Validated Maturity Science Review For NOAA-20 OMPS Total Ozone EDR – V8TOz

Presented by Lawrence E. Flynn
Date: 9/19/2019
with contributions from the NOAA & NASA OMPS Teams

JPSS NOAA NASA

Disclaimer

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

JPSS Data Products Maturity

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.

Validated Maturity Review - Entry Criteria

- Product Requirements
- Validated 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/EDRs feedback
- Risks, Actions, Mitigations
  - Potential issues, concerns
- Path forward
- Summary

Validated Maturity Review - Exit Criteria

- Validated 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 Validated Maturity Slide Package addressing review committee's comments for:
  - Cal/Val Plan and Schedules
  - Product Requirements
  - Validated Maturity Performance
  - Risks, Actions, Mitigations
  - Path forward

Outline

- Four-Tiered Approach to Validation
- What has Changed since Provisional
- Algorithm Cal/Val Team Members
- Product Overview/Requirements
- Evaluation of algorithm performance to specification requirements
  - Algorithm version, processing environment
  - Evaluation of the effect of required algorithm inputs
  - Quality flag analysis/validation
  - Error Budget
- User Feedback
- Risks, Actions, and Mitigations
- Documentation (Science Maturity Check List)
- Conclusion
- Path Forward

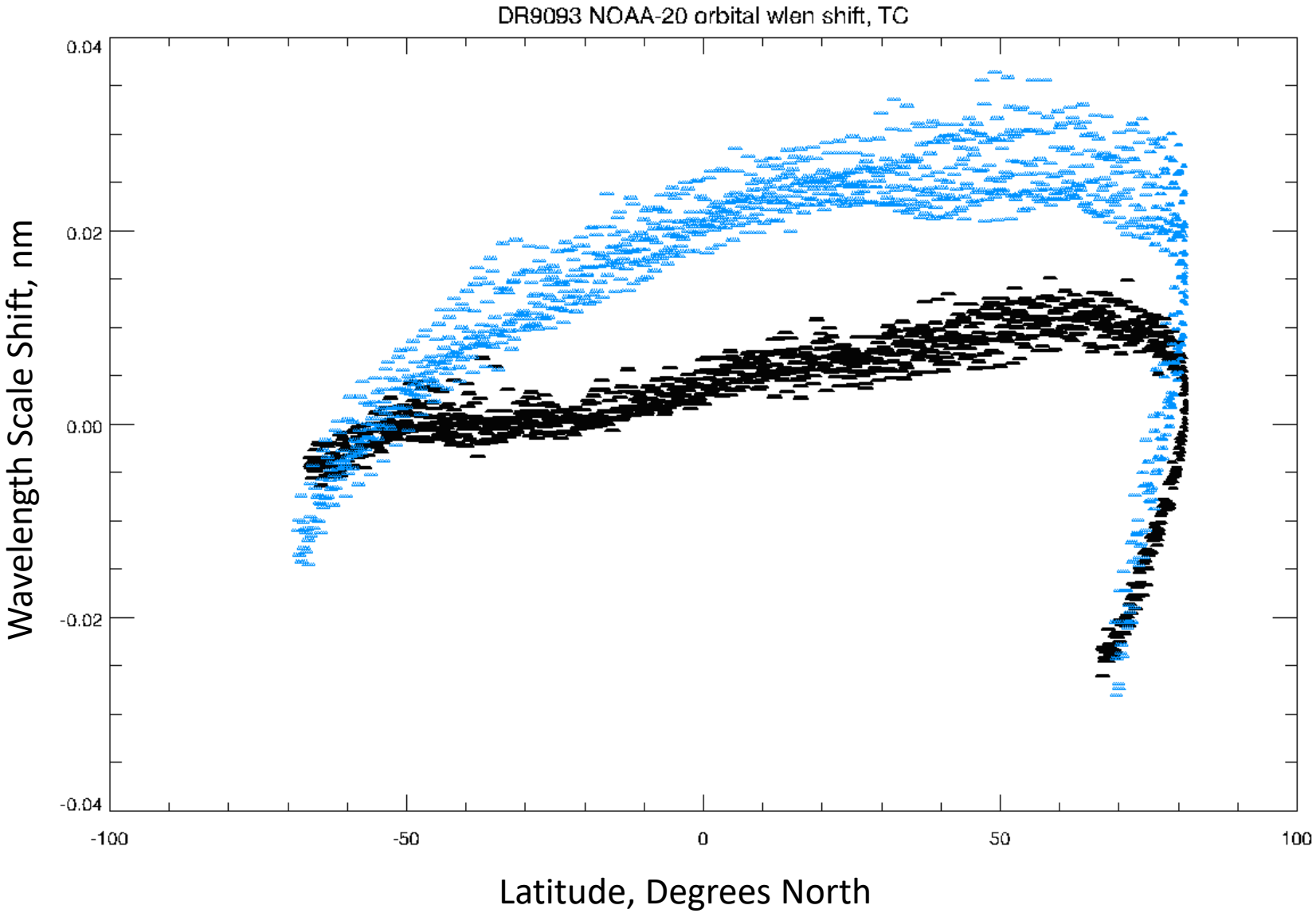
Four-Tiered Approach to V8TOz Validation

- Comparisons of Long-Term Satellite Records to Ground-based Ozone Estimates
  - S-NPP OMPS and EOS Aura OMI to Dobson and Brewer
- Comparisons of NOAA-20 OMPS to Validated Satellite Data
  - In-depth, daily, global matchups of NOAA-20 OMPS V8TOz versus OMI V8TOz & of NOAA-20 OMPS V8TOz versus S-NPP OMPS V8TOz
- Internal consistency checks and absolute comparisons for key statistics
  - NOAA-20 OMPS V8TOz versus S-NPP OMPS V8TOz
- Monitoring of stability and product quality
  - Operational Monitoring, STAR monitoring (ICVS and Products), STAR daily maps for both NOAA-20 and S-NPP OMPS V8TOz

What has changed since Provisional?

- New Sample Table (140 x 5-pixels) without extreme cross-track pixels
- Better Match-up with OMPS NP FOVs
- Retrievals for total ozone greater than 450 DU
- Switch accidentally turned off measurement-based along-orbit wavelength scale correction
- Update of four SDR tables in progress (Stray Light, Wavelength Scale, Day 1 Solar and Calibration Coefficients) with return of wavelength scale correction.

Intra-orbit Wavelength Shifts for S-NPP and NOAA-20 OMPS NM



SDR Timeline of Important Evens

Launch 11/17/2017, Activation 11/29/2017
First Darks 12/20/2017, Door Open 1/7/2018, Nominal Ops begins 2/9/2018

Measured at 104 CT by 5 scans, SDR output in 35x 5, from 2/9/2018 to 3/30/2018

Incorrect FAM 2/26/2018 DR8576,8577 Update for incorrect OMPS-TC,NP Field-Angle-Map Tables
The OMPS had incorrect lon,lat,SZA,... Ingested at Ops 2/26/2018.

15 scans per granule 3/30/2018, Measured at 104 CT by 15 scans, SDR output in 35x15

DR_8594 CCR-3821 NOAA-20 OMPS table updates for provisional Maturity table change. Ingest on Ops strings 03/30/2018
- OMPS-TBL-VERS-GND-PI
- OMPS-TC-TIMINGPATTERN-GND-PI
- OMPS-TC-EV-SAMPLE-GND-PI
- OMPS-TC-MACROTABLE-GND-PI
- OMPS-TC-WAVELENGTH-GND-PI
- OMPS-TC-OSOL-LUT
- OMPS-TC-STRAYLIGHT-LUT
- OMPS-TC-CF-EARTH-GND-PI

OMPS-TC Transition to 140 CT, flight table upload on 2/13/2019, Measured at 140 CT by 15 scans, SDR output in 35x15.

There were two major table deliveries, DR8617 had the sample and version tables. DR8816 had related calibration table updates.

DR8617 CCR-4137 OMPS-TC tables inactive until 2/13/2019.
- OMPS-TBL-VERS-GND-PI_j01
- OMPS-TC-CF-EARTH-GND-PI_j01
- OMPS-TC-EV-SAMPLE-GND-PI_j01
- OMPS-TC-MACROTABLE-GND-PI_j01
- OMPS-TC-WAVELENGTH-GND-PI_j01

DR8816 CCR-4303 New Tables 4/19/2019, Deployed to OPS (Switch for Table wavelength shifts is broken)
- OMPS-TC-OSOL-LUT_j01
- OMPS-TC-STRAYLIGHT-LUT_j01
- OMPS-TC-WAVELENGTH-GND-PI_j01

Ozone Cal/Val/Alg Team Membership

	Name	Organization	Task
Lead	Lawrence Flynn	NOAA/NESDIS/STAR	Ozone EDR Team
Sub-Lead	Irina Petropavlovskikh	NOAA/ESRL/CIRES	Ground-based Validation
Sub-Lead	Craig Long	NOAA/NWS/NCEP	Product Application
Sub-Lead	Trevor Beck	NOAA/NESDIS/STAR	Trace Gas Algorithm Development
Member	Jianguo Niu	STAR/IMSG/SRG	Algorithm development, trouble shooting, Limb Profiler science
Member	Eric Beach	STAR/IMSG	Validation, ICVS/Monitoring, Data management
Member	Zhihua Zhang	STAR/IMSG	V8 Algorithms implementation and modification
JAM	Laura Dunlap	JPSS/Aerospace	Coordination
Adjunct	Bigyani Das	STAR/AIT	Deliveries
PAL	Vaishali Kapoor	OSDPD	Atmospheric Chemistry Product Area 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	50x17 km^2 at nadir
Mapping Uncertainty	5 km at nadir	3 km at nadir (SDR Team)
Measurement Range	50 – 650 DU	90-700 DU (SDR range and past algorithm performance)
Measurement Accuracy		
X < 250 DU	9.5 DU	-5 to 5 DU vs. NPP (-2 DU avg.)
250 DU < X < 450 DU	13.0 DU	-5 to 5 DU vs. NPP (-2 DU avg.)
X > 450 DU	16.0 DU	-5 to 5 DU vs. NPP (-2 DU avg.)
Measurement Precision	for 50x50 km^2 product	for 50x17 km^2 product
X < 250 DU	6.0 DU	2 DU RMSDD, 5.0 DU NPPMU
250 DU < X < 450 DU	7.7 DU	3 DU RMSDD, 6.0 DU NPPMU
X > 450 DU	2.8 DU + 1.1%	4 DU RMSDD, 9.0 DU NPPMU

Processing Environment and Algorithms

- Algorithm version V8TOz_v3r1 at NDE Operations.
- LUTs use Radiative Tables from pre-launch and Soft Calibration Adjustment from 11/2018.
- Effective date: April 19, 2019.

- V8TOz versions 3, 4 & 5 and revision #s
  - Current v3r1: New Adjustment Table, new handling of Error Code 8 and checks for bad radiances.
  - Holding creation and delivery v3r2 of New Adjustment Tables pending SDR table deliveries.
  - Future v4: Code to use EOFs for outlier detection and noise reduction for Smaller FOV OMPS NM SDRs.
  - Future v5: Code to add measurement-based cloud top pressure.
  - We will use revision numbers for updates to soft calibration adjustment tables with separate tracking of S-NPP and NOAA-20 updates.

Data sources and naming convention

- There are two sources of products from NDE, the operational string and the integration and testing string (I&T). NDE runs new revisions on the I&T before moving them to operations. The I&T at NDE uses the SDRs from the I&T at IDPS. Both S-NPP OMPS and NOAA-20 OMPS V8TOz EDRs are on the operational system.
- We also make products at STAR either to compare with NDE or to test updates and revisions or because we want to create the EDRs with reprocessed SDRs.
- The EDRs have soft calibration adjustments and these are updated either as we make comparisons on the path to validation or when the SDRs change. There can be a time lag for the EDR adjustments after an SDRs change.
- There are satellite, version and revision numbers in the files names that track some of these changes. For examples,

V8TOZ-EDR_v3r0_npp_s201808012302421_e201808012303196_c201808020130010.nc

is version 3, revision 0 for S-NPP, and

V8TOZ-EDR_v3r1_j01_s201808201212230_e201808201213005_c201808201416070.nc

is version 3, revision 1 for NOAA-20

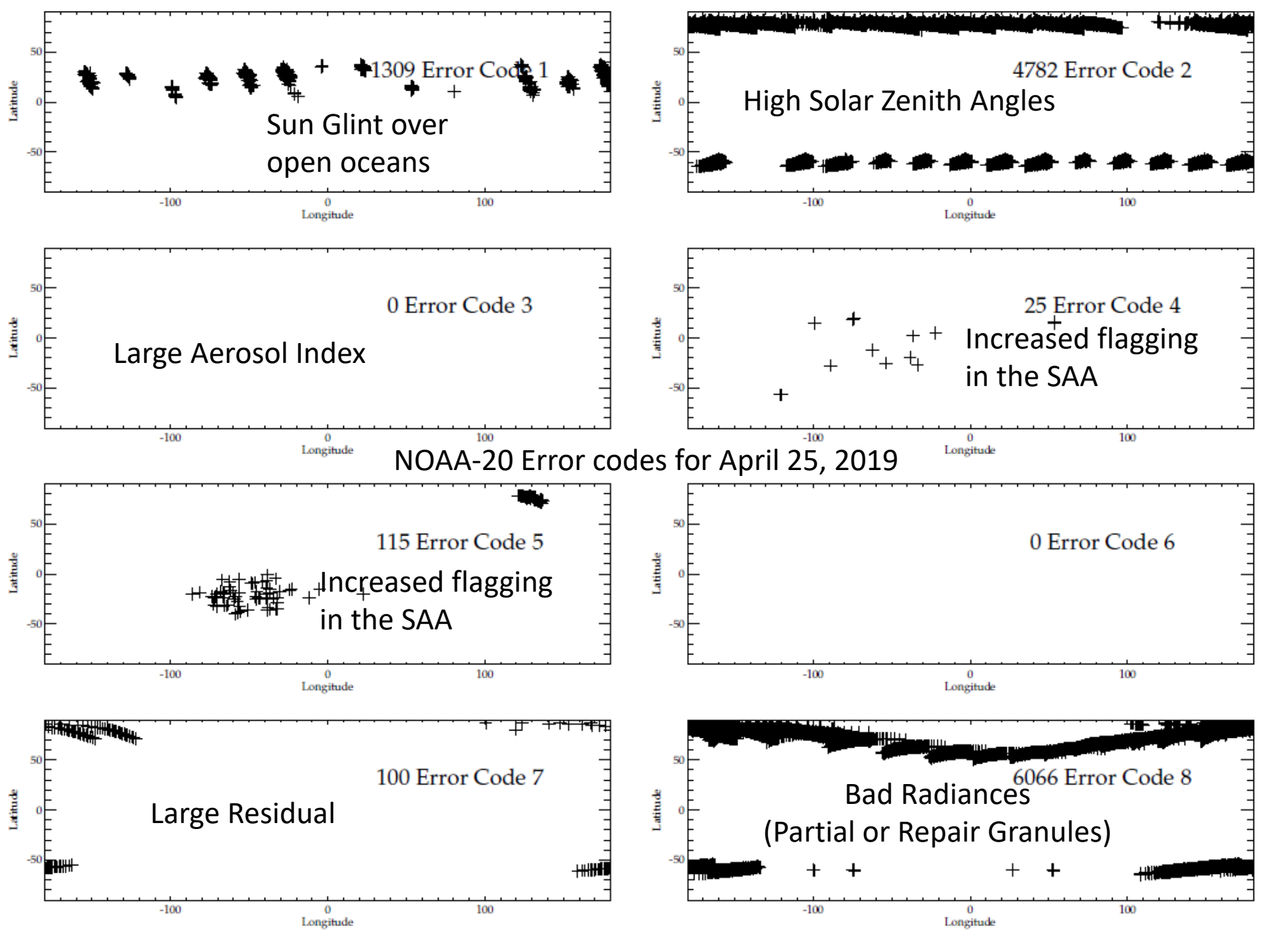
Required algorithm inputs

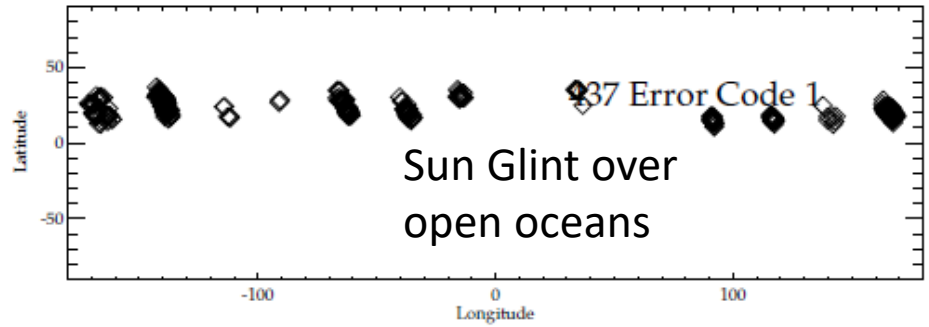
- Required Algorithm Inputs
  - Primary Sensor Data
    - NOAA-20 OMPS NM SDR and GEO
  - Ancillary Data
    - Standard ozone profiles, cloud top pressure, and other climatologies.
  - Upstream algorithms
    - OMPS SDR
  - LUTs / PCTs
    - Radiative Transfer Tables
    - N-value Adjustment Table

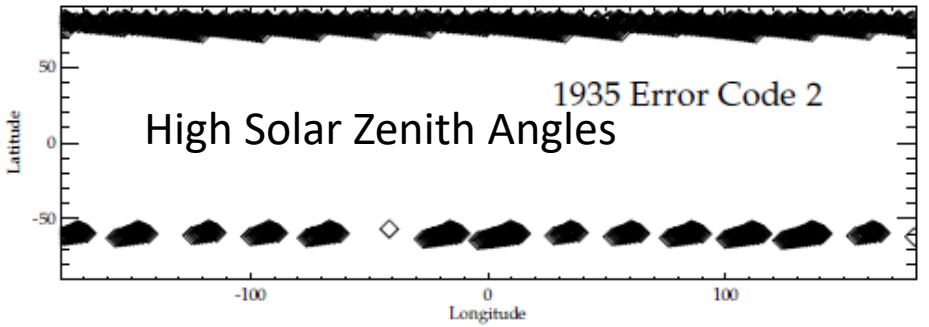
Quality Flags

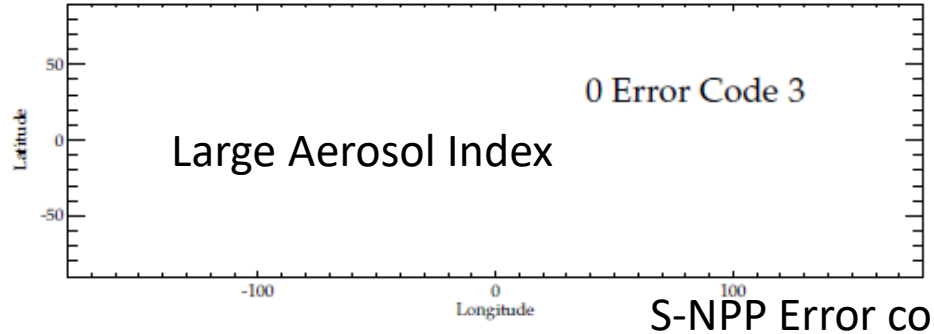
Output	Type	Description	
ErrorFlag		Good – 0	Good retrieval SZA <= 84°
		Sun Glint Geometry – 1	Good retrieval, open water with sun glint geometry present
		High SZA – 2	Good retrieval SZA > 84°
		Large Aerosol Index – 3	360 nm residual > threshold
		Profile Shape Error – 4	Residual at unused ozone wavelength > 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

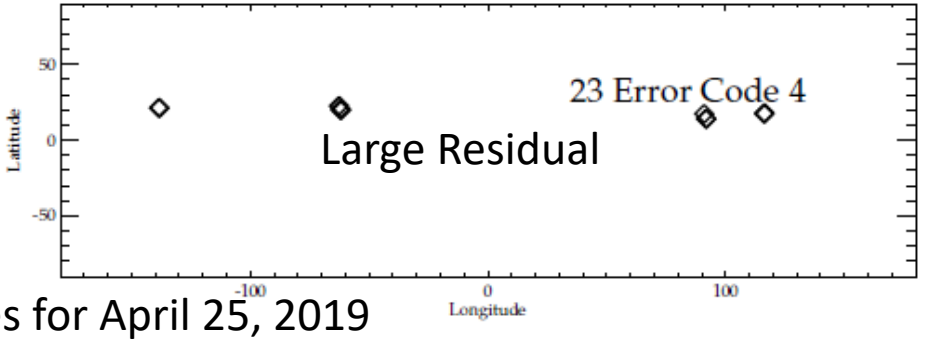
*The July 2, 2019 Solar eclipse flag was properly located in time and space.


1309 Error Code 1
Sun Glint over
open oceans
4782 Error Code 2
High Solar Zenith Angles
0 Error Code 3
Large Aerosol Index
25 Error Code 4
Increased flagging
in the SAA
NOAA-20 Error codes for April 25, 2019
115 Error Code 5
Increased flagging
in the SAA
0 Error Code 6
100 Error Code 7
Large Residual
6066 Error Code 8
Bad Radiances
(Partial or Repair Granules)
Latitude
Longitude
50
0
-50
-100
0
100

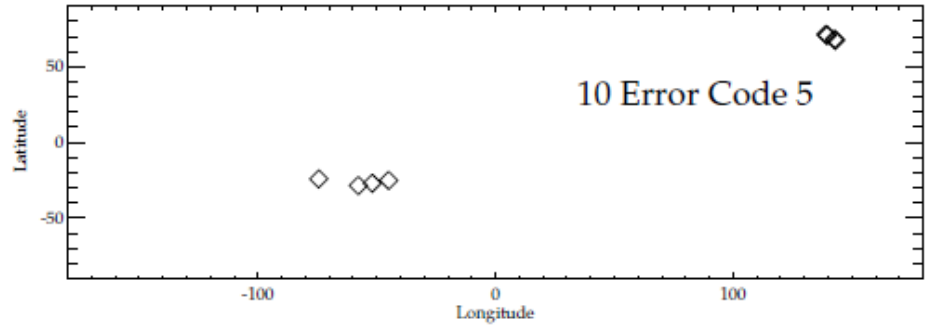


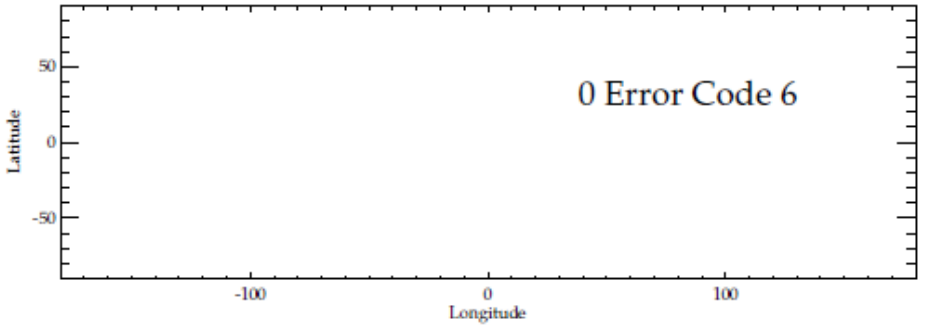


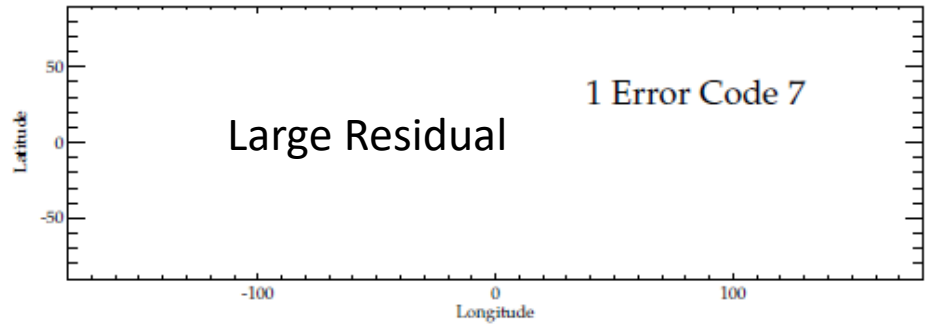


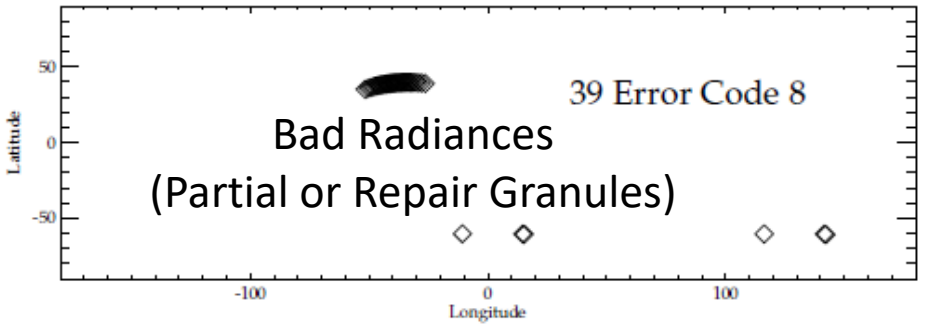


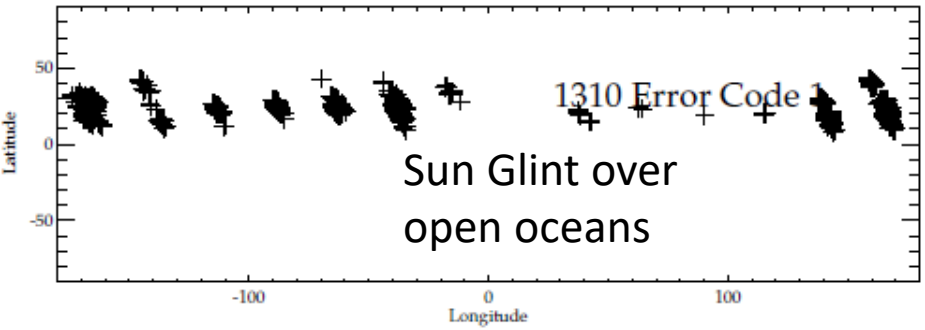
S-NPP Error codes for April 25, 2019

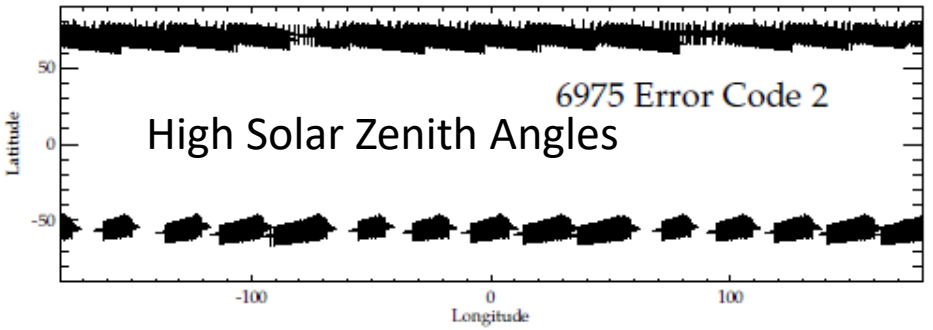


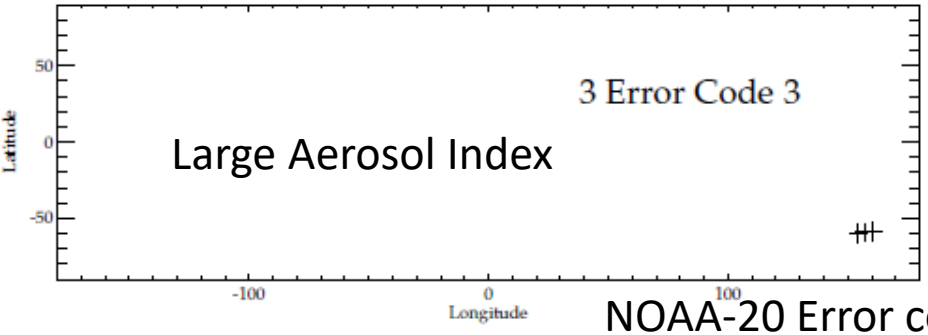


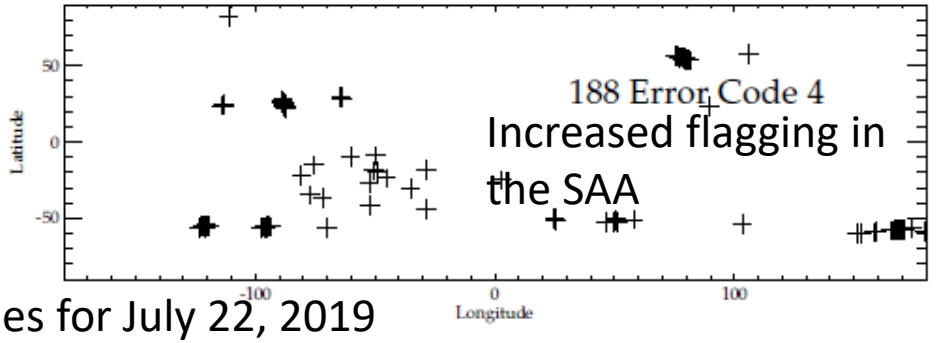




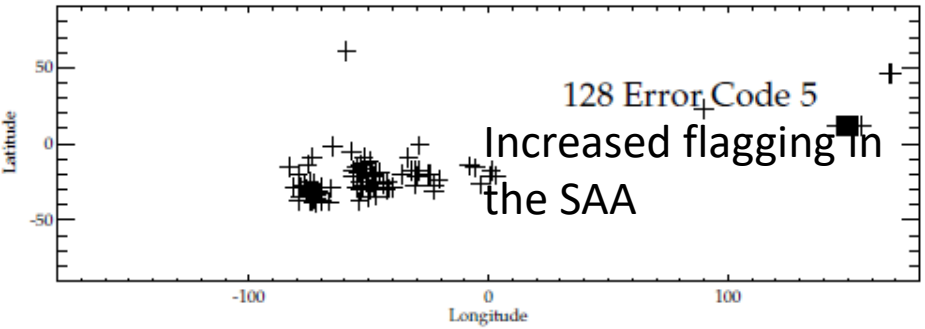


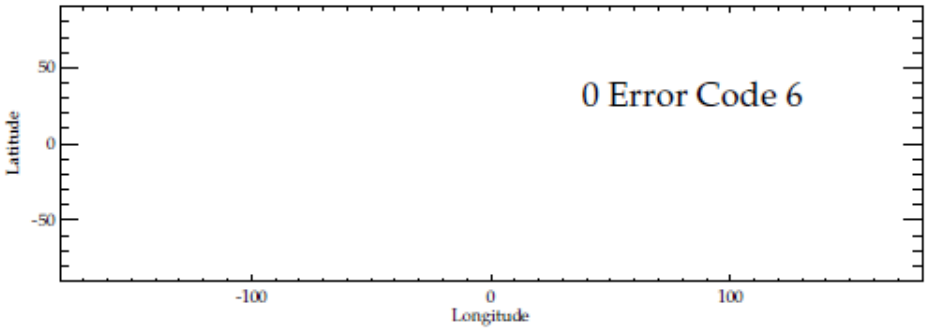


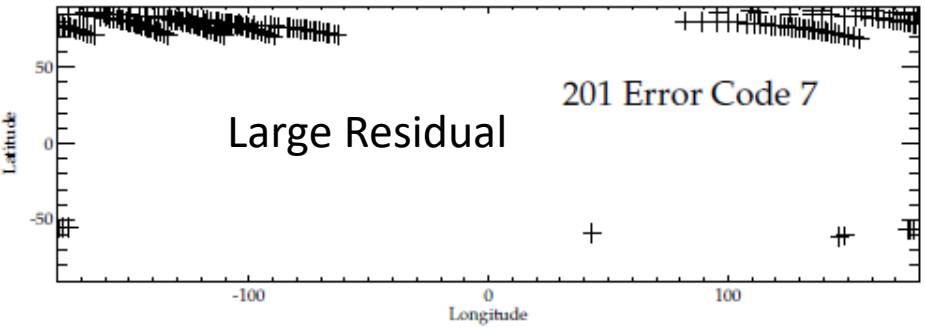


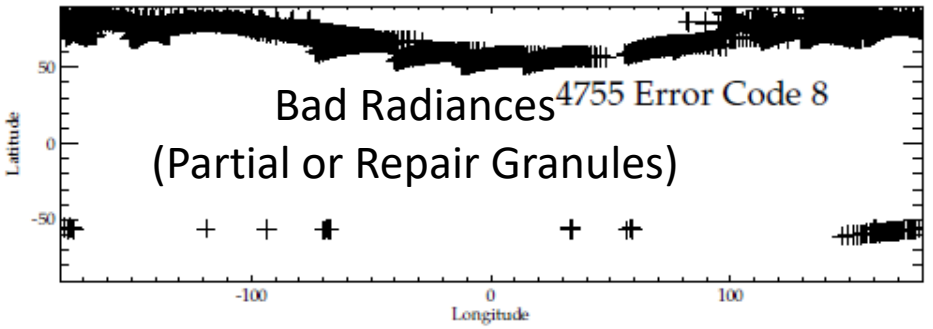


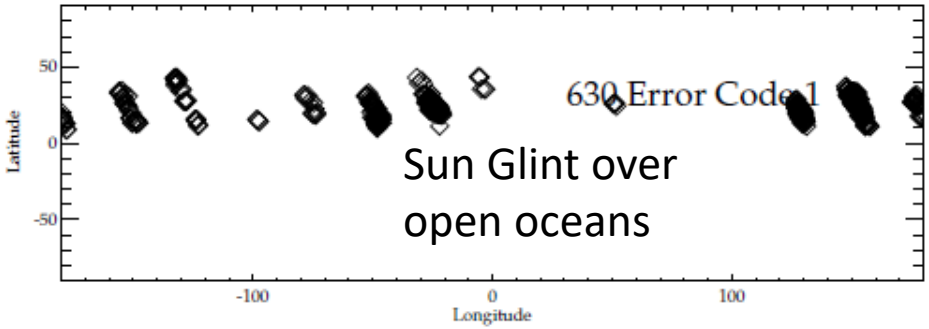
NOAA-20 Error codes for July 22, 2019

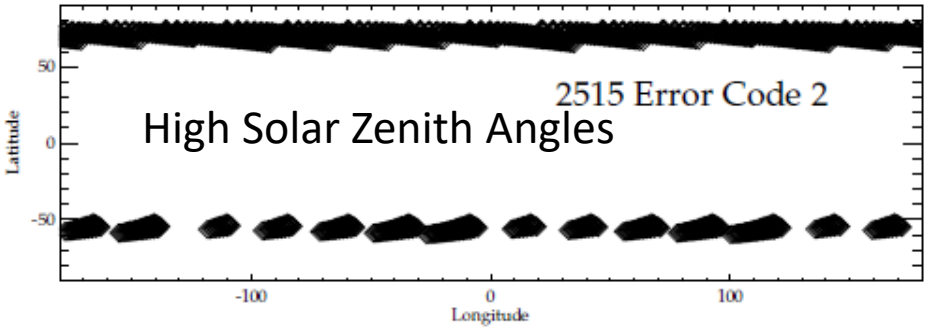


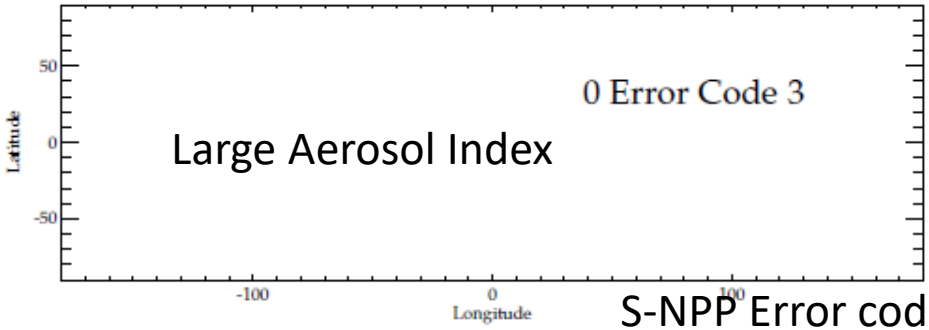


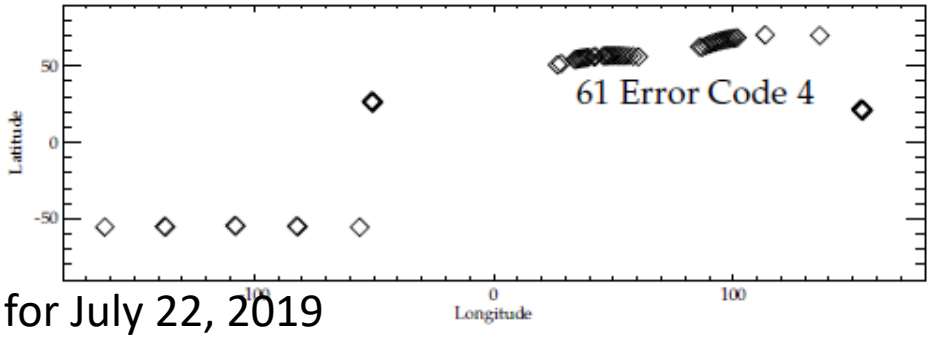




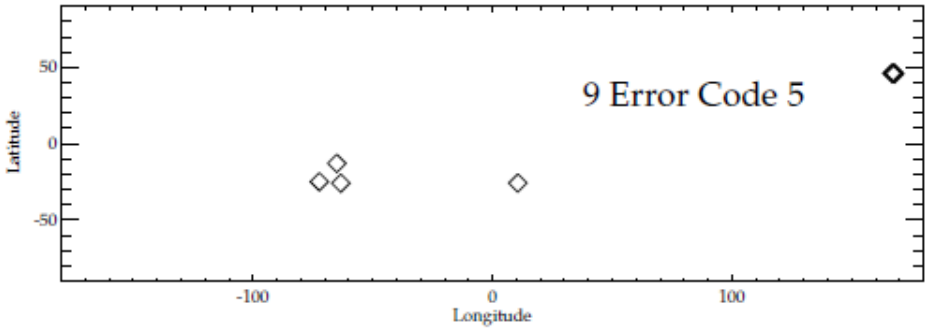


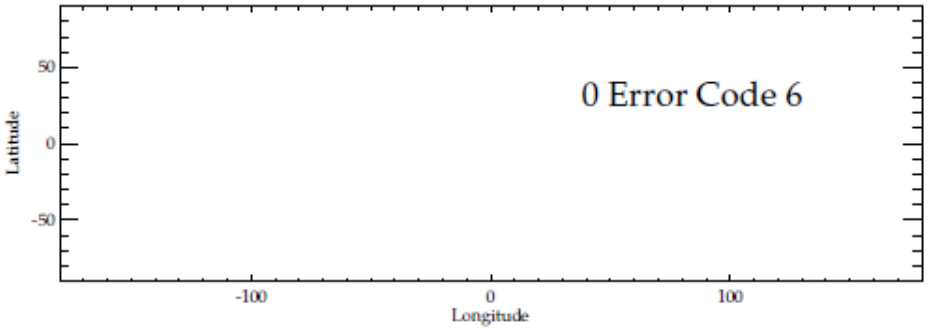


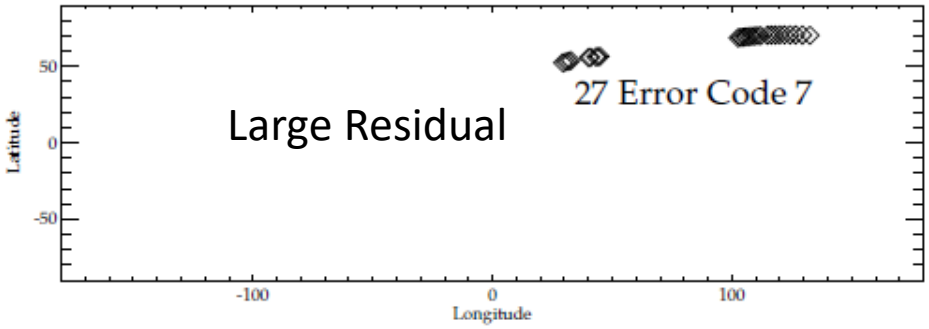


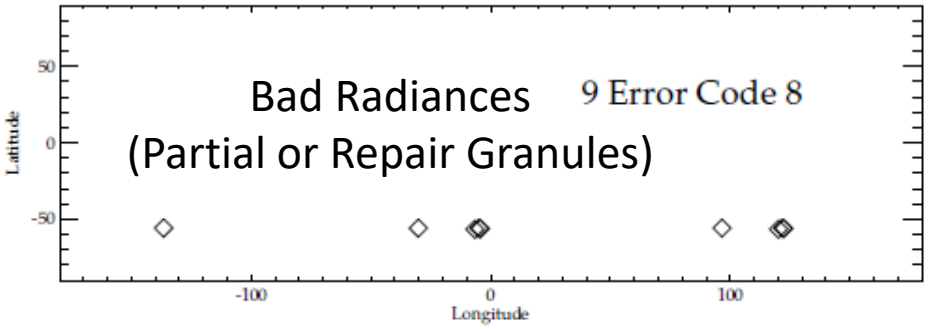


S-NPP Error codes for July 22, 2019



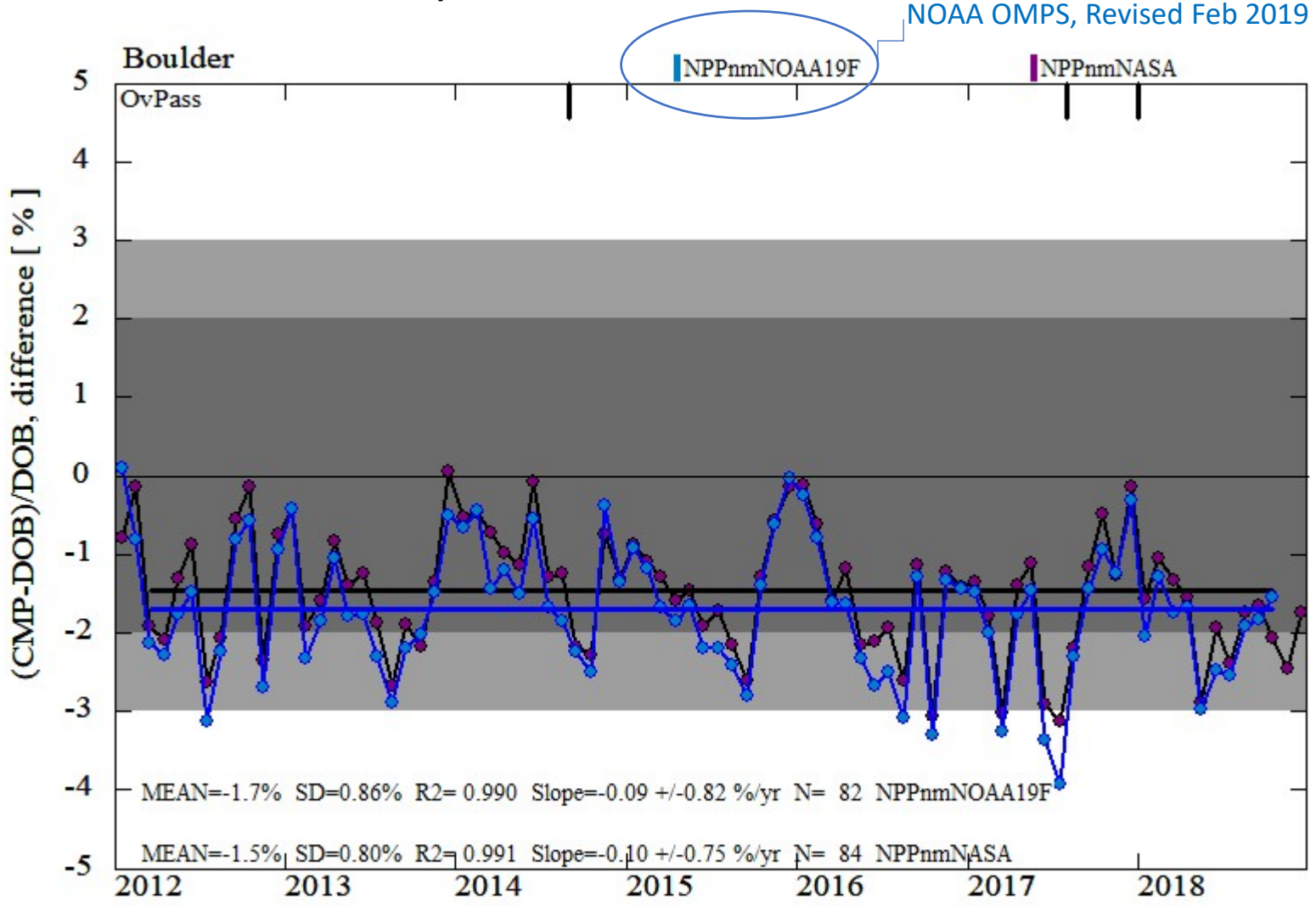






Boulder Monthly mean differences S-NPP V8TOz

NOAA OMPS, Revised Feb 2019



See Backup Slides for additional results from Ground-based comparions.

