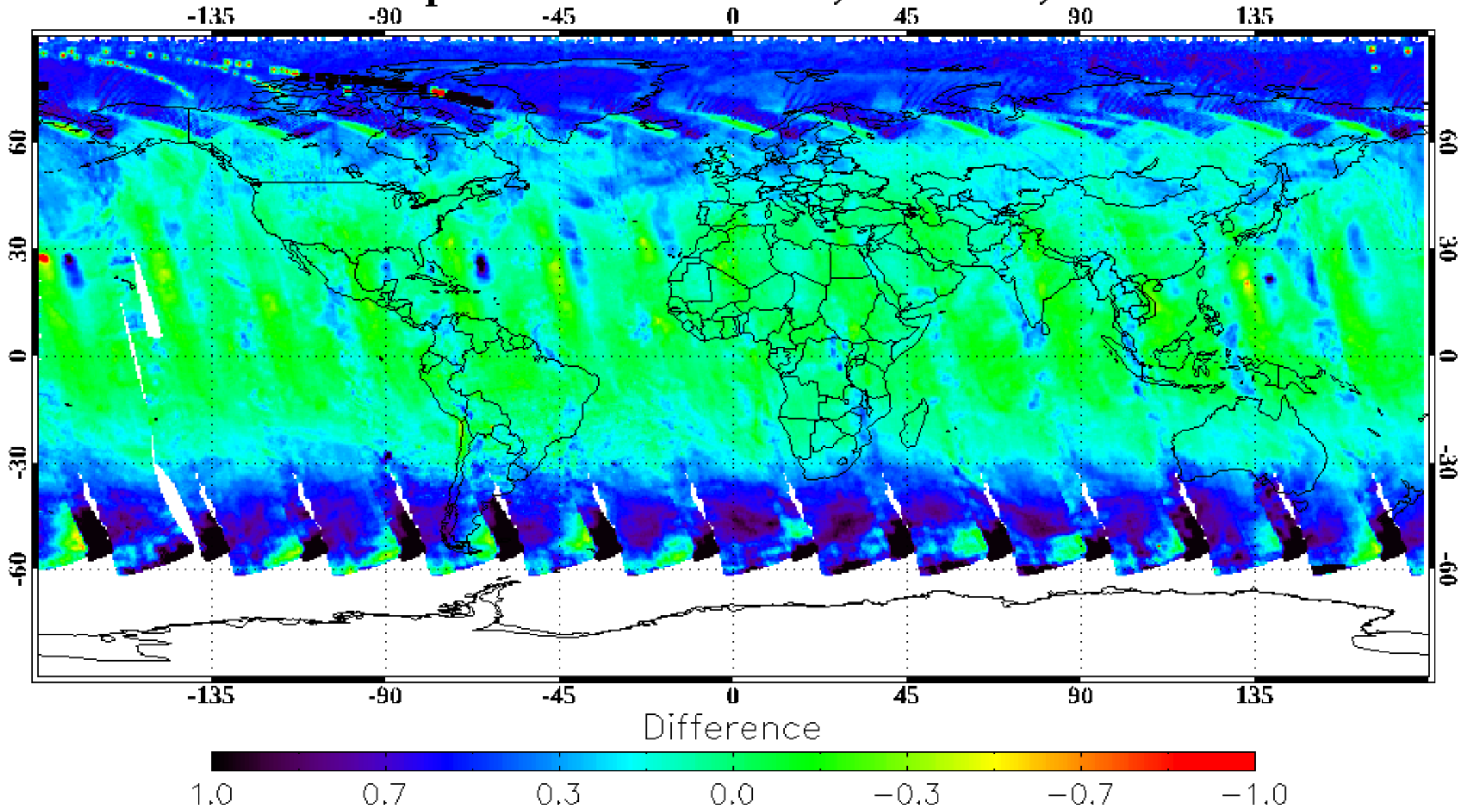
10%

N20 changes without versus with NOAA straylight correction.

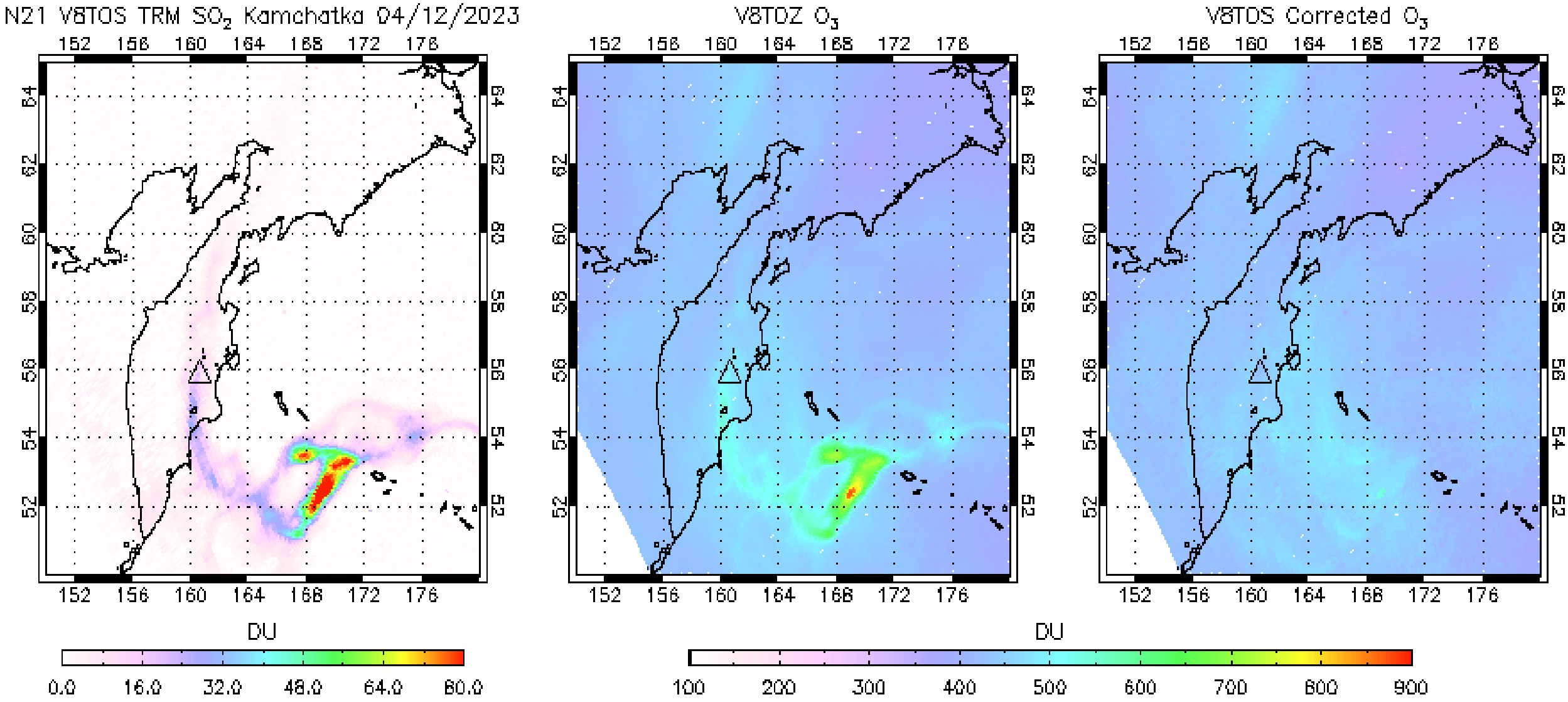
Additional Percent Change in Correction from OOB/R Straylight for a Flat Field



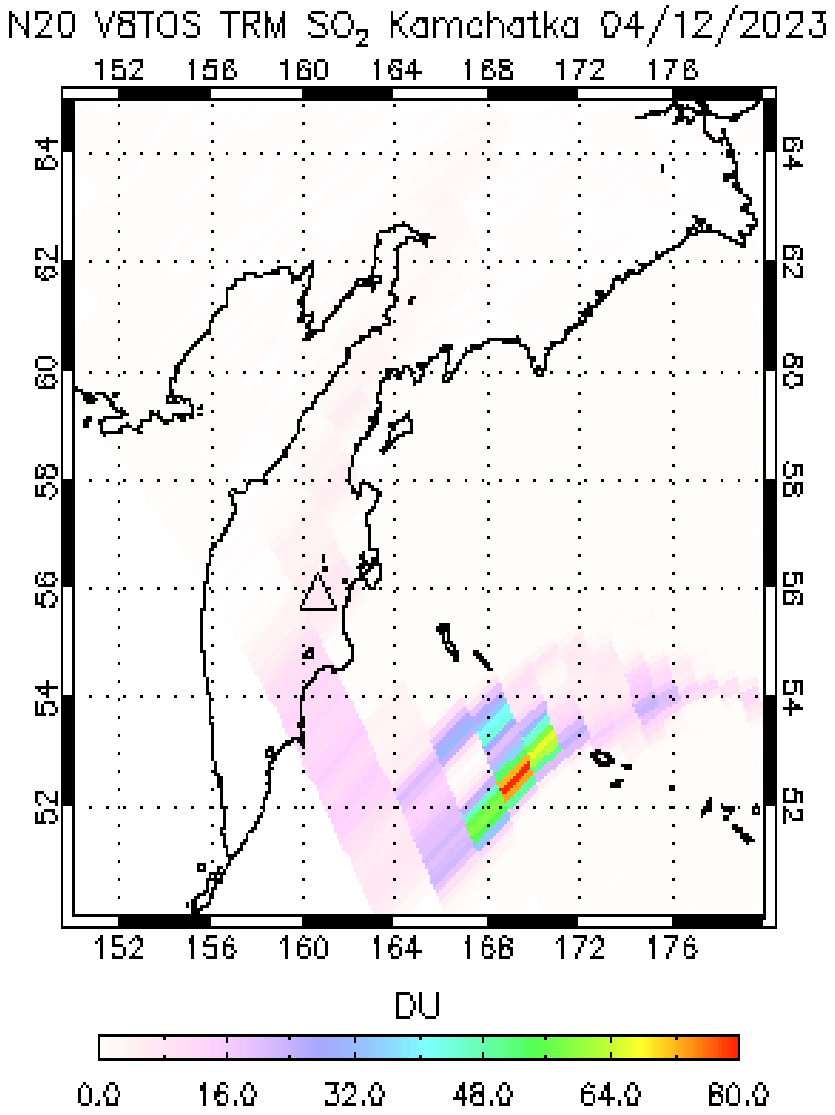

313nm Step2Residual Difference, NPP - N20, 20230706
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference
1.0
0.7
0.3
0.0
−0.3
−0.7
−1.0

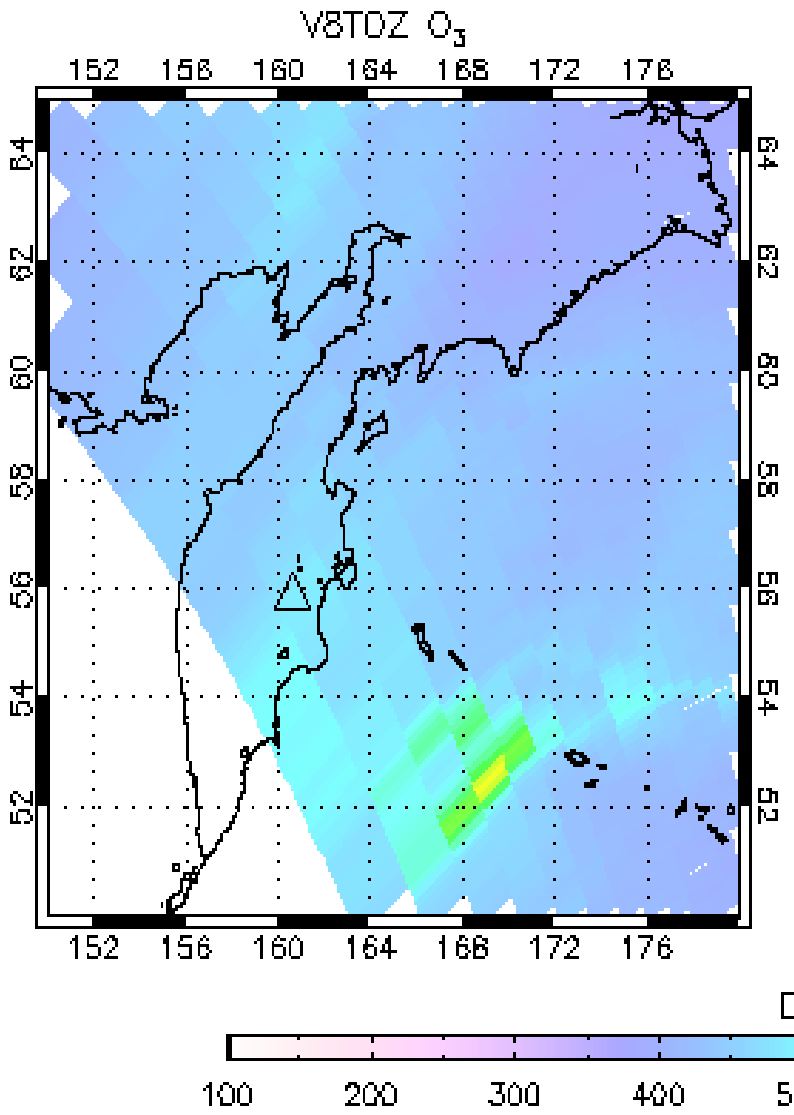

313nm Step2Residual Difference, N21 - N20, 20230706
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference
1.0
0.7
0.3
0.0
−0.3
−0.7
−1.0

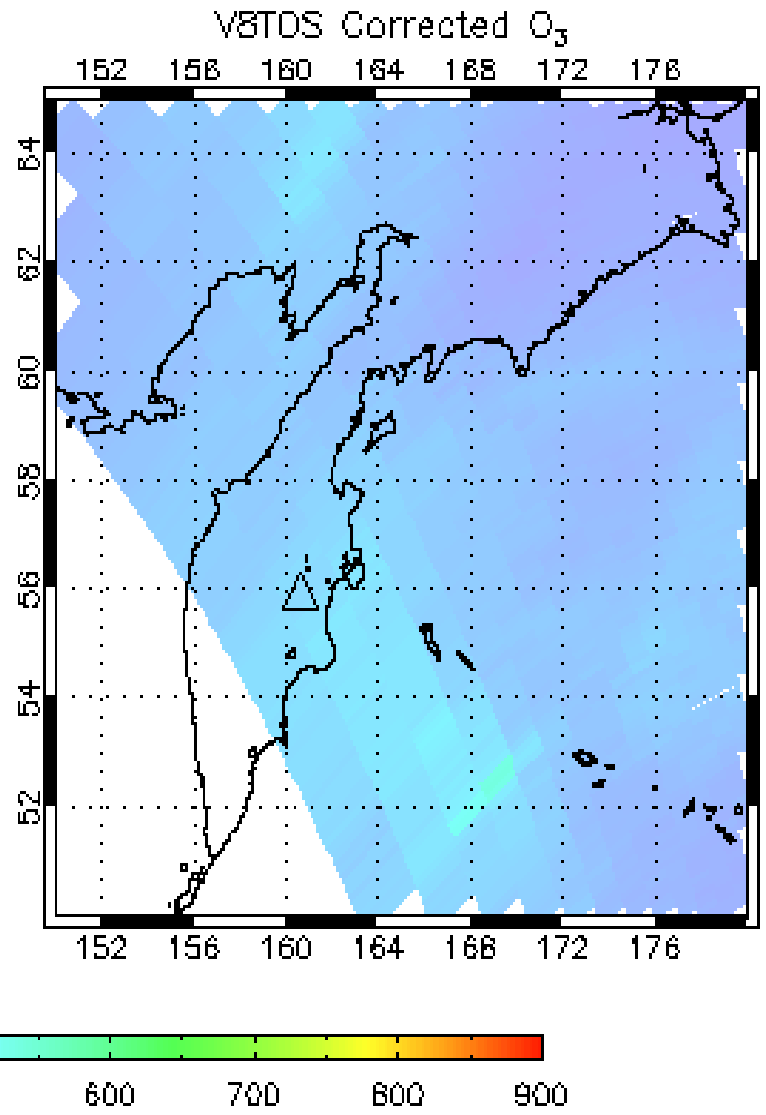
V8TOS Performance for NOAA-21



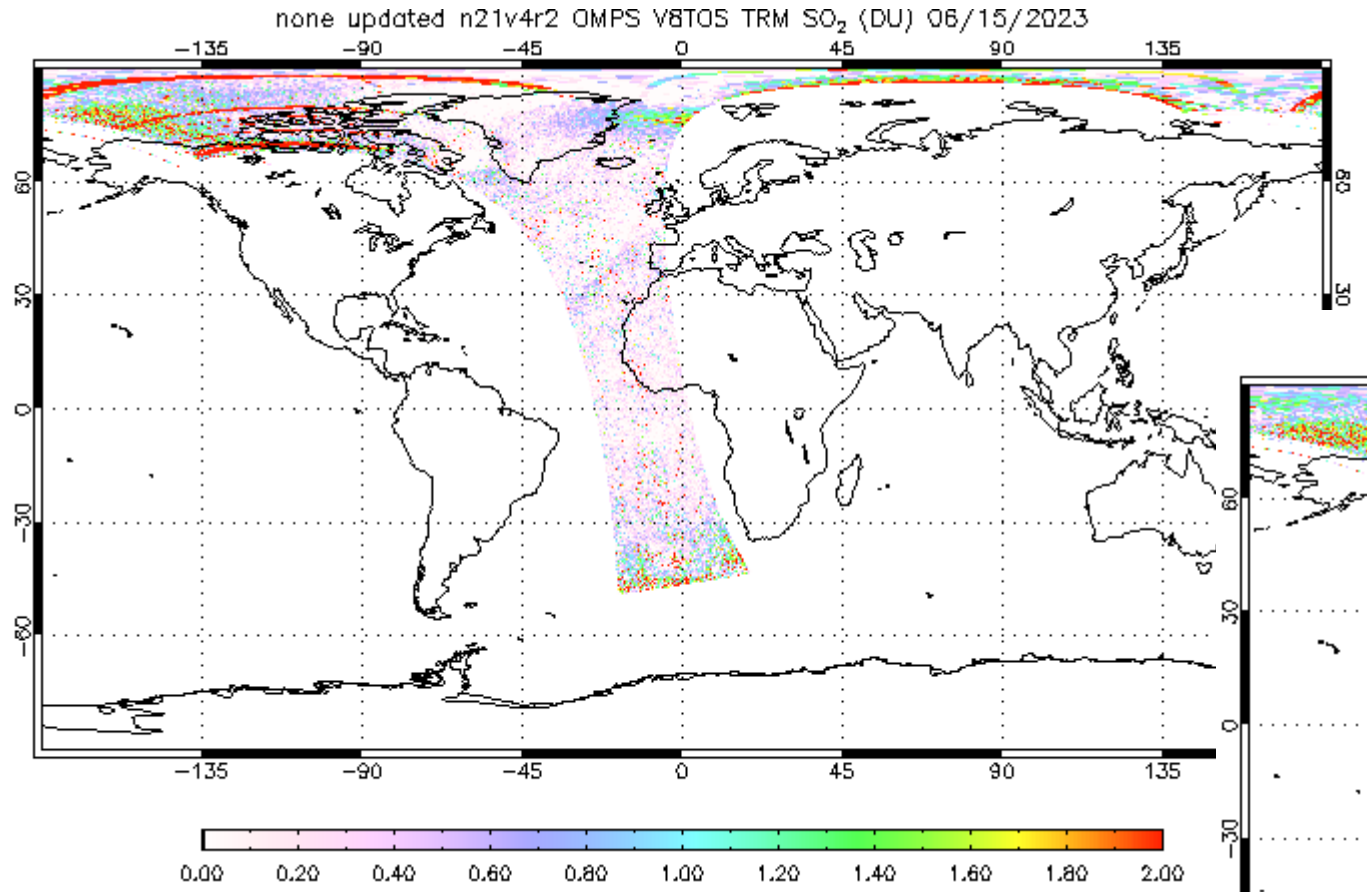
V8TOS Performance for NOAA-20



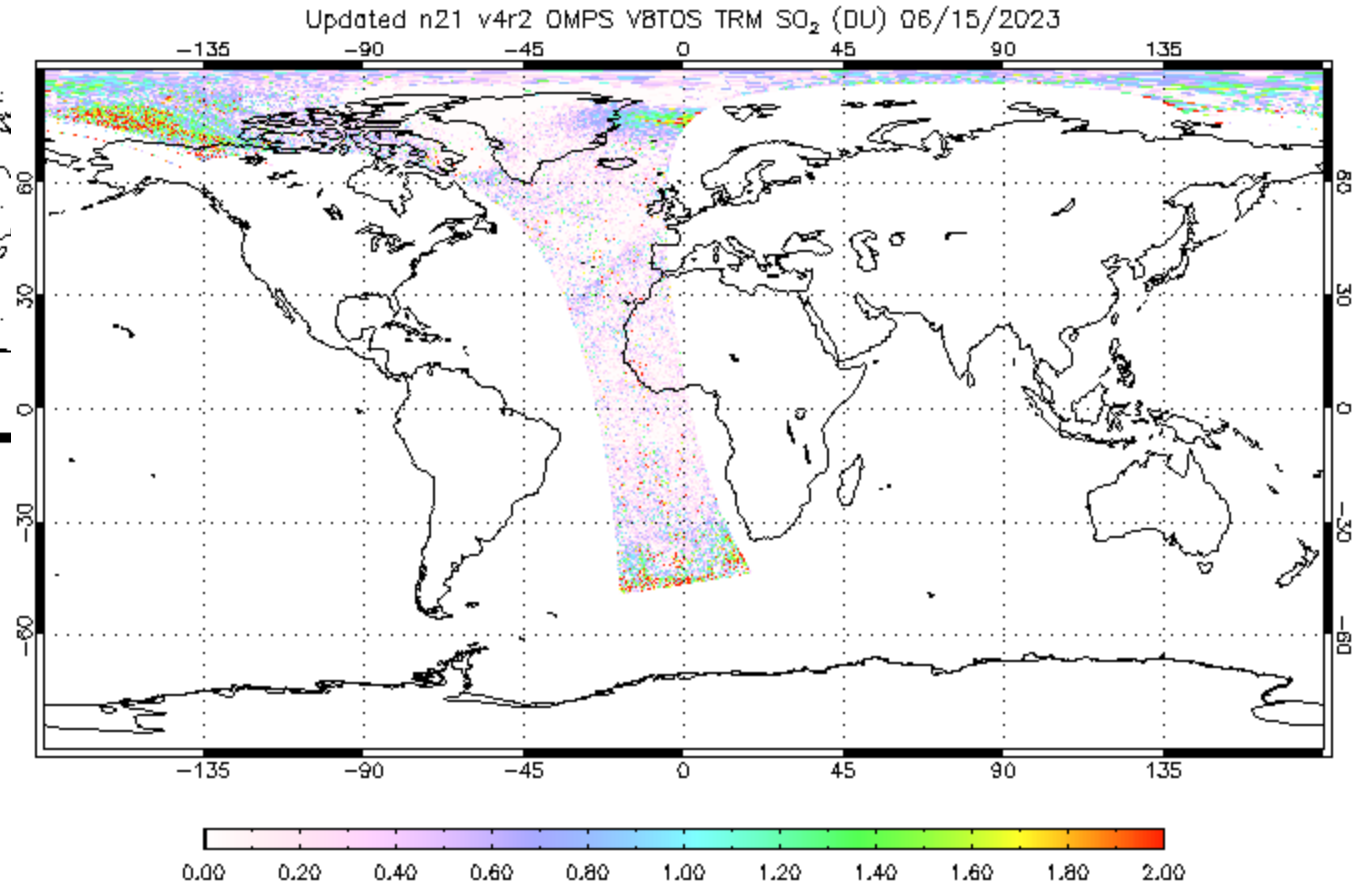


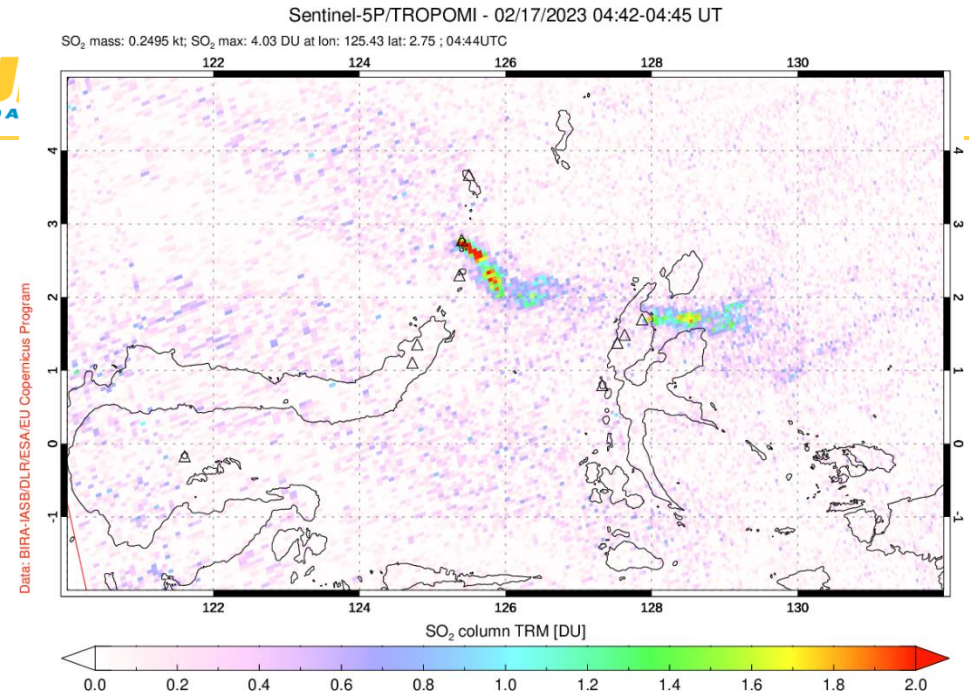


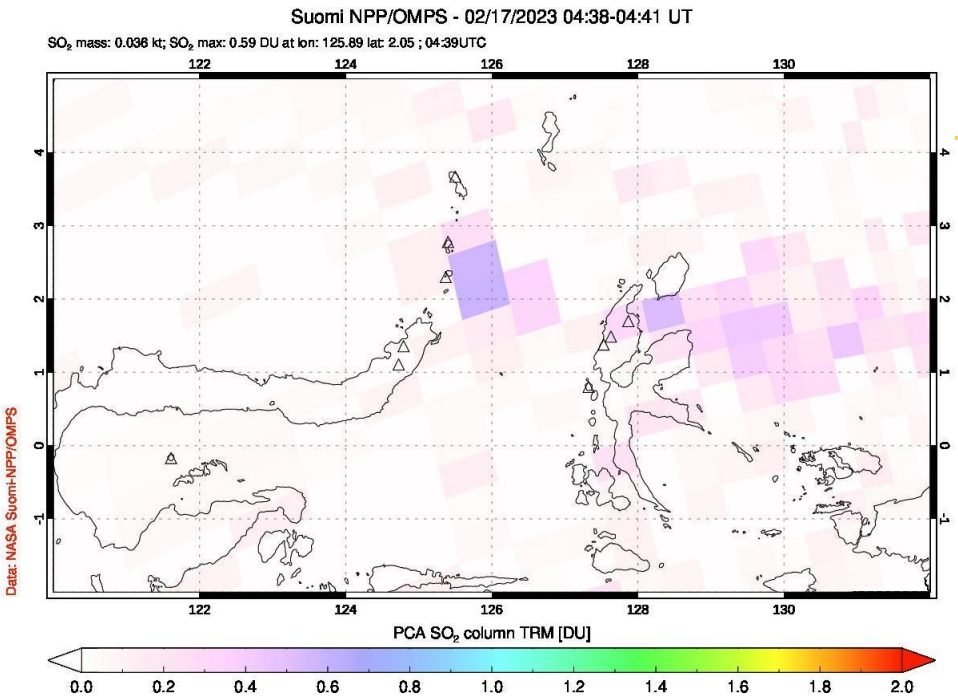
Before and After Maps for N21 V8TOS Flag Identification Upgrade



Requires approximately 30 lines of code changes in mai.f90 and so2_m_noaa.f90. Will be delivered for Validated Maturity.

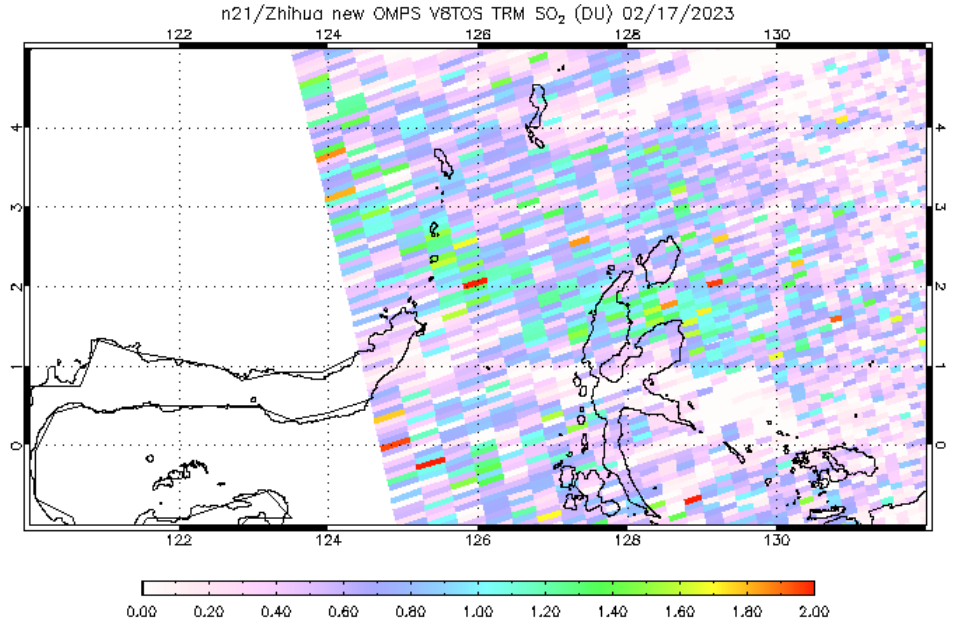






The increased noise in the NOAA-21 SO2 estimates is expected. We are investigating methods to use local fits (wavelength channel intervals) of radiance / irradiance rations to identify outliers and filter the measurements to reduce the noise.

