

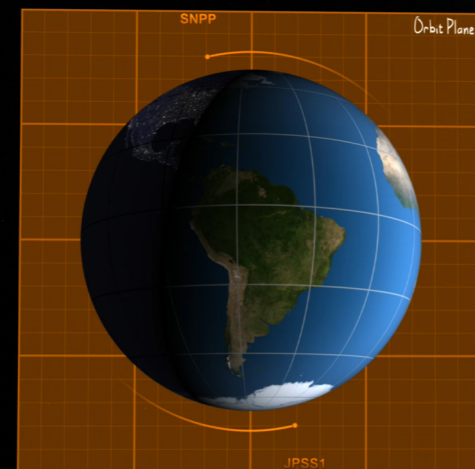


NOAA

Wednesday
January 15, 2020

JPSS & Product Algorithm Maturity Matrix and Application

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NESDIS Mission and Vision

OUR MISSION

NESDIS' mission is to provide secure and timely access to global environmental data and information from satellites and other sources to both promote and protect the Nation's environment, security, economy quality of life.

OUR VISION




Our vision is to expand understanding of our dynamic planet as the **Trusted** source of **Environmental** data.

How does one become a trusted source?

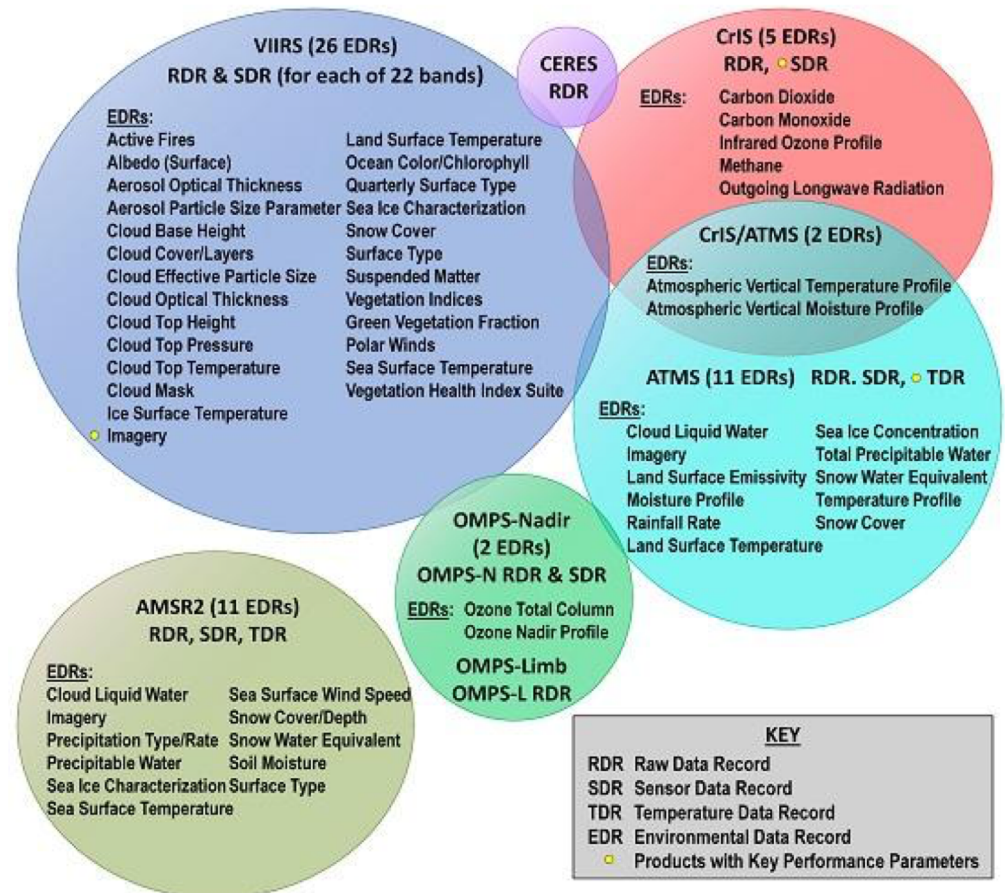
JPSS Instruments and Products

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

- S-NPP: Launched October 28, 2011
- NOAA-20 Launched: November 18, 2017
- Continuation until 2036
 - JPSS-2 (March 2022)
 - JPSS-3 (2027)
 - JPSS-4 (2031)

ATMS	CrIS	VIIRS	OMPS	CERES
Advanced Technology Microwave Sounder	Cross-track Infrared Sounder	Visible Infrared Imaging Radiometer Suite	Ozone Mapping and Profiler Suite	Clouds and the Earth's Radiant Energy System
				
ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks.		VIIRS provides many critical imagery products including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton and chlorophyll abundance.	Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts.	Scanning radiometer which supports studies of the Earth Radiation Budget (ERB).
				