Uncertainty Estimates from S-NPP Comparisons

Precision from Internal Double Differences:

	8/16/2018		8/23/2018		9/03/2018		1/15/2019		4/25/2019		7/22/2019	
	#	RMSD	#	RMSD	#	RMSD	#	RMSD	#	RMSD	#	RMSD
X < 250 DU	15K	2.4 DU	25K	2.3 DU	28K	2.3 DU	93K	1.0 DU	37K	1.3 DU	22K	1.7 DU
250 < X < 450 DU	468K	2.3 DU	475K	2.3 DU	474K	2.3 DU	424K	1.6 DU	421K	2.1 DU	509K	1.9 DU
X > 450 DU		NA	294	1.8 DU	235	2.3 DU	5k	4.2 DU	**50K**	**3.0 DU**	1K	3.0 DU

Sufficient data for X > 450 DU

Differences from zonal means, 10-degree latitude bands:

Range	-5 to 0DU	-4 to 1DU	-4 to 0DU	-4 to 0DU	-4 to 2DU	-5 to 1DU

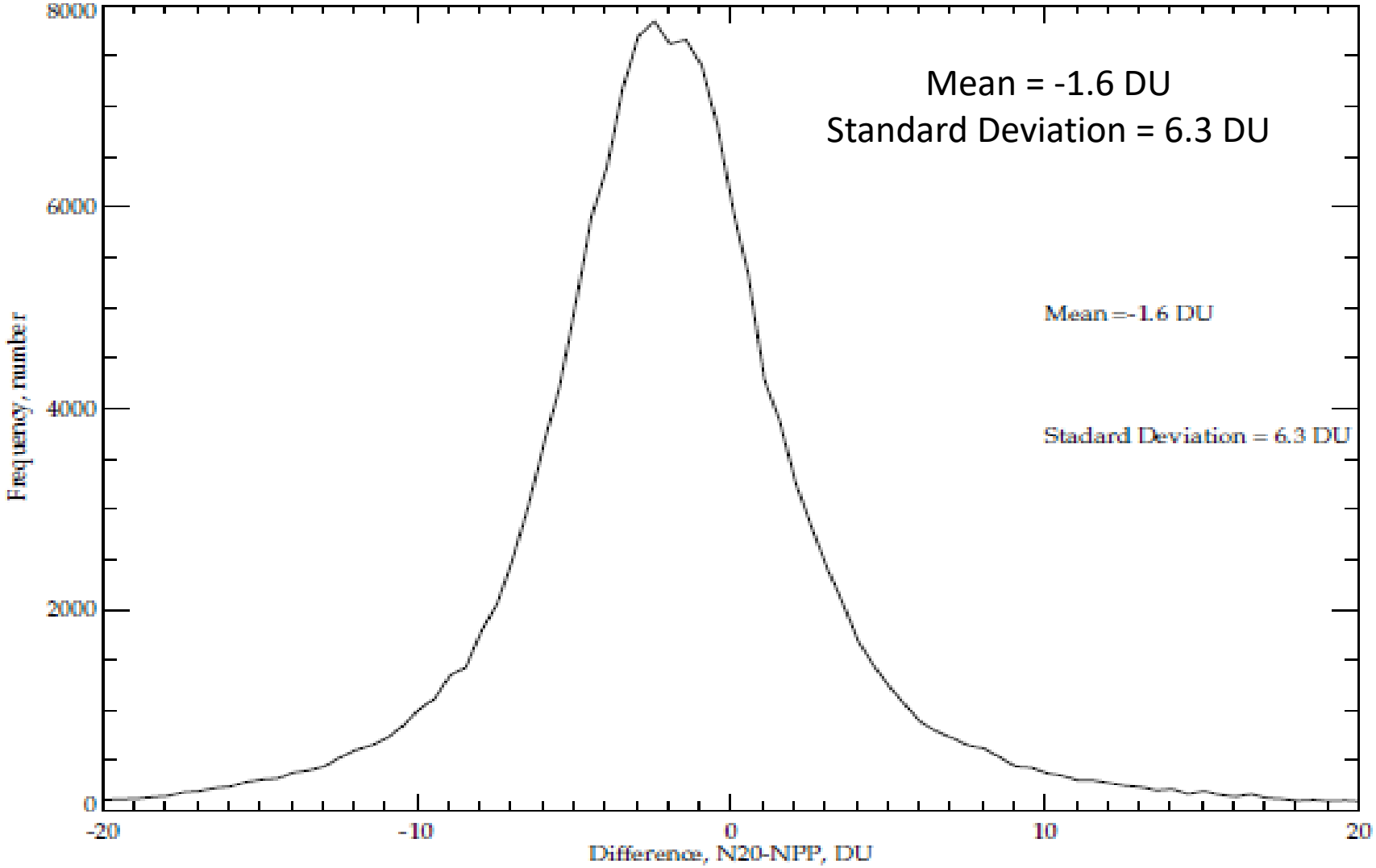
Differences from cross-track means:

Range	-5 to 0DU	-5 to 0DU	-5 to 0DU	-4 to 0DU	-4 to 2DU	-5 to 1DU

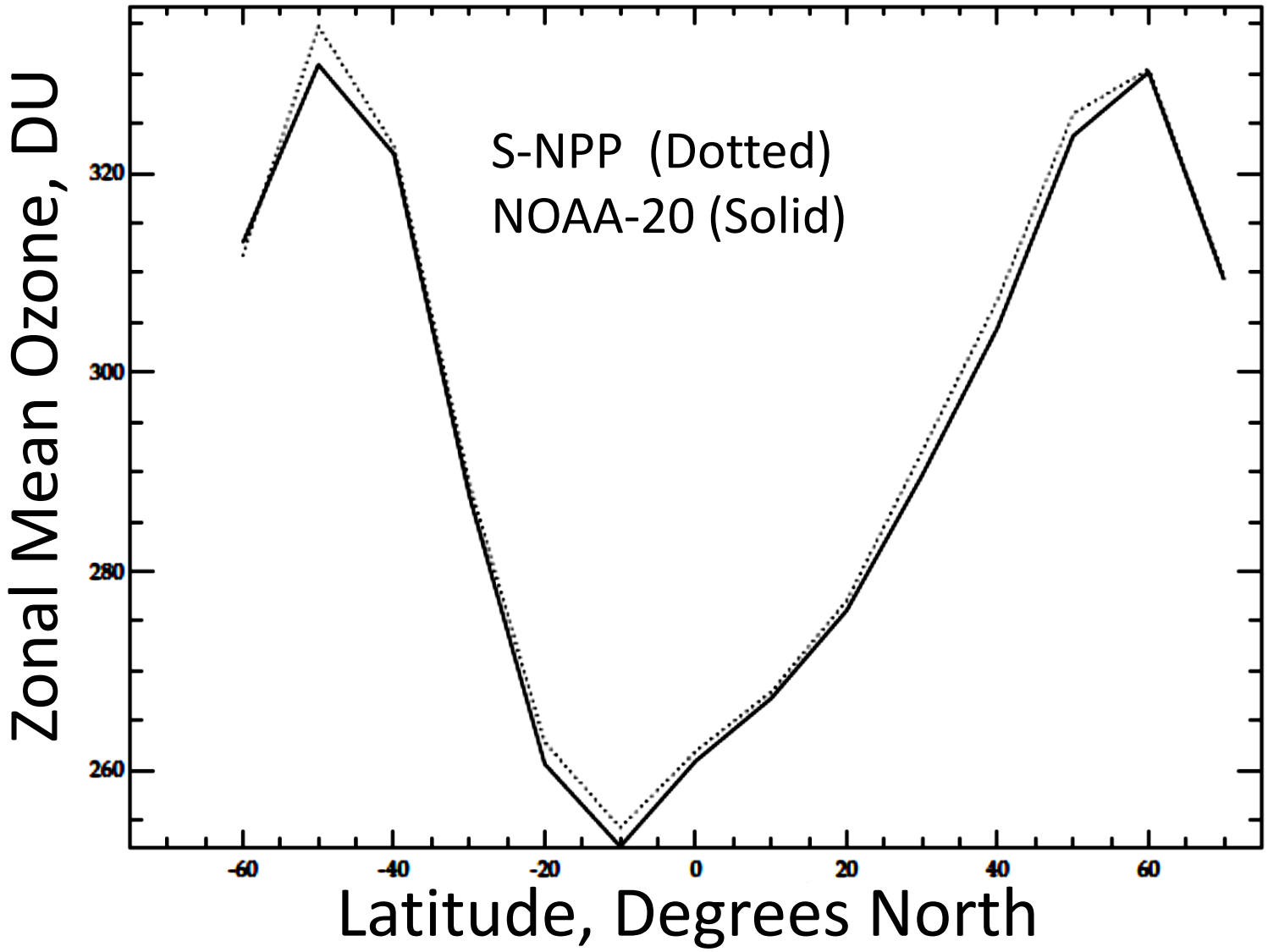
Histogram Statistics >125000 points per daily direct matchups:

Standard Deviation	5.7 DU	5.1 DU	5.0 DU	4.6 DU	5.2 DU	6.3 DU
Average Bias	-2.4 DU	-2.3 DU	-2.5 DU	-2.5 DU	-1.3 DU	-1.6 DU

Histogram of Matchup differences for S-NPP and NOAA-20 for V8TOz for July 22, 2019



Zonal Means for S-NPP and NOAA-20 for V8TOz for July 22, 2019



Validation & Monitoring Websites

- STAR EDR Product Monitoring and Equatorial Statistics

https://www.star.nesdis.noaa.gov/smcd/spb/OMPSDemo/proOMPSbeta.TOZ_N20_V8.php

- OSPO Operational EDR Product Monitoring

https://www.ospo.noaa.gov/data/atmosphere/ozone/Products_atmosphere_OMPS.html

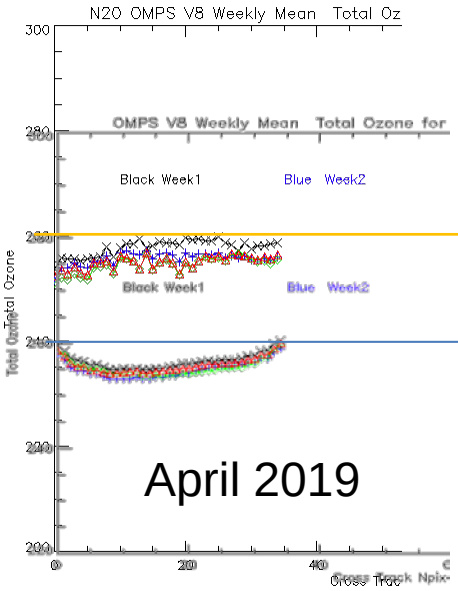
- STAR SDR Product ICVS Monitoring

https://www.star.nesdis.noaa.gov/icvs/status_N20_OMPS_NM.php

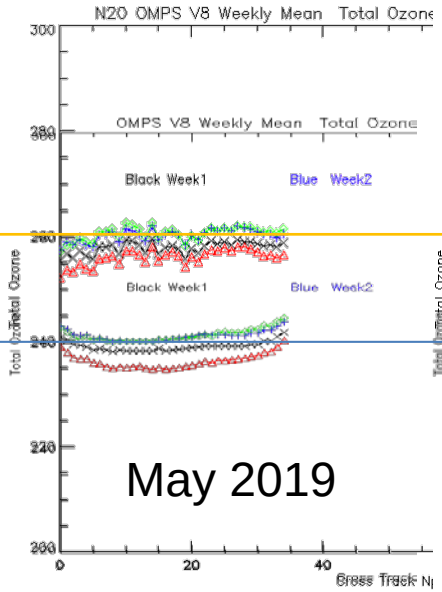
- STAR Daily Ozone Product Maps

https://www.star.nesdis.noaa.gov/jpss/EDRs/products_ozone.php#

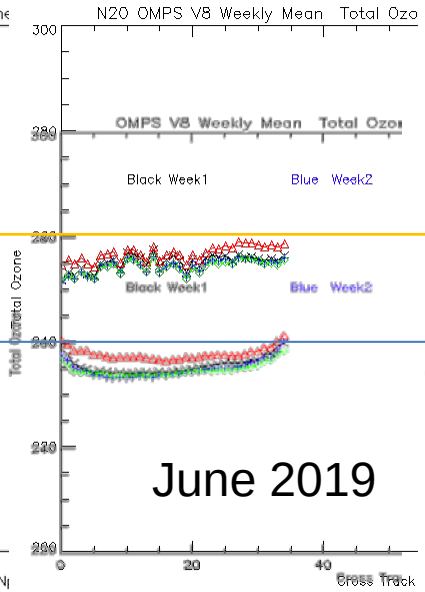
Four Months of Pacific Box Monitoring



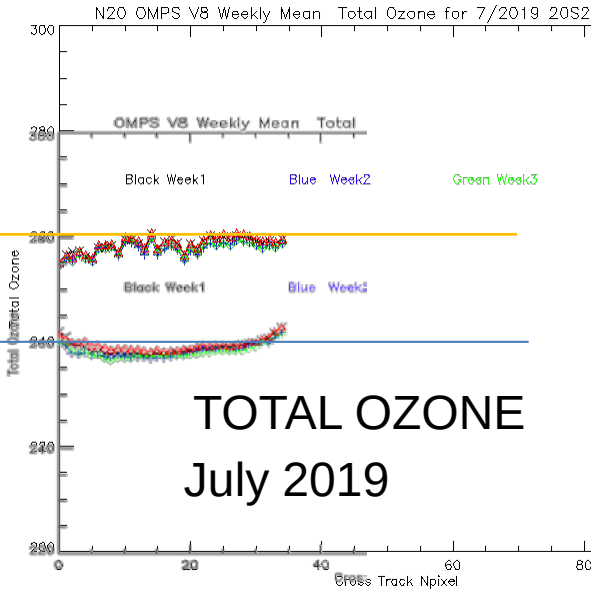
April 2019



May 2019

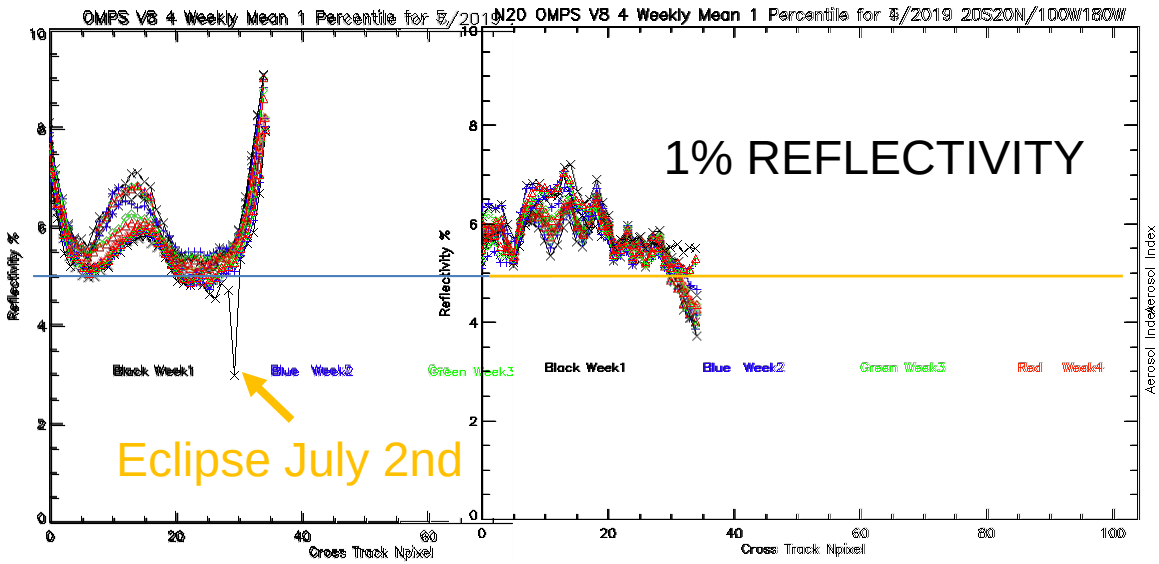


June 2019



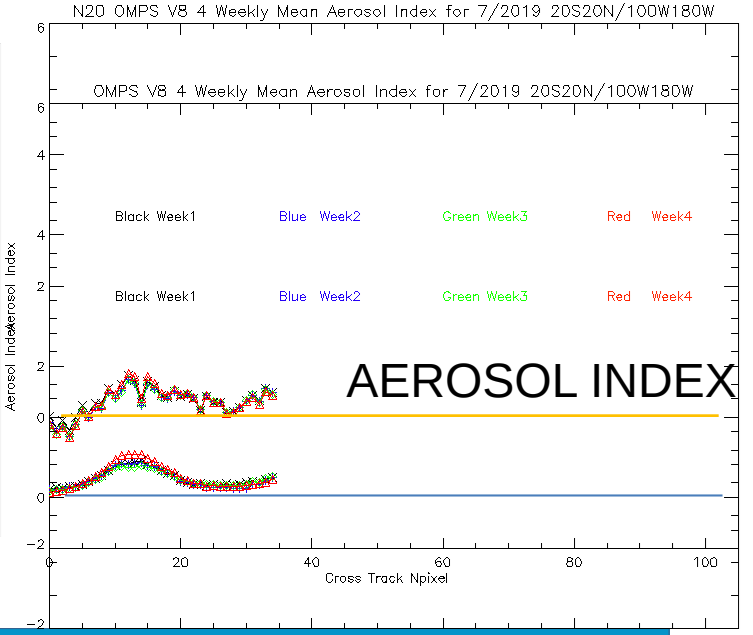
TOTAL OZONE

July 2019



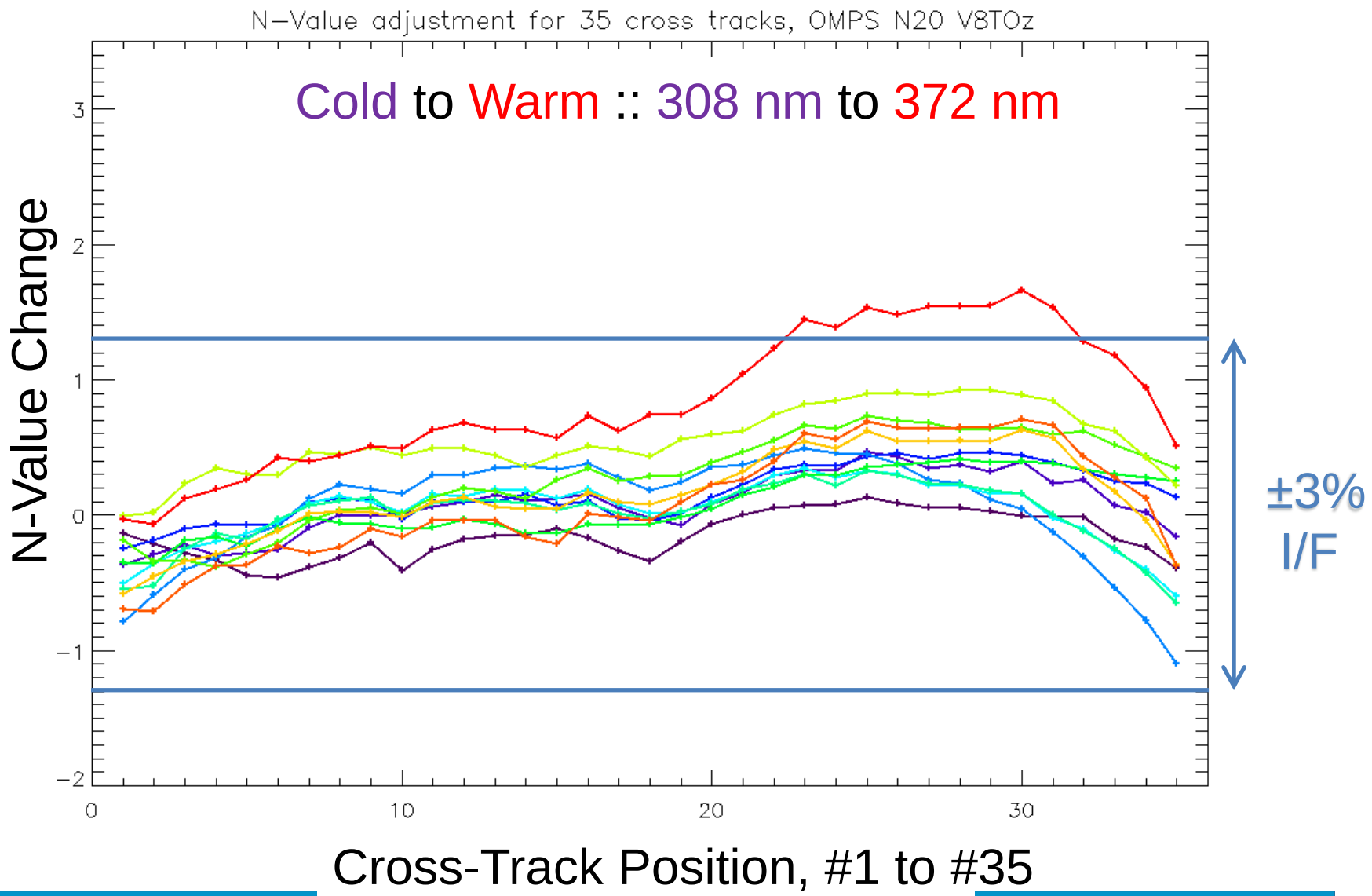
Eclipse July 2nd

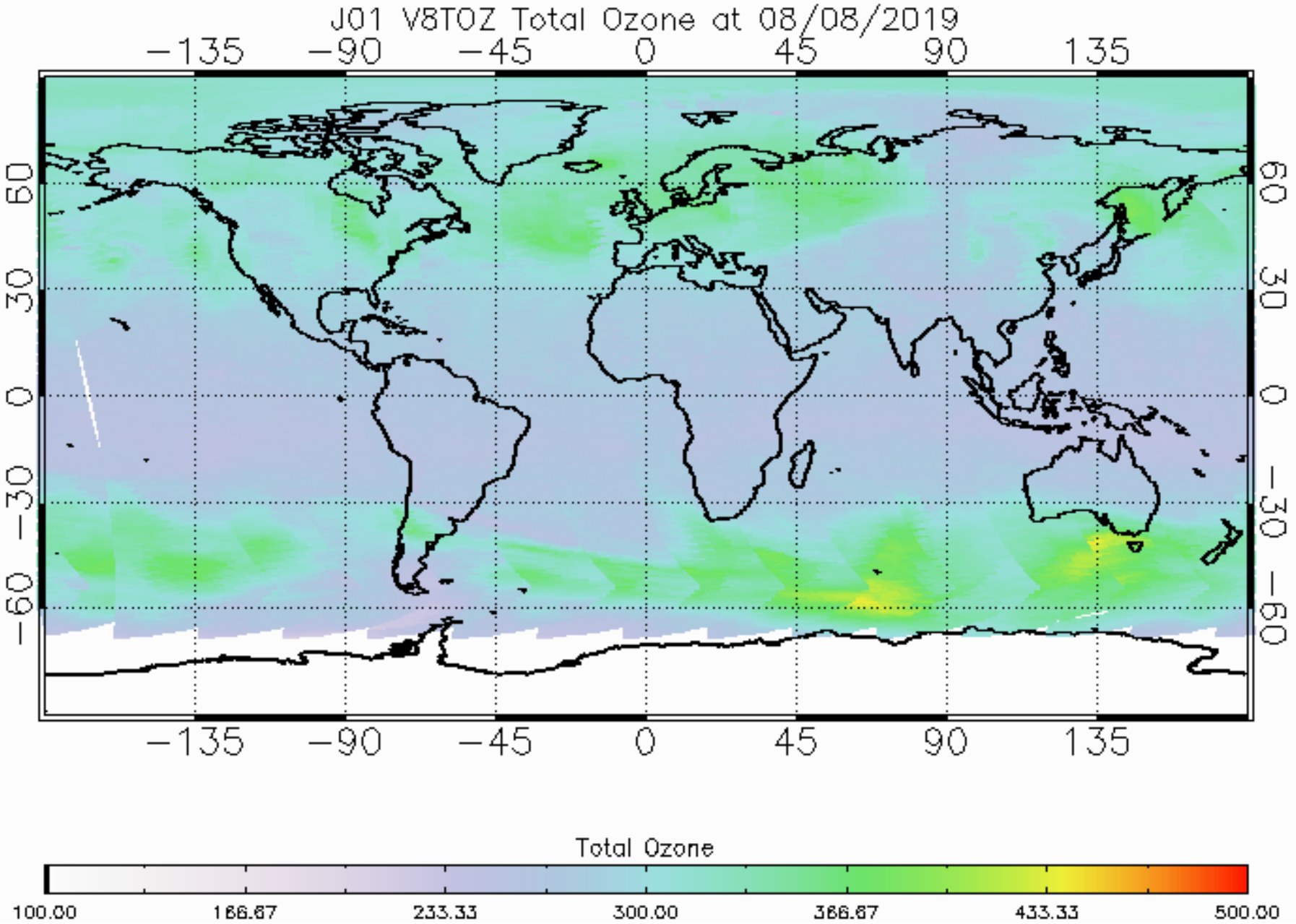
1% REFLECTIVITY

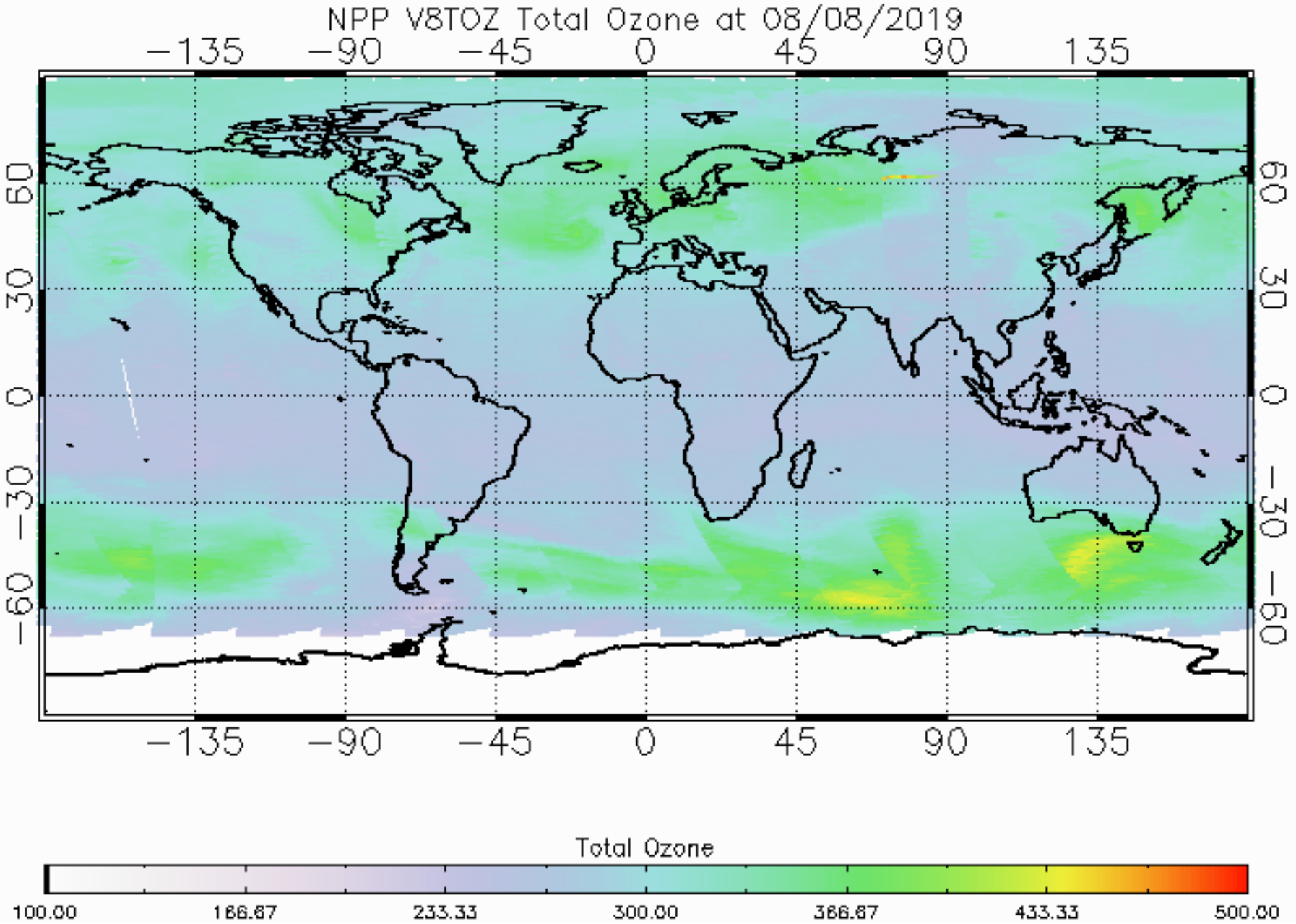


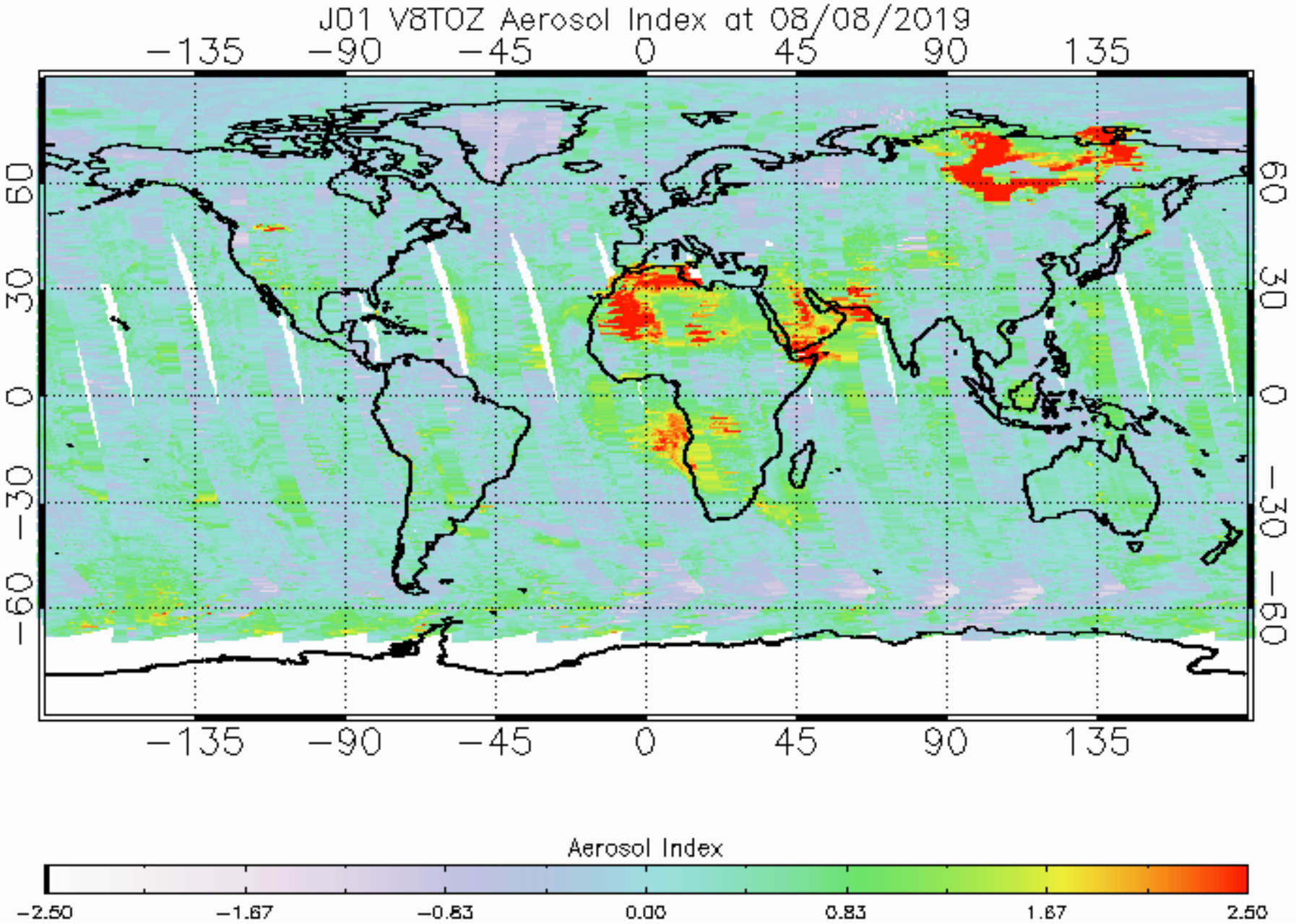
AEROSOL INDEX

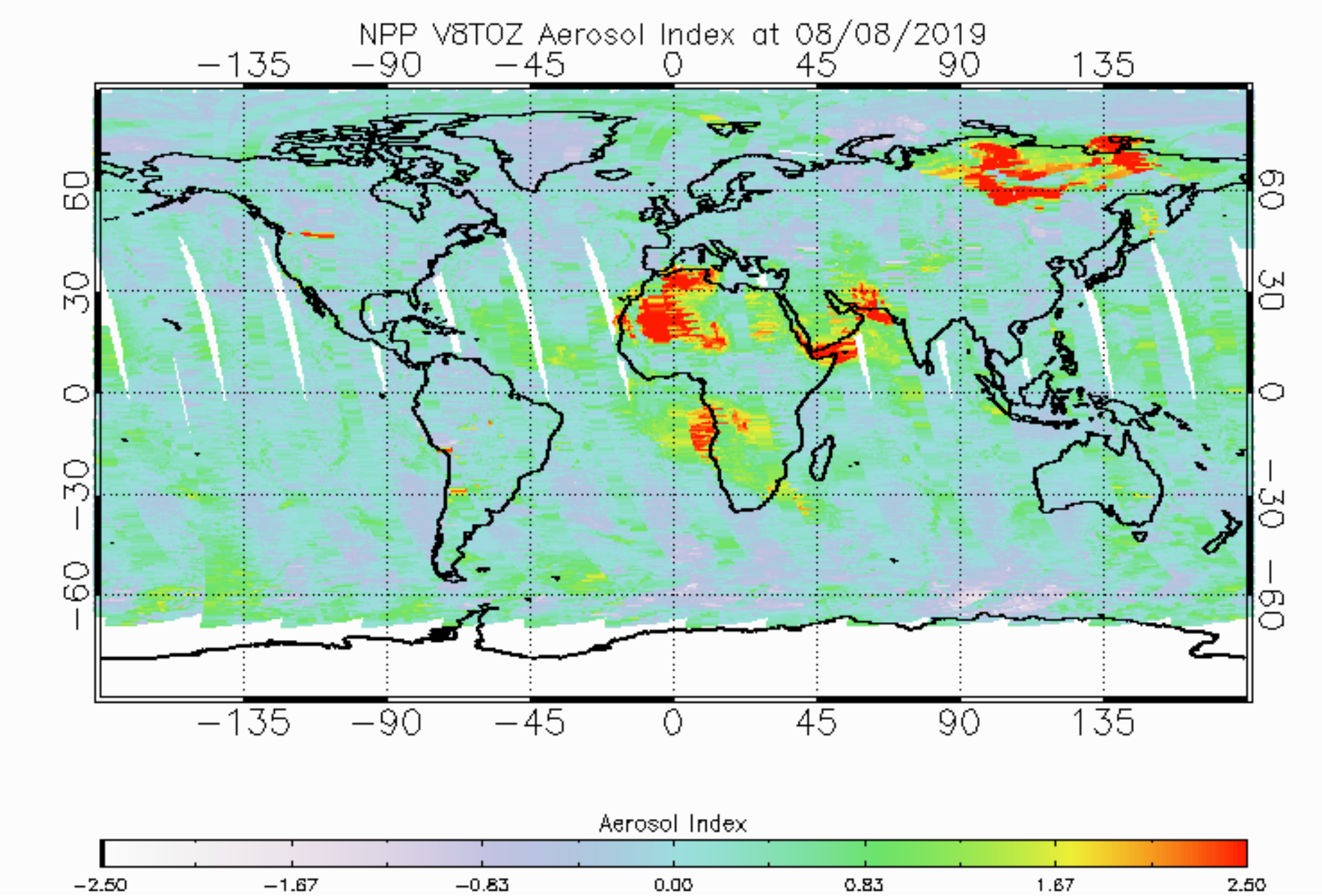
Latest (not in NDE) N-value Adjustments for NOAA-20 OMPS V8TOz




J01 V8TOZ Total Ozone at 08/08/2019
−135
−90
−45
0
45
90
135
60
30
0
−30
−60
Total Ozone
100.00
166.67
233.33
300.00
366.67
433.33
500.00


NPP V8TOZ Total Ozone at 08/08/2019
−135
−90
−45
0
45
90
135
60
30
0
−30
−60
Total Ozone
100.00
166.67
233.33
300.00
366.67
433.33
500.00


J01 V8TOZ Aerosol Index at 08/08/2019
−135
−90
−45
0
45
90
135
60
30
0
−30
−60
Aerosol Index
−2.50
−1.67
−0.83
0.00
0.83
1.67
2.50


NPP V8TOZ Aerosol Index at 08/08/2019
−135
−90
−45
0
45
90
135
60
30
0
−30
−60
Aerosol Index
−2.50
−1.67
−0.83
0.00
0.83
1.67
2.50

Risk Going Forward

- New OMPS NM SDR tables for stray light, wavelength scale, calibration coefficients and Day 1 Solar spectra will require development and implementation of new soft calibration adjustment tables.
- It is not clear how closely we can coordinate the implementation of the new NDE V8TOz adjustment table with the IDPS implementation of the new OMPS NM SDR tables.
- Turning back on the measurement-based along-orbit wavelength scale adjustments should lead to a better product with less along-orbit variation relative to the S-NPP V8TOz results. We will evaluate test data from the SDR Team to confirm this.

