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Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirement Specification (SRS) for the Surface Albedo

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National Aeronautics and
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Goddard Space Flight Center
Greenbelt, Maryland

Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirement Specification (SRS) for the Surface Albedo JPSS Review/Approval Page

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Preface

This document is under JPSS Ground Project configuration control. Once this document is approved, JPSS approved changes are handled in accordance with Class I and Class II change control requirements as described in the JPSS Configuration Management Procedures, and changes to this document shall be made by complete revision.

Any questions should be addressed to:

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Change History Log

Revision	Effective Date	Description of Changes (Reference the CCR & CCB/ERB Approve Date)
Rev-	Aug. 29, 2013	This version incorporates 474-CCR-13-1153 which was approved by JPSS Ground ERB on the effective date shown.
A	Jan 30, 2014	This version incorporates 474-CCR-13-1439 which was approved by JPSS Ground ERB on the effective date shown.
A1	Oct 23, 2014	This version incorporates 474-CCR-14-2091 which was approved by the JPSS Ground ERB for CO10 on the effective date shown.
B	Nov. 13, 2014	This version incorporates 474-CCR-14-1721, 474-CCR-14-1741, 474-CCR-14-1781, 474-CCR-14-2103 and 474-CCR-14-2110 which was approved by JPSS Ground ERB on the effective date shown.
C	Apr 07, 2016	This version incorporates 474-CCR-15-2452, 474-CCR-15-2480, 474-CCR-15-2657, and 474-CCR-16-2828 which was approved by JPSS Ground ERB on the effective date shown.
0200D	Sep 22, 2016	This version incorporates 474-CCR-16-2939 and 474-CCR-16-3049 which was approved by JPSS Ground ERB on the effective date shown.

Table of TBDs/TBRs

TBx	Type	ID	Text	Action
None				

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1 Introduction

The Joint Polar Satellite System (JPSS) is the National Oceanic and Atmospheric Administration's (NOAA) next-generation operational Earth observation program that acquires and distributes global environmental data primarily from multiple polar-orbiting satellites. The program plays a critical role in NOAA's mission to understand and predict changes in weather, climate, oceans and coasts, and the space environment, which support the Nation's economy and protect lives and property. The first JPSS satellite mission, the Suomi National Polar-orbiting Partnership (S-NPP) satellite, successfully launched in October 2011. S-NPP, along with the legacy NOAA Polar Operational Environmental Satellites (POES), provides continuous environmental observations. Two JPSS satellites will follow S-NPP: JPSS-1, planned for launch in fiscal year (FY) 2017, with JPSS-2 to follow in FY2021. In the future, the JPSS Polar Follow-On (PFO) provides for two additional missions, JPSS-3 and JPSS-4, as follow-on to the JPSS-2 mission to extend the JPSS Program lifecycle out to 2038.

In addition to the JPSS Program's own satellites operating in the 1330 (±10) Local Time of the Ascending Node (LTAN) orbit, NOAA also leverages mission partner assets for complete global coverage. These partner assets include the Department of Defense (DoD) Defense Meteorological Satellite Program (DMSP) operational weather satellites (in the 1730 - 1930 LTAN orbit), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Meteorological Operational (Metop) satellites (in the 2130 LTAN orbit) and the Japanese Aerospace Exploration Agency (JAXA) Global Change Observation Mission-Water (GCOM-W) satellite (in the 1330 LTAN orbit). JPSS routes Metop data from McMurdo Station, Antarctica to the EUMETSAT facility in Darmstadt, Germany and EUMETSAT, in turn, provides Metop data to NOAA. For GCOM, JPSS routes the GCOM-W data from Svalbard, Norway to the NOAA Satellite Operations Facility (NSOF) in Suitland, MD, processes GCOM-W data and delivers GCOM-W products to the JPSS users who have JAXA permissions.

Additionally, the JPSS Program provides data acquisition and routing support to the DMSP and the WindSat Coriolis Program. JPSS routes DMSP data from McMurdo Station to the 557th Weather Wing at Offutt Air Force Base in Omaha, NE. After processing, the 557th releases the DMSP data for public consumption over the Internet via the National Geophysical Data Center in Boulder, CO. The JPSS Program provides data routing support to the National Science Foundation (NSF), as well as the National Aeronautics and Space Administration (NASA) Space Communications and Navigation (SCaN)-supported missions, which include the Earth Observing System (EOS). As part of the agreements for the use of McMurdo Station, JPSS provides communications/network services for the NSF between McMurdo Station, Antarctica and Centennial, Colorado.

As a multi-mission ground infrastructure, the JPSS Ground System supports the heterogeneous constellation of the before-mentioned polar-orbiting satellites both within and outside the JPSS Program through a comprehensive set of services as listed in Table 1-1.