JPSS Program Data Products



All information on algorithm maturity, documentation, instrument performance and access in one place

JPSS Algorithms Maturity Matrix

•Validation Data Sources:

- Ground-based Measurements; Campaigns of Opportunity (Field Campaigns), Model Analysis Fields (ECMWF, GFS); Correlative observations from other satellite sensors, SNOs; RT simulations, other algorithms
- Lessons learned, setting up of validation data sources, validation and visualization tools developed for S-NPP have helped to expedite NOAA-20 product maturity

<https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>

Beta—the product is minimally validated and may still contain significant errors, based on product quick looks using initial calibration parameters.

Provisional—product performance has been demonstrated through a large, but still (seasonally or otherwise) limited, number of independent measurements. The analysis is sufficient for limited qualitative determinations of product fitness-for-purpose, and the product is potentially ready for testing operational use.

Full—product performance has been demonstrated over a large and wide range of representative conditions, with comprehensive documentation of product performance, including known anomalies and their remediation strategies. Products are ready for operational use.

JPSS/SNPP Data Product Operational Matrix

Sensor	Data Product	Priority	ATBD	S-NPP		NOAA-20	
				Operational	Maturity	Operational	Maturity
ATMS	ATMS TDR/SDR	1	●	✓	Validated	✓	Validated
CrIS	CrIS SDR	1	●	✓	Validated	✓	Validated
VIIRS	VIIRS SDR	1	●	✓	Validated	✓	Validated
OMPS	OMPS Total Column SDR	3	●	✓	Validated	✓	Validated
OMPS	OMPS Nadir Profiler SDR	3	●	✓	Validated	✓	Validated
OMPS	OMPS Total Column Ozone EDR	3	●	✓	Validated	✓	Validated
OMPS	OMPS Nadir Profiler Ozone EDR	3	●	✓	Validated	✓	Provisional
VIIRS	VIIRS Imagery	1	●	✓	Validated	✓	Validated
VIIRS	Ocean Color	2	●	✓	Validated	✓	Provisional
VIIRS	Sea Surface Temperature	2	●	✓	Validated	✓	Validated
VIIRS	VIIRS Polar Winds	2	●	✓	Validated	✓	Validated

Consistent Cal Val Process for S-NPP, NOAA-20 (and extended to GOES-16/17):

SDR/EDR Products - -> Beta - -> Provisional - -> Validated

Validation Maturity and Documentations

Validated Maturity End State	Assessment
Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).	Validation against 4 months of global AERONET data
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.	Yes
Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.	Yes
Product is ready for operational use based on documented validation findings and user feedback.	Product is in operations and user feedback did not reveal any issues
Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument	Yes

Science Maturity Check List	Yes ?
ReadMe for Data Product Users	Yes
Algorithm Theoretical Basis Document (ATBD)	Yes
Algorithm Calibration/Validation Plan	Yes, in preparation for J2
(External/Internal) Users Manual	Yes
System Maintenance Manual (for ESPC products)	Yes
Peer Reviewed Publications (Demonstrates algorithm is independently reviewed)	Yes
Regular Validation Reports (at least annually) (Demonstrates long-term performance of the algorithm)	As required

