**NOAA Technical Information Series NESDIS**
**DSMR-00263 Version 1.0**

doi: 10.25923/hy30-6g71

# Data Stewardship Maturity Report for GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 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 - 1 | Data Quality Control/Monitoring - 1 |
| Data Quality Assessment - 0 | 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 GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 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, GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 2), is assessed based on a reference stewardship maturity framework. The current maturity ratings of GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 2) are at Level 1 or higher for all nine key components with two Level 1, one Level 2, one Level 3, one Level 4, and three Level 5 key components.

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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

| Revision | Description | Date |
|---|---|---|
| V01r00 | Initial Release | 12/27/2021 |

**NOAA Technical Information Series NESDIS DSMR-00263**

**Version 1.0**

doi: 10.25923/hy30-6g71

# Data Stewardship Maturity Report for GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 2)

Raisa Ionin, Katy Luquire
NOAA's National Centers of Environmental Information (NCEI)
151 Patton Avenue, Asheville, NC 28801, (828) 271-4800

**Recommended Citation**

Raisa Ionin, Katy Luquire. (2021), Data Stewardship Maturity Report for GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 2), NOAA Technical Information Series NESDIS DSMR-00263 Version 1.0, 20pp., doi: 10.25923/hy30-6g71

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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.

# NOAA Technical Information Series NESDIS DSMR-00263 Version 1.0

# Data Stewardship Maturity Report for GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 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 Group for High Resolution Sea Surface Temperature (GHRSST) global Level 4 sea surface temperature analysis produced daily on a 0.09-degree grid at Remote Sensing Systems. This product uses optimal interpolation (OI) from both microwave (MW) sensors including the Global Precipitation Measurement (GPM) Microwave Imager (GMI), the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI), the NASA Advanced Microwave Scanning Radiometer-EOS (AMSRE), the Advanced Microwave Scanning Radiometer 2 (AMSR2) onboard the GCOM-W1 satellite, and WindSat operates on the Coriolis satellite, and infrared (IR) sensors such as the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA Aqua and Terra platform and the Visible Infrared Imaging Radiometer Suite (VIIRS) on board the Suomi-NPP satellite. The through-cloud capabilities of microwave radiometers provide a valuable picture of global sea surface temperature (SST) while infrared radiometers (i.e., MODIS) have a higher spatial resolution.

This analysis does not use any in situ SST data such as drifting buoy SST. Comparing with previous version 4.0 dataset, the version 5.0 has made the updates in several areas, including the diurnal warming model, the sensor-specific error statistics (SSES) for each microwave sensor, the sensor correlation model, and the quality mask.

### 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 | |
|---|---|
| **Dataset Title** | GHRSST Level 4 MW_IR_OI Global Foundation Sea Surface Temperature analysis (GDS versions 1 and 2) |
| **Dataset Information URL** | https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc%3AGHRSST-MW_IR_OI-REMSS-L4-GLOB/html |
| **Data Provider POC (Name; Email; Affiliation)** | National Centers for Environmental Information, NESDIS, NOAA, U.S. Department of Commerce301-713-3277NCEI.Info@noaa.gov |
| **Dataset POC (Name; Email; Affiliation)** | Sharon Tremble;REMSS (Remote Sensing Systems)tremble@remss.com |
| **SMM Version (Document ID and Version Number)** | NCDC-CICS-SMM_0001_Rev.1 12/09/2014 |
| **SMM POC (Name; E-mail; Affiliation)** | Ge Peng, ge.peng@uah.edu, University of Alabama-Huntsville |
| **SMM Template Version (Document ID and Version Numbers)** | NCDC-CICS-SMM_0001_Rev.1 v4.0 06/23/2015 |
| **SMM Template POC** | Ge Peng, ge.peng@uah.edu, University of Alabama-Huntsville |
| **SMM Assessment Version (v<nn>r<mm>, e.g., v01r00)** | v01r04 |
| **SMM Assessment Date (MM/DD/YYYY)** | 04/16/2019 |
| **SMM Assessment POC (Name; E-mail; Affiliation)** | Raisa Ionin, raisa.ionin@noaa.gov, Earth Resources Technology, Inc. |
| **Stewardship Maturity Ratings (each key component) (kc1/kc2/kc3/kc4/kc5/kc6/kc7/kc8/kc9)** | 5/5/4.5/5/1/1/0/2.5/3 |
| **SMM Original Assessment Date (MM/DD/YYYY)** | 06/20/2016 |
| **SMM Original Assessment POC (Name; E-mail; Affiliation)** | Raisa Ionin, raisa.ionin@noaa.gov, Earth Resources Technology, Inc. |
| **SMM Last Modified Date (MM/DD/YYYY)** | 11/08/2021 |
| **SMM Last Modification POC (Name; E-mail; Affiliation)** | Katy Luquire, catherine.luquire@noaa.gov , CASE Consultants International |
| **SMM Modified Date (MM/DD/YYYY)** | 04/16/2019 |
| **SMM Modification POC (Name; E-mail; Affiliation)** | 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 |
| **Preservability** | Level 5<br>▪ Archived by NCEI, which is NOAA designated repository. NOAA is compliant to NARA standards<br>▪ Metadata following ISO 19115-2 standards.<br>▪ Compliant to OIAS RM<br>▪ Plans to update metadata to ISO 19115-1 at a later date<br>▪ Using NCEI Silver Spring Archive Management System, AMS.<br><br>Comments: |
| **Accessibility** | Level 5<br>▪ Collection level searchable online<br>▪ Granule level is searchable online<br>▪ Additional search options available from collection level site<br>▪ Direct file download available from<br>▪ THREDDS: https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L4/GLOB/REMSS/mw_ir_OI/catalog.html<br>▪ HTTP: https://www.ncei.noaa.gov/data/oceans/ghrsst/L4/GLOB/REMSS/mw_ir_OI/<br>▪ FTP: ftp://ftp-oceans.ncei.noaa.gov/pub/data.nodc/ghrsst/L4/GLOB/REMSS/mw_ir_OI/<br>▪ Data citation is also available from NASA PODAAC site: https://podaac.jpl.nasa.gov/dataset/MW_IR_OI-REMSS-L4-GLOB-v4.0<br>▪ Dissemination reports are available to the public https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/<br>▪ Future technology changes are planned<br><br>Comments: |
| **Usability** | Level 4.5<br>▪ The format is interoperable: nc.gz for granules<br>▪ User Guide [GHRSST, 2011] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHRSSTUserGuidev91.pdf<br>▪ User Manual [GHRSST, 2011] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf<br>▪ All GHRSST collections have error estimate.<br>▪ All GHRSST collections have enhanced online capability (e.g., visualization, multiple data formats): TDS, DAP, LAS (*data servers maintained at NCEI); access from metadata main landing page.<br>▪ A GHRSST User Guide, Quick Start Guide, GHRSST Data Specification (GDS) manual, and other relevant documents describing GHRSST data sets can be found in the archive accession, Documentation for The Group for High Resolution Sea Surface Temperature (GHRSST) data archived at NODC (NODC Accession 0123222), https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0123222<br>▪ No external ranking<br>▪ No Algorithm or ATBD documents exist for GHRSST collections<br><br>Comments:<br>No algorithm documents are present here for GHRSST. Data providers have them, but these are not available at NCEI. Will be planned for the future. |

