Effective Date: January 18, 2012
Revision A

GSFC JPSS CMO
January 26, 2012
Released

Joint Polar Satellite System (JPSS) Ground Project
Code 474
474-00080

Joint Polar Satellite System (JPSS) Operational Algorithm Description (OAD) Document for VIIRS Land and Ice Surface Albedo (LISA) Intermediate Product (IP) and Combined Albedo (CA) Environmental Data Record (EDR) Software

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Goddard Space Flight Center
Greenbelt, Maryland

National Aeronautics and
Space Administration

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Joint Polar Satellite System (JPSS) Operational Algorithm Description (OAD) Document for VIIRS Land and Ice Surface Albedo (LISA) Intermediate Product (IP) and Combined Albedo (CA) Environmental Data Record (EDR) Software

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Preface

This document is under JPSS Ground Algorithm ERB 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)
Original	06/03/2011	This version incorporates **474-CCR-11-0080** which converts D39539, Operational Algorithm Description (OAD) Document for VIIRS Land and Ice Surface Albedo Intermediate Product and Combined Albedo Environmental Data Record, Rev B, dated 04/28/2010 to a JPSS document, Rev -. This was approved by the JPSS Ground Algorithm ERB on June 3, 2011.
Revision A	01/18/2012	**474-CCR-11-0263:** This version baselines 474-00080, Joint Polar Satellite System (JPSS) Operational Algorithm Description (OAD) Document for VIIRS Land and Ice Surface Albedo (LISA) Intermediate Product (IP) and Combined Albedo (CA) Environmental Data Record (EDR) Software, for the Mx 6 IDPS release. This CCR was approved by the JPSS Algorithm ERB on January 18, 2012.

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NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS)

OPERATIONAL ALGORITHM DESCRIPTION DOCUMENT FOR VIIRS LAND AND ICE SURFACE ALBEDO (LISA) INTERMEDIATE PRODUCT (IP) AND COMBINED ALBEDO (CA) ENVIRONMENTAL DATA RECORD (EDR)

SDRL No. S141
SYSTEM SPECIFICATION SS22-0096

RAYTHEON COMPANY
INTELLIGENCE AND INFORMATION SYSTEMS (IIS)
NPOESS PROGRAM
OMAHA, NEBRASKA

IAW DFAR 252.227-7036, Raytheon hereby declares that, to the best of its knowledge and belief, the technical data delivered under Subcontract No. 7600002744 is complete, accurate, and complies with all requirements of the Subcontract.

TITLE: NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM (NPOESS) OPERATIONAL ALGORITHM DESCRIPTION DOCUMENT FOR VIIRS LAND AND ICE SURFACE ALBEDO (LISA) INTERMEDIATE PRODUCT (IP) AND COMBINED ALBEDO (CA) ENVIRONMENTAL DATA RECORD (EDR)

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Engineering & Manufacturing Development (EMD) Phase
Acquisition & Operations Contract

CAGE NO. 11982

Operational Algorithm Description

VIIRS LAND AND ICE SURFACE ALBEDO (LISA) INTERMEDIATE PRODUCT (IP) AND COMBINED ALBEDO (CA) ENVIRONMENTAL DATA RECORD (EDR)

Document Date: Sep 19, 2011

Document Number: D39539
Revision: C4

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Under
Contract No. F04701-02-C-0502

This document has been identified per the NPOESS Common Data Format Control Book – External Volume 5 Metadata, D34862-05, Appendix B as a document to be provided to the NOAA Comprehensive Large Array-data Stewardship System (CLASS) via the delivery of NPOESS Document Release Packages to CLASS.

Northrop Grumman Space & Mission Systems Corp. **Space Technology** One Space Park Redondo Beach, CA 90278	NORTHROP GRUMMAN Raytheon

Revision/Change Record	**Document Number D39539**

Revision	Document Date	Revision/Change Description	Pages Affected
---	9-17-04	Initial Release.	All
A1	1-17-06	02Nov05 Reflects Raytheon-Omaha's initial Science To Operational (Sci2Ops) Code Conversion to include adding a company coversheet, title/signature page, etc. 15Dec05 – Inserted replacement table for Section 1.3.3 titled "Source Code & Test Data References" plus did minor tech writer/wordsmith edits prior to 20Dec05 Optimization CUTPR and Code Completion PR. 10Jan06 – Replaced logo on coversheet, updated coversheet copyright (2004-2006), inserted Unit Test for code completion, did minor edits for official delivery to NGST within 30 days of code completion peer review date (i.e., 20Dec05). 17Jan06 – Made minor edits per comments from Omaha's quality assurance person, added Omaha's electronic signatures, did a sync of dates in document's upper right header, signature page, and Revision/Change Record page.	All
A2	6-15-07	Logo, cleanup updates. Delivered to NGST.	All
A3	12-13-07	Added documentation for Bright Pixel Exclusion Flag per NP-EMD.2007.510.0045.	9, 11, 13
A4	9-16-08	Added Bright Pixel Absence Quality Flag information.	10
A5	10-17-08	Implemented TM NP-MD.2008.510.0014 and TM NP-MD.2008.510.0016 to add ice albedo and global/combined albedo. Reformatted to conform to new template. Addressed comments from CCPR. Incorporated NGST comments from previous delivery. Delivered to NGST.	All
A6	11-11-08	Updated LSA IP quality flag information, Removed bright pixel as an input	9
A7	3-18-09	Updated for SDRL comments. Prepared OAD for TIM.	All
A	4-15-09 5-13-09	Incorporated TIM comments and prepared for ARB/ACCB submittal and updated Tables 6 (pg 9) and Table 11 (pg 15) due to IDPS PCR020193. Incorporated RFA Nos. 237 & 238 for ARB.	All
B1	7-13-09	Updated table as described in tech memo NP-EMD.2008.510.0072_NPP_OceanAlbedo_DegradQFUpdate for PCR 1925	15
B2	11-06-09	Updated table 9. Changed wind speed CMIS source to MIS per ATBD. PCR020506	15
B3	11-09-09	Update quality flags as described in tech memo NP-EMD-2009.510.0063 Rev A VIIRS Albedo input quality flags specification	Tables 5, 6 & 11

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Revision/Change Record

Document Number **D39539**

Revision	Document Date	Revision/Change Description	Pages Affected
B	4-28-10	Prepared for TIM/ARB/ACCB. Includes Title change as described by ECR_A291A.	All
C1	8-18-10	Updated Table 1 & 2 due to omission of TM 2010.510.0005.Rev-C	Table 1 & 2
C2	10-15-10	Updated due to document convergence to include tech memo: 2010.510.0011	All
C3	09-19-11	Updated for PCR026169	Tables 1 & 2
C4	09-19-11	Updated for PCR026775	16

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1.0 INTRODUCTION

1.1 Objective

The purpose of the Operational Algorithm Description (OAD) document is to express, in computer-science terms, the remote sensing algorithms that produce the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) end-user data products. These products are individually known as Raw Data Records (RDRs), Temperature Data Records (TDRs), Sensor Data Records (SDRs) and Environmental Data Records (EDRs). In addition, any Intermediate Products (IPs) produced in the process are also described in the OAD.

The science basis of an algorithm is described in a corresponding Algorithm Theoretical Basis Document (ATBD). The OAD provides a software description of that science as implemented in the operational ground system -- the Data Processing Element (DPE).