Caveats from Provisional EDR Review (1/2) Updates

- The OMPS NM SDR processing can drop scans when the RDRs contain 16 scans in a granule. A fix to correct this problem (CCR 18-3829) transfer to IDPS operations with Block 2.1 Mx3 in October 2018. The extra scan led to the loss of a full granule and an offset in the next granule matchup between the NM and NP. This correction is in the current IDPS/NDE I&T production as of August 10, 2018;
- The current recommendation is to only use products for cross-track positions #3 to #33 as some small geolocation errors for the extreme viewing angles are under investigation. The current recommendation is to only use products with Error Flag values of 0 and 1 (instead of the standard recommendation to use 0, 1 and 2) as the effects of channel calibration biases are magnified at higher solar zenith angles. This restriction has been removed; performance with new sample tables, as of 2/13/2019, is more consistent; and
- The first round of updates to the NOAA-20 OMPS sample tables do not provide good enough matchups between the NP and NM FOVs as needed by the V8Pro algorithm. A new set of nadir mapper sample tables have been tested and will be implemented (DR 8617). A full set of SDR tables (including wavelength, solar, and stray light) have been developed for use with the new sample table. New tables provide good match-up between NOAA-20 OMPS NM and OMPS NP FOVs as of 4/2019.

Caveats from Provisional EDR Review (2/2) Updates

- The NM SDRs have some cross-track biases which appear in the retrieved EDRs as striping in the V8TOz product maps. The current soft calibration is not optimal; there are cross-track variations in the total ozone and reflectivity and there is a small bias (0.3) in the aerosol index values. These problems may be reduced as new tables are put into IDPS processing but a final set of soft calibration adjustments will need to be devised for implementation at NDE to reduce the EDR biases to maintain validated maturity levels. We are analyzing test products for the latest SDR table deliveries, and will deliver new optimal adjustments;
- The V8TOz is infrequently setting residual limit flags (Error Codes 4 and 5) in the South Atlantic Anomaly but more frequently for NOAA-20 than is observed for S-NPP. This is expected from the smaller FOVs provided by the NOAA-20 products;
- The V8TOz products with the most recent SDRs cannot be used to validate the retrievals for situations with total ozone greater than 450 DU. These high values are found primarily in the northern hemisphere in the late winter and early spring; This restriction has been removed; high total ozone values were observed during the first four months of 2019; Performance is good; and
- Tuning and refinement of the stray light corrections for the NM SDRs are continuing. Changes in these will impact the absolute accuracy of the V8TOz EDRs and affect the final V8TOz EDR adjustments. We are analyzing test products for the latest SDR table deliveries, and will deliver new optimal adjustments;.

User Feedback

Name	Organization	Application	User Feedback - User readiness dates for ingest of data and bringing data to operations
Haixia Liu	NWS	Ozone Assimilation	User has been evaluating S-NPP V8TOz BUFR and will add NOAA-20 BUFR.
Craig Long	NCEP	Ozone Monitoring	User has been using S-NPP Total Ozone to monitor the ozone layer / ozone hole and used NOAA-20 Total Ozone as well this last year.

Craig Long: I have looked at several days of September for the S-NPP and N20 V8TOz products on your web pages and cannot see any differences except due to orbital tracks and time differences in between.

User update

- From: **Craig Long - NOAA Federal** <craig.long@noaa.gov>
  Date: Fri, Apr 19, 2019 at 1:29 PM
  Subject: OMPS-NM, -NP in GFS v15 parallel
- EMC and NCO decided to use the S-NPP OMPS-NM and -NP data sooner than anticipated. NCO began assimilating those data in their parallel model beginning with the 12z run today. That's a big accomplishment.

Note from L. Flynn

Promotion of NOAA-20 V8TOz to Validated Maturity is the last step on the NESDIS side to provide double the coverage currently obtained from S-NPP V8TOz.

Check List - Validated Maturity

Validated Maturity End State	Assessment
Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).	Some variations with latitude but they are within the allowed range.
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.	Error flag frequencies are understood and at acceptable levels.
Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.	Four-tiered approach provides confidence in product agreement with ground-based and S-NPP.
Product is ready for operational use based on documented validation findings and user feedback.	Product is compatible with current applications of S-NPP V8TOz.
Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.	Extensive monitoring provide by OSPO and STAR. New adjustment table in preparation.

Documentation

Science Maturity Check List	Yes / No
ReadMe for Data Product Users (Validated)	Yes (NOAA-20)
Algorithm Theoretical Basis Document (ATBD)	Yes (V8TOz)
Algorithm Calibration/Validation Plan	Yes (JPSS-1 Ozone)
(External/Internal) Users Manual	Yes (V8TOz)
System Maintenance Manual (for ESPC products)	Yes (V8TOz)
Peer Reviewed Publications (Demonstrates algorithm is independently reviewed)	Yes (V8TOz alg. and V8TOz S-NPP)
Regular Validation Reports (at least annually) (Demonstrates long-term performance of the algorithm)	Yes, and JPSS Annual and NSC presentations

Requirement Check List – OMPS Ozone V8TOz

JERD	Requirement	Meet Requirement (Y/N)?
JERD-2423	The algorithm shall produce an ozone total column product that has a horizontal cell size of 50 x 50 km^2 at Nadir	Yes, three 50x17 km^2 can be aggregated.
JERD-2450	The algorithm shall produce an ozone total column product that has a vertical cell size of 0-60 km	Yes, physics and RT Table construction.
JERD-2451	The algorithm shall produce an ozone total column product that has a mapping uncertainty, 1 sigma, of 5 km at Nadir	Yes, SDR Validation
JERD-2452	The algorithm shall produce an ozone total column product that has a measurement range of 50-650 milli-atm-cm	Yes, SDR range and V8TOz Performance
JERD-2453	The algorithm shall produce an ozone total column product that has a measurement precision of: 6.0 milli-atm-cm for X < 0.25 atm-cm, 7.7 milli-atm-cm for 0.25 < X < 0.45 atm-cm, and 2.8 milli-atm-cm + 1.1% for X > 0.45 atm-cm	6 DU Full Matchup 1.5 to 2.5 DU DD, 1.5 to 2.5 DU DD, 3.3 DU DD
JERD-2454	The algorithm shall produce an ozone total column product that has a measurement accuracy of: 9.5 milli-atm-cm for X < 0.25 atm-cm, 13.0 milli-atm-cm for 0.25 < X < 0.45 atm-cm, and 16.0 milli-atm-cm + 1.1% for X > 0.45 atm-cm	-5 to 1 DU with Lat or CT -3 to -2 DU MU Global -3 to -2 DU MU Global -5 to -2 DU MU Global

Check List - Validated Maturity

Validated Maturity End State	Assessment
Product performance has been demonstrated through analysis of a large global and seasonally representative number of independent measurements, and associated ground truth	Global comparison to S-NPP V8TOz EDR and of seven years of S-NPP data products with ground-based validation. Limitations noted in ReadMe.
Product analysis is sufficient to communicate product performance to users relative to expectations (Performance Baseline).	Soft calibration to S-NPP V8TOz EDR.
Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community.	Soft Calibration approach has been used for S-NPP OMPS and GOME-2. Error codes are understood and at acceptable levels.
Product is ready for operational use.	With caveats as noted in the ReadMe.

Backup Slides and Past Presentations

Provisional Maturity Science Review For NOAA-20 OMPS Total Ozone EDR – V8TOz

Presented by Lawrence E. Flynn

Date:2018/10/02

Disclaimer

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

JPSS Data Products Maturity

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.

Provisional Maturity Review - Entry Criteria

- Product Requirements
- Provisional Maturity Performance Validation
  - On-orbit instrument performance assessment
    - Identify all of the instrument and product characteristics you have verified/validated
- Users/EDRs feedback
  - Product is on NDE I&T, Access is involved.
- Risks, Actions, Mitigations
  - Potential issues, concerns
- Path forward to Validated Maturity
- Summary

Provisional 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
- Updated Provisional Maturity Slide Package addressing review committee's comments for:
  - Cal/Val Plan and Schedules
  - Product Requirements
  - Provisional Maturity Performance
  - Risks, Actions, Mitigations
  - Path forward to Validated Maturity

Outline

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

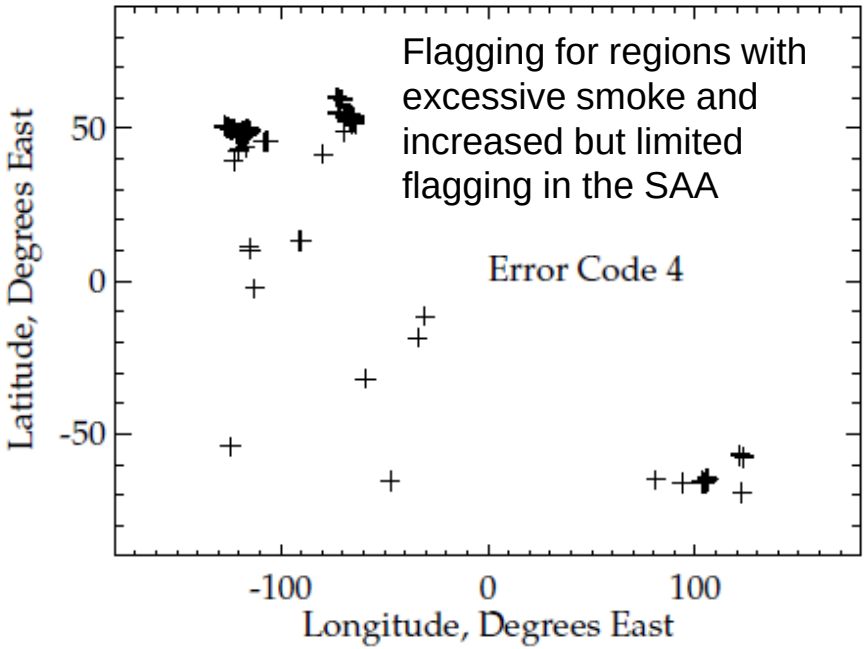
Product Overview/Requirements (At Provisional)

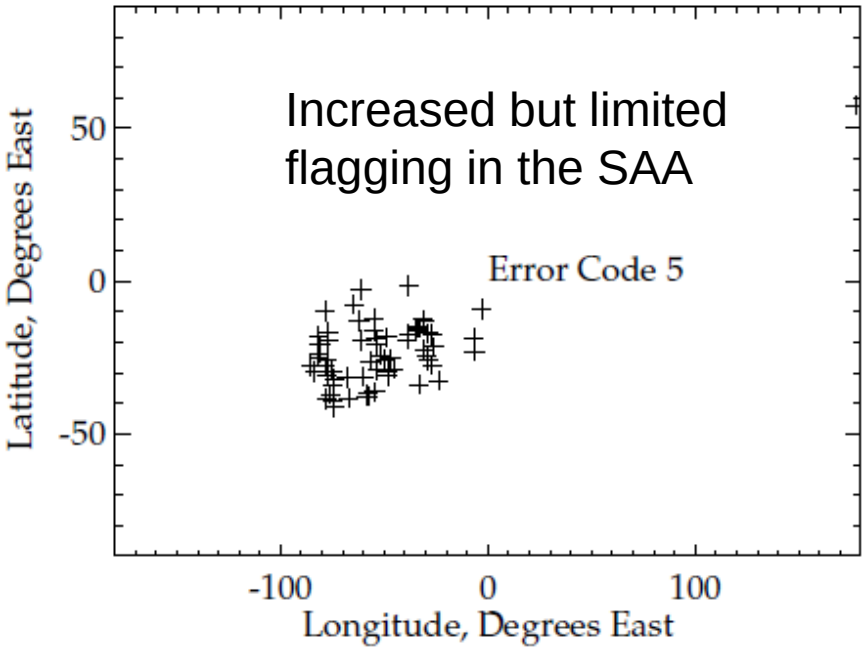
- Product performance requirements from JPSS L1RD supplement (threshold) versus observed/validated/JERD Vol. II

Attribute	Threshold	Observed/validated
Geographic coverage	90% Daily Global Earth	SZA < 70° (80%) SZA<80° (90%)
Vertical Coverage	0-60 km	0-60 km (RT tables, physics)
Vertical Cell Size	NA	NA
Horizontal Cell Size	50x50 km^2 at nadir	50x17 km^2 at nadir
Mapping Uncertainty	5 km at nadir	3 km at nadir (SDR Team)
Measurement Range	50 – 650 DU	90-700 DU (SDR range and past algorithm performance)
Measurement Accuracy		
X < 250 DU	9.5 DU	-5 to +5 DU, vs. NPP
250 DU < X < 450 DU	13.0 DU	-5 to +5 DU, vs. NPP
X > 450 DU	16.0 DU	New Data March & April 2019
Measurement Precision		
X < 250 DU	6.0 DU	2.3 DU RMSDD, 6.0 DU NPPMU
250 DU < X < 450 DU	7.7 DU	2.3 DU RMSDD, 6.0 DU NPPMU
X > 450 DU	2.8 DU + 1.1%	New Data March & April 2019

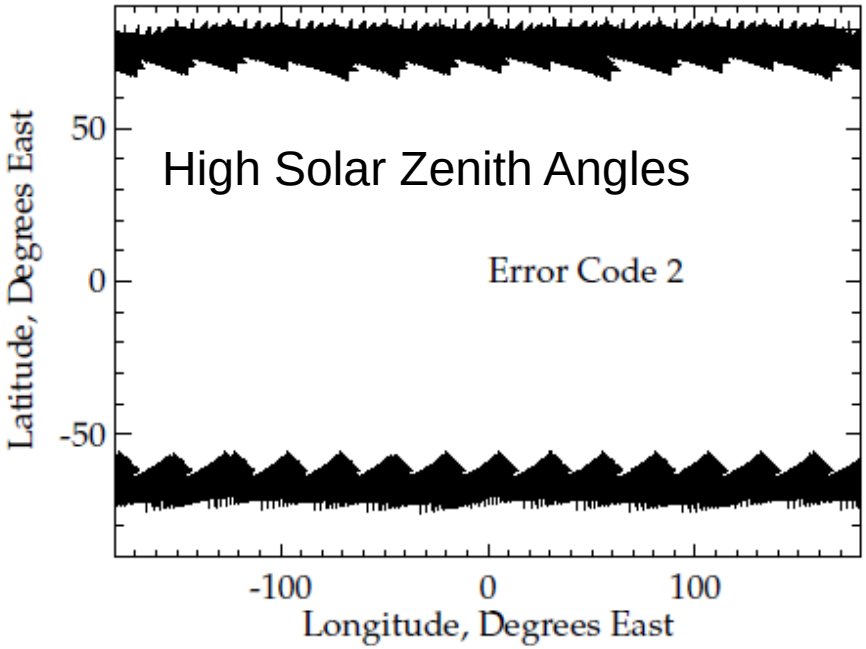
DR8816 CCR4303 began in IDPS on the afternoon of April 11. There are six tables:

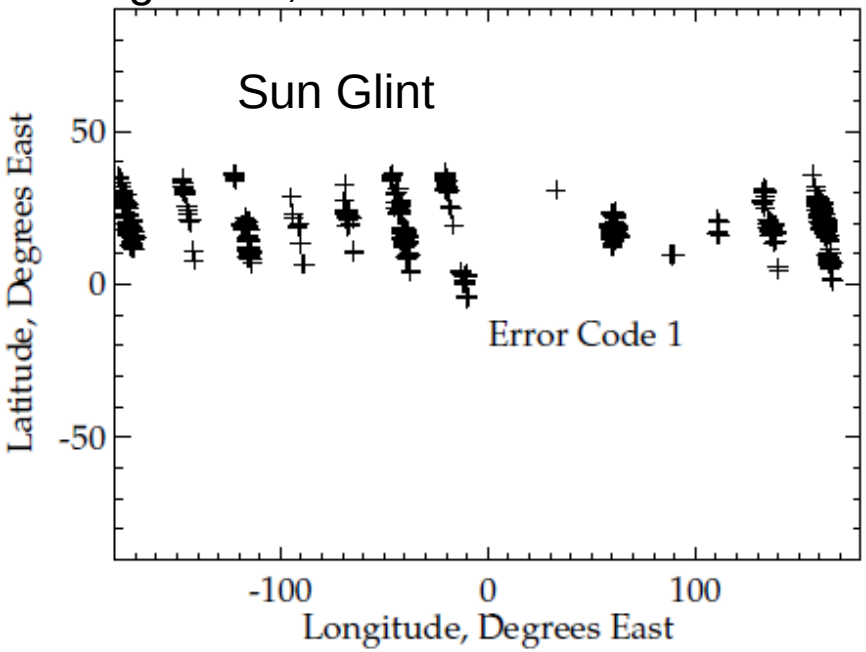
- OMPS-NP-OSOL-LUT_j01
- OMPS-NP-STRAYLIGHT-LUT_j01
- OMPS-NP-WAVELENGTH-GND-PI_j01
- OMPS-TC-OSOL-LUT_j01
- OMPS-TC-STRAYLIGHT-LUT_j01
- OMPS-TC-WAVELENGTH-GND-PI_j01

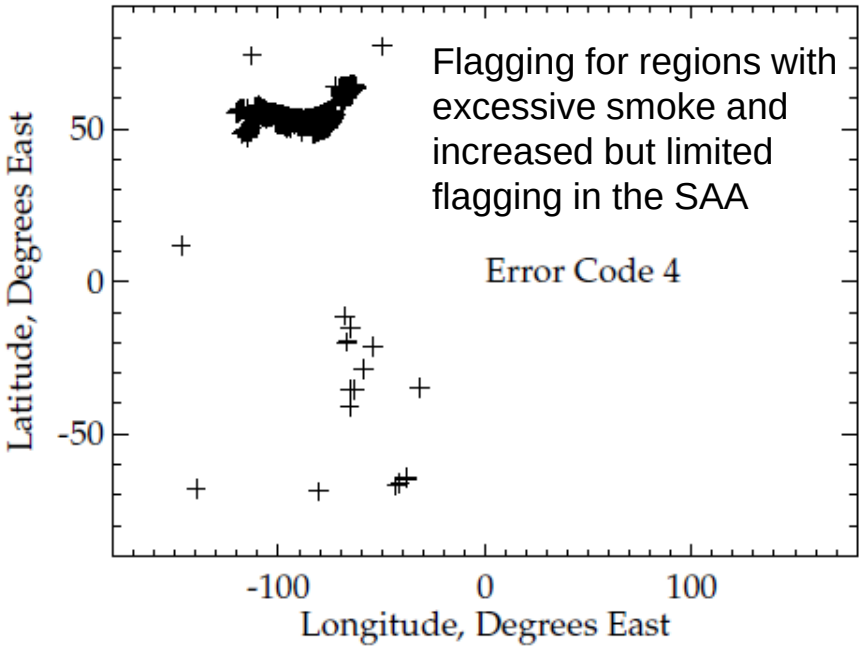


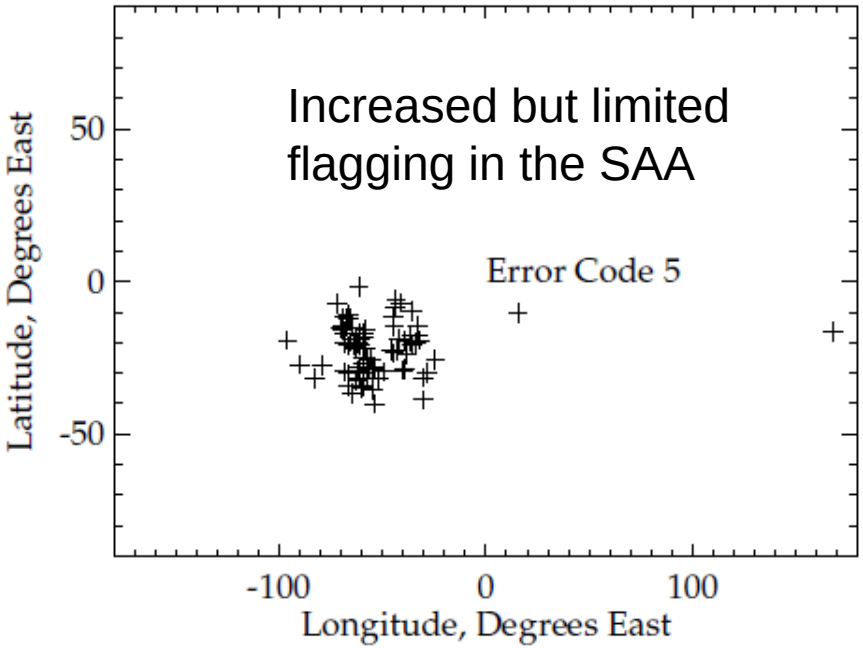


NOAA-20 Error codes for August 19, 2018

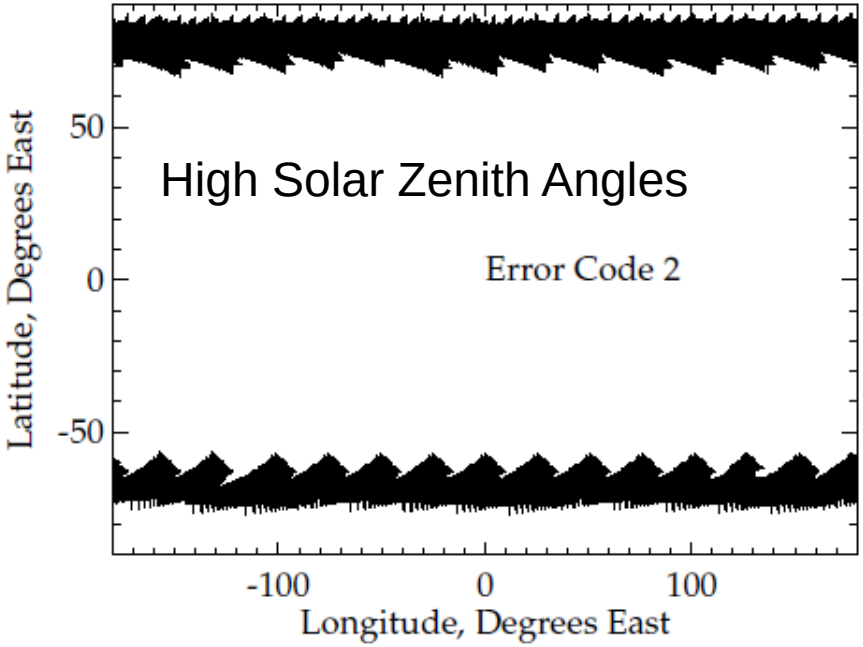


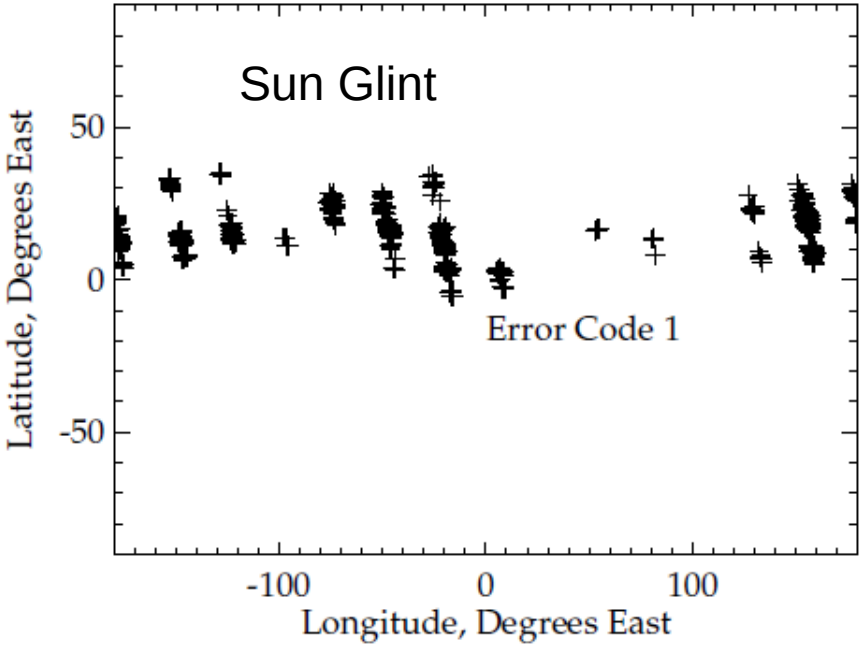


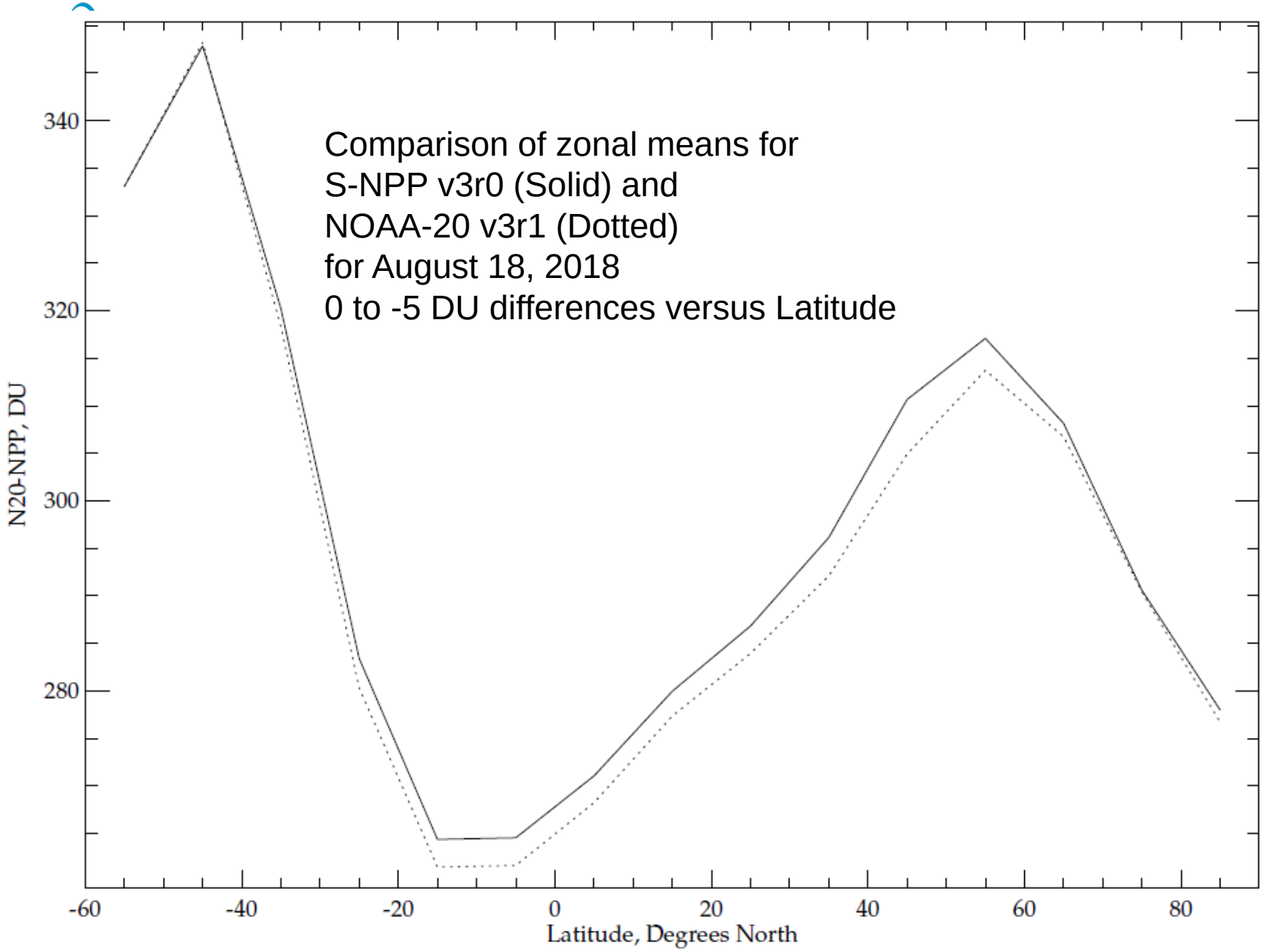


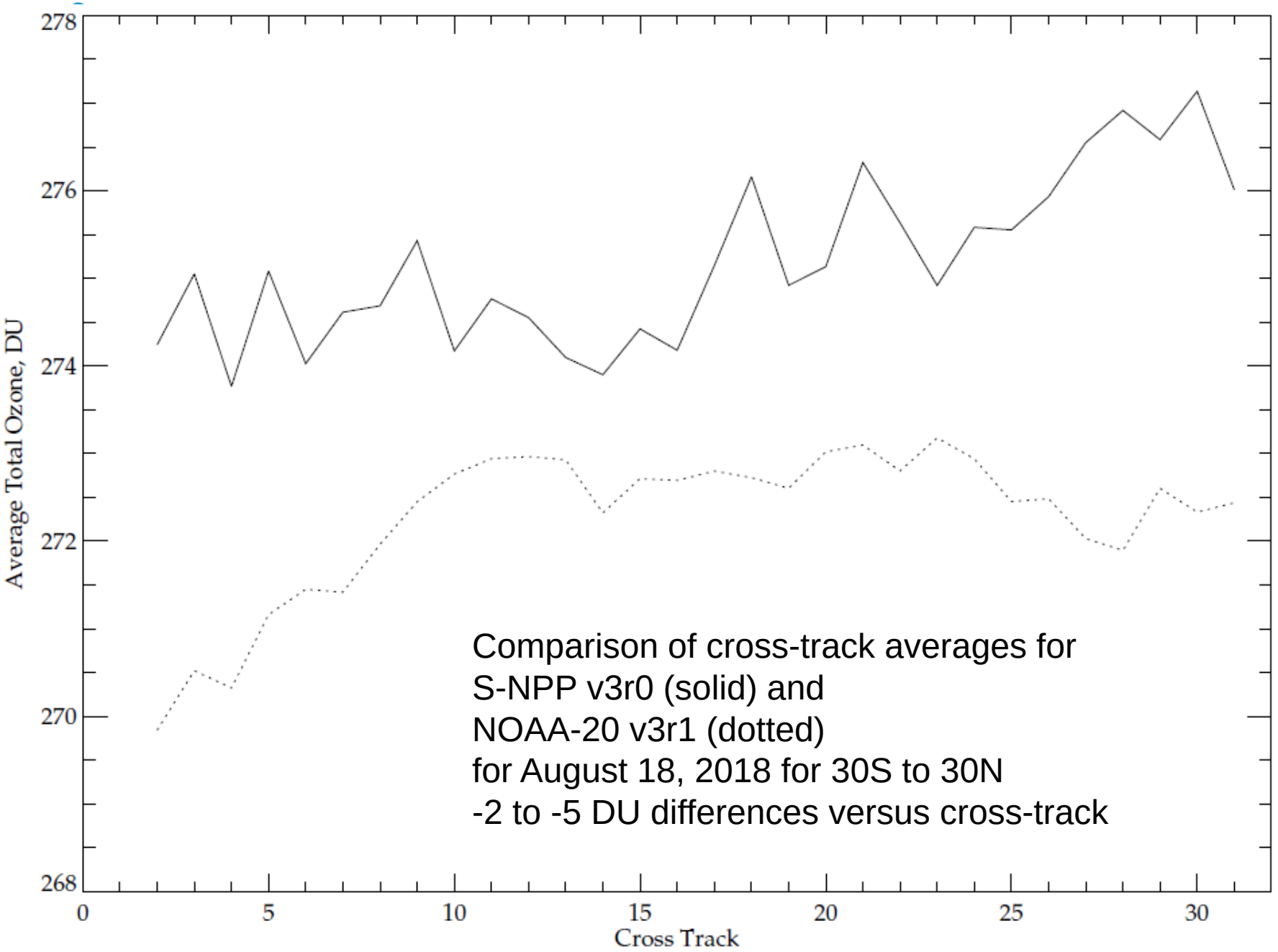


NOAA-20 Error codes for August 23, 2018






Comparison of zonal means for
S-NPP v3r0 (Solid) and
NOAA-20 v3r1 (Dotted)
for August 18, 2018
0 to -5 DU differences versus Latitude
N20-NPP, DU
340
320
300
280
-60
-40
-20
0
20
40
60
80
Latitude, Degrees North



Comparison of cross-track averages for
S-NPP v3r0 (solid) and
NOAA-20 v3r1 (dotted)
for August 18, 2018 for 30S to 30N
-2 to -5 DU differences versus cross-track

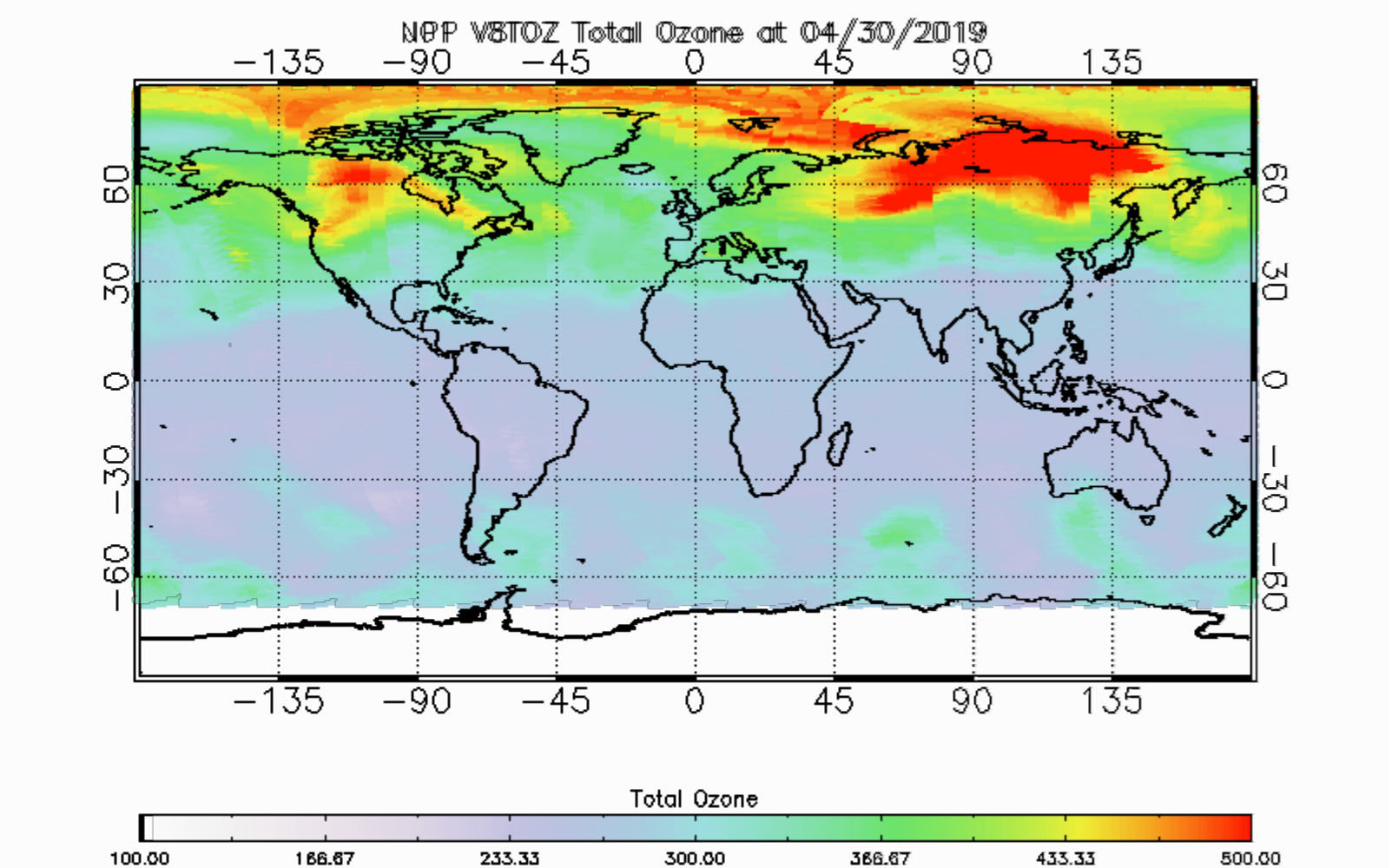
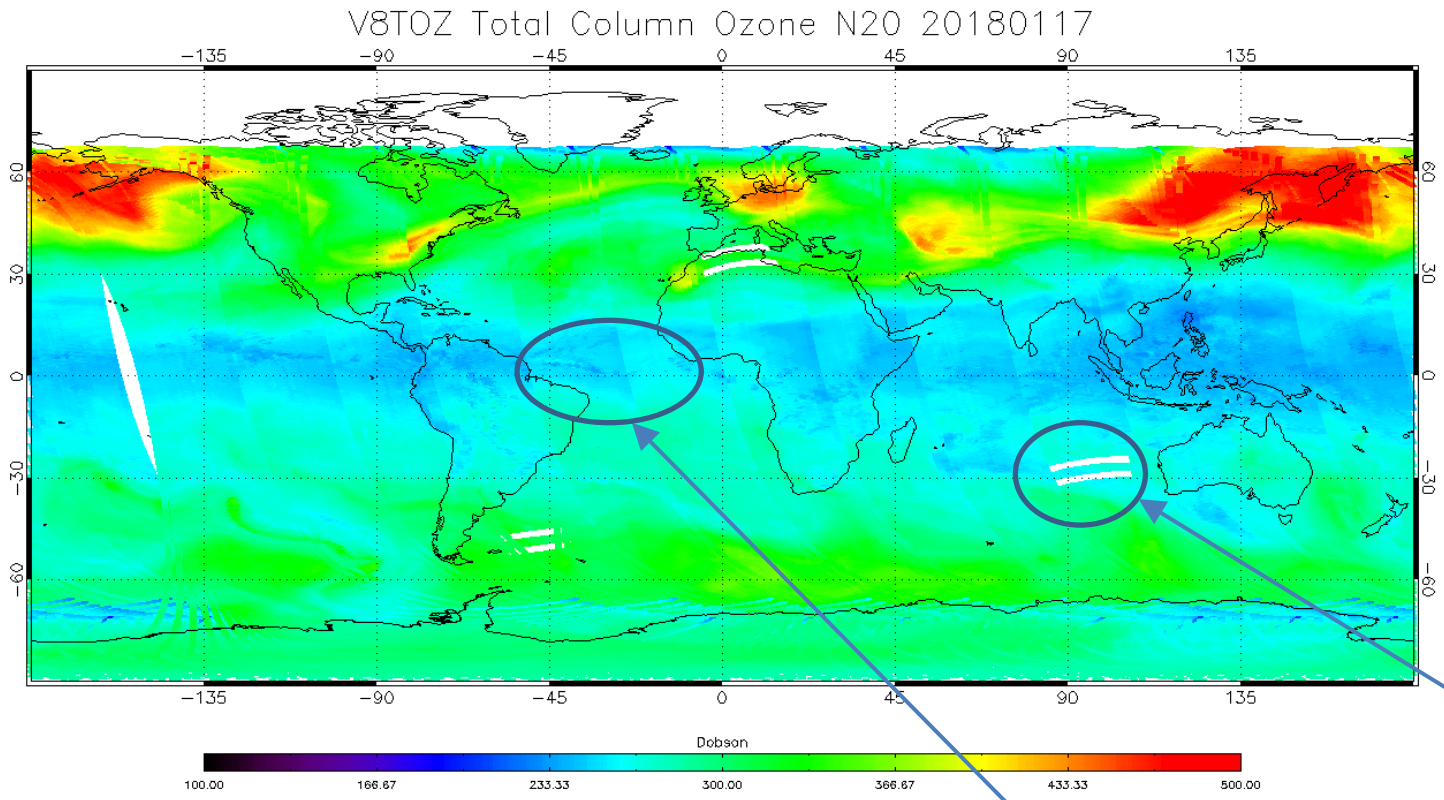