Table: 1-1 JPSS Ground System Services

Service	Description
Enterprise Management and Ground Operations	Provides mission management, mission operations, ground operations, contingency management and system sustainment
Flight Operations	Provides launch support and early orbit operations, telemetry and commanding, orbital operations, mission data playback, payload support, flight software upgrade, flight vehicle simulation, and disposal at the end of mission life
Data Acquisition	Provides space/ground communications for acquiring mission data
Data Routing	Provides routing of telemetry, mission and/or operations data through JPSS' global data network
Data Product Generation	Provides the processing of mission data to generate and distribute raw, sensor, environmental, and ancillary data products
Data Product Calibration and Validation	Provides calibration and validation of the data products
Field Terminal Support	Provides development and operational support to the Field Terminal customers

1.1 Identification

This SRS provides requirements for the VIIRS Surface Albedo EDR. The Surface Albedo EDR will be computed for all clear, daytime, land surface pixels at the VIIRS moderate resolution (approximately 750 m at nadir). A clear moderate resolution pixel in this context has been flagged either "confidently clear," "probably clear," or "probably cloudy" by the VIIRS Cloud Mask. If the pixel is "probably clear" or "probably cloudy," the retrieval will be flagged in the generalized Land Quality Flag (LQF) output appended to the VIIRS Surface Reflectance Intermediate Product (IP) and copied to the Surface Albedo EDR output file. Retrievals will also be generated for pixels that have been categorized as thin cirrus by the VIIRS Cloud Mask [VIIRS Cloud Mask ATBD]. The strategy for correcting thin cirrus and the limits of applying this correction are discussed in VIIRS Surface Reflectance ATBD. A daytime pixel is one for which the average solar zenith angle is less than or equal to 85 degrees. Pixels with a solar zenith angle of 65 degrees or higher are flagged in the LQF output. Nine spectral bands from VIIRS are used to generate the Surface Albedo EDR. We have altered the approach to exclusive use of moderate resolution bands, to address concerns of matching point spread functions between the different resolutions.

1.2 Algorithm Overview

The requirements were used as guidance for the derivation of the algorithm. Reference should be made to the latest version of the system specification document for up to date information.

The specifications set the limits for an error budget in the Surface Albedo EDR. There are four crucial parameters that directly constrain the allowable errors in the Surface Albedo: accuracy, precision, uncertainty, and long-term stability.

Note that there are really two products required: a moderate resolution Surface Albedo driven by edge-of-scan performance, and a fine resolution Surface Albedo driven by nadir performance. Our solution for this EDR produces a single Surface Albedo product to satisfy the moderate and fine requirements, with a nadir resolution of 750 m, growing to a resolution of 1600 m at the edge of the scan.

Note also that Horizontal Coverage is global implying land and ocean surfaces. However, it is well known that albedo retrieval methods for land surface and for ocean surface are significantly different. The algorithm described by this document is for land surface only. Validation of Surface Albedo over the ocean is an objective requirement.

There are two sub-algorithms utilized to produce the Surface Albedo EDR. The dark pixel sub-algorithm (DPSA) is based on the MODIS approach, and is used for all dark surfaces, including most vegetation and water. The bright pixel sub-algorithm (BPSA) is a regression approach, and is used for all bright surfaces, including snow, desert, and many instances of bare soil. Both algorithms will be executed for all pixels satisfying the conditions listed in the previous section. A dark pixel or bright pixel flag is inherited from Aerosol Optical Thickness IP that indicates the preference of the DPSA and BPSA products. This preference flag recommends which albedo product best represents the true albedo. The DPSA involves the production of the Gridded Surface Albedo IP, which contains the Bidirectional Reflectance Distribution Function (BRDF) information as well as Nadir BRDF-Adjusted Reflectance (NBAR) values, in 1-km ground resolution. In real time processing, the BRDF information is applied to derive black sky and white sky albedos that are interpolated to produce the albedo EDR. As a result, the surface BRDF information and NBAR values are available independently from the instantaneous retrieval of albedo in VIIRS pixels.

1.3 Document Overview

Section	Description
Section 1	Introduction - Provides a brief overview of the JPSS Ground System and the relevant algorithm, as reference material only.
Section 2	Related Documentation - Lists related documents and identifies them as Parent, Applicable, or Information Documents such as, MOAs, MOUs, technical implementation agreements, as well as Data Format specifications. This section also establishes an order of precedence in the event of conflict between two or more documents.
Section 3	Algorithm Requirements - Provides a summary of the science requirements for the products covered by this volume.
Appendix A	Requirements Attributes - Provides the mapping of requirements to verification methodology and attributes.

2 Related Documentation

The latest JPSS documents can be obtained from URL: https://jpssmis.gsfc.nasa.gov/frontmenu_dsp.cfm. JPSS Project documents have a document number starting with 470, 472 or 474 indicating the governing Configuration Control Board (CCB) (Program, Flight, or Ground) that has the control authority of the document.

2.1 Parent Documents

The following reference document(s) is (are) the Parent Document(s) from which this document has been derived. Any modification to a Parent Document will be reviewed to identify the impact upon this document. In the event of a conflict between a Parent Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

Doc. No.	Document Title
470-00067	Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD)
470-00067-02	Joint Polar Satellite System (JPSS) Ground System Requirements Document (GSRD), Volume 2 - Science Product Specification
474-00448-01-01	Joint Polar Satellite System (JPSS) Algorithm Specification Volume I: Software Requirements Specification (SRS) for the Common Algorithms

2.2 Applicable Documents

The following document(s) is (are) the Applicable Document(s) from which this document has been derived. Any modification to an Applicable Document will be reviewed to identify the impact upon this document. In the event of conflict between an Applicable Document and the content of this document, the JPSS Program Configuration Change Board has the final authority for conflict resolution.

