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**Data Stewardship Maturity Report for GHRSSST Level 4 K10_SST Global 10 km
Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO)
(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 - 3.5	Data Quality Control/Monitoring - 4
Data Quality Assessment - 1	Transparency/Traceability - 2.75	Data Integrity - 4

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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 Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (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, GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (GDS versions 1 and 2), is assessed based on a reference stewardship maturity framework. The current maturity ratings of GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (GDS versions 1 and 2) are at Level 1 or higher for all nine key components with one Level 1, one Level 2, one Level 3, three 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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Data Stewardship Maturity Report for GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (GDS versions 1 and 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 GHR SST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (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

This is a Group for High Resolution Sea Surface Temperature (GHR SST) Level 4 sea surface temperature (SST) analysis dataset produced daily on an operational basis by the Naval Oceanographic Office (NAVO) on a global 0.1x0.1 degree grid. The K10 (NAVO 10-km gridded SST analyzed product) L4 analysis uses SST observations from the following instruments: Advanced Very High Resolution Radiometer (AVHRR), Visible Infrared Imaging Radiometer Suite (VIIRS), and Spinning Enhanced Visible and InfraRed Imager (SEVIRI). The AVHRR data for this comes from the MetOp-A, MetOp-B, and NOAA-19 satellites; VIIRS data is sourced from the Suomi_NPP satellite; SEVIRI data comes from the Meteosat-8 and -11 satellites. The age (time-lag), reliability, and resolution of the data are used in the weighted average with the analysis tuned to represent SST at a reference depth of 1-meter. Input data from the AVHRR Pathfinder 9km climatology dataset (1985-1999) is used when no new satellite SST retrievals are available after 34 days. Comparing with its predecessor, this updated dataset has no major changes in Level-4 interpolated K10 algorithm, except for using different satellite instrument data, and updating metadata and file format.

The major updates include: (a) updated and enhanced the granule-level metadata information, (b) converted the SST file from GHRSSST Data Specification (GDS) v1.0 to v2.0, (c) added the sea_ice_fraction variable to the product, and (d) updated the filename convention to reflect compliance with GDS v2.0.

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	GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) (GDS versions 1 and 2)
Dataset Information URL	https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc:GHRSSST-K10_SST-NAVO-L4-GLOB/html
Data Provider POC (Name; Email; Affiliation)	National Centers for Environmental Information, NESDIS, NOAA, U.S. Department of Commerce 301-713-3277 NCEI.Info@noaa.gov
Dataset POC (Name; Email; Affiliation)	Daniel Olszewski Daniel.olszewski@navy.mil Naval Oceanographic Office (NAVOCEANO)
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)	V01r00
SMM Assessment Date (MM/DD/YYYY)	02/01/2022
SMM Assessment POC (Name; E-mail; Affiliation)	Katy Luquire, catherine.luquire@noaa.gov, CASE Consultants International
Stewardship Maturity Ratings (each key component) (kc1/kc2/kc3/kc4/kc5/kc6/kc7/kc8/kc9)	5/5/4.5/5/3.5/4/1/2.75/4
SMM Original Assessment Date (MM/DD/YYYY)	02/01/2022
SMM Original Assessment POC (Name; E-mail; Affiliation)	Katy Luquire, catherine.luquire@noaa.gov, CASE Consultants International
SMM Last Modified Date (MM/DD/YYYY)	02/01/2022
SMM Last Modification POC (Name; E-mail; Affiliation)	Katy Luquire, catherine.luquire@noaa.gov, CASE Consultants International
SMM Modified Date (MM/DD/YYYY)	02/02/2022
SMM Modification POC (Name; E-mail; Affiliation)	Katy Luquire, catherine.luquire@noaa.gov, CASE Consultants International