| 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 |
| **Production Sustainability** | Level 5<br>▪ The dataset is currently supported, according to LTSRF Table: https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/<br>▪ Long-term institutional commitment REMMS, Remote Sensing Systems<br>▪ Long-term international commitment (GHRSST is an international group)<br>▪ Changes for technology are available from individual dataset producers.<br><br>Comments:<br>Changes for technology are available from individual dataset producers. NOAA does not have them documented.<br>From LTSRF page, the product is listed under REMMS, then mw_ir_OI GLOB |
| **Data Quality Assurance** | Level 1<br>▪ No documentation exists for GHRSST collections<br><br>Comments: |
| **Data Quality Control/ Monitoring** | Level 3<br>▪ Limited Quality Control metrics are available: https://www.star.nesdis.noaa.gov/sod/sst/squam/<br>▪ Sampling and analysis are frequent and systematic but not automatic<br>▪ Procedure documented and available online<br>▪ Community metrics defined and partially implemented<br><br>Comments: |
| **Data Quality Assessment** | Level 0<br>▪ No Algorithm Based Documentation (ATBD) available<br><br>Comments: |
| **Transparency / Traceability** | Level 2.5<br>▪ Limited product information available, metadata only on the GHRSST L4 MW OIGFSSTA landing page: https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc%3AGHRSST-MW_IR_OI-REMSS-L4-GLOB/html<br>▪ Product information/publications is available in literature [Gentemann, 2007] and is available online http://images.remss.com/papers/rssconf/Gentemann_satmet_2004_norfolk_MISST.pdf<br>▪ Data citation tracked, DOI is available from podaac site: 10.5067/GHMWI-4FR04 https://podaac.jpl.nasa.gov/dataset/MW_IR_OI-REMSS-L4-GLOB-v4.0<br>▪ No Algorithm document<br>▪ GHRSST datasets are under Configuration Management principles https://doi.org/10.5281/zenodo.4700465<br><br>Comments: |

| 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 |
| **Data Integrity** | Level 3<br>▪ Data archive integrity verifiable - Checksum technology is available, each GHRSST_L4_MW_IR_OI_GFSSTA 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. https: //www.nodc.noaa.gov/archive/arc0027/0065166/0065166.1.1.xml<br>▪ Data authenticity is verifiable (since data can be downloaded via HTTPS and HTTPS uses certificates to prove site authenticity)<br>▪ NCEI-MD does not provide digital signatures for data dissemination<br><br>Comments:<br>Example of a checksum file (.md5 file) can also be seen at ftp://podaac-ftp.jpl.nasa. gov/allData/ghrsst/data/GDS2/L4/GLOB/REMSS/mw_ir_OI/v4.0/2015/012/<br>PODAAC ftp site: ftp://podaac-ftp.jpl.nasa. gov/allData/ghrsst/data/GDS2/L4/GLOB/REMSS/mw_ir_OI/v4.0 |

## 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


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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].

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

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

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

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