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**Data Stewardship Maturity Report for GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2)**

Table 1 Legend				
Level 1	Level 2	Level 3	Level 4	Level 5
Ad Hoc	Minimal	Intermediate	Advanced	Optimal
Little or no management	Limited Management	Defined Management, partially implemented	Well-defined Management, fully implemented	Full Management, audited, measured, controlled

Table 1. Scores for the Nine DSMM Key Components at a Glance		
Preservability - 5	Accessibility - 5	Usability - 4.5
Production Sustainability - 5	Data Quality Assurance - 3.5	Data Quality Control/Monitoring - 3
Data Quality Assessment - 2	Transparency/Traceability - 3	Data Integrity - 3

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**U.S. DEPARTMENT OF COMMERCE**  
National Oceanic and Atmospheric Administration  
National Environmental Satellite, Data, and Information Service

Cover Image: Data Stewardship Rating Diagram for GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2)

Shades of green are used to represent level 1 through level 5 ratings; denoting Ad Hoc, Minimal, Intermediate, Advanced, and Optimal stages for each of the nine key components, respectively. The dark green level indicates all the practices are completely satisfied. The lighter green levels indicate only some of the practices are satisfied. The lightest green level indicates none of the practices are satisfied.

The stewardship maturity of NCEI data product, GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2), is assessed based on a reference stewardship maturity framework. The current maturity ratings of GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2) are at Level 1 or higher for all nine key components with zero Level 1, one Level 2, four Level 3, one Level 4, and three Level 5 key components.

The National Environmental Satellite, Data, and Information Service (NESDIS) manages the Nation's civil Earth-observing satellite systems, as well as global national data bases for meteorology, oceanography, geophysics, and solar-terrestrial sciences. From these sources, it develops and disseminates environmental data and information products critical to the protection of life and property, national defense, and the national economy, energy development and distribution, global food supplies, and the development of natural resources.

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Copies of earlier reports may be available by contacting NESDIS Chief of Staff, NOAA/ NESDIS, 1335 East-West Highway, SSMC1, Silver Spring, MD 20910, (301) 713-3578 .

## ASSESSMENT REVISION HISTORY

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## Preface

In response to the President's Open Government Initiative and related policies, NOAA has committed to providing improved public access to all of its environmental information, to enable research and commercial innovation through ease of data discovery and use [Casey, 2016].

OneStop supports NOAA's efforts by leveraging existing access technologies and infusing specific innovations to provide improved discover, access, and visualization services for NOAA's data. Also, OneStop is viewed by a NESDIS as a pathfinder effort with an initial focus on selected high-priority datasets from NESDIS and other program data meeting OneStop standards, but eventually scalable across NOAA's data. Lastly, OneStop is implementing the USGEO Common Framework for Earth Observation Data and leveraging/supporting the NOAA Big Data Project (BDP) and Big Earth Data Initiative (BEDI) [Casey, 2016].

As with any process of improvement planning, agencies need to find out where they are in terms of their compliance to the federal regulations and what they need to do if any areas of non-compliance are identified. To this end, a unified framework would be beneficial for assessing the current stage of stewardship practices applied to individual datasets and for providing a road map that will guide future investments towards enhanced stewardship of environmental datasets. The value and quality of a dataset depends in part on the stewardship practices applied after its development and production. Therefore, a unified framework providing a holistic view of the quality of stewardship practices applied to individual datasets is beneficial to data stewards and users [Casey, 2016].

The Data Stewardship Maturity Matrix (DSMM), jointly developed by domain (data management, technology, and science) subject matter experts from NOAA's National Centers for Environmental Information (NCEI) and Cooperative Institute for Climate and Satellites – North Carolina (CICS-NC), provides such a consistent framework [Peng *et al.*, 2016]. The DSMM, leveraging institutional knowledge and community practices and standards, defines a graduated maturity scale for each of nine key components of scientific data stewardship to enable a consistent assessment of the measurable stewardship practices applied to a given data set or product.