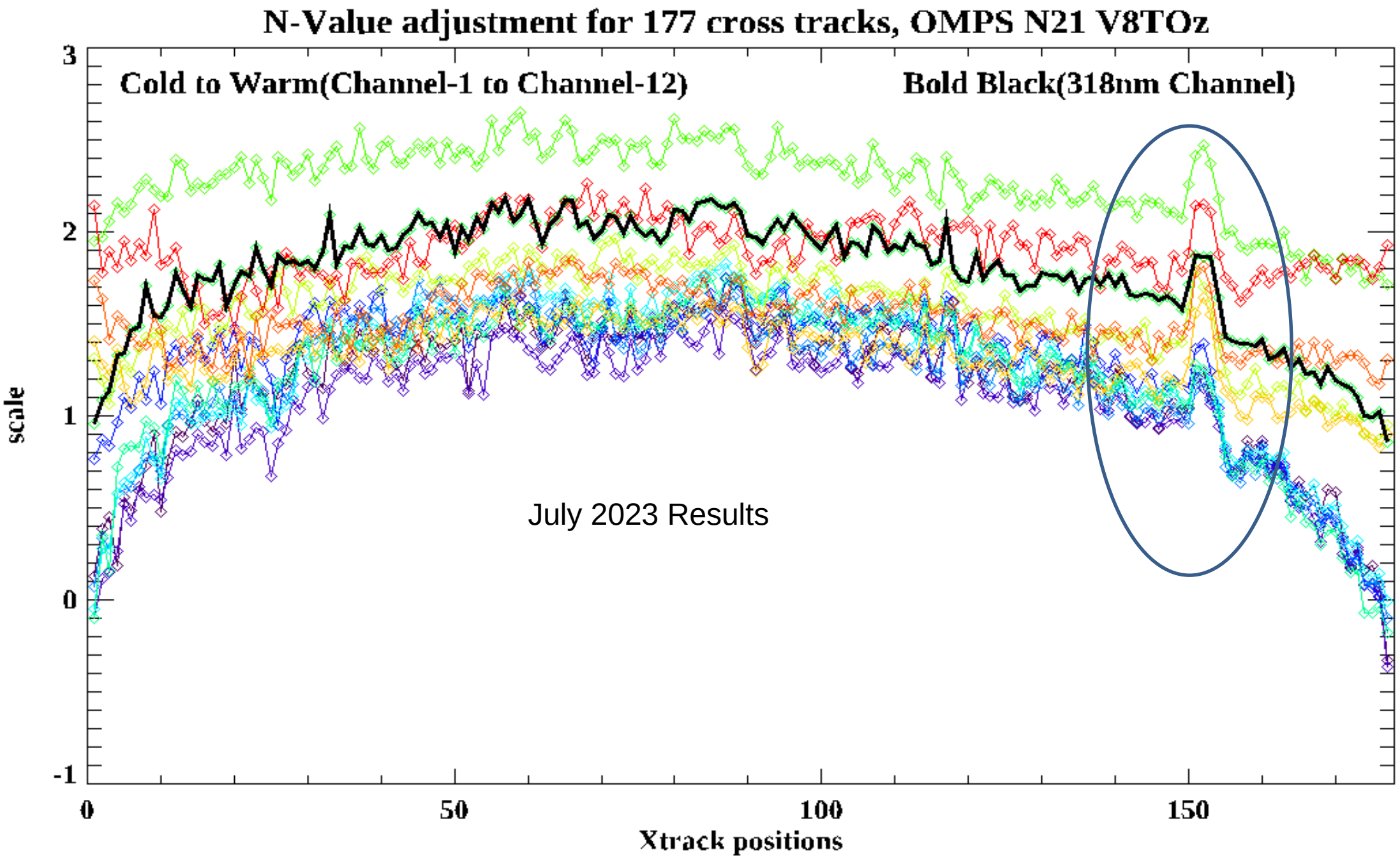
The two earlier slides showed the good performance for a recent volcanic event in Russia.

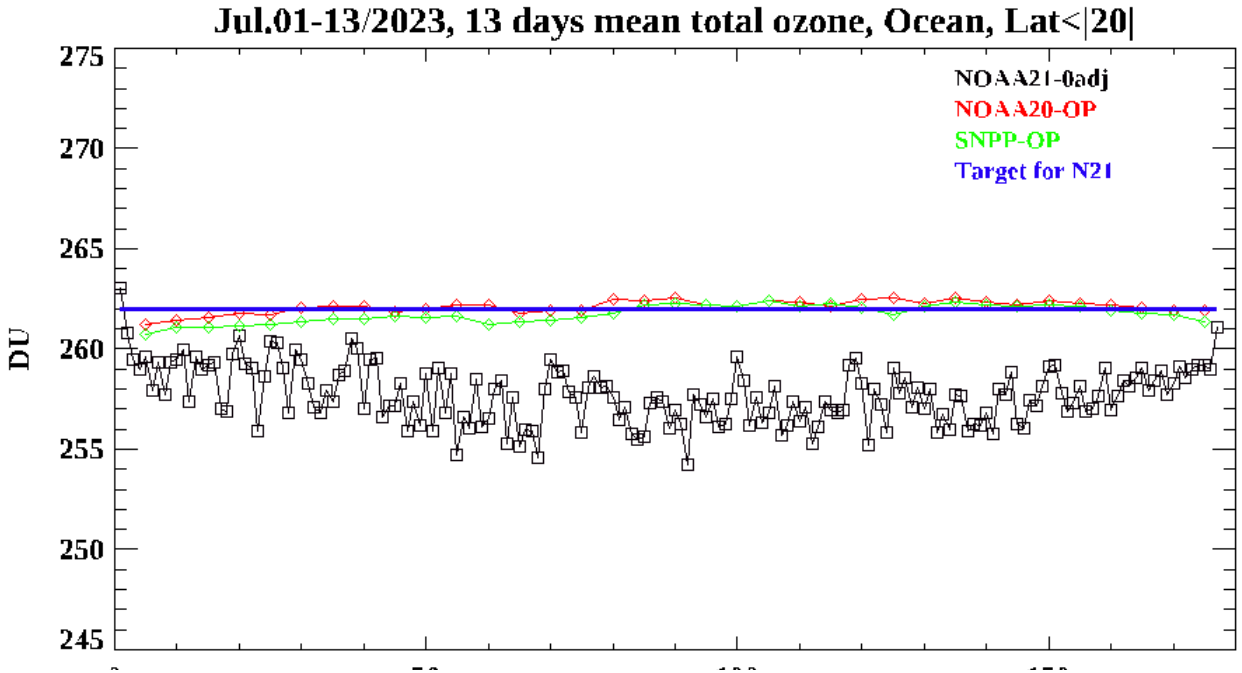


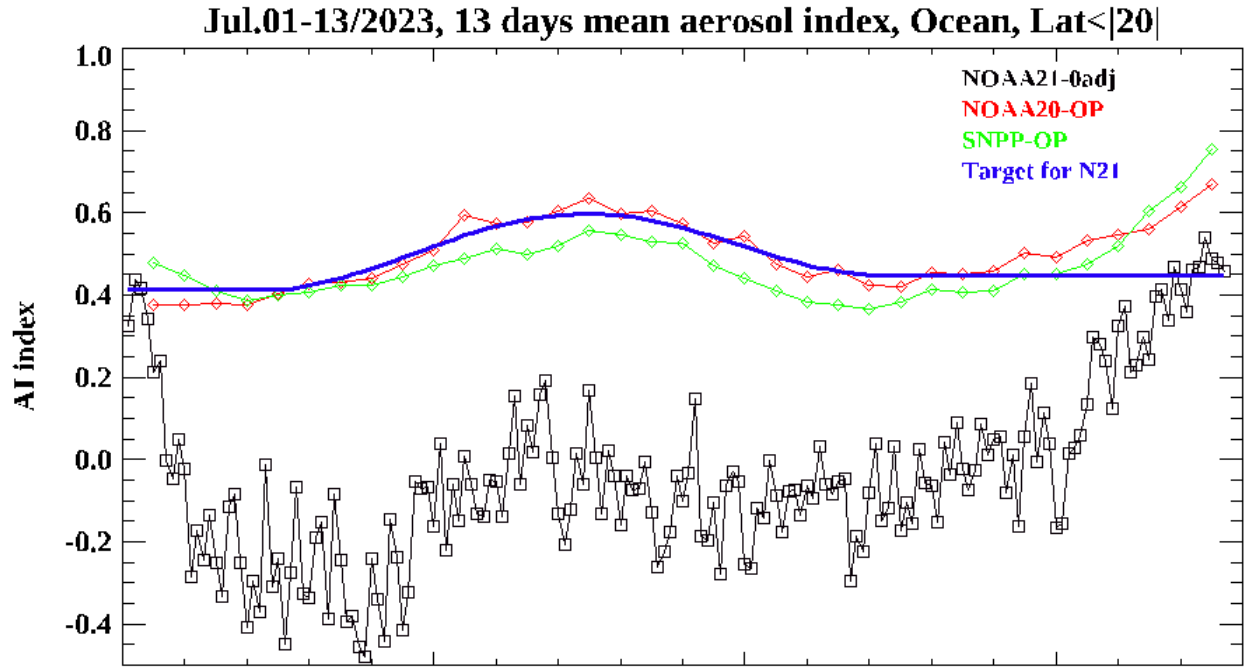
The purpose of generating Soft-Calibration Adjustments for N21 V8TOz is to make its retrievals close to those from current operational NPP/N20 V8TOz.

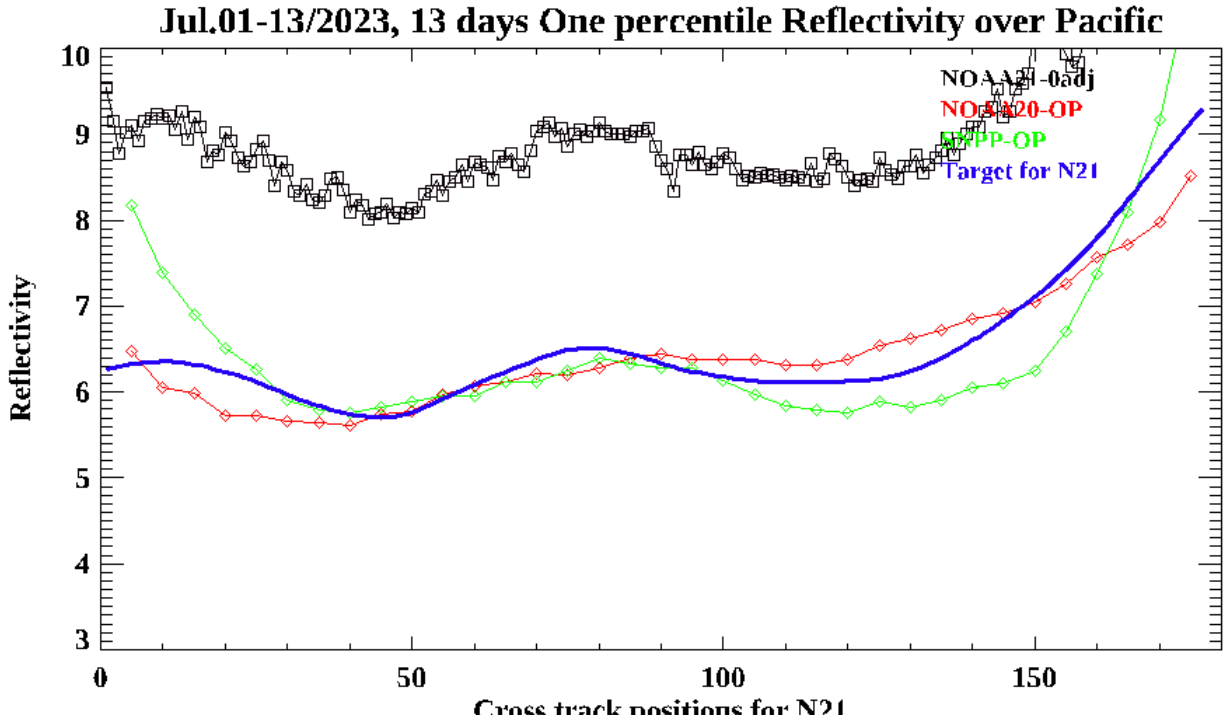
13 consecutive days' (Jul. 01~Jul.13, 2023) of data that have full daily orbits with stable SDR were selected to create adjustments.

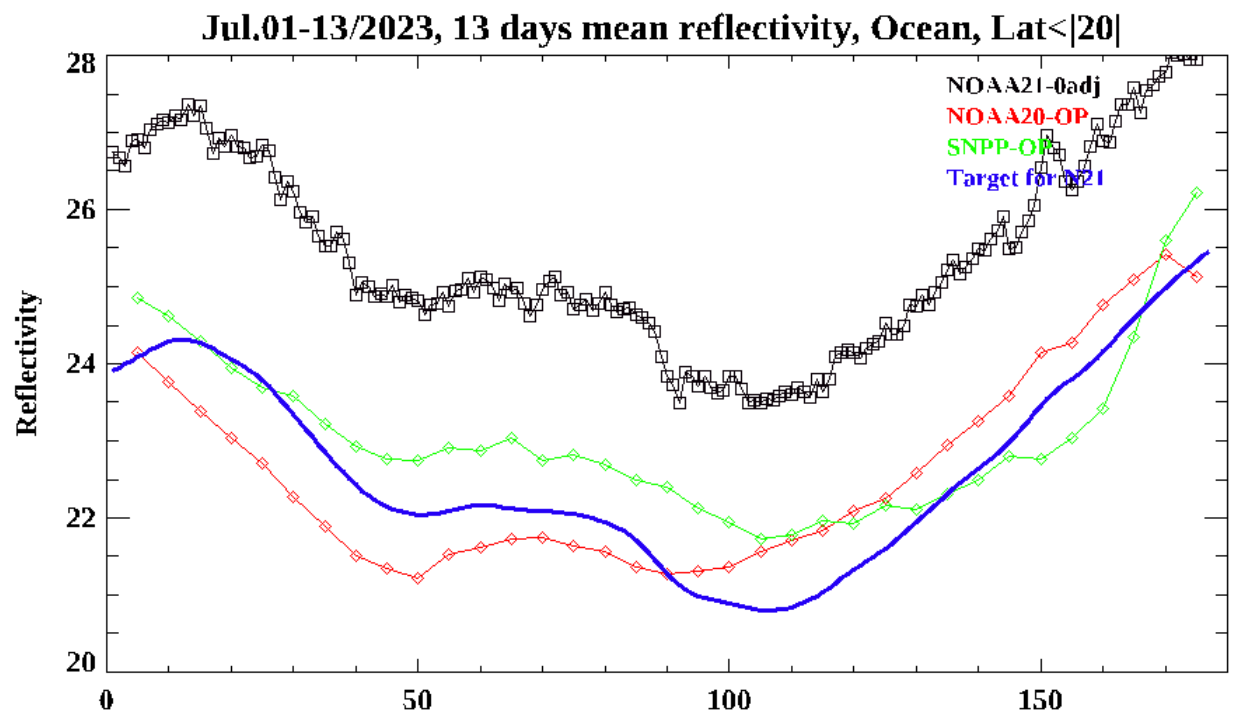
Note: Dates around the Equinoxes – Mar. 21 or Sep. 21 – are better for generating high quality soft-calibration.

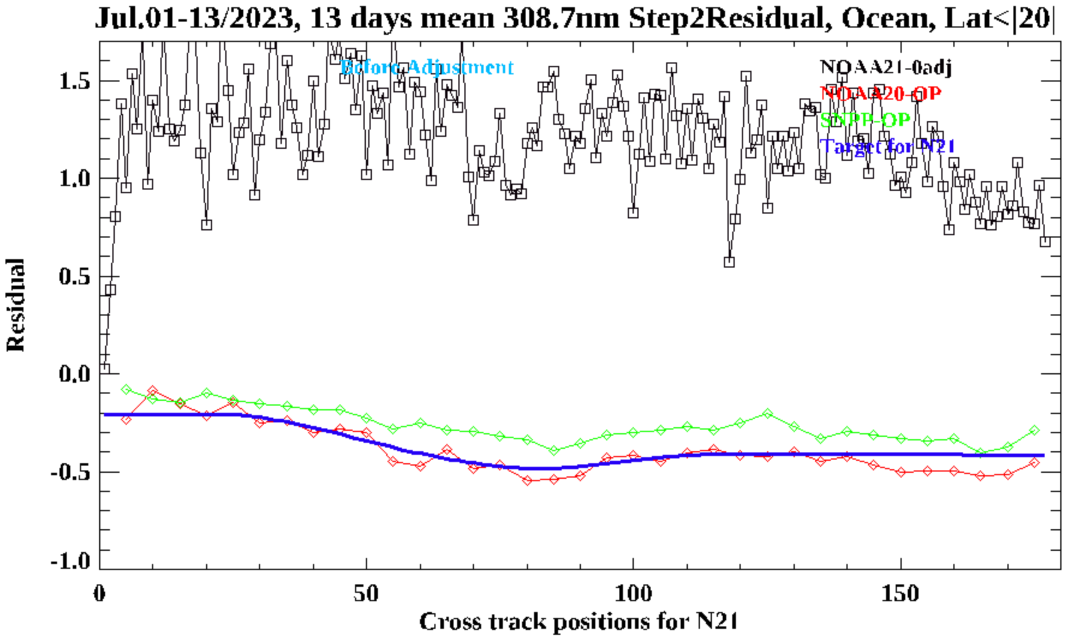

N-Value adjustment for 177 cross tracks, OMPS N21 V8TOz
Cold to Warm(Channel-1 to Channel-12)
Bold Black(318nm Channel)
July 2023 Results
scale
Xtrack positions
3
2
1
0
-1
0
50
100
150

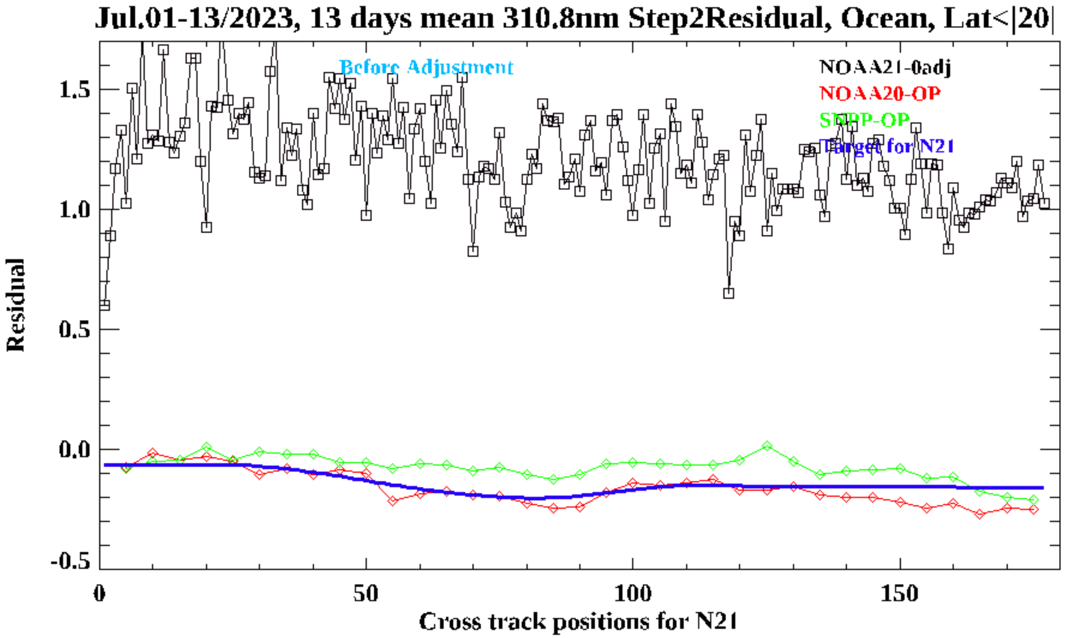

Jul.01-13/2023, 13 days mean total ozone, Ocean, Lat<|20|
NOAA21-0adj
NOAA20-OP
SNPP-OP
Target for N21
DU
275
270
265
260
255
250
245


Jul.01-13/2023, 13 days mean aerosol index, Ocean, Lat<|20|
NOAA21-0adj
NOAA20-OP
SNPP-OP
Target for N21
AI index
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4

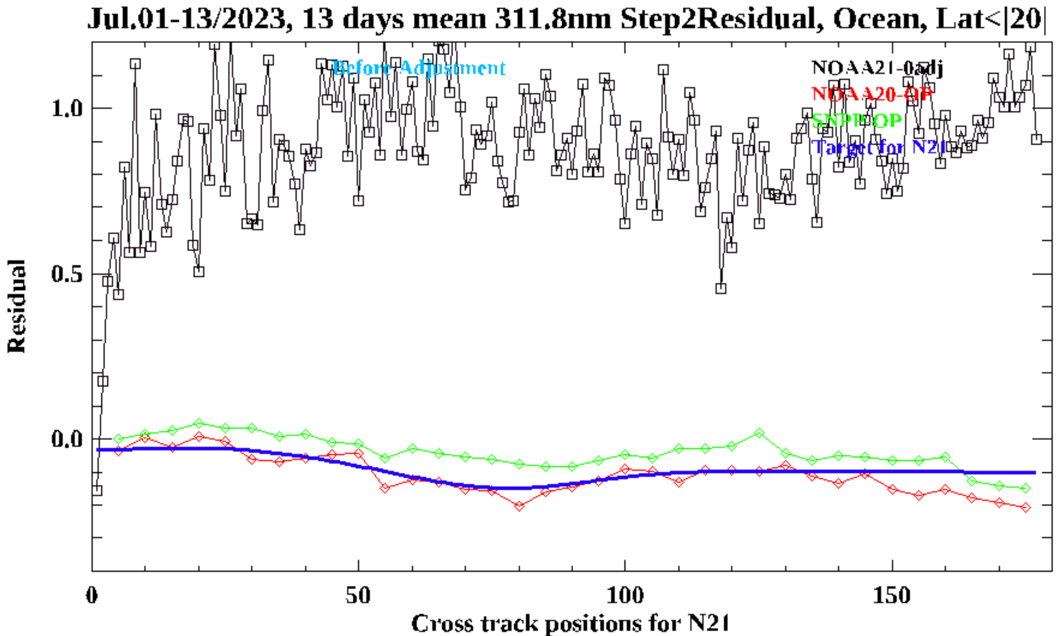

Jul.01-13/2023, 13 days One percentile Reflectivity over Pacific
NOAA21-0adj
NOAA20-OP
SNPP-OP
Target for N21
Reflectivity
10
9
8
7
6
5
4
3
0
50
100
150
Cross track positions for N21


Jul.01-13/2023, 13 days mean reflectivity, Ocean, Lat<|20|
NOAA21-0adj
NOAA20-OP
SNPP-OP
Target for N21
Reflectivity
28
26
24
22
20
0
50
100
150

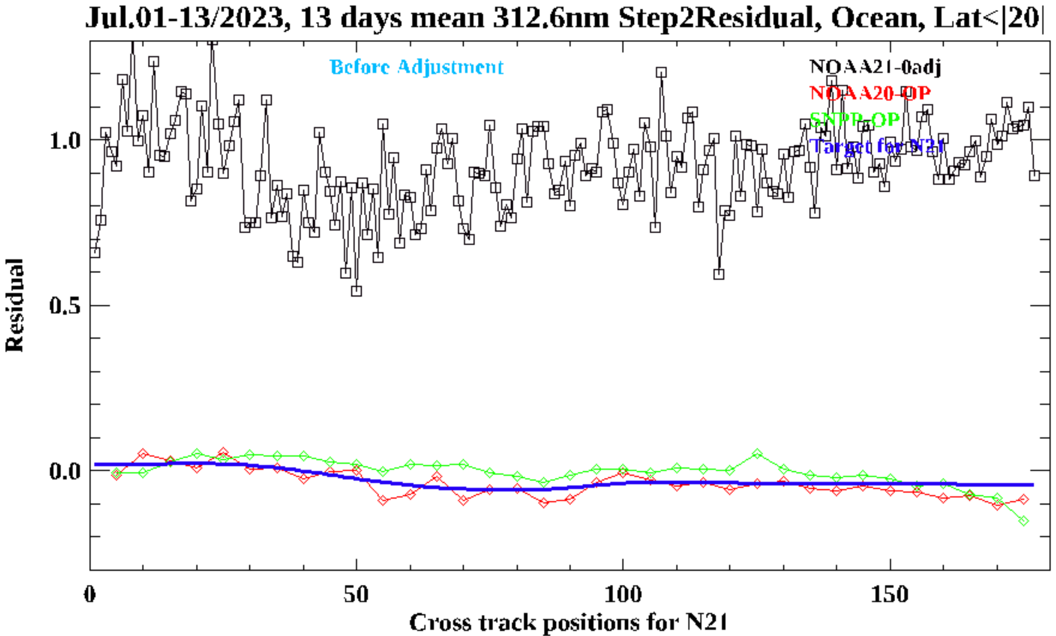


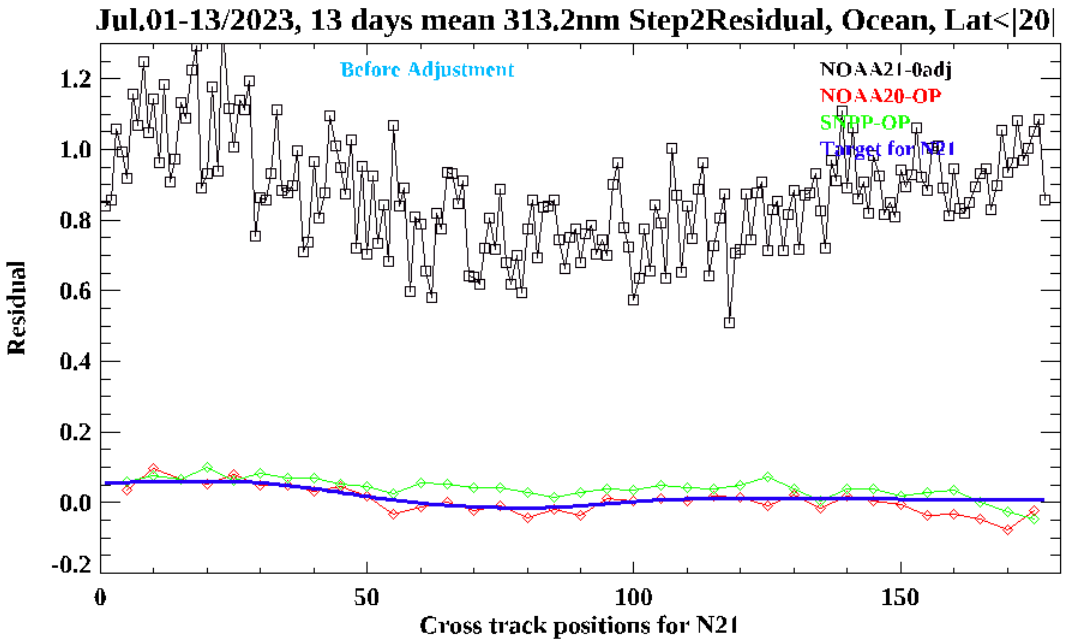


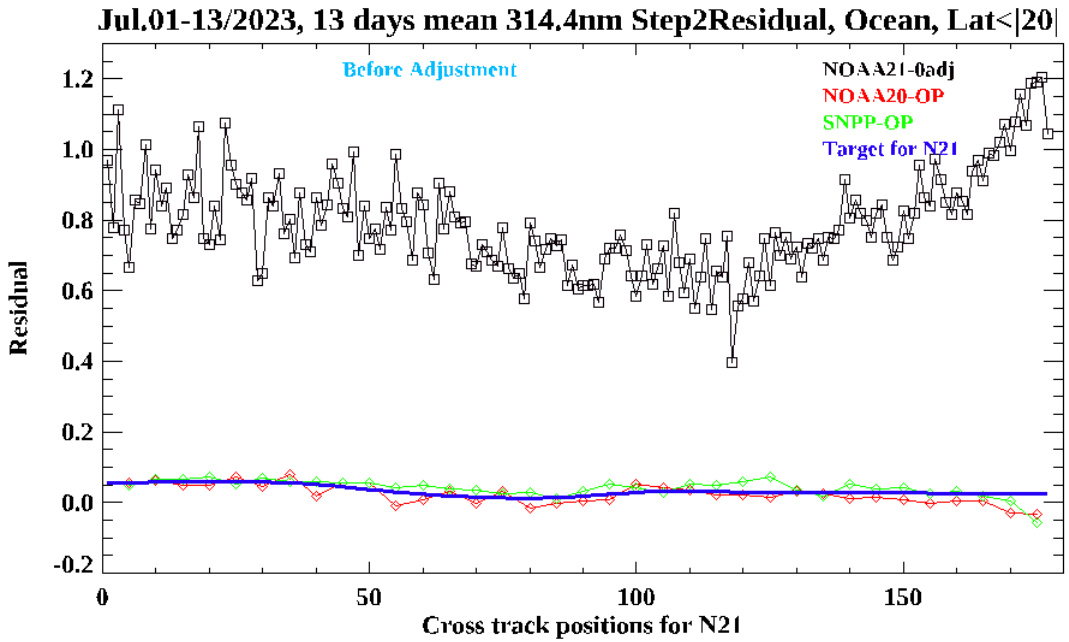
Step2 Residuals by channel before Soft Calibration



