MEMORANDUM FOR:	The JPSS Program Record
SUBMITTED BY:	JPSS VIIRS Ocean Color EDR Team Lead Menghua Wang
CONCURRED BY:	JPSS Algorithm Management Project Lead Lihang Zhou
	JPSS STAR Program Manager Satya Kalluri
APPROVED BY:	JPSS Program Scientist Mitch Goldberg

SUBJECT:	NOAA-20 VIIRS Ocean Color EDR provisional maturity status
DATE:	07/17/2020

Validated maturity status declaration for VIIRS ocean color product

Review Date:	**07/17/2020**
Effective Date:	**07/17/2020**
Operational System:	**MSL12, Version 1.3.0**

The JPSS Algorithm Maturity Readiness Review Board approved the release of the NOAA-20 VIIRS Ocean Color Chlorophyll Environmental Data Record (EDR) to the public with a Validated maturity level quality as of 07/17/2020, based on JPSS Validation Maturity Review held on 07/17/2020.

1. **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

2. **The Board recommends that users be informed of the following product information and characteristics when evaluating the product.**
   - **Algorithm description**: The Multi-Sensor Level-1 to Level-2 (MSL12) ocean color data processing system has been used for processing VIIRS-NOAA-20 ocean color EDR products from the SDR data. MSL12 is an enterprise data processing system which is based on the SeaDAS version 4.6. Some significant improvements include (1) the SWIR-based ocean color data processing, (2) improved Rayleigh and aerosol LUTs, (3) algorithms for detecting absorbing aerosols and turbid waters, (4) ice detection algorithm, (5) improved straylight/cloud shadow detection algorithm, (5) producing consistent ocean color data from both VIIRS on SNPP and NOAA-20, & others. In recent years, some new algorithms, e.g., the BMW–a new NIR reflectance correction algorithm, destriping algorithm, $K_d(PAR)$, new I-band $nL_w(\lambda)$ data at 638 nm and 642 nm for VIIRS-SNPP and VIIRS-NOAA-20, respectively, new atmospheric correction using the

short blue band information, etc., were implemented in MSL12. All details are provided in the VIIRS Ocean Color Algorithm Theoretical Basis Document.

- **List of products:** The output of VIIRS-NOAA-20 EDR includes 10 operational (standard) products (see details in the Ocean Color ATBD listed below):
  - Normalized water-leaving radiance $nL_w(\lambda)$ at VIIRS visible bands M1-M5 and I1 (642 nm)
  - 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), $K_d(PAR)$
  - QA score for data quality ($nL_w(\lambda)$ spectra)
  - Level-2 quality flags

All global VIIRS ocean color product images are routinely produced and shown at the NOAA Ocean Color Team website: https://www.star.nesdis.noaa.gov/socd/mecb/color/index.php.

- **Additional products:** In addition, global daily gap-free Chl-a data are being routinely produced and distributed through NOAA CoastWatch. Global gap-free Chl-a data are derived from the merged VIIRS SNPP and NOAA-20 Chl-a data, which are also being routinely produced.

- **Input requirements:** The input for VIIRS-NOAA-20 EDR include VIIRS-NOAA-20 SDR data, terrain-corrected geo-location file, and ancillary meteorology and ozone data.

- **Quality flags:** The data quality flags are provided and discussed in the VIIRS Ocean Color Algorithm Theoretical Basis Document and shown in Table 4.

- **Algorithm performance dependence:** The performance of the VIIRS OC EDR data depend strongly on the performance of the VIIRS SDR product (i.e., instrument on-orbit calibration) and the quality of geolocation data. In addition, the sensor on-orbit vicarious calibration has been applied using the VIIRS-SNPP observations over the Hawaii MOBY site, particularly for the period after April 27, 2018. It also depends on the ancillary data quality.

- **Known errors/issues/limitations:** VIIRS-NOAA-20 ocean color data before April 27, 2018 have some data quality issues and not reliable due to SDR calibration problems in that period. The SDR errors before April 27, 2018 will be corrected in the planned mission-long OC data reprocessing.

- **Output data format:** Ocean color EDR (Level-2) data file is in NetCDF4 format for both VIIRS SNPP and NOAA-20. 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 HDF5 and NetCDF4 Level-2 files.

- **Product evaluation/validation:** The NOAA-20 VIIRS OC EDR data quality assessment for Validated maturity was based on validation over various in situ measurements (SeaBASS data sets, MOBY in situ data, and AERONET-OC data), as well as extensive global OC product comparisons with OC data derived from VIIRS-SNPP and OLCI-Sentinel-3A.

- **Other data processing information:** At present, only near-real-time (NRT) SDR data from the IDPS are used for global ocean color EDR data processing. The science quality NOAA-20 EDR data have not been implemented/released yet, but will be available in the future (after VIIRS mission-long OC data reprocessing for both SNPP and NOAA-20).

- **Product availability/reliability**: VIIRS-NOAA-20 OC EDR data were produced since January 1, 2018. However, ocean color data before April 27, 2018 have some data quality issues and not reliable due to SDR calibration problems in that period. Therefore, it is not recommended (or users should be cautious) to use VIIRS-NOAA-20 ocean color data before April 27, 2018.

3. Changes since last maturity stage

Since the Provisional maturity declaration, there are no changes in the operational implementation of the ocean color product suite.

4. Review board recommendations

The Review Board concurred with the recommendation.

5. Path Forward/Future Plan

The VIIRS mission-long OC EDR data reprocessing will be carried out for both SNPP and NOAA-20 to include some algorithm improvements (using the improved MSL12 v1.40). The NOAA JPSS Ocean Color EDR team and Cal/Val team will continue product validation and monitoring using both in situ data and other satellite measurements from global open ocean and coastal/inland waters. Specifically, routine VIIRS ocean color data quality monitoring for both SNPP and NOAA-20 are being provided through the NOAA Ocean Color Team website at: https://www.star.nesdis.noaa.gov/socd/mecb/color/index.php. It should be noted that further improvements in both SDR and EDR are needed, in particular, for ocean color products over coastal and inland waters (i.e., MSL12 ocean color data processing system).

6. Additional Items to note

None.

Additional information is available in the VIIRS Ocean Color Algorithm Theoretical Basis Document (ATBD) at: https://www.star.nesdis.noaa.gov/jpss/documents/ATBD/ATBD_OceanColor_v1.0.pdf

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