The NOAA data stewardship maturity technical series captures stewardship maturity assessment results for individual datasets, provides consistent representation and citable documents of those assessments, ensures transparency, and allows better data quality information integration and content-based search and discovery of NOAA data.



**Data Stewardship Maturity Report for GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2)**

**1. Introduction**

**1.1 Purpose**

The purpose of this document is to describe the results of stewardship maturity assessment for NOAA Climate Data Record for Mean Layer Temperature (Upper Troposphere & Lower Stratosphere from UCAR, Version 2, utilizing the Scientific Data Stewardship Maturity Matrix or DSMM [Peng, et al, 2016]. DSMM defines levels of stewardship maturity stages for Preservability, Accessibility, Usability, Production Sustainability, Data Quality Assurance, Data Quality Control/Monitoring, Data Quality Assessment, Transparency/Traceability, and Data Integrity key components. Each of these components is ranked from ‘Ad hoc’ to ‘Optimal’ (see Appendix I). This report is based on evaluation performed by NOAA OneStop metadata specialists working with Subject Matter Experts and utilizing the DSMM template [Peng, 2016].

**1.2 Scope**

Assessing stewardship maturity - the current state of how datasets are documented, preserved, stewarded, and made accessible publicly, is a critical step towards meeting U.S. federal regulations, organizational requirements, and user needs [Peng et al., 2016]. The goal of this document is to provide consistent and transparent stewardship maturity information to data users and decision-makers.

**1.3 Dataset Abstract**

The Joint Polar Satellite System (JPSS), starting with S-NPP launched on 28 October 2011, is the new generation of the US Polar Operational Environmental Satellites (POES). The Suomi National Polar-orbiting Partnership (S-NPP) is a collaboration between NASA and NOAA. NOAA is responsible for all JPSS products, including SST from the Visible Infrared Imaging Radiometer Suite (VIIRS). VIIRS is a whiskbroom scanning radiometer, which takes measurements in the cross-track direction within a field of view of 112.56-deg using 16 detectors and a double-sided mirror assembly. At a nominal altitude of 829 km, the swath width is 3,060 km, providing global daily coverage for both day and night passes. VIIRS has 22 spectral bands covering the spectrum from 0.4-12 um, including 16 moderate resolution bands (M-bands). The L2P SST product is derived at the native sensor resolution (~0.75 km at nadir, ~1.5 km at swath edge) using NOAA's Advanced Clear-Sky Processor for Ocean (ACSPO) system, and reported in 10-minute granules in netCDF4 format, compliant with the GHRSSST Data Specification version 2 (GDS2). There are 144 granules per 24hr interval, with a total data volume of 27GB/day.

In addition to pixel-level earth locations, Sun-sensor geometry, and ancillary data from the NCEP global weather forecast, ACSPO outputs include four brightness temperatures (BTs) in M12 (3.7 $\mu$ m), M14 (8.6 $\mu$ m), M15 (11 $\mu$ m), and M16 (12 $\mu$ m) bands, and two reflectances in M5 (0.67 $\mu$ m) and M7 (0.87 $\mu$ m) bands. The reflectances are used for cloud identification. Beginning with ACSPO v2.60, all BTs and reflectances are destriped (Bouali and Ignatov, 2014) and resampled (Gladkova et al., 2016), to minimize the effect of bow-tie distortions and deletions. SSTs are retrieved from destriped BTs. SSTs are derived from BTs using the Multi-Channel SST (MCSST; night) and Non-Linear SST (NLSST; day) algorithms (Petrenko et al., 2014). An ACSPO clear-sky mask (ACSM) is provided in each pixel as part of variable `l2p_flags`, which also includes day/night, land, ice, twilight, and glint flags (Petrenko et al., 2010). Fill values are reported in all invalid pixels, including those with >5 km inland. For each valid water pixel (defined as ocean, sea, lake or river, and up to 5 km inland), four BTs in M12/14/15/16 (included for those users interested in direct "radiance assimilation", e.g., NOAA NCEP, NASA GMAO, ECMWF) and two reflectances in M5/7 are reported, along with derived SST. Other variables include NCEP wind speed and ACSPO SST minus reference SST (Canadian Met Centre 0.1deg L4 SST). Only ACSM confidently clear pixels are recommended (equivalent to GDS2 quality level=5). Per GDS2 specifications, two additional Sensor-Specific Error Statistics layers (SSES bias and standard deviation) are reported in each pixel with QL=5. Note that users of ACSPO data have the flexibility to ignore the ACSM and derive their own clear-sky mask, and apply it to BTs and SSTs. They may also ignore ACSPO SSTs, and derive their own SSTs from the original BTs. The ACSPO VIIRS L2P product is monitored and validated against quality controlled in situ data provided by NOAA in situ SST Quality Monitor system (iQuam; Xu and Ignatov, 2014) using another NOAA system, SST Quality Monitor (SQUAM; Dash et al, 2010). Corresponding clear-sky BTs are validated against RTM simulations in the Monitoring IR Clear-sky Radiances over Ocean for SST system (MICROS; Liang and Ignatov, 2011). A reduced size (1GB/day), equal-angle gridded (0.02-deg resolution), ACSPO L3U product is also available, where gridded L2P SSTs with QL=5 only are reported, and BT layers omitted.