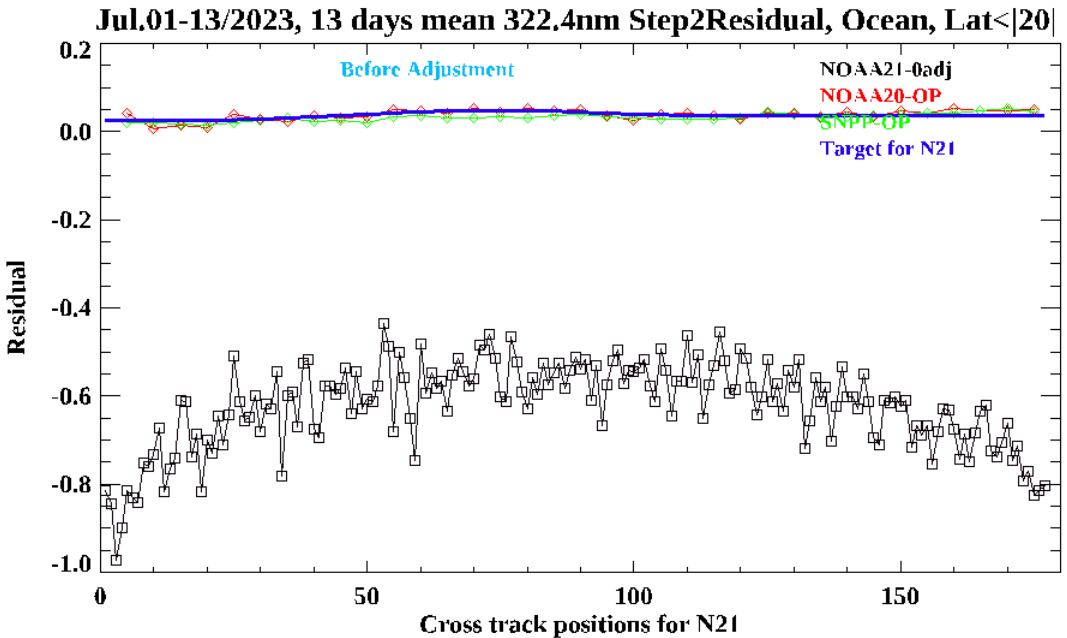
Validation Matu

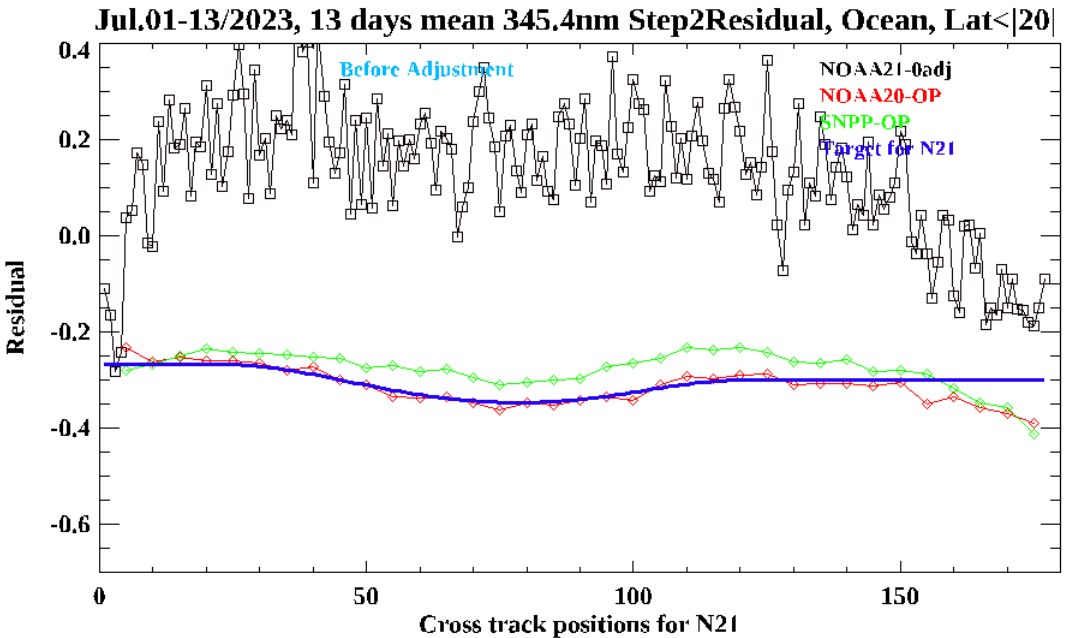


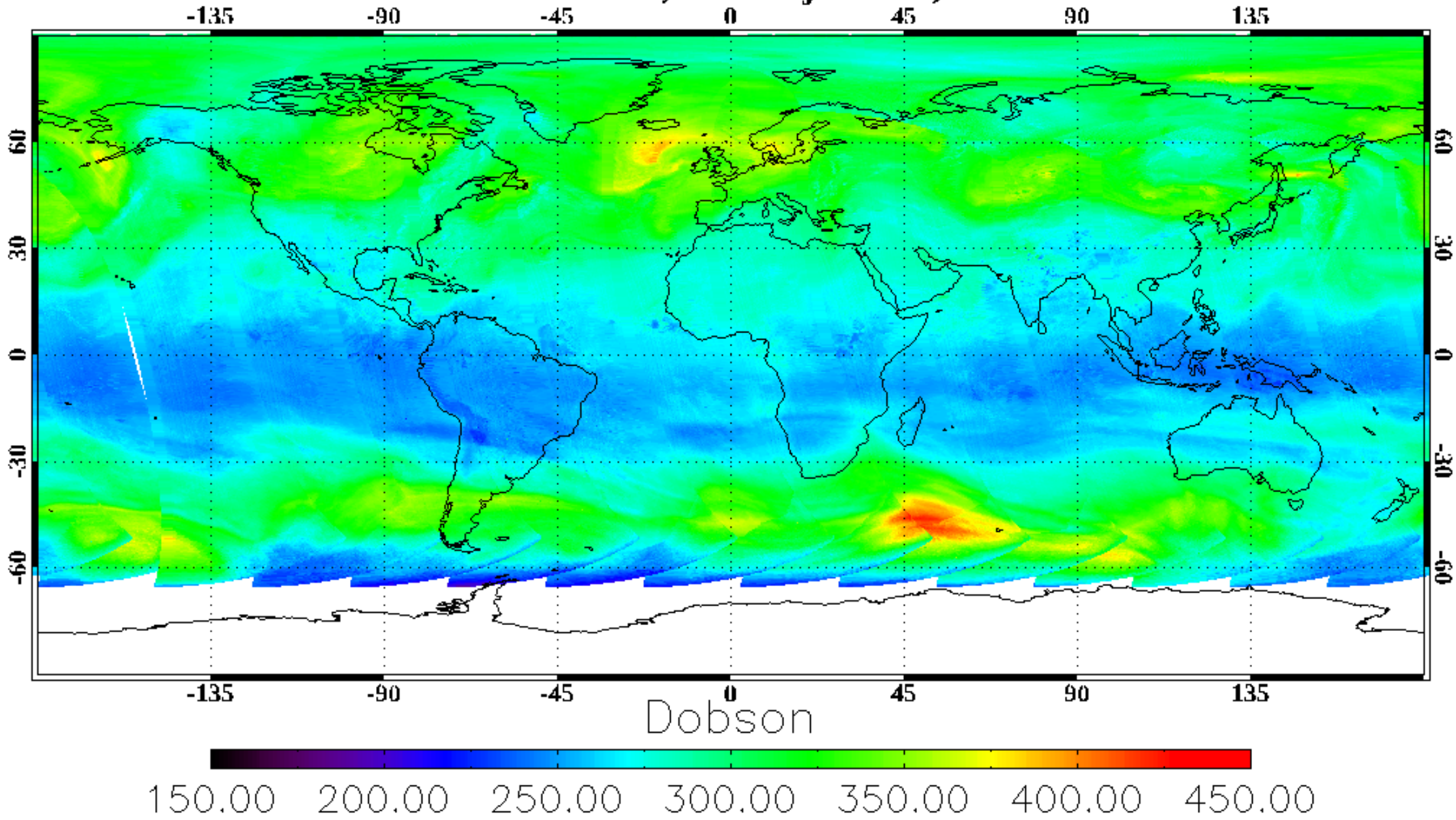


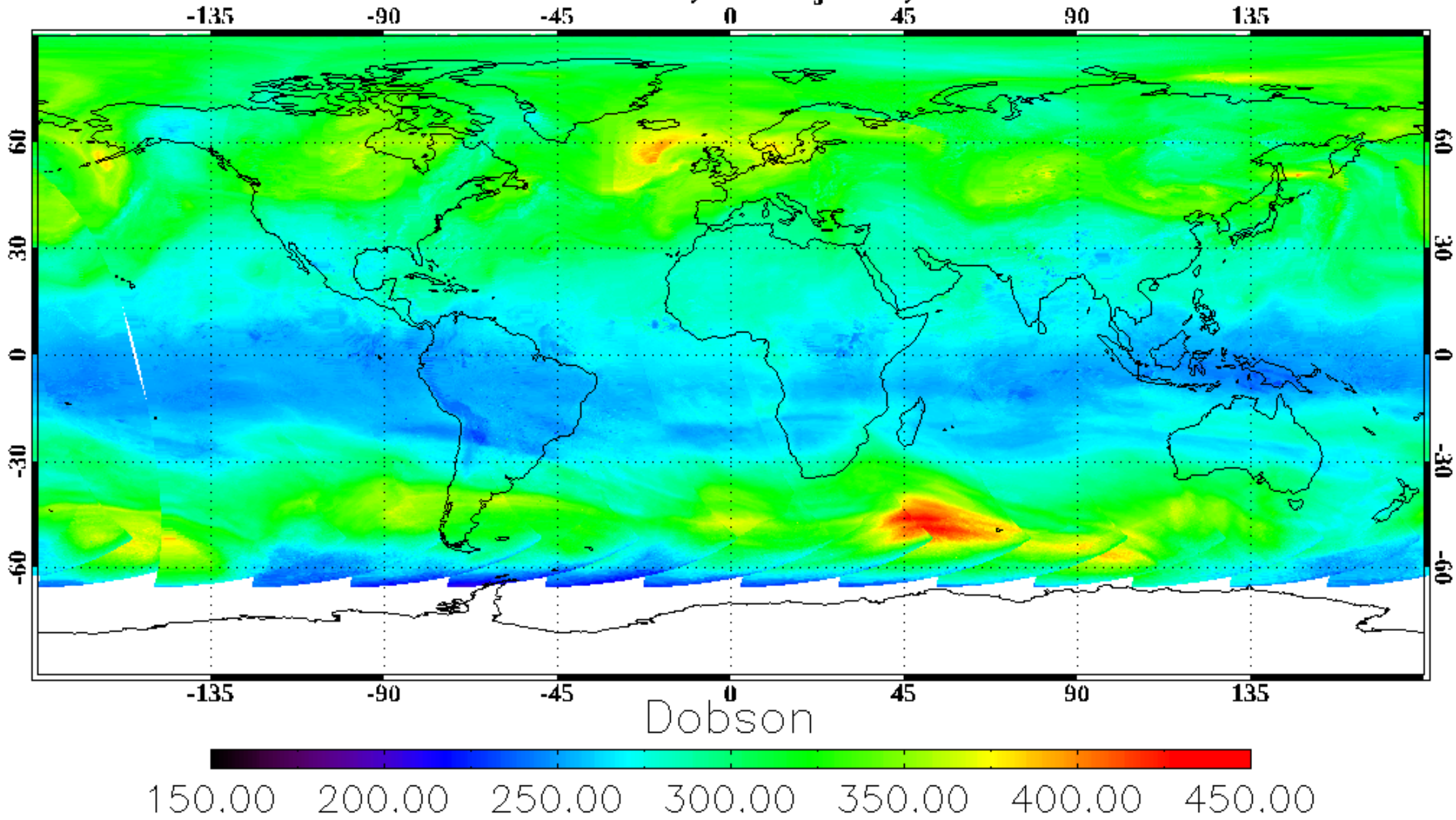


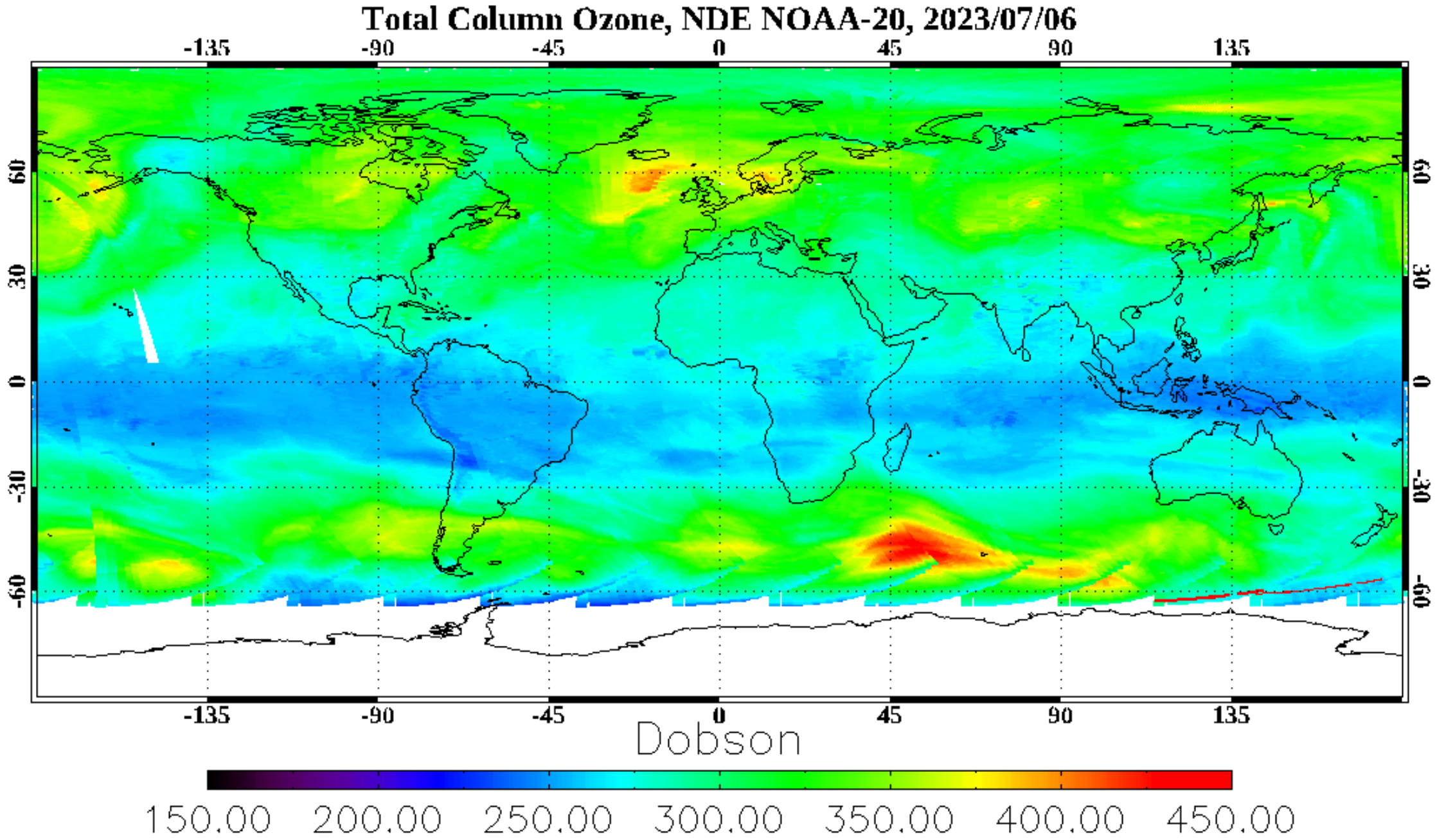
Step2 Residuals by channel before Soft Calibration

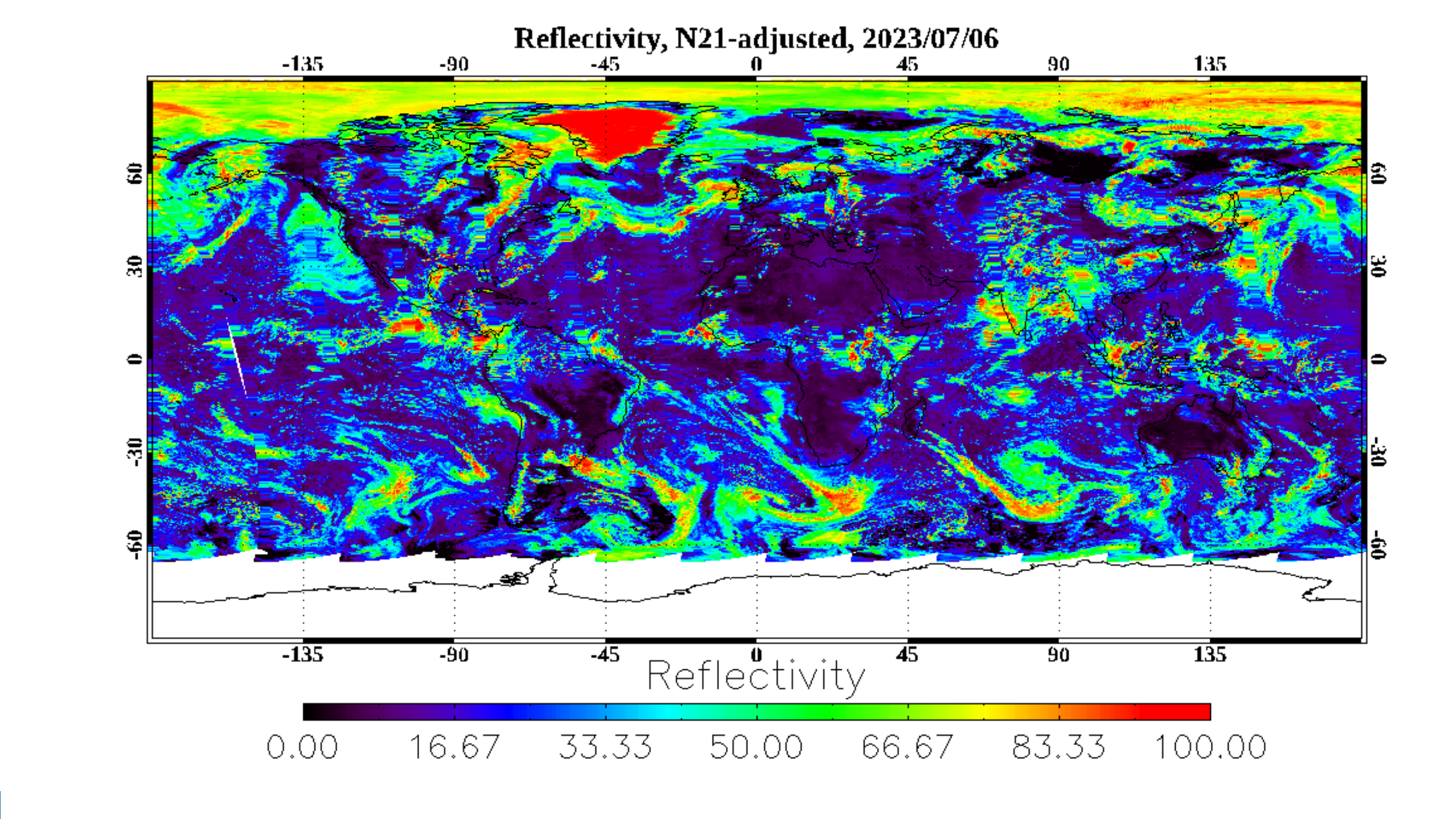


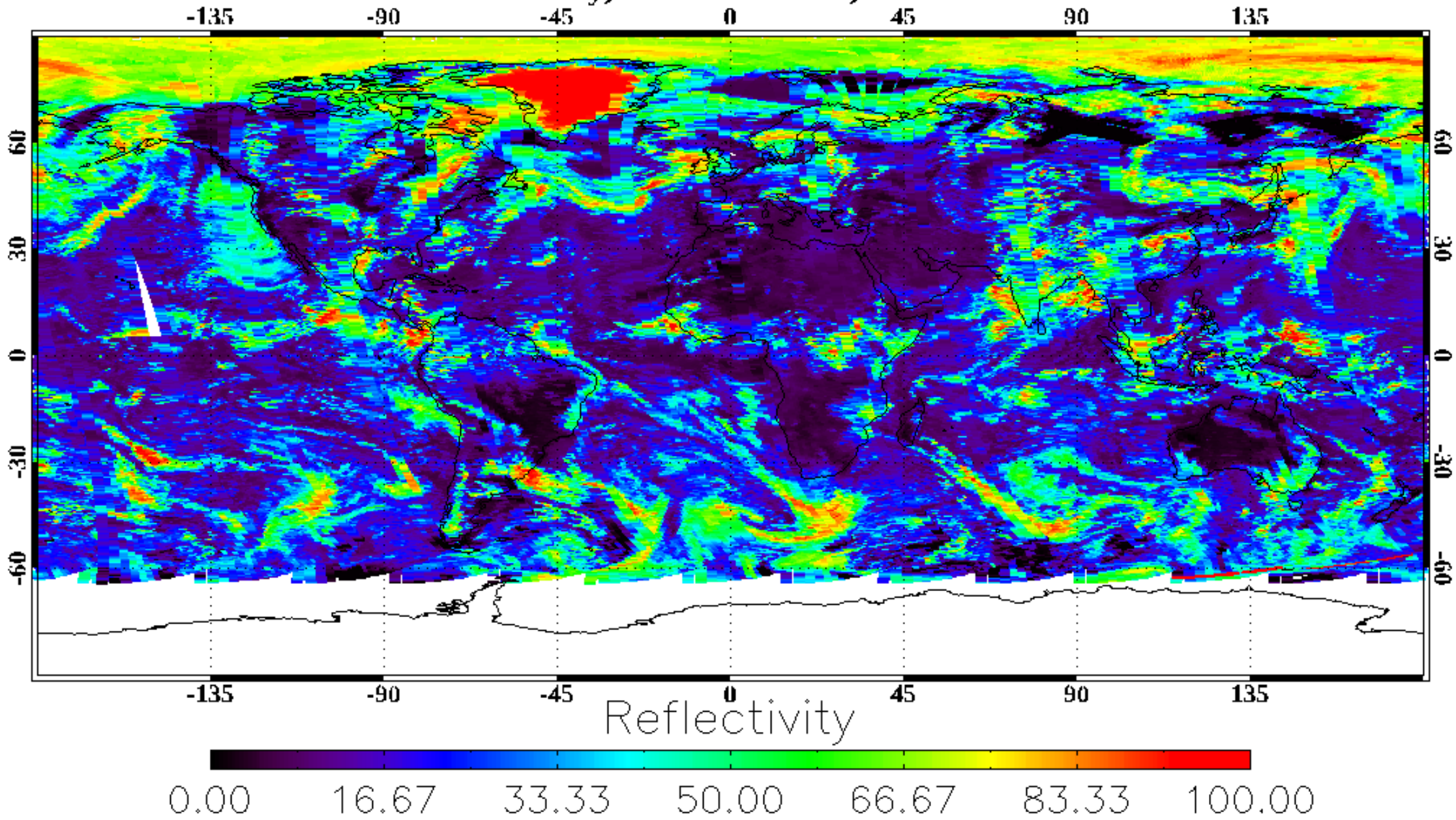


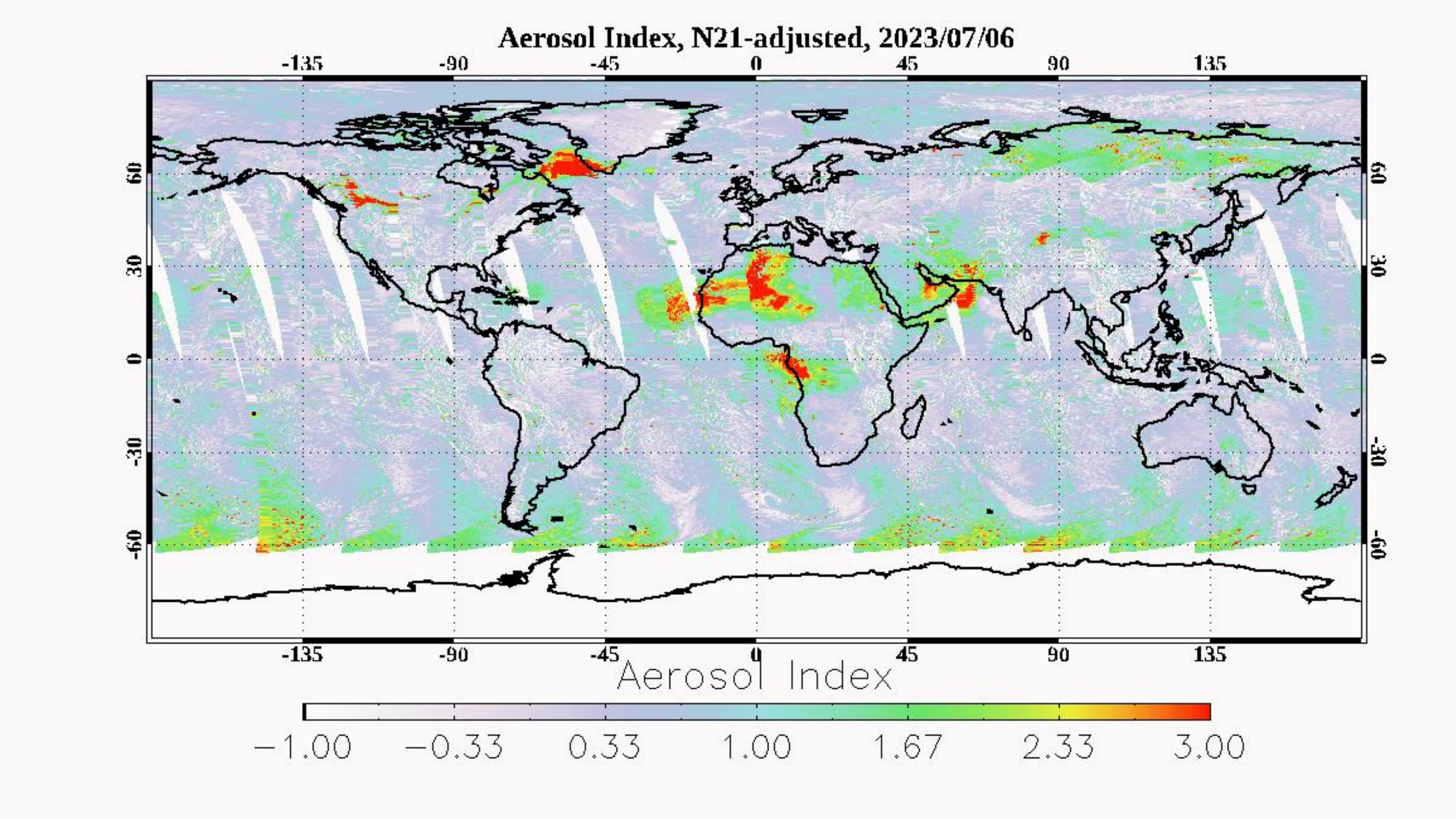

Total Column Ozone, N21-0adjustment, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Dobson
150.00
200.00
250.00
300.00
350.00
400.00
450.00

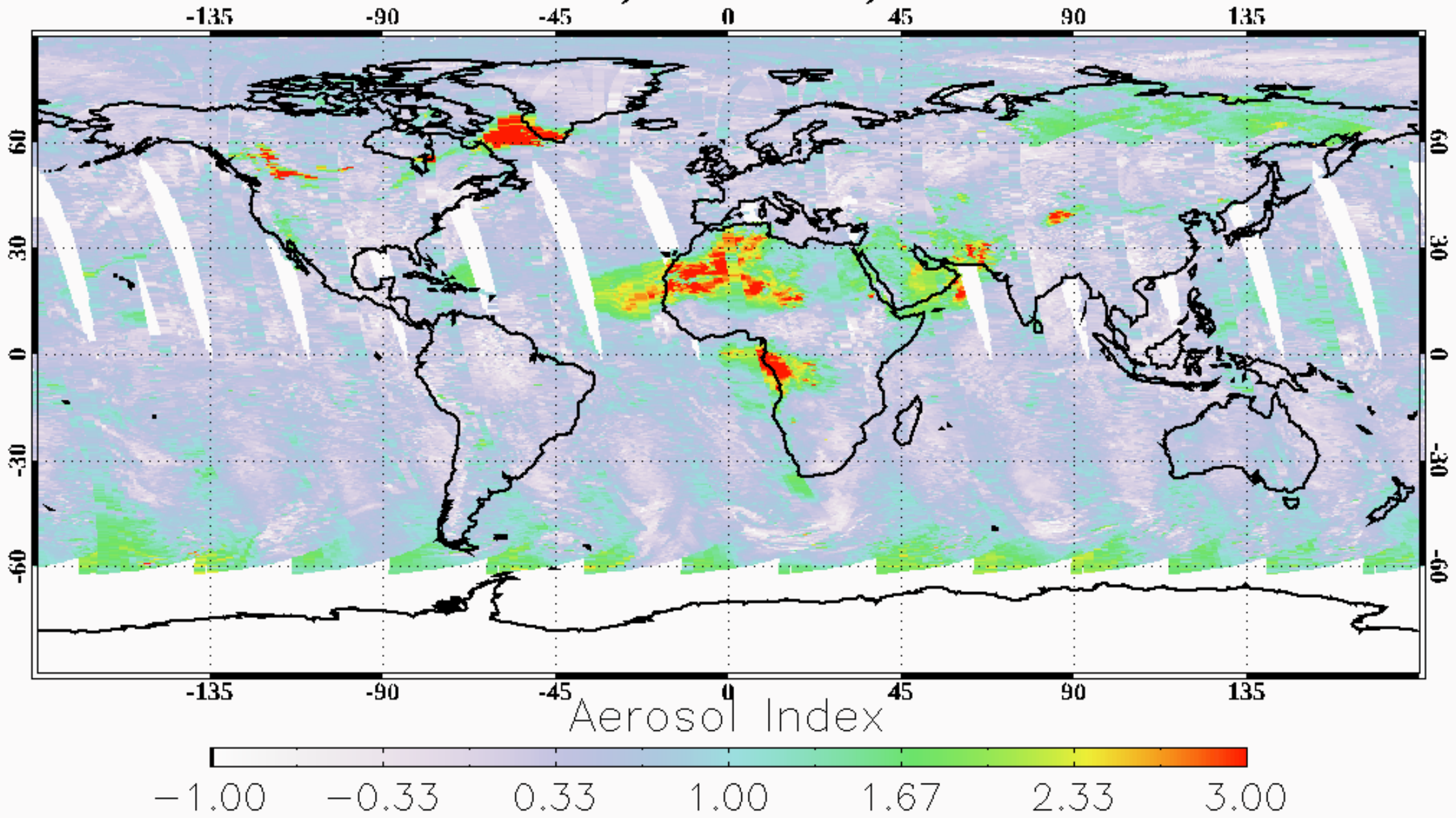

Total Column Ozone, N21-adjusted, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Dobson
150.00
200.00
250.00
300.00
350.00
400.00
450.00


Total Column Ozone, NDE NOAA-20, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Dobson
150.00
200.00
250.00
300.00
350.00
400.00
450.00


Reflectivity, N21-adjusted, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Reflectivity
0.00
16.67
33.33
50.00
66.67
83.33
100.00


Reflectivity, NDE NOAA-20, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Reflectivity
0.00
16.67
33.33
50.00
66.67
83.33
100.00


Aerosol Index, N21-adjusted, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Aerosol Index
−1.00
−0.33
0.33
1.00
1.67
2.33
3.00

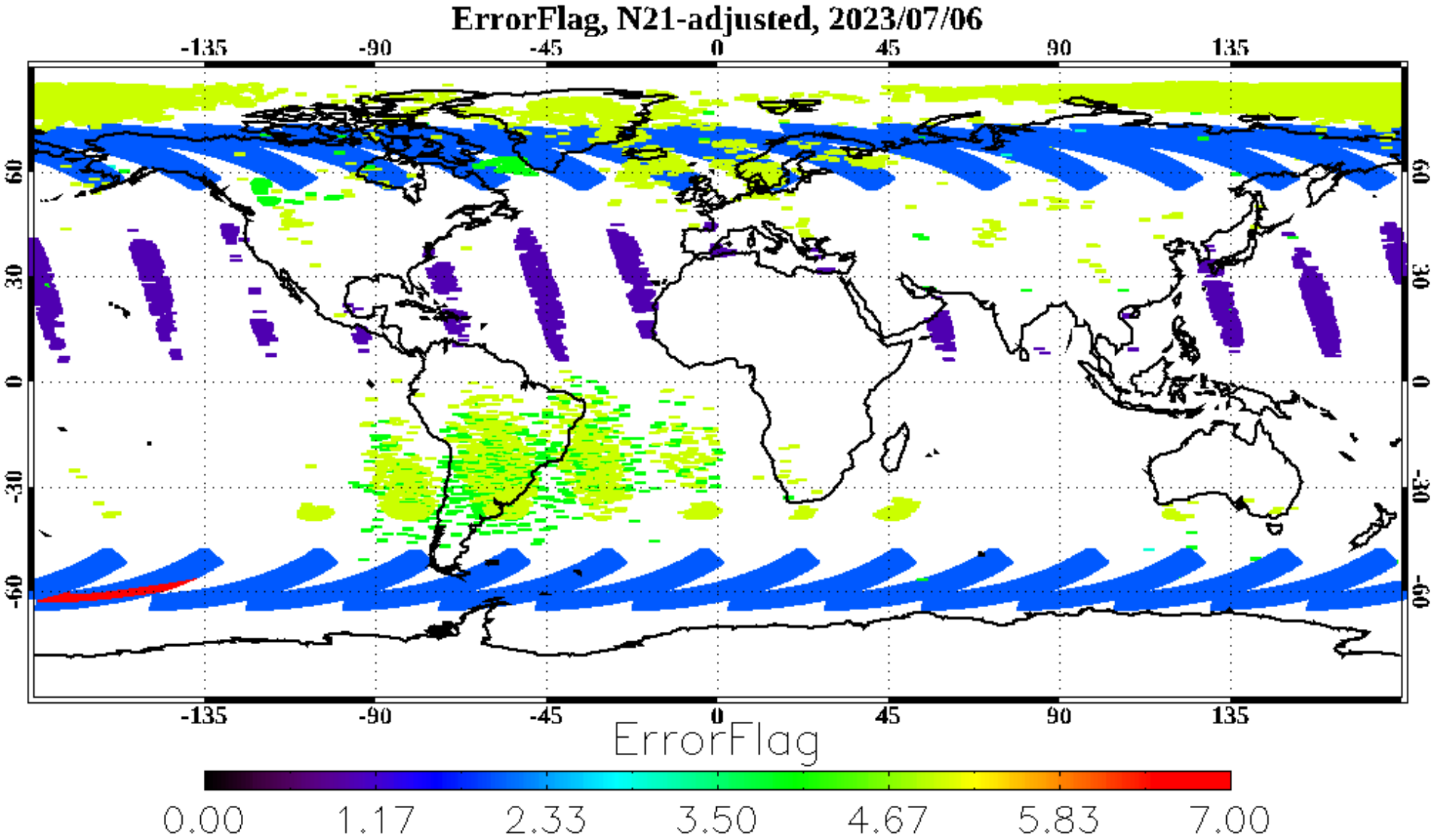

Aerosol Index, NDE NOAA-20, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Aerosol Index
−1.00
−0.33
0.33
1.00
1.67
2.33
3.00