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>Preservability</p>	<p>Level 5</p> <ul style="list-style-type: none"> ▪ Archived by NCEI, which is NOAA designated repository. NOAA is compliant to NARA standards ▪ Metadata following ISO 19115-2 standards. ▪ Compliant to OAIS RM ▪ Plans to update metadata to ISO 19115-1 at a later date ▪ Using NCEI Silver Spring Archive Management System, AMS. <p>Comments:</p>
<p>Accessibility</p>	<p>Level 5</p> <ul style="list-style-type: none"> ▪ 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/L4/GLOB/NAVO/K10_SST/catalog.html ▪ HTTPS: https://www.ncei.noaa.gov/data/oceans/ghrsst/L4/GLOB/NAVO/K10_SST/ ▪ FTP: ftp://ftp-oceans.ncei.noaa.gov/pub/data.nodc/ghrsst/L4/GLOB/NAVO/K10_SST/ ▪ 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 ▪ These data are in NetCDF format following ACDD and/or CF conventions. <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
Usability	<p>Level 4.5</p> <ul style="list-style-type: none"> ▪ The format is interoperable: nc.bz2 for granules ▪ User Guide [GHRSSST, 2011] GHRSSST User Guide version 9.1, 2011, retrieved online: https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHRSSSTUserGuidev91.pdf (Accessed 24 January 2022) is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GHRSSSTUserGuidev91.pdf ▪ GDS User Manual [GHRSSST GDS, 2012] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf ▪ This collection includes data from the following product(s): GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) in GDS2.0 (GHRSSST-K10_SST-NAVO-L4-GLOB-v01); GHRSSST Level 4 K10_SST Global 1 meter Sea Surface Temperature Analysis (GHRSSST-NAVO-L4HR1m-GLOB-K10_SST). ▪ Dataset citation landing pages from PODAAC site: ▪ GHRSSST Level 4 K10_SST Global 1 meter Sea Surface Temperature Analysis: https://doi.org/10.5067/GHK10-41N01 ▪ GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) in GDS2.0: https://doi.org/10.5067/GHK10-L4N01 ▪ All GHRSSST collections have error estimate. ▪ 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. ▪ 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 NCEI (NCEI Accession 0123222), https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0123222 ▪ No external ranking ▪ While no formal ATBD documents exists, the K10 Building Procedure is available online: https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/contents.html <p>Comments:</p>
Production Sustainability	<p>Level 5</p> <ul style="list-style-type: none"> ▪ The dataset is currently supported, according to LTSRF Table: https://www.ncei.noaa.gov/access/ghrsst-long-term-stewardship-and-reanalysis-facility/ ▪ Long-term institutional commitment Naval Oceanographic Office (NAVOCEANO) ▪ Long-term international commitment (GHRSSST is an international group) ▪ Changes for technology are available from individual dataset producers. <p>Comments:</p> <p>Changes for technology are available from individual dataset producers. NOAA does not have them documented.</p> <p>From LTSRF page, the product is listed under NAVO, then K10_SST GLOB</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>Data Quality Assurance</p>	<p>Level 3.5</p> <ul style="list-style-type: none"> ▪ DQA procedure defined, documented and implemented based on this publication: [Martin, 2012] is available online https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/GMPE_Matthew_2012.pdf ▪ File level quality flags exist which can be considered limited data quality assurance metadata. <p>Comments:</p>
<p>Data Quality Control/Monitoring</p>	<p>Level 4</p> <ul style="list-style-type: none"> ▪ No Quality Control metrics are available: https://www.star.nesdis.noaa.gov/sod/sst/squam/ ▪ Sampling and analysis are frequent and systematic but not automatic ▪ Procedure documented and available online ▪ Anomaly detection and documented in GDS 2.0 User Manual [GHRSSST GDS, 2012] is available online https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf ▪ Cross-validation documented in [Martin, 2012] is available online https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/GMPE_Matthew_2012.pdf ▪ Conforming to community quality metadata & standards <p>Comments:</p>
<p>Data Quality Assessment</p>	<p>Level 1</p> <ul style="list-style-type: none"> ▪ While no formal ATBD documents exists, the K10 Building Procedure is available online: https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/contents.html <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>Transparency / Traceability</p>	<p>Level 2.75</p> <ul style="list-style-type: none"> ▪ Limited product information available, metadata only on the GHRSSST L4 K10 SST landing page: https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.nodc:GHRSSST-K10_SST-NAVO-L4-GLOB/html# ▪ While no formal ATBD documents exists, the K10 Building Procedure is available online: https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/contents.html ▪ Product information available in literature: [Martin, 2012] is available online https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/GMPE_Matthew_2012.pdf ▪ Data citation tracked, GHRSSST Level 4 K10_SST Global 1 meter Sea Surface Temperature Analysis DOI available from the PODAAC site: DOI: 10.5067/GHK10-41N01 ▪ Data citation tracked, GHRSSST Level 4 K10_SST Global 10 km Analyzed Sea Surface Temperature from Naval Oceanographic Office (NAVO) in GDS2.0: DOI: 10.5067/GHK10-L4N01 ▪ OID assigned: gov.noaa.nodc:GHRSSST-K10_SST-NAVO-L4-GLOB ▪ GHRSSST datasets are under Configuration Management principles: https://doi.org/10.5281/zenodo.4700465 ▪ <p>Comments:</p>
<p>Data Integrity</p>	<p>Level 4</p> <ul style="list-style-type: none"> ▪ Data archive integrity verifiable - Checksum technology is available, each GHRSSST_L4_K10_SST_GMSSTA 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/arc0069/0121699/0121699.1.1.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 <p>Comments:</p>

3. Acknowledgment

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The Recommended GHRSSST Data Specification (GDS) GDS 2.0 revision 5, 2012, retrieved online <https://www.nodc.noaa.gov/archive/arc0072/0123222/1.1/data/0-data/GDS20r5.pdf> (Accessed 31 January 2022)

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Martin, Matthew, et al. (2012) Group for High Resolution Sea Surface temperature (GHRSSST) analysis fields inter-comparisons. Part 1: A GHRSSST multi-product ensemble (GMPE), *Deep-Sea Research II* 77-80 (2012) 21-30, retrieved online: https://podaac-opendap.jpl.nasa.gov/opendap/allData/ghrsst/data/GDS2/L4/GLOB/NAVO/K10_SST/docs/GMPE_Matthew_2012.pdf (Accessed 31 January 2022)

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

<p>Usability</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 & 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) & 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>Production Sustainability</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>Data Quality Assurance</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 & standards</p> <p>External review</p>

<p>Data Quality Control/Monitoring</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 & 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 & spatial characteristics</p> <p>Physical consistency check</p> <p>Conforming to community quality metadata & standards</p>
<p>Data Quality Assessment</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 & standards</p> <p>External ranking</p>
<p>Transparency/Traceability</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) & 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>Data Integrity</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