The purpose of an OAD is two-fold:

1. Provide initial implementation design guidance to the operational software developer.
2. Capture the “as-built” operational implementation of the algorithm reflecting any changes needed to meet operational performance/design requirements.

An individual OAD document describes one or more algorithms used in the production of one or more data products. There is a general, but not strict, one-to-one correspondence between OAD and ATBD documents.

1.2 Scope

The scope of this document is limited to the description of the core operational algorithm(s) required to create the (1) VIIRS Land and Ice Surface Albedo IP and (2) VIIRS Global Albedo EDR. The theoretical basis for this algorithm is described in Section 3.3 of the Surface Albedo Algorithm Theoretical Basis document ATBD, 474-00040.

1.3 References

1.3.1 Document References

The science and system engineering documents relevant to the algorithms described in this OAD are listed in Table 1.

Table 1. Reference Documents

Document Title	Document Number/Revision	Revision Date
Surface Albedo Algorithm Theoretical Basis document ATBD	474-00040	22 Apr 2011
VIIRS Net Heat Flux (NHF) Environmental Data Record (EDR) and Ocean Surface Albedo Intermediate Product (IP) ATBD	474-00036	22 Apr 2011
VIIRS Surface Albedo Unit Level Detailed Design Document	Y2483 Ver. 5 Rev. 4	27 May 2004
VIIRS Surface Land Module Software Architecture Document	Y2474 Ver. 5 Rev. 9	27 May 2004
VIIRS Radiometric Calibration Unit Level Detailed Design	Y2490 Ver. 5 Rev. 4	30 Sep 2004

Document Title	Document Number/Revision	Revision Date
VIIRS Surface Albedo EDR Software Unit Test Report	TP60822-VIR-018 Initial Release	17 May 2004
JPSS Environmental Data Record (EDR) Production Report for NPP	474-00012 Rev. A	09 Feb 2011
JPSS Environmental Data Record (EDR) Interdependency Report (IR) for NPP	474-0007 Rev. A	09 Feb 2011
NPP Mission Data Format Control Book and App A (MDFCB)	472-REF-00057	06 Jan 2011
JPSS Internal Data Format Control Book Volume III – Retained Intermediate Product Formats (IDFCB)	474-00020-03, Rev-	18 Feb 2011
JPSS Common Data Format Control Book - External - Volume I - Overview	474-00001-01, Rev-	10-Dec-10
JPSS Common Data Format Control Book - External - Volume II - RDR Formats	474-00001-02, Rev-	10-Dec-10
JPSS Common Data Format Control Book - External - Volume III - SDR/TDR Formats	474-00001-03, Rev-	16-Feb-11
JPSS Common Data Format Control Book - External - Volume IV - Part I - IPs, ARPs, and Geolocation Data	474-00001-04-01, Rev-	10-Dec-10
JPSS CDFCB - External - Volume IV - Part II - Imagery, Atmospheric, and Cloud EDRs	474-00001-04-02, Rev-	10-Dec-10
JPSS Common Data Format Control Book - External - Volume IV - Part III - Land and Ocean/Water EDRs	474-00001-04-03, Rev-	10-Dec-10
JPSS Common Data Format Control Book - External - Volume IV - Part IV - Earth Radiation Budget and Space EDRs	474-00001-04-04, Rev-	18-Feb-11
JPSS Common Data Format Control Book - External - Volume V - Metadata	474-00001-05, Rev-	16-Feb-11
JPSS CDFCB - External - Volume VI - Ancillary Data, Auxiliary Data, Messages, and Reports	474-00001-06, Rev-	10-Dec-10
JPSS Common Data Format Control Book - External - Volume VII - Part I - JPSS Downlink Data Formats	474-00001-07-01, Rev-	16-Feb-11
JPSS CDFCB - External - Volume VII - Part 2 - JPSS Downlink Data Formats - CrIS	474-00001-07-02, Rev-	16-Feb-11
JPSS CDFCB - External - Volume VII - Part 3 - JPSS Downlink Data Formats - OMPS	474-00001-07-03, Rev-	16-Feb-11
JPSS CDFCB - External - Volume VII - Part 4 - JPSS Downlink Data Formats - ATMS	474-00001-07-04, Rev-	16-Feb-11
JPSS CDFCB - External - Volume VII - Part 5 - JPSS Downlink Data Formats - VIIRS	474-00001-07-05, Rev-	16-Feb-11
JPSS Common Data Format Control Book - External - Volume VIII - Look Up Table Formats	474-00001-08, Rev-	10-Dec-10
NPP Command and Telemetry (C&T) Handbook	D568423 Rev. C	30 Sep 2008
JPSS CGS Data Processor Inter-subsystem Interface Control Document (DPIS ICD) Vol I – IV	IC60917-IDP-002, Rev C	29-Sep-11
JPSS CGS Acronyms and Glossary	LI60917-GND-005, Rev -	17-Oct-11
NGST/SE technical memo – Surface_Albedo_EDR_QF_memo	NP-EMD.2005.510.0095	15 Aug 2005
NGST/SE technical memo – Bright_Pixel_Flag_for_Albedo	NP-EMD.2007.510.0045	17 July 2007
NGST/SE technical memo – NPP_Global_Albedo_EDR	NP-EMD.2008.510.0014	27 Mar 2008
NGST/SE technical memo – NPP_Albedo_OAD Update	NP-EMD.2008.510.0016	28 Mar 2008
NGST/SE technical memo –		

Document Title	Document Number/Revision	Revision Date
NGST/SE technical memo – Land Surface Gridded Albedo IP OAD update (Referenced for ISIN to SIN conversion)	NP-EMD.2007.510.0031	26 Apr 2007
NGST/SE technical memo – Aerosol_Model_Updates_for_Albedo_EDR	NP-EMD.2008.510.0039	19 Jun 2008
NGST/SE technical memo – Out_of_Range_Flagging_for_Albedo_EDR	NP-EMD.2010.510.0064	06 Nov 2009
NGST/SE technical memo – Granule-Level Summary Exclusion Flag Definition Rev. C.doc	NP-EMD.2010.510.0005.Rev-C	2 Mar 2010
NGST/SE technical memos: LUT_OAD_Drop History_Corrections	NPOESS GJM-2010.510.0011	21 Sep 2010
NGST/SE technical memos: Update of regression coefficients for the VIIRS surface albedo EDR due to RSR updates	NP-EMD.2010.510.0093	30 Nov 2010

1.3.2 Source Code References

The science and operational code and associated documentation relevant to the algorithms described in this OAD are listed in Table 2.

