



## Read-me for Data Users

**MEMORANDUM FOR:** The JPSS Program Record  
**SUBMITTED BY:** JPSS Ocean Color Team Lead, Menghua Wang  
**CONCURRED BY:** JPSS Algorithm Management Project Lead Lihang Zhou  
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**APPROVED BY:** JPSS Program Scientist Satya Kalluri

**SUBJECT:** NOAA-21 Ocean Color EDR Product Validated maturity status and public release  
**DATE:** 03/07/2024

### Validated maturity status declaration for ocean color

**Maturity Review Date:** 03/07/2024  
**Effective Date:** 03/07/2024  
**Operational System:** MSL12, Version 1.61

The JPSS Algorithm Maturity Readiness Review Board approved the release of the NOAA-21 Ocean Color EDR product to the public with a Validated maturity level quality as of 03/07/2024 (effective date), based on JPSS Validation Maturity Review held on 03/07/2024.

### Validated Maturity stage definition

- 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.

The definition of Validated maturity stage is available at the JPSS Algorithm Maturity Matrix webpage: <https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>

### Algorithm Description

NOAA-21 ocean color EDR data are processed using the NOAA official enterprise ocean color data processing system, Multi-Sensor Level-1 to Level-2 (MSL12), which was developed in the late 90s and has been used to process ocean color data for VIIRS sensors on current SNPP and NOAA-20 satellites. As one of its major advantages, with the same data processing system, MSL12 can produce consistent ocean color products for different ocean color satellite sensors. Some significant improvements include (1) the SWIR-based data processing, (2) Rayleigh and aerosol LUTs, (3) algorithms for detecting absorbing aerosols and turbid waters, (4) ice detection algorithm, (5) improved straylight/cloud shadow algorithm, & others, (6) some new algorithms (BMW–new NIR reflectance correction, destriping,  $K_d(\text{PAR})$ , QA score for data quality, etc.) were implemented in the

NOAA-MSL12. For Chl-a, the ocean color index (OCI) based algorithm is used. For  $K_d(490)$ , a combination of the standard open ocean algorithm and the coastal turbid water algorithm is used. In addition, Chl-a and  $K_d(490)$  algorithms in MSL12 have been adjusted to produce consistent ocean color products from multiple satellite sensors.

### **List of Products**

NOAA-21 ocean color EDR include 10 operational (standard) products:

- Normalized water-leaving radiance ( $nL_w(\lambda)$ ) at VIIRS visible bands M1–M5 and I1 (641 nm) band
- Chlorophyll-a (Chl-a) concentration
- Diffuse attenuation coefficient for the downwelling spectral irradiance at the wavelength of 490 nm,  $K_d(490)$
- Diffuse attenuation coefficient of the downwelling photosynthetically available radiation (PAR),  $K_d(\text{PAR})$
- QA Score for data quality ( $nL_w(\lambda)$  spectra)
- Level-2 quality flags

### **Product evaluation/validation**

NOAA-21 ocean color products are routinely monitored in the NOAA VIIRS ocean color Cal/Val system (<https://www.star.nesdis.noaa.gov/socd/mecb/color/>), which includes:

- Match-up comparison with MOBY in situ data.
- Match-up comparison with AERONET-OC in situ data at 7 stations: CSI, LISCO, USC, MVCO, AAOT and Lake Erie.
- Global monitoring at deep waters (bathymetry > 1 km), and oligotrophic waters (climatology Chl-a < 0.1 mg/m<sup>3</sup>).
- Regional monitoring at U.S. East Coast, Hawaii, South Pacific Gyre, and Chesapeake Bay.

### **Product availability/reliability**

NOAA-21 ocean color EDR data have been produced in near-real-time since February 3, 2023.

Recently, the on-orbit vicarious calibration has been carried out using the MOBY in situ data, and a new set of gains were derived and applied to NOAA-21 ocean color EDR for routine near-real-time and science quality data processing. Previous data since the beginning of the NOAA-21 mission were also reprocessed for the science quality data stream.

NOAA-21 ocean color EDR (Level-2) file is in NetCDF4 format. The NetCDF4 output is defaulted to be chunked and compressed with deflate level-1, with file size reduced to about 1/4 of the uncompressed size. The NetCDF4 output is compliant with NetCDF Climate and Forecast (CF) conventions as well as conventions for Unidata Dataset Discovery. All post-process programs have been modified to be compatible with both HDF4 and NetCDF4 L2 files.

### **Algorithm Performance Dependence**

The performance of the VIIRS ocean color product depends on the performance of the VIIRS SDR product in the visible, NIR, and SWIR bands. The ocean color team worked closely with the SDR team to address our concerns with degradations in VIIRS sensors on the SNPP, NOAA-20, and NOAA-21.

### **Review Board Recommendations**



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Declare NOAA-21 ocean color products Validated Maturity as 03/07/2024.

### **Path Forward/Future Plan**

It is noted that further improvement in both SDR and EDR are needed, particularly for coastal/inland waters. In addition, very positive responses from various users for VIIRS-SNPP and VIIRS-NOAA-20 OC data, and VIIRS-NOAA-21 produced comparable OC data quality. We will work on to produce consistent OC product data from three VIIRS on SNPP, NOAA-20, and NOAA-21.

### **Additional Items to note**

Additional information is available in the VIIRS ocean color EDR algorithm theoretical basis document (ATBD) and validation maturity review briefing, which can be accessed at:

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

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