Read-me for Data Users

MEMORANDUM FOR: The JPSS Program Record
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SUBJECT: NOAA-21 VIIRS Imagery EDR Validated maturity status and public release
DATE: 8/03/2023

Validated maturity status declaration for VIIRS Imagery EDR
Maturity Review Date: 8/03/2023
Effective Date: 6/23/2023
Operational System:

Algorithm version: IDPS Block 2.3 Release Mx7 (until 7/13/2023) and Mx8 (thereafter)
Version of LUTs used: at-launch LUT versions with the following updates effective on the dates shown below

- F-PREDICTED LUT on 1/12/2023 (VNIR only), 3/23/2023 (adds SWIR), 4/20/2023 (adds SWIR degradation correction), 5/11/2023 (adds SWIR bias corrections for I3, M8, M10, M11), 6/1/2023, 6/23/2023 (adds SWIR bias correction for M9), 7/27/2023
- GEO-DNB/IMG/MOD-PARAM LUTs on 1/12/2023 (post-lunch mounting matrix)
- DNB Onboard Offset Tables (ID 5 & 33-35) on 3/17/2023 (using spacecraft “backflip” pitch maneuver)
- DNB DN0 and GAIN-RATIOS LUTs on 3/9/2023, 3/30/2023, 4/27/2023, 6/1/2023, 6/29/2023, 7/27/2023, and continuing monthly after each new moon
- DNB STRAY-LIGHT-CORRECTION LUTs on 3/30/2023, 4/27/2023, 6/1(2)/2023, 6/29/2023, 7/27/2023, and continuing monthly after each new moon during the first year on orbit
- RVF (RVS) LUT on 6/7/2023 (TEB LWIR only, using spacecraft “backflip” pitch maneuver)
- RSBAUTOCAL-HISTORY file on 6/8/2023 (re-initialized RSBautoCal calculations)

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The JPSS Algorithm Maturity Readiness Review Board approved the release of the VIIRS Imagery EDR product (both KPP and non-KPP) to the public with a Validated maturity level quality as of 6/23/2023, based on JPSS Validation Maturity Review held on 8/03/2023 (link to review artifacts).

1. Validated Maturity Definition

a. Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
b. 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.
c. Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
d. Product is ready for operational use based on documented validation findings and user feedback.
e. Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

2. VIIRS Imagery EDR Overview:

The VIIRS Imagery EDR product consists of 16 M-Bands (750-m), 5 I-Bands (375-m), and a Near Constant Contrast (NCC) product (742-m), all remapped to the Ground Track Mercator (GTM) grid, eliminating overlapping pixels and bowtie deletions seen in SDR granules. The NCC Imagery product is a pseudo-albedo derived from the DNB, an image product that normalizes contrasts in DNB radiances across the day-night terminator. The VIIRS Imagery EDR Key Performance Parameter (KPP) is defined as bands I1, I3, I4, I5, M14, M15, M16, and NCC for latitudes greater than 60°N in the Alaskan region, with 87-Minute data latency.

The VIIRS Imagery EDR team is responsible for the Imagery EDR product, and consists of Imagery experts from NOAA, CSU/CIRA, UW/CIMSS, and UA/GINA. The team routinely conducts Imagery validation, participates in research projects leading to the development of new Imagery-related products, and maintains Imagery display systems, namely CIRA Polar SLIDER. The Imagery EDR team collaborates closely with a variety of end-users on many of these tasks.

The table below defines the VIIRS Imagery EDR and KPP vs non-KPP.

Imagery EDR Product	VIIRS Band	Wavelength (µm)	Spatial Resolution Nadir/Edge-of-Scan
Visible/Reflective	I1	0.60 – 0.68	0.4 km/0.8 km
NIR	I2	0.846 – 0.885	0.4 km/0.8 km
SWIR	I3	1.58 – 1.64	0.4 km/0.8 km
MWIR	I4	3.55 – 3.93	0.4 km/0.8 km
LWIR	I5	10.5 – 12.4	0.4 km/0.8 km
Visible/Reflective	M1	0.402 – 0.422	0.8 km/1.6 km
Visible/Reflective	M2	0.436 - 0.454	0.8 km/1.6 km
Visible/Reflective	M3	0.478 - 0.488	0.8 km/1.6 km
Visible/Reflective	M4	0.545 – 0.565	0.8 km/1.6 km