Quality flag analysis/validation

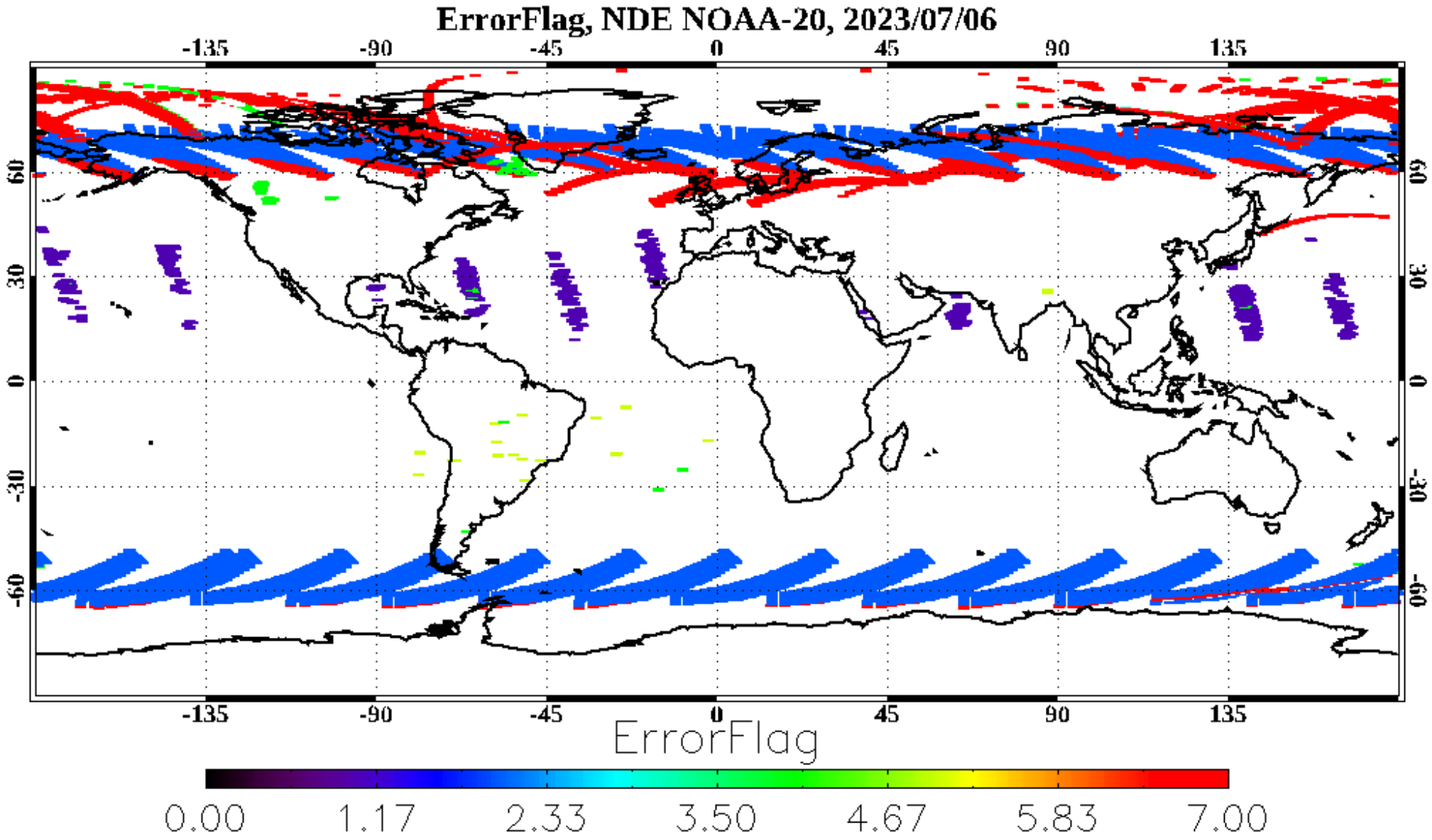
- Defined Quality Flags
  - Variable
  - Description
  - Value
- Quality flag analysis/validation
  - Test / example / ground truth data sets
  - Analysis / validation results
  - Analysis / validation plan

Quality Flags V8TOz Error Codes

Output	Type	Description	
ErrorFlag		Good – 0	Good retrieval SZA <= 84°
		Sun Glint Geometry – 1	Good retrieval, open water with sun glint geometry present
		High SZA – 2	Good retrieval SZA > 84°
		Large Aerosol Index – 3	360 nm residual > threshold
		Profile Shape Error – 4	Residual at unused ozone wavelength > 4 σ
		High SO_2 – 5	SO_2 Index > 4 σ
		Non-Convergence – 6	Algorithm does not converge
		Large Residual – 7	Absolute residual > 32
		Bad Radiances – 8	Negative or missing radiances (Partial Granule Fix)
EclipseFlag*		0 – Good, 1 – Eclipse	Solar Eclipse Condition

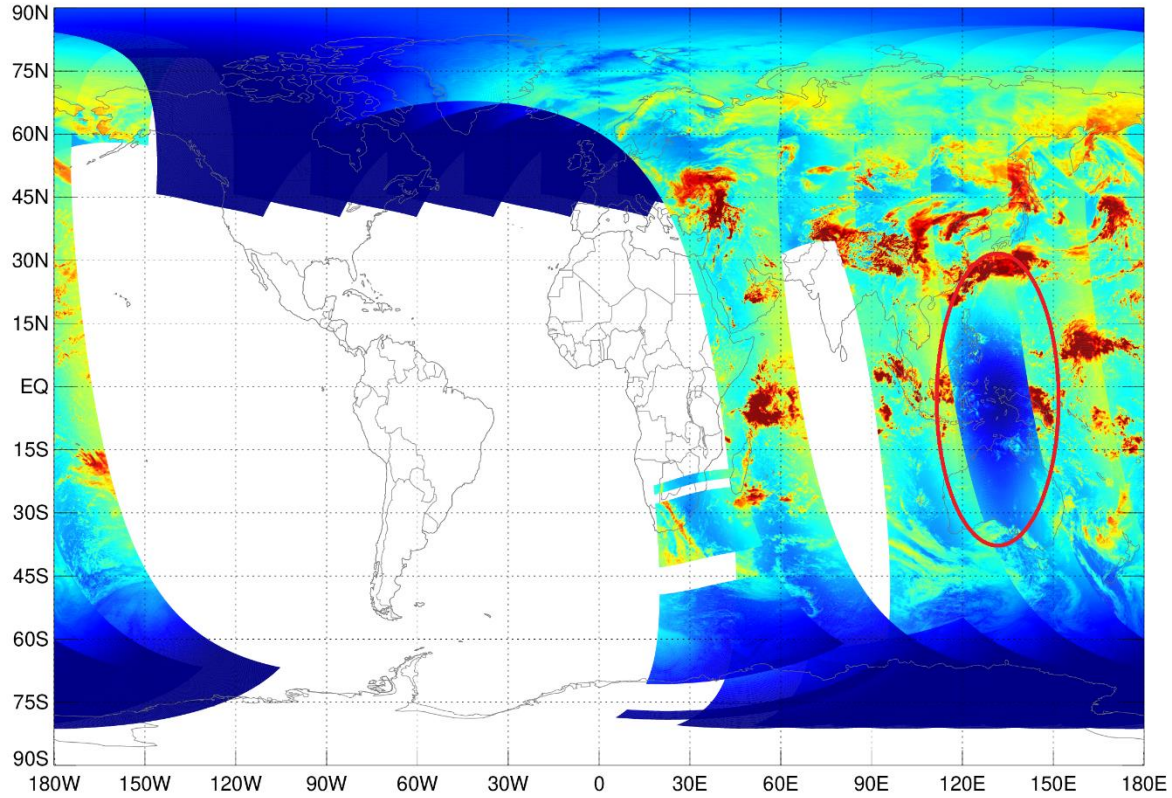


Increased error flags for 4 and 5 are under investigation. There are two known contributions. One is particle events in the SAA and auroral ozone, combined with the smaller FOVs (less aggregation). The other is from the use of preliminary values to generate the SO2 Index error flag. The SDR Team is also looking at improvements to the stray light correction.

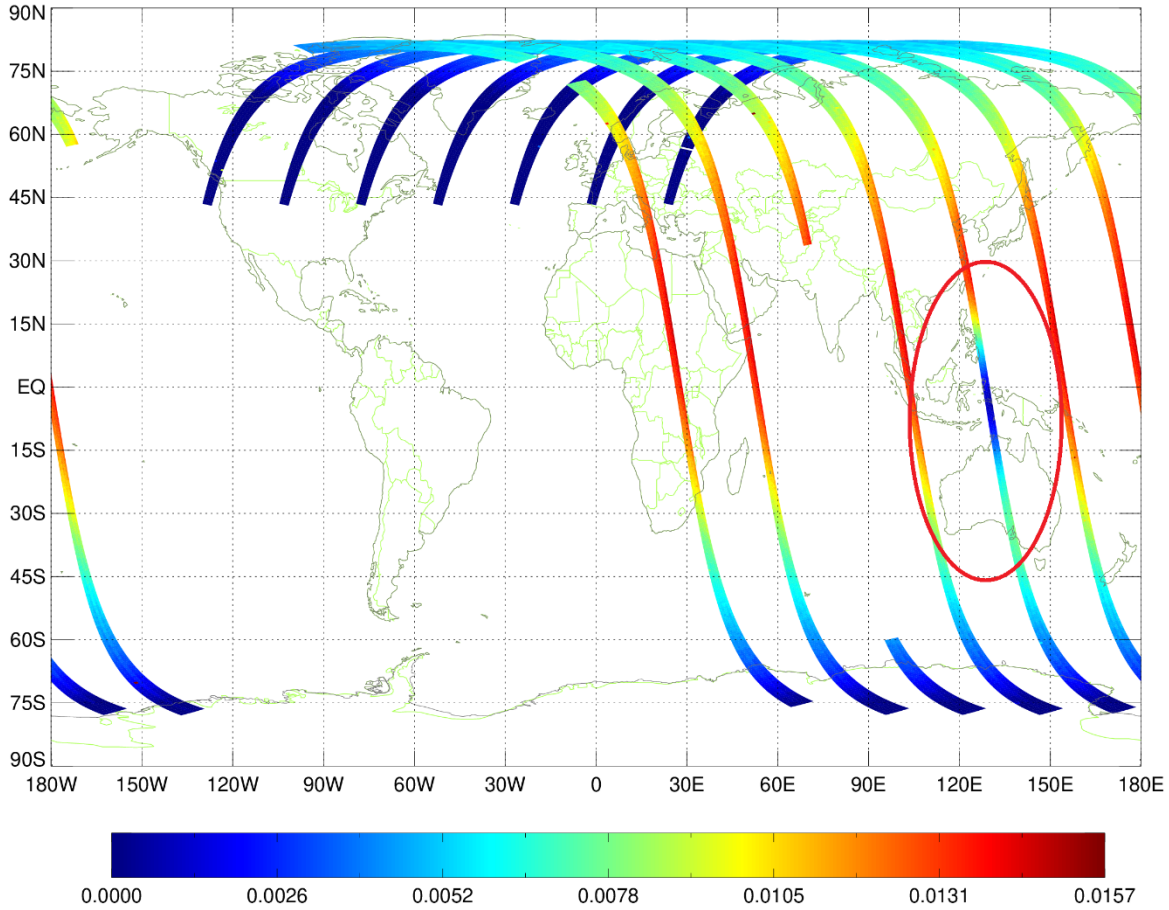

ErrorFlag, NDE NOAA-20, 2023/07/06
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
ErrorFlag
0.00
1.17
2.33
3.50
4.67
5.83
7.00

Solar Eclipse impact on Radiances for April 20, 2023

NOAA21 OMPS TC Radiance mW m^{-2} nm^{-1} sr^{-1} 2023/04/20 at 331.1nm

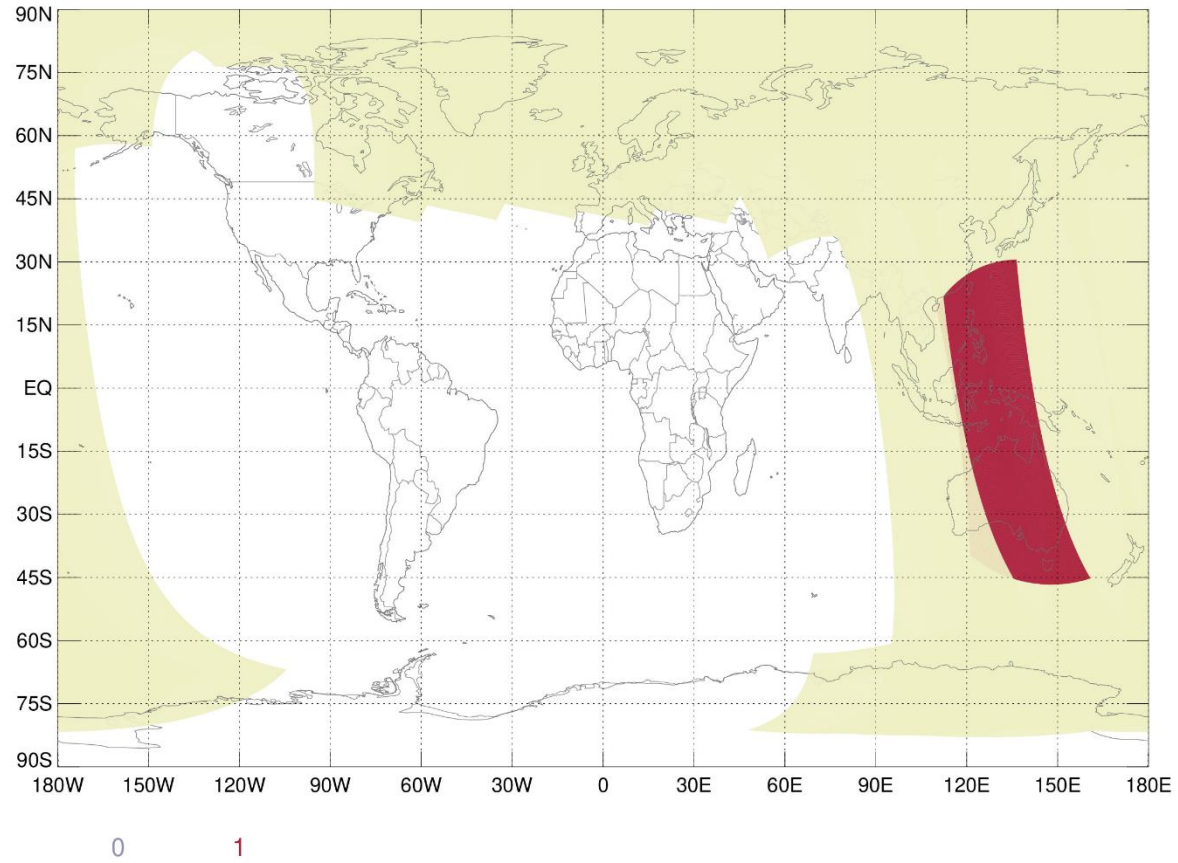


NOAA21 OMPS NP Radiance mW m^{-2} nm^{-1} sr^{-1} 2023/04/20 at 253.4nm

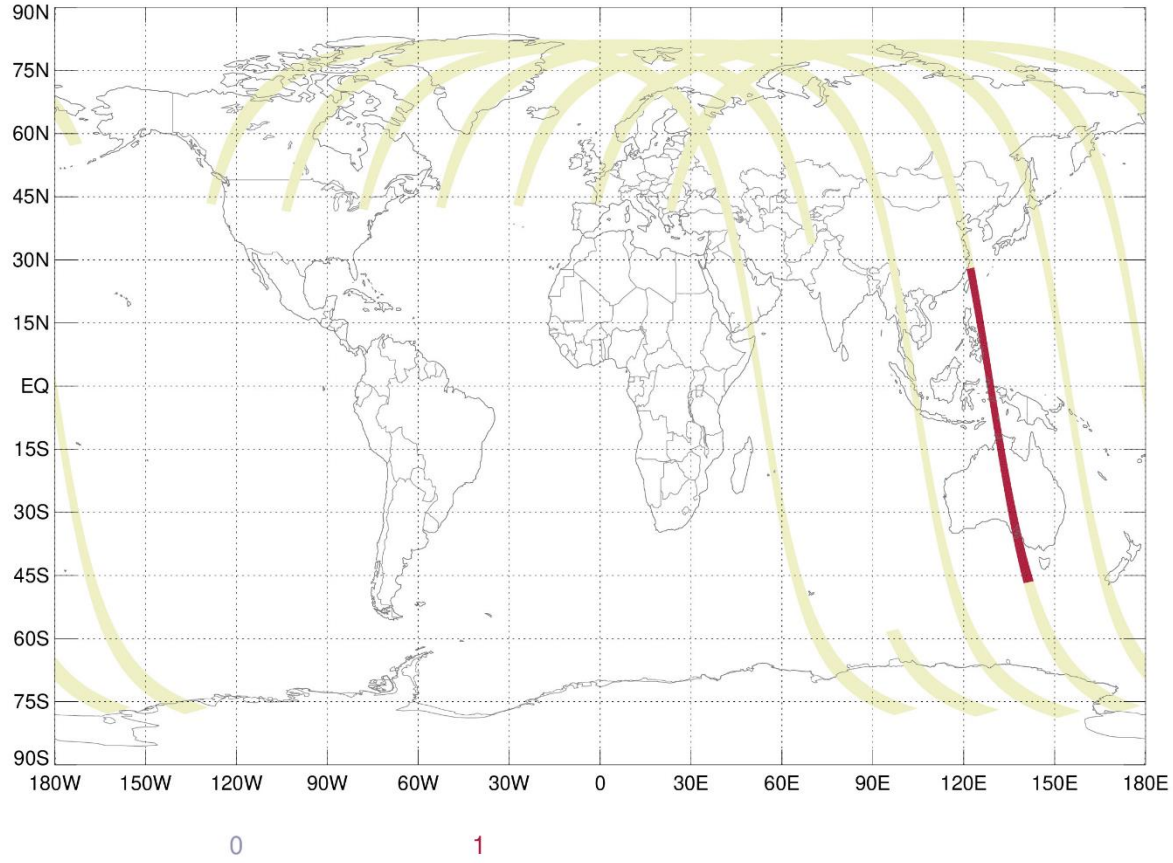


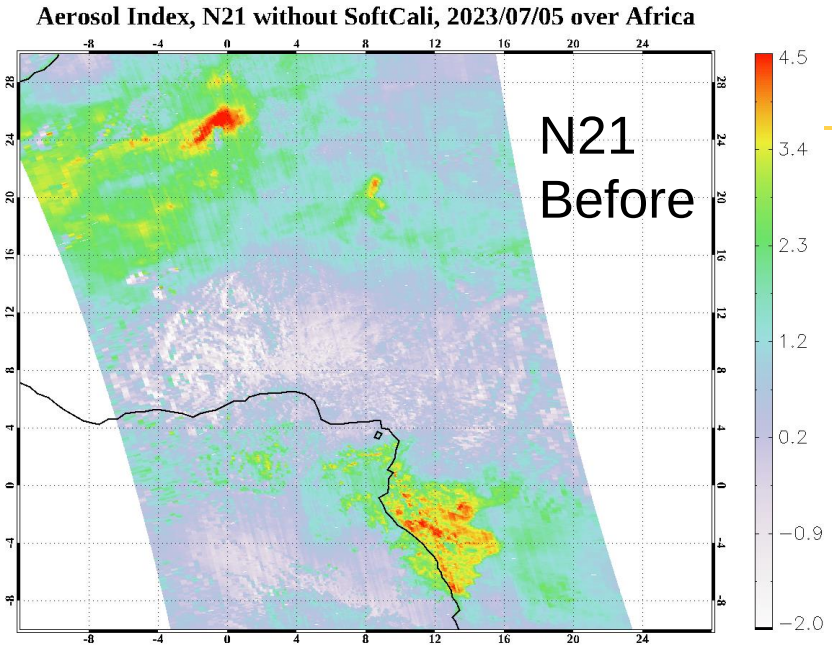
Solar Eclipse Flag for April 20, 2023

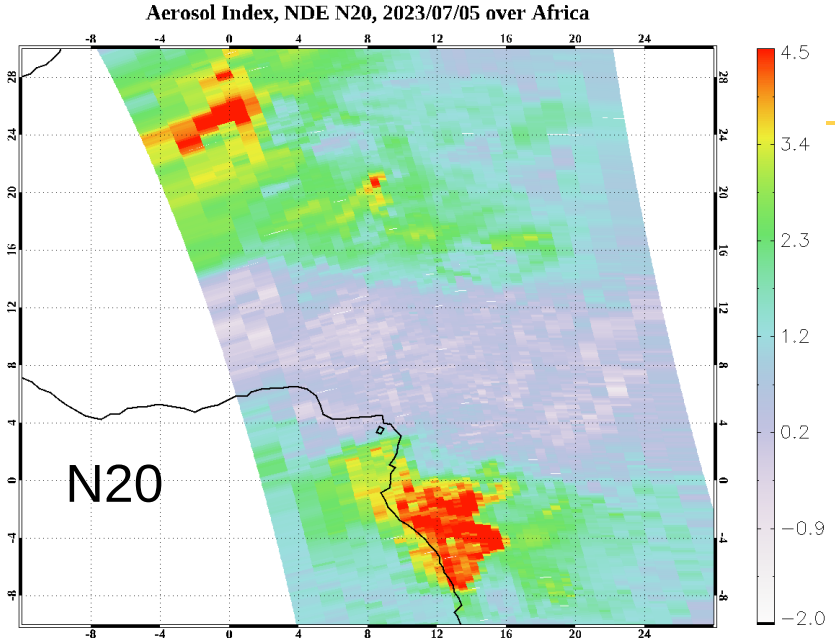
NOAA-21 OMPS TC Solar Eclipse Flag 2023/04/20

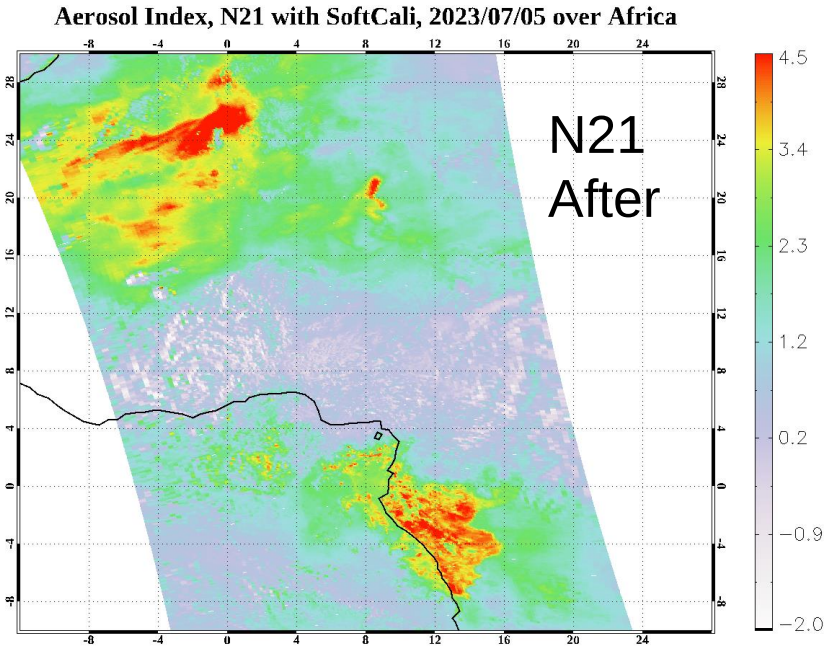


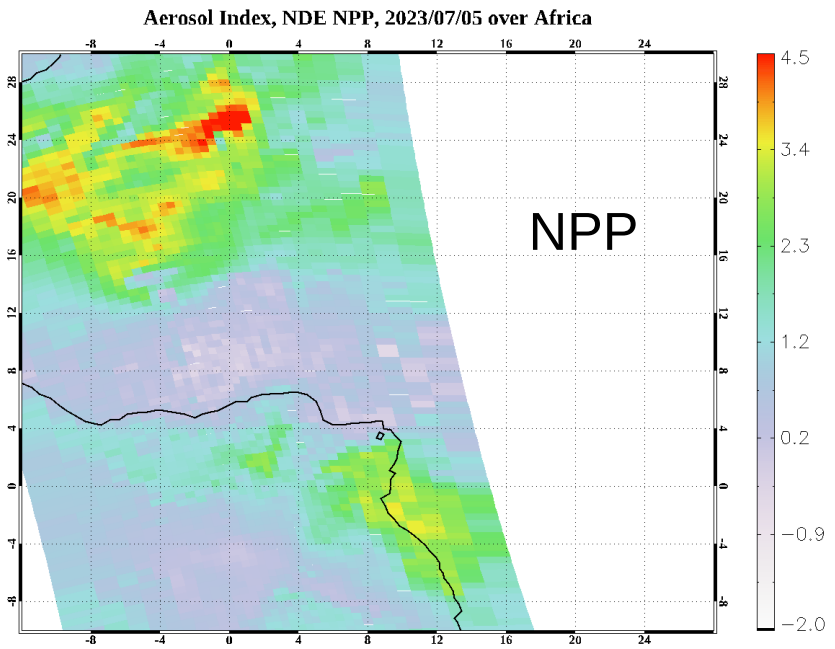
NOAA-21 OMPS NP Solar Eclipse Flag 2023/04/20