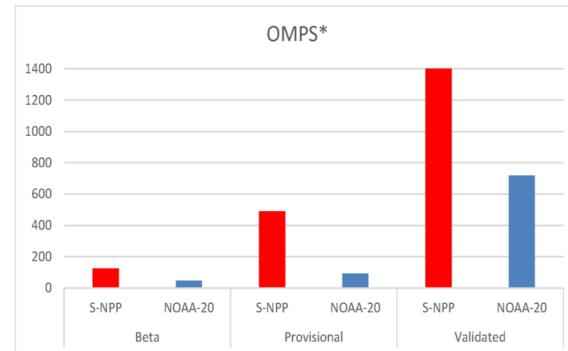
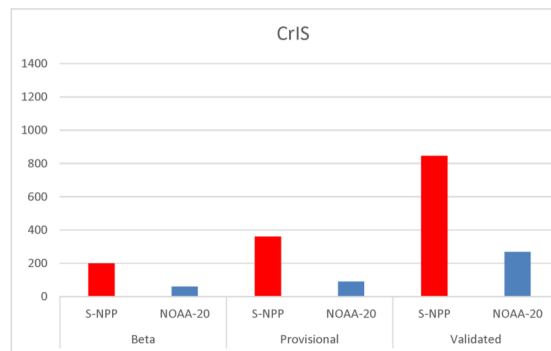
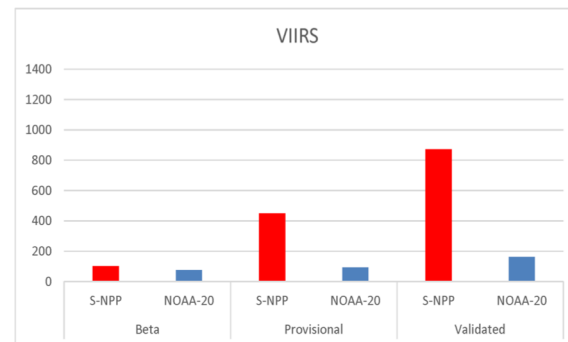
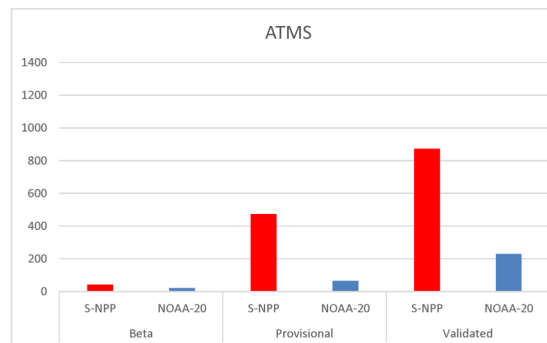
Review Team Chaired by NESDIS and JPSS Chief Scientist; composed of User Representatives, Product Operation Management, and Program Stakeholders... Users' feedback is required for the review

NOAA-20 SDR Maturity Achieved in Record Time

Key to the Successful Transition:

- Sensors are well-understood by the science teams
- Tools tested with S-NPP, Proxy data available, Algorithms baselined
- Mission-agnostic EDR algorithms: Once the SDRs were calibrated validated, the EDRs follow closely behind
- Well coordinated science teams
- Lessons learned from SNPP applied

Suomi NPP vs NOAA-20 Sensor Data Records (SDRs) Maturity Review Timeline Comparison



<https://www.star.nesdis.noaa.gov/jpss/AlgorithmOperational.php>

JPSS Algorithms and Cal Val Websites

NOAA CLASS links to the website - Information accessible to public users

Detailed information on
JPSS instruments
Science data products
and documents
ATBDs
Cal Val Plans
Product maturity status
README files
Long term validation
and science monitoring
of SDR/EDR Products
Documentation,
Meeting presentations,
Reports

- ATBDs
- Cal/Val Docs
- Data Formats
- Requirements Documents



STAR JPSS
STAR Joint Polar Satellite System Website
Maintaining the continuity of climate observations and critical environmental data from the polar orbit — Increasing the timeliness and accuracy of severe weather event forecasts

STAR JPSS Home

- JPSS Data Products
- Algorithm Cal/Val Maturity
- Product Operational Matrix
- Documentation

Product Monitoring

- ICVS
- EDR LTM Site

JPSS Instruments/SDRs

- ATMS
- CrIS
- VIIRS
- OMPS

Environmental Data Records

- Ocean Products
 - Sea Surface Temperature
 - Ocean Color
- Land Products
 - Active Fires
 - Land Surface Temperature
 - Surface Albedo
 - Surface Type
 - Surface Reflectance
 - Vegetation Index
 - Green Vegetation Fraction
 - Vegetation Health
- Cryosphere Products
 - Snow Cover
 - Sea Ice
 - Ice Surface Temperature
- Atmosphere
 - Imagery
 - Clouds
 - Aerosols
 - VIIRS Polar Winds
 - NUCAPS IR+MW Products
 - MIRS MW Products
 - OMPS Ozone

STAR JPSS Website

Suomi-NPP/VIIRS Automatic Flood Detection Map in West Gulf Region, USA
Aug 31, 2017 18:42 (UTC)

Hurricane Harvey
Mitch Goldberg / Sanmei Li (JPSS PGRR)