NPP V8TOZ Total Ozone at 04/30/2019
−135
−90
−45
0
45
90
135
60
30
0
−30
−60
Total Ozone
100.00
166.67
233.33
300.00
366.67
433.33
500.00

FIGURE FROM BETA MATURITY REVIEW

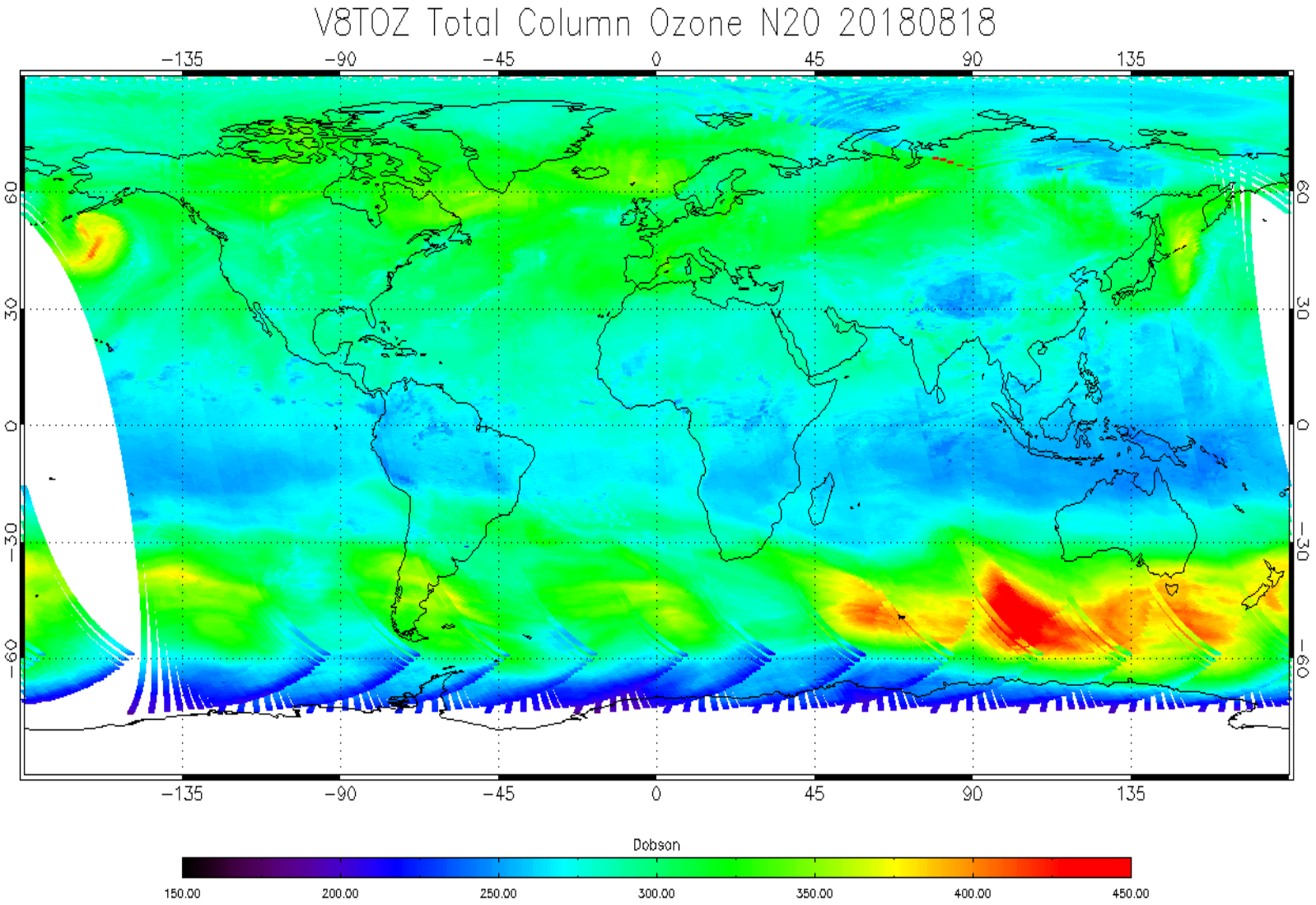


16-Image Granule Errors

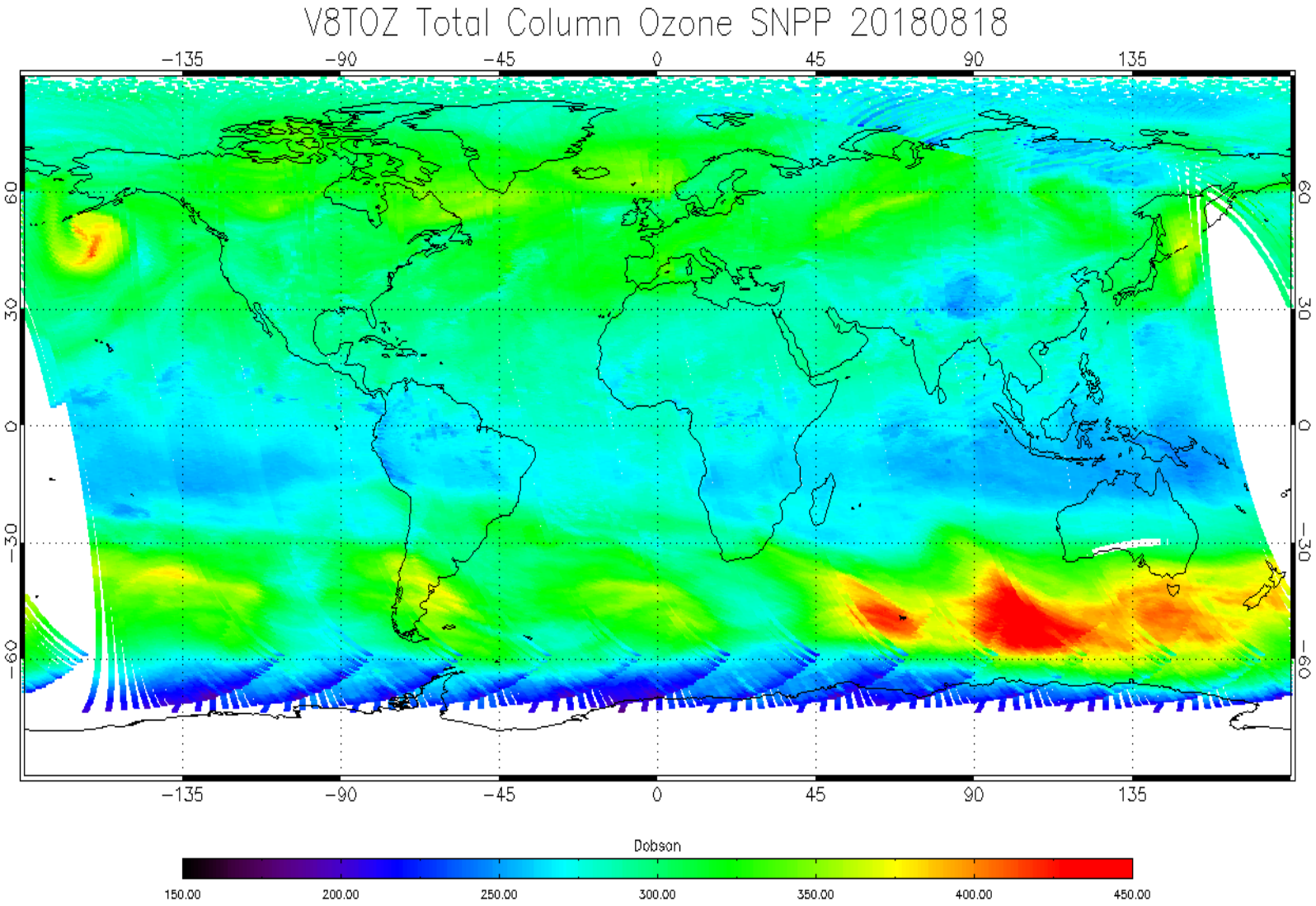
Cross-Track Bias

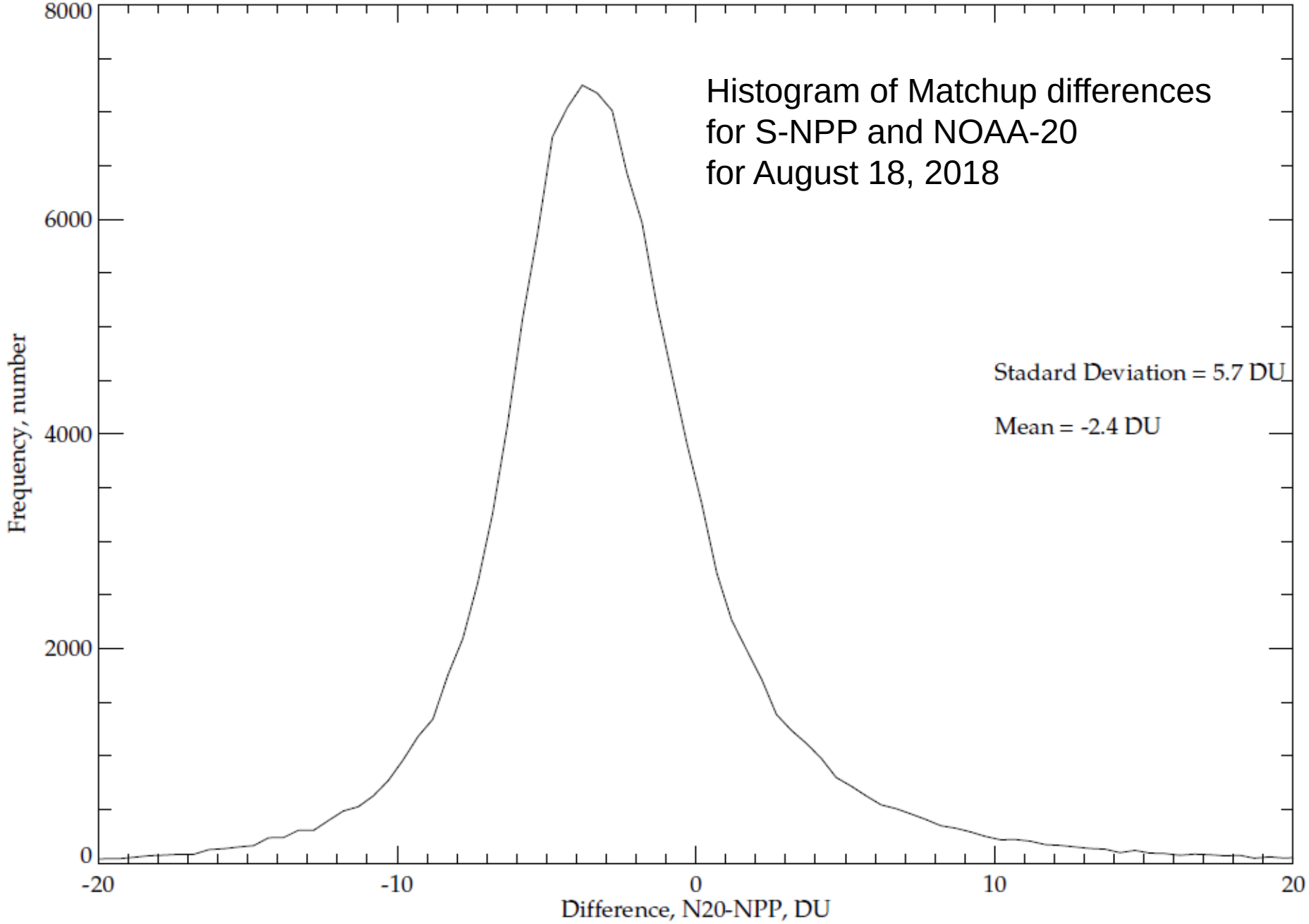
NOAA-20 Total Column Ozone results are in-family with S-NPP products with known deficiencies.

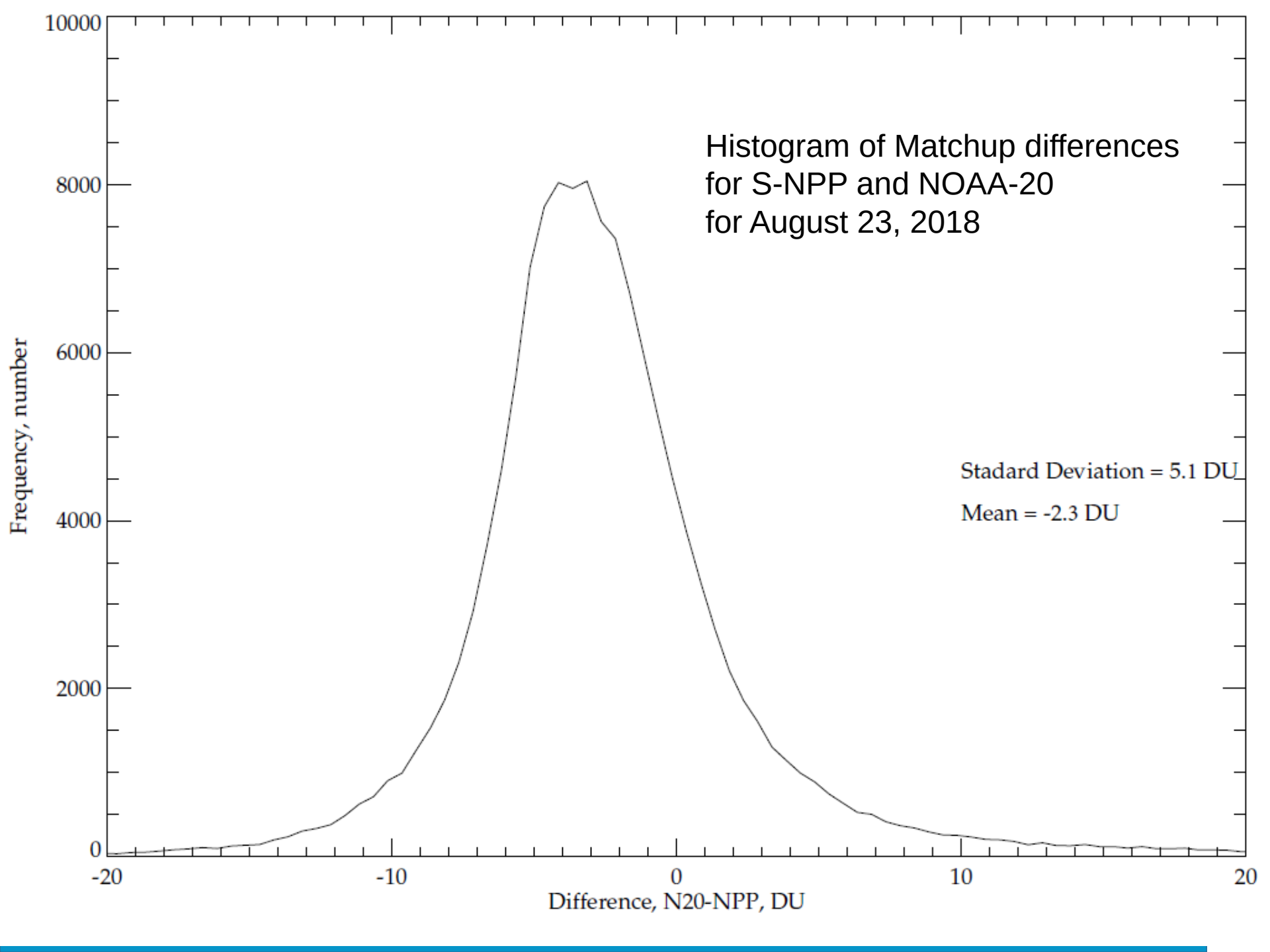
Total Ozone from NOAA-20 OMPS

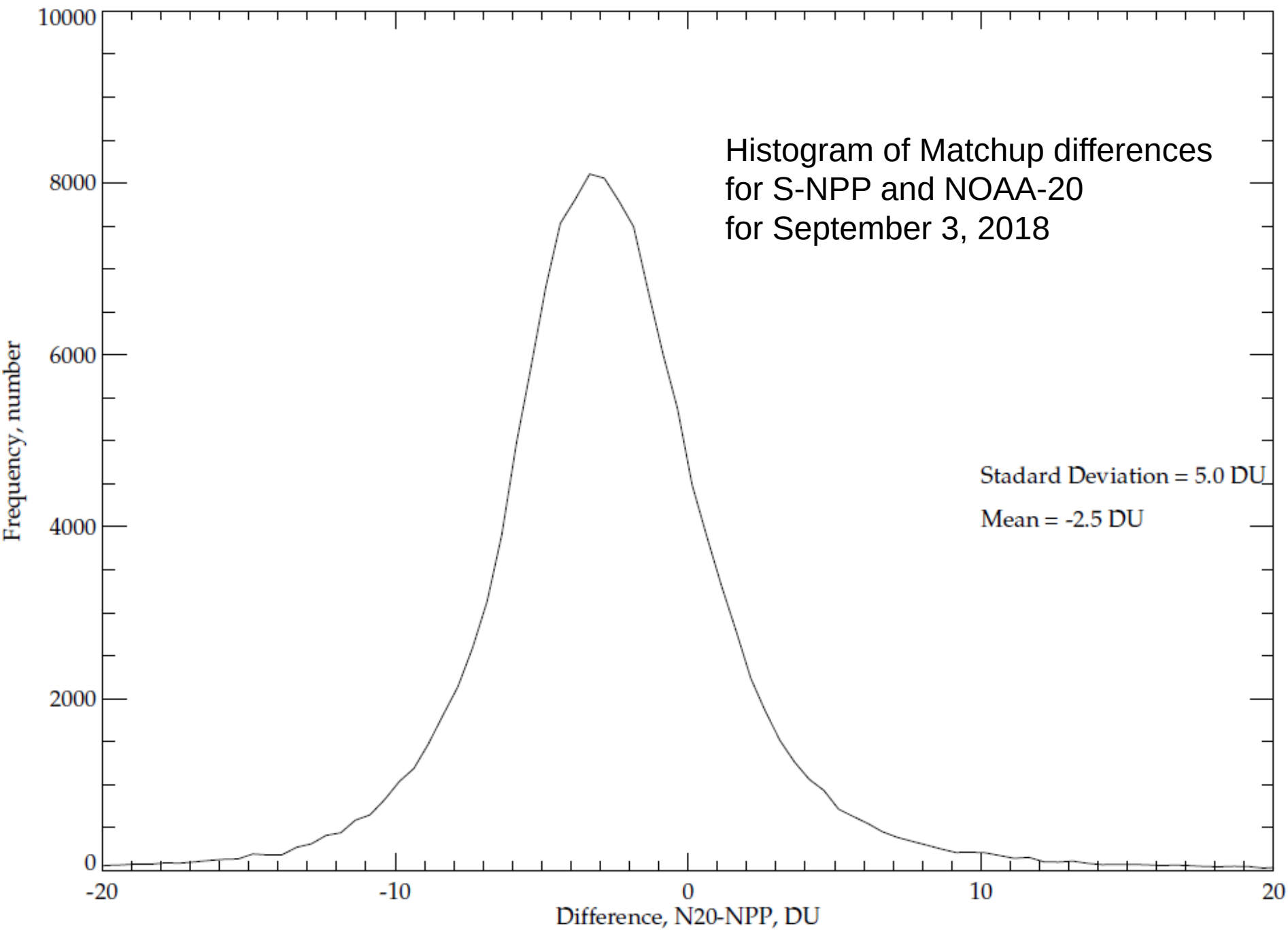


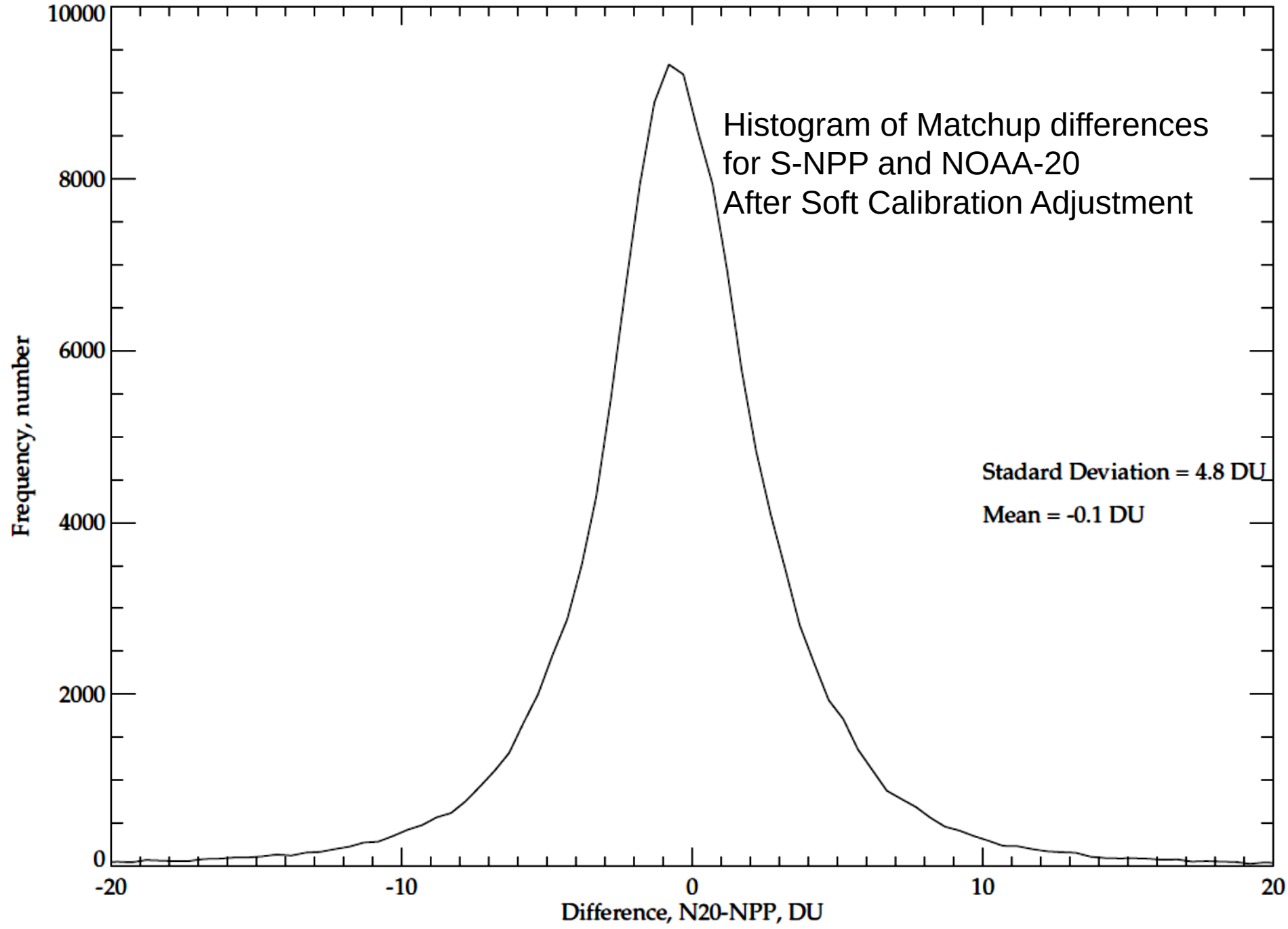
Total Ozone from S-NPP OMPS




Histogram of Matchup differences
for S-NPP and NOAA-20
for August 18, 2018
Stadard Deviation = 5.7 DU
Mean = -2.4 DU
Frequency, number
8000
6000
4000
2000
0
-20
-10
0
10
20
Difference, N20-NPP, DU


Histogram of Matchup differences
for S-NPP and NOAA-20
for August 23, 2018
Stadard Deviation = 5.1 DU
Mean = -2.3 DU
Frequency, number
10000
8000
6000
4000
2000
0
-20
-10
0
10
20
Difference, N20-NPP, DU


Histogram of Matchup differences
for S-NPP and NOAA-20
for September 3, 2018
Stadard Deviation = 5.0 DU
Mean = -2.5 DU
Frequency, number
10000
8000
6000
4000
2000
0
-20
-10
0
10
20
Difference, N20-NPP, DU


Histogram of Matchup differences
for S-NPP and NOAA-20
After Soft Calibration Adjustment
Stadard Deviation = 4.8 DU
Mean = -0.1 DU
Frequency, number
Difference, N20-NPP, DU
10000
8000
6000
4000
2000
0
-20
-10
0
10
20

Uncertainty Estimates from S-NPP Comparisons

Precision from Internal Double Differences:

	8/16/2018		8/23/2018		9/03/2018		9/21/2018		4/13/2019
	#	RMSD	#	RMSD	#	RMSD	#	RMSD	# RMSD
X < 250 DU	15K	2.4 DU	25K	2.3 DU	28K	2.3 DU	53K	2.7 DU	2.4 DU
250 < X < 450 DU	468K	2.3 DU	475K	2.3 DU	474K	2.3 DU	460K	2.3 DU	2.5 DU
X > 450 DU	79	2.1 DU	294	1.8 DU	235	2.3 DU	130	4.2 DU	3.3 DU

Differences from zonal means, 10-degree latitude bands:

Range	-5 to 0 DU	-4 to 0 DU	-4 to 0 DU	-4 to 0 DU	-3 to 3 DU

Differences from cross-track means:

Range	-5 to -1 DU	-5 to -1 DU	-5 to -1 DU	-4 to -1DU	-5 to 3 DU

Histogram >125000 points per daily direct matchups:

Standard Deviation	5.7 DU	5.1 DU	5.0 DU	4.6 DU
Average Bias	-2.4 DU	-2.3 DU	-2.5 DU	-2.5 DU

wp) & print, nwp,r/sqrt(1.5) & endfor

5

w2) & print, nw2,r/sqrt(1.5) & endfor

1

lat2-o3latp)-0.5)

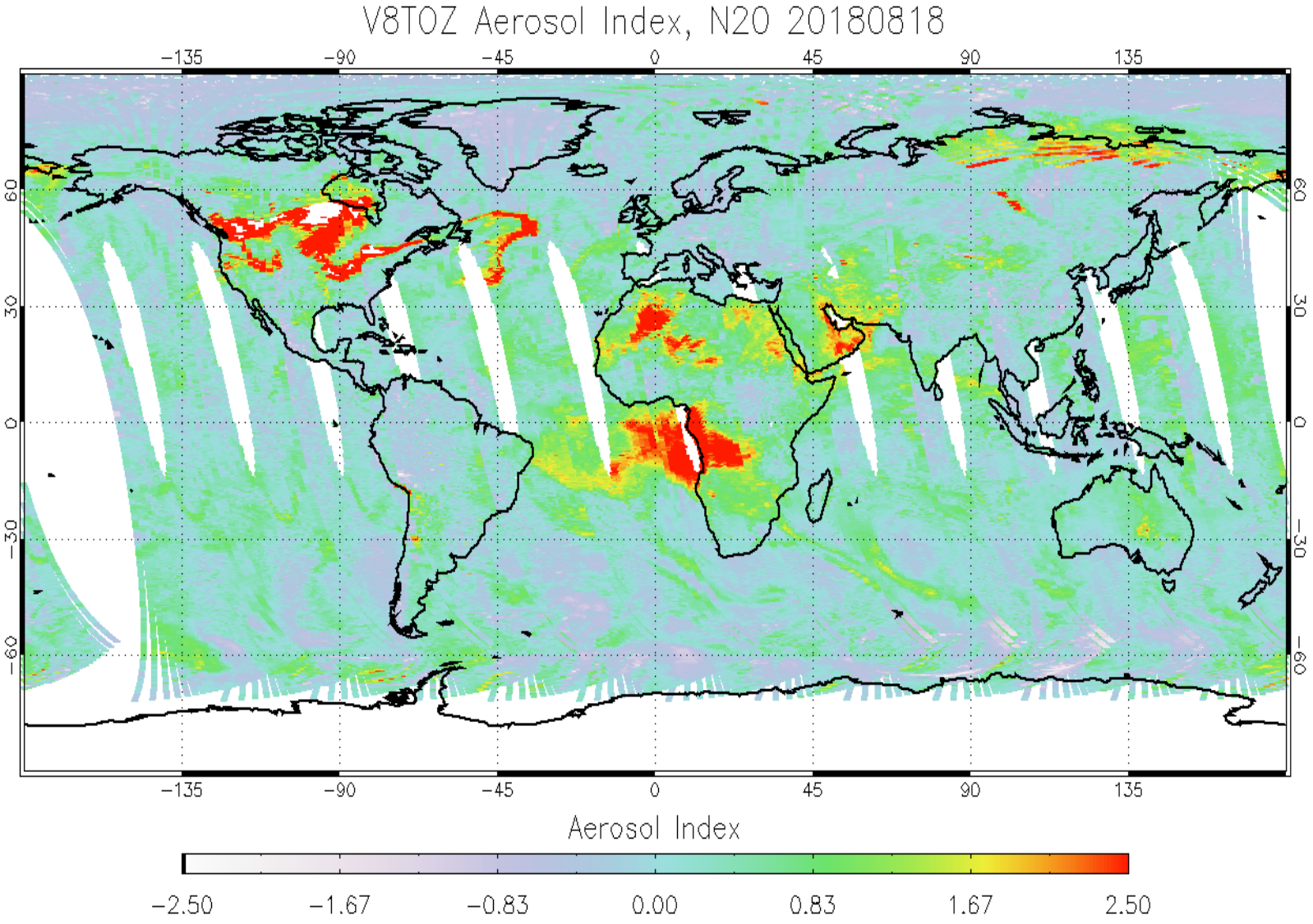
-1 -1 -1 -1 0 0 -

0 -2

Results for V8TOZ for 4/13/2019 (with new SDR tables) for Validated

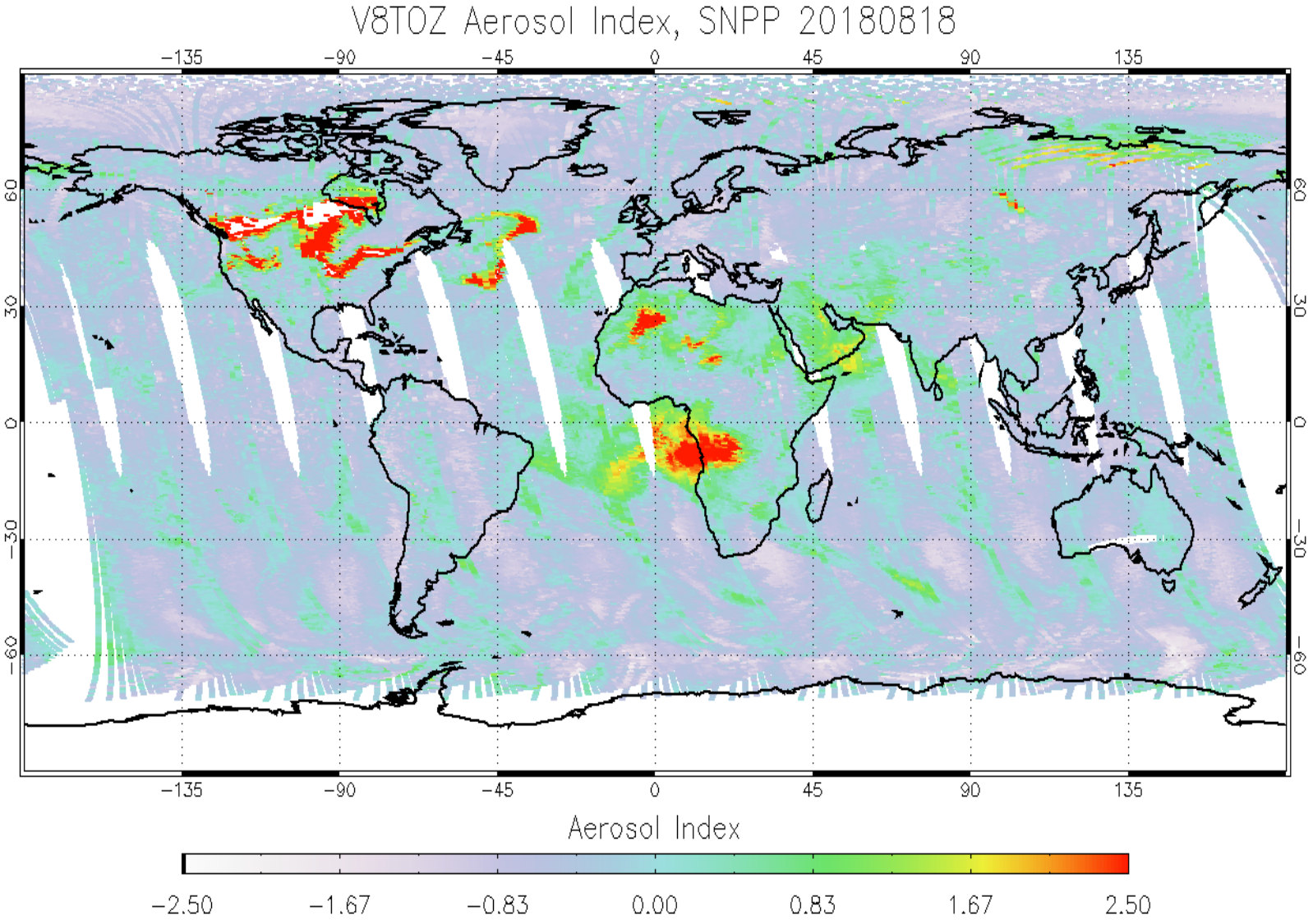
Precision (DU)	S-NPP	N-20
<250	2.4	2.0
250-450	2.6	2.5
>450	3.5	3.3

Aerosol Index from NOAA-20 OMPS



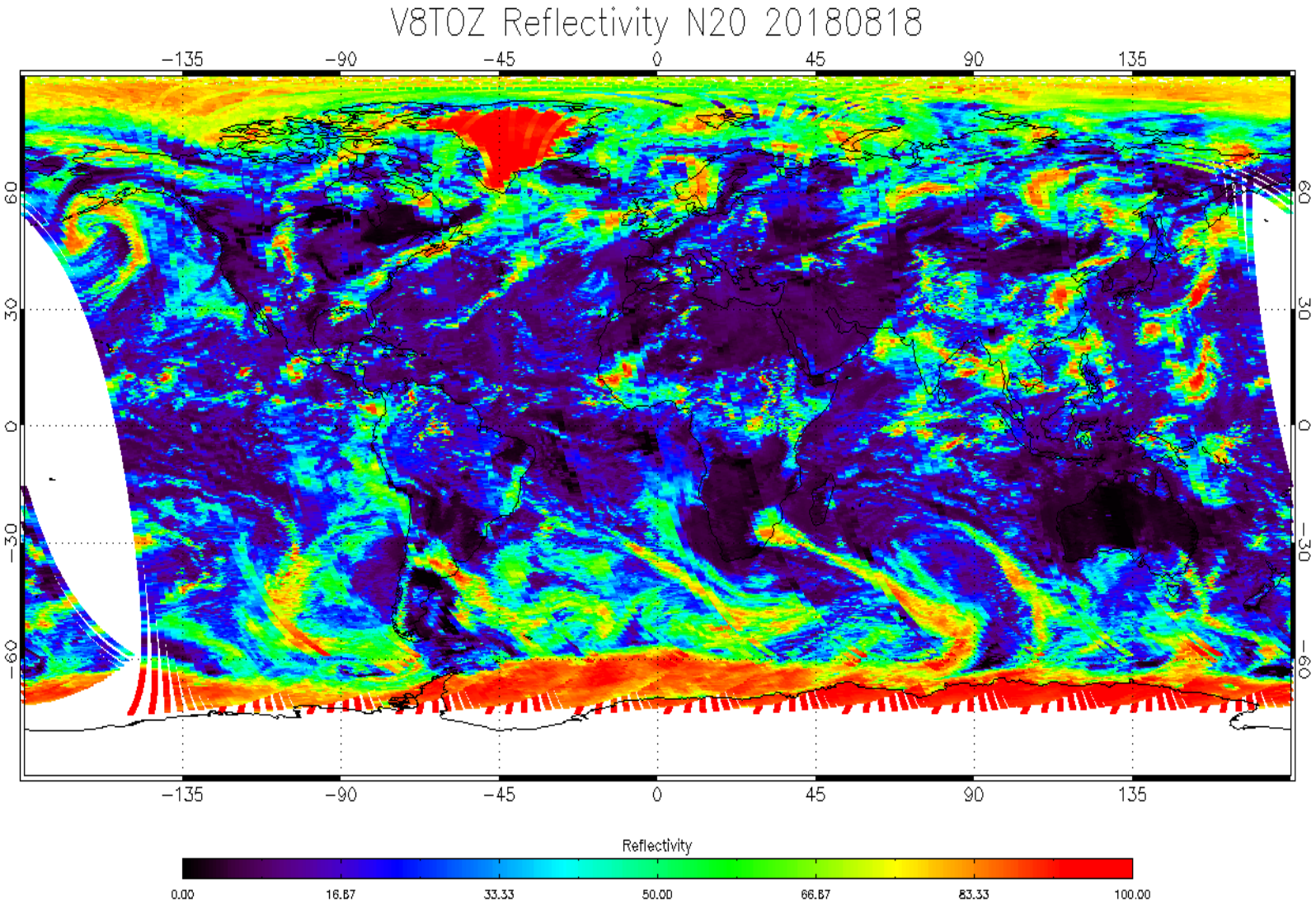
Slight positive bias (0.3)

Aerosol Index from S-NPP OMPS

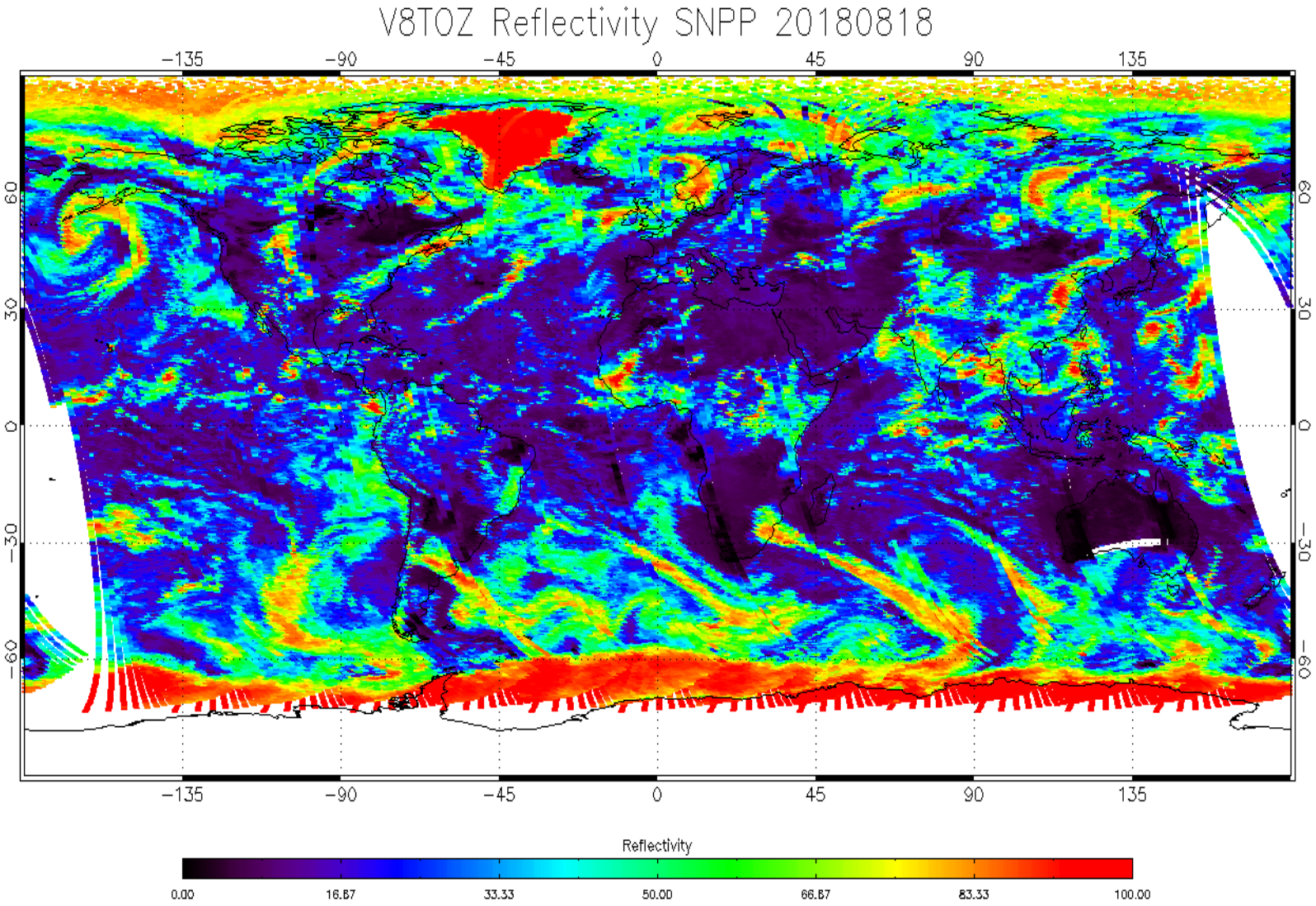


Slight negative bias (-0.3)

Effective Reflectivity from NOAA-20 OMPS



Effective Reflectivity from S-NPP OMPS



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
NDE Table Updates	Soft Calibration adjustment tables will be updated as SDRs mature. We do not know how long this process will take.	Delays in reaching validated maturity	Identify a process similar to the “Fast Track” table approach at IDPS.
NDE Code Updates	Code to reduce the effects of noise and outliers is being developed. These improvement will enter the queue for implementation at NDE.	Delays in reaching validated maturity for Medium FOVs	Should be a delta delivery as only 30 lines of code in one subroutine and one new data set will be added.