Doc. No.	Document Title
D0001-M01-S01-023	Joint Polar Satellite System (JPSS) VIIRS Surface Albedo Algorithm Theoretical Basis Document (ATBD)
D0001-M01-S01-028	Joint Polar Satellite System (JPSS) Net Heat Flux Algorithm Theoretical Basis Document (ATBD)
474-00448-02-20	Joint Polar Satellite System (JPSS) Algorithm Specification Volume II: Data Dictionary for the Surface Albedo
474-00448-04-20	Joint Polar Satellite System (JPSS) Algorithm Specification Volume IV: Software Requirement Specification Parameter File (SRSPF) for the Surface Albedo

2.3 Information Documents

The following documents are referenced herein and amplify or clarify the information presented in this document. These documents are not binding on the content of this document.

Doc. No.	Document Title
474-00333	Joint Polar Satellite System (JPSS) Ground System (GS) Architecture Description Document (ADD)

Doc. No.	Document Title
474-00054	Joint Polar Satellite System (JPSS) Ground System (GS) Concept of Operations (ConOps)
470-00041	Joint Polar Satellite System (JPSS) Program Lexicon
474-00448-03-20	Joint Polar Satellite System (JPSS) Algorithm Specification Volume III: Operational Algorithm Description (OAD) for the Surface Albedo
429-05-02-42	Joint Polar Satellite System (JPSS) Mission Data Format Control Book for NPP
472-00251	Joint Polar Satellite System (JPSS) Mission Data Format Control Book for JPSS-1
474-00033	Joint Polar Satellite System (JPSS) VIIRS Cloud Mask Algorithm Theoretical Basis Document (ATBD)
474-00034	Joint Polar Satellite System (JPSS) VIIRS Surface Reflectance Algorithm Theoretical Basis Document (ATBD)

3 Algorithm Requirements

3.1 States and Modes

3.1.1 Normal Mode Performance

SRS.01.20_147 The Surface Albedo EDR algorithm shall calculate the albedo with a mapping uncertainty of 1 km at Nadir

Rationale: The mapping uncertainty at 3 sigma was flowed down from Level 1 and Level 2 documents.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_148 The Surface Albedo EDR algorithm shall calculate the albedo with a horizontal cell size of 4 km.

Rationale: The horizontal cell size was flowed down from Level 1 and Level 2 documents. The Surface Albedo product is generated at the 0.8 km moderate resolution band pixel resolution but the performance of the product is to be met at the HCS of 4 km.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_149 The Surface Albedo EDR algorithm shall calculate the albedo with a measurement precision of 0.05.

Rationale: The measurement precision was flowed down from Level 1 and Level 2 documents. The Surface Albedo product is generated at the 0.8 km moderate resolution band pixel resolution but the performance of the product is to be met at the HCS of 4 km.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_150 The Surface Albedo EDR algorithm shall calculate the albedo with a measurement accuracy of 0.08.

Rationale: The measurement accuracy was flowed down from Level 1 and Level 2 documents. The Surface Albedo product is generated at the 0.8 km moderate resolution band pixel resolution but the performance of the product is to be met at the HCS of 4 km.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_151 The Surface Albedo EDR algorithm shall calculate the albedo with available refresh of 90% coverage of the globe every 24 hours, averaged monthly, for the Bright Pixel Sub-Algorithm.

Rationale: The global coverage through the refresh constraint was flowed from Level 1 and Level 2 document.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_392 The Surface Albedo EDR algorithm shall calculate the albedo with a measurement range of 0 to 1.0.

Rationale: The measurement range was flowed down from Level 1 and Level 2 documents.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_393 The Surface Albedo EDR algorithm shall calculate the albedo globally, including land, and ice surface conditions, for the bright pixel sub-algorithm.

Rationale: The applicable coverage conditions were flowed down from Level 1 and Level 2 documents. Validation of Surface Albedo over the ocean is an objective requirement.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.1.2 Graceful Degradation Mode Performance

SRS.01.20_695 The Land Surface Albedo software shall use NCEP extended forecast data for fallback processing when the relevant NCEP current forecast input is not available

Rationale: The IP software through its algorithm must generate products using back up data sources to meet the graceful degradation requirement. These degraded products are not required to meet the algorithm performance requirements. The forecasts used include the NCEP Total Column Ozone and Total Column Percepitible Water.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_698 The Land Surface Albedo software shall use NAAPS AOT current forecast [750m Granulation] for fallback processing when the relevant VIIRS AOT IP data input is not available.

Rationale: The IP software through its algorithm must generate products using back up data sources to meet the graceful degradation requirement. These degraded products are not required to meet the algorithm performance requirements.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_717 The Land Surface Albedo software shall use NAAPS AOT extended forecast [750m Granulation] for fallback processing when the relevant VIIRS AOT IP data input and NAAPS AOT current forecast data are not available.

