



Read-me for Data Users

MEMORANDUM FOR: The JPSS Program Record
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SUBJECT: NOAA-20 Surface Albedo EDR Validated maturity status
DATE: 11/21/2019

Validated maturity status declaration for Surface Albedo EDR

Maturity Review Date: 11/21/2019
Effective Date: 11/21/2019
Operational System: NDE, v1r2

The JPSS Algorithm Maturity Readiness Review Board approved the release of NOAA-20 surface albedo product to the public with a Validated Maturity level quality as of 11/21/2019 (effective date), based on JPSS Validation Maturity Review held on 11/21/2019 (link to review artifacts).

1. 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..

(reference to the AMM webpage for maturity definition:

<https://www.star.nesdis.noaa.gov/jpss/documents/Status/DataProductMaturityLevelDefinitions.pdf>
)

2. Product Description

The NDE surface albedo EDR product is granule-based dataset covering land and sea-ice surfaces. It is derived from an enterprise algorithm (for the entire JPSS mission) which regresses top of atmospheric (TOA) visible and shortwave reflectances to a land surface broadband albedo, with one online process and one offline process. The L2 granule albedo product is estimated online from a combination of the directly estimated albedo (i.e. the regression) and a historical temporally filtered gap-free albedo; the historical albedo is derived offline using previous granule albedo data.

The directly estimated albedo is computed from a regression relationship of the albedo and the satellite sensed multichannel TOA reflectances. The Level-3 gridded albedo product provides 1-km daily global daily mean shortwave albedo map in Sinusoidal projection, which is implemented based on Level-2 data with two processing steps: anchoring the science data to specific geographic points and composition in temporal dimension to produce daily global SURFALB map that has been gridded into a specific map projection.

- Product requirements/Exclusions (L1RDS)**

Surface albedo is defined as the solar radiation in 0.4 to 4.0 micron reflected by the Earth’s surface into an upward hemisphere (sky dome), including both diffuse and direct components, divided by the total amount incident from this hemisphere, including both direct and diffuse components. Surface albedo is an important variable in determining the radiative balance at the surface (how much incident energy goes toward surface heating versus how much is reflected back to space). Albedo is also of use in determining surface type and as a background against which to detect and screen out clouds.

Table 1. Surface Albedo product requirement

Attribute	Threshold
Geographic coverage	global, including land ocean and ice surface conditions
Horizontal Cell Size	0.80 km
Mapping Uncertainty	1 km at Nadir
Measurement Range	0 to 1.0 (albedo units)
Measurement Accuracy	0.08 (albedo units)
Measurement Precision	0.05 (albedo units)

- List of Products (Collection Short Name (CSN))**

The product is stored in one NetCDF file.

Table 2. Layers contained in NOAA-20 Albedo files.

Product	Output Data	Description
Level-2	VIIRS_Albedo_EDR	VIIRS Improved Surface Albedo EDR
	DataQualityFlag (DQF)	VIIRS Surface Albedo 2-bit High-level Data Quality Flag
	ProductQualityInformation (PQI)	VIIRS Surface Albedo 2-byte Product Quality Information
	AlbScl	VIIRS SURFALB Albedo Scale Factor

	AlbOff	VIIRS SURFALB Albedo Offset
	Latitude	Latitude
	Longitude	Longitude
	Metadata Variables	Details in metadata list in ATBD
Level-3	VIIRS_Albedo_1km	VIIRS daily mean shortwave surface albedo with 1km resolution
	QualityFlag	Product Quality Information

In the table, AlbScl, AlbOff and Metadata Variables are single values; others are data array.

• **Level 2 Quality flags (Table 3 and 4)**

There are two quality flag arrays available with the EDR product. In which, Product Quality Information (PQI) flags are provided for the data quality information, and Data Quality Flag (DQF) flag is provided for the product monitoring purpose.

(a) Product Quality Information flags

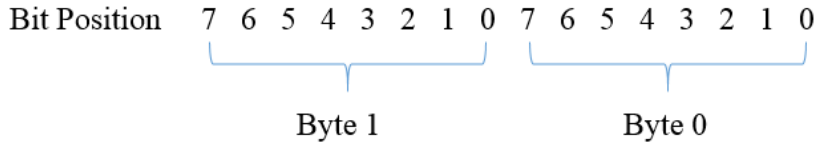


Table 3. Product Quality Information (PQI)

