# EOSDIS Data Maturity Levels

## 1.1 Status of this Memo

This document describes a naming convention for the NASA Earth Science Data Systems (ESDS) community. Distribution of this document is unlimited.

## 1.2 Copyright Notice



## 1.3 Suggested Citation

ESDIS Standards Coordination Office. (2024). Data Maturity Levels. NASA Earth Science Data and Information System Standards Coordination Office.
https//doi.org/10.5067/DOC/ESCO/ESDS-RFC-051v1.

## 1.4 Change Explanation

Added reference to the CEOS Land Product Validation Hierarchy.

## 1.5 Abstract

The Earth Science Data and Information System (ESDIS) Project manages the science systems of the Earth Observing System Data and Information System (EOSDIS). EOSDIS is a comprehensive distributed Earth science data and information system designed to support NASA's Earth science missions.

This document defines the common terminology to be used for all data managed by EOSDIS on behalf of NASA’s Earth Science Division (ESD). The purpose of this document is to define Earth Science terminology so there is a common definition among new and existing science teams, science data processing systems, and data archive elements across all of EOSDIS.

This document recognizes the current status of ESDS Data Maturity Level definitions and establishes those definitions as the baseline for future updates.

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## 2 Introduction

The goal of the NASA Earth System Observatory (ESO) is to advance the understanding of the entire Earth system on a global scale by improving our knowledge of the components of the system, the interactions among them, and how the Earth system is changing.

The Earth Science Data and Information System (ESDIS) Project maintains and operates a data and information system for NASA's Science Mission Directorate (SMD) and its Earth Science Division (ESD) to support multidisciplinary research in Earth science and public data access. This system, called the EOSDIS, acquires, archives, manages, and distributes Earth system science data to a broad user community.

The Earth Observing System Data and Information System (EOSDIS) is a key core capability in NASA's Earth Science Data Systems (ESDS) Program. It provides end-to-end capabilities for managing NASA's Earth science data from various sources – satellites, aircraft, field measurements, and various other programs. EOSDIS distributes thousands of Earth system science data products and associated services for interdisciplinary studies.

The EOSDIS has common elements that apply across the system. Standards are the key to labeling and communicating data readiness for various levels of scientific integration. A common user interface to search and download data across the Distributed Active Archive Centers (DAACs) is one such example. This common user interface, called Earthdata Search (https://search.earthdata.nasa.gov/search), is made possible by a Common Metadata Repository (CMR). Data must be organized and cataloged, which makes accurate, complete, and consistent metadata a requirement for efficient accessibility. In addition to standard data formats, it is necessary to define a common language to describe the data in terms of the levels of data maturity.

This document recognizes the Data Maturity Level definitions currently implemented by ESDIS, including the validation stages derived from the CEOS Land Product Validation Hierarchy [2], and establishes those definitions as the baseline for future updates.

## 3 Definition of Data Maturity Levels

EOSDIS data products are defined by the Data Maturity Levels; beta, provisional, and validated, with 4 stages of validation (Table 1). These levels of data maturity provide guidance on the product's suitability for use in scientific research and applications and provide a user with a degree of confidence in the accuracy of data as applied to their scientific research. In general, beta and provisional products can increase in maturity level through validation, modeling or algorithm

improvements, and independent scientific investigation. Beta and provisional products can be provided or is up to the user to determine if these products are suitable for integration into further analysis and/or other usage scenarios. Validated Stage 3 and 4 (Table 1) data products represent high-quality, well-validated data suitable for further integrated studies.

**Table 1. Data Maturity Level Definitions.**

| Level Name | Description | |
|---|---|---|
| Beta | Products intended to enable users to gain familiarity with the parameters and the data formats. | |
| Provisional | Product was defined to facilitate data exploration and process studies that do not require rigorous validation. These data are partially validated, and improvements are continuing; quality may not be optimal since validation and quality assurance are ongoing. | |
| Validated | Products are high quality data that have been fully validated and quality checked, and that are deemed suitable for systematic studies such as climate change, as well as for shorter term, process studies. These are publication quality data with well-defined uncertainties, but they are also subject to continuing validation, quality assurance, and further improvements in subsequent versions. Users are expected to be familiar with quality summaries of all data before publication of results; when in doubt, contact the appropriate instrument team. Validation levels are further defined as Stage 1 through Stage 4. | |
| | Stage 1 Validation | Product accuracy is estimated using a small number of independent measurements obtained from selected locations and time periods and ground-truth/field program efforts. |
| | Stage 2 Validation | Product accuracy is estimated over a significant set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product and with similar products has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature. |
| | Stage 3 Validation | Product accuracy has been assessed. Uncertainties in the product and its associated structure are well quantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically robust way over |

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| | | multiple locations and time periods representing global conditions. Spatial and temporal consistency of the product and with similar products has been evaluated over globally representative locations and periods. Results are published in the peer-reviewed literature. |
| | Stage 4 Validation | Validation results for stage 3 are systematically updated when new product versions are released and as the time-series expands. |

## 4 References

[1] Earthdata ESDS Program: Data Maturity Levels. https://www.earthdata.nasa.gov/engage/open-data-services-and-software/data-and-information-policy/data-maturity-levels

[2] CEOS Land Product Validation Hierarchy, CEOS Land Product Validation Subgroup. https://lpvs.gsfc.nasa.gov/

## 5 RFC Authors Contact Information

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## 6 Appendix A

### 6.1 Glossary of acronyms

| Acronym | Description |
|---|---|
| CMR: | Common Metadata Repository |
| DAACs: | Distributed Active Archive Centers |
| DOI: | Digital Object Identifier |
| EOS: | Earth Observing System |
| EOSDIS: | Earth Observing System Data and Information System |
| ESCO: | ESDIS Standards Coordination Office |
| ESD: | Earth Science Division |
| ESDIS: | Earth Science Data and Information System |
| ESDS: | Earth Science Data Systems |
| RFC: | Request for Comments |
| SMD: | Science Mission Directorate |