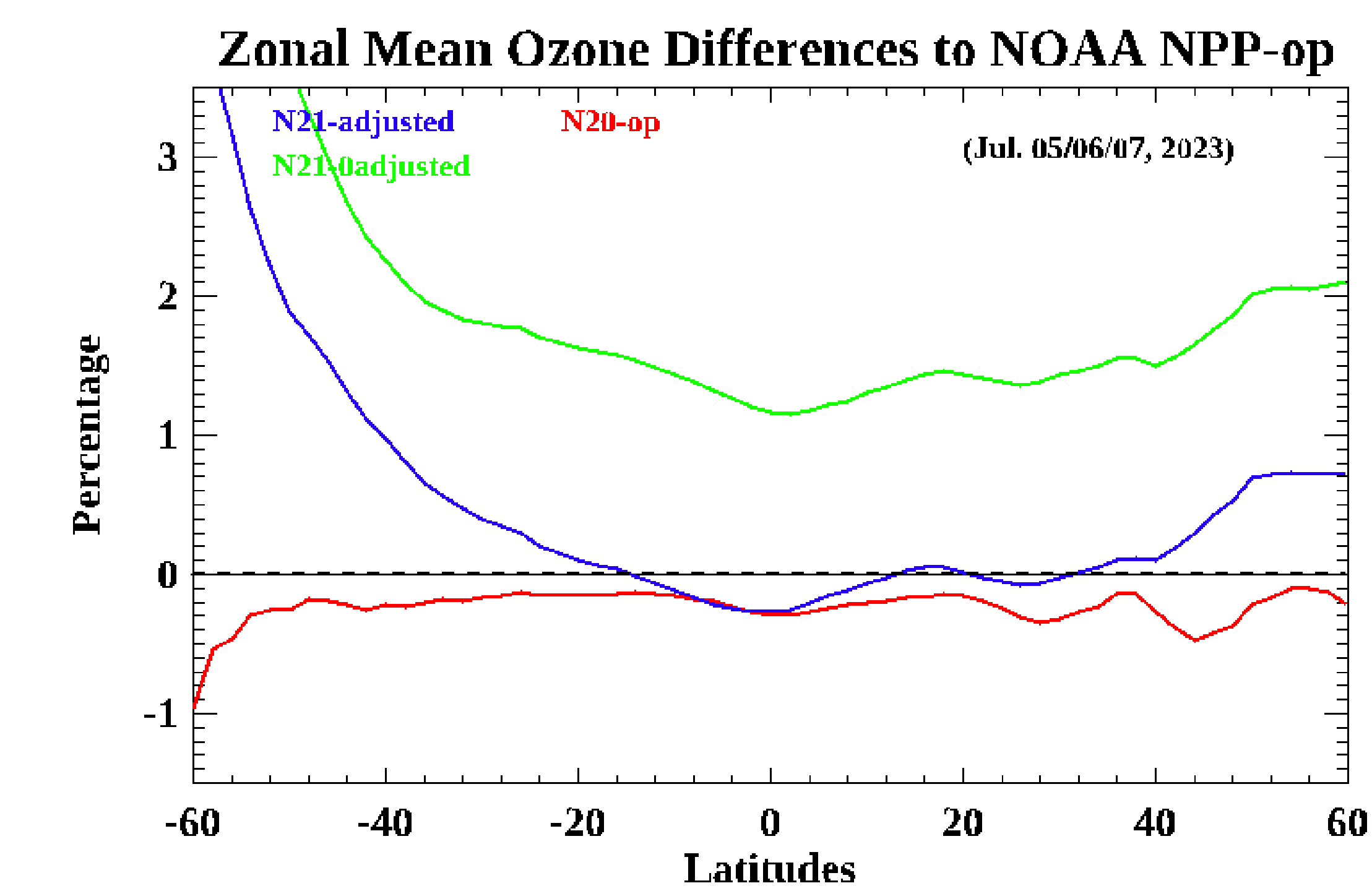




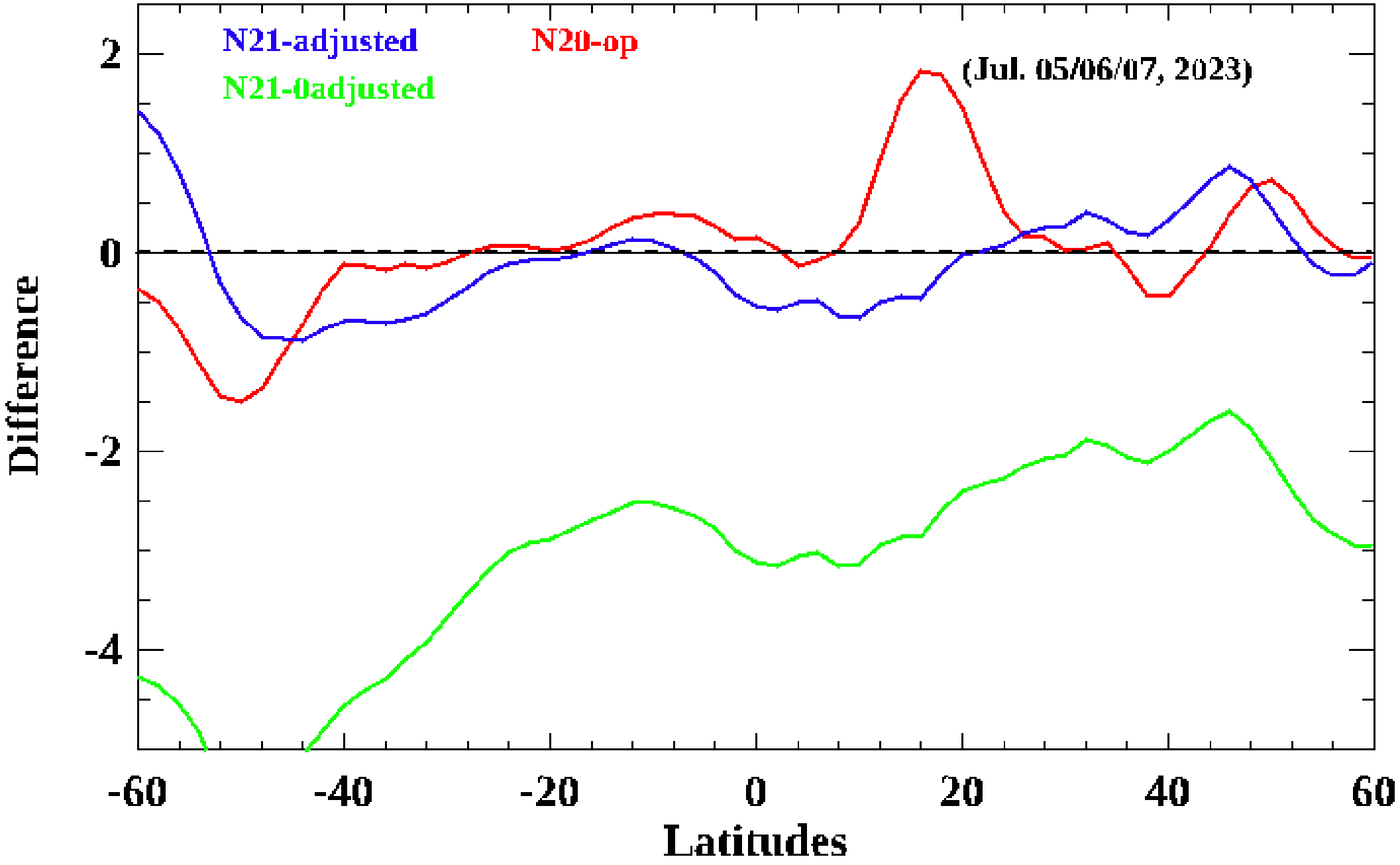


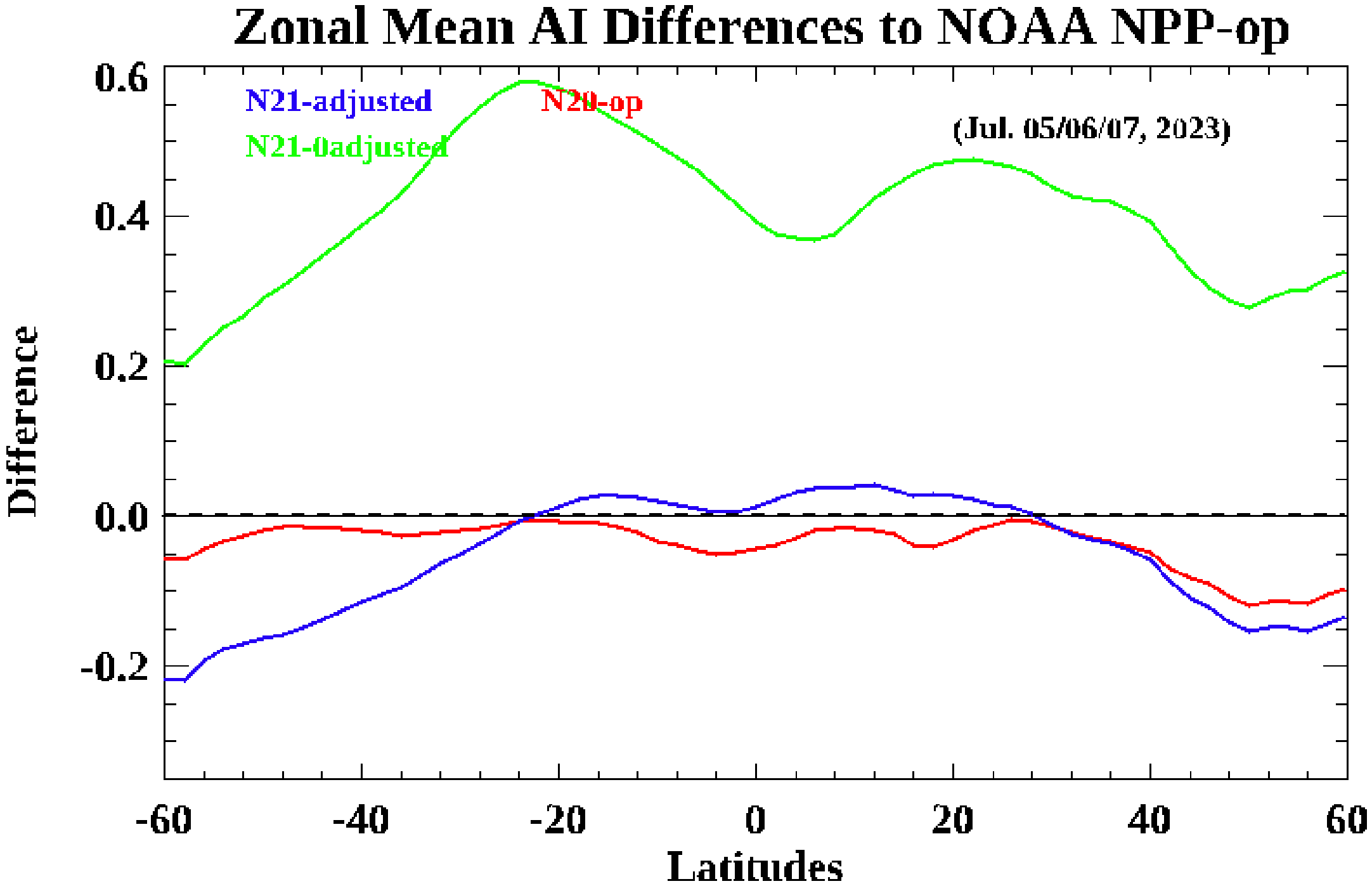


Dust and Smoke over Africa from OMPS NPP / N20 / N21 for July 5, 2023.


Zonal Mean Ozone Differences to NOAA NPP-op
N21-adjusted
N20-op
N21-0adjusted
(Jul. 05/06/07, 2023)
Percentage
3
2
1
0
-1
-60
-40
-20
0
20
40
60
Latitudes

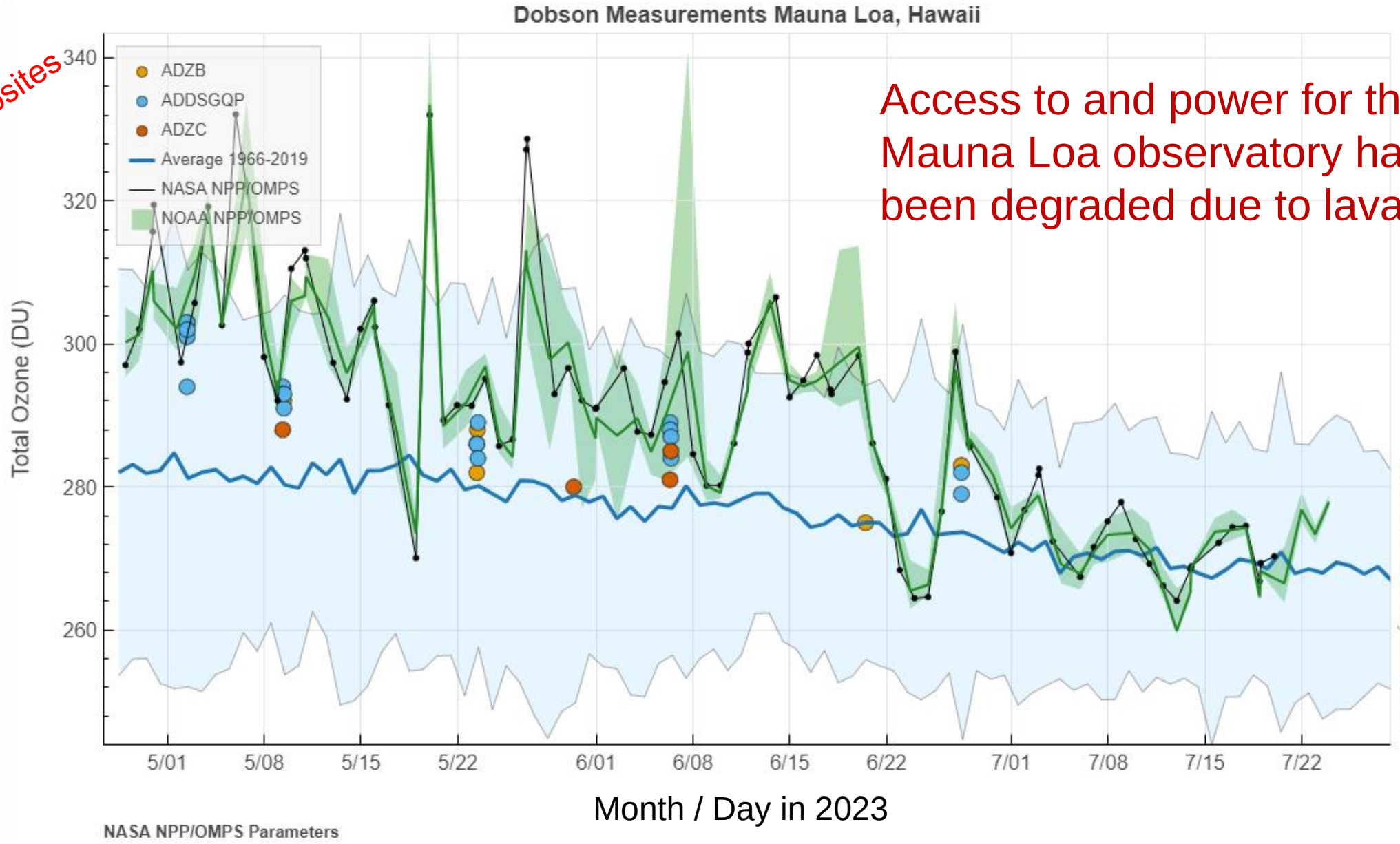
Zonal Mean Reflectivity Differences to NOAA NPP-op




Zonal Mean AI Differences to NOAA NPP-op
N21-adjusted
N20-op
N21-0adjusted
(Jul. 05/06/07, 2023)
Difference
0.6
0.4
0.2
0.0
-0.2
-60
-40
-20
0
20
40
60
Latitudes

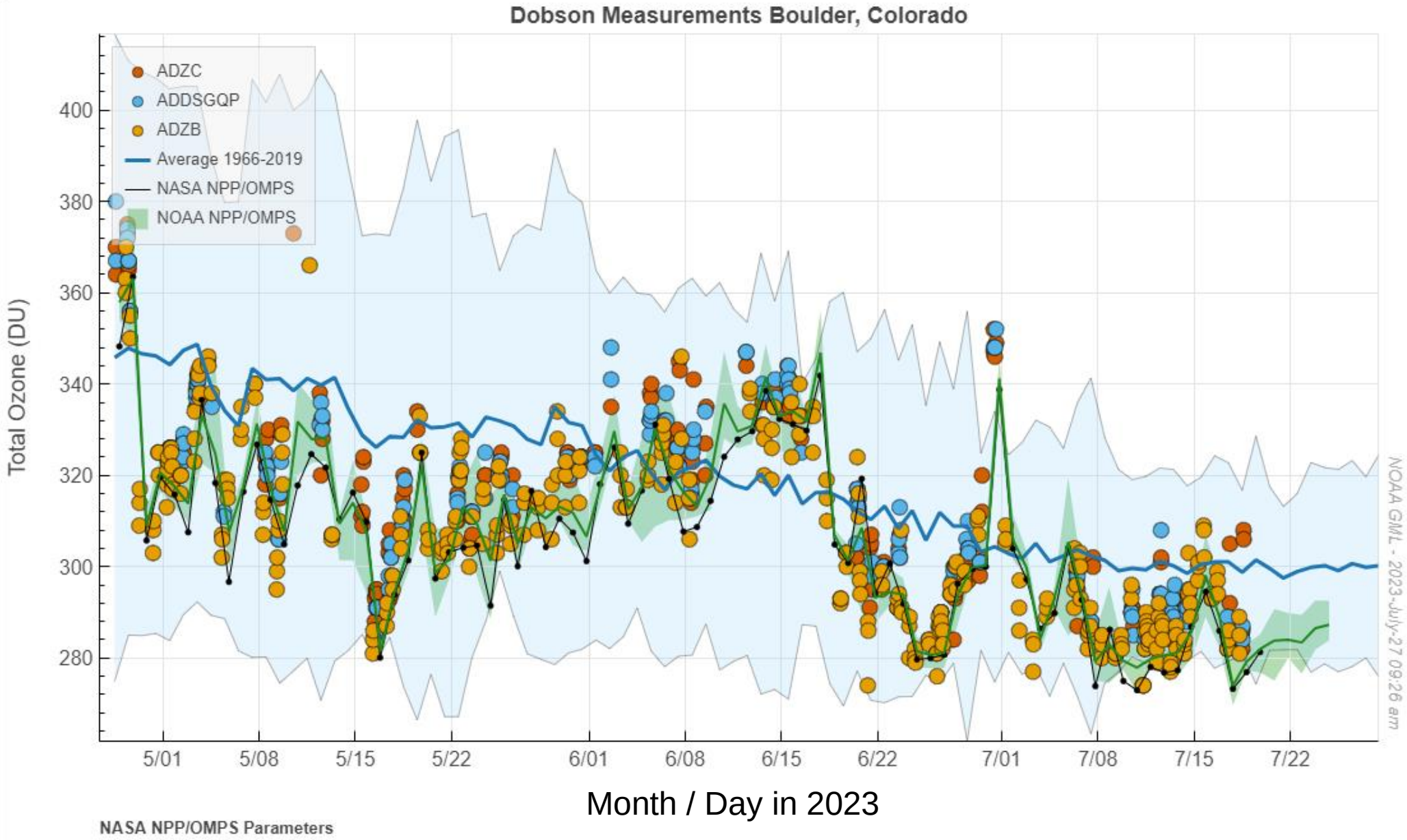
Comparisons of NPP Overpass to Dobson Stations, Mauna Loa HI

Put in Websites

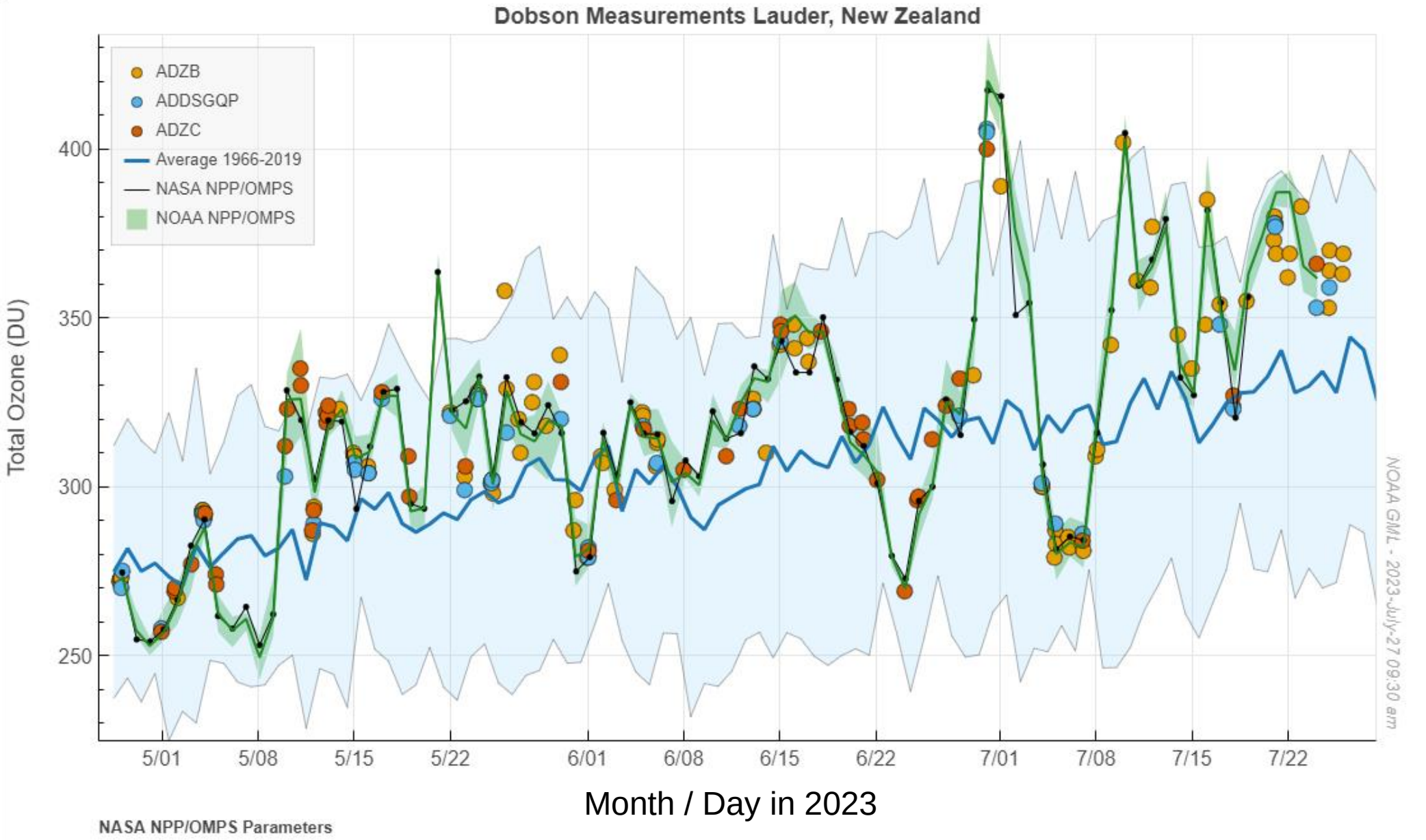


Access to and power for the Mauna Loa observatory has been degraded due to lava flows.

Comparisons of NPP Overpass to Dobson Stations, Boulder CO



Comparisons of NPP Overpass to Dobson Stations, Lauder NZ



Risks, Actions, and Mitigations

- Provide updates for the status of the risks/actions identified during the previous maturity review(s); add new ones as needed

Identified Risk	Description	Impact	Action/Mitigation and Schedule
Latitude Dependence	NOAA-21 V8TOz Zonal Means show 1-3% biases at higher latitudes versus NPP and N20.		Examine Stray Light OOR/B corrections; examine Polarization sensitivity.
Increased Noise	Smaller FOVs use less aggregation so measurements are noisier.	Error flags in SAA and at high SZA.	Develop and implement filtering / information concentration similar to that used for the V8Pro.
V8TOS Error Handling	V8TOS does not filter bad residuals as well as it should.	Creates bad values in retrievals	Provide revised code with improved filtering prior to Validated Maturity.

Documentations (Check List, 1 slide)

Science Maturity Check List	Yes
ReadMe for Data Product Users	Yes (after approval)
Algorithm Theoretical Basis Document (ATBD)	Yes
Algorithm Calibration/Validation Plan	Yes
(External/Internal) Users Manual	Yes
System Maintenance Manual (for ESPC products)	Yes
Peer Reviewed Publications (Demonstrates algorithm is independently reviewed)	Yes
Regular Validation Reports (at least annually) (Demonstrates long-term performance of the algorithm)	

Check List - Beta Maturity

Beta Maturity End State	Assessment
Product is minimally validated, and may still contain significant identified and unidentified errors	NDE I&T product has significant errors from an error in creating the prelaunch Instrument Radiance Table.
Information/data from validation efforts can only be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose	Ozone values should only be used for qualitative assessment due to instrument table error.
Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists	New RT Instrument and Soft Calibration Adjustment Tables will be delivered to advance to Provisional Maturity. The new RT Instrument Table is in NDE I&T as of April 7, 2023.

Check List - Provisional Maturity

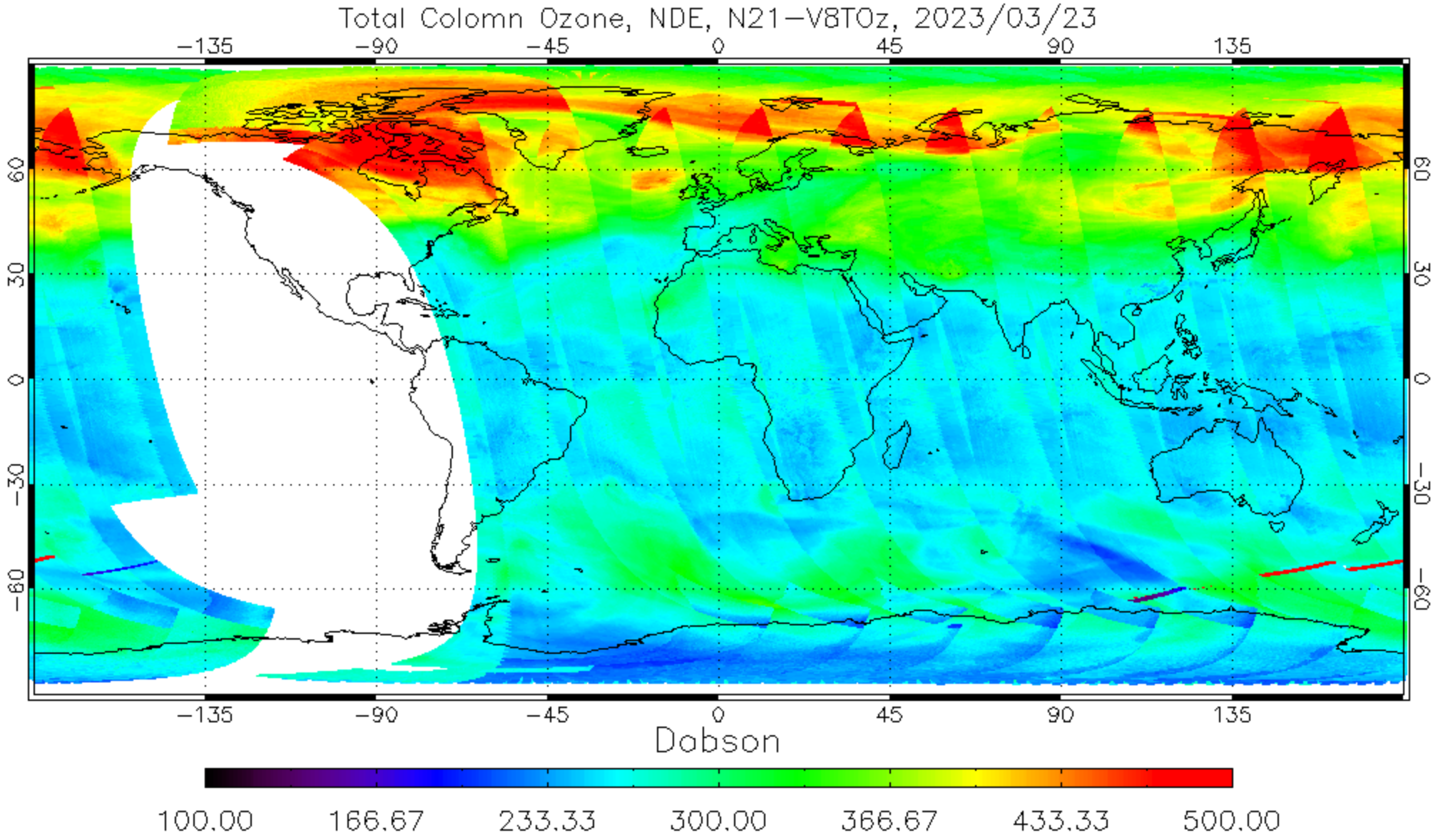
Provisional Maturity End State	Assessment
Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from select locations, periods, and associated ground truth or field campaign efforts.	Total Column Ozone product performance with the latest soft calibration adjustment table is good between 35S and 35N. Errors outside of the that region increase to 3%. The new soft calibration adjustment table will be delivered this month.
Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.	Comparisons to NOAA-20 and S-NPP document the performance relative to expected behavior.
Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.	The primary area for improvement is in the OMPS NM SDR Straylight OOR/B correction. The OMPS SDR Team is aware of the deficiency. The Ozone Team is investigating methods to improve performance for smaller FOVs.
Product is recommended for potential operational use (user decision) and in scientific publications after consulting product status documents.	Operational applications should only use products within 35° of latitude of the Equator. Other regions can be used in testing and offline studies for validation and comparisons.

Conclusions, Caveats and Path Forward at Provisional

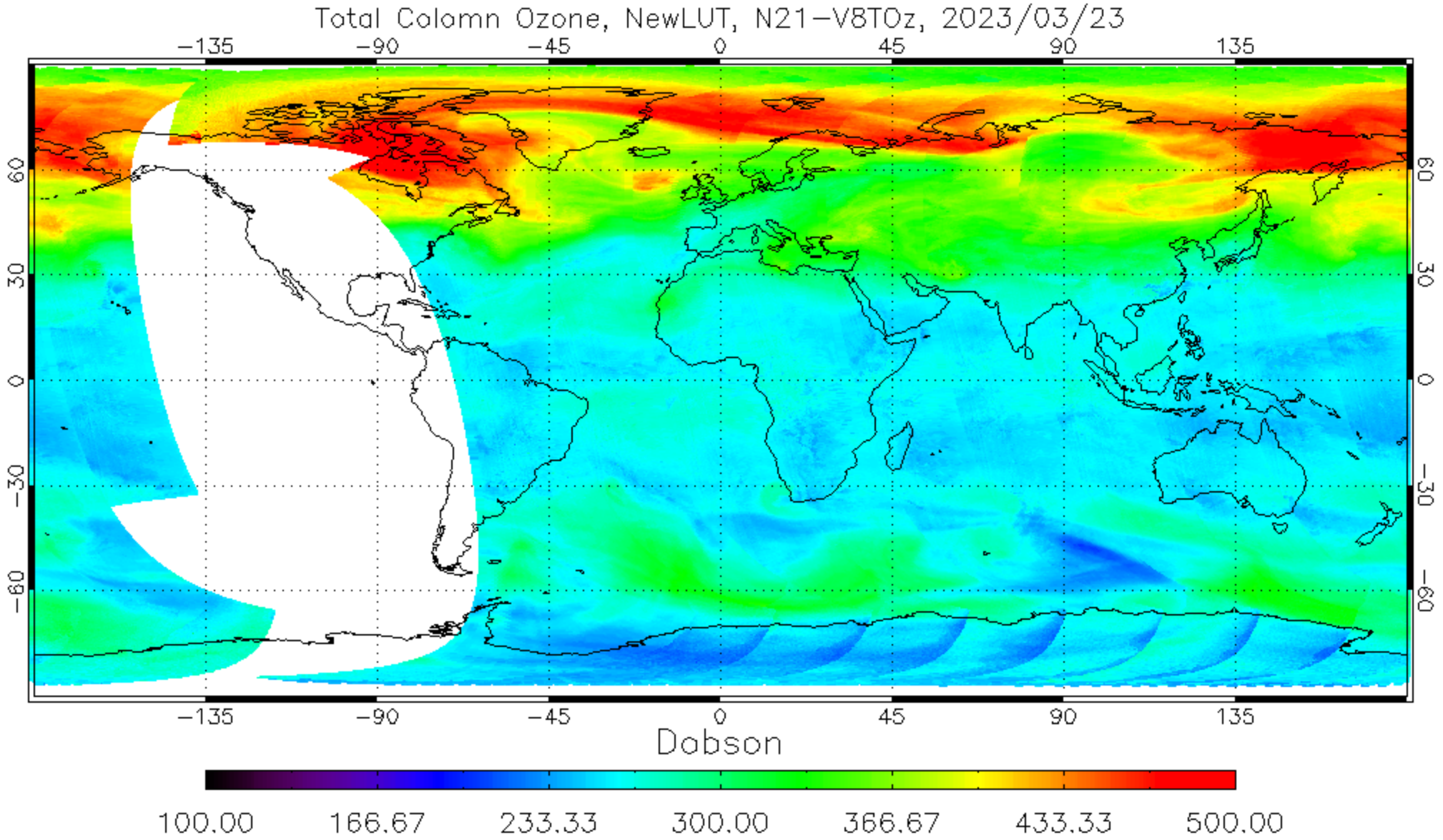
- The NOAA-21 OMPS NM SDRs have improved performance as of the end of June 2023.
  - The OMPS NM SDRs have a corrected sample table update for macro-pixel #177.
  - The OMPS NM SDRs have 1-AU Day 1 solar irradiance.
  - The OMPS NM SDRs have a new stray light correction.
- While the NDE I&T NOAA-21 V8TOz and V8TOS v4r2 EDRs are reasonable
  - A 2nd iteration of soft calibration adjustments to force agreement with S-NPP and NOAA-20 V8TOz EDRs has been completed using data from July 2023. The table will be delivered in August 2023.
  - The smaller FOV measurements show increased noise especially in the SAA and for SO2 retrievals. We are developing outlier detection and local fitting processes to increase the SNRs of the values used in the retrieval algorithm. We will also be checking whether aggregation / averaging of the smaller FOVs recovers the performance obtained for NOAA-20.
  - A mishandling of bad values in the V8TOS during the background bias estimation step is leading to some errors in the SO2 values. We will provide a correction involving a modest amount of code changes this month.
  - We recommend that the NOAA-21 V8TOz & V8TOS EDRs from NDE I&T & NCCF be reported at Provisional Maturity as of implementation of the latest adjustment table. The product performance is very good for latitudes **within 35° of the Equator.** The OMPS V8TOz is in regular operations.