## 1.4 Document Maintenance

This document is generated and maintained by NOAA's National Centers for Environmental Information. More on policy is available at <https://www.ncei.noaa.gov/>.

## 2. Results

The data stewardship maturity assessment information is summarized in Table 1. Each component is displayed along with its corresponding score in a color-coded table.

**Table 2. Dataset and Data Stewardship Maturity Assessment Metadata**

<b>Dataset Title</b>	GHRSSST 2 Level 2P Global Skin Sea Surface Temperature from the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi NPP satellite created by the NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) (GDS version 2)
<b>Dataset Information URL</b>	<a href="https://doi.org/10.7289/V5PR7SX5">https://doi.org/10.7289/V5PR7SX5</a>
<b>Data Provider POC (Name; E-mail; Affiliation)</b>	NOAA National Centers for Environmental Information (NCEI), NCEI.Info@noaa.gov
<b>Dataset POC (Name; E-mail; Affiliation)</b>	Alexander Ignatov, Alex.Ignatov@noaa.gov, NOAA Center for Satellite Applications and Research (STAR)
<b>SMM Version (Document ID and Version Number)</b>	NCDC-CICS-SMM_0001_Rev.1 12/09/2014
<b>SMM POC (Name; E-mail; Affiliation)</b>	Ge Peng, ge.peng@uah.edu, University of Alabama-Huntsville
<b>SMM Template Version (Document ID and Version Numbers)</b>	NCDC-CICS-SMM_0001_Rev.1 v4.0 06/23/2015
<b>SMM Template POC</b>	Ge Peng, ge.peng@uah.edu, University of Alabama-Huntsville
<b>SMM Assessment Version (v&lt;nn&gt;r&lt;mm&gt;, e.g., v01r00)</b>	V01r05
<b>SMM Assessment Date (MM/DD/YYYY)</b>	04/29/2019
<b>SMM Assessment POC (Name; E-mail; Affiliation)</b>	Paul Lemieux III, Paul.Lemieux@noaa.gov, Earth Resources Technology, Inc.
<b>Stewardship Maturity Ratings (each key component) (kc1/kc2/kc3/kc4/kc5/kc6/kc7/kc8/kc9)</b>	5 / 5 / 4.5 / 5 / 3.5 / 3 / 2 / 3 / 3
<b>SMM Original Assessment Date (MM/DD/YYYY)</b>	08/02/2016
<b>SMM Original Assessment POC (Name; E-mail; Affiliation)</b>	Paul Lemieux III, Paul.Lemieux@noaa.gov, Earth Resources Technology, Inc.
<b>SMM Last Modified Date (MM/DD/YYYY)</b>	09/27/2021
<b>SMM Last Modification POC (Name; E-mail; Affiliation)</b>	Katy Luquire, catherine.luquire@noaa.gov , CASE Consultants International
<b>SMM Modified Date (MM/DD/YYYY)</b>	04/29/2019
<b>SMM Modification POC (Name; E-mail; Affiliation)</b>	Paul Lemieux III, Paul.Lemieux@noaa.gov, Earth Resources Technology, Inc.