Table 2. Source Code References

Reference Title	Reference Tag/Revision	Revision Date
VIIRS Land Surface Albedo science-grade software (original reference source)	ISTN_VIIRS_NGST_2.8	17 Sep 2004
VIIRS Land Surface Albedo operational software	B1.4	20 Dec 2005
NGST/SE technical memo – Surface_Albedo_EDR_QF_memo	NP-EMD.2005.510.0095	15 Aug 2005
VIIRS Land Surface Albedo science-grade software includes TM 2007.510.0031	ISTN_VIIRS_NGST_4.5 (ECR A-123A)	23 May 2007
NGST/SE technical memo – Bright_Pixel_Flag_for_Albedo	NP-EMD.2007.510.0045	17 July 2007
OAD – VIIRS LSA-IP Rev. A3 (TM 2007.510.0045)	Build 1.5.x.1	19 Dec 2007
OAD – VIIRS LSA-IP Rev. A5 (ECR-IDP-R886) Includes PCRs 017652 & 017716	Build 1.5.x.1-E	17 Oct 2008
OAD – VIIRS LSA-IP Rev. A6	Build 1.5.x.1-I	11 Nov 2008
PCR 21632 [TM 2010.510.0005.Rev-C] (No OAD update required)	Build Sensor Characterization SC-09	30 Mar 2010
ACCB (no code updates)	OAD Rev B	28 Apr 2010
Convergence Update (No code updates)	(OAD Rev C2)	15 Oct 2010
Science-grade software: ISTN_VIIRS_NGST_2.8.2 (Includes TM 2010.510.0093)	ECR A-346A	17 Jan 2011
Operational Software: PCR026169-OAD (and PCR025929-Code)	Maintenance Build 1.05.06-F (OAD Rev C3)	19 Sep 2011
PCR026775	(OAD Rev C4)	19 Sep 2011

2.0 ALGORITHM OVERVIEW

The purpose of the Land Surface Albedo IP algorithm is to produce the broadband surface albedo between 0.4 and 4 microns. Two sub-algorithms, the Dark Pixel Sub Algorithm (DPSA) and the Bright Pixel Sub Algorithm (BPSA) are used in the current algorithm to compute the broadband land surface albedo.

The DPSA is based on the gridded surface albedo IP remapped to the swath by the gridding/regridding module. It uses the Bi-directional Reflectance Distribution Function (BRDF) coefficients retrieved by the Land Surface Albedo IP to compute the black-sky and white–sky albedo from which the broadband albedo is derived via linear regression equation.

The BPSA bypasses the BRDF information of the Land Surface Albedo IP and instead uses a linear regression on the Top of Atmosphere (TOA) reflectances (corrected for gaseous absorption) to derive the broadband albedo. It has been extended to apply to sea ice pixels as identified by the sea ice concentration IP produced as part of the sea ice age processing

Figure 1 shows the Land Surface Albedo IP processing chain.

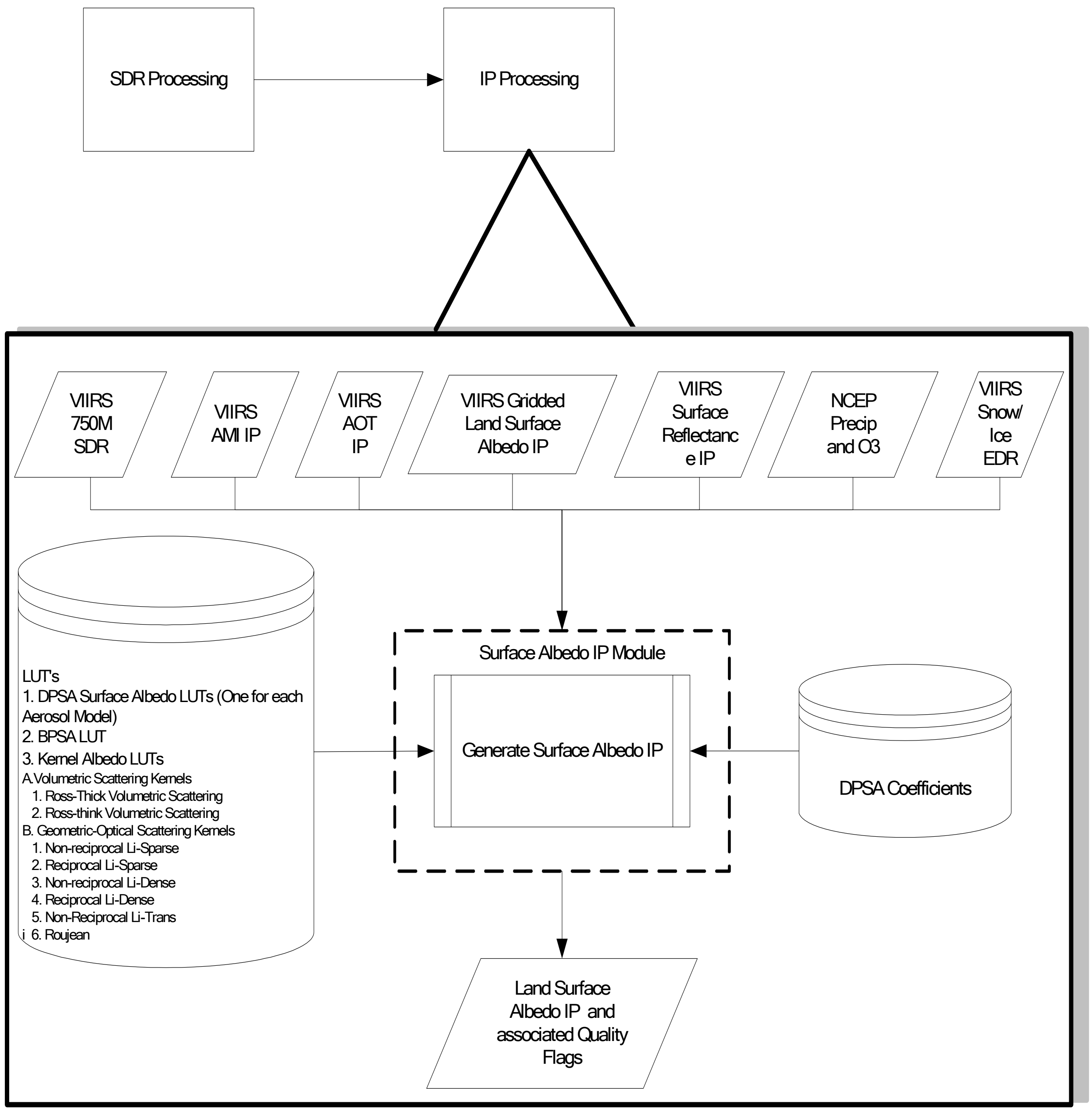

Figure 1. Land Surface Albedo IP Processing Chain

2.1 Land and Ice Surface Albedo IP Description

The Land and Ice Surface Albedo IP retrieval algorithm and the theoretical basis are described in detail in Section 3.3 of the Surface Albedo Algorithm Theoretical Basis document ATBD, 474-00040.

2.1.1 Interfaces

To begin data processing, the Infrastructure (INF) Subsystem Software Item (SI) initiates the Land and Ice Surface Albedo IP algorithm. The INF SI provides tasking information to the algorithm indicating which granule to process. The Data Management Subsystem (DMS) SI provides data storage and retrieval capability. A library of C++ classes, which implement the SI interfaces, are depicted in Figure 2.