Conclusion

- Cal/Val results summary:
  - Team recommends algorithm provisional maturity
    - Caveats provide on two slides and in Readme

Path Forward (1/2)

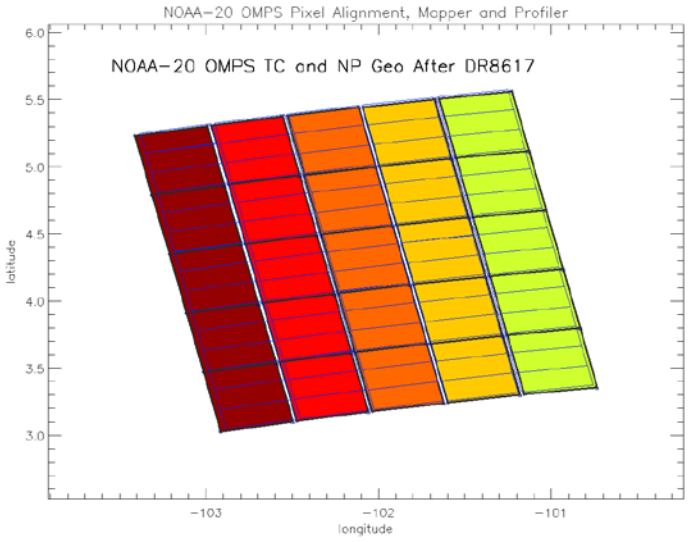
- SDR and EDR team communication is essential.
- Updates to Soft Calibration will be made with input from users on desired “truth” data.
- Code to identifier outliers and reduce noise is under development for smaller FOV processing.
- Collected statistics for V8TOS performance over volcanic events with large SO2 releases. This has led to a change in the LFSO2 code logic to make a more consistent product.

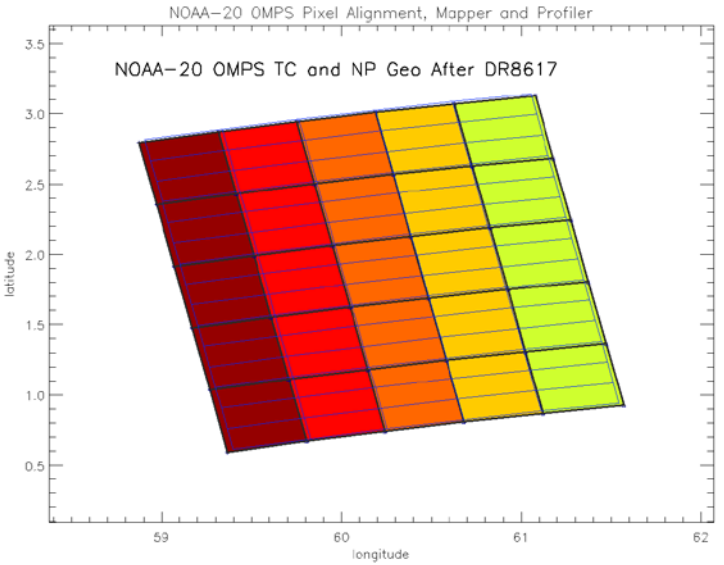
Path Forward (2/2)

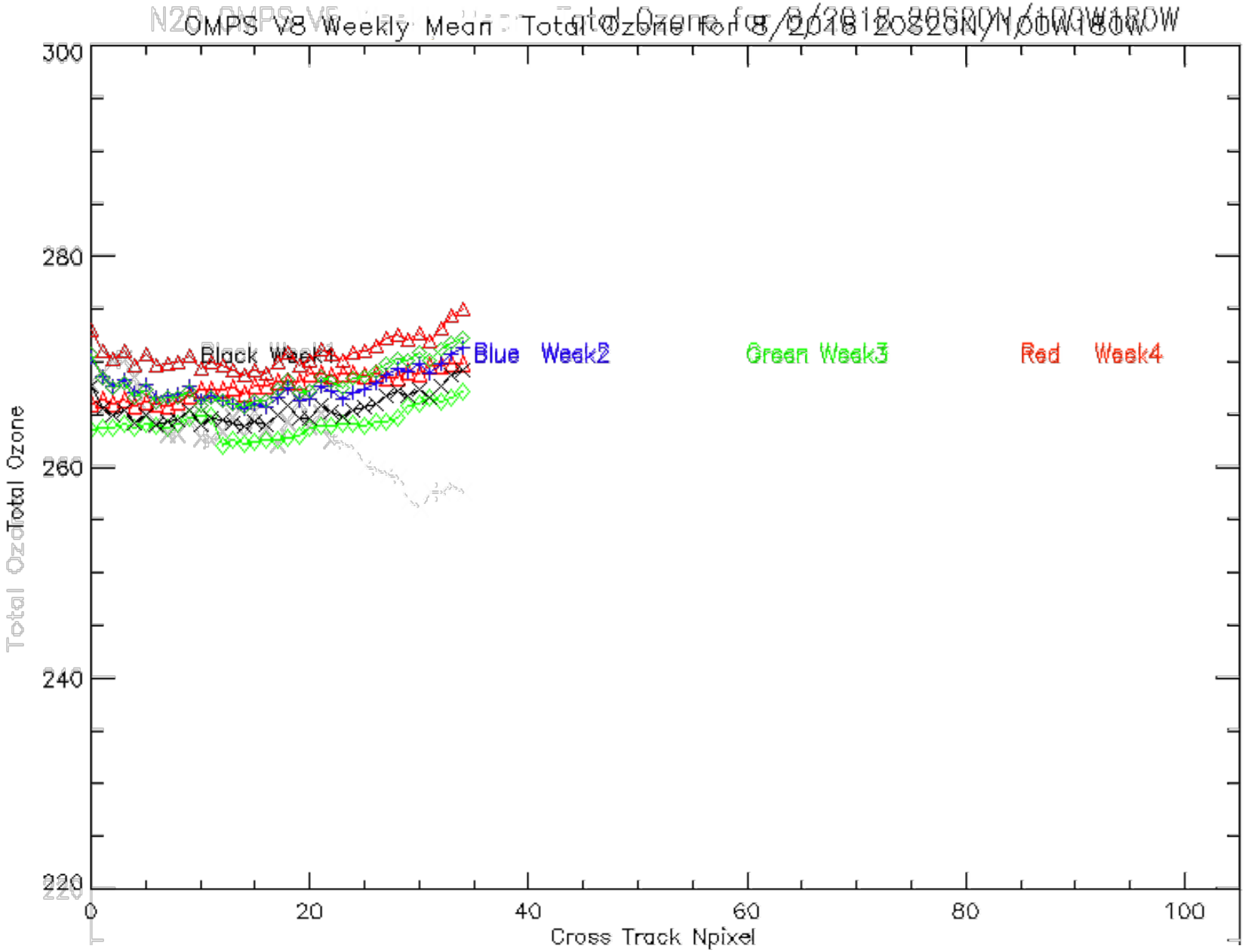
- Continue to make comparisons of Equatorial Pacific regional means, zonal latitudinal means, and global matchups for V8TOz and V8TOS with those for S-NPP. Compare total ozone products to ground-based measurements by using overpass data sets for Dobson and Umkehr stations. Compare BUFR products to current assimilation forecasts;
- Estimate cross-track bias in the 12 channels used in the V8TOz EDRs from weekly statistics segregated by cross-track position;
- Investigate methods to reduce the effects of transient signals and noise in the medium resolution NM SDR on the V8TOz EDRs. The planned approach uses Empirical Orthogonal Functions from analysis of the covariance matrix to identify and remove outliers and increase the measurement precision for the selected V8TOz channels;
- Track the impact of continued improvements in the SDR as planned by the SDR team; and
- Provide deliveries of adjustment tables and code changes for V8TOz to NDE as SDR maturity progresses and stabilizes and validation results are analyzed and updated.

Matchup GEO between OMPS NM and NP

The ground pixel corner geolocation is modified. The first image below shows the ground pixels for on 37 second granule for OMPS-NP and OMPS-TC. The gaps between each FOV are about 2.4km.






OMPS V8 Weekly Mean Total Ozone for 8/2018 20S20N/60W180W
Black Week1
Blue Week2
Green Week3
Red Week4
Total Ozone
Cross Track Npixel
300
280
260
240
220
0
20
40
60
80
100

Notes from first review

Ozone v8TOz (Total Column)

- Ozone TC is at BETA because only 1 day of data validation was shown and there are still updates to be delivered to NDE. Request the science teams do additional validation after the updates have been integrated into NDE I&T.
- "Final" updates will not be available until after all SDR updates are available and examined.
- Caveat statements provided for readme files were well received. Is there a need for periodic updates caveat statements (readme files) for SNPP based on findings?
- Recommend provisional be effective once IDPS Mx3 is in operations

LF Comment: currently running on IDPS I&T).

- ● Many changes soon to happen. Were all seemingly small, but in aggregate, concerned that there could be issues and differences.

LF Comment: Most changes are for SDR and it is Provisional.

- ● Slide 9 - for geographic coverage, recommend the 90% daily global earth is done per requirements for validated review. How does “SZA < 70°” translate to % earth covered?

LF Comment: SZA < 80° satisfies 90% coverage. SZA<70 Degrees is still over 80%.

LF Comment: The coverage for NOAA-20 is the same as for S-NPP.

- ● Slide 9 - for validated review, need to show data for > 450DU, even if insufficient, show the samples achieved.
- ● Slide 28 - user feedback of two bullets is insufficient. Doesn’t say how the evaluation of
- data has been, what issues they have seen, and suitability to use data.

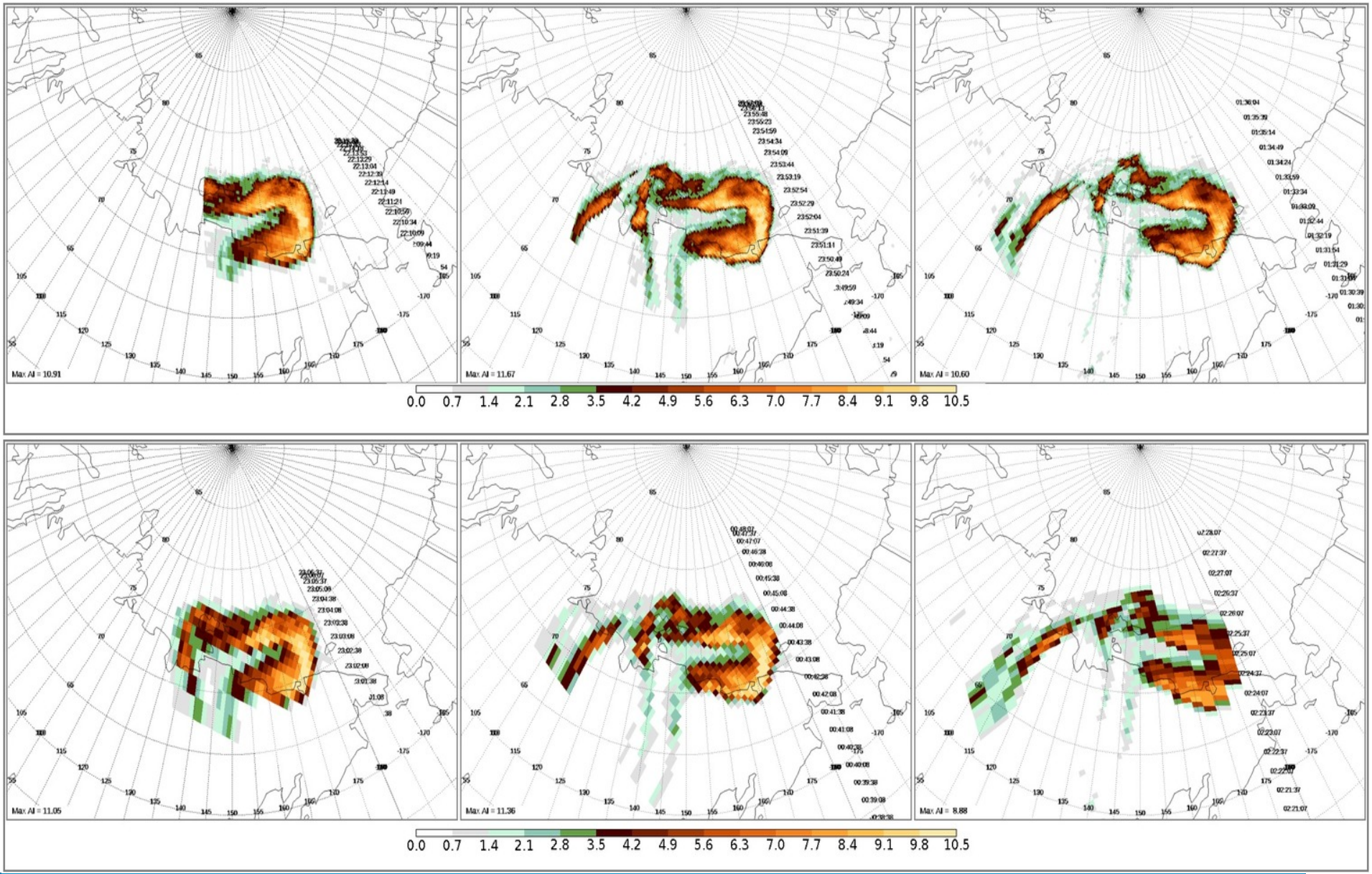
Key SDR changes

- DR8616 16-scan granule problem Block 2.1 Mx3 TTO to IDPS 9/24/2018.
- DR8615: NP macropixel calculations
  - CCR 18-3829 TTO to IDPS July 2, 2018.
- New Day 1 Solar and Wavelength Scale tables are in testing for NOAA-20 OMPS NM and NP.
- DR_8617 demonstrated the updated tables could not meet validated stage requirements because of the FOV mismatch between TC and NP.

Key OMPS NM SDR Tables

- New versions of the following tables are needed for NOAA-20 OMPS to reach Validated Maturity:
- OMPS-TBL-VERS-GND-PI
- OMPS-TC-TIMINGPATTERN-GND-PI
- OMPS-TC-EV-SAMPLE-GND-PI
- OMPS-TC-MACROTABLE-GND-PI
- OMPS-TC-WAVELENGTH-GND-PI
- OMPS-TC-OSOL-LUT
- OMPS-TC-STRAYLIGHT-LUT
- OMPS-TC-CF-EARTH-GND-PI

Aerosol Index Resolution: NOAA-20 (top) vs. S-NPP (bottom)

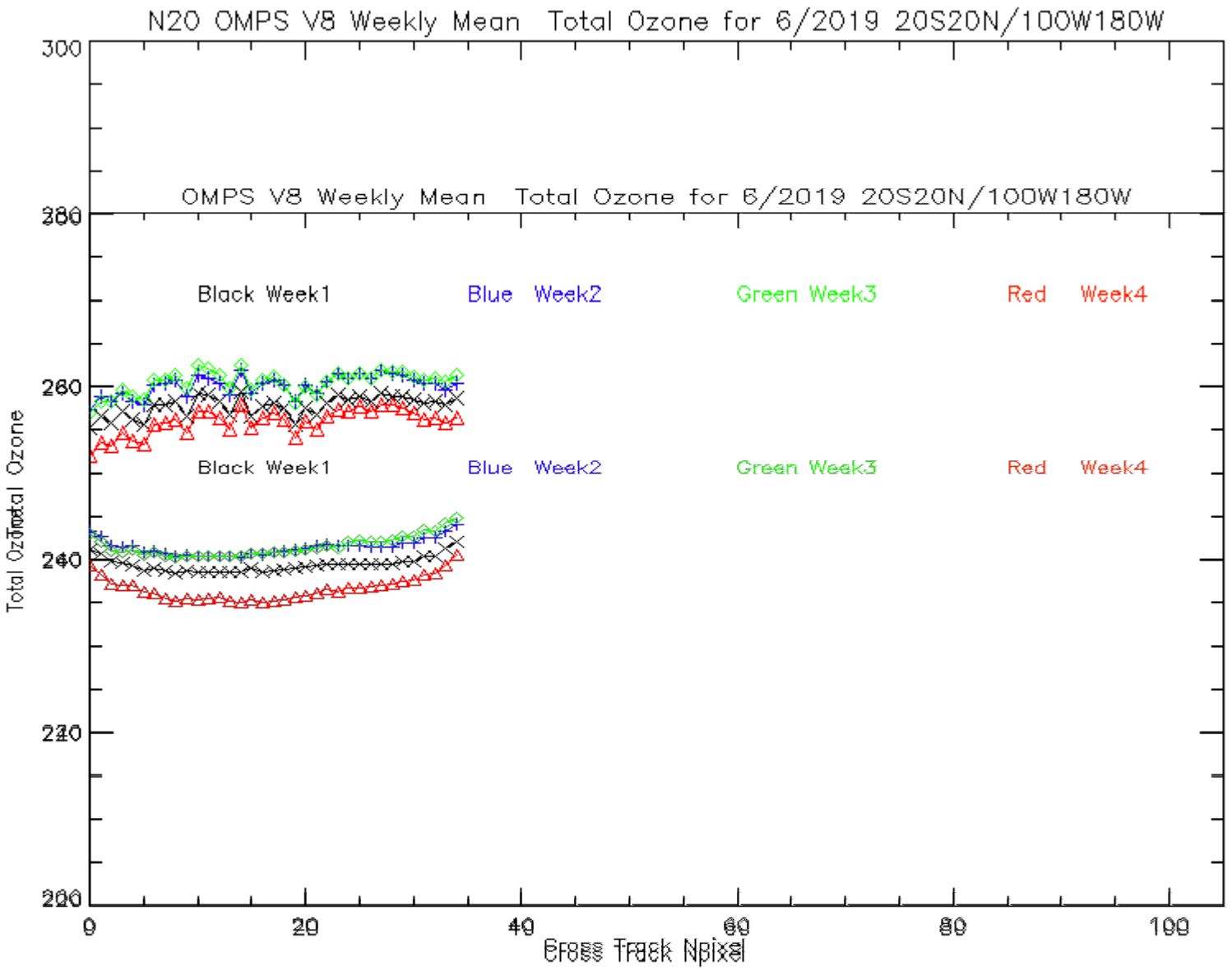


Key Issue for Path Forward for V8Pro

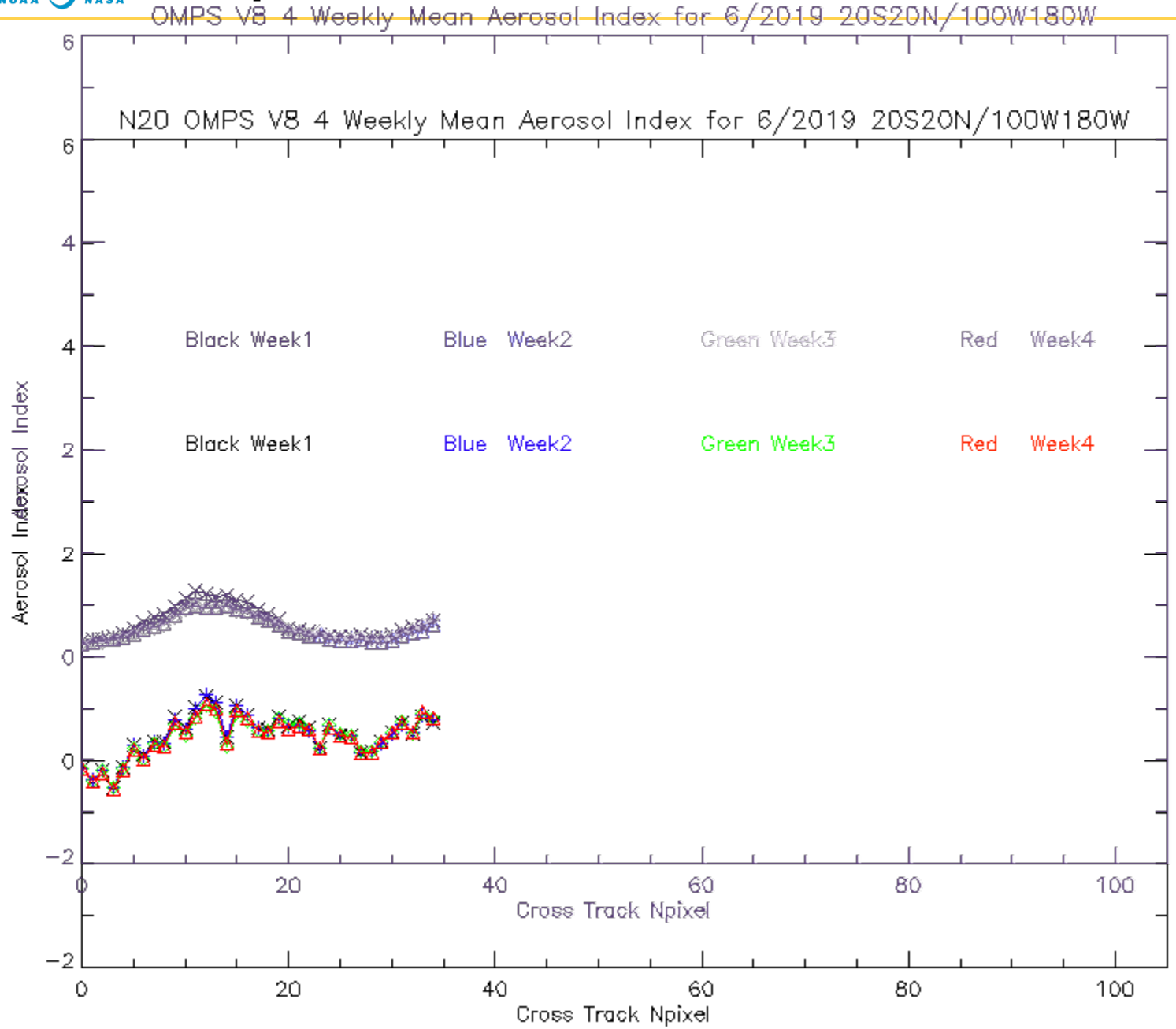
- ADR 8730 New DR. Counts not uniformly distributed for NOAA-20 OMPS NP. This has been traced to discretization errors from the non-linearity correction. A path forward with a new flight non-linearity and adjustments to the calibration coefficients is proceeding.
- Test data was taken with NOAA-20 OMPS using the new sample tables -- 140 5-pixel for NM and rectangular NP. Tables are under development to make operational 103x15 granule NM SDRs. The SDR team will be requesting that the instrument be switched to the 140 5-pixel mode. We will need to adjust the V8Pro Glueware to handle the NMmacropixels with

  [10,10,10,10,5,10,5,10,10,10,10] pixels
- We will need to provide new adjustment tables once these changes are implemented and new SDR data are available.

Comparisons of Total Column Ozone Values



Comparison of Aerosol Index Values



SPSRB DECISION BRIEF ON DECLARING NOAA-20 OMPS V8TOZ AND V8TOS PRODUCTS OPERATIONAL

(S-NPP OMPS V8TOZ AND V8TOS ARE ALREADY OPERATIONAL)

Vaishali Kapoor (OSPO)
Lawrence Flynn (STAR)

November 05, 2018

OSGS Lead: Arron Layns (OSGS)
STAR Lead: Lawrence Flynn (STAR)
OSPO Lead: Vaishali Kapoor (OSPO)

Background

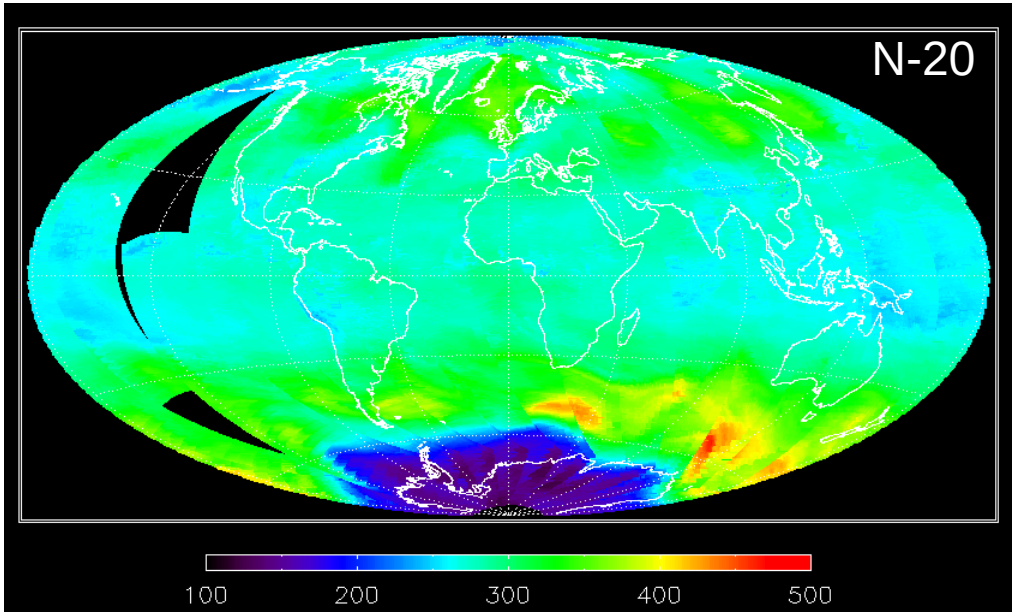
- Project Lead(s): Larry Flynn (STAR)
- Project Name: (JPSS) NOAA-20 OMPS V8TOz & V8TOS
  - The operational considerations for the NOAA-20 OMPS products are
    - Replacement for POES SBUV/2 and EOS OMI total ozone products to NWS
    - Continuing afternoon SBUV/2 ozone products for Ozone Climate Data Records
  - NWS requests continuity of NOAA products between current and future NOAA operational satellites
  - Demonstration of NOAA's goal of enterprise solutions by employing same algorithms for "POES" and "JPSS"
  - Supports NWS OS&T implementation strategy of multi-sensor algorithms and products

- Product Deliverable Name(s): NOAA-20 OMPS V8TOz & V8TOS EDRs
- Operational Center: NESDIS/OSPO
- Product Phase Dates:
  - AUG 2015 Development Phase Began
  - Jan 2016 Pre-operational Phase Began
  - Oct 2017 Operational Phase Began for S-NPP
  - Nov 2018 Operational Phase proposed for NOAA-20

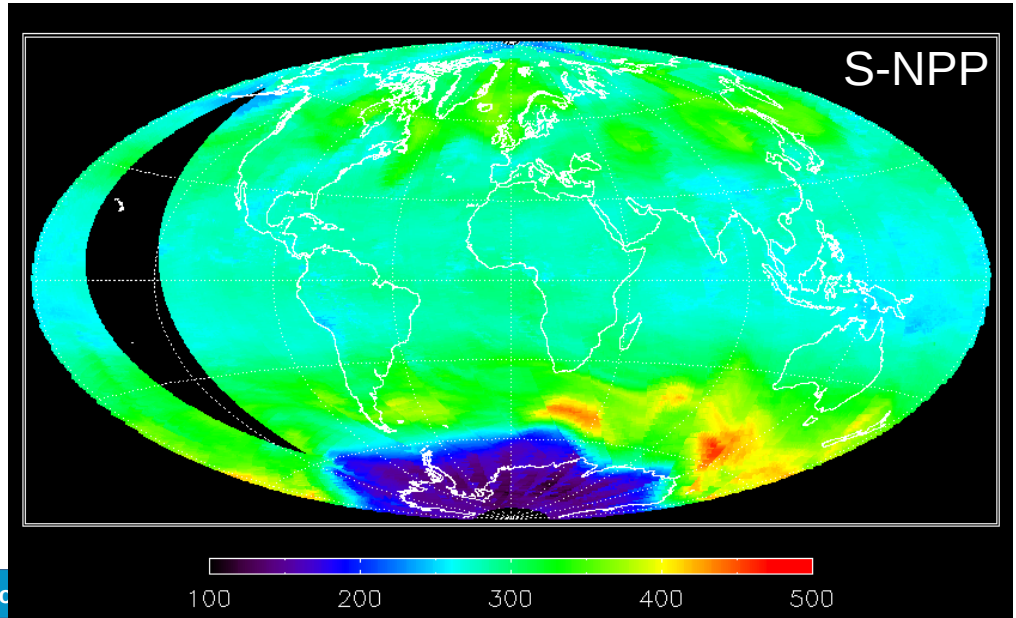
Background and Benefit

- The N-20 V8TOz provisional review was held on 2 Oct 2018 and approved on 24 Oct 2018.
- S-NPP and N-20 total ozone products are used at NCEP to monitor the health of the ozone layer and will be assimilated into models in place of the current EOS Aura OMI total ozone products for UV Index and Weather Forecast applications.
- With the two afternoon satellites operating in tandem 50 minutes apart in orbit, users have increase coverage, especially at the middle and high latitudes.
- The V8TOS SO2 column products will be used in the alert system

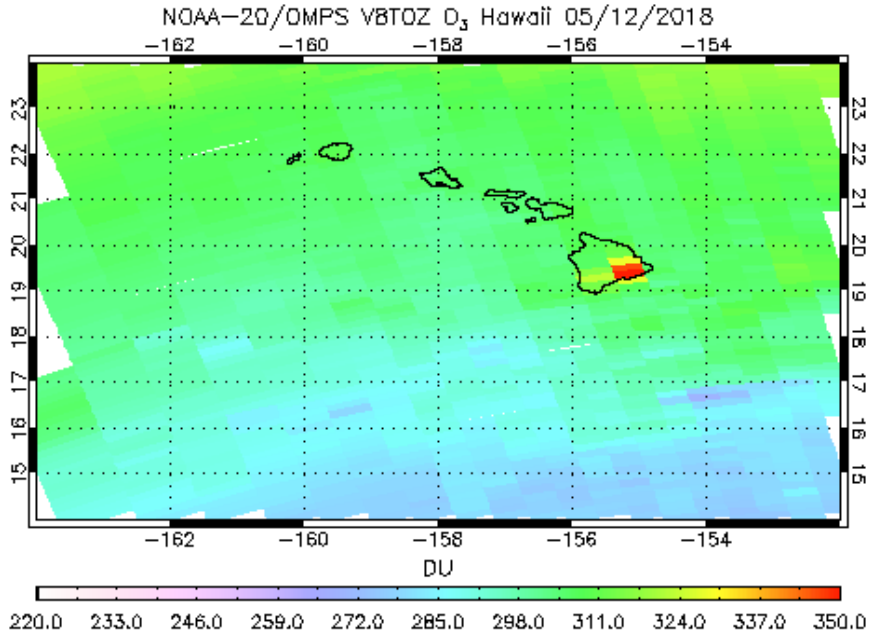
https://www.ospo.noaa.gov/Products/atmosphere/ompsso2/index.html

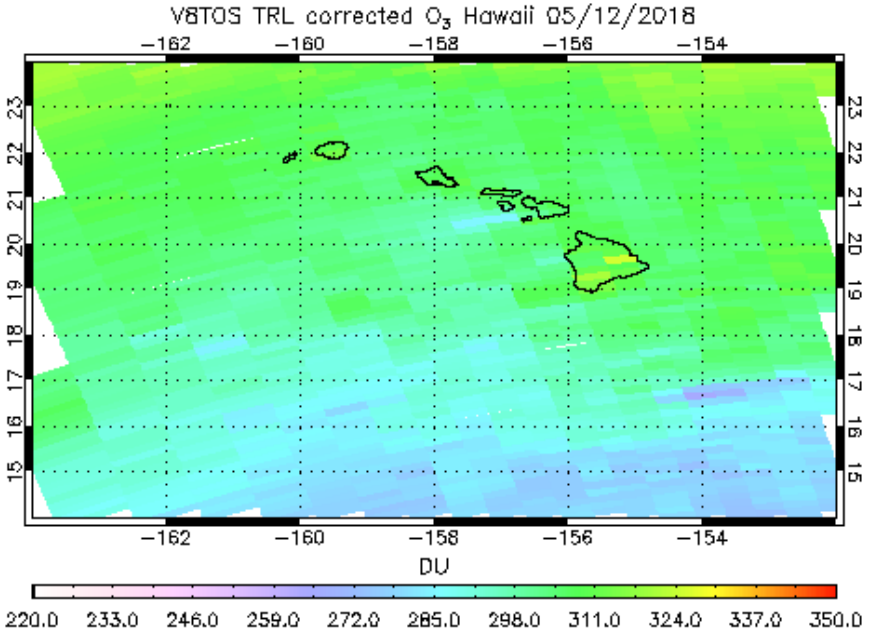


September 9, 2018



Improved Total Ozone

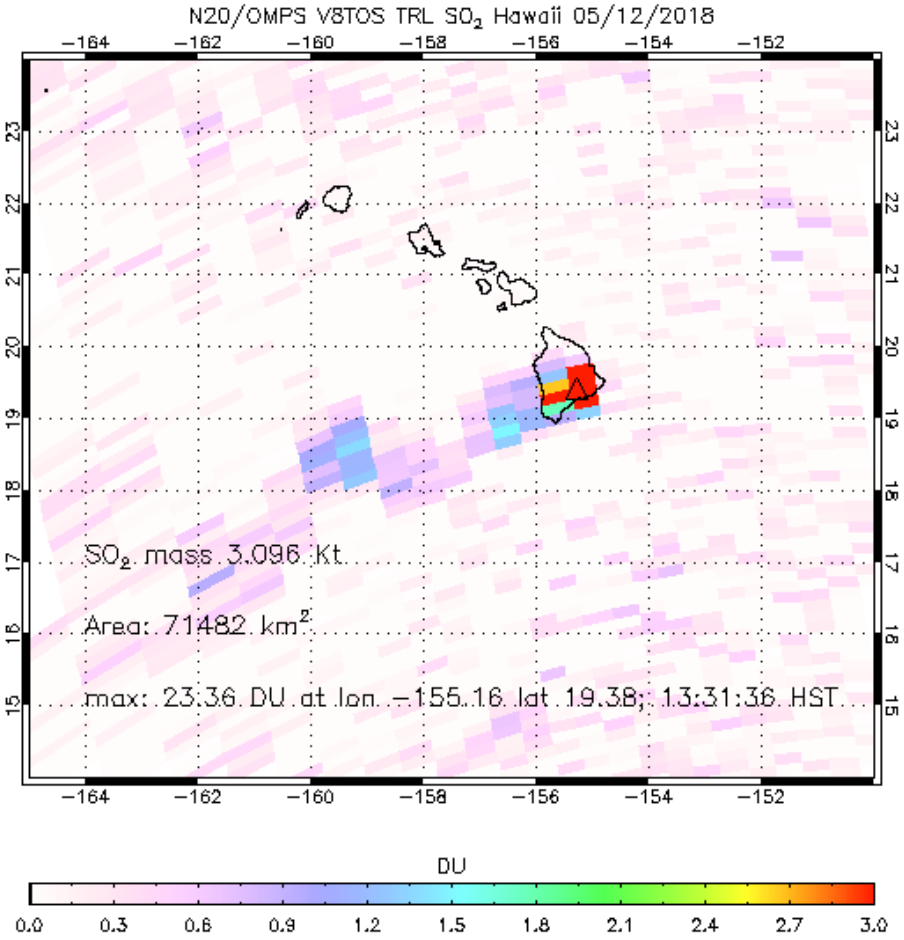




The LFSO2 algorithm recalculates the total column ozone correcting for the estimated SO2 column amount. The figures to the left show the ozone field before (Top, V8TOz) and after (Bottom, V8TOS) corrections for the retrieval for the Mauna Loa Volcano for May 12, 2018.

