



Read-me for Data Users

MEMORANDUM FOR: The JPSS Program Record
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SUBJECT: NOAA-20 OMPS Total Ozone EDR Validated Maturity Status
REVIEW DATE: September 19, 2019
EFFECTIVE DATE: April 19, 2019

1. Background:

The Joint Polar Satellite System-1 (JPSS-1) was successfully launch on November 18, 2017 and renamed NOAA-20 after reaching polar orbit. With the same design as that of the Suomi NPP OMPS Nadir Sensors, the NOAA-20 OMPS consists of two spectrometers each with different spectral and spatial coverage. The OMPS Nadir Mapper (NM) SDR has spectral coverage from 300 nm to 380 nm with 196 channels and 1.1-nm bandpass. The OMPS Nadir Profiler (NP) SDR has spectral coverage from 250 nm to 310 nm with 150 channels and 1.1-nm bandpass. The OMPS nadir suite provides global measurements of total ozone, ozone profile, sulfur dioxide, UV reflectivity and an aerosol index.

Forty-eight days after launch, on January 5, 2018, the NOAA-20 Ozone Mapper Profiler Suite (OMPS) opened its door and started collecting science data. The initial data was in a high-spatial-resolution limited-spectral mode and was not compatible with the operational EDR algorithms. Since February 13, 2018 the instrument has been operated in a medium resolution mode and the NDE processing of the IDPS SDRs has created ozone EDR products on the I&T string. Since April 19, 2019 the instrument has been operated in a higher spatial resolution mode and the SDR have been process to a mixed spatial resolution mode 17x50 km² at nadir.

The OMPS Ozone EDR team consists of experts from NOAA, NASA, IMSG, and industry partner Raytheon. The team has been working on OMPS EDR validation for the Total Column Ozone EDRs from V8TOz and V8TOS algorithms, and the Ozone Profile EDRs from V8Pro algorithm as processed operationally at NDE.

2. Validated maturity stage definition:

- 1) Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
- 2) 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.
- 3) Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
- 4) Product is ready for operational use based on documented validation findings and user feedback.
- 5) Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

3. **Justifications for declaring OMPS EDR data products validated maturity:**

The OMPS SDR and EDR team members have been analyzing the OMPS science RDR, telemetry RDR, SDR and GEO and EDR data products for the last nineteen months. Based on their analysis the following assessments of the OMPS SDR and EDR products were compiled:

- The SDR team reported that the performance for the SDRs met provisional maturity starting on July 2, 2018. The SDR noise level are as expected and weekly updates are used to maintain them adequately to meet EDR precision requirements. Additional improvements on the path to validated maturity were also identified. Please see the caveats in the memo of record from March 20, 2018 and further caveats on the SDRs in this memo. The SDR Team is briefing the OMP NM SDR validated maturity concurrent with the V8TOz briefing;
- The EDR Team delivered revised algorithms and tables to NDE in April 2018 for implementation in the operational processing system to improve the product quality. These revisions (v3r1 for V8TOz and v3r1 for V8TOS) were promoted to the I&T stream at NDE starting in August 2018 and to operations in December 2018;
- The NDE Operational system has been routinely creating the V8TOz EDR with good coverage and performance;
- The product performances with these revisions meet requirements;
- The product error flags are functioning as designed and are identifying deficient products and compromised viewing conditions;
- The NOAA-20 V8TOz EDR products have been adjusted to agree with S-NPP V8TOz EDR products – NOAA-20 ozone results are similar to those for S-NPP with differences as noted below and in the Validated Maturity briefing;
- On-orbit SDR radiometric biases were estimated based on comparisons with Suomi NPP OMPS, EOS Aura OMI and NOAA-19 SBUV/2 EDR measurement residuals and retrieval product sensitivities. These were used to generate the initial Total Ozone EDR adjustments provided to NDE. Further rounds of adjustments will be constructed and provided as the SDRs are modified with the latest set of tuned calibration tables; and
- NOAA-20 OMPS EDR data products are ready for the full range of applications and science studies.