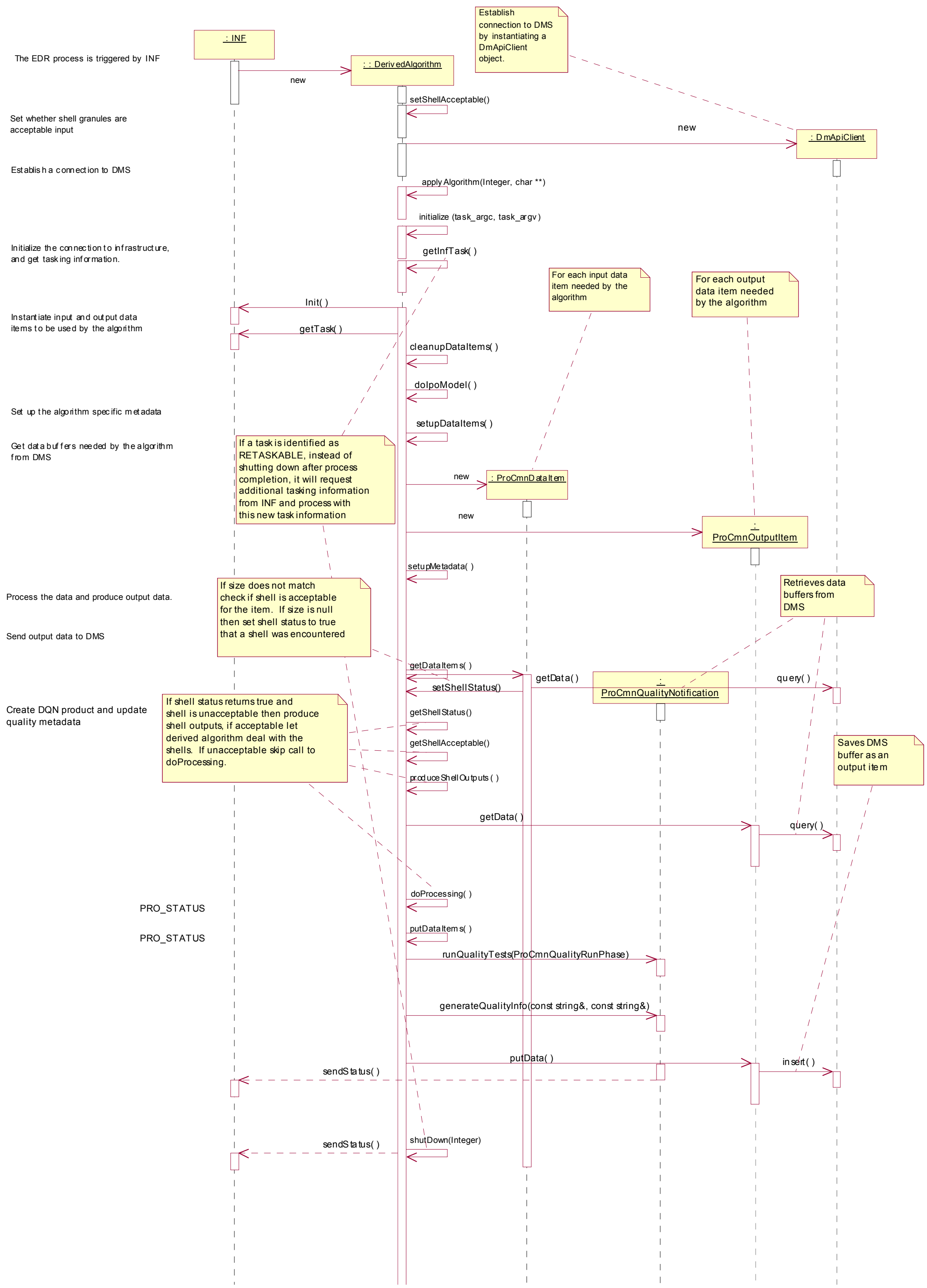

Figure 2. IPO Model Interface to INF and DMS

2.1.1.1 Inputs

Table 3 explains the land and ice surface albedo main inputs. Refer to the CDFCB-X, D34862, for a detailed description of the inputs.

Table 3. Land Surface Albedo Main Inputs

Input	Type	Description/Source	Units/Valid Range
M1	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M1/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M2	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M2/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M3	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M3/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M4	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M4/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M5	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M5/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M7	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M7/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M8	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M8/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M10	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M10/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
M11	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Reflectance value for VIIRS band M11/ VIIRS 750 m resolution SDR	Unitless / >0 Please refer to VIIRS Radiometric Calibration Document, Y2490
Surf Reflect IP	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS x 2]	VIIRS Surface Reflectance IP, bands M5 and M7	Unitless / 0.0 – 1.5
SolZenAngle	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Solar Zenith Angle/ VIIRS 750 m resolution SDR	Radians / 0 – π/2
ViewZenAngle	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Sensor Zenith Angle/ VIIRS 750 m resolution SDR	Radians / 0 – π/2
SolAziAngle	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Solar Azimuth Angle / VIIRS 750 m resolution SDR	Radians / -π - π

Input	Type	Description/Source	Units/Valid Range
ViewAziAngle	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Sensor Azimuth Angle / VIIRS 750 m resolution SDR	Radians / -π - π
Height	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Terrain Height/ VIIRS 750 m resolution SDR	Meters
SnowFrac	Float32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Snow Fraction/Snow Cover EDR	Unitless / 0.0 - 1.0 FILL_VALUE = -999.9
AMI	UInt8 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Aerosol Model IP	Unitless / 0 - 9 FILL_VALUE = 255
AOT	Float32 x [MBATRACKS x MBASCANS]	AOT for VIIRS Band M4	Unitless/ 0.0 – 2.0
Sea Ice Concentration	Float32 x [I_VIIRS_SDR_ROWS x I_VIIRS_SDR_COLS	Ice Concentration IP	Unitless / 0.0 – 1.0
Precip	Int32 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	NCEP Precipitable Water	cm FILL_VALUES = -999.00
O3	UInt16 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	NCEP Column Ozone	Atm-cm / 0.5 to 6.5 (Scaled Units) FILL_VALUES = -999.00
Gridded Surface Albedo IP	Float32 x [NUM_VEG_LAYERS x 3 x MAX_MOD_BANDS x M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS	VIIRS Gridded Surface Albedo IP	Unitless / 0.0 – 1.0
KERNEL_ALBEDO_LUT	BlackSky: Float32 x [NumBins_KernelBlackSkyAlbedo x NUM_KERNELS] WhiteSky: Float32 x [NUM_KERNELS]	White and Black Sky values for bands M1-M5, M7, M8, M10, M11	Unitless
DPSA COEFF LUT	Float32 x [MAX_MOD_BANDS]	Dark Pixel Sub-Algorithm (DPSA) LUT Coefficients	Unitless/
BPSA LUT	Float32 x [MAX_MOD_BANDS x NUM_BPSA_AERO_MODELS x NUM_SIZE_BPSA]	BPSA Coefficients LUT for bands M1-M5, M7, M8, M10, M11	Unitless/ 0 < BPSA_Coeffs < 1
BPSA_SEA_ICE_LUT	Float32x [LUT_SIZE_BPSA_SEA_ICE]	BPSA Coefficients LUT for bands M1-M5, M7, M8, M10, M11 for Sea Ice pixels for each Solar Angle Bin	Unitless
SURF_ALBEDO_AC	Structure	Tunable algorithm parameters	Refer to Table 8: List of Tunable Algorithm Parameters

2.1.1.2 Outputs

Table 4 explains the surface albedo IP output. Refer to the CDFCB-X, D34862, for a detailed description of the outputs. Table 5 gives a brief description of surface albedo IP quality flags. Table 6 describes how a quality flag is set.