The large errors (high ozone values) in the top figure are brought down to more reasonable values in the results in the bottom figure. Volcanic ash creates some additional errors that are not resolved.

SO2 for Previous Slide



Promotion Checklist

#	IPT Lead is responsible for completing these items	Completed? / Comments?
1	User coordination, endorsement, and approval	completed
2	Oversight Panel coordination, endorsement, and approval	Needs SPSRB approval
3	Implementation on primary and backup operational systems	Will be implemented into operations on December 2018
4	Implementation on distribution system(s) including archives if appropriate	Data already flowing to PDA from NDE I&T – data will be archived at CLASS
5	Documentation completion and/or updating	updating
6	Implementation of monitoring procedures	Completed – same as V8TOz NPP
7	Receive Office/Division Chief approval to declare operational status	Needs approval
8	Announcement of operational enhancement promotion in Office/Division weekly/monthly reports	Will be announced after operational implementation
9	Provide this completed briefing to Aaron Layns (JPSS) or Jamese Sims (GOES-legacy/R, Satellite) SPSD Division Chief (Tom Renkevens) SPB Branch Chief (Antonio "Ricky" Irving) SPSRB Executive Secretary and SPSRB Manager SPIWG Co-Chair/Executive Secretary	Will do after approval, ATBD is same as NPP V8TOz, N20 information is being added in existing NPP V8TOz SMM and EUM documents.

Product Deliverable Details

					Product Type and Number					
Fiscal Year (FY)	Product Delivery/Tracking Name	Environmental Observational Parameters	Satellites	Sensors	N #	E #	R #	T #	O #	Tailoring Options or Comments
2018	OMPS Nadir Mapper Total Ozone Environmental Data Record (EDR) OMPS Nadir Profiler Ozone Profile EDR	Total Column Ozone, Ozone Vertical Profile, Effective Reflectivity, Aerosol Index Ozone Vertical Profile, Effective Reflectivity, Aerosol Index	S-NPP	OMPS-NM OMPS-NP	1		1	3		Formats: NetCDF4, Coverage areas: Global Resolutions: 50KM Update cycle: Daily Other: Formats: NetCDF4, Coverage areas: Global Resolutions: 250KM Update cycle: Daily
2018	OMPS Nadir Mapper SO2 EDR	Total Column SO2	S-NPP	OMPS-NM	1			1		Formats: NetCDF4, Coverage areas: Global Resolutions: 50KM Update cycle: Daily
2019	OMPS Nadir Mapper Total Column Ozone & SO2 EDRs	Total Column Ozone and SO2, Eff. Reflectivity, Aerosol Index	NOAA-20	OMPS-NM	1			1		Formats: NetCDF4, Coverage areas: Global Resolutions: 50(17)KM Update cycle: Daily

N=New E=Enhanced R=Replacement T=Tailored O=Other

ECMT Application – J1 V8TOz

- Name: J1 V8 OMPS Total Ozone products
- Short Names: J1 OMPS V8TOZ, J1 OMPS V8TOS
- Status: Operational
- Support Level: 24x7
- User Impact:
- Notification Tier: 1
- Approval Level: PAL
- Escalation Tier: B
- Application Type: Application
- Description: V8 Total Ozone products from J1
- Instrument: OMPS Nadir Mapper
- System: NDE 2.0
- CIP: CBU

ECMT Product – NOAA-20 V8TOz/V8TOS

- Name: J1 V8 OMPS Total Ozone Products
- Short Name: J1 OMPS_TC_BUFR
- Application Short Name: J1 V8TOz/V8TOS
- Status: Operational
- Support Level: 24/7
- Format: netcdf4, BUFR
- Primary Use: NCEP/CPC
- Description: Version 8 Total Ozone products in BUFR format - The Version 8 total O3 algorithm (V8TOz) is the most recent version of a series of BUV (backscattered ultraviolet) total O_3 algorithms and includes better understanding of UV radiation transfer, internal consistency checks, and comparison with ground-based instruments.
- Output Filenames: V8TOZ-EDR_v1r0_npp_s201702211804490_e201702211805265_c201702211902090.nc
  V8TOS-EDR_v1r0_npp_s201712181423470_e201712181424244_c201712181648269.nc
  V8TOZ-EDR_v3r1_j01_s201811031812115_e201811031812490_c201811032055250_nc
  V8TOS-EDR_v3r1_j01_s201811031526590_e201811031527264_c201811032024337_nc
- Operational: October 2017 (NPP V8TOz)
- Operational: March 2018 (NPP V8TOS)
- Projected date to go operational: November 2018 (j1 V8TOz/V8TOS)
- Horizontal resolution: 50*50 KM^2 at Nadir
- Vertical resolution: Total Column 0 to 60 km
- Frequency: Daily
- Coverage: Global
- Accuracy: 2%
- Product Oversight Panel: ZPOP
  - Users: C. Long (NCEP/CPC), A. Collard (NCEP/EMC others: International NWP users, NWP FOs, Climate Users
- Web page: http://www.ospo.noaa.gov/data/atmosphere/ozone/Products_atmosphere_OMPS.html
- Archive: Class

SPSRB User Request Status

- Has the SPSRB user request been fully satisfied?

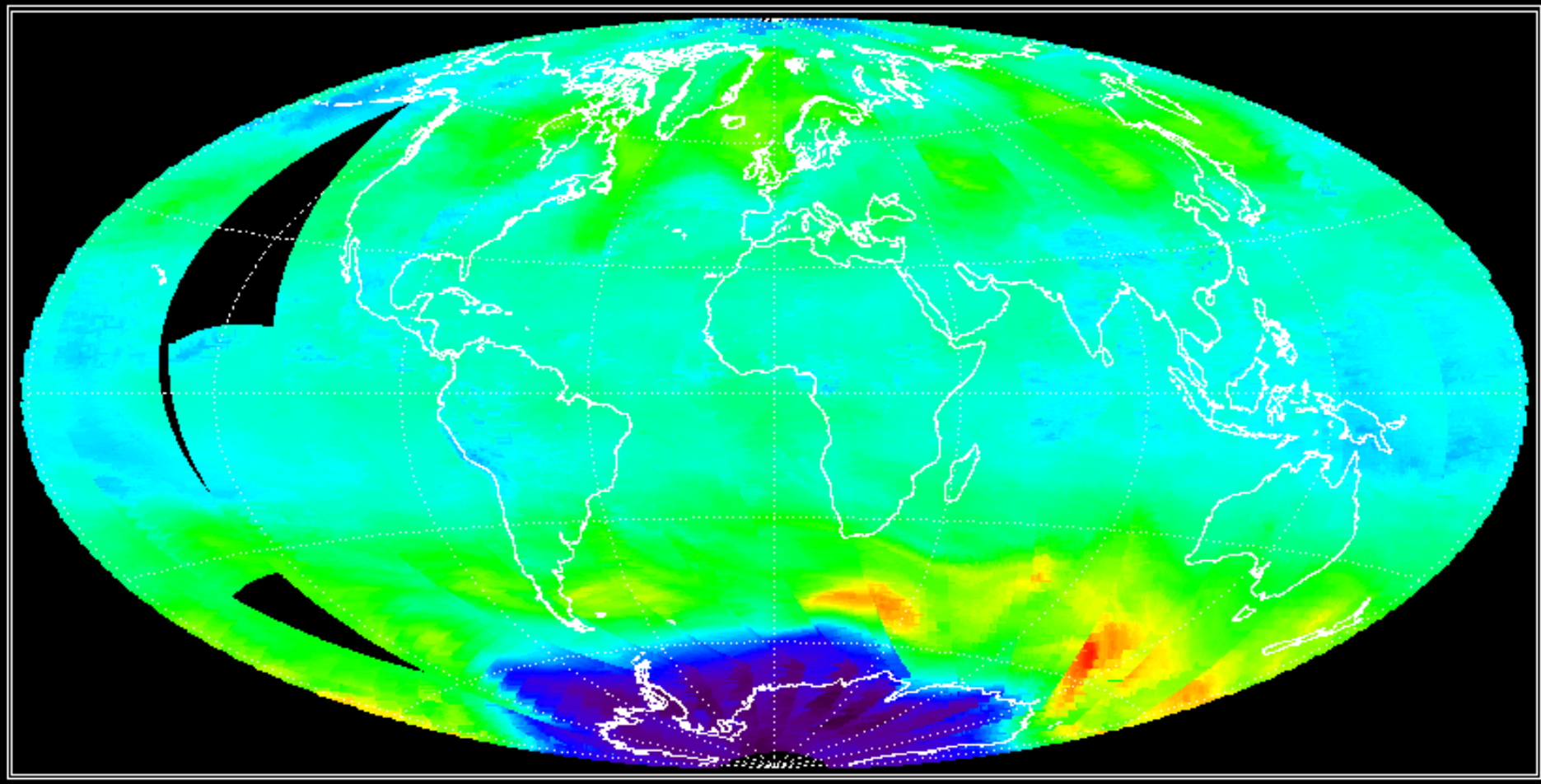
Backup Slides

- Monitoring sites:

https://www.star.nesdis.noaa.gov/smcd/spb/OMPSDemo/proOMPSbeta.TOZ_N20_V8.php

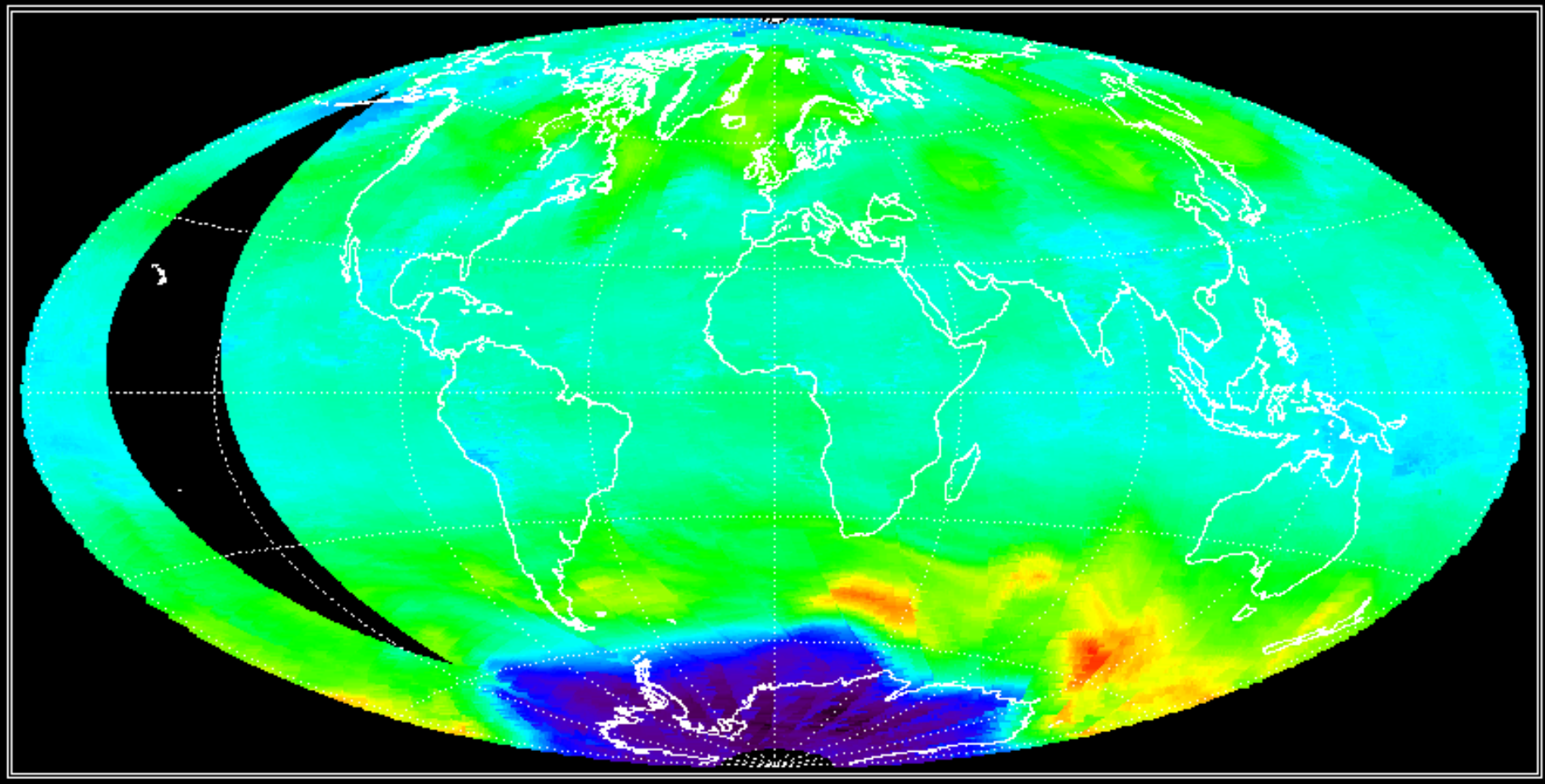
https://www.ospo.noaa.gov/data/atmosphere/ozone/Products_atmosphere_OMPS.html

N20 OMPS V8 Total Ozone for 20180921

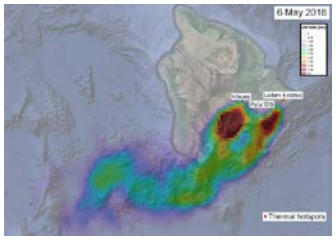


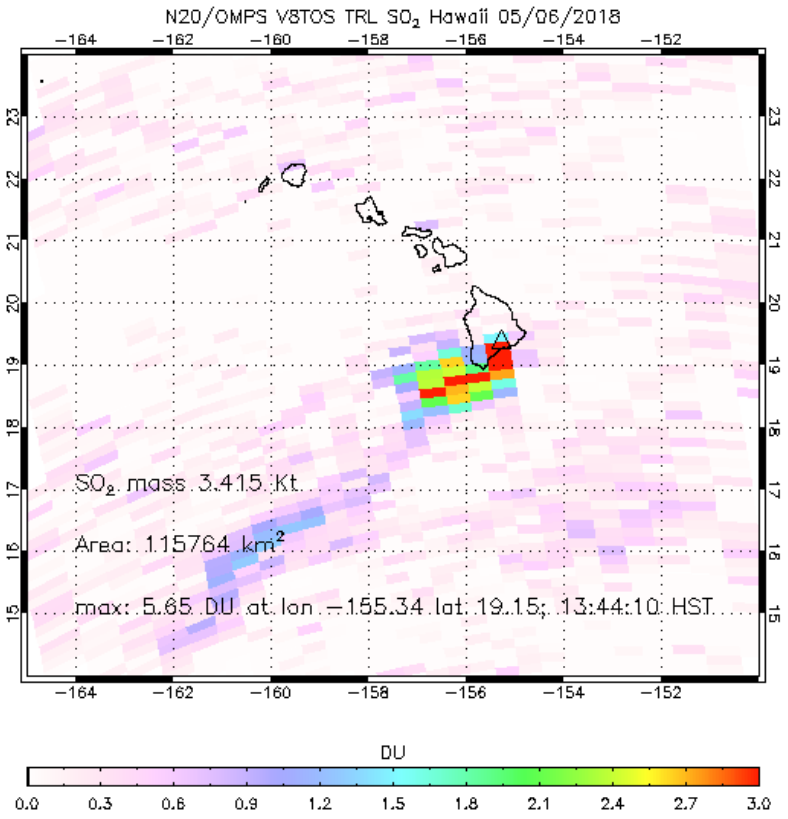
100 200 300 400 500

OMPS V8 Total Ozone for 20180921

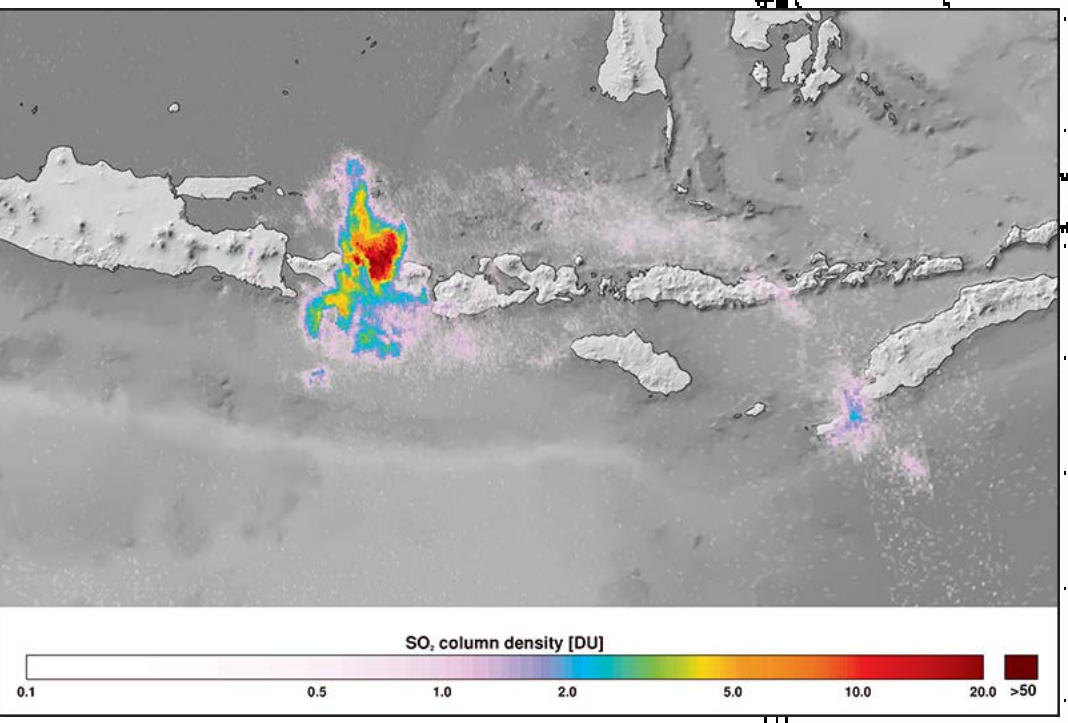


Comparison of NOAA-20 OMPS with TROPOMI

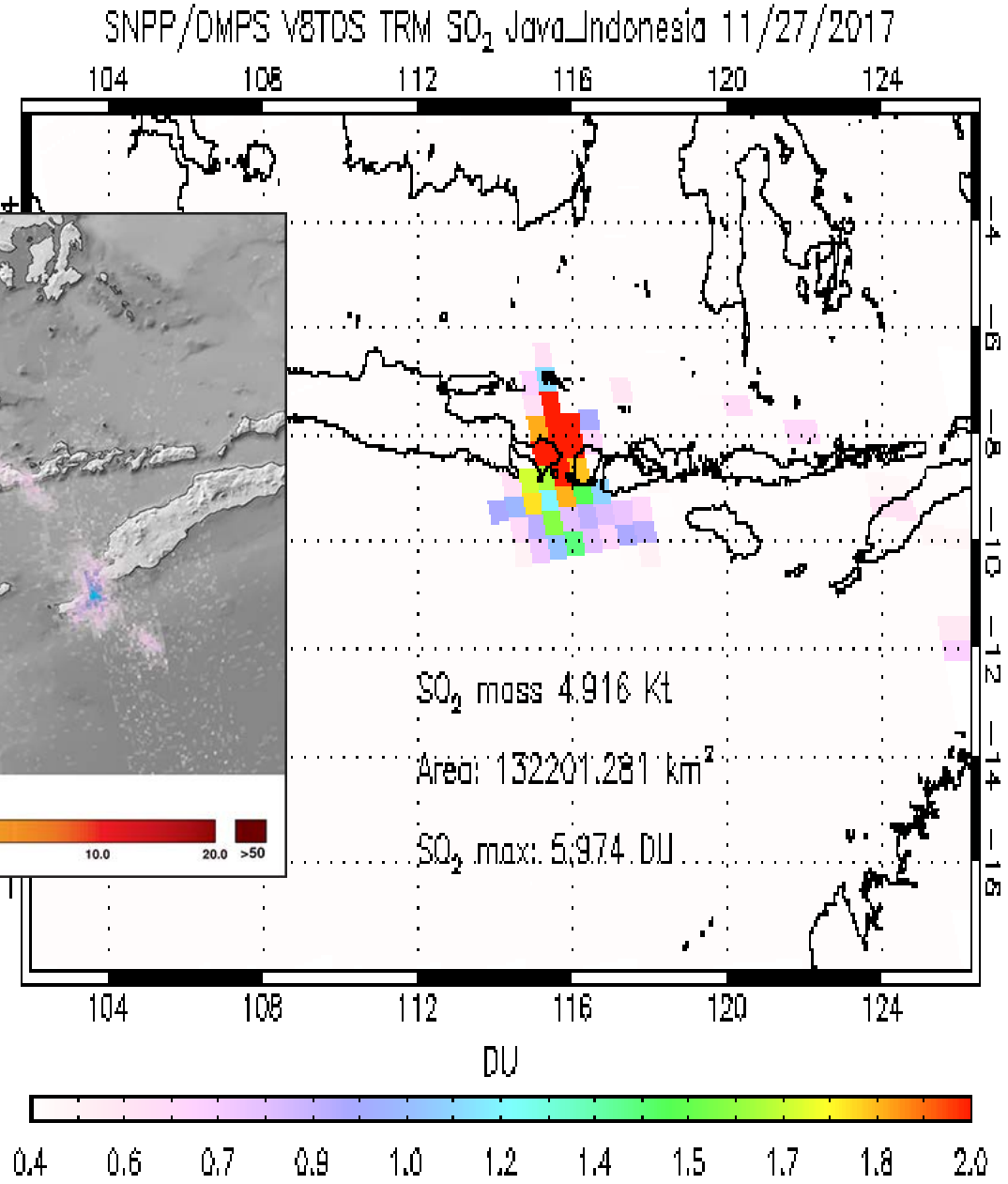




Comparison of TROPOMI to S-NPP OMPS



TropoMI



SO2 retrieval comparisons for Indonesian Volcano on 11/27/2017.

Comparisons between Dobson Total Ozone and OMPS NOAA_NPP_NM_V8 (Ver. Feb_2019)

Koji Miyagawa and Irina Petropavlovskikh

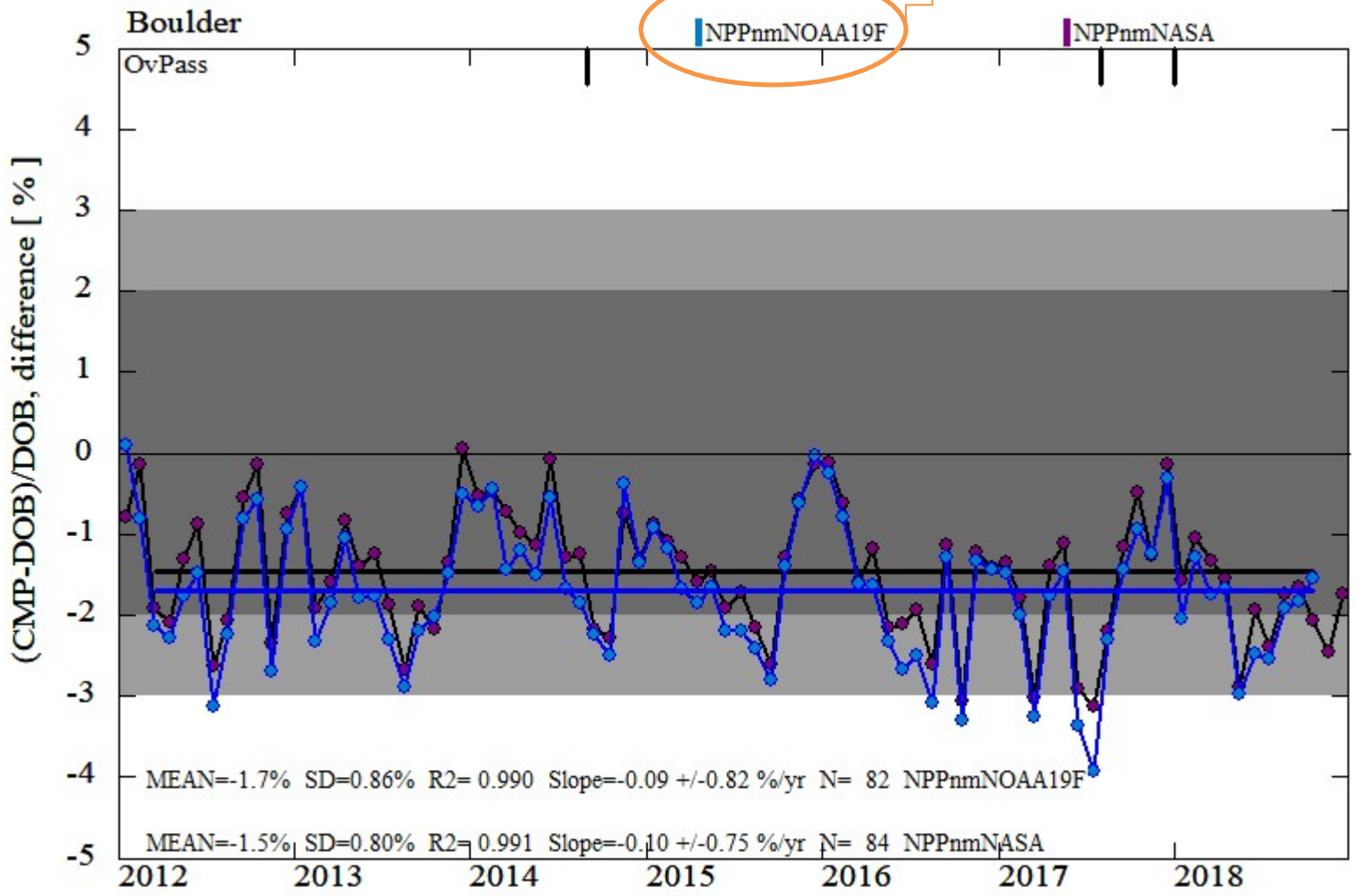
February, 2019

Overpass Data Sets

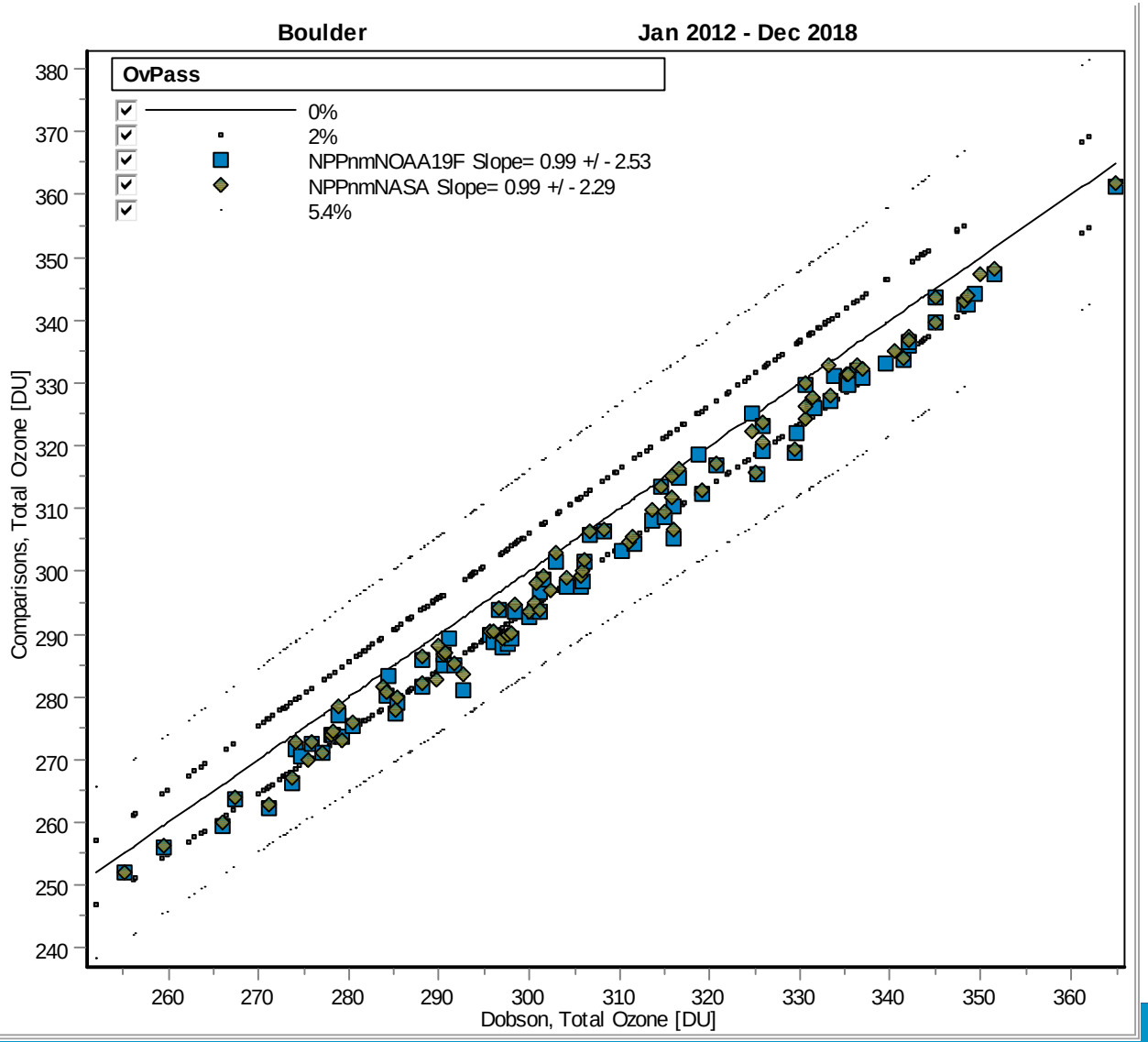
- OMPS NOAA_NPP
  - NM: Jan 2012 - Nov 2018
    - Closest_Dist < 50 km
    - ftp://ftp.star.nesdis.noaa.gov/pub/smcd/spb/ozone/irina/NPP/NM/V8/reproc_feb_2019/
- OMPS NASA_NPP
  - NM: Jan 2012 – Present
    - Closest_Dist < 50 km
    - ftp://toms.gsfc.nasa.gov/pub/omps_tc/overpass/suomi_npp_omps_l2ovp_nmto3_v02_boulder.co_067.txt
- Dobson
  - Temperature adjustment based on McPeters and Labow (2011) seasonal climatology for 40-50N.
  - B&P Ozone Cross Sections

Boulder
Monthly mean (Matched ADDS)

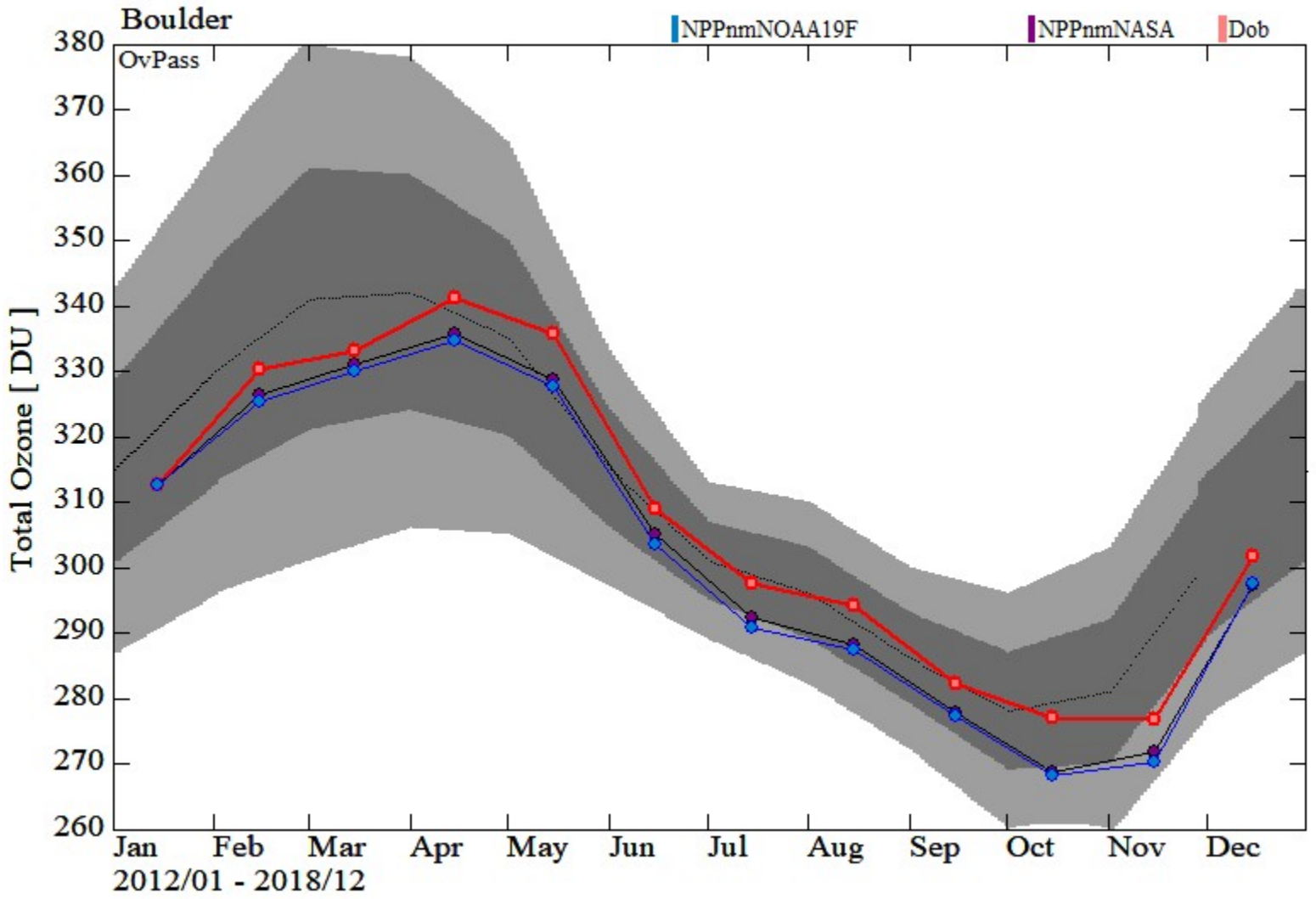
NOAA OMPS, Revised Feb 2019



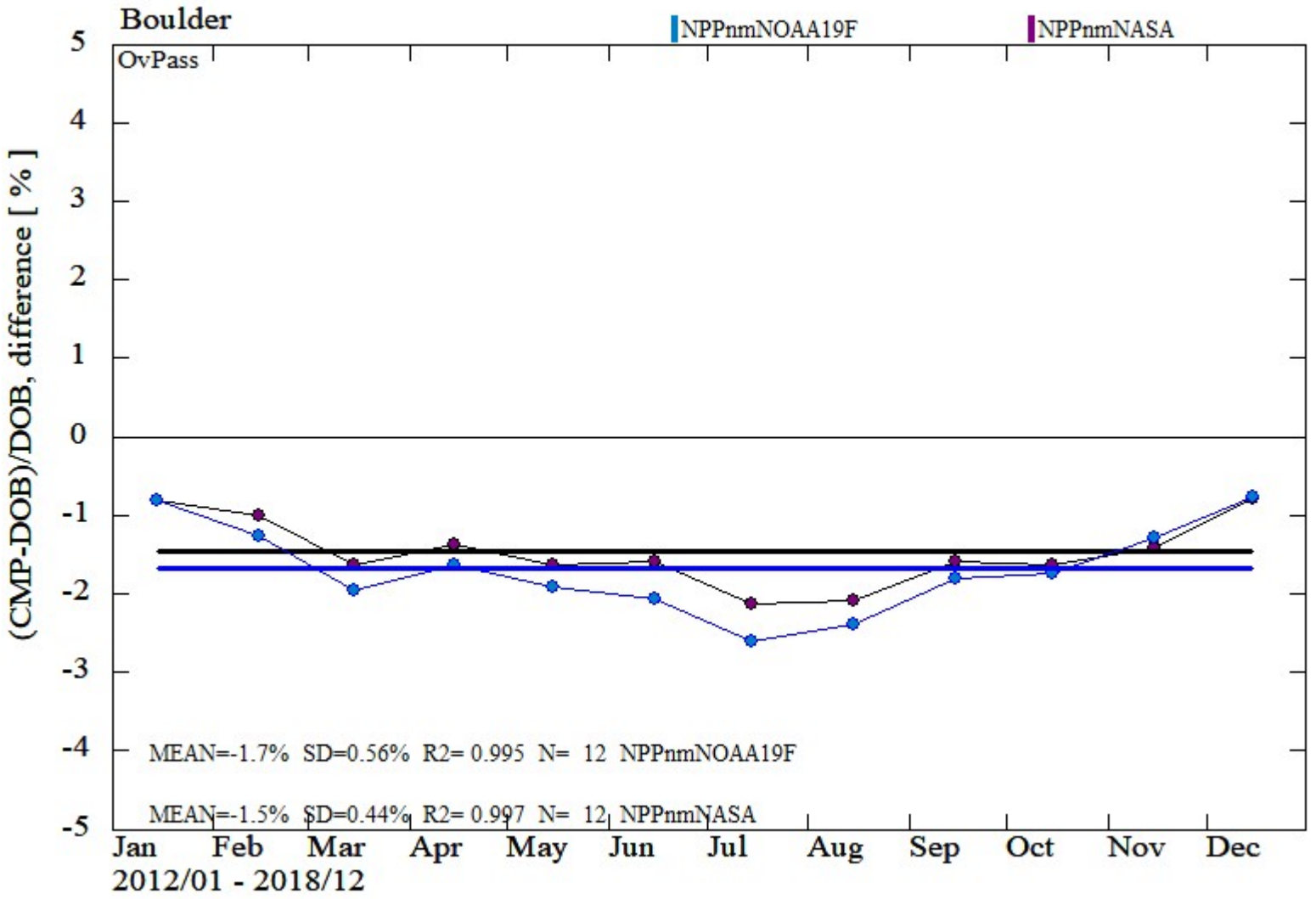
Boulder Monthly mean scatter plot (Matched OMPS and ADDS Dobson)