Backup Material

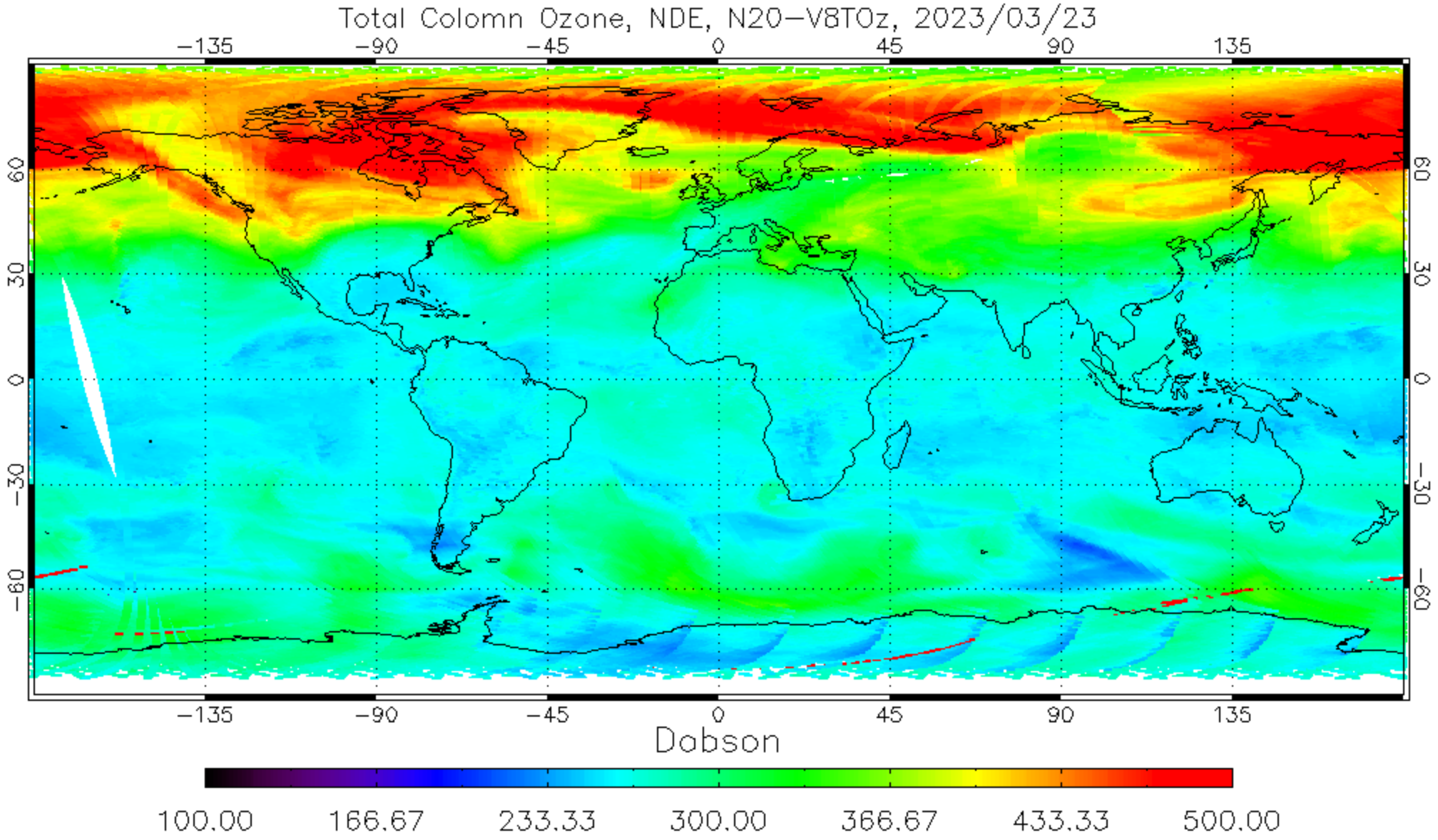
Old Bad RT Instrument Table



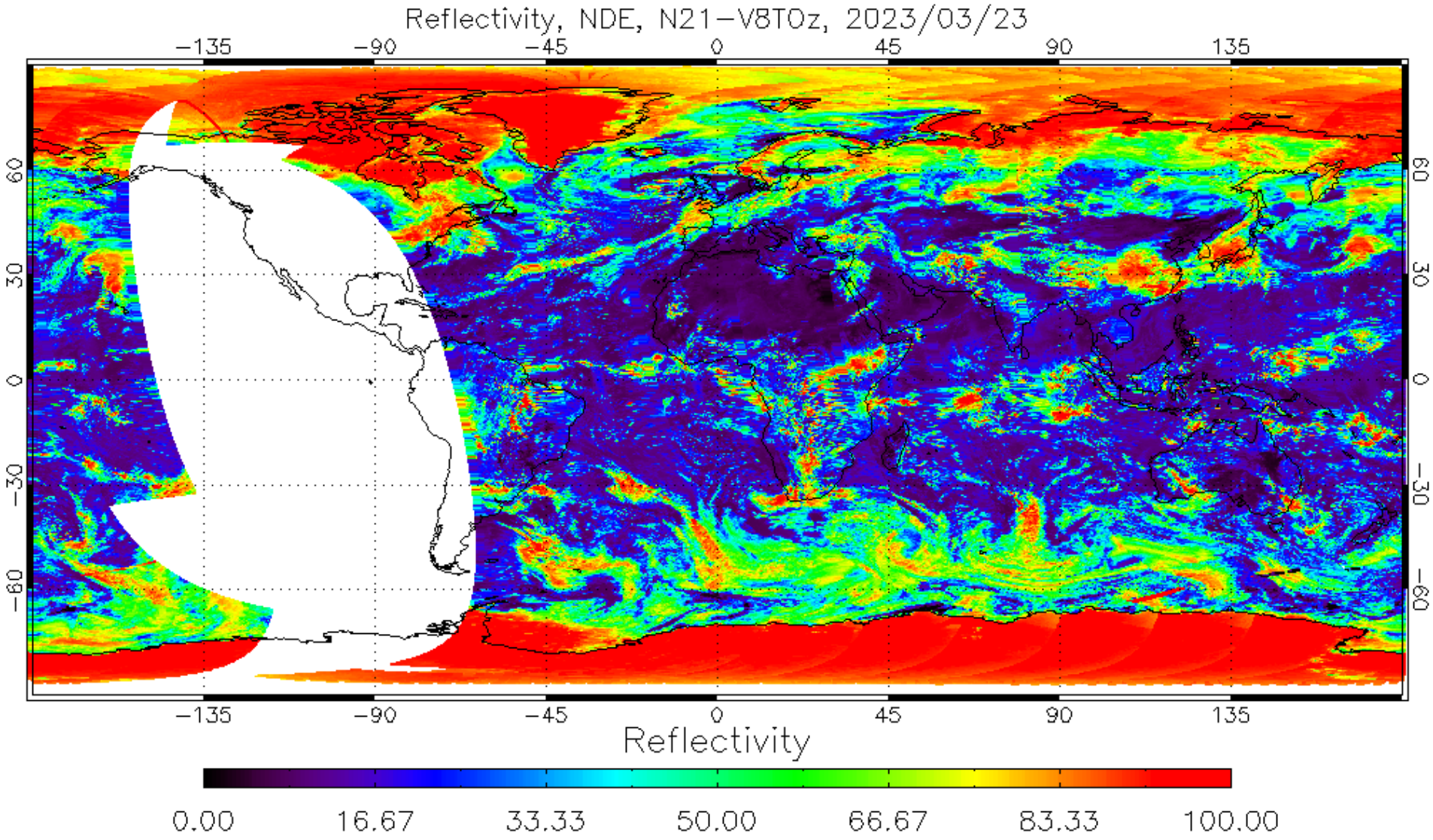
New Good N21 RT Instrument Table



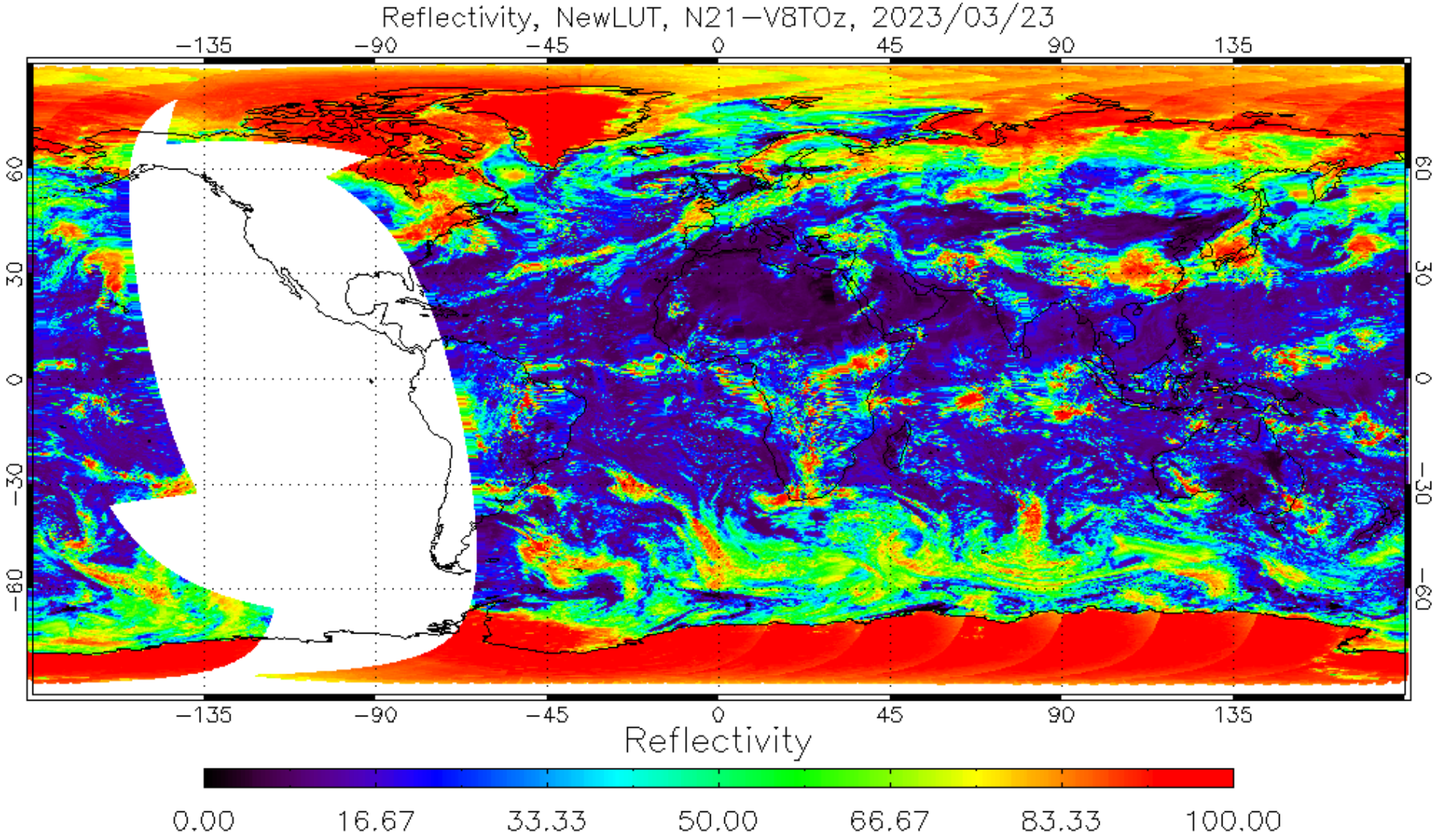
NOAA-20 RESULTS



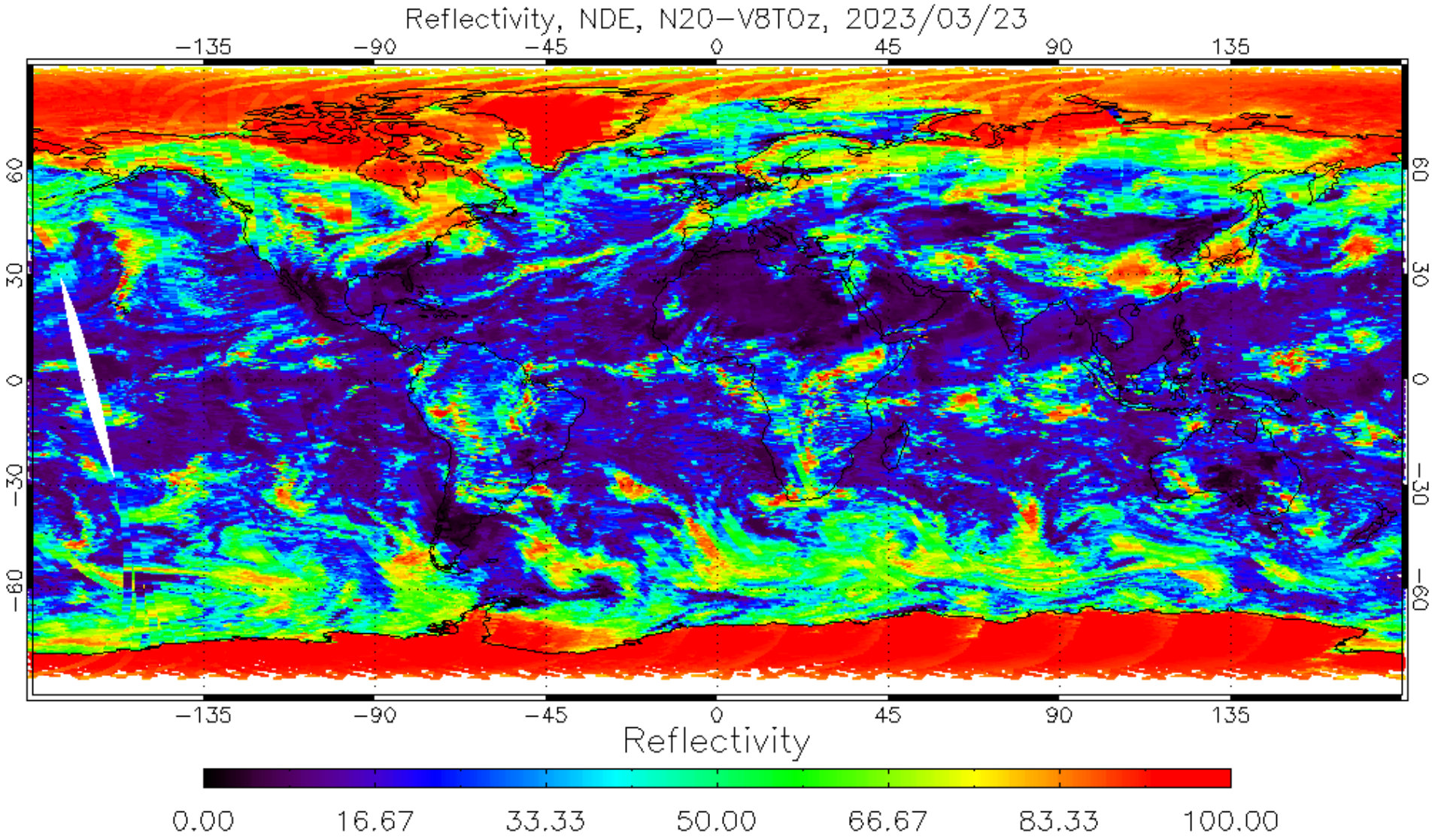
Old Bad RT Instrument Table



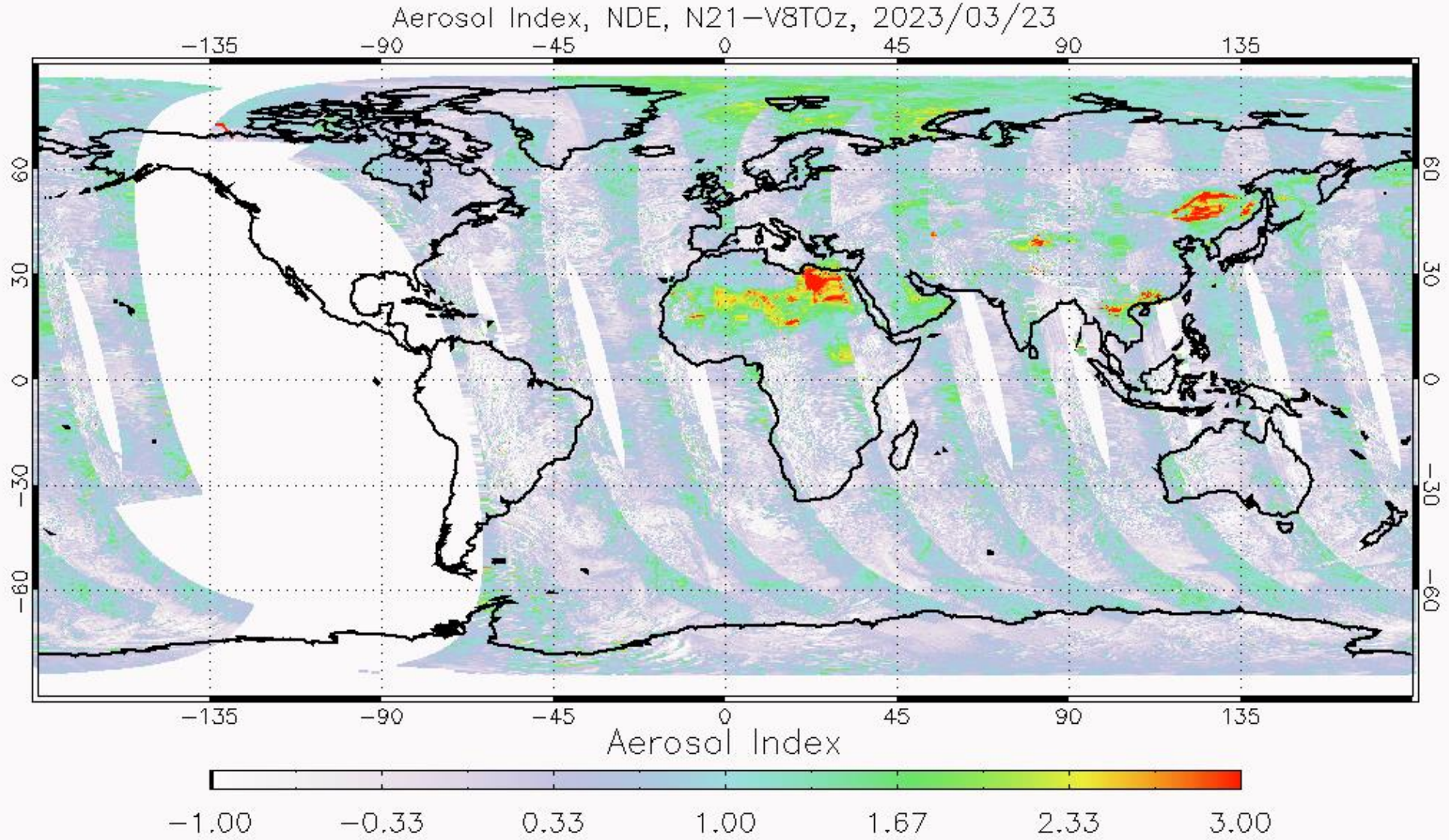
New Good N21 RT Instrument Table



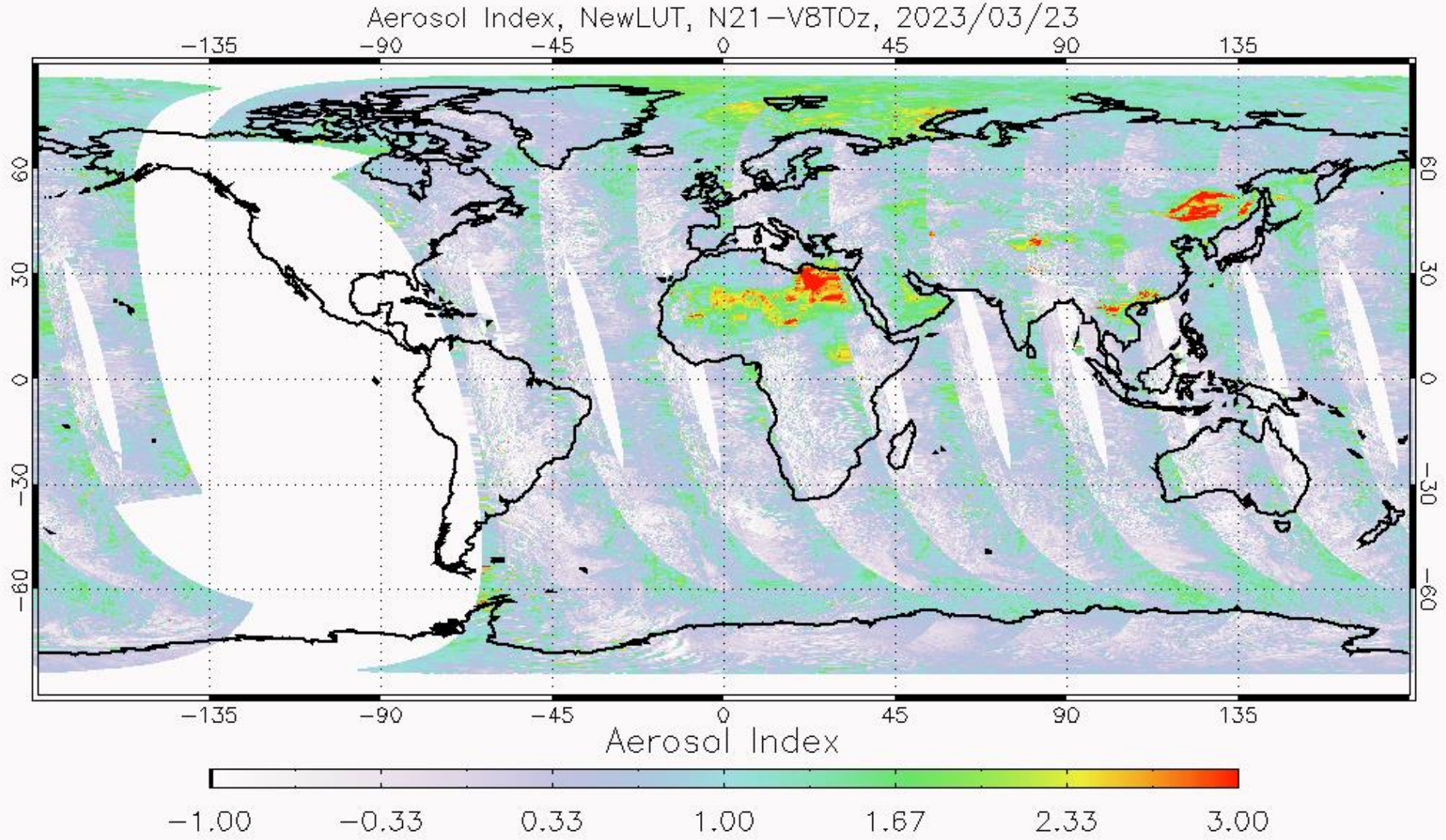
NOAA-20 RESULTS



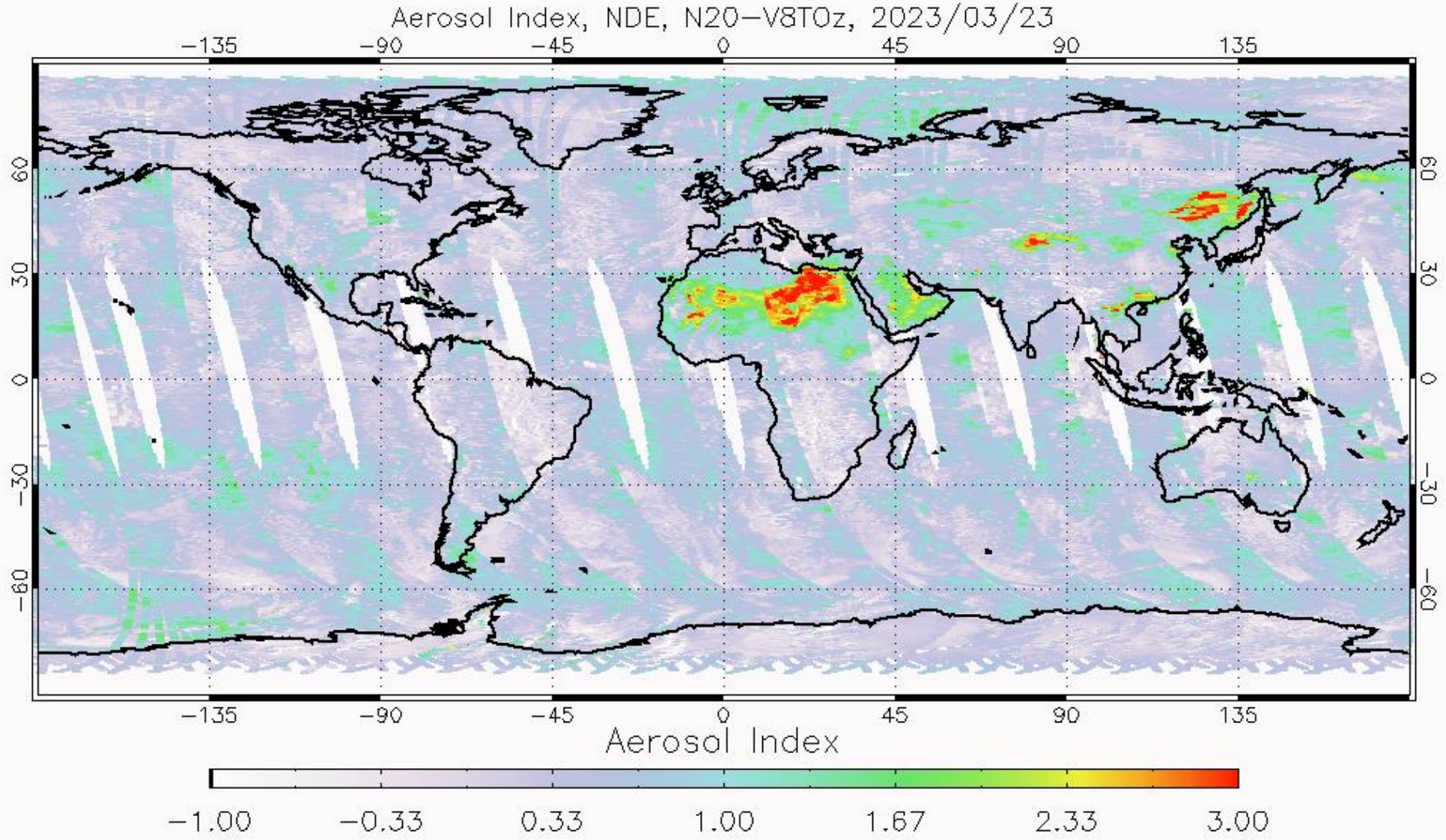
Old Bad RT Instrument Table



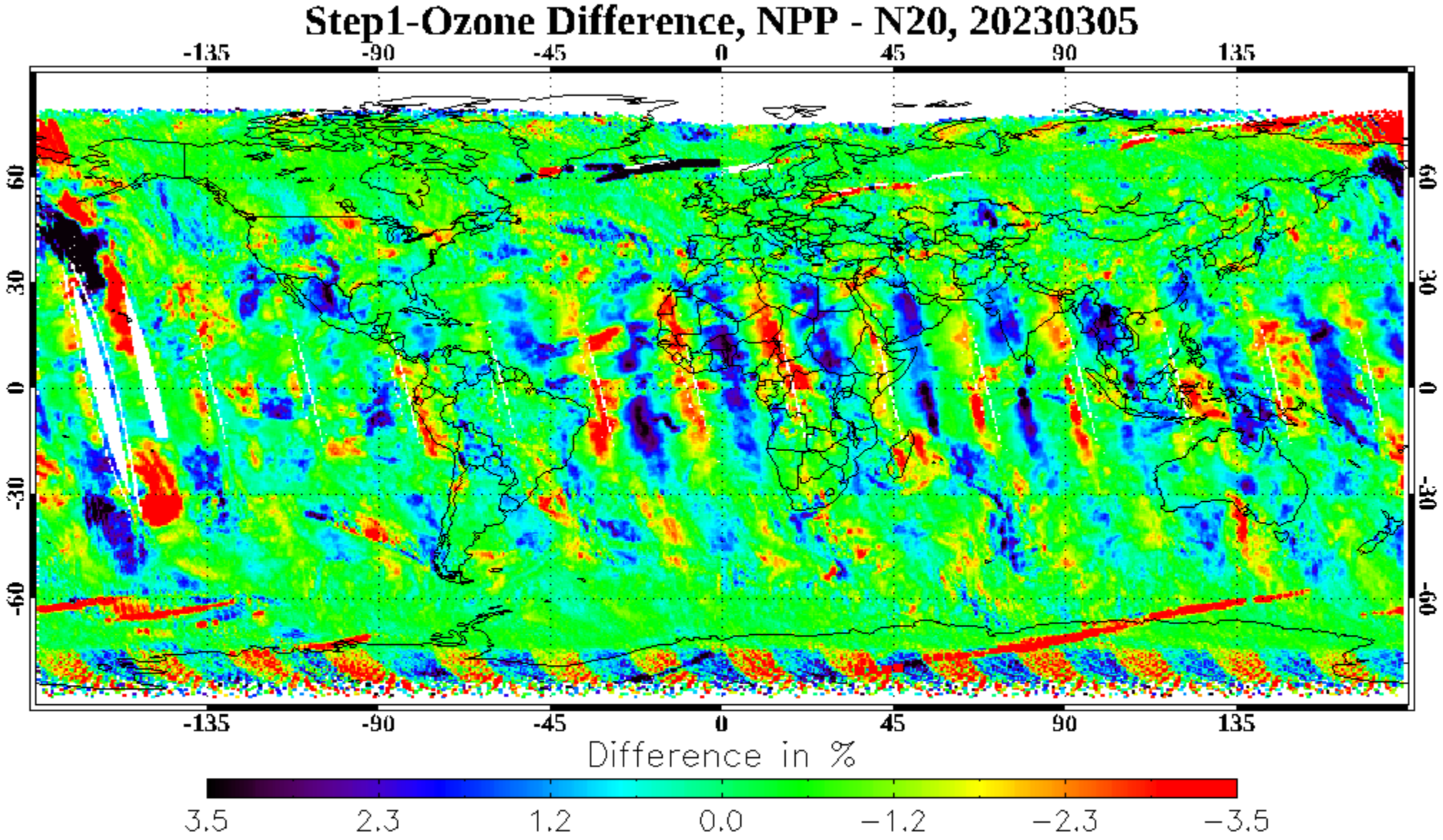
New Good N21 RT Instrument Table

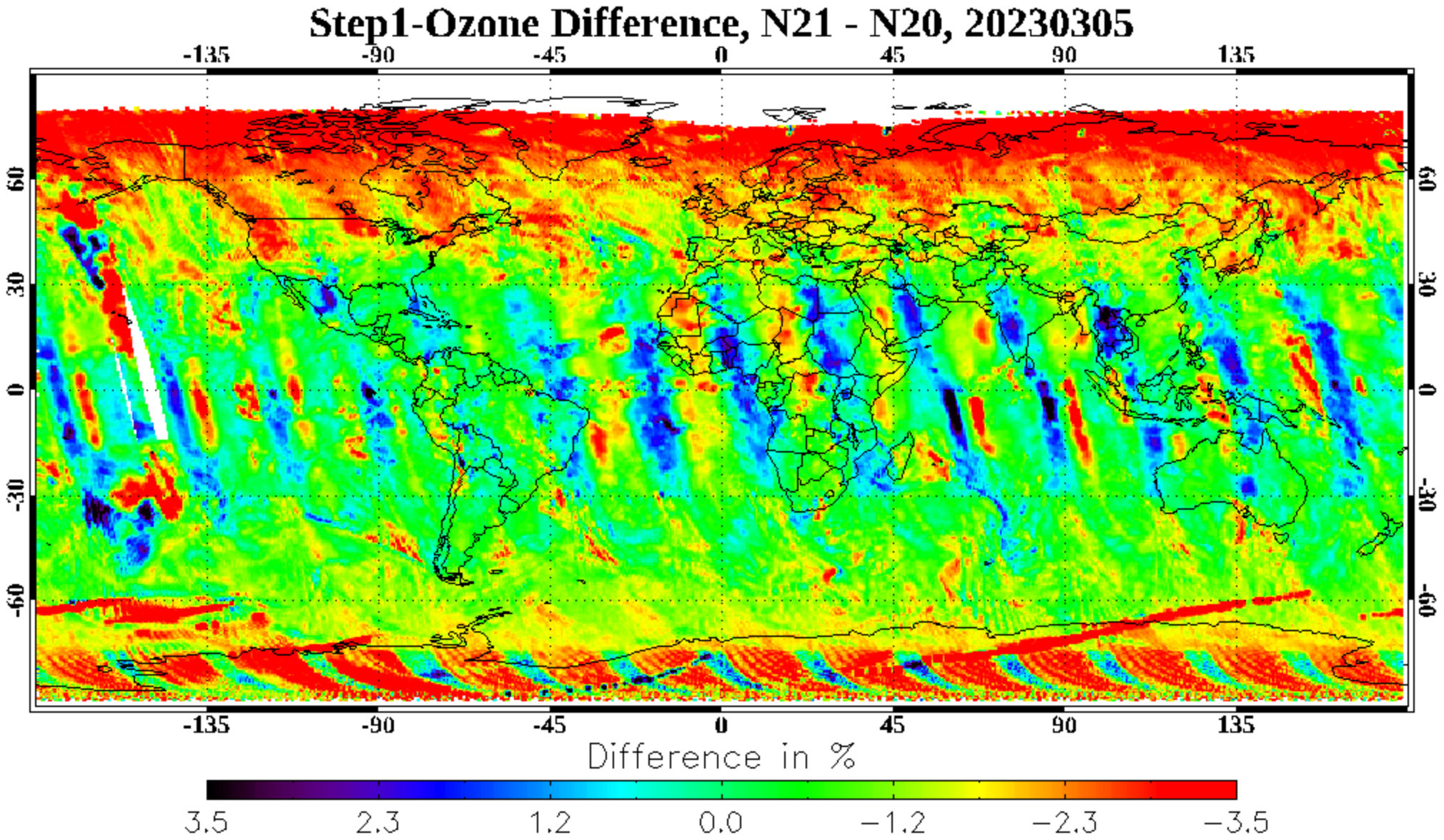


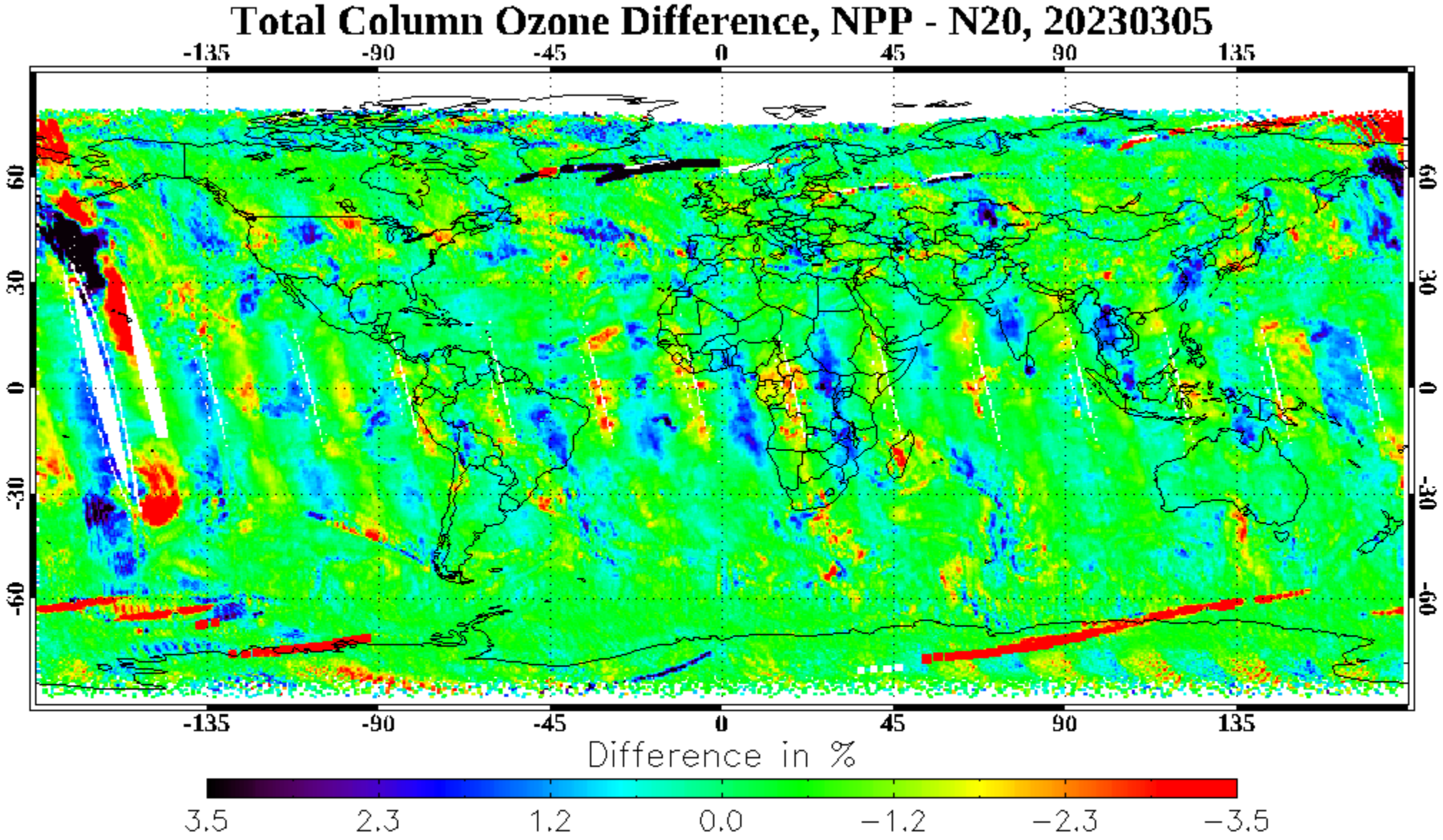
NOAA-20 RESULTS

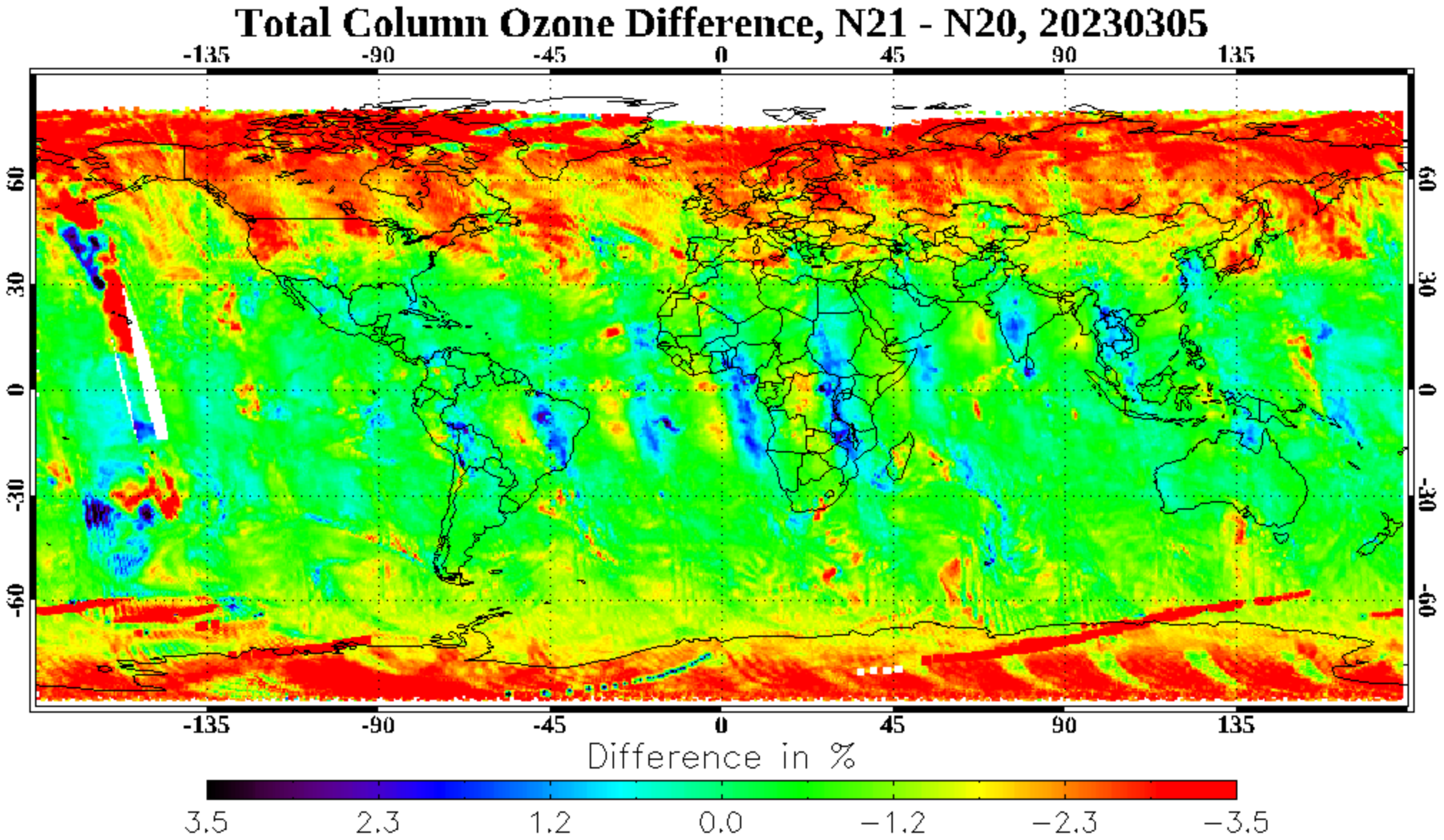


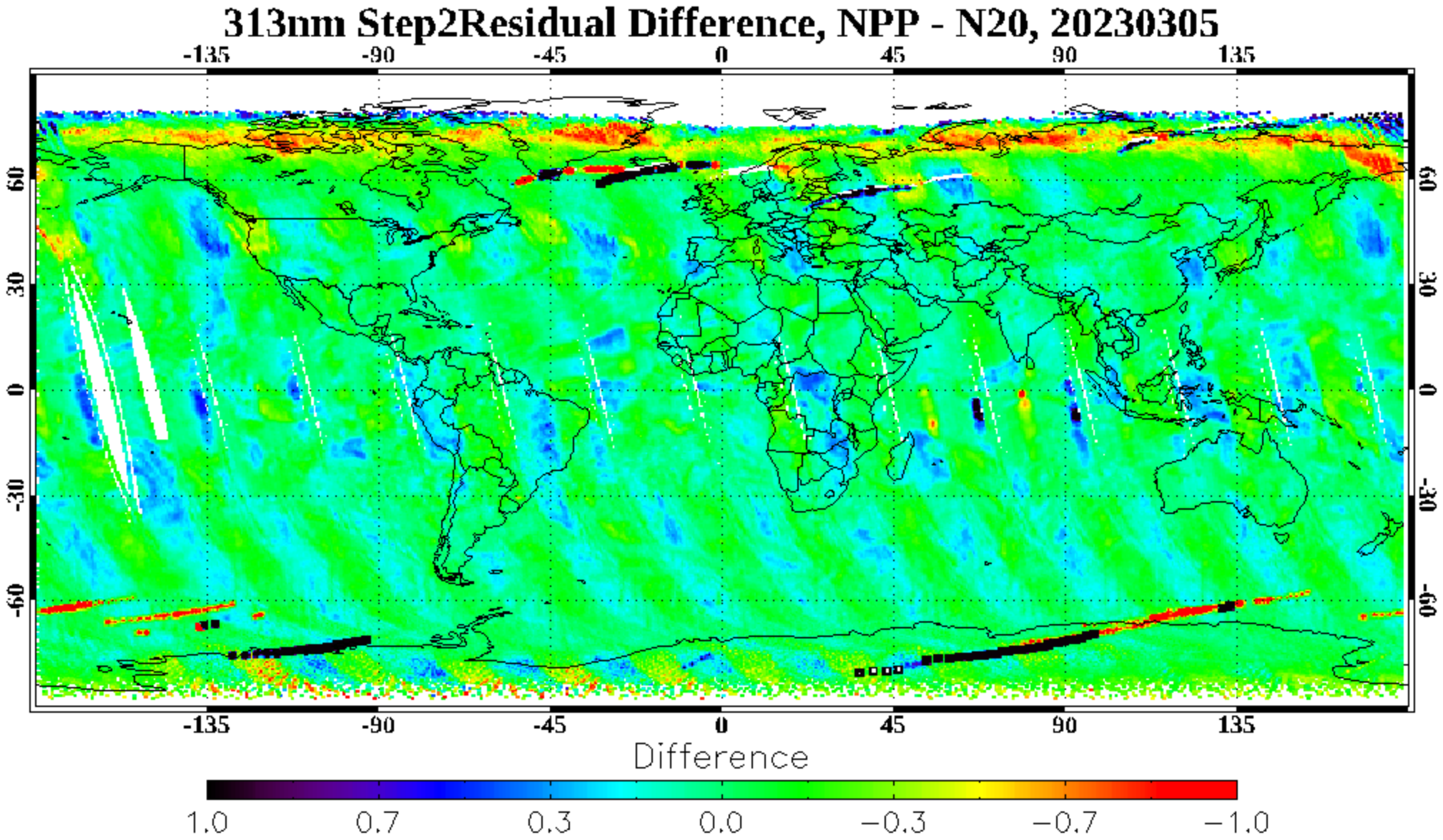
Backup earlier results