Table 4. Surface Albedo IP Output

Output	Data Type/Size	Description	Units/Valid Range
BPSA	UInt16 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS	Surface Albedo Values for Bright Pixel Sub-Algorithm	Unitless/ 0.0 – 1.0 (IP Scaled Units) FILL_VALUE = 65535 (Un-scaled Units)
DPSA	UInt16 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	Spectral Albedo Values for Dark Pixel Sub-Algorithm	Unitless/ 0.0 – 1.0 (IP Scaled Units FILL_VALUE = 65535 (Un-scaled Units)
Land_Quality_Flags	UInt8 x [M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS x NumBytes_LQF]	Land Surface Albedo Quality Flags for each VIIRS pixel - see Table 5	N/A
landSurfAlbedoScale	Float64	The scale value for the Land Surface Albedo is the maximum acceptable value over the maximum range of a UInt16	1 / 65528
landSurfAlbedoOffset	Float32	The offset value is the minimum acceptable value for Land Surface Albedo	0.0

Table 5. Surface Albedo IP Quality Flags Description

Byte	Bit	Flag Description Key	Result
0	0	Out of Expected Range	0 = In Range 1 = Out of Range
	1	Exclusion Condition	0 = AOT within Range 1 = AOT out of Range
	2-3	Solar Zenith Angle Degradation and Exclusion	0 = No Degrad. or Excl. 1 = Degradated 2 = Exclusion
	4-5	Input Data Quality	0 = Good 1 = Degrad. 2 = No Retrieval
	6	Algorithm Branch	0 = Land 1 = Sea Ice
	7	Spare	N/A

Table 6. Description of How Quality Flag is Set

Bit Location	Flag Description	How Flag Is Set
Byte 0, Bit 0	Out of Range	0: In Range: BPSA & DPSA is >= 0.0 & <= 1.0
		1: Out of Range: BPSA or DPSA is < 0.0 || > 1.0

Bit Location	Flag Description	How Flag Is Set
Byte 0, Bit 1	Exclusion Condition	0: AOT in Range: Cloud Confidence Indicator bit < 2 (Clear) Night_Mask bit in SR IP != 1 (Day) Heavy_Aerosol_Mask bit in SR IP != 1 (Day)
		1: AOT out of Range: Cloud Confidence Indicator bit >= 2 (Cloudy) Night_Mask bit in SR IP == 1 (Night) Heavy_Aerosol_Mask bit in SR IP == 1 (Night)
Byte 0, Bit 2-3	Solar Zenith Angle Degradation and Exclusion	0: No Degrad. Of Excl.: Solar Zenith Angle is < 65^{o}
		1: Degraded: Solar Zenith Angle is >= 65^{o} & Solar Zenith Angle <= 85^{o}
		2: Exclusion: Solar Zenith Angle is > 85^{o}
Byte 0, Bit 4-5	Input Data Quality	0: Good: If all the Bands M1-M5,M7,M8,M10,M11 SDR Quality are set to Good 1: Degraded: If any of the Bands M1-M5,M7,M8,M10,M11 SDR Quality are set to Poor and none of the Bands M1-M5,M7,M8,M10,M11 SDR Quality are set to No Calibration 2: No retrieval: If any of the Bands M1-M5,M7,M8,M10,M11 SDR Quality are set to “No Calibration”.
Byte 0, Bit 6	Algorithm Branch	0: Ice Concentration < Sea Ice Threshold 1: Ice Concentration > Sea Ice Threshold
Byte 0, Bits 7	Spare	Initialized to 0

2.1.2 Algorithm Processing

Figure 3 shows a surface albedo IP function-by-function flow chart. The acronyms BPSA and DPSA are discussed in Section 2.0, Algorithm Overview.

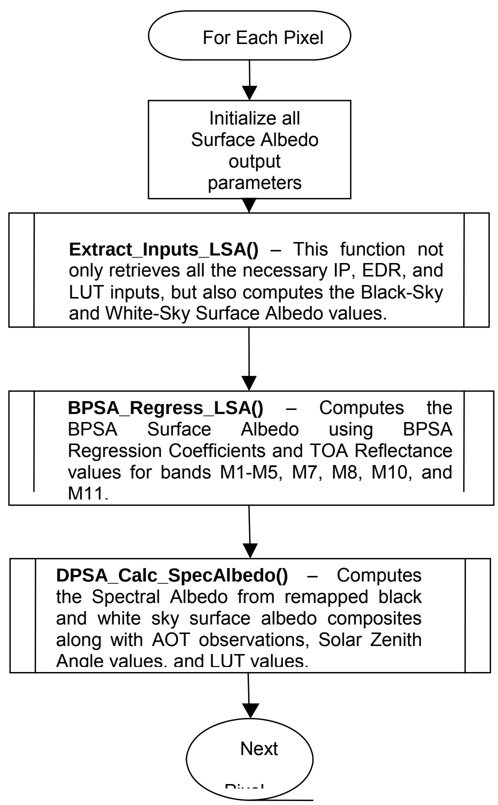

Figure 3. Surface Albedo IP Function-By-Function Flow

2.1.2.1 Main Module - Generate_LSA_IP.cpp

This function is the main driver for the Land Surface Albedo retrieval algorithm. It also checks Bright Pixel data for each pixel and sets the corresponding exclusion flag if the pixel is bright.

2.1.2.2 Extract_Inputs_LSA.cpp

This module applies the precipitable water and column ozone corrections to the TOA Reflectance values. Furthermore, this module computes the Black-Sky and White-Sky Albedo values using the kernel model parameters, which are part of the output of the Remapped Gridded Surface Albedo IP. The computation of the White Sky Albedo values simply takes the sum of each White Sky Kernel Parameter, for each band, multiplied by the LUT value for the corresponding kernel. A similar regression scheme is used for the Black Sky Albedo. In this case however since the Black sky albedo is computed at the mean solar zenith angle, a linear interpolation is performed using the LUT values to evaluate the black sky albedo at the current mean solar zenith angle.

2.1.2.3 BPSA_Regress_LSA( )

This function applies a regression equation to the TOA Reflectance values by computing the BPSA regression coefficients, BPSAxx, through linear interpolation of the BPSA LUT values with Solar Zenith, View Zenith, and Relative Azimuth angles. The subscript [B] represents the bands at which these coefficients are computed. This computation is only done when the pixel is:

Daytime (Land Quality Flag) &&
Contains no clouds or contains only thin cirrus clouds (Land Quality Flag) &&
Solar Zenith Angle is not Fill_Value &&
TOA Reflectance for band M1 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M2 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M3 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M4 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M5 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M7 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M8 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M10 is not Fill_Value (750M SDR) &&
TOA Reflectance for band M11 is not Fill_Value (750M SDR) &&
Aerosol Model Information is Available.

If these conditions are not met, the BPSA value for the current pixel is set to the FILL_VALUE.