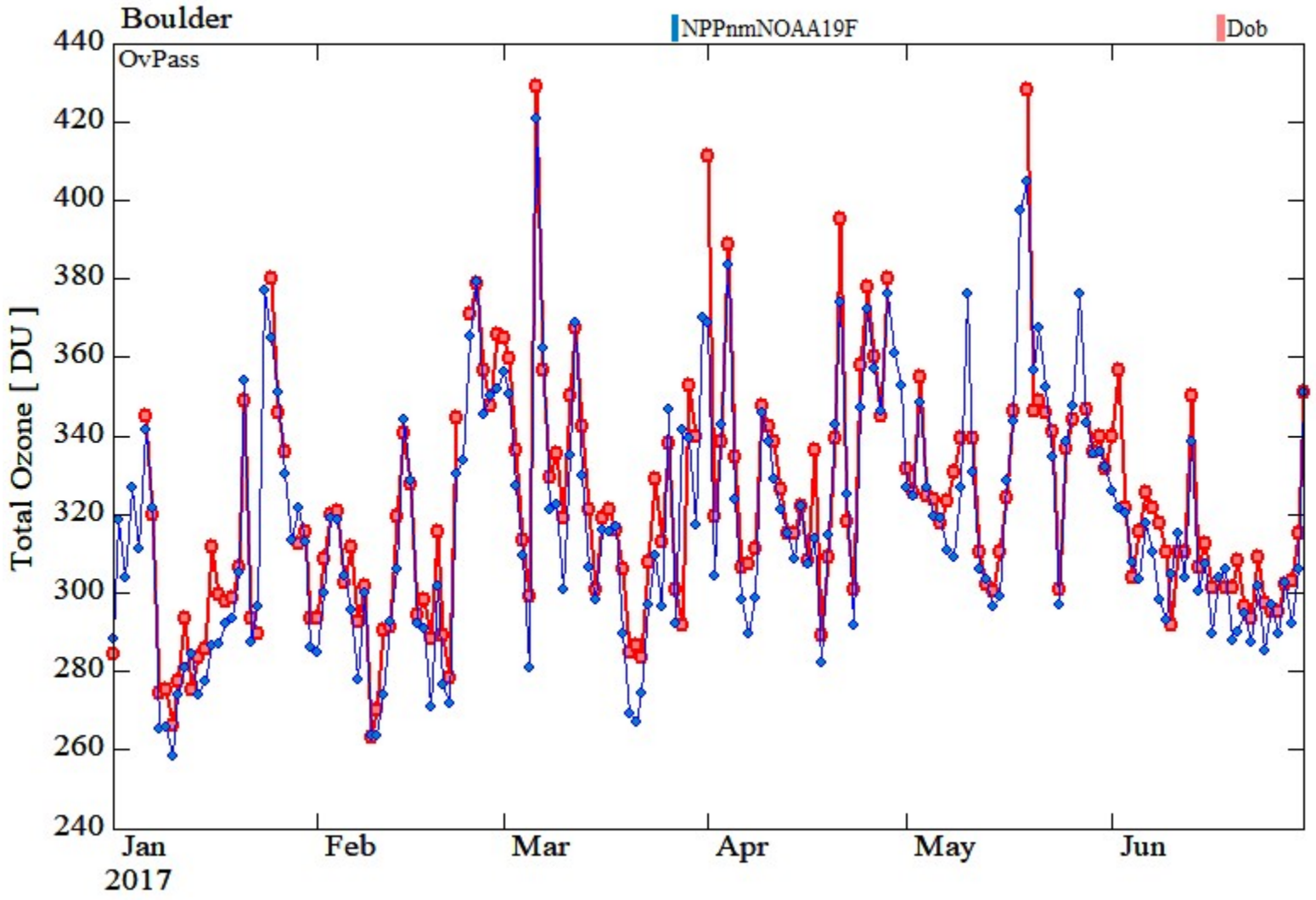
Boulder
Annual Cycle (Matched ADDS)



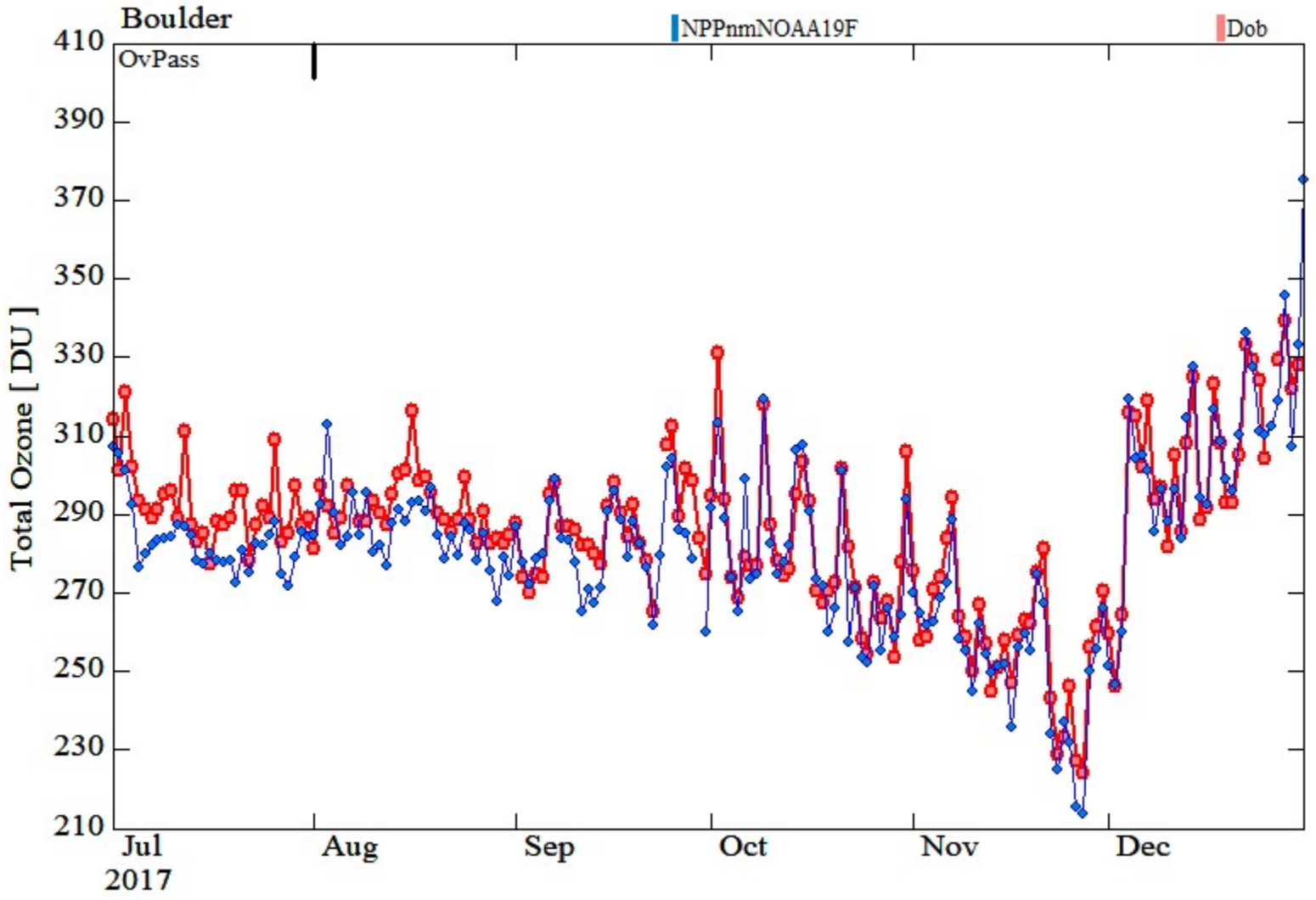
Boulder
Seasonal Bias, % (Matched ADDS)



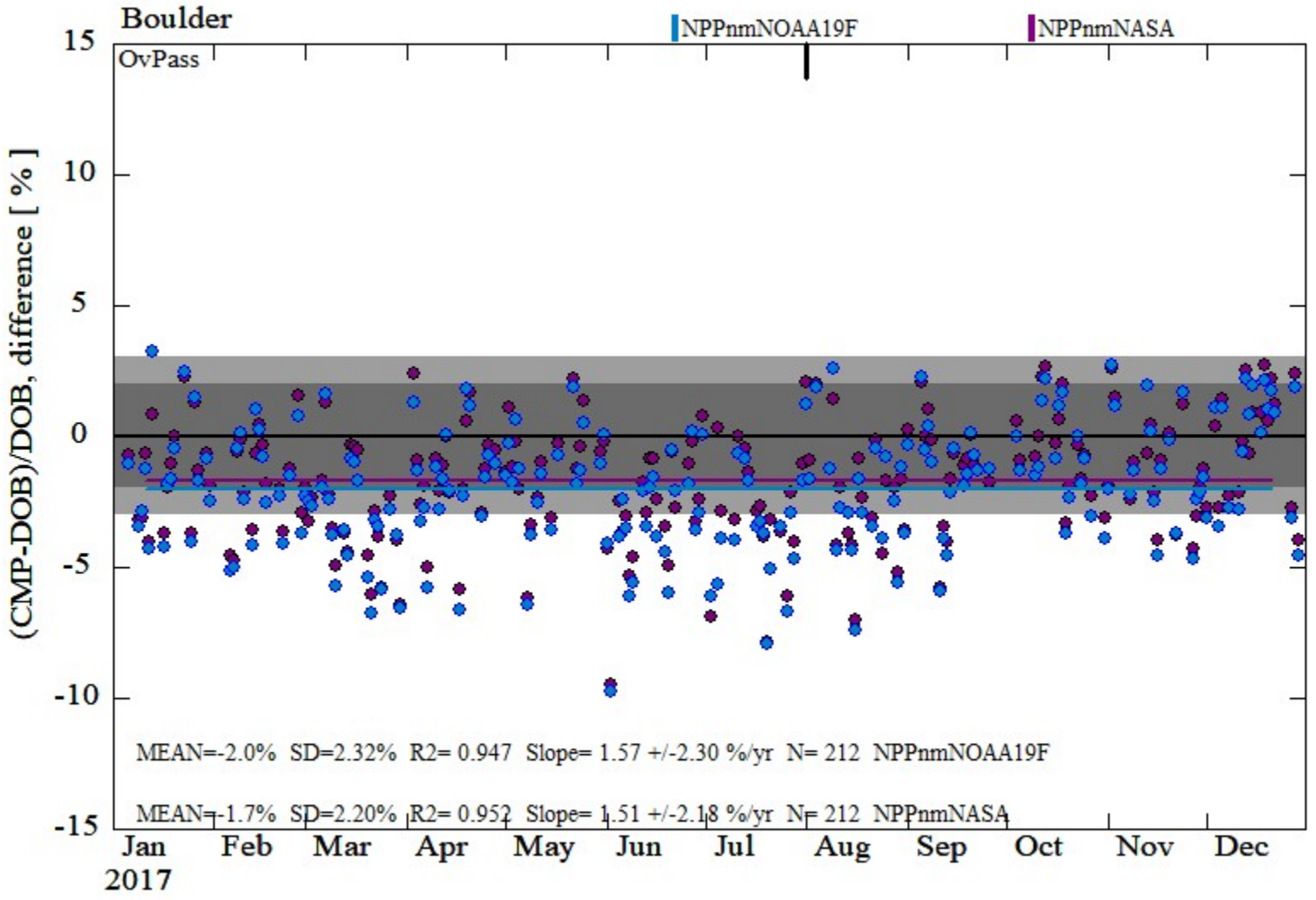
Boulder
1-6/2017 Daily



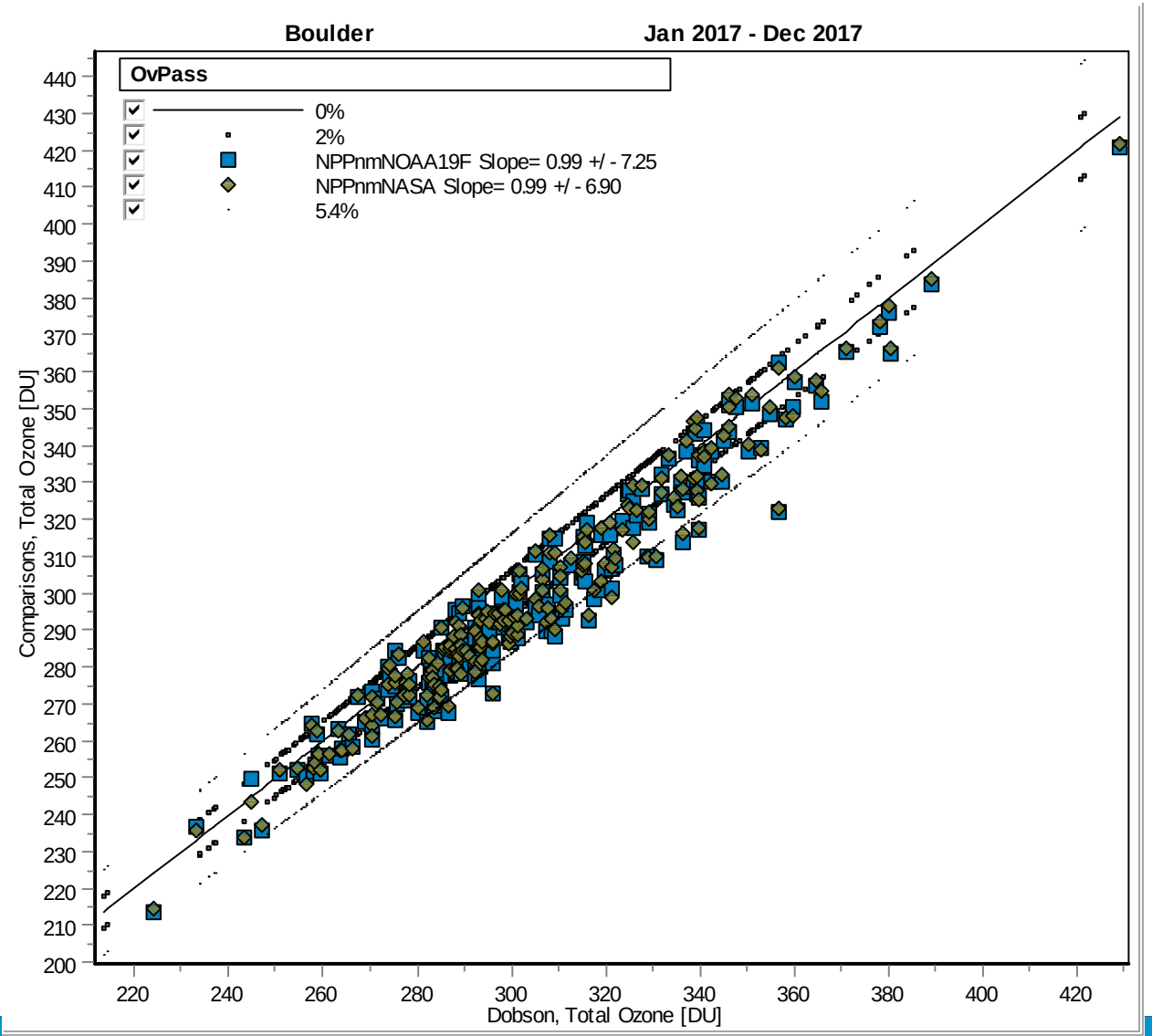
Boulder
7-12/2017 Daily



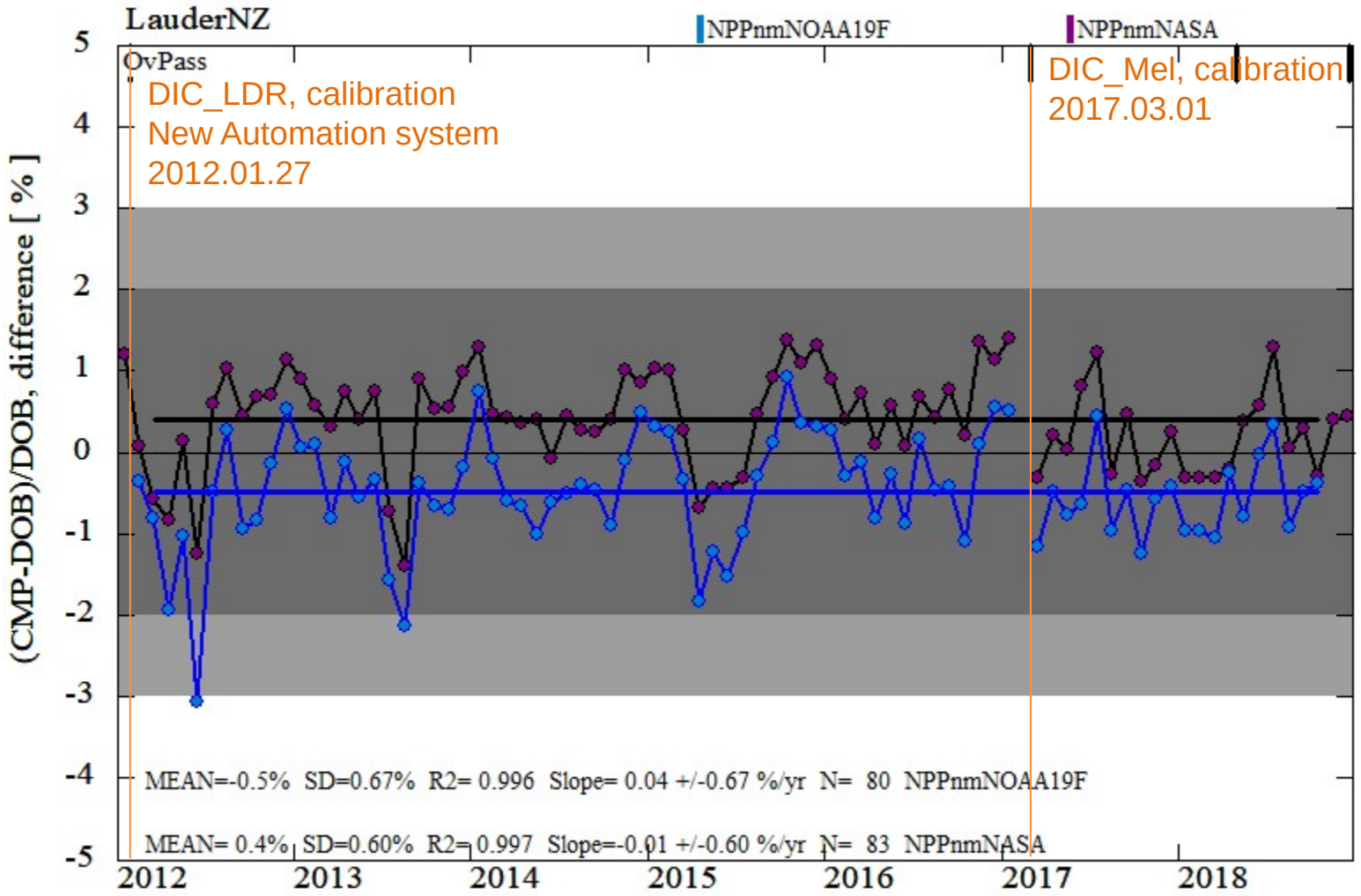
Boulder
% difference, 2017 daily (Matched ADDS)



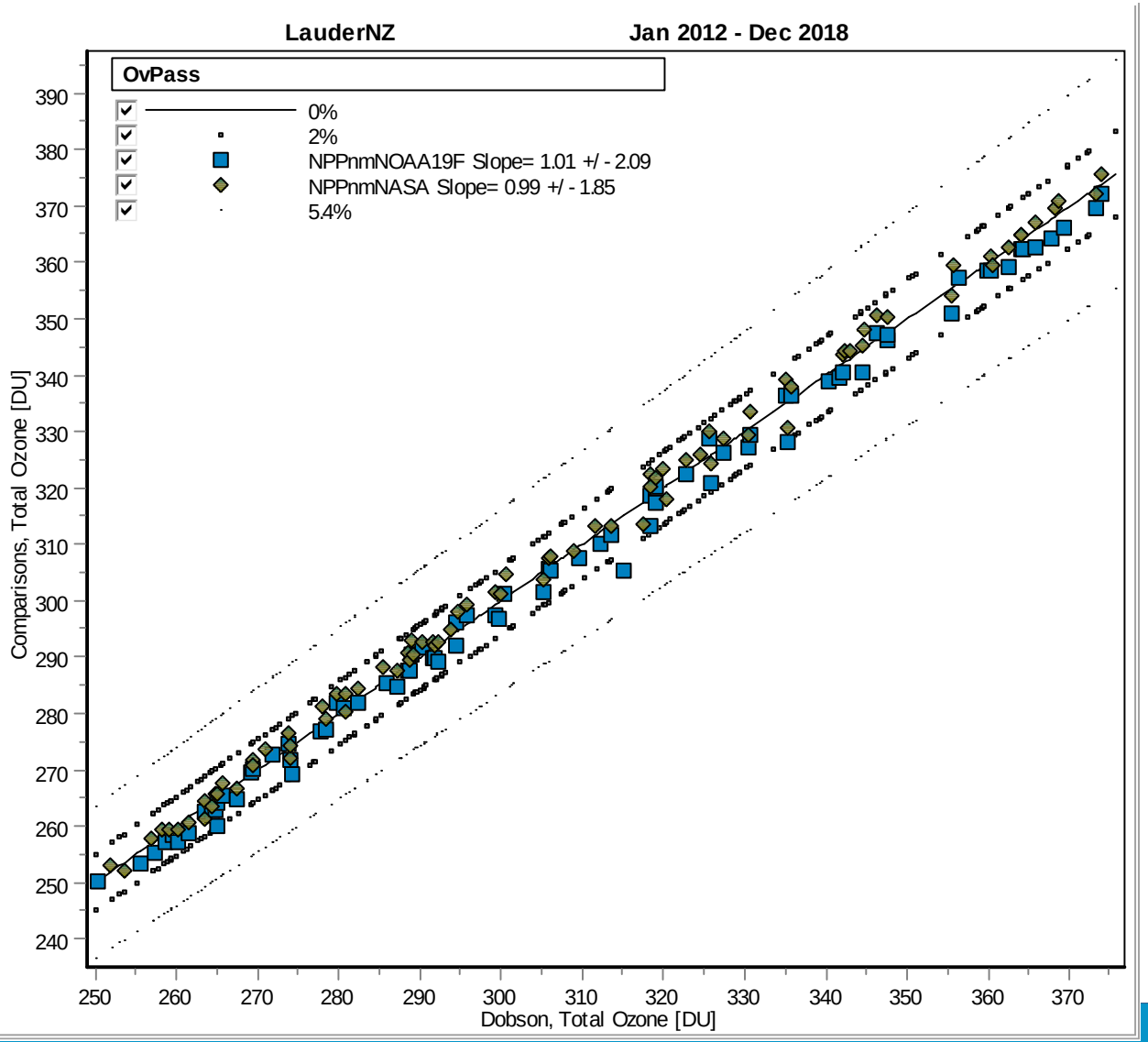
Boulder
2017 daily scatter plot (Matched ADDS)



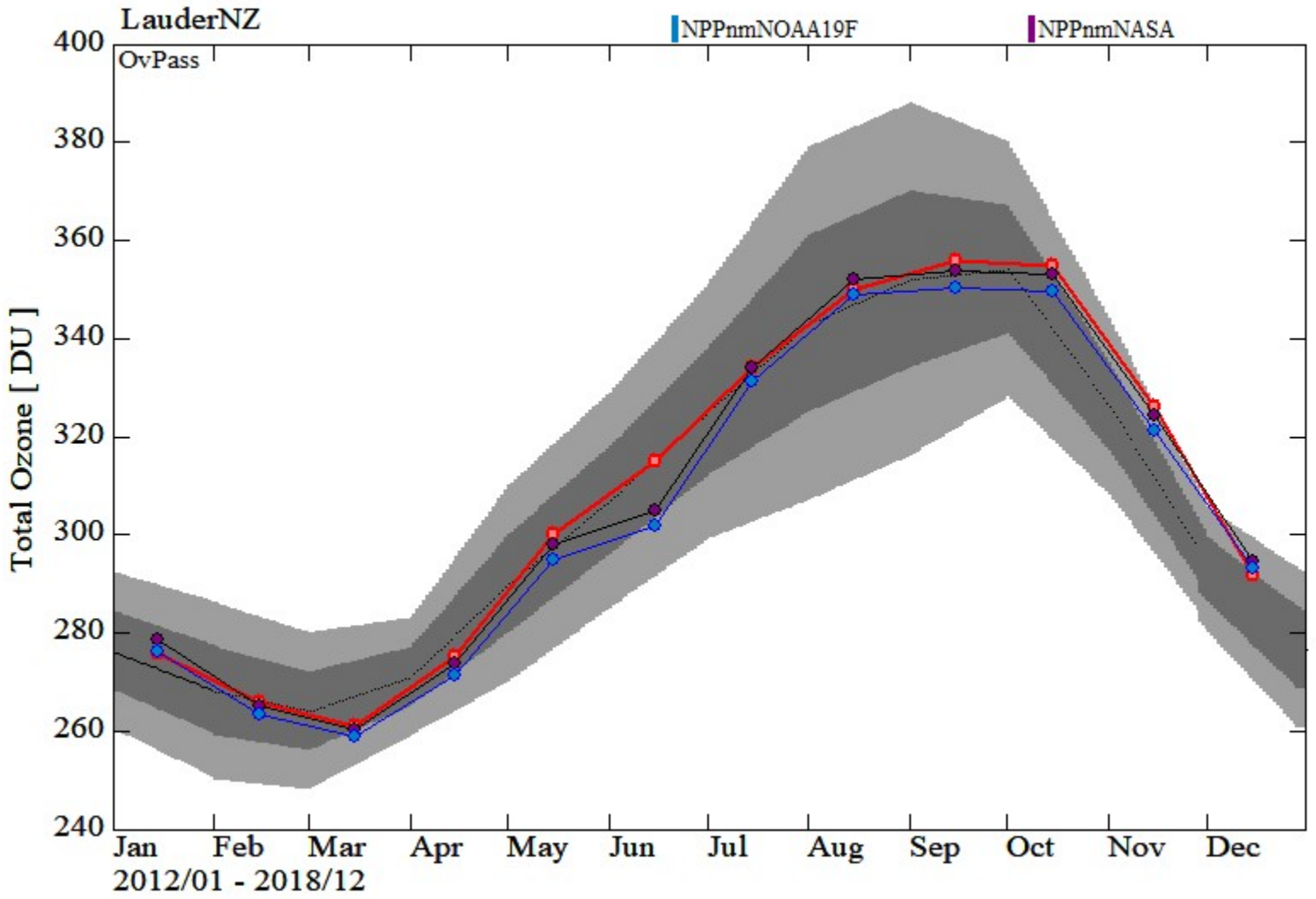
Lauder
Monthly mean (Matched ADDS)



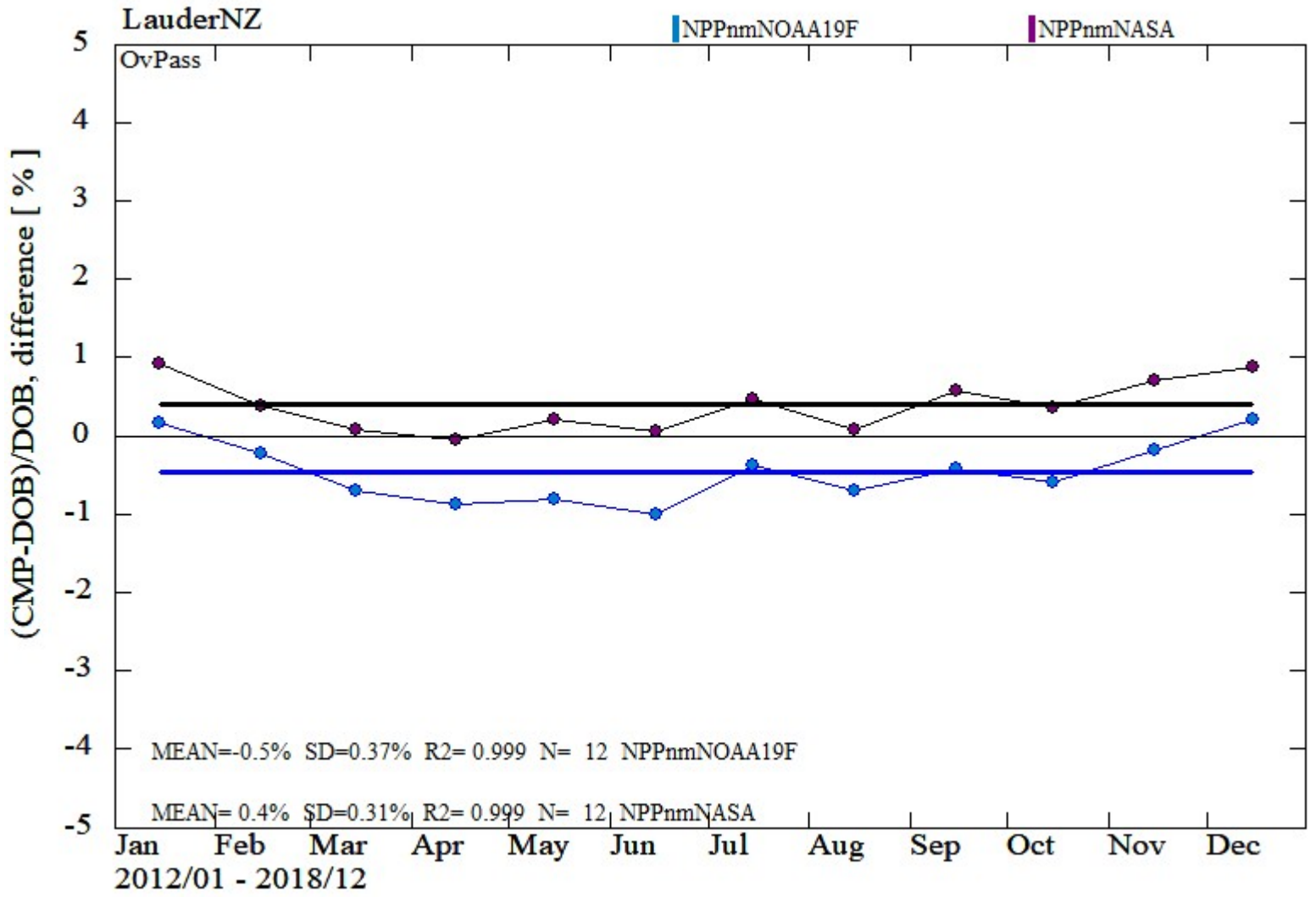
Lauder
Monthly mean scatter plot (Matched ADDS)



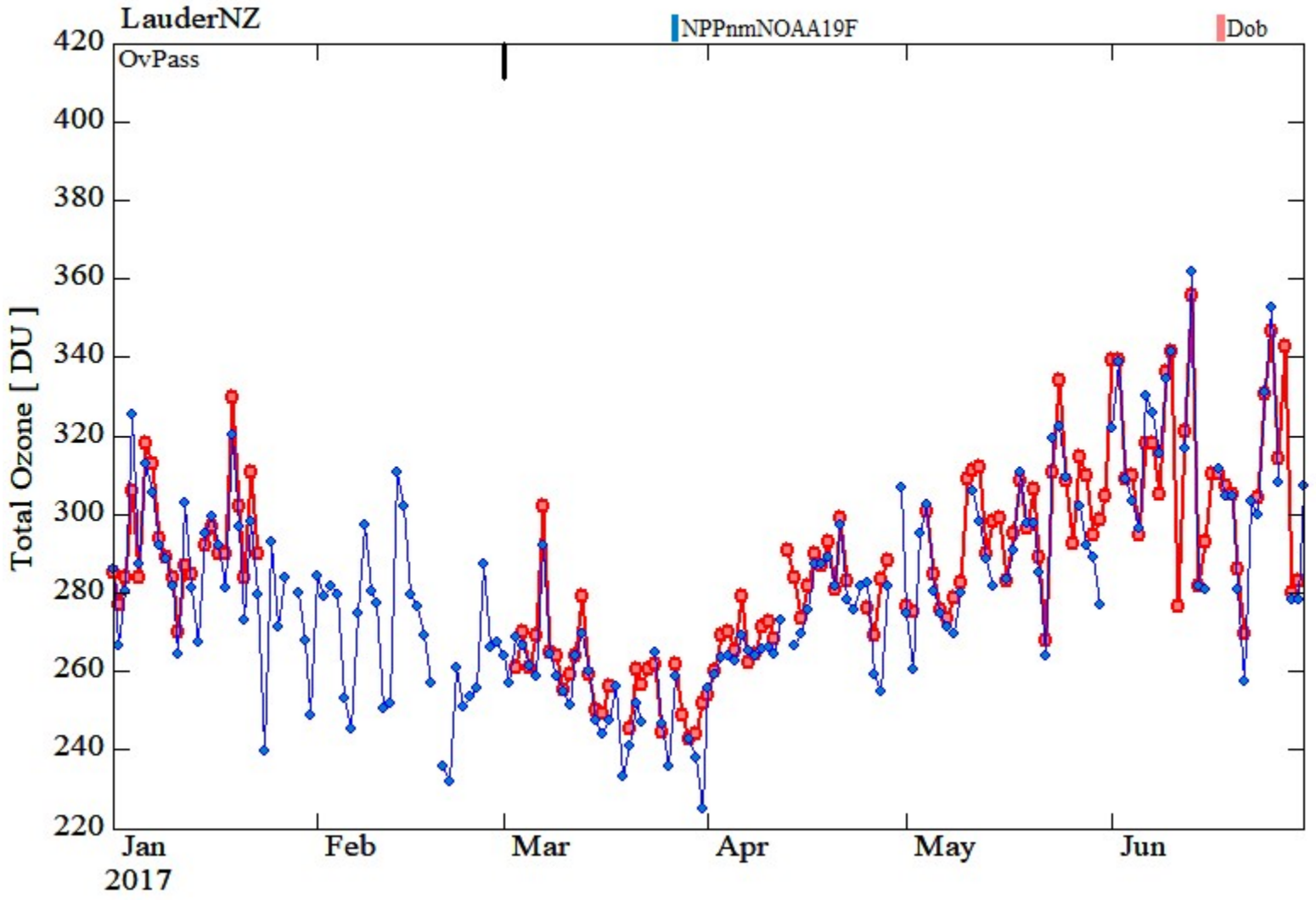
Lauder
Annual Cycle (Matched ADDS)



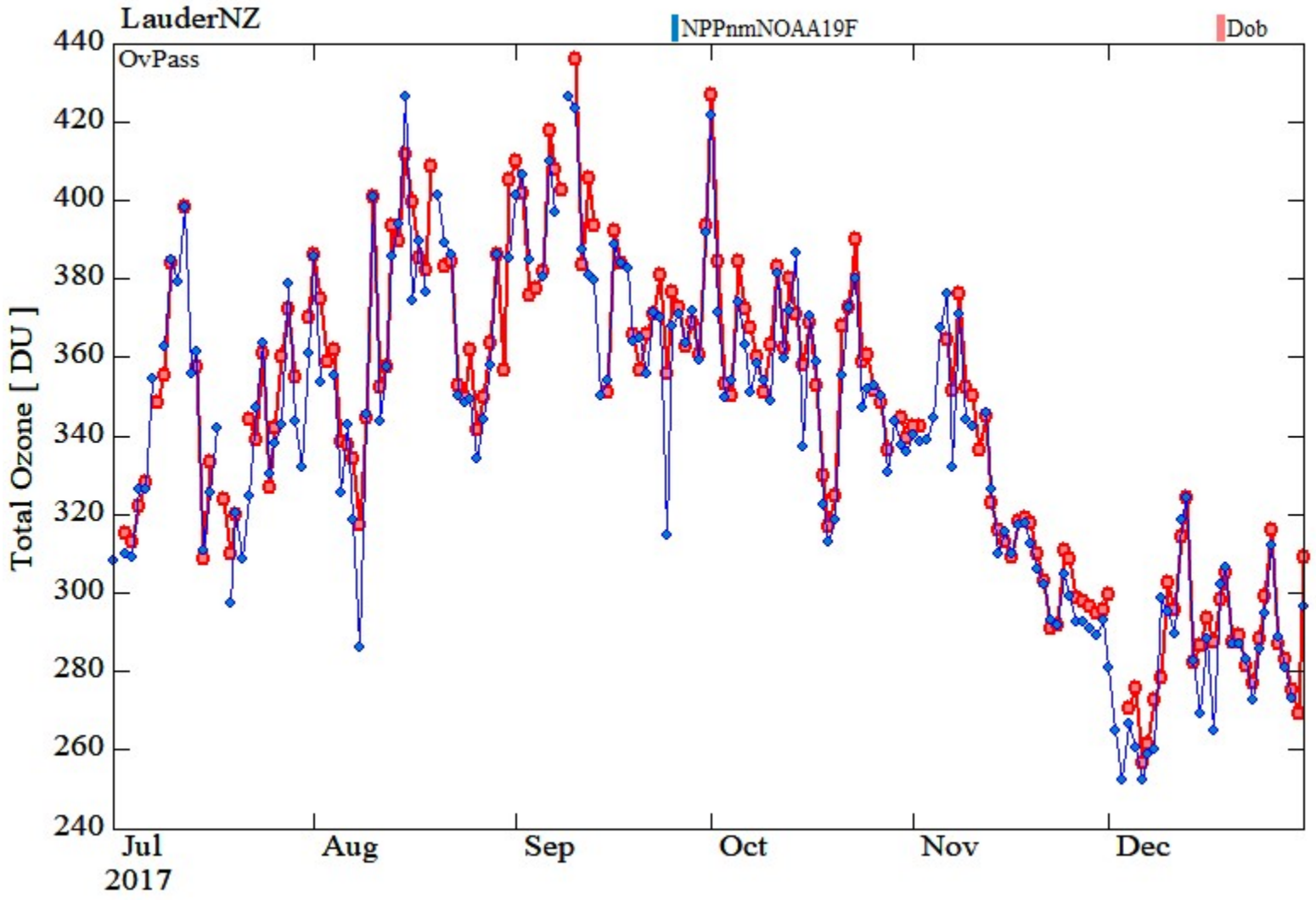
Lauder
Seasonal Bias, % (Matched ADDS)