Rationale: The IP software through its algorithm must generate products using back up data sources to meet the graceful degradation requirement. These degraded products are not required to meet the algorithm performance requirements.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_699 The Land Surface Albedo software shall use GACP Aerosol Climatology data [750m Granulation] for fallback processing when the relevant VIIRS AOT IP data and NAAPS AOT current and extended forecast inputs are not available.

Rationale: The IP software through its algorithm must generate products using back up data sources to meet the graceful degradation requirement. These degraded products are not required to meet the algorithm performance requirements.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.2 Algorithm Functional Requirements

3.2.1 Product Production Requirements

Not applicable.

3.2.2 Algorithm Science Requirements

SRS.01.20_141 The Surface Albedo EDR software shall incorporate a computing algorithm provided for combined surface albedo.

Rationale: The EDR software through its computing algorithm must produce the surface albedo in accordance with the algorithm is described in the JPSS VIIRS Surface Albedo ATBD (D0001-M01-S01-023) and the JPSS Net Heat Flux ATBD (D0001-M01-S01-028).

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.2.3 Algorithm Exception Handling

SRS.01.20_142 The Surface Albedo EDR software shall set each <FillField> to <FillValue> according to <FillCondition> specified in the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) <SurfaceAlbedoEDR><fill>.

Rationale: The EDR software through its computing algorithm must fill the surface albedo values based on the established fill conditions to satisfy exclusion and fill conditions.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.3 External Interfaces

3.3.1 Inputs

SRS.01.20_145 The Surface Albedo EDR software shall incorporate inputs per Table 3-1.

Rationale: The EDR generation software must be able to receive and process the resource interaction items shown in Table 3-1 in order to produce the intended Surface Albedo products.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_719 The Surface Albedo EDR software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Surface Albedo (474-00448-02-20).

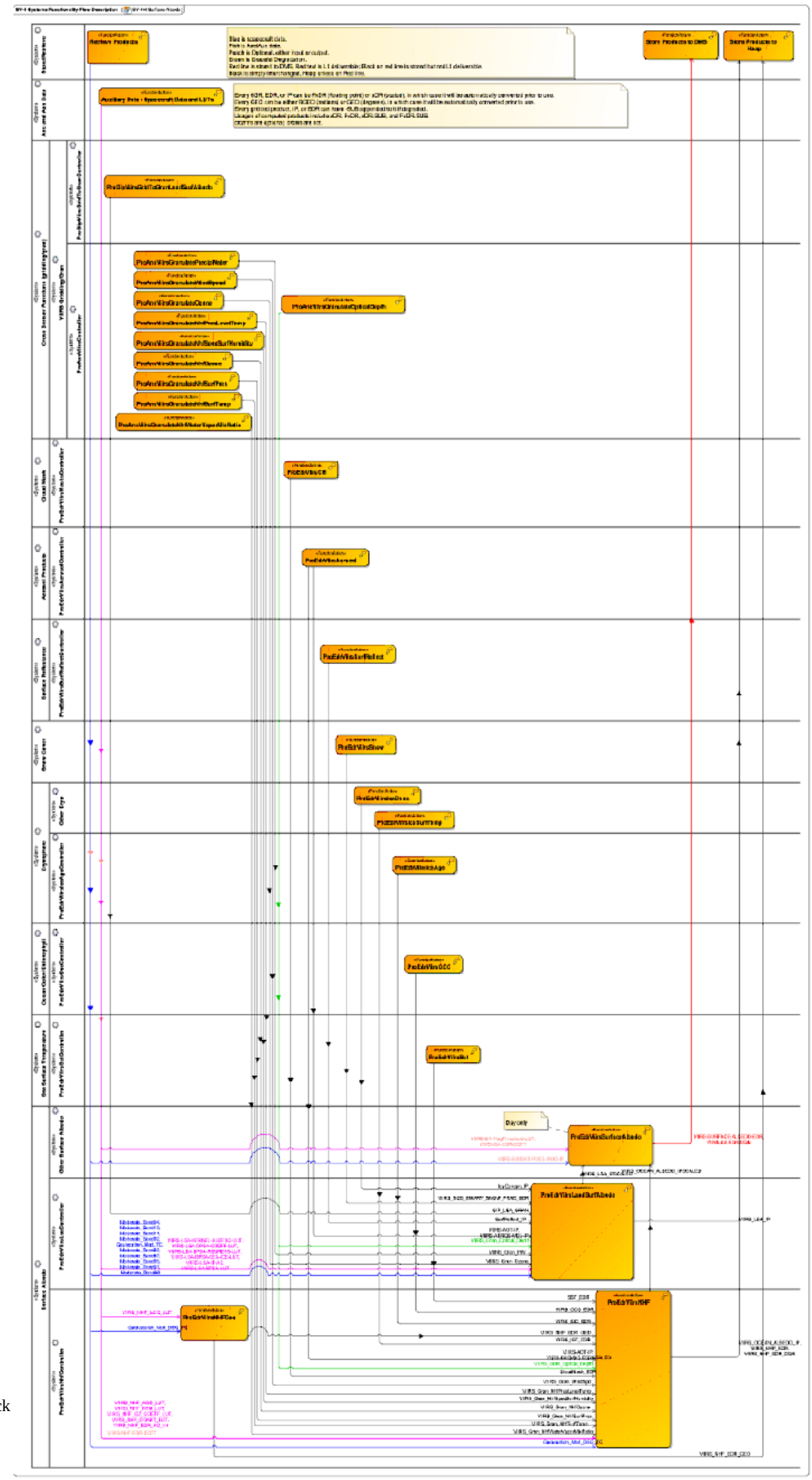
Rationale: This defines the formats for Lookup Tables, and Processing Coefficients for input into the algorithm module. This also includes the inputs for internal IPs that help form the SA EDR.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