Byte	Bit	Flag	Source	Description
0	0-1	Overall quality	SURFALB	00: high-quality retrieval, 01: retrieval, 10:no retrieval
	2-3	Cloud condition	Cloud mask	00=confidently clear, 01=probably clear,10=probably cloudy,11=confidently cloudy
	4	SDR quality	SDR	0 = normal , 1 = bad data
	5	Solar zenith angle flag	SDR	0: favorable SZA, 1: very large SZA (>60)
	6	View zenith angle flag	SDR	0: favorable VZA, 1: very large VZA (>60)
	7	Spare		
1	0-2	Retrieval Path	SURFALB	000: generic, 001: desert, 010: snow, 011: sea-ice, 100: no retrieval
	3-4	Temporal filter quality flag	SURFALB	00: high-quality retrieval, 01: degraded retrieval, 10:no retrieval
	5	Online filter flag	Online filter	0: no filter, 1: filtered
	6-7	Spare		

(b) Data Quality Flag

Bit Position 7 6 5 4 3 2 1 0

Table 4. Data Quality Flag (DQF)

Byte	Bit	Flag	Source	Description
0	0-1	Overall quality	SURFALB	00: high-quality retrieval, 01: retrieval, 10:no retrieval

* **Note:** The left-most bit is the most significant bit (the high-order bit) in the definition and description of both PQI and DQF.

- **Level 3 Quality flag (Table 5)**

Bit Position 7 6 5 4 3 2 1 0

Table 5. Product Quality Flag

Byte	Bit	Flag	Source	Description
0	0-1	Overall quality	SURFALB	00: high-quality retrieval, 01: mid-quality retrieval, 10: low-quality retrieval, 11:no retrieval
	2-3	Cloud condition	Cloud mask	00=confidently clear, 01=probably clear, 10=probably cloudy, 11=confidently cloudy
	4-6	Retrieval Path	SURFALB	000: generic, 001: desert, 010: snow, 011: sea-ice, 100: no retrieval
	7	Spare		

3. Product Evaluation/Validation

The Albedo product Evaluation/Validation is performed through

- Visual inspection of the global composite NOAA-20 SURFALB image
- Algorithm performance validation
 - Direct-comparison with ground measurements
 - Cross-comparison with MODIS Albedo
- Metadata analysis/validation
 - Check possible error in metadata calculation

4. Product availability/reliability

NOAA-20 Surface Albedo EDR data has been produced since 09/19/2019 in the NDE system. The product can be accessed from NOAA CLASS system.

5. Algorithm performance dependence

The performance of the VIIRS Albedo product largely depends on the performance of upstream

data including the VIIRS SDR product, Cloud mask EDR product, snow mask EDR product, and ice concentration EDR product. In addition, look-up tables (LUTs) used in the algorithm have direct influence to the product reliability.

6. Known errors/issues/limitations

- Degradation of albedo quality is found at large angles and the heterogeneity ground station data – it's found to be the inherent uncertainty in albedo validation.
- The cross-comparison using MODIS data shows that the snow-covered pixels in Antarctic show some difference, mainly caused by the snow cover difference – would be improved through recognizing permanent snow using VIIRS surface type data (input depending on framework feed).
- Updated sea-ice climatology tested in framework has not been applied in operational system – new climatology submitted to ASSISTT in Sep 2018 would be delivered soon.
- Data discontinuity within Greenland in October due to climatology discontinuity – would be improved in July 2020 DAP.

7. Changes since last maturity stage

- 1) Updated to NOAA-20 land LUTs according to the spectral response function of NOAA VIIRS sensor
- 2) Set the sea-water pixels as fill value
- 3) Excluded the pure sea-water granules in output to save storage
- 4) Excluded the sea-water tiles in offline run to save time

8. Review board recommendations

Input from the reviewers?

9. Path Forward/Future Plan

- Algorithm improvements
 - Update to NOAA-20 land LUTs (planned)
 - Set the sea-water pixels as fill value (delivered)
 - Exclude pure sea-water granules in output to save storage (planned)
 - Exclude sea-water tiles in offline run to save time (delivered)
 - Update sea-ice albedo climatology (delivered)
- Future Cal/Val activities / milestones
 - Validation for 2019 DAPs
 - Validation for validated maturity review
- Improved albedo products (in investigation)
 - NOAA-20 Gridded Surface Albedo Product
 - Blended Albedo product with S-NPP VIIRS Albedo
- Promote the application of VIIRS SURFALB product in NOAA climate models

10. Additional Items to note

None



Read-me for Data Users

Further information is available in the JPSS VIIRS Surface Albedo algorithm theoretical basis document (ATBD) and validation maturity review briefing, which can be accessed at:

https://www.star.nesdis.noaa.gov/jpss/documents/ATBD/ATBD_EPS_Land_SurfaceAlbedo_v1.3.pdf

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