Table 3. Stewardship Maturity Levels and Detailed Justifications for Each of Nine DSMM Key Components for the Dataset.

DSMM Key Component	Stewardship Maturity Rating, Justification, and Comments
<p><b>Preservability</b></p>	<p>Level 5</p> <ul style="list-style-type: none"> <li>▪ Archived by NCEI which is a NOAA designated archive compliant to NARA standards.</li> <li>▪ Metadata following ISO 19115-2.</li> <li>▪ Compliant to OIAS RM.</li> <li>▪ Plans to update metadata to ISO 19115-1 at a later date and will be a pilot dataset for the OneStop initiative.</li> <li>▪ Multiple access points provide several layers of redundancy.</li> <li>▪ Using NCEI Silver Spring Archive Management System, AMS.</li> </ul> <p>Comments: No comments</p>
<p><b>Accessibility</b></p>	<p>Level 5</p> <ul style="list-style-type: none"> <li>▪ Collection level searchable online</li> <li>▪ Granule level is searchable online</li> <li>▪ Additional search options available from collection level site</li> <li>▪ Direct file download available from</li> <li>▪ FTP: <a href="ftp://ftp-ocean.ncei.noaa.gov/pub/data.nodc/ghrsst/L2P/VIIRS_NPP/OSPO/">ftp://ftp-ocean.ncei.noaa.gov/pub/data.nodc/ghrsst/L2P/VIIRS_NPP/OSPO/</a></li> <li>▪ HTTP: <a href="https://ncei.noaa.gov/data/oceans/ghrsst/L2P/VIIRS_NPP/OSPO/">https://ncei.noaa.gov/data/oceans/ghrsst/L2P/VIIRS_NPP/OSPO/</a></li> <li>▪ THREDDS:</li> <li>▪ <a href="https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L2P/VIIRS_NPP/OSPO/catalog.html">https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L2P/VIIRS_NPP/OSPO/catalog.html</a></li> <li>▪ Dissemination reports are available to the public <a href="https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/">https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/</a></li> <li>▪ New technology for OneStop search and discovery planned (i.e. ElasticSearch, Hyrax Servers, etc.) This is part of the GHRSSST data group that will be OneStop ready.</li> <li>▪ Additional enhanced data server performance (TDS, DAP) are maintained by NCEI and accessible from the metadata landing page.</li> </ul> <p>Comments: No comments</p>
<p><b>Usability</b></p>	<p>Level 4.5</p> <ul style="list-style-type: none"> <li>▪ Community standard interoperable format: NetCDF</li> <li>▪ A GHRSSST User Guide, Quick Start Guide, GHRSSST Data Specification (GDS) manual, and other relevant documents describing GHRSSST data sets can be found in the archive accession, Documentation for The Group for High Resolution Sea Surface Temperature (GHRSSST) data archived at NODC (NODC Accession 0123222), <a href="https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0123222">https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0123222</a></li> <li>▪ All GHRSSST collections have online visualization capabilities</li> <li>▪ VIIRS ASCPO SST retrieval algorithm is described in literature [Gladkova, Kihai, Ignatov, et al., 2015] available online here: <a href="https://doi.org/10.1016/j.rse.2015.01.003">https://doi.org/10.1016/j.rse.2015.01.003</a></li> <li>▪ Aggregating granules is possible via THREDDS server.</li> </ul> <p>Comments: No known external rankings.</p>

Table 3. Stewardship Maturity Levels and Detailed Justifications for Each of Nine DSMM Key Components for the Dataset.

