



## *Read-me for Data Users*

**MEMORANDUM FOR:** The JPSS Program Record  
**SUBMITTED BY:** JPSS Ozone Team Lead, Lawrence Flynn  
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**SUBJECT:** NOAA-21 V8TOz & V8TOS Total Ozone EDR Provisional Maturity  
**DATE:** 08/04/2023

### **Provisional maturity status declaration for OMPS Total Ozone EDRs (V8TOz & V8TOS)**

**Maturity Review Date:** 08/03/2023

**Effective Date:** 9/14 after The soft calibration table switch to the 20230726 version took place on 9/14/2023

**Operational System:** V8TOz & V8TOS NDE I&T v4r2 & NCCF v4r3

#### **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 compare with 15 2.5 S scans for NOAA-20. The nadir field-of-view (FOV) resolution is now 10x9 km<sup>2</sup> versus the precious 50x17<sup>2</sup> km sizes.

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 process at NDE I&T.

#### **2. Provisional maturity stage definition**

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

- 1) Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from select locations, periods, and associated ground truth or field campaign efforts.

- 2) Product analysis is sufficient to communicate product performance to users relative to expectations (Performance Baseline).
- 3) 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.
- 4) Product is ready for operational use and for use in comprehensive cal/val activities and product optimization.

### **3. Justifications for declaring OMPS EDR data products beta 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 five months of intensive evaluation and monitoring of OMPS 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 March 23, 2023, 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 to 1 Astronomical Unit has been delivered to operations on June 13<sup>th</sup> 2023;
- 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 July 13<sup>th</sup> 2023;
- Errors and artifacts in the SDR and EDR data products were documented. Solutions have been proposed and evaluated, but not necessarily implemented. These include the In-Band Straylight (IBSL) for the OMPS NP SDR at high solar zenith angles in the Northern Hemisphere, and the use of shifted wavelength centers for the V8TOz Radiative Transfer Instrument Table. The latter has been corrected in NDE I&T processes as of March 8, 2023;
- The NOAA-21 EDR products from NDE were compared to S-NPP and NOAA-20 EDR. After applying soft calibration adjustments based on the first two weeks of July, the NOAA-21 ozone results are similar to those for S-NPP and NOAA-20 with differences and caveats as noted below; and
- NOAA-21 OMPS Nadir SDR and EDR data products can be used for making initial qualitative or limited quantitative assessments,

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 Provisional maturity caveats**

The following caveats are provided to provisional 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 soft calibration adjustments.

2) The NOAA-21 V8TOz EDRs are in good agreement with NPP and NOAA-20 EDRs between 30°S and 30°N. Outside of that region biases of 1 to 3 % are observed.

3) The stray light corrections for the OMPS NM SDRs is still a work in progress. Changes in these will impact the absolute accuracy of the V8TOz EDRs and affect the final EDR adjustments. In particular, the latest table update (In operations on June 23<sup>rd</sup>, 2023) does not include the out-of-band contributions to the stray light correction. That is, the stray light with sources longer than 380 nm.

4) 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. We are considering implementing software to detect, screen or filter these events.

#### **5. Path Forward**

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

- 1) Compare regional means for V8TOz EDRs with those for NOAA-20 and S-NPP for longer overlap periods.
- 2) 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 NDE & NCCF as SDR maturity progresses and stabilizes and validation results are analyzed.
- 6) Deliver code changes to the V8TOS to improve error handling and remove unnecessary fill values.

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](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>



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Long-term <https://www-dev.star1.nesdis.noaa.gov/OMPSDemo/index.php>

Daily maps [https://www.star.nesdis.noaa.gov/jps/EDRs/products\\_ozone.php](https://www.star.nesdis.noaa.gov/jps/EDRs/products_ozone.php)

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

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