31-Aug-17 - On August 25 Hurricane Harvey made landfall near Rockport, Texas, as a Category 4 storm with winds of 130 mph. Afterwards, Harvey had degraded to a tropical storm. Over the next five days, the storm dumped feet of rain over most of southeast Texas. Some areas around Houston and Beaumont saw upwards of 4 feet of rain during this time. The left image shows Aug 31, 2017 Flood Detection Map for Houston Beaumont area generated from 375m VIIRS imagery data.
[Read more.](#)

Latest JSTAR Updates

[California Fires: 2017 Hurricanes: Maria, IRMA, Harvey](#)

[Solar Eclipse Seen from SNPP](#) - Suomi NPP passed directly over the solar eclipse path of totality as it crossed the southeastern United States, producing interesting and beautiful images via VIIRS, CrIS, and OMPS.

[STAR JPSS 2017 Annual Science Team Meeting](#), 14-18 August 2017, STAR JPSS successfully held its fourth Annual Science Team Meeting at NCWCP. Scientists from NOAA, NASA, Universities, and industries attended the meeting. (slides to be posted soon)

VIIRS Global Surface Type (GST) annual update The GST-2016 products (spatial resolution: 1km) can be downloaded from

JSTAR Newsletter

Message from the Program Manager: August was a very eventful month for STAR JPSS. The program held a successful STAR JPSS Annual Meeting, allowing team members to come together for important face to face meetings reviewing the progress and planning for the future of the program. Team members also participated in the SPIE OC+D conference and CALCON. In late August the teams were able to showcase Suomi NPP data by mapping the effects of the [Great American Eclipse](#) and the torrential rainfall in the wake of [Hurricane Harvey](#).

















Upcoming Events

- [The 8th Asia/Oceania Meteorological Satellite Users' Conference \(AOMSUC-8\)](#) 7, Vladivostok city, Russia, 2017-09-24-26, 2017

<https://www.star.nesdis.noaa.gov/jpss/>

Draft JPSS-2 Cal-Val Plans Delivered Jun 30, 2020

- Initial J2 Cal-Val Updates due to NJO June 2020
 - **Leverage** NOAA-20 plans
 - **Make leverageable** by other programs (METOP-SG, etc) to the extent possible.
 - **Right-size time spent** on this update

My Drive > JSTAR > JPSS Cal Val Plans > For-Dec31-Delivery			
Name		Owner	Last modified
 JPSS_Cal_Val_Plan_CrIS_SDR.docx		Xingpin Liu - NOAA Affiliate	Nov 25, 2019
 JPSS_Cal_Val_Plan_MIRS_SFR.doc		Xingpin Liu - NOAA Affiliate	Apr 26, 2020
 JPSS_Cal_Val_Plan_Volcanic_Ash.doc		Xingpin Liu - NOAA Affiliate	Dec 19, 2019
 JPSS_Cal_Val_Plan_Overview.docx		Xingpin Liu - NOAA Affiliate	Jul 13, 2019
 JPSS_Cal_Val_Plan_Overview-1.docx		Lihang Zhou - NOAA Federal	Jul 12, 2019
 JPSS_Cal_Val_Plan_Land_VH.docx		Xingpin Liu - NOAA Affiliate	May 9, 2020
 JPSS_Cal_Val_Plan_Land_GVF.doc		Xingpin Liu - NOAA Affiliate	May 9, 2020
 JPSS_Cal_Val_Plan_VIIRS_Polar_Wind...		Xingpin Liu - NOAA Affiliate	May 9, 2020



What is next?

Need to continue to climb the maturity ladder?

- Establishing partnerships for independent validation (aka cross checks)

Reprocess the mission data - already reprocessed the SDRs for SNPP

- Using cloud computing environment for future reprocessing.

Reinforce and establish partnerships related to being a trusted source of environment information

- Best practices and verification for community endorsed data access, formats, documentation, and maturity



Summary

NOAA-20 Products Cal Val have been performed as planned; most of SDRs/KPPs and EDRs reached validated maturity

Long term monitoring systems fully function for monitoring both NOAA-20 and S-NPP.

Eight+ years of extremely successful JPSS SNPP and N20 cal/val and product maturity; and building the reprocessing SDRs/EDRs with matured algorithms.