The final Surface Albedo for the Bright Pixel Sub-Algorithm (A) regression equation is

$$A = BPSA_C + BPSA_{M1}\rho_{M1}^{TOA} + BPSA_{M2}\rho_{M2}^{TOA} + BPSA_{M3}\rho_{M3}^{TOA} + BPSA_{M4}\rho_{M4}^{TOA} + \\ BPSA_{M5}\rho_{M5}^{TOA} + BPSA_{M7}\rho_{M7}^{TOA} + BPSA_{M8}\rho_{M8}^{TOA} + BPSA_{M10}\rho_{M10}^{TOA} + BPSA_{M11}\rho_{M11}^{TOA}$$

where ρ_B^{TOA} represents the TOA reflectance for bands M1-M5, M7, M8, M10, and M11. The BPSA Surface Albedo value is one data field in the Surface Albedo IP output. For a more detailed discussion on the theoretical basis of this calculation refer to the Surface Albedo Algorithm Theoretical Basis document ATBD, 474-00040, Section 3.3.2.1.10.

2.1.2.4 DPSA_Calculate_SpecAlbedo( )

This module computes the spectral albedo for each VIIRS pixel from which the broadband albedo is derived; the broadband albedo is the DPSA Surface Albedo IP output. First, the atmospheric state, SB, must be computed for each moderate resolution band (M1-M5, M7, M8, M10, M11). This is done by interpolating the DPSA LUT values for SB in AOT and Solar Zenith Angle. Then the interpolated atmospheric state is used with the black and white sky spectral albedo (for each vegetation layer) to produce the spectral narrowband albedo according to the equation:

$$SpecAlb = (1 - S_B)a_B^{bs} + S_B a_B^{ws}$$

where a_B^{bs} and a_B^{ws} are the black sky and white sky albedo values, at the vegetation layer and for each moderate resolution band, respectively.

This computation is done for:

Daytime pixels (Land Quality Flag) &&
Non-cloudy pixels or pixels that only contain thin cirrus clouds (Land Quality Flag) &&
Pixels where the Solar Zenith angle is available &&
Pixels where the Surface Reflectance is available for bands M5 and M7 &&
Pixels where the Aerosol Model is available &&
Pixels where the Black Sky albedo is available.

If these conditions are not met, the DPSA value for the current pixel is set to the FILL_VALUE.

2.1.2.5 DPSA_Narrow_to_Broad( )

This function converts the spectral narrowband albedo values, computed by the function DPSA_Calculate_SpecAlbedo( ), to broadband albedo values, the second component to the DPSA Surface Albedo IP output. The broadband conversion is performed by a regression equation described in the Surface Albedo Algorithm Theoretical Basis document ATBD, 474-00040, Section 3.3.2.19; see Equation 3.27. The regression coefficients are the DPSA coefficients.

2.1.3 Graceful Degradation

2.1.3.1 Graceful Degradation Inputs

There are two cases where input graceful degradation is indicated in the LSA:

1. A primary input denoted in the algorithm configuration guide cannot be successfully retrieved but an alternate input can be retrieved.
2. An input that is retrieved for an algorithm has the N_Graceful_Degradation metadata field set (propagation).

Table 7 details the instances of these cases. Note that the shaded cells indicate that the graceful degradation was done upstream at product production.

Table 7. Graceful Degradation

Input Data Description	Baseline Data Source	Primary Backup Data Source	Secondary Backup Data Source	Tertiary Backup Data Source	Graceful Degradation Done Upstream
Total Column Ozone	VIIRS_GD_09.4.1 NCEP	VIIRS_GD_09.4.1 NCEP (Extended Forecast)	N/A	N/A	Yes
Global Snow Cover	VIIRS_SN_01.4.1 VIIRS	N/A	N/A	N/A	N/A
Total Column Precipitable Water	VIIRS_GD_09.4.11 NCEP	VIIRS_GD_09.4.11 NCEP (Extended Forecast)	N/A	N/A	Yes
Aerosol Optical Thickness	VIIRS_GD_15.4.1 VIIRS AOT IP	VIIRS_GD_25.4.1 NAAPS	VIIRS_GD_15.4.1 Climatology	N/A	Yes, backup only

2.1.3.2 Graceful Degradation Processing

None.

2.1.3.3 Graceful Degradation Outputs

None.

2.1.4 Exception Handling

Error handling code was already implemented in the algorithm to check input items for fill values and to take appropriate steps for an input item which contains fill. These recovery steps, in almost all cases, involve the pixel being filled with the appropriate fill value and the algorithm continues on to process the next pixel. No debug or fail message is sent if this condition is met.

2.1.5 Data Quality Monitoring

None.

2.1.6 Computational Precision Requirements

None.

2.1.7 Algorithm Support Considerations

2.1.7.1 Program Parameters for Continuous Monitoring

Table 8 contains tunable algorithm parameters that need to be monitored.

Table 8. List of Tunable Algorithm Parameters

Algorithm Parameter Name	Description	Assigned Value
SnowThreshold	Snow Fraction Threshold	0.5

Algorithm Parameter Name	Description	Assigned Value
IceConcentrationFraction	IceConcentrationFraction (in BPSA_Regress_SurfAlbedo.c).	0.99
NDVI_Threshold	NDVI Threshold	0.15
NumBins_SolarZenith	Number of Solar Zenith Angle Values/Bins	86
BinSize_SolarZenith	Solar Zenith Angle Bin Size, angular increment	1.0
NumBins_KernelBlackSkyAlbedo	Number of Black Sky Albedo Bins in the LUTs	170
BinSize_KernelBlackSkyAlbedo	Bin size for each Kernel Black Sky Albedo	0.5
NumBins_AOT	Number of AOT Bins	101
BinSize_AOT	AOT Bin Size	0.02
NUM_KERNELS	Number of Surface Albedo LUTs	8
NUM_KERNEL_LUT	Number of Kernel Model LUTs	8
MAX_LUT_DIM	Maximum LUT Dimensions (Represents the 3 Geometry Parameters: Solar Zenith, View Zenith, and Relative Azimuth)	3
BPSA_NUM_BINS_SOLAR_ZENITH	Number of Solar Zenith Angles LUT bins	12
BPSA_NUM_BINS_VIEW_ZENITH	Number of View Zenith Angle LUT bins	17
BPSA_NUM_BINS_REL_AZIMUTH	Number of Relative Azimuth Angle LUT bins	11
BinCoord_SeaIce_SolarZenith[15]	Grid coordinates for BPSA SEA ICE LUTs	{0, 53.5, 57.5, 61, 63.5, 66, 68.25, 70.25, 72.25, 74.25, 76, 78, 79.5, 81, 83}
BinCoord_SolarZenith[12]	Grid Coordinates for BPSA LUT for Solar Zenith Angles	{ 5, 15, 25, 35, 45, 52.5, 57.5, 62.5, 67.5, 72.5, 77.5, 80}
BinCoord_ViewZenith[17]	Grid Coordinates for BPSA LUT for View Zenith Angles	{ 2.5, 7.5, 12.5, 17.5, 22.5, 27.5, 32.5, 37.5, 42.5, 47.5, 52.5, 57.5, 62.5, 67.5, 72.5, 77.5, 82.5 }
BinCoord_RelAzimuth[11]	Grid Coordinates for BPSA LUT for Relative Azimuth Angles	{2.5, 7.5, 20, 45, 75, 105, 135, 160, 172.5, 177.5, 180}
Lut_Size_Bpsa	Size of LUT for BPSA	BPSA_NUM_BINS_SOLAR_ZENITH * BPSA_NUM_BINS_VIEW_ZENITH * BPSA_NUM_BINS_REL_AZIMUTH
Lut_Size_Bpsa_Sea_Ice	Size of LUT for BPSA for Sea Ice Pixels	12*15

Algorithm Parameter Name	Description	Assigned Value
Bpsa_Map_Aerosol[5]	Aerosol Model map used for interpolation	{ 1, 2, 3, 4, 5 }

2.1.7.2 Science Enhancement Opportunities

See Section 3.3 of the ATBD, 474-00040, for details on the theoretical description of the land surface albedo retrieval (IP and EDR). For a detailed theoretical description of various kernel models incorporated into Lookup Table (LUT) values, see Sections 3.3.2.1.2.1 (Volumetric Scattering Kernels) and 3.3.2.1.2.2 (Geometric Optical Scattering Kernels).

