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**Data Stewardship Maturity Report for GHR SST Regional Bulk Sea Surface
Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the
NOAA-17 satellite produced by NAVO (GDS version 1)**

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 - 2	Data Quality Assurance - 3.5	Data Quality Control/Monitoring - 3
Data Quality Assessment - 3	Transparency/Traceability - 2.75	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 GHR SST Regional Bulk Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-17 satellite produced by NAVO (GDS version 1)

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, GHR SST Regional Bulk Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-17 satellite produced by NAVO (GDS version 1), is assessed based on a reference stewardship maturity framework. The current maturity ratings of GHR SST Regional Bulk Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-17 satellite produced by NAVO (GDS version 1) are at Level 1 or higher for all nine key components with zero Level 1, two Level 2, four Level 3, one Level 4, and two 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.

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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 GHR SST Regional Bulk Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-17 satellite produced by NAVO (GDS version 1)

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 regional Group for High Resolution Sea Surface Temperature (GHR SST) 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 NOAA-17 platform (launched 24 June 2002) produced and used operationally in oceanographic analyses and forecasts by the US Naval Oceanographic Office (NAVO). The AVHRR is a space-borne scanning sensor on the National Oceanic and Atmospheric Administration (NOAA) family of Polar Orbiting Environmental Satellites (POES) having a operational legacy that traces back to the Television Infrared Observation Satellite-N (TIROS-N) launched in 1978. AVHRR instruments measure the radiance of the Earth in 5 (or 6) relatively wide spectral bands. The first two are centered around the red (0.6 micrometer) and near-infrared (0.9 micrometer) regions, the third one is located around 3.5 micrometer, and the last two sample the emitted thermal radiation, around 11 and 12 micrometers, respectively. The legacy 5 band instrument is known as AVHRR/2 while the more recent version, the AVHRR/3 (first carried on the NOAA-15 platform), acquires data in a 6th channel located at 1.6 micrometer.

Typically the 11 and 12 micron channels are used to derive SST sometimes in combination with the 3.5 micron channel. The NOAA platforms are sun synchronous generally viewing the same earth location twice a day (latitude dependent) due to the relatively large AVHRR swath of approximately 2400 km. The highest ground resolution that can be obtained from the current AVHRR instruments is 1.1 km at nadir. AVHRR data are acquired in three formats: High Resolution Picture Transmission (HRPT), Local Area Coverage (LAC), and Global Area Coverage (GAC). HRPT data are full resolution image data transmitted to a ground stations as they are collected. LAC are also full resolution data, but the acquisition is prescheduled and recorded with an on-board tape recorder for subsequent transmission during a station overpass. GAC data provide daily subsampled global coverage recorded on tape recorders and then transmitted to a ground station. This particular dataset is derived from LAC data. Further binning and averaging of the 1.1 km LAC pixels results in a final dataset resolution of 2.2 km. The coverage of the LAC data can vary but generally contains scenes over the oceans adjacent to Australia and the North Indian Ocean.