Start working on J2 Algorithms preparation and Cal Val planning

Consistent Cal Val process across satellite programs, promote best practice and procedures. Support science to operation to application. Putting together lessons learned for JPSS Cal Val

International collaboration is essential for advancing the utilization of satellite observing systems



Backup

NOAA-20 Science Product Validation & Operations (1 of 2)

	Beta	Provisional	SPSRB Declared Ready for Operations	Validated
ATMS Level 1 Products				
Temperature Data Record (TDR)*	08-Dec-2017	23-Jan-2018	28-Feb-2018	14-Jun-2018
Sensor Data Record (SDR)	08-Dec-2017	23-Jan-2018	28-Feb-2018	14-Jun-2018
CrIS Level 1 Product				
SDR*	17-Jan-2018	16-Feb-2018	28-Feb-2018	2-Oct-2018
VIIRS Level 1 Product				
VIIRS SDR	1-Feb-2018	16-Feb-2018	28-Feb-2018	15-Jun-2018
OMPS Level 1 Products				
Total Column	5-Jan-2018	18-Apr-2018	7-Mar-2019	20-Sep-2019
Nadir Profile	5-Jan-2018	2-Jul-2018	Sep-2019	23-Apr-2020
VIIRS Level 2 Products(s)				
VIIRS Imagery*	1-Feb-2018	16-Feb-2018	28-Feb-2018	22-Aug-2018

Validation Maturity Levels

Not Validated	Beta Maturity	Provisional Maturity	Validated Maturity
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Ready for Operations

SPSRB Declaration

*Key Performance Parameter (KPP)

Product quality documentation available: <https://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>

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bit.ly/Pre-ESIP-FAIR-DQI-Wkshp

Updated: Lihang Zhou, 06/23/20



NOAA-20 Science Product Validation & Operations (2 of 2)

	Beta	Provisional	Available in Ops	Validated
VIIRS Level 2 Products				
Cloud Height	23-Jul-2018	2-Oct-2018	7-Mar-2019	16-May-2019
Cloud Properties (night)	21-Mar-2018	21-Mar-2019	10-Apr-2019	16-May-2019
Cloud Properties (day)	23-Jul-2018	27-Nov-2018	7-Mar-2019	16-May-2019
Cloud Type/Phase	2-Oct-2018	2-Oct-2018	7-Mar-2019	16-May-2019
Cloud Mask	18-Apr-2018	2-Oct-2018	7-Mar-2019	16-May-2019
Aerosol Optical Depth and Particle Size Parameter	18-Apr-2018 ¹	18-Apr-2018 ¹	7-Mar-2019	16-May-2019
Aerosol Detection	18-Apr-2018 ¹	18-Apr-2018 ¹	7-Mar-2019	16-May-2019
Ice Surface Temperature	15-Jun-2018	16-May-2019	20-Jun-2019	16-May-2019
Sea Ice Concentration and Ice Thickness	15-Jun-2018	16-May-2019	20-Jun-2019	16-May-2019
Snow Cover (Binary Map & Snow Cover Fraction)	15-Jun-2018	16-May-2019	20-Jun-2019	18-Jun-2020
Active Fire	18-Apr-2018	18-Apr-2018	13-Aug-2018	6-Feb-2020
Land Surface Temperature	23-Jul-2018	21-Mar-2019	Sep-2019	21-Nov-2019
Land Surface Albedo	23-Jul-2018	21-Mar-2019	Sep-2019	21-Nov-2019
GST (Global Gridded Surface Type)	19-Sep-2019	Sep-2020	--	Sep-2020
Land Surface Reflectance	15-Jun-2018	21-Mar-2019	23-Apr-2019	18-Jun-2020

