NOAA Technical Information Series NESDIS
DSMR-00005 Version 1.0

doi:10.25923/e6pf-sq49

Data Stewardship Maturity Report for NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0

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 - 4.5	Accessibility - 4.5	Usability - 4
Production Sustainability - 3	Data Quality Assurance - 4	Data Quality Control/Monitoring - 3
Data Quality Assessment - 3	Transparency/Traceability - 3.5	Data Integrity - 3.5

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 NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0

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, NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0, is assessed based on a reference stewardship maturity framework. The current maturity ratings of NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0 are at Level 1 or higher for all nine key components with zero Level 1, zero Level 2, five Level 3, four Level 4, and zero Level 5 key components.

NOAA Technical Memorandum Series
National Environmental Satellite, Data, and Information Service

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

Revision	Description	Date
V01r00	Initial Release	10/27/2021

NOAA Technical Information Series NESDIS DSMR-00005

Version 1.0

doi:10.25923/e6pf-sq49

Data Stewardship Maturity Report for NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0

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

Recommended Citation

Paul Lemieux III, Katy Luquire. (2021), Data stewardship maturity report for NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0

NOAA/NESDIS Technical Report DSMR-00005, 21pp., doi:10.25923/e6pf-sq49

Table of Contents

List of Tables

Preface

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

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

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

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

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

NOAA Technical Report NESDIS DSMR-00005

Data Stewardship Maturity Report for NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0

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 dataset contains Level 1c inter-calibrated brightness temperatures from the Microwave Sounding Unit (MSU) sensors onboard nine polar orbiting satellites (TIROS-N, NOAA-6, -7, -8, -9, -10, -11, -12, and -14) spanning from 1978 to 2006. The dataset was produced by the NOAA Center for Satellite Applications and Research (STAR), and is a Fundamental Climate Data Record (FCDR) of microwave brightness temperatures in the NOAA CDR Program. MSU is a four-channel microwave radiometer measuring at 50.3, 53.74, 54.96, and 57.95 GHz, and has ground spatial resolution of about 250 km in diameter at nadir. The native MSU Level 1b data were inter-calibrated using the Integrated Microwave Inter-Calibration Approach (IMICA) method to obtain a long-term data product to be used in climate analyses. For comparison, data files also include the operational data used in NWP forecasting along with the IMICA calibrated radiances, which minimize or remove the biases found in the operational calibration. In addition, limb adjusted radiances for both the IMICA and operational calibrations are included for certain type of climate applications, such as atmospheric layer temperature development using the radiance datasets. The orbital swath data files include MSU channels 2 through 4 for the IMICA calibration, and channels 1 through 4 for the operational calibration. The inter-calibrated MSU data are not expected to change for the dataset time period.

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	NOAA Climate Data Record (CDR) of MSU Level 1c Brightness Temperature (TB), Version 1.0
Dataset Information URL	https://doi.org/10.7289/V51Z429F
Data Provider POC (name; email; affiliation)	NOAA National Centers for Environmental Information (NCEI), ncei.orders@noaa.gov
Dataset POC (name; email; affiliation)	NOAA Climate Data Record Office, zou_msu_contacts@noaa.gov
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)	V02r04
SMM Assessment Date (MM/DD/YYYY)	12/19/2016
SMM Assessment POC (Name; E-mail; Affiliation)	Paul Lemieux III, paul.lemieux@noaa.gov, Earth Resources Technology, Inc.; Candace Hutchins, Candace.Hutchins@noaa.gov, Global Science & Technology,
Stewardship Maturity Ratings (each key component) (kc1/kc2/kc3/kc4/kc5/kc6/kc7/kc8/kc9)	4.5 / 4.5 / 4 / 3 / 4 / 3 / 3 / 3.5 / 3.5
SMM Original Assessment Date (MM/DD/YYYY)	06/13/2016
SMM Original Assessment POC (Name; E-mail; Affiliation)	Paul Lemieux III, paul.lemieux@noaa.gov, Earth Resources Technology, Inc.
SMM Last Modified Date (MM/DD/YYYY)	09/21/2021
SMM Last Modification POC (Name; E-mail; Affiliation)	Katy Luquire, catherine.luquire@noaa.gov , CASE Consultants International
SMM Modified Date (MM/DD/YYYY)	03/14/2018
SMM Modification POC (Name; E-mail; Affiliation)	Paul Lemieux III, paul.lemieux@noaa.gov, Earth Resources Technology, Inc.; Candace Hutchins, Candace.Hutchins@noaa.gov, NOAA National Centers for Environmental Information (NCEI)