Visible/Reflective	M5	0.662 - 0.682	0.8 km/1.6 km
NIR	M6	0.739 - 0.754	0.8 km/1.6 km
NIR	M7	0.846 - 0.885	0.8 km/1.6 km
SWIR	M8	1.23 - 1.25	0.8 km/1.6 km
SWIR	M9	1.371 – 1.386	0.8 km/1.6 km
SWIR	M10	1.58 - 1.64	0.8 km/1.6 km
SWIR	M11	2.23 - 2.28	0.8 km/1.6 km
MWIR	M12	3.61 - 3.79	0.8 km/1.6 km
MWIR	M13	3.97 - 4.13	0.8 km/1.6 km
LWIR	M14	8.4 – 8.7	0.8 km/1.6 km
LWIR	M15	10.263 – 11.263	0.8 km/1.6 km
LWIR	M16	11.538 – 12.488	0.8 km/1.6 km
NCC	DNB	0.5 – 0.9	0.75 km/0.75 km

Table 1: Required Imagery EDR Products. The VIIRS bands with text highlighted in yellow are considered to be VIIRS Key Performance Parameters (KPPs) for latitudes greater than 60°N in the Alaskan region

3. Justifications for declaring VIIRS Imagery EDR Validated maturity:

The VIIRS Imagery EDR product has no quantitative requirements that address quality. Therefore, the Imagery EDR team relies on qualitative analysis of the Imagery, which includes the collection of feedback from Imagery users. The VIIRS Imagery EDR team has been evaluating the VIIRS EDR Imagery since the initial availability of science data on 5 Dec 2022, with evaluation of the Thermal Emissive Band (TEB) Imagery and NCC product taking place since the cryo-cooler door was opened on 8 Feb 2023. Analysis in this review focused on the recent appearance of the 5 I-bands,16 M-bands, and NCC since 24 July 2023. The qualitative analysis of NOAA-21 VIIRS Imagery EDR has included:

a) Granule-by-granule analysis of all 22 bands over full-day periods across the full globe, which includes a variety of atmospheric phenomena, surface types, and seasons, during the day and night.
b) Comparison of all 22 bands with those from S-NPP and NOAA-20.
c) Review of widely used (by end-users) multispectral Red-Green-Blue (RGB) imagery products.
d) Specific attention to the evaluation of imagery in extreme and uniform scenes, including deep moist convection, tropical cyclones, ice sheets, clear sky ocean, clear sky deserts and forests, to name a few.
e) End-user collaborators were also consulted on their experience with the imagery thus far.

Based on the intensive qualitative evaluation up to this point, the EDR Imagery appears to be of excellent quality for all 22 bands, and is suitable for operational use. A few very minor caveats to note include:

a) Very subtle striping may be visible to users in certain bands. The striping does not impact ones ability to use the imagery to complete a given task.
    a. Most notably, in bands M4, M8 and M13 across uniform scenes
    b. In NCC near the edge of granule, in sunglint and moonglint areas, and near the day-night terminator.
b) DNB/NCC “Smearing” that was identified pre-launch and assigned a waiver.

a. Along-scan "smearing" of light is present, qualitatively, in the Imagery, especially in low-light situations. It is determined that the smearing does not impact ones ability to use the imagery to complete a given task. Further, the smearing does not appear to be any more significant than what is present in DNB from NOAA-21 and S-NPP. Therefore, we recommend no action.

4. Path Forward/Future Plan

The VIIRS Imagery EDR team will continue to monitor the NOAA-21 VIIRS EDR Imagery routinely, paying special attention to imagery quality following calibration updates, and those minor caveats previously identified. Feedback will continue to be provided to the VIIRS SDR team. The team will continue to engage its users regarding Imagery access, quality, and application.

Additional information is available in the VIIRS Imagery Algorithm Theoretical Basis Document (ATBD): https://www.star.nesdis.noaa.gov/jpss/documents/ATBD/D0001-M01-S01-008_JPSS_ATBD_VIIRS-Imagery_E.pdf and Validated maturity review briefing package: https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php

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