Table 3-1 and Figure 3-1 are best viewed together since they describe the processes governed by this SRS in different ways. The figure diagrams the data flowing into, out of, and within the code

governed by this SRS. The table lists these same data interactions as well as all downstream dependencies for outputs from this SRS.

Each row in the table describes a single software interaction - data flowing from one software item to another. The data is listed in the first column. The second and third columns include the short name and mnemonic for the data. Blanks indicate there is no mnemonic. The fourth and fifth columns contain the SRS that generates the data product(s) in the first column, and the SRS that receives those products. The final two columns contain the actual function name in Algorithm Development Library (ADL) that produces those products, and the function that inputs those products. The SRS's titled "Ingest MSD" and "Store/Retrieve" are non-existent SRS's functioning as data handling for the IDPS. The software functions "Store Products" and "Retrieve Products" are similar non-existent functions that operate as IDPS data handling.



Check to use.

Figure: 3-1 Surface Albedo Data Flows

Table: 3-1 Systems Resource Flow Matrix: Surface Albedo

	Data Product Name	Collection Short Name	Mnemonic	Sending SRS	Receiving SRS	Sending Function	Receiving Function
1	•VIIRS-LSA-KERNEL-ALBEDO-LUT •VIIRS-LSA-DPSA-COEFF-LUT •VIIRS-LSA-BPSA-REGRESS-LUT •VIIRS-LSA-BPSA-SEA-ICE-LUT •VIIRS-LSA-IP-AC •VIIRS-LSA-BPSA-LUT	•VIIRS-LSA-KERNEL-ALBEDO-LUT •VIIRS-LSA-DPSA-COEFF-LUT •VIIRS-LSA-BPSA-REGRESS-LUT •VIIRS-LSA-BPSA-SEA-ICE-LUT •VIIRS-LSA-IP-AC •VIIRS-LSA-BPSA-LUT	•NP_NU-LM0233-019 •NP_NU-LM0040-016 •NP_NU-LM0040-015 •NP_NU-LM0040-111 •DP_NU-LM2020-021 •NP_NU-LM0040-014	Anc and Aux Data	Surface Albedo	Auxiliary Data - Spacecraft Data and LUTs	ProEdrViirsLandSurfAlbedo
2	•VIIRS_NHF_AGG_LUT •VIIRS_NHF_RTM_LUT •VIIRS_NHF_OZ_COEFF_LUT •VIIRS_NHF_COART_LUT •VIIRS_NHF_EDR_AC_Int	•VIIRS-NHF-AGG-LUT •VIIRS-NHF-RTM-LUT •VIIRS-NHF-OZ-COEFF-LUT •VIIRS-NHF-COART-LUT •VIIRS-NHF-EDR-AC	•NP_NU-LM0234-007 •NP_NU-LM0234-001 •AN_NP-L10135-002 •NP_NU-LM0234-000 •DP_NU-LM2020-001	Anc and Aux Data	Surface Albedo	Auxiliary Data - Spacecraft Data and LUTs	ProEdrViirsNHF
3	•VIIRS-NHF-EDR-DQTT	•VIIRS-NHF-EDR-DQTT	•DP_NU-LM2030-000	Anc and Aux Data	Surfae Albedo	Auxiliary Data - Spacecraft Data and LUTs	ProEdrViirsNHF
4	•VIIRS_NHF_AGG_LUT	•VIIRS-NHF-AGG-LUT	•NP_NU-LM0234-007	Anc and Aux Data	Surface Albedo	Auxiliary Data - Spacecraft Data and LUTs	ProEdrViirsNHFGeo
5	•VIIRS-BP-FlagThreshold-LUT •VIIRS-SA-EDR-DQTT	•VIIRS-BP-FlagThreshold-LUT •VIIRS-SA-EDR-DQTT	•NP_NU-LM0235-002 •DP_NU-LM2030-000	Anc and Aux Data	Surface Albedo	Auxiliary Data - Spacecraft Data and LUTs	ProEdrViirsSurfaceAlbedo