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 4.5 ▪ Archived at NOAA NCEI-NC ▪ Following NOAA Climate Data Record (CDR) Research-2-Operation (R2O) transition process with the Initial Operation Capability (IOC) ▪ Following OAIS RM ▪ Conforms to ISO 19115-2 metadata standard ▪ Conforming to NetCDF CF metadata conventions. ▪ Conforming to CDR Program (CDRP) guidelines on coding and NCEI Archive Branch (AB) guidance on file and variable naming conventions per Submission Agreement (SA) ▪ Plans to transition ISO metadata to newer 19115-1 standard Comments: No known audits of the archiving processes
Accessibility	Level 4.5 ▪ Collection level searchable online: https://data.noaa.gov/onestop/#/ ▪ Direct download via HTTPS: https://www.ncei.noaa.gov/data/msu-brightness-temperature-noaa/access/ ▪ Direct download via THREDDS Catalog: https://www.ncei.noaa.gov/thredds/satellite/msu_brt_tmp.html ▪ Granule searchable and orderable via HDSS: https://www.ncei.noaa.gov/has/HAS.FileAppRouter?datasetname=NSTAR_FCDR&subqueryby=STATION&applname=&outdest=FILE ▪ Reports available internally for the FTP/HTTP servers ▪ New technology for OneStop search and discovery planned (i.e. ElasticSearch, Hyrax Servers, etc.) This is part of the CDR data group that will be OneStop ready. Comments: Dissemination reports available internally but not online to the public
Usability	Level 4 ▪ NetCDF-4 data format (CF compliant) ▪ Data Flow Diagram [Zou and NOAA CDR Program, 2013] is available online here: ▪ C-ATBD [Zou and Wang, 2013] is available online here: ▪ Aggregating available via HDSS ordering system ▪ Error budgets available in C-ATBD [Zou and Wang, 2013] which is available online here: Comments: No known external rankings

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 3 ▪ Under NOAA CDR Operation & Maintenance (O&M) ▪ CDR program is managed by NCEI ▪ Contract deliverables were met but funding is no longer allocated to this dataset therefore product improvements are no longer planned. Comments: No comments
Data Quality Assurance	Level 4 ▪ Agile development procedure in place with defined/fixed set of analysis metrics ▪ Master reference data are included in the source code package which is available online here: https://www.ncei.noaa.gov/products/climate-data-records/amsu-brightness-temperature-noaa ▪ Sensor Quality flags available at the file level which qualifies as limited data quality assurance metadata Comments: No known external reviews
Data Quality Control/ Monitoring	Level 3 ▪ DQC is done after each data processing ▪ Sampling and analysis are regular over widely distributed times/locations by multiple investigators but it is not well documented or automatic ▪ Procedures documented in the C-ATBD [Zou and Wang, 2013] available online here: Comments: No data quality information in the metadata record
Data Quality Assessment	Level 3 ▪ Research product assessed in literature [Zou & Wang, 2009] and available online here: https://doi.org/10.1117/12.824459 ▪ Several operational assessments in literature available ▪ Assessment carried out in the NCEI CDR R2O process ▪ CDR Initial Operational Capability (IOC) stage ▪ Product Maturity Matrix assessment [Zou and NOAA Climate Data Record Program, 2013] is available and online here: Comments: No data quality assessment information in the metadata record No known external ranking