DSMM Key Component	Stewardship Maturity Rating, Justification, and Comments
<p><b>Production Sustainability</b></p>	<p>Level 5</p> <ul style="list-style-type: none"> <li>▪ Long-term commitment in place for the VIIRS instrument and S-NPP platform. ACSPO SST products see very high use from users, even more so than the VIIRS EDR SST product.</li> <li>▪ NOAA NCEI-MD supporting long term stewardship of GHRSSST collections as part of LTSRF: <a href="https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/">https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/</a></li> <li>▪ Long-term international commitment (GHRSSST is an international collaboration).</li> </ul> <p>Comments: Changes for technology are available from individual dataset producers. NOAA does not have them documented.</p>
<p><b>Data Quality Assurance</b></p>	<p>Level 3.5</p> <ul style="list-style-type: none"> <li>▪ DQA procedures are outlined in this data paper [Petrenko, Ignatov, Kihai, et al., 2014] available online here: <a href="https://doi.org/10.1002/2013JD020637">https://doi.org/10.1002/2013JD020637</a></li> <li>▪ File level quality flags exist which can be considered limited data quality assurance metadata.</li> </ul> <p>Comments: No comments</p>
<p><b>Data Quality Control/Monitoring</b></p>	<p>Level 3</p> <ul style="list-style-type: none"> <li>▪ Limited Quality Control metrics are available: <a href="https://www.star.nesdis.noaa.gov/socd/sst/squam/">https://www.star.nesdis.noaa.gov/socd/sst/squam/</a></li> <li>▪ Sampling and analysis are frequent and systematic but not automatic</li> <li>▪ Procedure documented and available online</li> <li>▪ Community metrics defined and partially implemented</li> </ul> <p>Comments: No comments</p>
<p><b>Data Quality Assessment</b></p>	<p>Level 2</p> <ul style="list-style-type: none"> <li>▪ VIIRS ASCPO SST retrieval algorithm is described in literature [Gladkova, Kihai, Ignatov, et al., 2015] and available online here: <a href="https://doi.org/10.1016/j.rse.2015.01.003">https://doi.org/10.1016/j.rse.2015.01.003</a></li> <li>▪ Research product assessed in this paper [Petrenko, Ignatov, Kihai, et al., 2014] available online here: <a href="https://doi.org/10.1002/2013JD020637">https://doi.org/10.1002/2013JD020637</a></li> </ul> <p>Comments: No external reviews of the data quality assessment</p>

Table 3. Stewardship Maturity Levels and Detailed Justifications for Each of Nine DSMM Key Components for the Dataset.

DSMM Key Component	Stewardship Maturity Rating, Justification, and Comments
<p><b>Transparency / Traceability</b></p>	<p>Level 3</p> <ul style="list-style-type: none"> <li>▪ VIIRS ASCPO SST retrieval algorithm is described in literature [Gladkova, Kihai, Ignatov, et al., 2015] available online here: <a href="https://doi.org/10.1016/j.rse.2015.01.003">https://doi.org/10.1016/j.rse.2015.01.003</a></li> <li>▪ Product information [Petrenko, Ignatov, Kihai, et al., 2014] available in literature: <a href="https://doi.org/10.1002/2013JD020637">https://doi.org/10.1002/2013JD020637</a></li> <li>▪ DOI assigned: <a href="https://doi.org/10.7289/V5PR7SX5">https://doi.org/10.7289/V5PR7SX5</a></li> <li>▪ OID assigned: GHRSSST-VIIRS_NPP-OSPO-L2P</li> <li>▪ GHRSSST datasets are under configuration management principles: <a href="https://doi.org/10.5281/zenodo.4700465">https://doi.org/10.5281/zenodo.4700465</a></li> </ul> <p>Comments: No OAD available</p>
<p><b>Data Integrity</b></p>	<p>Level 3</p> <ul style="list-style-type: none"> <li>▪ Data archive integrity verifiable</li> <li>▪ Checksum technology is available, each GHRSSST_OSPO_VIIRS_NPP_L2P package is accompanied by a manifest in XML format containing hash digests generated using various algorithms, including MD5, SHA-1, SHA-384, etc. That includes checksums (.md5) for every file package. <a href="https://www.nodc.noaa.gov/archive/arc0049/0099038/0099038.1.1.xml">https://www.nodc.noaa.gov/archive/arc0049/0099038/0099038.1.1.xml</a></li> <li>▪ Data authenticity is verifiable (since data can be downloaded via HTTPS and HTTPS uses certificates to prove site authenticity)</li> <li>▪ NCEI-MD does not provide digital signatures for data dissemination</li> </ul> <p>Comments: Checksum file available for download from PODAAC FTP: <a href="ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/VIIRS_NPP/OSPO/v2.4/">ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/VIIRS_NPP/OSPO/v2.4/</a></p>

### **3. Acknowledgment**

This work is supported by the NOAA OneStop Project.

