



Read-me for Data Users

MEMORANDUM FOR: The JPSS Program Record
SUBMITTED BY: JPSS Ozone Team Lead, Lawrence Flynn
CONCURRED BY: JPSS Algorithm Management Project Lead, Lihang Zhou
JPSS STAR Program Manager, Ingrid Guch
APPROVED BY: JPSS Program Scientist, Satya Kalluri
SUBJECT: NOAA-21 V8TOz & V8TOS Total Ozone EDR Validated Maturity
DATE: 09/19/2024

Validated maturity status declaration for OMPS Total Ozone EDRs (V8TOz & V8TOS)

Maturity Review Date: 09/19/2024
Effective Date: XX/2024 (upon implementation of 9/11/2024 table deliveries)
Operational System: NCCF V8TOz & V8TOS v4r5

<https://drive.google.com/drive/u/0/folders/1v6wbuhxNp3Jcbevfh9GICmJ8LtP9iSPV>

1. Background:

The Joint Polar Satellite System-2 (JPSS-2) was successfully launch on November 10, 2022 and renamed NOAA-21 after reaching polar orbit. With the same basic design as that of the Suomi NPP and NOAA-20 OMPS Nadir Sensors, the NOAA-21 OMPS Nadir component 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. The main change from the NOAA-20 OMPS Nadir Sensors is that the NOAA-21 OMPS NM is sending down data with much less aggregation. The IDPS OMPS NM SDRs for NOAA-21 have 177 cross-track macro-pixels (of four spatial cross-track pixels each) while the NOAA-20 SDRs have 35 cross-track macro-pixels (of 20 spatial cross-track pixels each). The NOAA-21 reports measurements with twice the frequency, creating 30 1.25 S scans per 38 S granule compared with 15 2.5 S scans for NOAA-20. The nadir field-of-view (FOV) resolution is now 10x9 km² versus the previous 50x17 km² size.

Since February 9, 2023 the instrument has been opened and, intermittent with continued diagnostic and calibration mode measurements, it has been operated in a high resolution Earth Science mode. The NDE processing of the IDPS SDRs for these measurements has created V8Pro, V8TOz and V8TOS ozone EDR products.

The OMPS Ozone EDR team consists of experts from NOAA, NASA, IMSG, and industry partner Raytheon. The team has been working OMPS EDR pre- and post-launch calibration and validation for the Total Column Ozone EDRs from V8TOz and V8TOS, and the Ozone Profile EDRs from V8Pro as processed at NDE I&T and NCCF UAT and Operations.

2. Validates maturity stage definition

(<http://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>):

- 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:

After NOAA-21 OMPS activation, the OMPS SDR and EDR team members immediately started analysis of OMPS science RDR, telemetry RDR, SDR and GEO and EDR data. The JPSS Algorithm Maturity Readiness Review Board approved the release of the NOAA-21 OMPS Nadir Mapper and Nadir Profiler SDRs to the public with a Beta Maturity level quality effective as of 03/23/2023, based on JPSS Maturity Review held on 02/23/2023 and with Provisional Maturity level quality effective 04/13/2023 based on JPSS Maturity Review held on 3/30/2023.

Based on 18 months of intensive evaluation and monitoring of OMPS V8TOz EDR data, the following assessments of the OMPS SDR and EDR products were compiled:

- The NOAA STAR EDR team has successfully used the SDR data in total ozone and ozone profile retrievals and are generally positive about the measurement quality.
- OMPS SDR products for the Earth-view Nadir Mapper SDR & GEO and Nadir Profiler SDR & GEO were checked and the performance is well within the specifications. The EDRs use the same geolocation information as the SDRs;
- The OMPS solar measurements were compared to prelaunch model spectra and wavelength shifts were found for both the OMPS Nadir Mapper (NM) and Nadir Profiler (NP). The SDR wavelength scales have been adjusted for these changes effective 3/23/2024, and the NM measurement-based intra-orbit wavelength scale adjustment is working well. The EDRs use the SDR solar and wavelength scale to compute the radiance/irradiance spectra. A new Day 1 solar adjusted for calibration biases has been in use since 4/11/2024;
- Dark current and LED calibration parameters were evaluated and compared to prelaunch measurements. The noise levels are as expected and the weekly updates will maintain them adequately for the EDR processing. The non-linearity is well within specifications;
- The pixel aggregation for the extreme cross-track FOV (#177) was incorrect. The SDR Team has provided a correction and it was implemented on 7/13/2023;
- Errors and artifacts in the SDR and EDR data products were documented. Solutions have been proposed, evaluated and implemented. These include iterative improvements to the stray light tables and the use of shifted wavelength centers for the V8TOz Radiative Transfer Instrument Table. The former was improved with updates to the Stray Light tables on 6/23/2023 and 3/21/2024, and the latter has been corrected in NDE I&T and NCCF processes as of 3/8/2023;
- Delivered code changes to the V8TOS to improve error handling and remove unnecessary fill values as of 4/20/2024;
- The NOAA-21 EDR products from NDE were compared to S-NPP and NOAA-20 EDR. After applying soft calibration adjustments based on the last two week of March 2024, the NOAA-21 ozone results are similar to those for S-NPP and NOAA-20 with differences and caveats as noted below and in the review briefing; and
- NOAA-21 OMPS NM V8TOz and V8TOS EDR data products can be used as validated in all applications,

Additional information is available in the V8TOz Total Column Ozone algorithm theoretical basis document (ATBD) and maturity review briefings, which can be accessed at:

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



4. NOAA-21 OMPS Ozone EDR Validated maturity caveats

The following caveats are provided to validated EDR product users:

1) The NM SDRs have some cross-track biases which appear in the retrieved EDRs as striping in the V8TOz product maps. This problem is greatly reduced with the use of the latest soft calibration adjustments. The results of the third set of adjustments using March 2024 data are presented in the validated maturity review briefing.

2) The NOAA-21 V8TOz EDRs are in good agreement with NPP and NOAA-20 EDRs with variations ranging between -0.5% and +0.5% for zonal latitude means.

3) The smaller FOVs for the NOAA-21 V8TOz and V8TOS EDRs lead to poorer performance (noisier retrievals from transient spikes in the SAA), than is seen for NOAA-20 or SNPP. Most of these effects are mitigated by the use of broad channels for the 318 nm and longer wavelengths. Error codes using variations of the residuals (Error Codes 4 and 5) for the shorter channels are often set in the SAA even though the ozone EDR is good. We are investigating methods to improve error flagging in that region.

4) The shorter channels are also used to provide information for the SO₂ retrievals and corrections. As a result, the SO₂ retrievals are noisier than those for S-NPP or NOAA-20 without spatial aggregation, especially in the SAA. Even so, the noise in the SO₂ retrievals is only at the 0.7 DU level globally.

5. Path Forward

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

- 1) Continue to compare regional means for V8TOz EDRs with those for NOAA-20 and S-NPP for longer overlap periods.
- 2) Continue to compare overpass data to ground-based Dobson station total ozone estimates.
- 3) Investigate methods to reduce the effects of transient signals in the high resolution NOAA-21 OMPS NM SDRs on the V8TOz EDRs.
- 4) Track the impact of continued improvements in the SDR as planned by the SDR team.
- 5) Provide deliveries of adjustment tables and code changes for V8TOz to NCCF as SDR performance degrades over time.

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

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

and

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

Provisional NOAA-21 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>

Pre-operational NOAA-21 OMPS EDR near-real-time status and performance monitoring web pages will become 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-dev.star1.nesdis.noaa.gov/OMPSSDemo/index.php>

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

Activity <https://ozoneaq.gsfc.nasa.gov/activity/omps/n21/>

Points of Contact:

Name: Lawrence E. Flynn, EDR Team Lead

Email: Lawrence.E.Flynn@noaa.gov

Phone: 301-683-3612

Vaishali Kapoor, Ozone Product Area Lead

Vaishali.Kapoor@noaa.gov

301-683-3246