



## *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 OMPS V2Limb Level 1 (SDR) and Level 2 (Ozone EDR)  
Validated Maturity  
**DATE:** 9/19/2024  
**Maturity Review Date:** 9/19/2024  
**Effective Date:** Jan/2025 Upon implementation at the NCCF system  
**Operational System:** NCCF V2.7Limb Level 1 and V2.6Limb Level 2 Ozone and Aerosols

### **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 a similar design as that of the Suomi NPP OMPS Limb Profiler (LP) sensor, the NOAA-21 OMPS LP measures limb radiances for three vertical slits with spectral coverage from 290 nm to 1040 nm for two of the slits. The first slit for NOAA-21 has reduced spectral coverage with only the longer wavelengths – 385 nm to 1040 nm. The OMP LP measurements are used to create aerosol and ozone profile estimates with good vertical resolution from the Tropopause to 57 km.

Since February 9, 2023 the instrument has been opened and, intermittent with continued diagnostic and calibration mode measurements, it has been operated in Earth Science mode. The OMPS LP was placed into a new timing pattern for science measurements on December 12, 2023, and has been using a new sample table since April 4, 2024. The OMPS Limb Ozone EDR team consists of experts from NOAA, NASA, IMSG, SSAI and SAIC.

### **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:**

Since NOAA-21 OMPS activation, the NASA OMPS Limb Profiler Level 1 and Level 2 team members and the NOAA OMPS Limb Profiler SDR and EDR team members have been conducting analysis of OMPS science RDR, telemetry RDR, Level 1 / SDR and Geolocation and Level 2 / EDR data. NASA has recently presented a poster and submitted a journal article providing validation results for these products and will be releasing them this month. A summary of these and other results is provided in the NOAA-21 OMPS LP V2Limb beta / provisional maturity review presentation.

#### **4. Algorithm Description:**

The Version 2.6 OMPS Limb Level 1 and Version 2.7 OMPS Limb Level 2 codes create several intermediate products. The processing at NCCF will deliver three of these products to users in near-real-time. These are 30-S granule files: for Level 1B Calibrated Radiances in NetCDF, for Level 2 Ozone Profile EDRs in NetCDF and for Level 2 Ozone Profile EDRs in BUFR.

Based on over one year of evaluation and monitoring of OMPS data, the following assessments of the OMPS Limb Profiler Level 1B and Level 2 Ozone Profile products were compiled:

- The Level 1B and 1G radiance and irradiance products have been compared to S-NPP OMPS LP products and performance is similar.
- The OMPS Limb Profiler Level 1 products for the Earth-view GEO were checked and the performance is well within the specifications. The Level 2 / EDRs use the same geolocation information as the Level 1.
- The Timing Pattern was changed from using 15-second intervals with two per 30-second granule to using 7.5-second intervals with four per 30-second granule. This provides better spatial resolution for the Level 2 products with a modest reduction in precision.
- The Sample Table was adjusted to include a small number of additional channels.
- 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 NOAA-21 Level 2 Ozone EDR products from NDE were compared to S-NPP – NOAA-21 ozone results are similar to those for S-NPP with differences as noted; and
- NOAA-21 OMPS LP Level 1 / SDR and Level 2 Ozone Profile EDR data products for the Center Slit products can be used for all applications.

Additional information is available in the V2Limb algorithm theoretical basis document (ATBD) and maturity review briefings, which can be accessed at:

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

The NASA OMPS Limb Team has submitted a validation paper on the V2.6 Algorithm at

[10.22541/essoar.171288980.01678231/v1](https://doi.org/10.22541/essoar.171288980.01678231/v1)

#### **5. NOAA-20 OMPS Limb Ozone Profile (V2Limb Ozone Profile Level 1B / SDR and Level 2 / EDR) validated maturity caveats**

The following caveats are provided to validated Level 1 / SDR and Level 2 Ozone EDR product users:

1. Users should concentrate on the Center Slit retrievals. The right slit has provisional validation, and the left slit has only partial coverage of the profile.
2. The V2Limb Level 1B does not have fully validated stray light or height adjustment corrections for the right slit. This will produce some uncertainties in the Level 2 Ozone Profile EDRs.
3. The NOAA-21 V2Limb has reduced spectral coverage for the left slit. The retrieval information ends at 37 km.
4. The NOAA processing use different temperature profiles than those used by the NASA processing. The information in the NOAA temperatures is less accurate at the top of the profile. The information comes from the 6-hour GFS products. The logic used to select temperature is less than optimal in some cases. We are investigating improvements to the temperature selection.
5. Additional information is provided in the notes in Appendix I.



## **6. Path Forward**

The teams will work to continue with the following planned calibration and validation tasks to maintain and improve validation for all three slits for the OMPS EDR data products to validated maturity:

- 1) The NASA Team will continue to work the known issues described in Appendix I.
- 2) The NOAA Team will transition any improvements to the operational processing.
- 3) The Operational monitoring will begin producing orbital curtain plots of ozone profiles when the products are at the NCCF UAT.
- 4) The ICVS will begin producing monitoring plots of measurement residuals when the products are at the NCCF UAT.

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

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

and

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

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## APPENDIX I. NASA RELEASE NOTES: Version 1.0 for NOAA-21 OMPS V2.6Limb Level 1 (April 2024, Glen Jaross, GSFC) (NASA Level 1 release expected 9/2024)

### Initial status

- Product format and dimensions are identical to SNPP Level 1G, Version 2.6 (including wavelength grid).
- Rare longitude reporting errors (observed in SNPP) are corrected.
- Data are limited to below 92° Solar Zenith Angle
- Day 1 (3 March, 2023) calibrations are established.
- Static tangent height adjustments. Center slit is based on RSAS results (50S – 20S) throughout year 1. East and West slits are based loosely on PSC height comparisons with SNPP LP.
- Low Gain TH adjustments relative to High Gain.
- Intra-orbital tangent height adjustments. No slit edge adjustment. The empirical adjustment is linear in orbit phase and identical to the SNPP adjustment.
- No intra-orbital corrections to wavelength registration.
- Long-term changes in wavelength registration are based on bi-weekly solar calibrations.
- Dynamic changes to radiometric calibration are based on annual Reference solar calibrations. Adjustments are introduced as a step change following each new solar measurement.
- Detector linearity corrections are applied in instrument electronics; same for every pixel.
- Stray light corrections are based on pre-launch PSF measurements.

### Known Issues

- The West Slit exhibits evidence of radiometric errors in the UV. These seem to lower the ozone at higher altitudes by as much as 20% in comparison with SNPP. These same errors affect the RSAS results (~800 m), though they are not used for TH adjustments.
- CCD timing pattern changes prior to launch resulted in radiometric changes, esp. PRNU, that are not accounted for. This affects detector non-linearity and Day 1 spectral registration.
- Telescope primary mirror scattering is currently ignored in the stray light correction, resulting in an under-correction especially in NIR wavelengths. The larger errors are at higher altitudes, in particular measurements used for normalization.
- The bandpass information provided in this product is simplified to a Gaussian FWHM. While this representation does capture the correct area-weighted mean of the function, it does not capture higher moments. Higher moments are prevalent in the UV.
- On Dec. 15, 2023 the image report period was decreased from 15 s to 7.5 s, effectively doubling the number of images in each orbital file. This results in a small decrease in the S/N ratio for measurements above 40 km.

### Processing Details

- Product generated by EV\_SDR\_GRID v2.7
- Primary input: Level 1B v1.2 (unreleased)