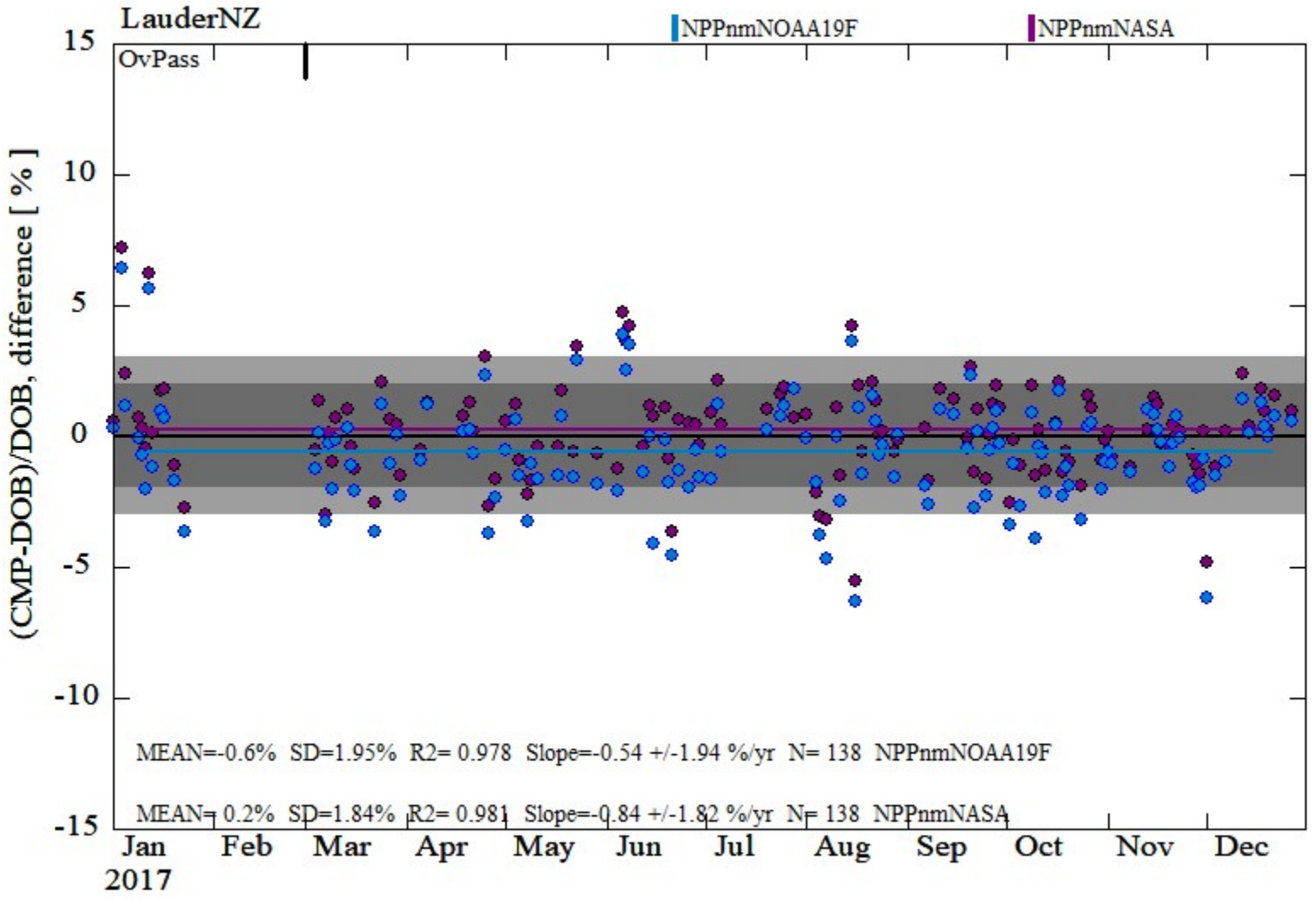
Lauder
1-6/2017 Daily



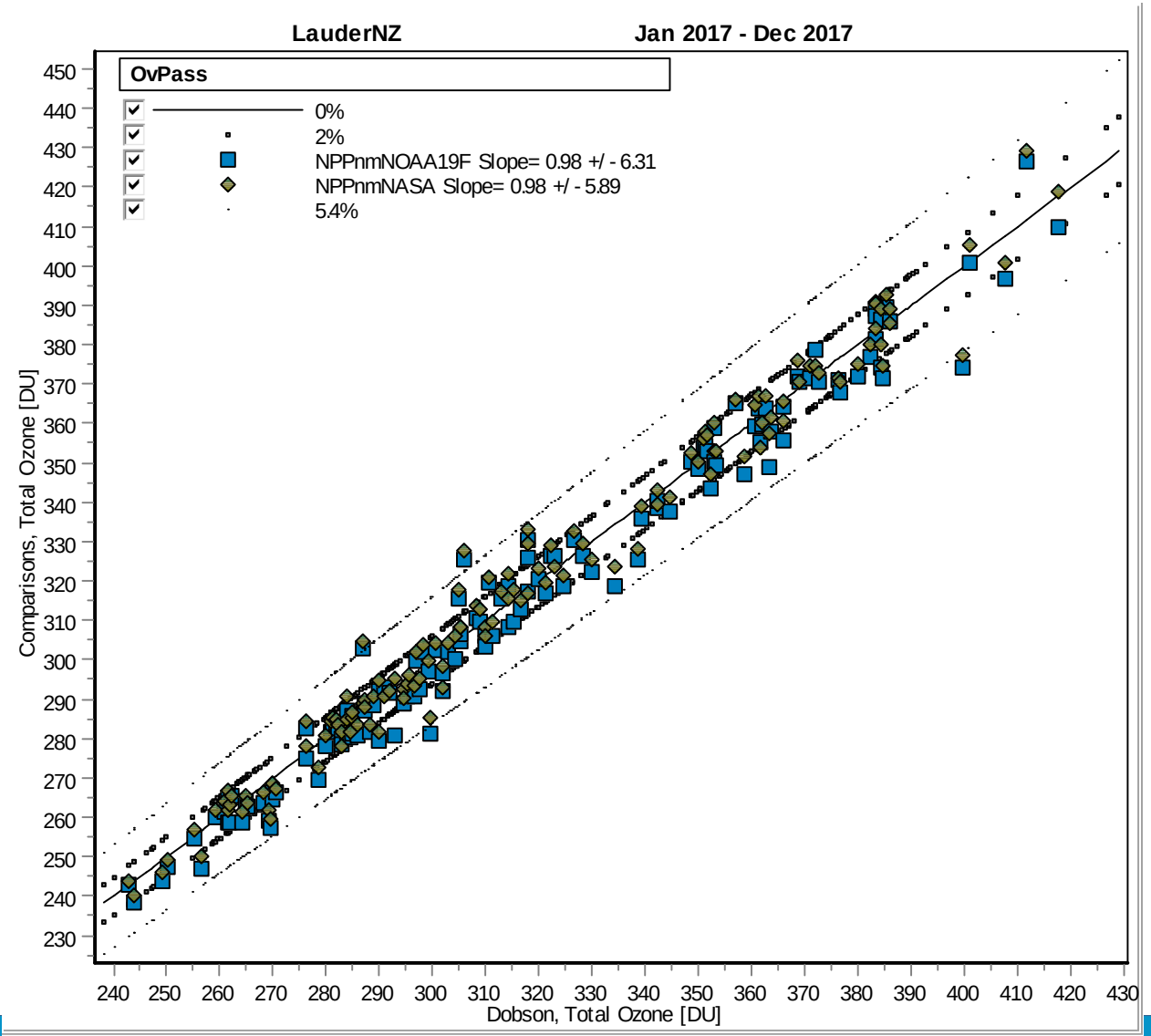
Lauder
7-12/2017 Daily



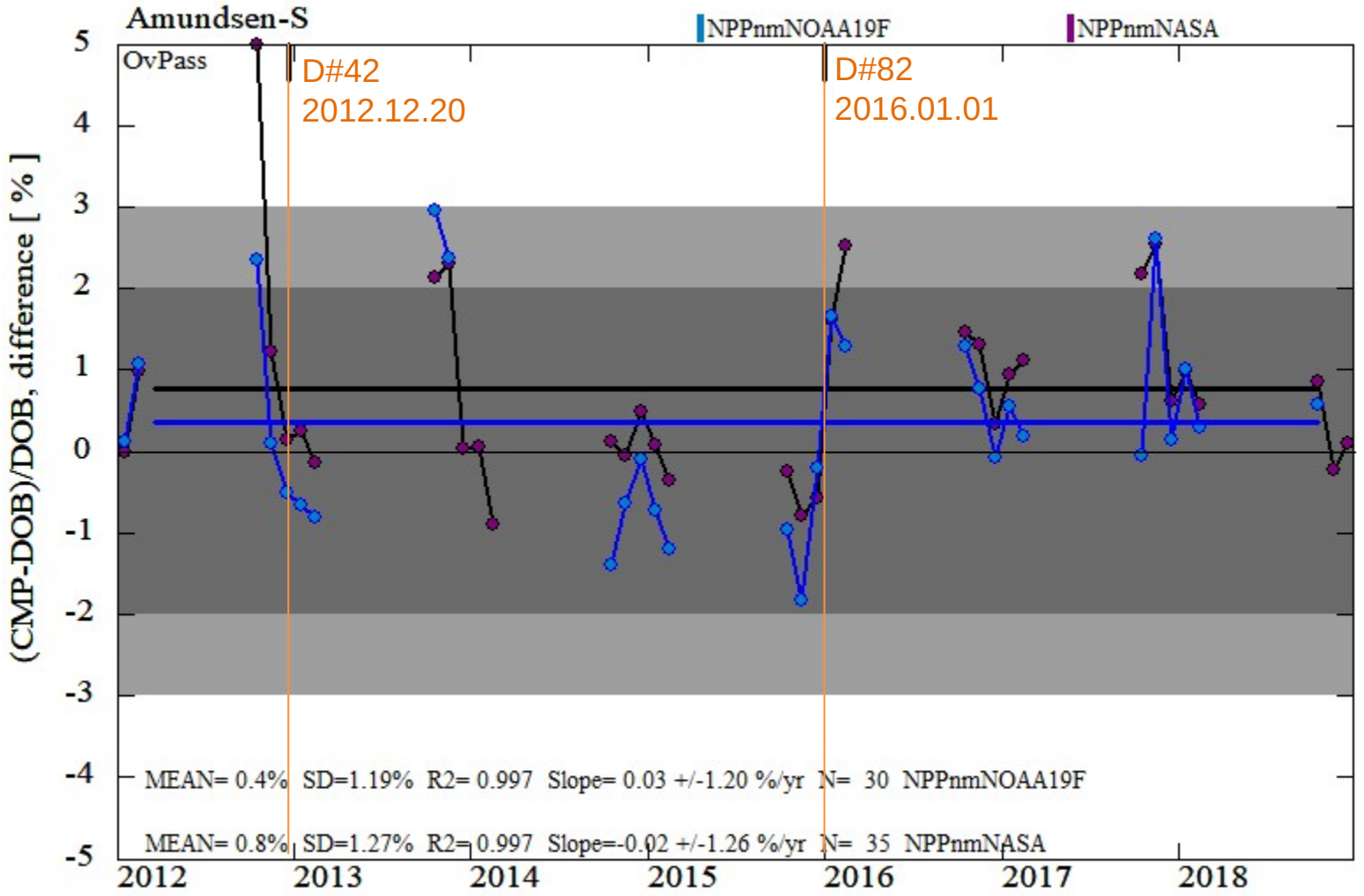
Lauder
% difference, 2017 (Matched ADDS)



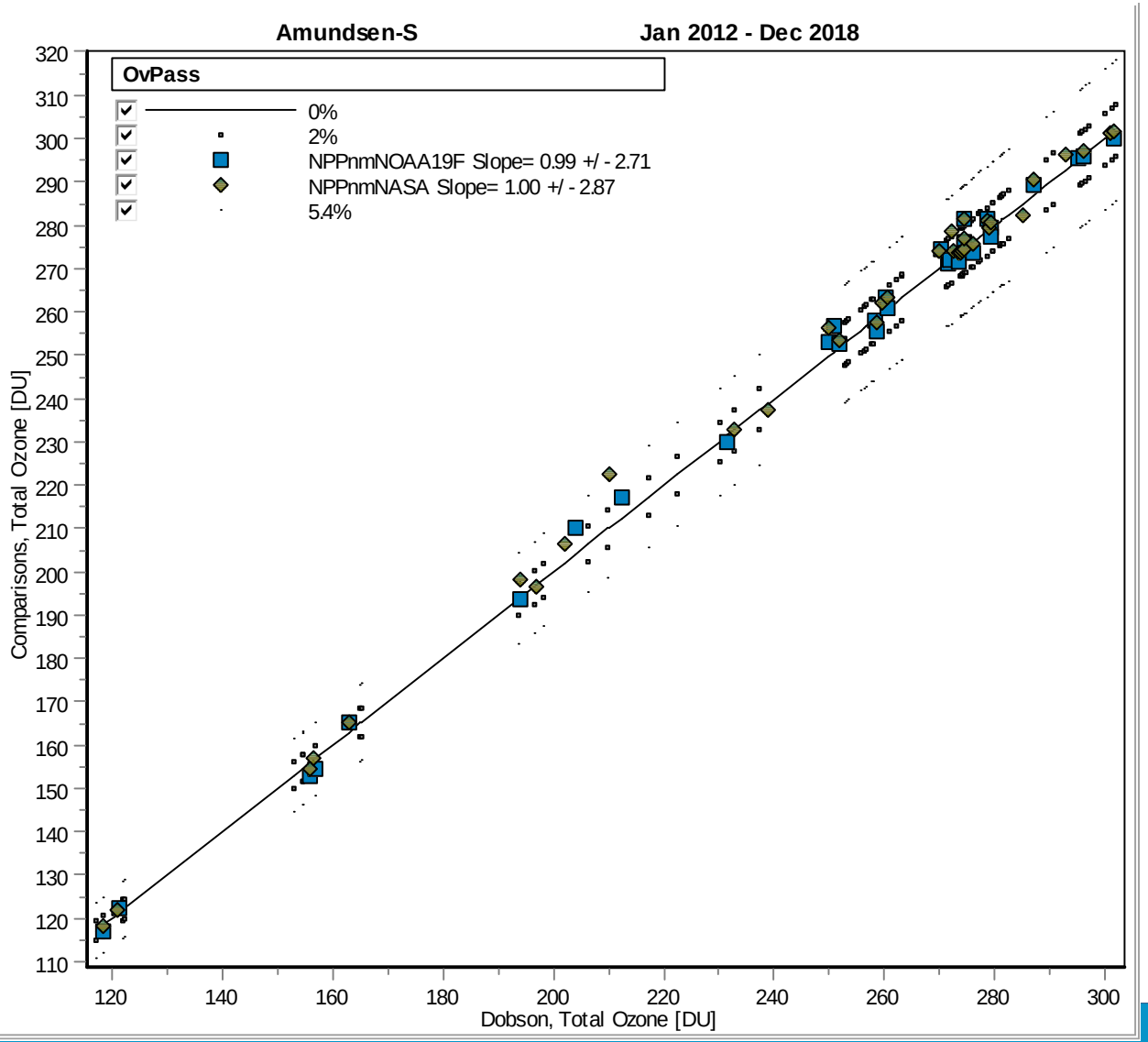
Lauder
2017 daily, scatter plot (Matched ADDS)



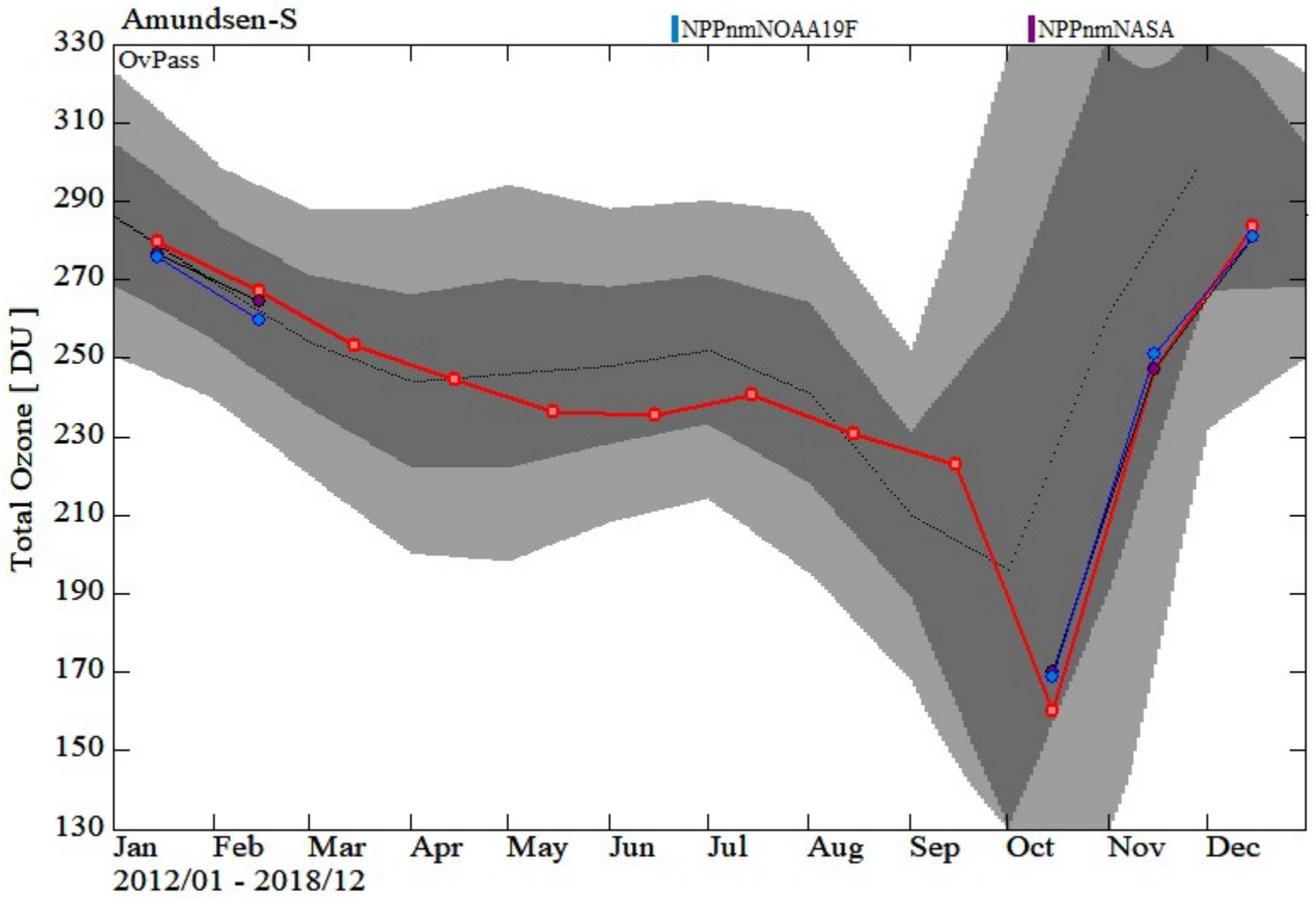
AMS (South Pole)
Monthly mean difference (Matched ADDS)



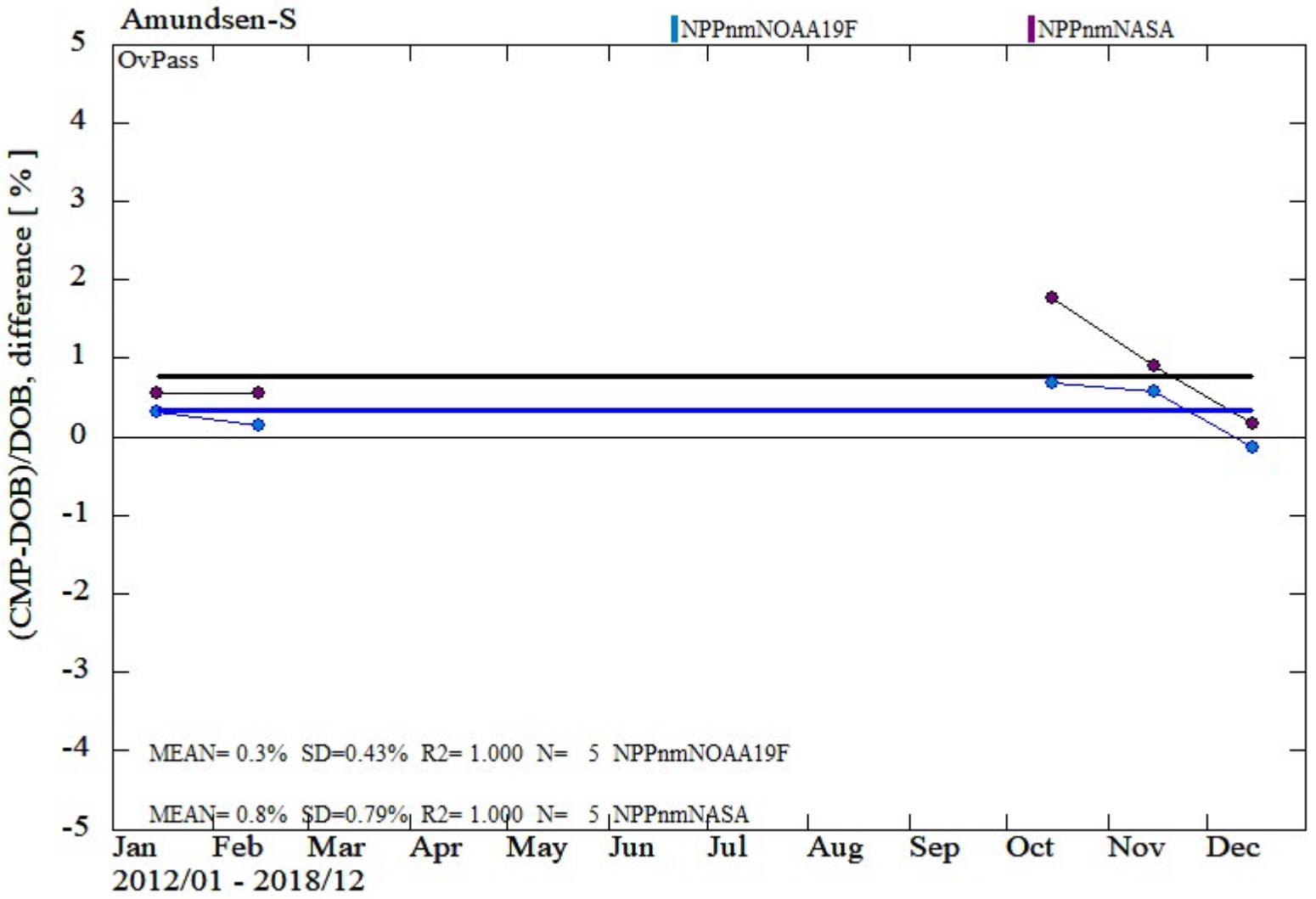
AMS (South Pole)
Monthly mean scatter plot (Matched ADDS)



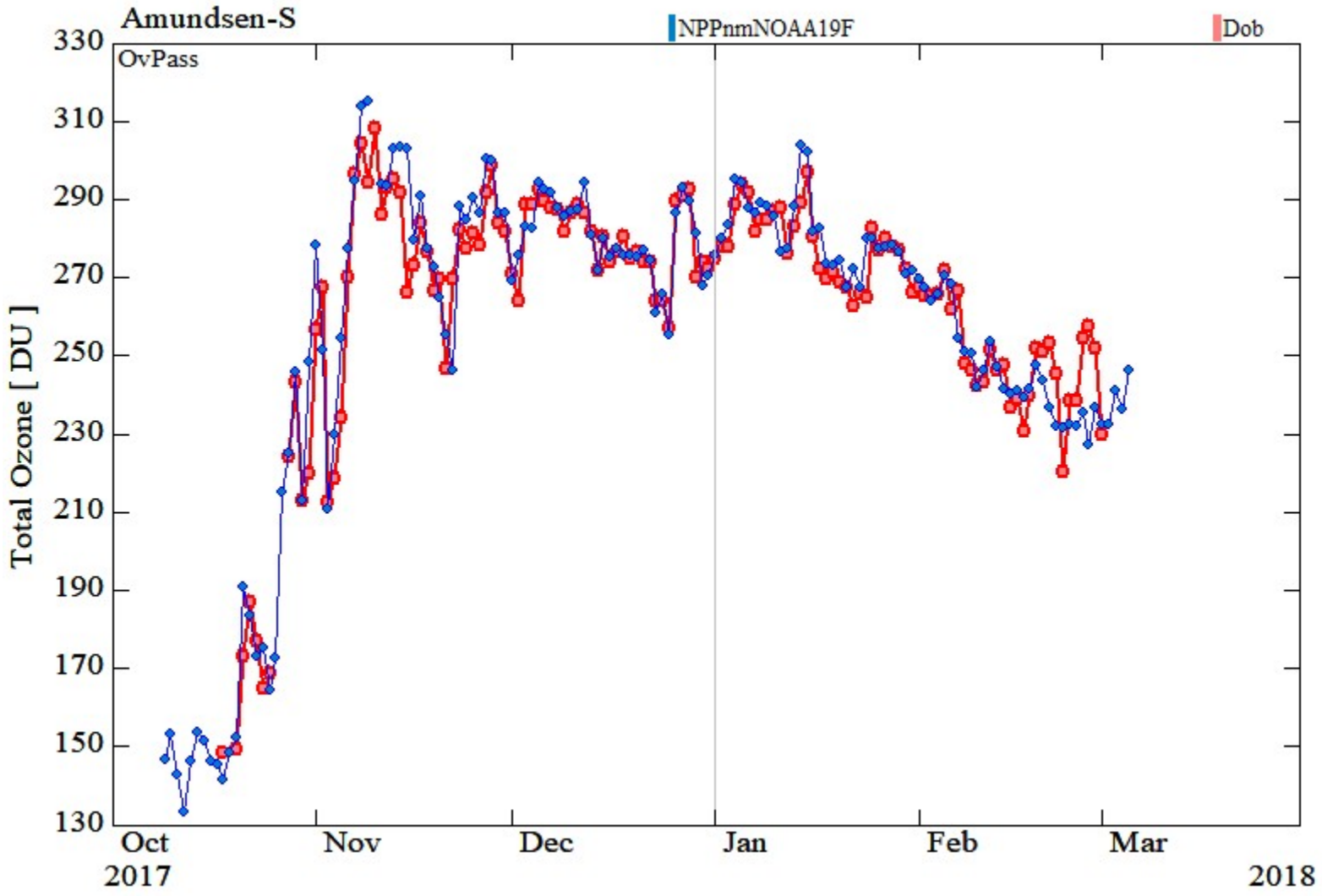
AMS (South Pole)
Annual Cycle (Matched ADDS)



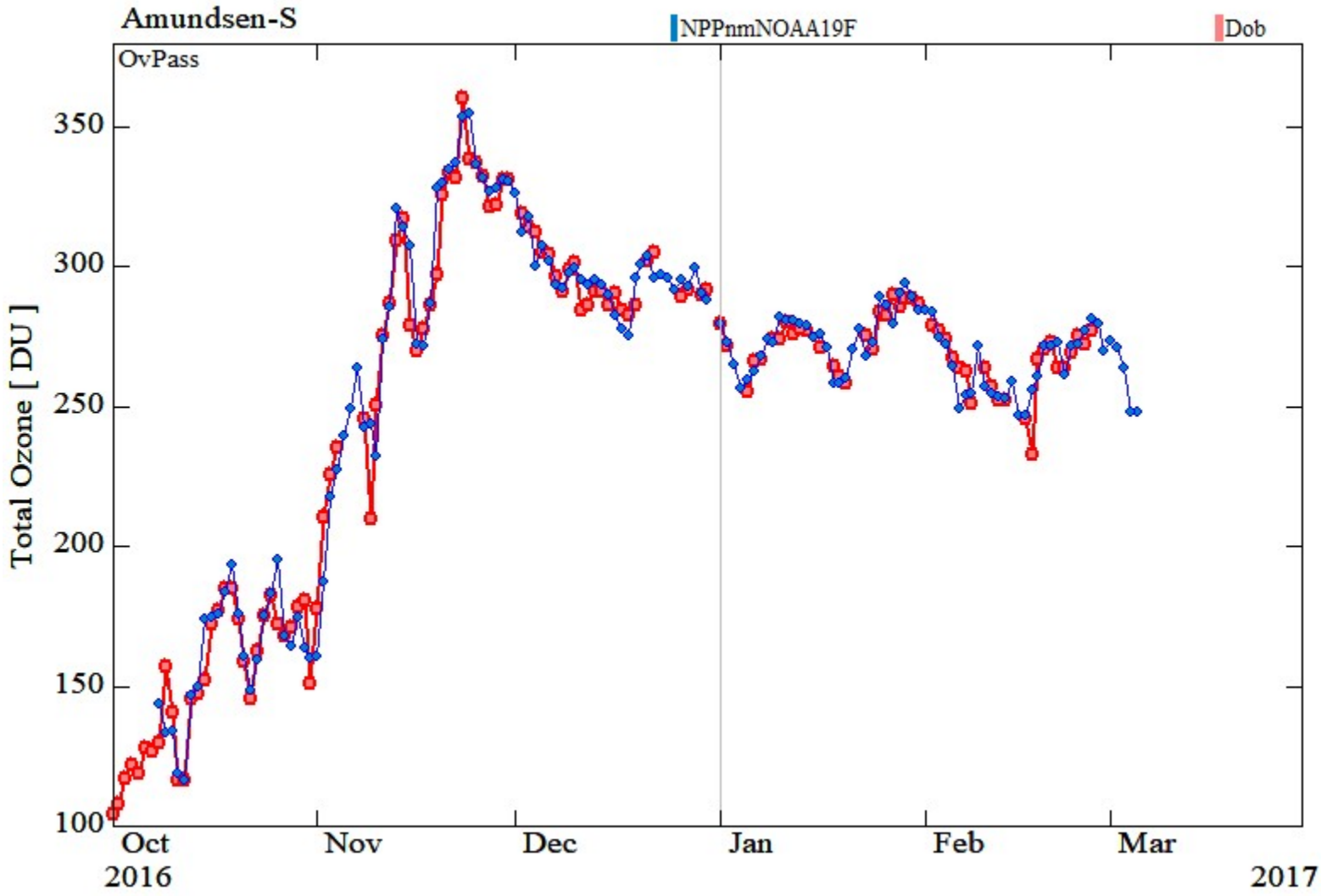
AMS (South Pole)
Seasonal Bias, % (Matched ADDS)



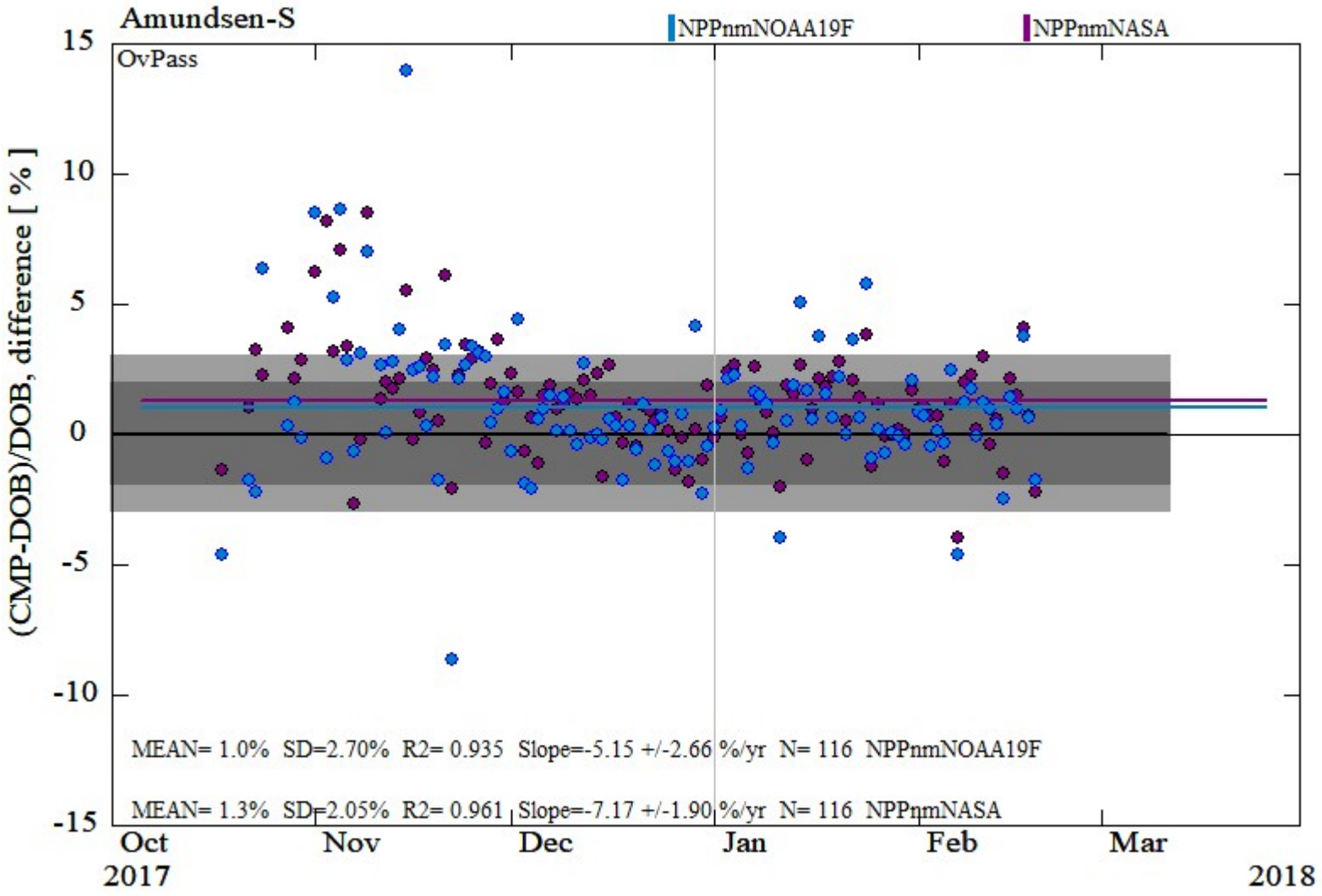
AMS (South Pole)
10/2017-3/2018 Daily



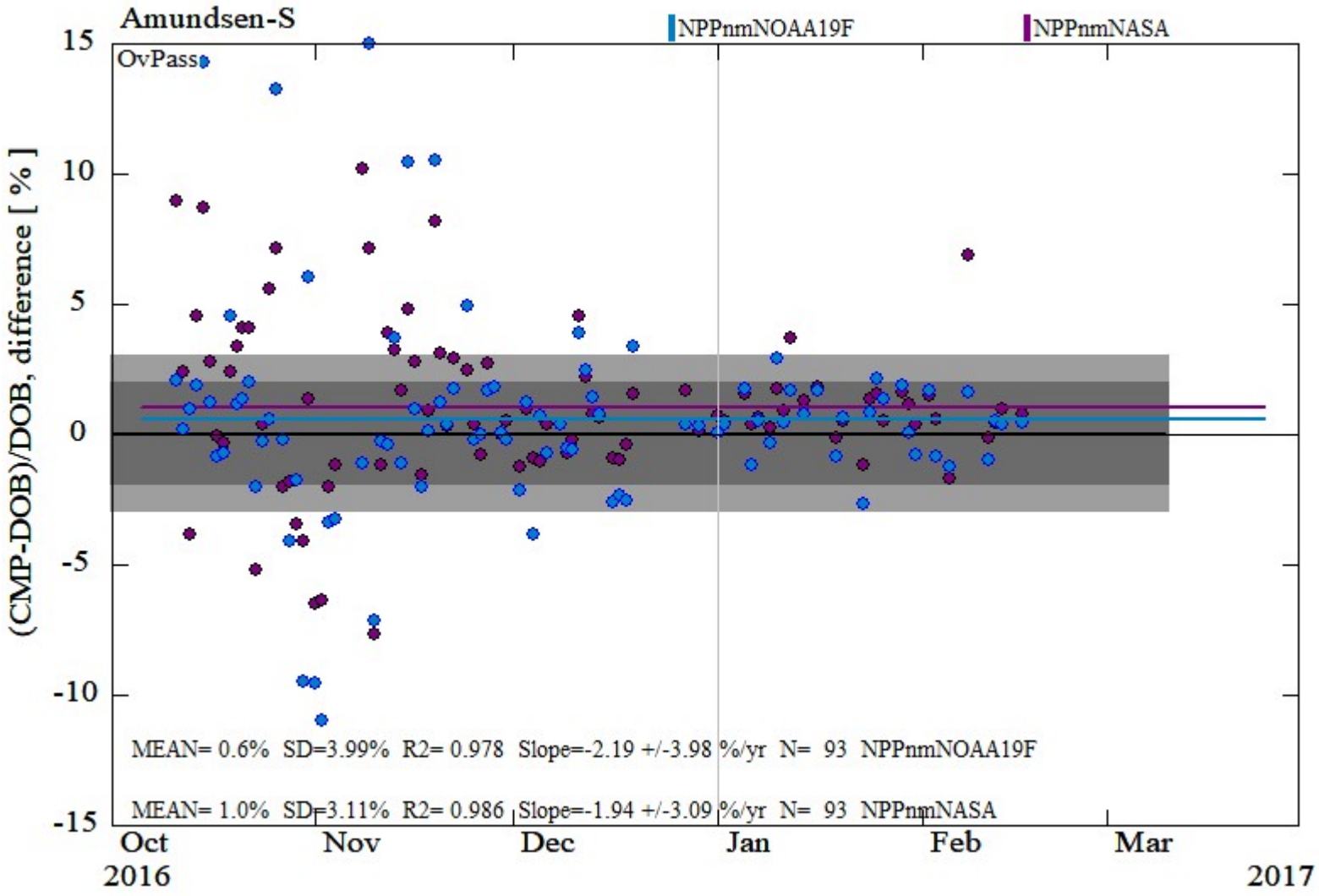
AMS (South Pole)
10/2016-03/2017 Daily



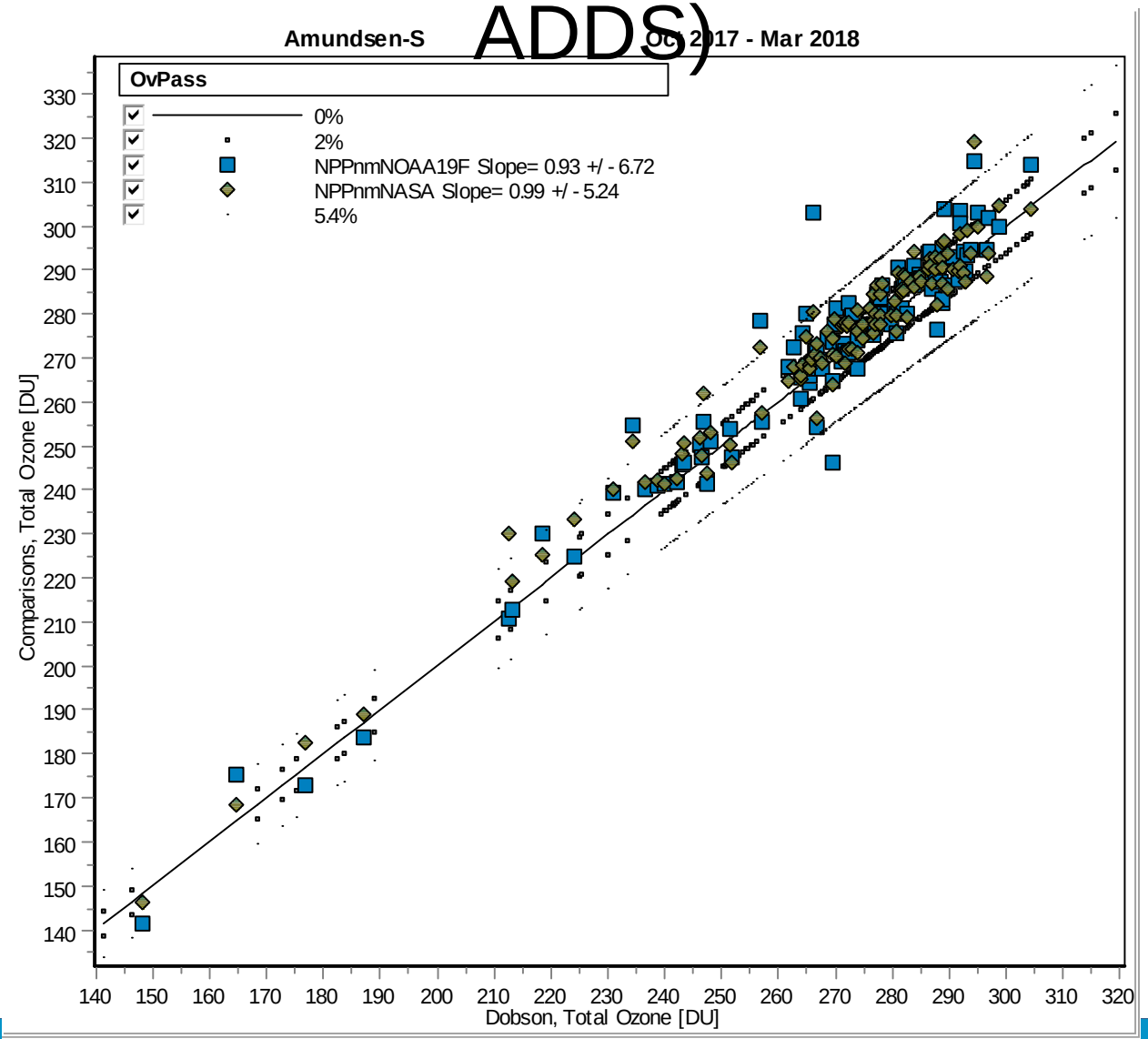
AMS (South Pole)
% difference, 2017 daily (Matched ADDS)



AMS (South Pole)
% difference, 2016 Daily (Matched ADDS)



AMS (South Pole) 2017-2018 daily scatter plot (Matched ADDS)



AMS (South Pole) 2016-2017 daily scatter plot (Matched ADDS)