We thank the dataset POCs for their valuable input, as well as the collaborative efforts of the OneStop teams, especially the Metadata team. We would also like to show appreciation to Ge Peng for her contributions.

The draft of this data stewardship maturity report is systematically generated by a tool created by Kieran Hodnett and populated with the stewardship maturity assessment done by the author(s) of this report. The tool was developed based on a Word template created collaboratively by Robert Partee II, Raisa Ionin, Paul Lemieux III, Ge Peng, Don Collins, and Sonny Zinn with helpful input from the NOAA Central Library and the NCEI Communication Team.

#### 4. References

Casey, K. (2016), The NOAA OneStop data discover and access framework project, Version: June 3, 2016. <https://cdn.ioos.noaa.gov/media/2017/12/OneStop-IOOS-DMAC-03-June-2016.pdf>

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Petrenko, B., Ignatov, A., Kihai, Y., Stroup, J., Dash, P., (2014), Evaluation and selection of SST regression algorithms for JPSS VIIRS, *Journal of Geophysical Research Atmospheres*, 119(8), 4580—4599, doi:10.1002/2013JD020637.



## Appendix I: The Scientific Data Stewardship Maturity Matrix (DSMM)

Table A1: This matrix (Version: NCDC-CICS-SMM-0001-Rev.1. 12/09/2014) describes the criterion used to evaluate data stewardship maturity for each of the nine DSMM key components [Peng *et al.*, 2015].

<b>DSMM Component</b>	<b>Level 1 <i>Ad hoc</i> Little or no management</b>	<b>Level 2 <i>Minimal</i> Limited management</b>	<b>Level 3 <i>Intermediate</i> Defined management, partially implemented</b>	<b>Level 4 <i>Advanced</i> Well-defined management, fully implemented</b>	<b>Level 5 <i>Optimal</i> Full management, audited, measured, controlled</b>
<b><i>Preservability</i></b> <i>(The state of being preservable)</i>	Any storage location  Data only	Non-designated repository  Redundancy  Limited archiving metadata	Designated archive  Redundancy  Community-standard archiving metadata  Conforming to limited archiving standards	Level 3 +  Conforming to community archiving standards	Level 4 +  Archiving process performance controlled, measured, and audited  Future archiving standard changes planned
<b><i>Accessibility</i></b> <i>(The state of being searchable and accessible publicly)</i>	Not publically available person-to-person	Publically available direct file download (e.g., via anonymous FTP server)  Collection or dataset level searchable online	Level 2 +  Non-standard data service  Limited data server performance  Granule/file level searchable  Limited search metrics	Level 3 +  Community-standard data service  Enhanced data server performance  Conforming to community search metrics  Dissemination report metrics defined and implemented internally	Level 4 +  Dissemination reports available online  Future technology and standard changes planned