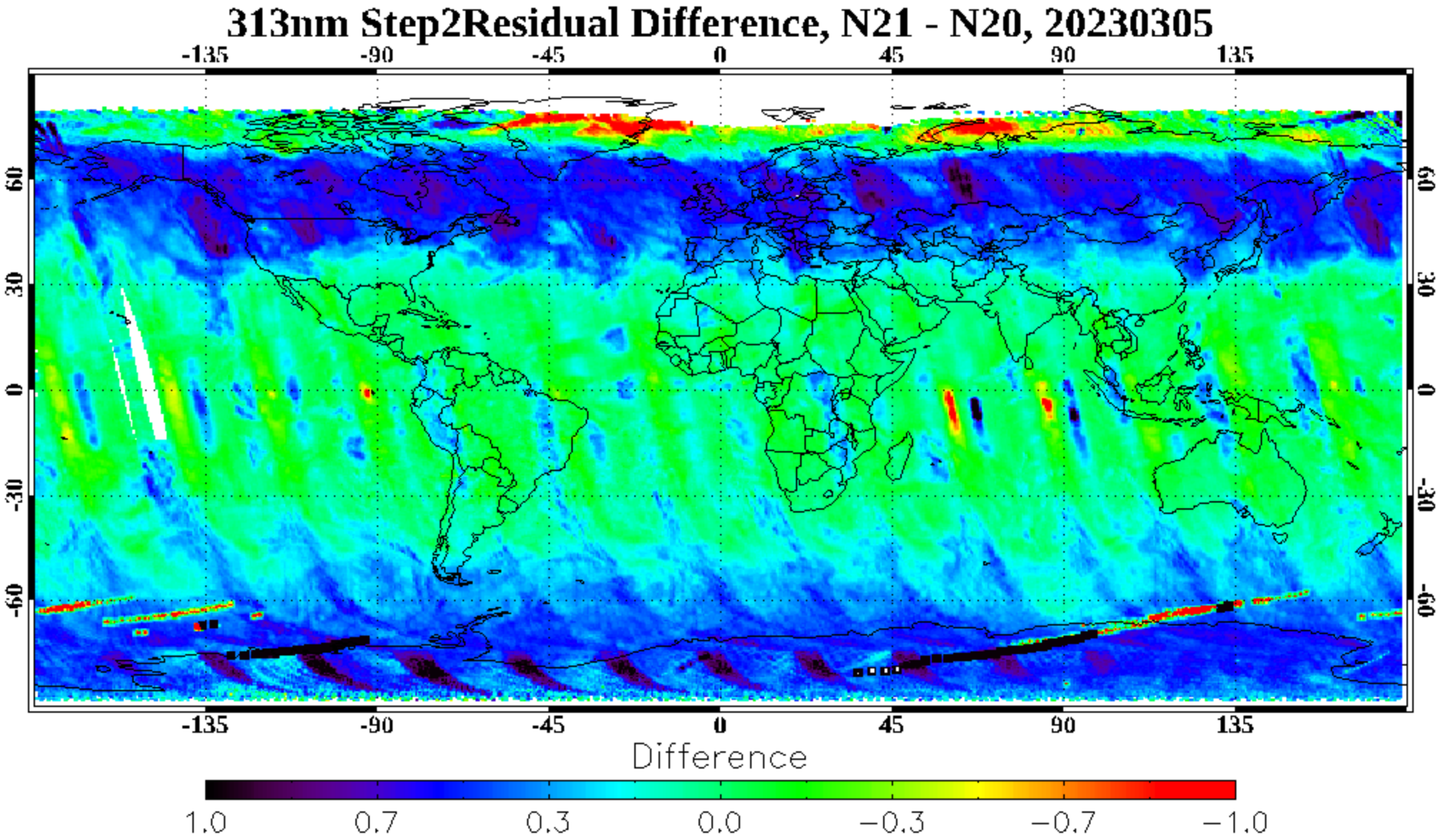

Step1-Ozone Difference, NPP - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference in %
3.5
2.3
1.2
0.0
−1.2
−2.3
−3.5

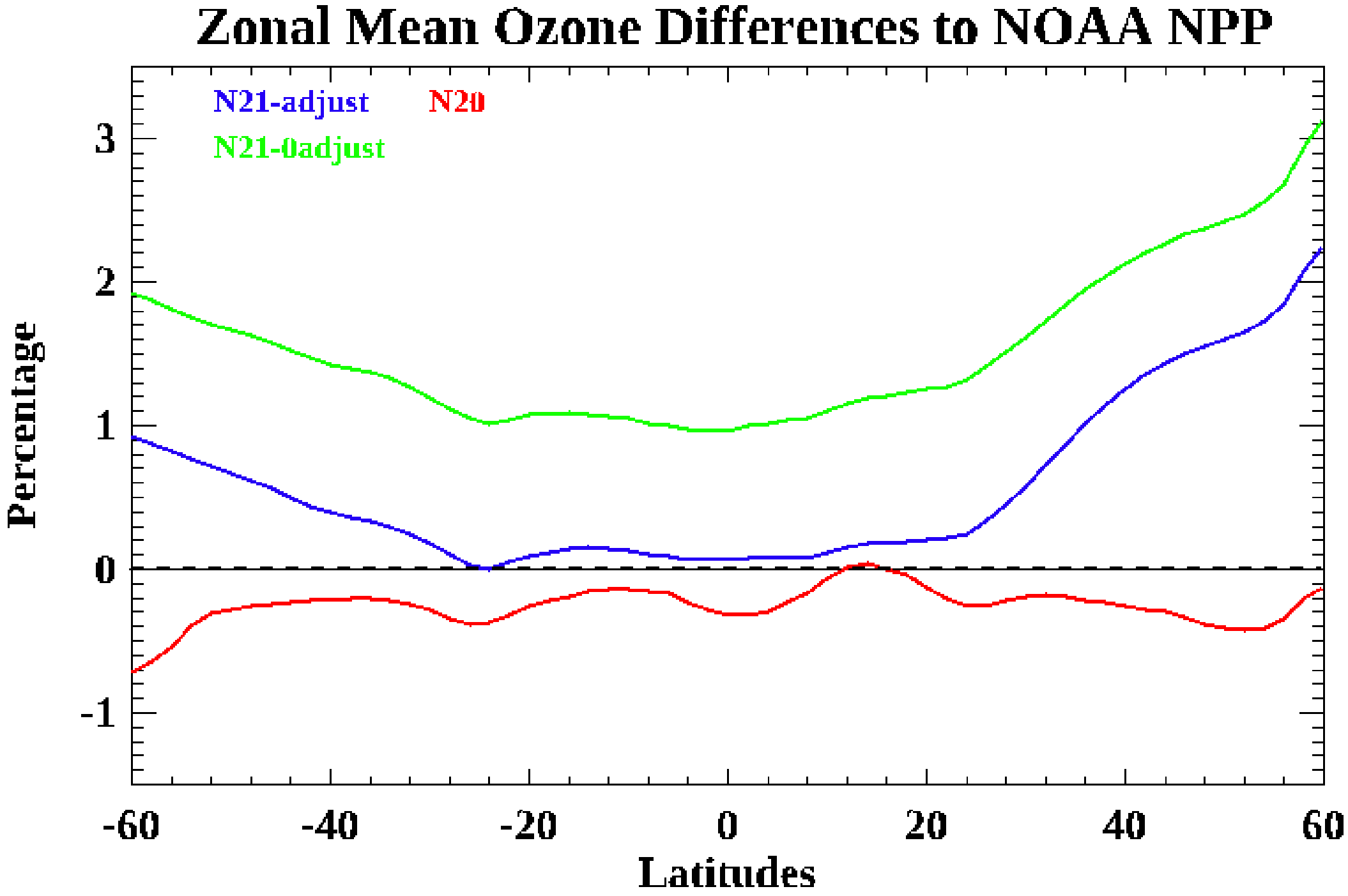

Step1-Ozone Difference, N21 - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference in %
3.5
2.3
1.2
0.0
−1.2
−2.3
−3.5

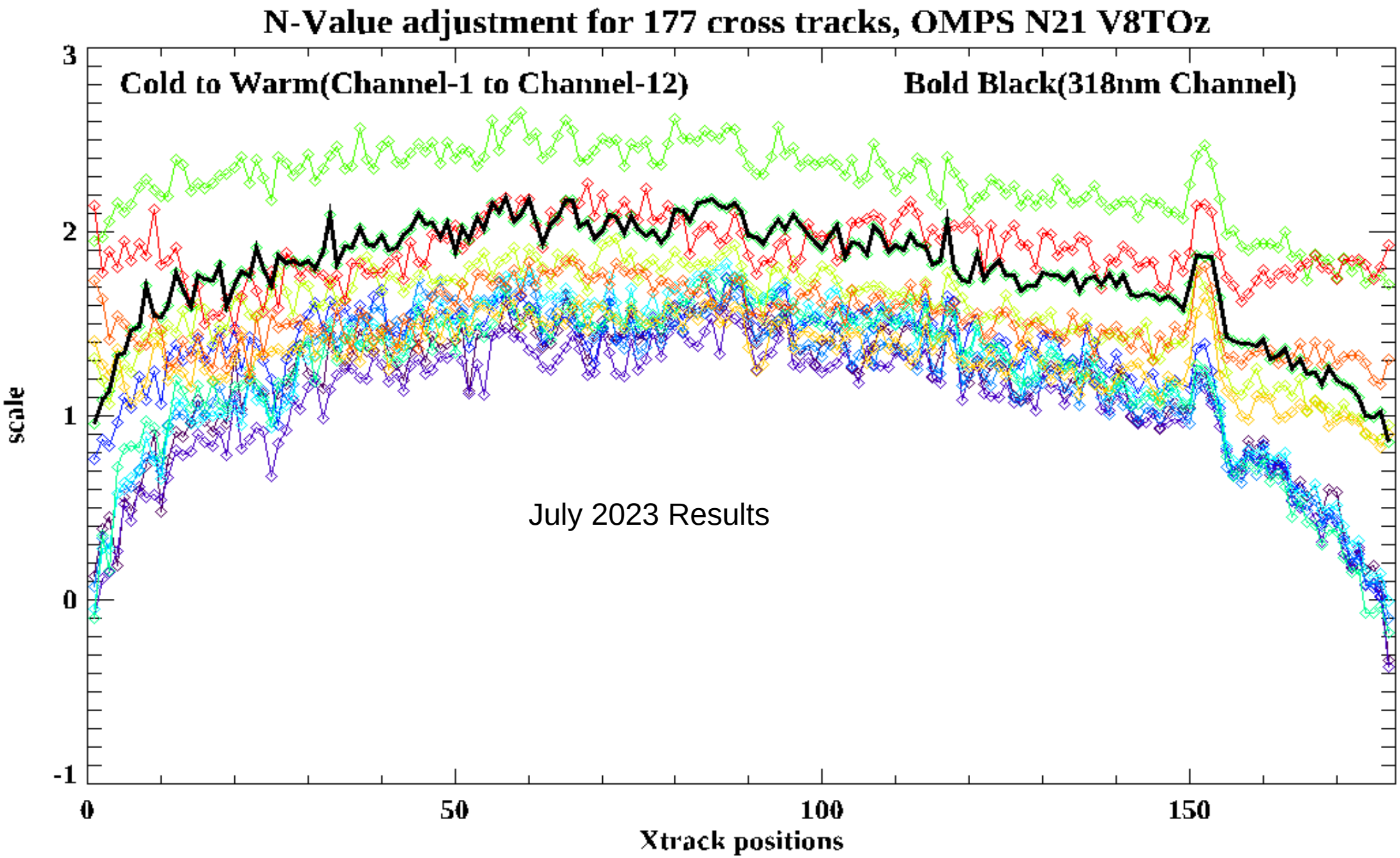

Total Column Ozone Difference, NPP - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference in %
3.5
2.3
1.2
0.0
−1.2
−2.3
−3.5

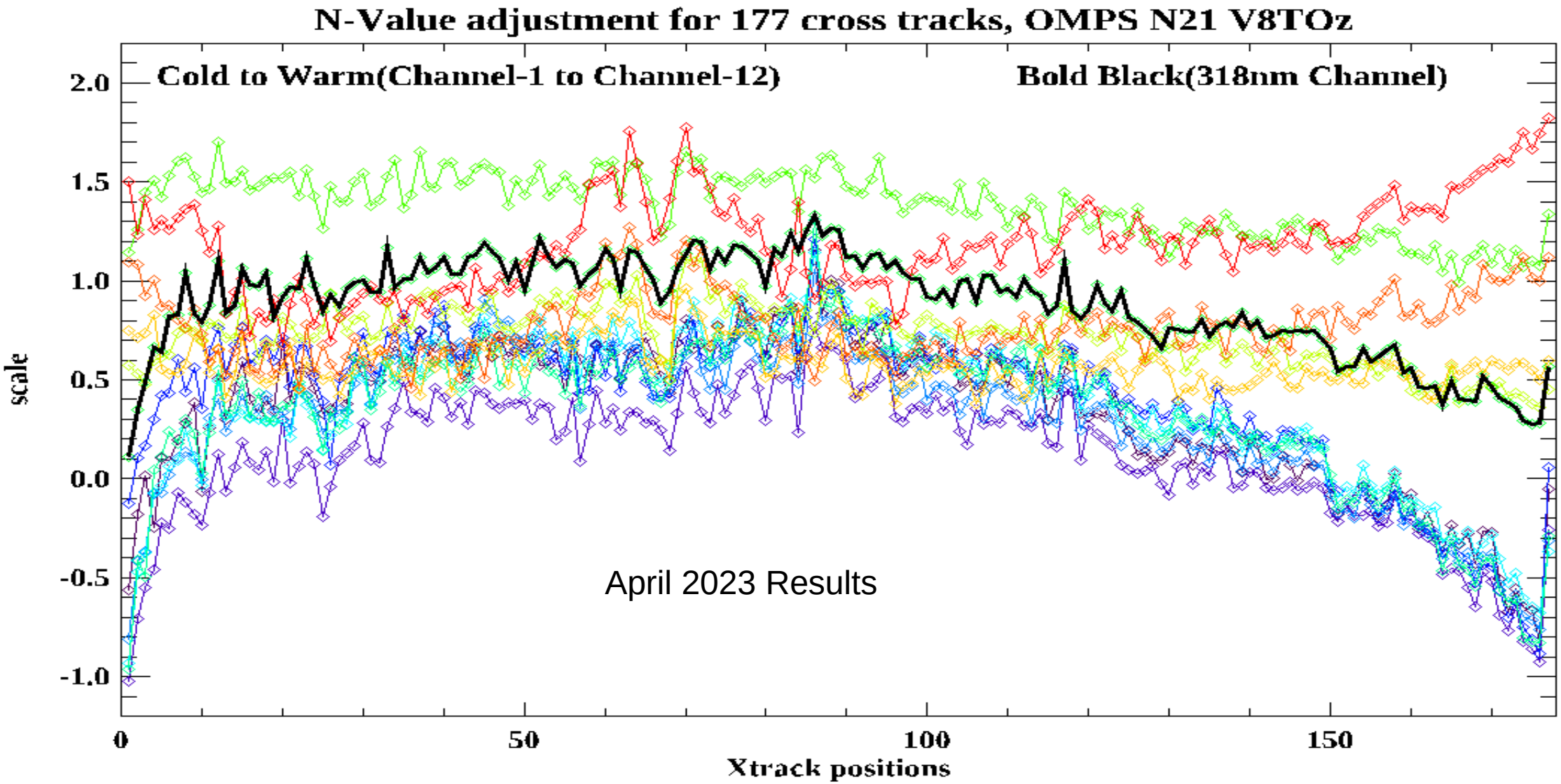

Total Column Ozone Difference, N21 - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference in %
3.5
2.3
1.2
0.0
−1.2
−2.3
−3.5


313nm Step2Residual Difference, NPP - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference
1.0
0.7
0.3
0.0
−0.3
−0.7
−1.0