	Data Product Name	Collection Short Name	Mnemonic	Sending SRS	Receiving SRS	Sending Function	Receiving Function
6	•VIIRS_Gran_NhfOzone	•VIIRS-ANC-Tot-Col-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfOzone	ProEdrViirsNHF
7	•VIIRS_Gran_NhfPresLevelTemp	•VIIRS-ANC-Iso-Lev-Temp-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfPresLevelTemp	ProEdrViirsNHF
8	•VIIRS_Gran_NhfSpecSurfHumidity	•VIIRS-ANC-Sp-Humd-Surf-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfSpecSurfHumidity	ProEdrViirsNHF
9	•VIIRS_Gran_NhfSurfPres	•VIIRS-ANC-Press-Surf-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfSurfPres	ProEdrViirsNHF
10	•VIIRS_Gran_NhfSurfTemp	•VIIRS-ANC-Temp-Surf2M-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfSurfTemp	ProEdrViirsNHF
11	•VIIRS_Gran_NhfWaterVaporMixRatio	•VIIRS-ANC-Wtr-Vpr-Mix-Ratio-Lev-Nhf-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateNhfWaterVaporMixRatio	ProEdrViirsNHF
12	•VIIRS_Gran_Optical_Depth	•VIIRS-ANC-Optical-Depth-Mod-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateOpticalDepth	ProEdrViirsLandSurfAlbedo
13	•VIIRS_Gran_Optical_Depth	•VIIRS-ANC-Optical-Depth-Mod-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateOpticalDepth	ProEdrViirsNHF
14	•VIIRS_Gran_Ozone	•VIIRS-ANC-Tot-Col-Mod-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateOzone	ProEdrViirsLandSurfAlbedo
15	•VIIRS_Gran_PW	•VIIRS-ANC-Preci-Wtr-Mod-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulatePrecipWater	ProEdrViirsLandSurfAlbedo
16	•VIIRS_Gran_WindSpd	•VIIRS-ANC-Wind-Speed-Mod-Gran	•None	Grid Gran	Surface Albedo	ProAncViirsGranulateWindSpeed	ProEdrViirsNHF
17	•VIIRS-AOT-IP	•VIIRS-Aeros-Opt-Thick-IP	•IMPI_VAOT_R0100	Aerosol Properties	Surface Albedo	ProEdrViirsAerosol	ProEdrViirsLandSurfAlbedo

	Data Product Name	Collection Short Name	Mnemonic	Sending SRS	Receiving SRS	Sending Function	Receiving Function
	•VIIRS-AEROS-MDL-IP	•VIIRS- Aeros-Modl-Info-IP	•IMPI_VAMI_R0100				
18	•VIIRS-AOT-IP •VIIRS-SUSMAT-EDRSCALED	•VIIRS-Aeros-Opt-Thick-IP •VIIRS-SusMat-EDR	•IMPI_VAOT_R0100 •EDRE-VRSM-C0030	Aerosol Properties	Surface Albedo	ProEdrViirsAerosol	ProEdrViirsNHF
19	•CloudMask_EDR	•VIIRS-CM-EDR	•EDRE-CMIP-C0030	Cloud Mask	Surface Albedo	ProEdrViirsCM	ProEdrViirsNHF
20	•VIIRS_SIC_EDR	•VIIRS-SIC-EDR	•EDRE-SICH-C1030	Cryosphere	Surface Albedo	ProEdrViirsIceAge	ProEdrViirsNHF
21	•IceConcen_IP	•VIIRS-I-Conc-IP	•IMPI_VIIC_R0100	Cryosphere	Surface Albedo	ProEdrViirsIceConc	ProEdrViirsLandSurfAlbedo
22	•VIIRS_IST_EDR	•VIIRS-IST-EDR	•EDRE-ICST-C1030	Cryosphere	Surface Albedo	ProEdrViirsIceSurfTemp	ProEdrViirsNHF
23	•VIIRS_LSA_IPSCALED	•VIIRS-LSA-IP	•None	Surface Albedo	Surface Albedo	ProEdrViirsLandSurfAlbedo	ProEdrViirsSurfaceAlbedo
24	•VIIRS_LSA_IP	•VIIRS-LSA-FIP	•None	Surface Albedo	Store/Retrieve	ProEdrViirsLandSurfAlbedo	Store Products to Heap
25	•VIIRS_OCEAN_ALBEDO_IPSCALED	•VIIRS-OCEAN-ALBEDO-IP	•None	Surface Albedo	Surface Albedo	ProEdrViirsNHF	ProEdrViirsSurfaceAlbedo
26	•VIIRS_NHF_EDR •VIIRS_NHF_EDR_DQN	•VIIRS-NHF-EDR •VIIRS-NHF-EDR-DQN	•EDRE-VNHF-C0030 •DP_NU-L00510-000	Surface Albedo	Store/Retrieve	ProEdrViirsNHF	Store Products to Heap
27	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Surface Albedo	ProEdrViirsNHFGeo	ProEdrViirsNHF
28	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfOzone
29	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfPresLevelTemp
30	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfSpecSurfHumidity

	Data Product Name	Collection Short Name	Mnemonic	Sending SRS	Receiving SRS	Sending Function	Receiving Function
31	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfSurfPres
32	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfSurfTemp
33	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Grid Gran	ProEdrViirsNHFGeo	ProAncViirsGranulateNhfWaterVaporMixRatio
34	•VIIRS_NHF_EDR_GEO	•VIIRS-NHF-EDR-GEO	•None	Surface Albedo	Store/Retrieve	ProEdrViirsNHFGeo	Store Products to Heap
35	•VIIRS_OCC_EDR	•VIIRS-OCC-EDR	•EDRE-VROC-C0030	Ocean Color and Chlorophyll	Surface Albedo	ProEdrViirsOCC	ProEdrViirsNHF
36	•VIIRS_SCD_BINARY_SNOW_FRAC_EDR	•VIIRS-SCD-BINARY-SNOW-FRAC-EDR	•EDRE-SNCD-C1030	Snow Cover	Surface Albedo	ProEdrViirsSnow	ProEdrViirsLandSurfAlbedo
37	•SST_EDR	•VIIRS-SST-EDR	•EDRE-SSTE-C1030	Sea Surface Temperature	Surface Albedo	ProEdrViirsSst	ProEdrViirsNHF
38	•VIIRS-SURFACE-ALBEDO-EDR •VIIRS-SA-EDR-DQN	•VIIRS-SA-EDR •VIIRS-SA-EDR-DQN	•EDRE-VRSA-C0030 •DP_NU-L00510-000	Surface Albedo	Store/Retrieve	ProEdrViirsSurfaceAlbedo	Store Products to DMS
39	•SurfReflect_IP	•VIIRS-Surf-Refl-IP	•IMPI_VISR_R0100	Surface Reflectance	Surface Albedo	ProEdrViirsSurfReflect	ProEdrViirsLandSurfAlbedo
40	•GIP_LSA_GRAN	•VIIRS-GridIP-VIIRS-Land-Surf-Albedo-Mod-Gran	•None	Grid Gran	Surface Albedo	ProGipViirsGridToGranLandSurfAlbedo	ProEdrViirsLandSurfAlbedo
41	•Moderate_Band04 •Moderate_Band10 •Moderate_Band11 •Moderate_Band02 •Geolocation_Mod_TC •Moderate_Band03 •Moderate_Band07	•VIIRS-M4-SDR •VIIRS-M10-SDR •VIIRS-M11-SDR •VIIRS-M2-SDR •VIIRS-MOD-RGEO-TC •VIIRS-M3-SDR	•SDRE-VM04-C0030 •SDRE-VM10-C0030 •SDRE-VM11-C0030	Store/Retrieve (VIIRS SDR)	Surface Albedo	Retrieve Products	ProEdrViirsLandSurfAlbedo

	Data Product Name	Collection Short Name	Mnemonic	Sending SRS	Receiving SRS	Sending Function	Receiving Function
	•Moderate_Band05 •Moderate_Band01 •Moderate_Band08	•VIIRS-M7-SDR •VIIRS-M5-SDR •VIIRS-M1-SDR •VIIRS-M8-SDR	•SDRE-VM02-C0030 •None •SDRE-VM03-C0030 •SDRE-VM07-C0030 •SDRE-VM05-C0030 •SDRE-VM01-C0030 •SDRE-VM08-C0030				
42	•Geolocation_Mod_DEG_TC	•VIIRS-MOD-GEO-TC	•None	Store/Retrieve (VIIRS SDR)	Surface Albedo	Retrieve Products	ProEdrViirsNHF
43	•Geolocation_Mod_DEG_TC	•VIIRS-MOD-GEO-TC	•None	Store/Retrieve (VIIRS SDR)	Surface Albedo	Retrieve Products	ProEdrViirsNHFGeo
44	•VIIRS-BRIGHT-PIXEL-MOD-IP	•VIIRS-Bright-Pixel-Mod-IP	•IMPI_VBPX_R0100	Store/Retrieve (VIIRS SDR)	Surface Albedo	Retrieve Products	ProEdrViirsSurfaceAlbedo

3.3.2 Outputs

SRS.01.20_143 The Surface Albedo EDR software shall generate the Surface Albedo EDR product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification Vol II: Data Dictionary for Surface Albedo (474-00448-02-20).

Rationale: The product profile must conform to the XML format file.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

SRS.01.20_144 The Surface Albedo EDR software shall use the terrain-corrected geolocation for the VIIRS M-band.

Rationale: The product must be associated with the geolocation to meet the geolocation accuracy requirement.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.4 Science Standards

Not applicable.

3.5 Metadata Output

Not applicable.

3.6 Quality Flag Content Requirements

SRS.01.20_152 The Surface Albedo EDR software shall report for each <FlagScope> quality flags using <FlagLogic> as specified for the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) <SurfaceAlbedoEDR><QF>.

Rationale: Quality Flags must be generated based on the established flag conditions, logic, and format.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.7 Data Quality Notification Requirements

SRS.01.20_146 The Surface Albedo EDR software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) for <SurfaceAlbedoEDR> <notification>.

Rationale: Notifications must be generated and sent based on the established logic and conditions.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.8 Adaptation

Not applicable.

3.9 Provenance Requirements

Not applicable.

3.10 Computer Software Requirements

Not applicable.

3.11 Software Quality Characteristics

Not applicable.