<p><b>Usability</b></p> <p><i>(The state of being easy to use)</i></p>	<p>Extensive product-specific knowledge required</p> <p>No documentation online</p>	<p>Non-standard data format</p> <p>Limited documentation (e.g., user's guide online)</p>	<p>Community standard-based interoperable format &amp; metadata</p> <p>Documentation (e.g. source code, product algorithm document, processing or/and data flow diagram) online</p>	<p>Level 3 +</p> <p>Basic capability (e.g., subsetting, aggregating) &amp; data characterization overall/global,</p> <p>e.g., climatology, error estimates) available online</p>	<p>Level 4 +</p> <p>Enhanced online capability (e.g., visualization, multiple data formats)</p> <p>Community metrics of data characterization (regional/cell) online</p> <p>External ranking</p>
<p><b>Production Sustainability</b></p> <p><i>(The state of data production being sustainable and extendable)</i></p>	<p>Ad Hoc or Not applicable</p> <p>To obligation or deliverable requirement</p>	<p>Short-term</p> <p>Individual PI's commitment (grant obligations)</p>	<p>Medium-term</p> <p>Institutional commitment (contractual deliverables with specs and schedule defined)</p>	<p>Long-term Institutional commitment</p> <p>Product improvement process in place</p>	<p>Level 4 +</p> <p>National or international commitment</p> <p>Changes for echnology planned</p>
<p><b>Data Quality Assurance</b></p> <p><i>(The state of data quality being assured)</i></p>	<p>Data quality assurance (DQA) procedure unknown or none</p>	<p>Ad Hoc and random</p> <p>QA procedure not defined and documented</p>	<p>DQA procedure defined and documented and partially implemented</p>	<p>DQA procedure well documented, fully implemented and available online with master reference data</p> <p>Limited data quality assurance metadata</p>	<p>Level 4 +</p> <p>DQA procedure monitored and reported</p> <p>Conforming to community quality metadata &amp; standards</p> <p>External review</p>

<p><b>Data Quality Control/Monitoring</b></p> <p><i>The state of data quality being controlled and monitored</i></p>	<p>None or Sampling unknown or spotty</p> <p>Analysis unknown or random in time</p>	<p>Sampling and analysis are regular in time and space</p> <p>Limited product-specific metrics defined &amp; implemented</p>	<p>Level 2 +</p> <p>Sampling and analysis are frequent and systematic but not automatic</p> <p>Community metrics defined and partially implemented</p> <p>Procedure documented and available online</p>	<p>Level 3 +</p> <p>Anomaly detection procedure well-documented and fully implemented using community metrics, automatic, tracked and reported</p> <p>Limited quality monitoring metadata</p>	<p>Level 4 +</p> <p>Cross-validation of temporal &amp; spatial characteristics</p> <p>Physical consistency check</p> <p>Conforming to community quality metadata &amp; standards</p>
<p><b>Data Quality Assessment</b></p> <p><i>(The state of data quality being assessed)</i></p>	<p>Algorithm/method/model</p> <p>Theoretical basis assessed (methods and results online)</p>	<p>Level 1 +</p> <p>Research product assessed (methods and results online)</p>	<p>Level 2 +</p> <p>Operational product assessed (methods and results online)</p>	<p>Level 3 +</p> <p>Quality metadata assessed</p> <p>Limited quality assessment metadata</p>	<p>Level 4 +</p> <p>Assessment performed on a recurring basis</p> <p>Conforming to community quality metadata &amp; standards</p> <p>External ranking</p>
<p><b>Transparency/Traceability</b></p> <p><i>(The state of being transparent, trackable, and traceable)</i></p>	<p>Limited product information available</p> <p>Person-to-person</p>	<p>Product information available in literature</p>	<p>Algorithm Theoretical Basis Document (ATBD) &amp; source code online</p> <p>Dataset configuration managed (CM)</p> <p>Unique Object Identifier (OID) assigned (dataset, documentation, source code)</p> <p>Data citation tracked (e.g., utilizing Digital Object Identifier</p>	<p>Level 3 +</p> <p>Operational Algorithm Description (OAD) online, OID assigned, and under CM</p>	<p>Level 4 +</p> <p>System information online</p> <p>Complete data provenance online</p>

<p><b>Data Integrity</b></p> <p><i>(The state of data integrity being verifiable)</i></p>	Unknown or no data ingest integrity check	Data ingest integrity verifiable (e.g., checksum technology)	(DOI) system) Level 2 + Data archive integrity verifiable	Level 3 + Data access integrity verifiable Conforming to community data integrity technology standard	Level 4 + Data authenticity verifiable (e.g., data signature technology) Performance of data integrity check monitored and reported