The presentations and Readmes for the OMPS NM SDR and V8TOz EDR products justifying their advances to beta, provisional and validated maturity can be found at

<https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>

4. **Updates on NOAA-20 OMPS Total Ozone EDR Provisional maturity caveats**

The following caveats are provided to validated-EDR product users:

- 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) transferred 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. **Only data products before October 2018 suffer from this problem.**
- The provisional recommendation was to only use products for cross-track positions #3 to #33 as some 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 errors are magnified at higher solar zenith angles. **This limitation is removed effective April 19, 2019; current and future adjustment tables are providing and will**

- provide good performance at all cross-track positions.
- The first round of updates to the NOAA-20 OMPS sample tables did 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 implemented (DR 8617). A full set of SDR tables (including wavelength, solar, and stray light) have been tested and were implemented for use with the new sample table and are in IDPS as of March 19, 2019.
- 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 will 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 validated maturity levels. The current adjustment tables are adequate to achieve validated maturity. An even better set of adjustments will be delivered to NDE once SDR tables updates are complete;
- The V8TOz is setting residual limit flags (Error Codes 4 and 5) in the South Atlantic Anomaly more frequently for NOAA-20 than is observed for S-NPP. This is expected given the smaller FOVs provided by the NOAA-20 products.
- Tuning and refinement of the stray light corrections, calibration coefficients, wavelength scales and Day 1 Solar are continuing for the NM SDRs. Changes in these may impact the absolute accuracy of the V8TOz EDRs and affect the final V8TOz EDR adjustments. In particular, ADR9093 provides new SDR tables and turns back on the measurement-based intra-orbital wavelength scale adjustments.

5. Path Forward

The team will work to continue with the following planned calibration and validation tasks after promotion of the OMPS EDR data products to maintain validated maturity:

- 1) 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;
- 2) Estimate and monitor cross-track bias in the 12 channels used in the V8TOz EDRs from weekly statistics segregated by cross-track position;
- 3) Investigate methods to reduce the effects of transient signals and noise in the medium resolution NM SDR on the V8TOz EDRs. One 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;
- 4) Track the impact of continued improvements in the SDR as planned by the SDR team; and
- 5) Provide deliveries of adjustment tables and code changes for V8TOz to NDE as SDR characterization progresses and validation results are analyzed and updated.
- 6) Implement a measurement-based cloud-top-pressure module as part of the V8TOz to improve performance in cloudy situations relative to the current climatology-based ancillary data.

Additional information is available in the OMPS V8TOz and V8Pro algorithm theoretical basis documents (ATBDs) and the SDR beta and provisional maturity review briefings, which can be accessed at:

<https://www.star.nesdis.noaa.gov/jpss/Docs.php>

and



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<https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>

NOAA-20 OMPS SDR near-real-time status and performance monitoring web page are available by using the following password protected websites:

https://www.star.nesdis.noaa.gov/icvs-beta/status_J01_OMPS_NM.php

NOAA-20 OMPS SDR near-real-time status and performance monitoring web page are available at the open website:

<https://www.star.nesdis.noaa.gov/icvs/index.php>

NOAA-20 OMPS EDR near-real-time status and performance monitoring web pages are available at the following websites:

Archive https://www.class.ncdc.noaa.gov/saa/products/search?datatype_family=JPSS_OZONE

Operations <http://www.ospo.noaa.gov/http://www.ospo.noaa.gov/Products/atmosphere/index.html>

Long-term <https://www.star.nesdis.noaa.gov/smcd/spb/OMPSDemo/proOMPSbeta.php>

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

Activity <https://ozoneaq.gsfc.nasa.gov/omps/n20/activity>

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Appendix A. Key items from OMPS SDR Provisional Memo.

- 1) There was a sub-optimal match in the CCD pixels for the OMPS-TC and OMPS-NP sample tables. The OMPS-TC and OMPS-NP are not viewing exactly the same spatial region within each FOV. A better alignment could be achieved. For example if a bright cloud fills one OMPS-TC FOV pixel but is cloud-free in an adjacent FOV pixel the OMPS-NP alignment will sample both the cloud and cloud free pixel. The alignment difference is small but could be significant in some cases. The difference in field of view will sometimes in the worst case combine the bright scene and dark scene in the NP pixel. There is a report on this issue, DR_8617, "FOV Mismatch between N20-OMPS-TC and N20-OMPS-NP". This is not an issue that affects provisional maturity of the OMPS-TC SDR as an independent product. **The new sample table (in use as of April 19, 2019) reduces the FOV mismatch to acceptable levels.**