2.1.8 Assumptions and Limitations

2.1.8.1 Assumptions

None

2.1.8.2 Limitations

None

2.2 Global/Combined Albedo Description

The land and ice albedo IP and the ocean albedo IP are combined to form the Global Albedo EDR.

2.2.1 Interfaces

To begin data processing, the Infrastructure (INF) Subsystem Software Item (SI) initiates the Global Albedo EDR algorithm. The INF SI provides tasking information to the algorithm indicating which granule to process. The Data Management Subsystem (DMS) SI provides data storage and retrieval capability.

2.2.1.1 Inputs

Table 9 shows the main inputs for combined albedo.

Table 9. Combined Albedo Main Inputs

Input	Data Type/Size	Description	Units/Valid Range
BPSA	Uint*16 x [MOD_TRACKS x MOD_SCANS]	Surface Albedo Values for Bright Pixel Sub-Algorithm	Unitless/ 0.0 – 1.0 (EDR Scaled Units)
OceanAlbedo	Float*32 x [MOD_TRACKS x MOD_SCANS]	Ocean surface albedo	Unitless / 0.0 to 1.0
BrightPixel Mod IP	UInt8 x [NUM_750M_BANDS x M_VIIRS_SDR_ROWS x M_VIIRS_SDR_COLS]	VIIRS Bright Pixel MOD IP (M1-M5,M7,M8,M10,M11)	Unitless/ 0 <= BrightPixel Flag <= 15

2.2.1.2 Outputs

Table 10 shows the combined albedo outputs.

Table 10. Combined Albedo Outputs

Output	Data Type/Size	Description	Units/Valid Range
Global Albedo	Uint*16 x [MOD_TRACKS x MOD_SCANS]	Surface Albedo Values for ocean, land, or ice	Unitless/ 0.0 – 1.0 (EDR Scaled Units)

Table 11 shows the quality flag structure for the global albedo EDR.

Table 11. Quality Flag Structure for Global Albedo EDR

Byte	Bit	Flag Description Key	Bit Value	IP
0	0-1	Albedo retrieval quality	00 = Good 01 = Poor 10 = No retrieval	All
	2	Retrieved albedo out of expected reporting range	0 = Within range (0<=Albedo<=1) 1 = Out of range	All
	3	Stray light maximum radiance exclusion	0 = No exclusion 1 = Stray light exclusion	All
	4	Input chlorophyll concentration	0 = Available 1 = Climatology	Ocean
	5-6	Input wind speed	00 = Not available 01 = NWP 11 = MIS	Ocean
	7	Spare	Set to 0	All
1	0-1	Cloud indicator	00 = Confident clear 01 = Probably clear 10 = Probably cloudy 11 = Confident cloudy	All
	2	Cloud shadow detected	0 = No 1 = Yes	All
	3-4	Background Type	00 = Land 01 = Sea Ice 10 = Ocean 11 = Not Produced	All
	5-6	Solar zenith angle for degradation and exclusion	00 = None (SZA<65^{o}) 01 = Degraded (65^{o} <= SZA <= 85^{o}) 10 = Exclusion (SZA > 85^{o})	All
2	0-1	Aerosol used	00 = None 01 = Interpolation Only 10 = Interpolation & Climatology/NAAPS 11 = Climatology/NAAPS only	All
	2	AOT exclusion (AOT @ 550 nm)	0 = No exclusion (AOT <= 1.0) 1 = Exclusion (AOT > 1.0)	All
	3	Coccolithophore degradation with calcite concentration due to coccolithophores ≥0.3 mg/m^3	0 = No degradation 1 = Degradation	Ocean
	4-5	Input Data Quality	0 = Good 1 = Degraded 2 = No Retrieval	All
	6-7	Spare	Set to 00000	Ocean

2.2.2 Algorithm Processing

The Global Albedo EDR algorithm consists of copying ocean albedo values to ocean pixels (as determined by the Land/Water mask = 011) and copying Land/Sea Ice albedo values to the pixels that are not ocean pixels.

2.2.2.1 Main Module – ProEdrViirsSurfaceAlbedo.cpp

This module assigns albedo values to pixels based on whether pixel is over land/ice or ocean. Quality flags are passed through from the albedo IPs, data quality is determined and final product is written to DMS.

2.2.3 Graceful Degradation

None. Graceful degradation is handled by the albedo IP algorithms.

2.2.3.1 Graceful Degradation inputs

None.

2.2.3.2 Graceful Degradation Processing

None.

2.2.3.3 Graceful Degradation Outputs

None.

2.2.4 Exception Handling

None.

2.2.5 Data Quality Monitoring

Overall data quality is classified as good, poor, or no retrieval at the pixel level during creation of the ocean and land/ice albedo IPs. These data are passed through to the Global EDR product and percentage of pixels with good albedo quality is determined and compared against the data quality threshold. The percentage of pixels having one or more exclusion criteria is calculated as well as the percentage of pixels outside of the valid range. All values for all three of these data quality attributes are stored as data quality metadata items.

2.2.6 Computational Precision Requirements

None. Global albedo values are stored as scaled integers.

2.2.7 Algorithm Support Considerations

None.

2.2.8 Assumptions and Limitations

None.

3.0 GLOSSARY/ACRONYM LIST

3.1 Glossary

The current glossary for the NPOESS program, D35836_H_NPOESS_Glossary, can be found on eRooms. Table 12 contains those terms most applicable for this OAD.

