

**NOAA Technical Information Series NESDIS  
DSMR-00113 Version 1.0**



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**Data Stewardship Maturity Report for GHRSSST Level 2P Global Subskin Sea  
Surface Temperature from the Advanced Very High Resolution Radiometer  
(AVHRR) on the MetOp-A satellite (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 - 1
Data Quality Assessment - 3	Transparency/Traceability - 2.5	Data Integrity - 3

NOAA National Centers for Environmental Information January 2020



**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 Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (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 Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (GDS version 2), is assessed based on a reference stewardship maturity framework. The current maturity ratings of GHRSSST Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (GDS version 2) are at Level 1 or higher for all nine key components with one Level 1, one Level 2, three 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.

Publication in the NOAA Technical Memorandum series does not preclude later publication in scientific journals in expanded or modified form. The NESDIS series of NOAA Technical Reports is a continuation of the former NESS and EDIS series of NOAA Technical Reports and the NESC and EDS series of Environmental Science Services Administration (ESSA) Technical Reports.

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

<b>Revision</b>	<b>Description</b>	<b>Date</b>
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Data Stewardship Maturity Report for GHRSSST Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (GDS version 2)

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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 measureable 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 Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (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**

A global 1 km Group for High Resolution Sea Surface Temperature (GHRSSST) Level 2P dataset based on multi-channel sea surface temperature (SST) retrievals generated in real-time from the Advanced Very High Resolution Radiometer (AVHRR) on the European Meteorological Operational-A (MetOp-A) satellite (launched 19 Oct 2006).

The European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), Ocean and Sea Ice Satellite Application Facility (OSI SAF) is producing SST products in near real time from Metop/AVHRR. Global AVHRR level 1b data are acquired at Meteo-France/Centre de Meteorologie Spatiale (CMS) through the EUMETSAT/EUMETCAST system. SST is retrieved from the AVHRR infrared channels (3.7, 10.8 and 12.0 micrometer) using a multispectral algorithm. Atmospheric profiles of water vapor and temperature from a numerical weather prediction model, together with a radiative transfer model, are used to correct the multispectral algorithm for regional and seasonal biases due to changing atmospheric conditions.

This product is delivered at full resolution in satellite projection as metagranule corresponding to 3 minutes of acquisition. The product format is compliant with the GHR SST Data Specification (GDS) version 2.