	Beta	Provisional	Available in Ops	Validated
VIIRS Level 2 Products				
Green Vegetation Fraction (GVF)	22-Aug-2018	21-Mar-2019	4-Jun-2019	23-Apr-2020
Vegetation Index (VI)	22-Aug-2018	21-Mar-2019	4-Jun-2019	23-Apr-2020
Vegetation Health (VH)	22-Aug-2018	21-Mar-2019	4-Jun-2019	21-Mar-2019
Volcanic Ash	27-Nov-2018	27-Nov-2018	7-Mar-2019	16-May-2019
Ocean Color	27-Nov-2018	27-Nov-2018	11-Jun-2020	Jul-2020
Sea Surface Temperature	18-Apr-2018 ¹	18-Apr-2018 ¹	7-Nov-2018	16-May-2019
VIIRS Polar Winds	2-Oct-2018	2-Oct-2018	7-Mar-2019	16-May-2019
CRIS/ATMS Level 2 Products				
NUCAPS: AVTP, AVMP	15-Jun-2018 ¹	15-Jun-2018 ¹	7-Mar-2019	28-Oct-2019
NUCAPS: Ozone, CO, OLR	15-Jun-2018 ¹	2-Oct-2018	7-Mar-2019	28-Oct-2019
NUCAPS: CH4	15-Jun-2018 ¹	28-Oct-2019	7-Mar-2019	23-Apr-2020
NUCAPS: CO2	15-Jun-2018 ¹	23-Apr-2020	7-Mar-2019	Dec-2020
ATMS Level 2 Products				
MiRS: AVTP, AVMP, TPW	18-Apr-2018 ¹	18-Apr-2018 ¹	7-Mar-2019	19-Sep-2019
MiRS: Snowfall Rate	18-Apr-2018	16-May-2019	7-Mar-2019	16-May-2019
MiRS: Other EDRs	18-Apr-2018 ¹	18-Apr-2018 ¹	7-Mar-2019	19-Sep-2019
OMPS Level 2 Products				
Ozone EDR: NP	18-Apr-2018	20-Sep-2019	Apr-16-2020	Sep-2020
Ozone EDR: TC	18-Apr-2018	2-Oct-2018	7-Mar-2019	20-Sep-2019

Validation Maturity Levels

Not Validated

Beta Maturity

Provisional Maturity

Validated Maturity



Operational

Available in Operations

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¹ Scientifically mature pending verification of NDE implementation.

Updated: Lihang Zhou, 06/23/20

Concept - System Maturity Matrix

Is the software robust and maintainable?

Are the data and methods well documented ?

What is the trueness of the data ?

Are the data well used and user feedback taken care of?

Software readiness	Metadata	User documentation	Uncertainty Characterization	Public Access, Feedback, Update	Utility
Are the codes compliant with standards, stable, portable and reproducible?	Do the metadata meet international standards, and allow provenance tracking?	Are the formal documents and peer-reviewed papers up-to-date and public?	Are the uncertainties assessed systematically in a standard manner?	Are the data, source code, and documents publicly available and regularly updated?	Are the data widely used in the scientific, and decision and policy making communities?

CDR Name Here

maturity level as of mm/dd/yyyy

Climate Data Record (CDR) Maturity Matrix

Maturity	Software Readiness	Metadata	Documentation	Product Validation	Public Access	Utility
1	Conceptual development	Little or none	Draft Climate Algorithm Theoretical Basis Document (C-ATBD); paper on algorithm submitted	Little or None	Restricted to a select few	Little or none
2	Significant code changes expected	Research grade	C-ATBD Version 1+ ; paper on algorithm reviewed	Minimal	Limited data availability to develop familiarity	Limited or ongoing
3	Moderate code changes expected	Research grade; Meets int'l standards: ISO or FGDC for collection; netCDF for file	Public C-ATBD; Peer-reviewed publication on algorithm	Uncertainty estimated for select locations/times	Data and source code archived and available; caveats required for use.	Assessments have demonstrated positive value.
4	Some code changes expected	Exists at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD; Draft Operational Algorithm Description (OAD); Peer-reviewed publication on algorithm; paper on product submitted	Uncertainty estimated over widely distributed times/location by multiple investigators; Differences understood.	Data and source code archived and publicly available; uncertainty estimates provided; Known issues public	May be used in applications; assessments demonstrating positive value.
5	Minimal code changes expected; Stable, portable and reproducible	Complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets international standards for dataset	Public C-ATBD, Review version of OAD, Peer-reviewed publications on algorithm and product	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Record is archived and publicly available with associated uncertainty estimate; Known issues public. Periodically updated	May be used in applications by other investigators; assessments demonstrating positive value
6	No code changes expected; Stable and reproducible; portable and operationally efficient	Updated and complete at file and collection level. Stable. Allows provenance tracking and reproducibility of dataset. Meets current international standards for dataset	Public C-ATBD and OAD; Multiple peer-reviewed publications on algorithm and product	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation; quantified errors	Record is publicly available from Long-Term archive; Regularly updated	Used in published applications; may be used by industry; assessments demonstrating positive value

1 & 2	Research
3 & 4	IOC
5 & 6	FOC

CDR-MTX-0008 V4.0 (12/20/2011)