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 3.5 ▪ CDR Program literature [Bates, Privette, Kearns, Glance, & Zhao, 2015] is available online here: ▪ C-ATBD [Zou and Wang, 2013] available online here: ▪ DOI Assigned: https://doi.org/10.7289/V51Z429F ▪ OID Assigned: DSI 3656_01 ▪ Dataset Configuration Management is EIA-649-B standard compliant and diagrammed in this presentation document [Hutchins, 2015] which is available online here: http://www1.ncdc.noaa.gov/pub/data/sds/cdr/conferences/2015%20PI%20Annual%20Meeting%20-%20Presentations/Day_1/(A-2)%20Operations%20and%20Maintenance%20(O_M)%20of%20NOAA%20IOC%20CDRs%20-%20(Hutchins).pdf Comments: No OAD available
Data Integrity	Level 3.5 ▪ Checksums generated at ingest which verifies ingest integrity. ▪ Using standard-based technology for generating checksum at ingest. ▪ Checksum verified when customer orders data. Comments: Checksums available at ingest, but not at archive so data access integrity is not verifiable.

3. Acknowledgment

This work is supported by the NOAA OneStop Project.

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

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

4. References

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

Peng, G. (2015) The scientific data stewardship maturity assessment model template, Version: NCDC-CICS-SMM-0001-Rev.1 v4.0 6/23/2015. doi:10.6084/m9.figshare.1211954.

Peng, G., J.L. Privette, E.J. Kearns, N.A. Ritchey, and S. Ansari (2015), A unified framework for measuring stewardship practices applied to digital environmental datasets, *Data Science Journal*, 13, 231-253, doi: 10.2481/dsj.14-049.

Peng, G., J. Lawrimore, V. Toner, C. Lief , R. Baldwin, N. Ritchey, D. Brinegar, and S. A. Delgreco (2016) assessing stewardship naturity of the global historical climatology network-monthly (GHCN-M) dataset: use case study and lessons learned, D-Lib Magazine, 22, doi:10.1045/november2016-peng.

Zou, C., and NOAA CDR Program Office, (2013), MSU Level 1c brightness temperature data flow diagram, _Rep. CDRP-DIA-0347_, NOAA National Centers for Environmental Information, Asheville, NC., retrieved online: https://www.ncei.noaa.gov/products/climate-data-records/msu-brightness-temperature-noaa (Accessed 19 December 2016).

Zou, C., and Wang, W., (2013), Climate Algorithm Theoretical Basis Document (C-ATBD) MSU Radiance fundamental Climate Data Record derived from integrated microwave inter-calibration approach, _Rep. CDRP-ATBD-0426_, NOAA National Centers for Environmental Information, Asheville, NC., retrieved online: (Accessed 19 December 2016).

Zou, C., and Wang, W., (2009), Diurnal drift correction in the NESDIS/STAR MSU/AMSU atmospheric temperature climate data record, paper presented at Atmospheric and Environmental Remote Sensing Data Processing and Utilization V: Readiness for GOESS III, San Diego, CA.

Zou, C., and NOAA Climate Data Record Program, (2013), MSU brightness temperatures – NOAA climate data record (CDR) maturity matrix, _Rep. CDRP-MM-0349 Rev 1_, NOAA National Centers for Environmental Information, Asheville, NC., retrieved online: (Accessed 19 December 2016).

Hutchins, C. (2015), Operations and Maintenance (O&M) of NOAA IOC CDRs, http://www1.ncdc.noaa.gov/pub/data/sds/cdr/conferences/2015%20PI%20Annual%20Meeting%20-%20Presentations/Day_1/(A-2)%20Operations%20and%20Maintenance%20(O_M)%20of%20NOAA%20IOC%20CDRs%20-%20(Hutchins).pdf (Accessed 19 December 2016).

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 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
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) 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

Usability *(The state of being easy to use)*	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
Production Sustainability *(The state of data production being sustainable and extendable)*	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
Data Quality Assurance *(The state of data quality being assured)*	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 *The state of data quality being controlled and monitored*	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 *(The state of data quality being assessed)*	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 *(The state of being transparent, trackable, and traceable)*	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

Data Integrity *(The state of data integrity being verifiable)*	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