#### **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.

<b>Table 2. Dataset and Data Stewardship Maturity Assessment Metadata</b>	
<b>Dataset Title</b>	GHR SST Level 2P Global Subskin Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the MetOp-A satellite (GDS version 2)
<b>Dataset Information URL</b>	<a href="https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc%3AGHRSSST-AVHRR_SST_METOP_A-OSISAF-L2P/html">https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc%3AGHRSSST-AVHRR_SST_METOP_A-OSISAF-L2P/html</a>
<b>Data Provider POC (Name; Email; Affiliation)</b>	National Centers for Environmental Information, NESDIS, NOAA, U.S. Department of Commerce 301-713-3277 NCEI.Info@noaa.gov
<b>Dataset POC (Name; Email; Affiliation)</b>	Pierre LeBorgne; pierre.leborgne@meteo.fr CMS, Meteorologie Spatiale
<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>	04/18/2019
<b>SMM Assessment POC (Name; E-mail; Affiliation)</b>	Raisa Ionin, raisa.ionin@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 /1 /3 /2.5 /3
<b>SMM Original Assessment Date (MM/DD/YYYY)</b>	08/25/2016
<b>SMM Original Assessment POC (Name; E-mail; Affiliation)</b>	Raisa Ionin, raisa.ionin@noaa.gov, Earth Resources Technology, Inc.
<b>SMM Last Modified Date (MM/DD/YYYY)</b>	10/18/2021
<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>	04/18/2019
<b>SMM Modification POC (Name; E-mail; Affiliation)</b>	Raisa Ionin, raisa.ionin@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
<b>Preservability</b>	<p>Level 5</p> <ul style="list-style-type: none"> <li>▪ Archived by NCEI, which is NOAA designated repository. NOAA is compliant to NARA standards</li> <li>▪ Metadata following ISO 19115-2 standards.</li> <li>▪ Compliant to OIAS RM</li> <li>▪ Plans to update metadata to ISO 19115-1 at a later date</li> <li>▪ Using NCEI Silver Spring Archive Management System, AMS.</li> </ul> <p>Comments:</p>
<b>Accessibility</b>	<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>▪ THREDDS: <a href="https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/catalog.html">https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/catalog.html</a></li> <li>▪ HTTP: <a href="https://www.ncei.noaa.gov/data/oceans/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/">https://www.ncei.noaa.gov/data/oceans/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/</a></li> <li>▪ FTP: <a href="ftp://ftp-oceans.ncei.noaa.gov/pub/data.nodc/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/">ftp://ftp-oceans.ncei.noaa.gov/pub/data.nodc/ghrsst/L2P/AVHRR_SST_METOP_A/OSISAF/</a></li> <li>▪ Data citation is also available from NASA PODAAC site:</li> <li>▪ <a href="https://podaac.jpl.nasa.gov/dataset/AVHRR_SST_METOP_A-OSISAF-L2P-v1.0">https://podaac.jpl.nasa.gov/dataset/AVHRR_SST_METOP_A-OSISAF-L2P-v1.0</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>▪ Future technology changes are planned</li> </ul> <p>Comments:</p>
<b>Usability</b>	<p>Level 4.5</p> <ul style="list-style-type: none"> <li>▪ The format is interoperable: nc.bz2 for granules</li> <li>▪ User Guide [GHRSSST, 2011] is available online <a href="https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHRSSSTUserGuidev91.pdf">https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHRSSSTUserGuidev91.pdf</a></li> <li>▪ User Manual [GHRSSST, 2011] is available online <a href="https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf">https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf</a></li> <li>▪ All GHRSSST collections have error estimate.</li> <li>▪ All GHRSSST collections have enhanced online capability (e.g., visualization, multiple data formats): TDS, DAP (*data servers maintained at NCEI); access from metadata main landing page.</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>▪ Algorithm document is available: OSISAF User Manual [OSISAF, 2018] is available online <a href="http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf">http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf</a></li> <li>▪ No external ranking</li> </ul> <p>Comments:</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>▪ The dataset currently supported, according to LTSRF Table: <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 institutional commitment through OSISAF,</li> <li>▪ EUMETSAT Ocean and Sea Ice Satellite Application Facility, Europe</li> <li>▪ Long-term international commitment (GHRSSST is an international group)</li> <li>▪ Changes for technology are available from individual dataset producers.</li> </ul> <p>Comments: Changes for technology are available from individual dataset producers. NOAA does not have them documented. From LTSRF page, the product is listed under OSISAF, then AVHRR_SST_METOP_A</p>
<p><b>Data Quality Assurance</b></p>	<p>Level 3.5</p> <ul style="list-style-type: none"> <li>▪ DQA procedure defined and documented and partially implemented in the following documentation: <a href="http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf">http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf</a></li> <li>▪ File level quality flags exist which can be considered limited data quality assurance metadata.</li> <li>▪</li> </ul> <p>Comments:</p>
<p><b>Data Quality Control/Monitoring</b></p>	<p>Level 1</p> <ul style="list-style-type: none"> <li>▪ No Quality Control metrics are available.</li> </ul> <p>Comments:</p>
<p><b>Data Quality Assessment</b></p>	<p>Level 3</p> <ul style="list-style-type: none"> <li>▪ Algorithm document is available: OSISAF User Manual [OSISAF, 2018] is available online <a href="http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf">http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf</a></li> <li>▪ Research product assessed in literature: [Le Borgne, 2007] is available online <a href="http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf">http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf</a></li> <li>▪ Operational product is assessed based on this publication: [Le Borgne, 2007] is available online <a href="http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf">http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf</a></li> </ul> <p>Comments:</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 2.5</p> <ul style="list-style-type: none"> <li>▪ Limited product information available, metadata only on the GHRSSST_L3P_GSST_AVHRR_MetOp_A_S landing page:</li> <li>▪ <a href="https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:GHRSSST-EUR-L3P-GLOB_AVHRR_METOP_A">https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:GHRSSST-EUR-L3P-GLOB_AVHRR_METOP_A</a></li> <li>▪ Product information available in literature: [Le Borgne, 2007] is available online <a href="http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf">http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&amp;rep=rep1&amp;type=pdf</a></li> <li>▪ Algorithm document is available: OSISAF User Manual [OSISAF, 2018] is available online <a href="http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf">http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_leo_sst.pdf</a></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> <li>▪ No DOI is assigned from NASA PODAAC site.</li> </ul> <p>Comments:</p>
<p><b>Data Integrity</b></p>	<p>Level 3</p> <ul style="list-style-type: none"> <li>▪ Data archive integrity verifiable - Checksum technology is available, each GHRSSST_L2P_GSST_AVHRR_MetOp_A_S 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/arc0075/0128061/0128061.1.1.xml">https://www.nodc.noaa.gov/archive/arc0075/0128061/0128061.1.1.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:</p> <p>Example of a checksum file(.md5 file) can be also seen at <a href="ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/AVHRR_SST_METOP_A/OSISAF/v1/2014/010/">ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/AVHRR_SST_METOP_A/OSISAF/v1/2014/010/</a>  PODAAC ftp site: <a href="ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/AVHRR_SST_METOP_A/OSISAF/v1">ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/AVHRR_SST_METOP_A/OSISAF/v1</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.

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The Recommended GHRSSST Data Specification (GDS) GDS 2.0 revision 5, 2011, retrieved online <https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf> (Accessed 22 December 2016)

Low Earth Orbiter Sea Surface Temperature Product User Manual. Version 3.3, 2018, retrieved online: [http://www.osi-saf.org/lml/doc/osisaf\\_cdop2\\_ss1\\_pum\\_1\\_eo\\_sst.pdf](http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_1_eo_sst.pdf) (Accessed August 20, 2018)

Low Earth Orbiter Sea Surface Temperature Product User Manual. Version 3.3, 2018, retrieved online: [http://www.osi-saf.org/lml/doc/osisaf\\_cdop2\\_ss1\\_pum\\_1\\_eo\\_sst.pdf](http://www.osi-saf.org/lml/doc/osisaf_cdop2_ss1_pum_1_eo_sst.pdf) (Accessed August 20, 2018)

Le Borgne, P. (2007) Operational SST Retrieval from METOP/AVHRR, paper presented at EUMETSAT Conference, Amsterdam, the Netherlands, retrieved online : <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&rep=rep1&type=pdf> (Accessed 14 December 2016)

Le Borgne, P. (2007) Operational SST Retrieval from METOP/AVHRR, paper presented at EUMETSAT Conference, Amsterdam, the Netherlands, retrieved online : <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.497.2393&rep=rep1&type=pdf> (Accessed 14 December 2016)



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## 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