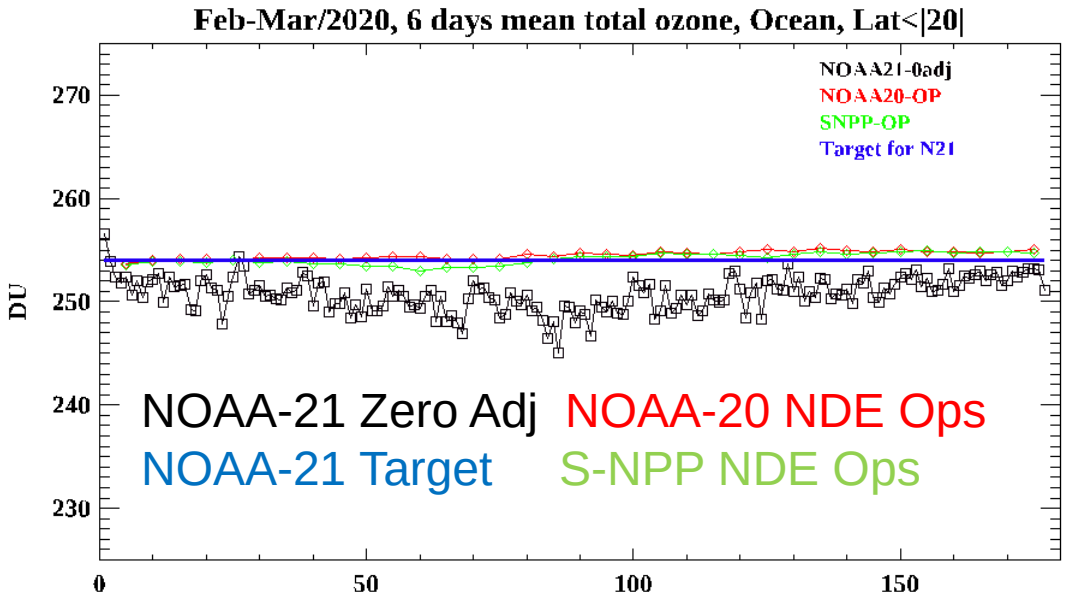

313nm Step2Residual Difference, N21 - N20, 20230305
-135
-90
-45
0
45
90
135
60
30
0
-30
-60
Difference
1.0
0.7
0.3
0.0
−0.3
−0.7
−1.0

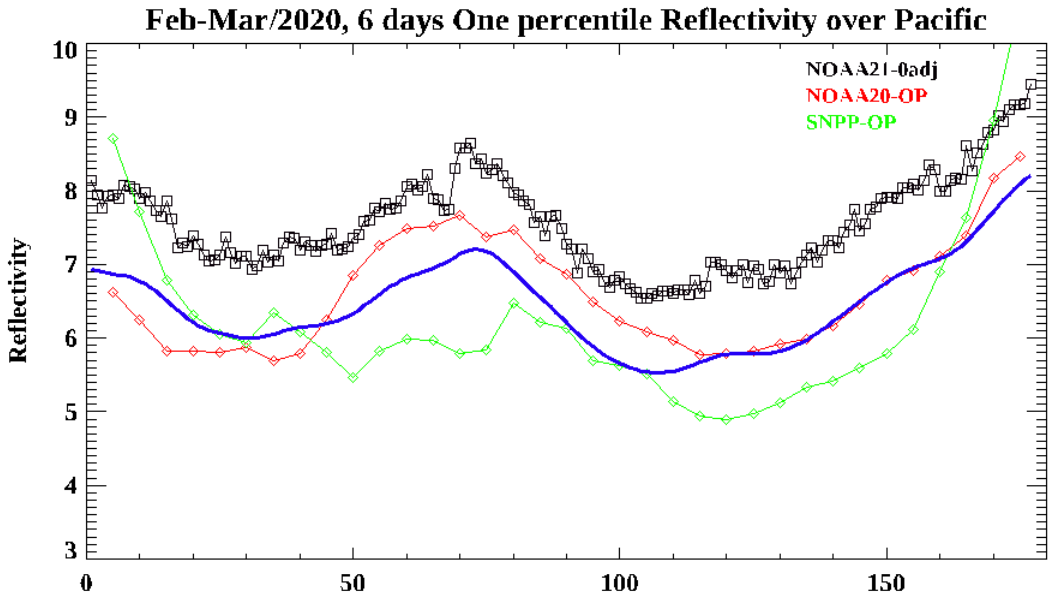

Zonal Mean Ozone Differences to NOAA NPP
N21-adjust
N20
N21-0adjust
3
2
1
0
-1
Percentage
-60
-40
-20
0
20
40
60
Latitudes

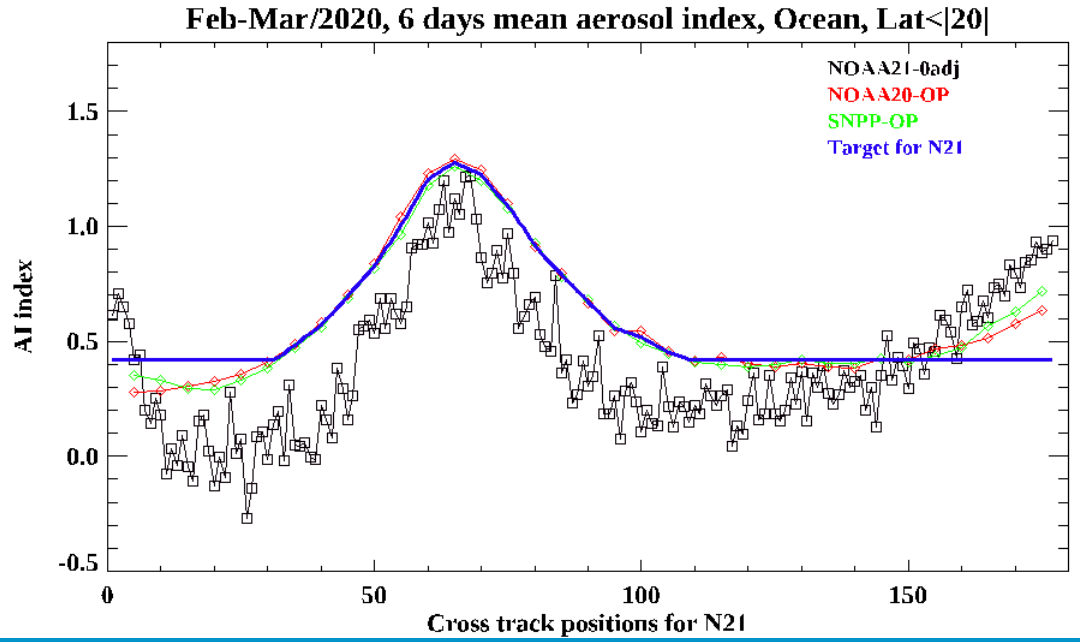

N-Value adjustment for 177 cross tracks, OMPS N21 V8TOz
Cold to Warm(Channel-1 to Channel-12)
Bold Black(318nm Channel)
July 2023 Results
scale
Xtrack positions
3
2
1
0
-1
0
50
100
150

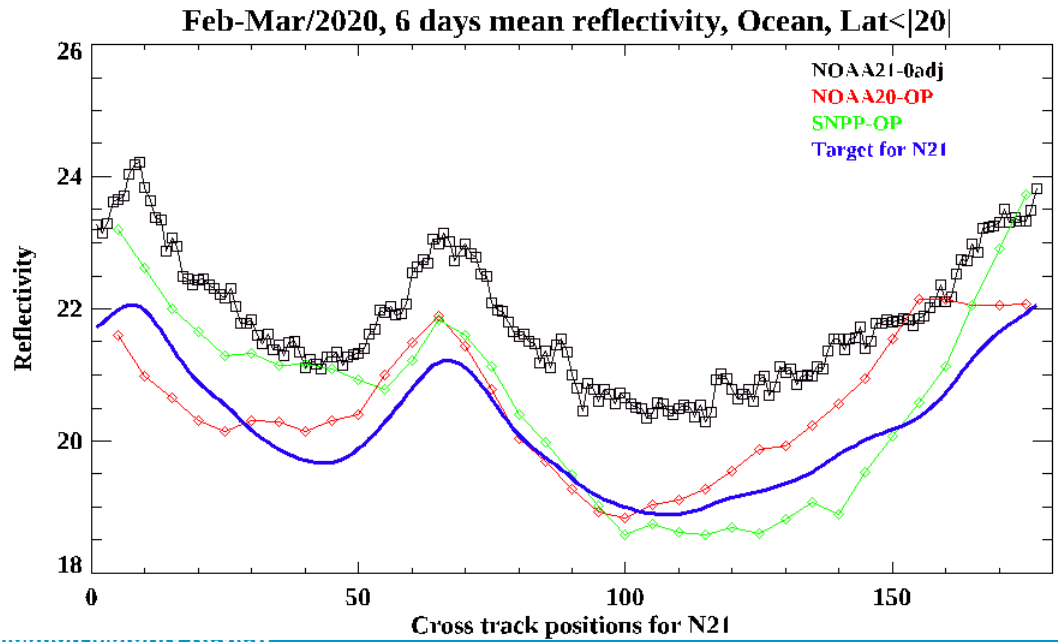

N-Value adjustment for 177 cross tracks, OMPS N21 V8TOz
Cold to Warm(Channel-1 to Channel-12)
Bold Black(318nm Channel)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
scale
0
50
100
150
Xtrack positions
April 2023 Results

Comparison of Cross-track Retrieval Averages (STAR) NEW RT TABLE

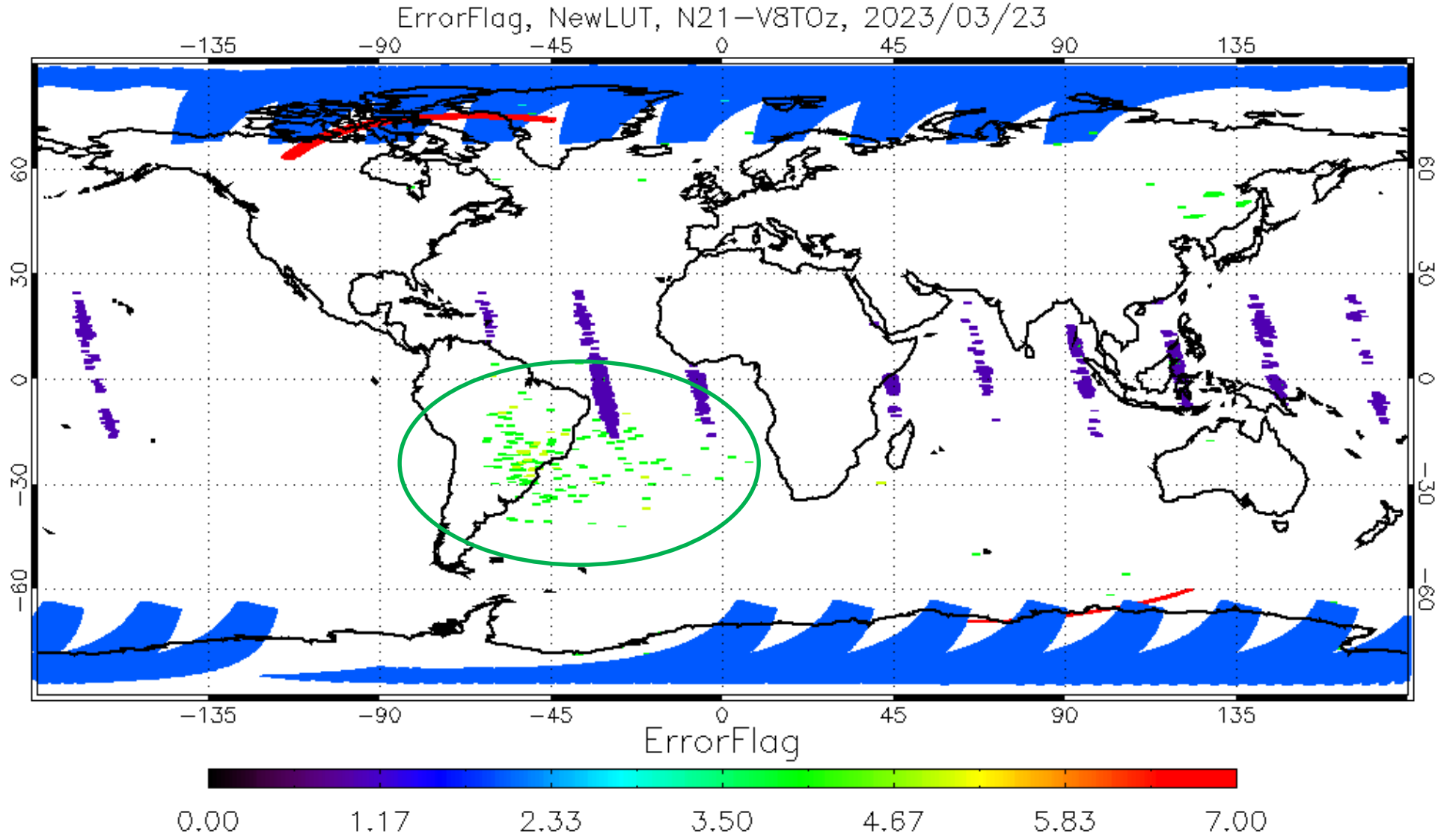






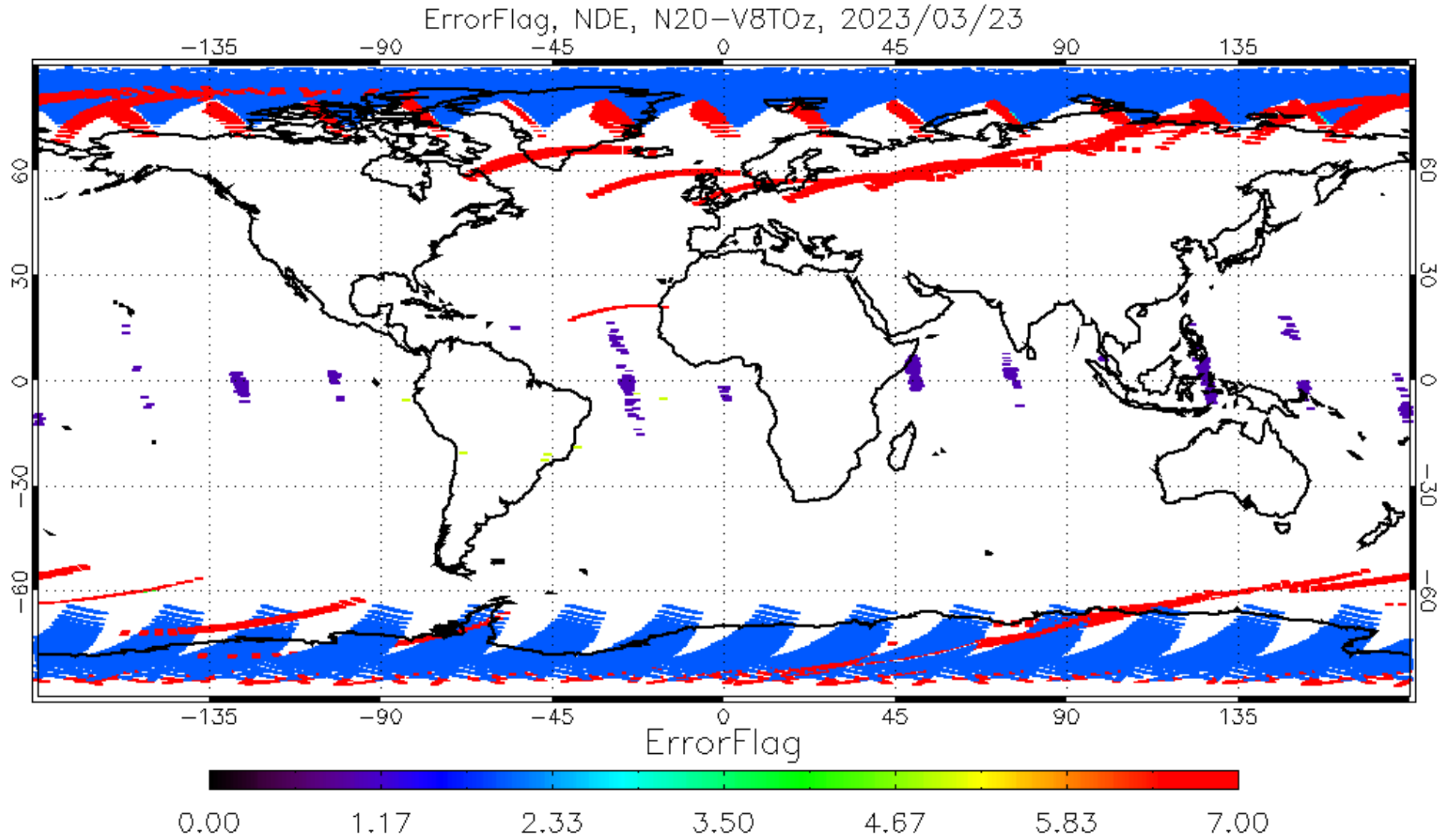


New Good N21 RT Instrument Table

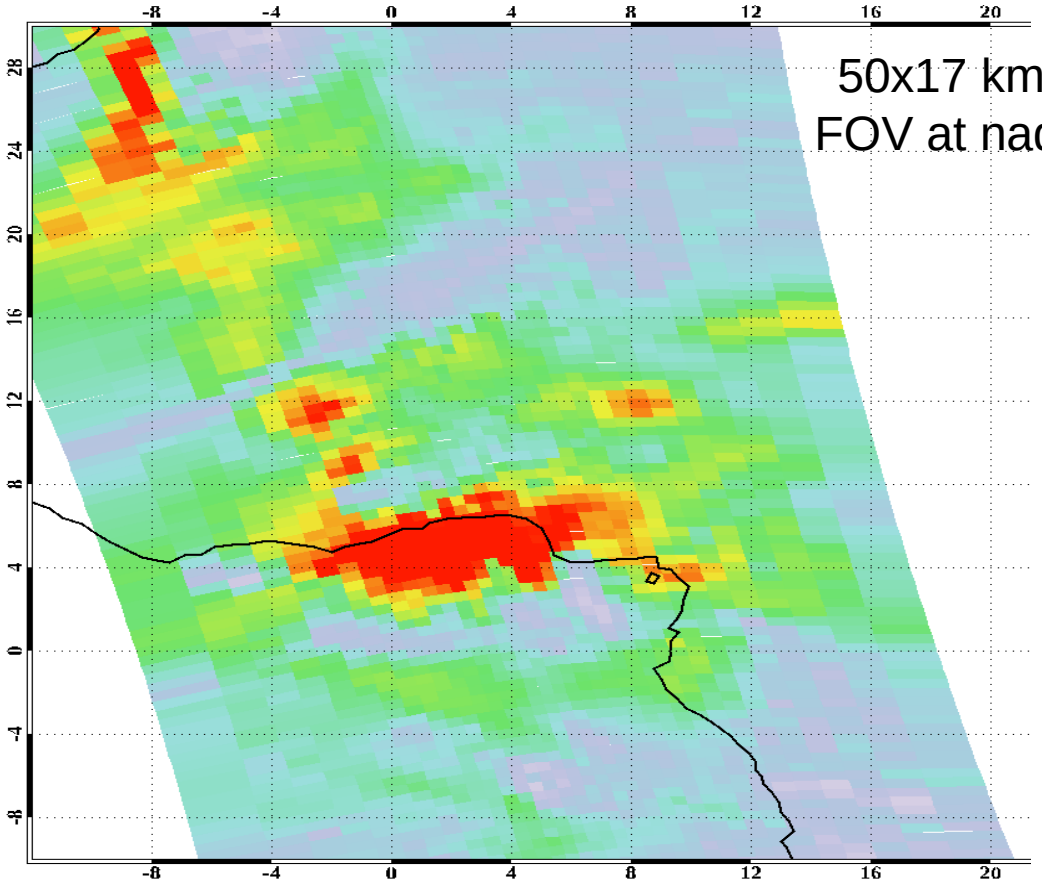


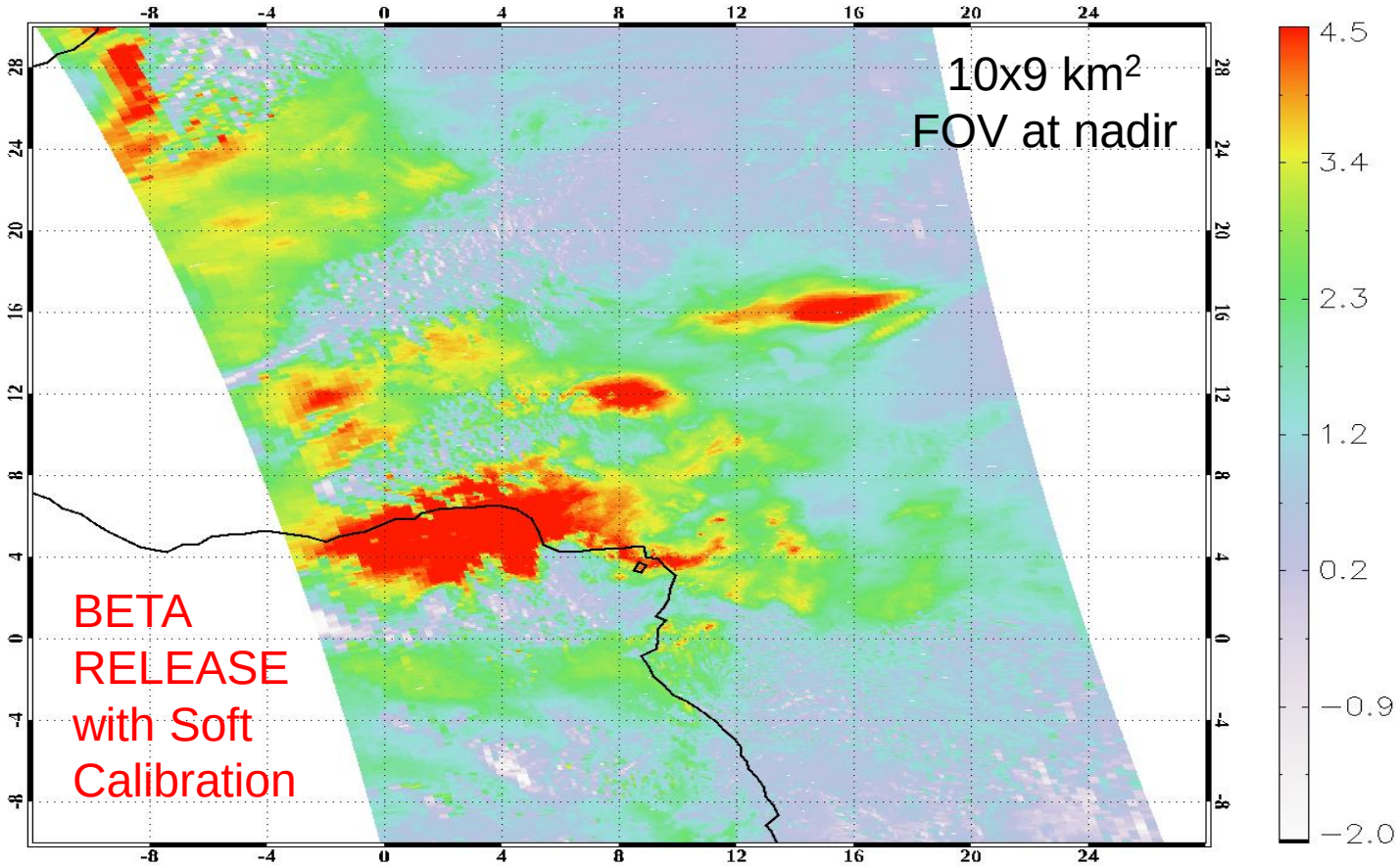
Smaller FOVs show increased flagging in the SAA

NOAA-20 RESULTS

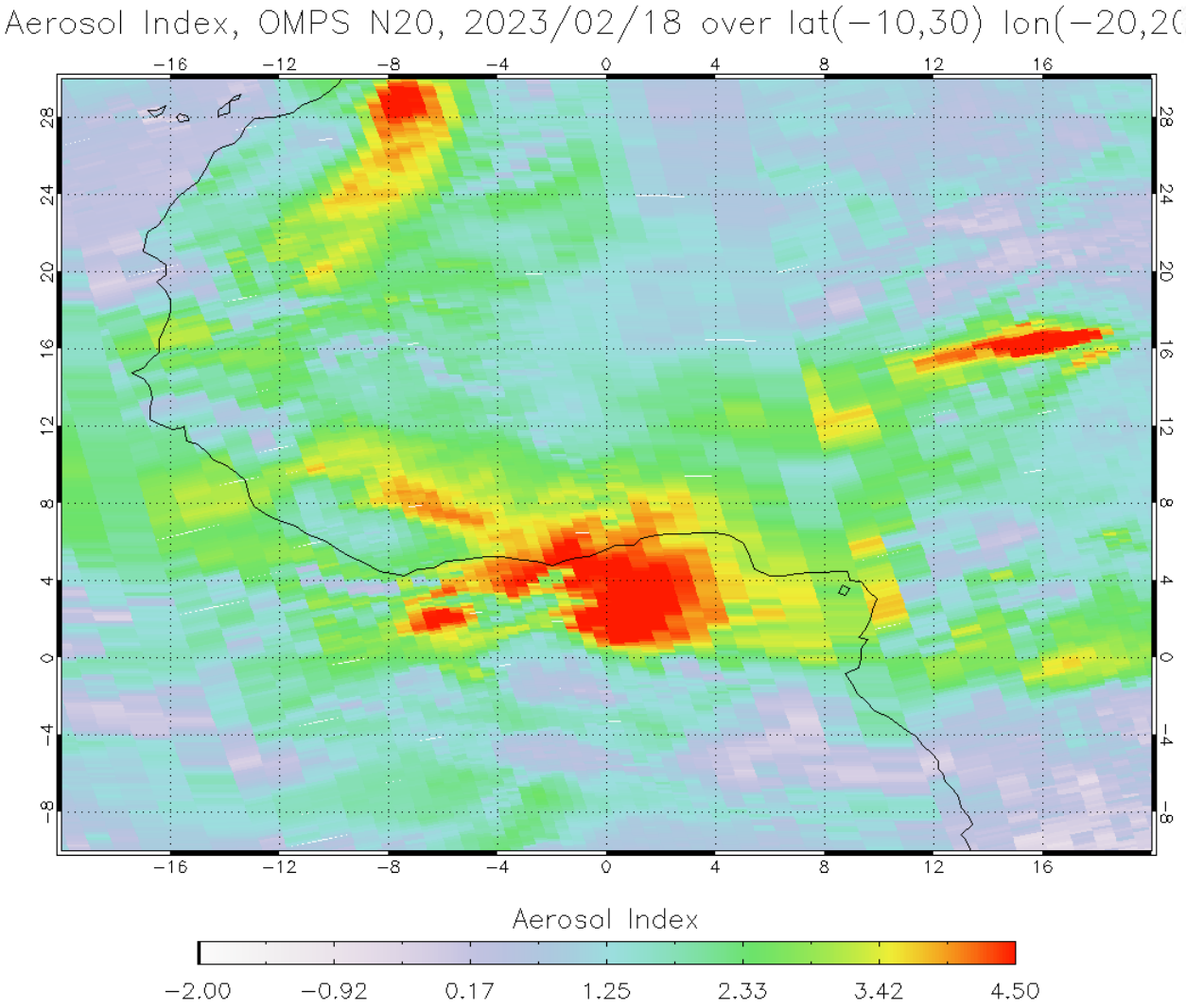


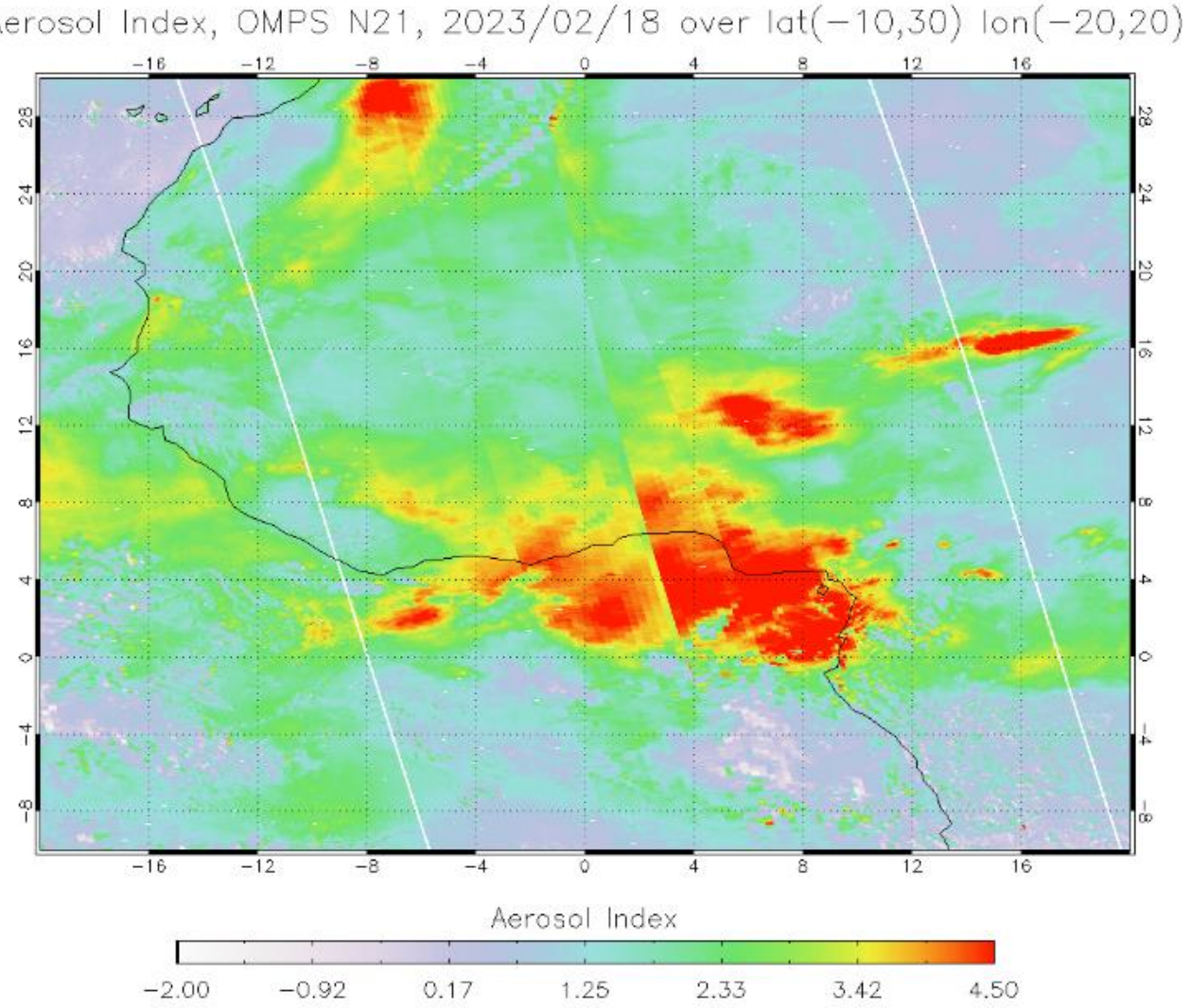
Comparisons of UV-Absorbing-Aerosol Index estimates for February 17, 2023 from NOAA-20 OMPS (left) and NOAA-21 OMPS (right) showing African biomass burning features.





Comparisons of UV Absorbing Aerosol Index estimates from NOAA-20 OMPS (left) and NOAA-21 OMPS (right) for one day showing Saharan Dust (upper feature) and biomass burning (lower).





While the NOAA-21 product shows cross-track calibration biases in the initial calibration, the much improved spatial resolution with the small Fields-of-View is obvious.