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	GHR SST Regional Bulk Sea Surface Temperature from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-17 satellite produced by NAVO (GDS version 1)
Dataset Information URL	https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:GHR SST-NAVO-L2P-AVHRR17_L
Data Provider POC (Name; Email; Affiliation)	National Centers for Environmental Information, NESDIS, NOAA, U.S. Department of Commerce301-713-3277 NCEI. Info@noaa.gov
Dataset POC (Name; Email; Affiliation)	Doug May; NAVO; Naval Oceanographic Office (NAVOCEANO); 228-688-4859 doug.may@navy.mil
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)	v01r05
SMM Assessment Date (MM/DD/YYYY)	04/19/2019
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)	5/5/4.5/2/3.5/3/3/2.75/3
SMM Original Assessment Date (MM/DD/YYYY)	08/15/2016
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)	11/17/2021
SMM Last Modification POC (Name; E-mail; Affiliation)	Lori Hager, lori.hager@noaa.gov, CASE Consultants International
SMM Modified Date (MM/DD/YYYY)	04/19/2019
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 ▪ Archived by NCEI, which is NOAA designated repository. NOAA is compliant to NARA standards ▪ Metadata following ISO 19115-2 standards. ▪ Compliant to OIAS RM ▪ Plans to update metadata to ISO 19115-1 at a later date ▪ Using NCEI Silver Spring Archive Management System, AMS. Comments:
Accessibility	Level 5 ▪ Collection level searchable online ▪ Granule level is searchable online ▪ Additional search options available from collection level site ▪ Direct file download available from ▪ THREDDS: https://www.ncei.noaa.gov/thredds-ocean/catalog/ghrsst/L2P/AVHRR17_L/NAVO/catalog.html ▪ HTTP: https://www.ncei.noaa.gov/data/oceans/ghrsst/L2P/AVHRR17_L/NAVO/ ▪ FTP: ftp://ftp-oceans.ncei.noaa.gov/pub/data.nodc/ghrsst/L2P/AVHRR17_L/NAVO/ ▪ Data citation is also available from NASA PODAAC site: https://podaac.jpl.nasa.gov/dataset/NAVO-L2P-AVHRR17_L ▪ Dissemination reports are available to the public https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/ ▪ Future technology changes are planned Comments:
Usability	Level 4.5 ▪ The format is interoperable: NetCDF or nc.bz2 for granules. ▪ User Guide [GHR SST, 2011] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHR SSTUserGuidev91.pdf ▪ User Manual [GHR SST, 2011] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf ▪ All GHR SST collections have error estimate. ▪ All GHR SST collections have enhanced online capability (e.g., visualization, multiple data formats): TDS, DAP (*data servers maintained at NCEI); access from metadata main landing page. ▪ A GHR SST User Guide, Quick Start Guide, GHR SST Data Specification (GDS) manual, and other relevant documents describing GHR SST data sets can be found in the archive accession, Documentation for The Group for High Resolution Sea Surface Temperature (GHR SST) data archived at NODC (NODC Accession 0123222), http://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0123222 ▪ Algorithm [May, 1998] is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ No external ranking 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
Production Sustainability	Level 2 ▪ The dataset is not currently supported, according to LTSRF Table: https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/ ▪ Stopped at 2008. Comments: Changes for technology are available from individual dataset producers. NOAA does not have them documented. From LTSRF page, the product is listed under NAVO, then AVHRR17_L
Data Quality Assurance	Level 3.5 ▪ Data quality assurance procedure is defined, documented and partially implemented based on the publications: ▪ [May, 1998] is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ File level quality flags exist which can be considered limited data quality assurance metadata. Comments:
Data Quality Control/Monitoring	Level 3 ▪ Information on Data Quality Control/Monitoring is provided at the following links: http://www.star.nesdis.noaa.gov/sod/sst/squam ▪ Information is also provided in the Algorithm document[May, 1998]and is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ Sampling and analysis are frequent and systematic but not automatic ▪ Community metrics defined and partially implemented ▪ Procedure documented and available online ▪ Quality checks of the data are done on a daily basis and statistics are calculated weekly (information received from SME/data provider) Comments:
Data Quality Assessment	Level 3 ▪ Algorithm is available: ▪ [May, 1998] is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ Research product assessed in the publications: ▪ [May, 1998] is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ Operational product is assessed based on the above publications. ▪ 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
Transparency / Traceability	Level 2.75 ▪ Limited product information available, metadata only on GHR SST_RBSST_AVHRR_NOAA_17_NAVO landing page https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:GHR SST-NAVO-L2P-AVHRR17_L ▪ Algorithm available: ▪ [May, 1998]and is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ Product information available in literature: ▪ [May, 1998]and is available online <a href="http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2">http://doi.org/10.1175/1520-0477(1998)079<0397:OPOSSS>2.0.CO;2 ▪ Data citation tracked, DOI is assigned from NASA PODAAC site: 10.5067/GH17L-2PN01 ▪ GHR SST datasets are under Configuration Management principles: ftp://ftp.nodc.noaa.gov/nodc/archive/arc0072/0123222/2.2/data/0-data/governance-documents/ Comments:
Data Integrity	Level 3 ▪ Data archive integrity verifiable - Checksum technology is available, each GHR SST_RBSST_AVHRR_NOAA_17_NAVO 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/arc0013/0037462/0037462.1.1.xml ▪ Data authenticity is verifiable (since data can be downloaded via HTTPS and HTTPS uses certificates to prove site authenticity) ▪ NCEI-MD does not provide digital signatures for data dissemination Comments:

3. Acknowledgment

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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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Naval Oceanographic Office, *Bulletin of the American Meteorological Society*,
79(3), 397–407, doi:10.1175/1520-0477(1998)079<0397:oposss>2.0.co;2

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 <i>Ad hoc</i> Little or no management	Level 2 <i>Minimal</i> Limited management	Level 3 <i>Intermediate</i> Defined management, partially implemented	Level 4 <i>Advanced</i> Well-defined management, fully implemented	Level 5 <i>Optimal</i> Full management, audited, measured, controlled
<i>Preservability</i> <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
<i>Accessibility</i> <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

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

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

<i>Data Integrity</i> <i>(The state of data integrity being verifiable)</i>	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