3.12 Design and Implementation Constraints

SRS.01.20_391 The JPSS Common Ground System shall execute the surface albedo algorithms.

Rationale: The CGS must incorporate algorithm changes that are supplied by the algorithm vendor.

Mission Effectivity: S-NPP, JPSS-1, JPSS-2

3.13 Personnel Related Requirements

Not applicable.

3.14 Training Requirements

Not applicable.

3.15 Logistics Related requirements

Not applicable.

3.16 Other Requirements

Not applicable.

3.17 Packaging Requirements

Not applicable.

3.18 Precedence and Criticality

Not applicable.

Appendix A. Requirements Attributes

The Requirements Attributes Table lists each requirement with CM-controlled attributes including requirement type, mission effectivity, requirement allocation(s), block start and end, method(s) for verifying each requirement, etc.

Req ID	SRS 20 - Surface Albedo	Level 3 Type	Product Type	Mission Effectivity	Allocated To	Block Start	Block End	Block 2.0.0 VM	Block 2.1.0 VM	Block 2.2.0 VM
SRS.01.20_147	The Surface Albedo EDR algorithm shall calculate the albedo with a mapping uncertainty of 1 km at Nadir	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_148	The Surface Albedo EDR algorithm shall calculate the albedo with a horizontal cell size of 4 km.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_149	The Surface Albedo EDR algorithm shall calculate the albedo with a measurement precision of 0.05.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_150	The Surface Albedo EDR algorithm shall calculate the albedo with a measurement accuracy of 0.08.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_151	The Surface Albedo EDR algorithm shall calculate the albedo with available refresh of 90% coverage of the globe every 24 hours, averaged monthly, for the Bright Pixel Sub-Algorithm.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_392	The Surface Albedo EDR algorithm shall calculate the albedo with a measurement range of 0 to 1.0.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_393	The Surface Albedo EDR algorithm shall calculate the albedo globally, including land, and ice surface conditions, for the bright pixel sub-algorithm.	P	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Test	NA	NA
SRS.01.20_695	The Land Surface Albedo software shall use NCEP extended forecast data for fallback processing when the relevant NCEP current forecast input is not available	G	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_698	The Land Surface Albedo software shall use NAAPS AOT current forecast	G	EDR	S-NPP JPSS-1	CGS	2.0.0	3.0.0	Inspection	NA	NA

Req ID	SRS 20 - Surface Albedo	Level 3 Type	Product Type	Mission Effectivity	Allocated To	Block Start	Block End	Block 2.0.0 VM	Block 2.1.0 VM	Block 2.2.0 VM
	[750m Granulation] for fallback processing when the relevant VIIRS AOT IP data input is not available.			JPSS-2						
SRS.01.20_717	The Land Surface Albedo software shall use NAAPS AOT extended forecast [750m Granulation] for fallback processing when the relevant VIIRS AOT IP data input and NAAPS AOT current forecast data are not available.	G	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_699	The Land Surface Albedo software shall use GACP Aerosol Climatology data [750m Granulation] for fallback processing when the relevant VIIRS AOT IP data and NAAPS AOT current and extended forecast inputs are not available.	G	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_141	The Surface Albedo EDR software shall incorporate a computing algorithm provided for combined surface albedo.	Ap	EDR	S-NPP JPSS-1 JPSS-2	algorithm provider	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_142	The Surface Albedo EDR software shall set each <FillField> to <FillValue> according to <FillCondition> specified in the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) <SurfaceAlbedoEDR><fill>.	E	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_145	The Surface Albedo EDR software shall incorporate inputs per Table 3-1.	I	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_719	The Surface Albedo EDR software shall ingest tables and coefficients formatted in accordance with Section 7 of the JPSS Algorithm Specification Vol II: Data Dictionary for Surface Albedo (474-00448-02-20).	Ft	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA

Req ID	SRS 20 - Surface Albedo	Level 3 Type	Product Type	Mission Effectivity	Allocated To	Block Start	Block End	Block 2.0.0 VM	Block 2.1.0 VM	Block 2.2.0 VM
SRS.01.20_143	The Surface Albedo EDR software shall generate the Surface Albedo EDR product in conformance with the XML format file in Attachment A.1 of the JPSS Algorithm Specification Vol II: Data Dictionary for Surface Albedo (474-00448-02-20).	F	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_144	The Surface Albedo EDR software shall use the terrain-corrected geolocation for the VIIRS M-band.	Fg	GEO	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_152	The Surface Albedo EDR software shall report for each <FlagScope> quality flags using <FlagLogic> as specified for the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) <SurfaceAlbedoEDR><QF>.	Q	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_146	The Surface Albedo EDR software shall send data quality notifications to the operator according to logic specified in the JPSS Algorithm Specification Vol IV: SRSPF for Surface Albedo, (474-00448-04-20) for <SurfaceAlbedoEDR> <notification>.	N	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA
SRS.01.20_391	The JPSS Common Ground System shall execute the surface albedo algorithms.	Ai	EDR	S-NPP JPSS-1 JPSS-2	CGS	2.0.0	3.0.0	Inspection	NA	NA