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| **MEMORANDUM FOR:** | The JPSS Program Record |
| **SUBMITTED BY:** | JPSS VIIRS Surface Reflectance Team: Ivan Csiszar, |
| | Eric Vermote (NASA/GSFC), Mike Wilson (IMSG) |
| **CONCURRED BY:** | JPSS Algorithm Management Project Lead Lihang Zhou |
| | JPSS STAR Program Manager Satya Kalluri |
| **APPROVED BY:** | JPSS Program Scientist Mitch Goldberg |

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| **SUBJECT:** | NOAA-20 VIIRS Surface Reflectance EDR provisional maturity status |
| **DATE:** | 6/18/2020 |

**Provisional maturity status declaration for VIIRS Surface Reflectance EDR**

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| **Review Date:** | **6/18/2020** |
| **Effective Date:** | **6/18/2020** |
| **Operational System:** | **NDE 2.0** |

The Joint Polar Satellite System-1 (JPSS-1) was successfully launched on November 18, 2017 and renamed NOAA-20 after reached the polar orbit. With the same design as that of the Suomi NPP Visible Infrared Imaging Radiometer Suite (VIIRS), NOAA-20 VIIRS is a cross-track scanning radiometer with 22 channels at wavelengths ranging from 0.41 to 12.5 µm, enabling global measurements of clouds, ocean and land surface temperatures, detection of aerosols and fires, as well as low light from human settlements at night.

On December 13, 2017, the NOAA-20 VIIRS started providing earth scene measurements for the reflective solar bands. Subsequently, the STAR JPSS Surface Reflectance Science Team started testing of the Surface Reflectance Algorithm for NOAA-20 VIIRS data. Based on evaluation presented to the NOAA JPSS program, the NOAA-20 VIIRS NDE Surface Reflectance product was declared to have Provisional maturity on 3/21/2019. Since then a more comprehensive accuracy assessment was conducted. Based on this assessment, and evidence of acceptable product performance, the VIIRS Surface Reflectance product was declared Validated on June 16, 2020.

1. **Maturity stage definition**
   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. **Algorithm Description:**
   The Surface Reflectance EDR consists of directional surface reflectance values in bands centered at 0.412 µm, 0.445 µm, 0.488 µm, 0.555 µm, 0.645 µm, 0.672 µm, 0.865 µm (two different spatial resolutions), 1.24 µm, 1.61 µm (two different spatial resolutions), and 2.25 µm. The algorithm for surface reflectance retrieval has been derived from that used to process Moderate Resolution Imaging Spectroradiometer (MODIS) data. The algorithm corrects for the effects of gaseous absorption, molecular and aerosol scattering, thin cirrus contamination, glare from surrounding surface pixels (adjacency adjustment), and the coupling of the atmosphere and the surface bidirectional reflectance as a function of the viewing and solar geometries, elevation of the target and spectral band. The output

products include surface reflectance for channels I1, I2, I3, M1, M2, M3, M4, M5, M7, M8, M10, and M11. Output also includes seven bytes of quality flags (QF1, QF2, QF3, QF4, QF5, QF6, QF7), which are each bitmasks representing various properties of both inputs and outputs. The product is generated in netCDF4 format.

Detailed information on the content of the netCDF4 data file is available in the NDE VIIRS Surface Reflectance EDR Algorithm Theoretical Basis document https://www.star.nesdis.noaa.gov/jpss/sr.php .

### Product requirements/Exclusions
VIIRS Surface Reflectance product requirements are documented in the Joint Polar Satellite System (JPSS) Ground Segment Data Product Specification document available at https://www.jpss.noaa.gov/technical_documents.html .

### Quality flags
The various bits within the seven Quality Flags provide details on the observing and environmental conditions, upstream data inputs and algorithm performance. Further details on the QA bits and detection confidence are described in the NDE Surface Reflectance Algorithm Theoretical Basis Document available at https://www.star.nesdis.noaa.gov/jpss/sr.php .

### Product evaluation/validation
The NOAA-20 VIIRS Surface Reflectance data quality assessment for Validated maturity was based on validation over 107 AERONET sites over approximately four months between January and May 2020.

### Product availability/reliability
The NOAA-20 NDE VIIRS Surface Reflectance product has been in operations since April 23, 2019.

### Algorithm performance dependence
The performance of the VIIRS Surface Reflectance product largely depends on the performance of the VIIRS SDR product as well as the upstream cloud mask and aerosol products. The performance of the NOAA-20 VIIRS upstream products is deemed adequate for the production of Surface Reflectance at a Validated maturity.

### Known errors/issues/limitations
While the product meets accuracy requirements, it does not meet requirements for precision (repeatability) for select bands most affected by the accuracy of the aerosol information used in the retrieval process. In addition, pixels with the bad NOAA-20 VIIRS I3 band detector are occasionally flagged as having valid surface reflectance retrievals. Users are advised to also use the SDR quality flag in the product to filter such pixels.

3. **Changes since last maturity stage**
Since the Provisional maturity declaration no changes in the operational implementation of the product have been made. There is an algorithm change for improved High Aerosol quality flag, which in general will allow for more retrievals to be assessed as high quality.

4. **Review board recommendations**

   The Review Board concurred with the recommendation.

5. **Path Forward/Future Plan**

   The NOAA JPSS Surface Reflectance team continues product validation and monitoring using reference data over AERONET sites and quality monitoring systems within NOAA/NESDIS Office of Satellite and Product Operations (OSPO) and Center for Satellite Applications and Research (STAR).

6. **Additional Items to note**

   None.

Additional information is available in the Surface Reflectance algorithm theoretical basis document (ATBD) and validated maturity review briefing, which can be accessed at:

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

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