Table 12. Glossary

Term	Description
Algorithm	A formula or set of steps for solving a particular problem. Algorithms can be expressed in any language, from natural languages like English to mathematical expressions to programming languages like FORTRAN. On NPOESS, an algorithm consists of: 1. A theoretical description (i.e., science/mathematical basis) 2. A computer implementation description (i.e., method of solution) 3. A computer implementation (i.e., code)
Algorithm Configuration Control Board (ACCB)	Interdisciplinary team of scientific and engineering personnel responsible for the approval and disposition of algorithm acceptance, verification, development and testing transitions. Chaired by the Algorithm Implementation Process Lead, members include representatives from IWPTB, Systems Engineering & Integration IPT, System Test IPT, and IDPS IPT.
Algorithm Verification	Science-grade software delivered by an algorithm provider is verified for compliance with data quality and timeliness requirements by Algorithm Team science personnel. This activity is nominally performed at the IWPTB facility. Delivered code is executed on compatible IWPTB computing platforms. Minor hosting modifications may be made to allow code execution. Optionally, verification may be performed at the Algorithm Provider's facility if warranted due to technical, schedule or cost considerations.
Ancillary Data	Any data which is not produced by the NPOESS System, but which is acquired from external providers and used by the NPOESS system in the production of NPOESS data products.
Auxiliary Data	Auxiliary Data is defined as data, other than data included in the sensor application packets, which is produced internally by the NPOESS system, and used to produce the NPOESS deliverable data products.
EDR Algorithm	Scientific description and corresponding software and test data necessary to produce one or more environmental data records. The scientific computational basis for the production of each data record is described in an ATBD. At a minimum, implemented software is science-grade and includes test data demonstrating data quality compliance.
Environmental Data Record (EDR)	*[IORD Definition]* Data record produced when an algorithm is used to convert Raw Data Records (RDRs) to geophysical parameters (including ancillary parameters, e.g., cloud clear radiation, etc.). *[Supplementary Definition]* An Environmental Data Record (EDR) represents the state of the environment, and the related information needed to access and understand the record. Specifically, it is a set of related data items that describe one or more related estimated environmental parameters over a limited time-space range. The parameters are located by time and Earth coordinates. EDRs may have been resampled if they are created from multiple data sources with different sampling patterns. An EDR is created from one or more NPOESS SDRs or EDRs, plus ancillary environmental data provided by others. EDR metadata contains references to its processing history, spatial and temporal coverage, and quality.
Model Validation	The process of determining the degree to which a model is an accurate representation of the real-world from the perspective of the intended uses of the model. [Ref.: DoDD 5000.59-DoD Modeling and Simulation Management]
Model Verification	The process of determining that a model implementation accurately represents the developer's conceptual description and specifications. [Ref.: DoDD 5000.59-DoD Modeling and Simulation Management]
Operational Code	Verified science-grade software, delivered by an algorithm provider and verified by IWPTB, is developed into operational-grade code by the IDPS IPT.

Term	Description
Operational-Grade Software	Code that produces data records compliant with the System Specification requirements for data quality and IDPS timeliness and operational infrastructure. The software is modular relative to the IDPS infrastructure and compliant with IDPS application programming interfaces (APIs) as specified for TDR/SDR or EDR code.
Raw Data Record (RDR)	*[IORD Definition]* Full resolution digital sensor data, time referenced and earth located, with absolute radiometric and geometric calibration coefficients appended, but not applied, to the data. Aggregates (sums or weighted averages) of detector samples are considered to be full resolution data if the aggregation is normally performed to meet resolution and other requirements. Sensor data shall be unprocessed with the following exceptions: time delay and integration (TDI), detector array non-uniformity correction (i.e., offset and responsivity equalization), and data compression are allowed. Lossy data compression is allowed only if the total measurement error is dominated by error sources other than the data compression algorithm. All calibration data will be retained and communicated to the ground without lossy compression. *[Supplementary Definition]* A Raw Data Record (RDR) is a logical grouping of raw data output by a sensor, and related information needed to process the record into an SDR or TDR. Specifically, it is a set of unmodified raw data (mission and housekeeping) produced by a sensor suite, one sensor, or a reasonable subset of a sensor (e.g., channel or channel group), over a specified, limited time range. Along with the sensor data, the RDR includes auxiliary data from other portions of NPOESS (space or ground) needed to recreate the sensor measurement, to correct the measurement for known distortions, and to locate the measurement in time and space, through subsequent processing. Metadata is associated with the sensor and auxiliary data to permit its effective use.
Retrieval Algorithm	A science-based algorithm used to 'retrieve' a set of environmental/geophysical parameters (EDR) from calibrated and geolocated sensor data (SDR). Synonym for EDR processing.
Science Algorithm	The theoretical description and a corresponding software implementation needed to produce an NPP/NPOESS data product (TDR, SDR or EDR). The former is described in an ATBD. The latter is typically developed for a research setting and characterized as "science-grade".
Science Algorithm Provider	Organization responsible for development and/or delivery of TDR/SDR or EDR algorithms associated with a given sensor.
Science-Grade Software	Code that produces data records in accordance with the science algorithm data quality requirements. This code, typically, has no software requirements for implementation language, targeted operating system, modularity, input and output data format or any other design discipline or assumed infrastructure.
SDR/TDR Algorithm	Scientific description and corresponding software and test data necessary to produce a Temperature Data Record and/or Sensor Data Record given a sensor's Raw Data Record. The scientific computational basis for the production of each data record is described in an Algorithm Theoretical Basis Document (ATBD). At a minimum, implemented software is science-grade and includes test data demonstrating data quality compliance.
Sensor Data Record (SDR)	*[IORD Definition]* Data record produced when an algorithm is used to convert Raw Data Records (RDRs) to calibrated brightness temperatures with associated ephemeris data. The existence of the SDRs provides reversible data tracking back from the EDRs to the Raw data. *[Supplementary Definition]* A Sensor Data Record (SDR) is the recreated input to a sensor, and the related information needed to access and understand the record. Specifically, it is a set of incident flux estimates made by a sensor, over a limited time interval, with annotations that permit its effective use. The environmental flux estimates at the sensor aperture are corrected for sensor effects. The estimates are reported in physically meaningful units, usually in terms of an angular or spatial and temporal distribution at the sensor location, as a function of spectrum, polarization, or delay, and always at full resolution. When meaningful, the flux is also associated with the point on the Earth geoid from which it apparently originated. Also, when meaningful, the sensor flux is converted to an equivalent top-of-atmosphere (TOA) brightness. The associated metadata includes a record of the processing and sources from which the SDR was created, and other information needed to understand the data.

Term	Description
Temperature Data Record (TDR)	*[IORD Definition]* Temperature Data Records (TDRs) are geolocated, antenna temperatures with all relevant calibration data counts and ephemeris data to revert from T-sub-a into counts. *[Supplementary Definition]* A Temperature Data Record (TDR) is the brightness temperature value measured by a microwave sensor, and the related information needed to access and understand the record. Specifically, it is a set of the corrected radiometric measurements made by an imaging microwave sensor, over a limited time range, with annotation that permits its effective use. A TDR is a partially-processed variant of an SDR. Instead of reporting the estimated microwave flux from a specified direction, it reports the observed antenna brightness temperature in that direction.

3.2 Acronyms

The current acronym list for the NPOESS program, D35838_H_NPOESS_Acronyms, can be found on eRooms. Table 13 contains those terms most applicable for this OAD.

Table 13. Acronyms

Acronym	Description
ALB	Albedo
AM&S	Algorithms, Models & Simulations
API	Application Programming Interfaces
ARP	Application Related Product
BP	Bright Pixel
BPSA	Bright Pixel Sub Algorithm
CDFCB-X	Common Data Format Control Book - External
DMS	Data Management Subsystem
DPIS ICD	Data Processor Inter-subsystem Interface Control Document
DPSA	Dark Pixel Sub Algorithm
DQTT	Data Quality Test Table
INF	Infrastructure
ING	Ingest
IP	Intermediate Product
LSA	Land Surface Albedo
LUT	Look-Up Table
MDFCB	Mission Data Format Control Book
QF	Quality Flag
SDR	Sensor Data Record
SI	International System of Units
TBD	To Be Determined
TBR	To Be Resolved
TOA	Top of the Atmosphere

4.0 OPEN ISSUES

Table 14. TBXs

TBX ID	Title/Description	Resolution Date
None		