GSFC ESDIS CMO
September 28, 2023
Released

423-10-69, Revision C
Earth Science Data and Information Systems (ESDIS) Project, Code 423

Requirements for Archiving, Distribution and User Services in EOS Data and Information System (EOSDIS)

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Greenbelt, Maryland

National Aeronautics
and
Space Administration

Requirements for Archiving, Distribution and User Services in EOS Data and Information System (EOSDIS)
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Preface

This document is under ESDIS Project configuration control. Once this document is approved, ESDIS approved changes are handled in accordance with Class I and Class II change control requirements described in the ESDIS Configuration Management Procedures, and changes to this document shall be made by change bars or by complete revision.

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Abstract

The purpose of this document is to provide common requirements for data archiving, data distribution and user services for EOSDIS-supported data. These services are currently being provided by the Distributed Active Archive Centers (DAACs). Other elements of EOSDIS may also be subject to a limited set of these general requirements. The scope of the EOSDIS systems has changed since this requirements document was first written. This document is being updated to reflect these changes.

Keywords: DAAC, Archive, User Services, Distribution, ESDIS, EOSDIS

Change History Log

Revision	Effective Date	Description of Changes (Reference the CCR & CCB Approval Date)
Baseline	08/09/2006	CCR 423-10-69-001; CCB approved
Revision A	02/01/2012	CCR 423-0059; CCB approved Pages: All
Revision B	03/02/2017	CCR 423-ESDIS-132; CCB approved 02/09/2017 Pages: All – cover through page 10; see DCN for details
Revision C	09/28/2023	CCR 423-ESDIS-412; CCB approved 09/22/2023 Pages: Revised cover through page 11; See DCN for detail of changes.

Table of Contents

1   INTRODUCTION

1.1   Scope and Assumptions

The purpose of this document is to provide common requirements for data archiving, data distribution, and user services for Earth Observing System Data and Information System (EOSDIS)-supported data. These services are currently being provided by the EOSDIS Data Centers or Distributed Active Archive Centers (DAACs) but may be provided by other organizational entities approved by the Earth Science Data and Information System (ESDIS) Project. It is also expected that some services may be split across multiple DAACs or other organizational entities. Other elements of EOSDIS may also be subject to a limited set of these general requirements. Rather than refer to specific DAACs, this document refers to an entity providing such services as an "X Distributed Active Archive Center (XDAAC)". The data system that provides the functionality to provide the services is referred to as an "X Data System (XDS)". It is assumed that the reader is familiar with Earth Observing System (EOS) Data and Information System (EOSDIS) terminology. The intent of this document is to specify "what" requirements as opposed to any implied implementation or "how".

This document does not include discussion of network requirements and communications systems. Security requirements are covered by pre-existing security plans tracked by the ESDIS Computer Security Officer. Network requirements are discussed in separate documents.

1.2   Related Documentation

The latest versions of all documents below should be used. The latest ESDIS Project documents can be obtained from Uniform Resource Locator (URL): https://ops1-cm.ems.eosdis.nasa.gov. ESDIS documents have a document number starting with either 423 or 505. Other documents are available for reference in the ESDIS project library website at: https://doclib.eosdis.nasa.gov/ or the Earthdata Wiki at https://wiki.earthdata.nasa.gov unless indicated otherwise.

1.2.1   Applicable Documents

The following documents are referenced within or are directly applicable or contain policies or other directive matters that are binding upon the content of this document.

Earth Science Data Systems (ESDS) Open Source Software Policy	https://www.earthdata.nasa.gov/engage/open-data-services-and-software/esds-open-source-policy
NASA Earth Science Data and Information Policy	https://www.earthdata.nasa.gov/data-and-information-policy
ESDIS Standards Coordination Office (ESCO)	https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices
NPR 2810.1	Security of Information Technology and NASA Policy Directive
NPD 2810.1	NASA Information Security Policy

2 REQUIREMENTS SPECIFICATION FOR ARCHIVE, DISTRIBUTION AND USER SERVICES

2.1 Overview

The XDAAC has the responsibility to meet the objectives of data product archiving, distribution, search, and user services for missions and data assigned to the NASA ESDIS Project. This includes all mission types (satellite, aircraft, field campaign, model, in-situ, and others) assigned by NASA Headquarters Earth Science Division to the EOSDIS.

As the EOSDIS evolves to greater use of the commercial cloud, it is recognized that one or more of the functionalities of archive, distribution, and user services may be assigned by ESDIS to non-DAAC entities. The requirements that follow apply to any DAAC or non-DAAC entity that provides these functionalities. The term "XDAAC" is used to refer to any such entity. The term X Data System or "XDS" is used to refer to the system that provides any or all the functionalities of archive, distribution, and user services. An XDS may be implemented fully on premises, in the commercial cloud, or a hybrid of both.

Data to be archived are ingested from one or more data production systems and various other mission and external data providers, as necessary, through interfaces described in specific Interface Control Documents (ICDs). Requirements to archive and distribute mission or other data extend as long as required by the ESDIS Project. This duration is dependent on the active use of the data by NASA funded investigators and the provisions of long-term archiving as determined by ESDIS. XDAACs will need to ensure that the data are transitioned to the appropriate long-term archive when National Aeronautics and Space Administration (NASA) notifies the XDAAC that it is appropriate to do so.

The XDS has a search and order/request/access function for data that it archives and distributes that 1) provides users with information about the available data products and data-related services (e.g., guide documents), 2) gives users the capability to identify and select their desired information, data products, or services before ordering/requesting/accessing, and 3) provides the requested data to users. The XDS shall provide users with functionalities to manipulate certain data products prior to ordering (e.g., spatial and/or spectral subsetting). The XDAAC shall provide a User Services function to assist their users, for example, with questions regarding data formats, data usage, system access, etc. While the XDAAC may only be staffed on a 40-hour workweek schedule, ESDIS expects the XDS to be available every day on a 24-hour basis with the exception of planned downtime.

To facilitate integrated reporting to NASA Headquarters, the ESDIS Project management determines the specific metrics information to be gathered based on the particular needs of the mission and the detailed information needed to monitor performance of the XDAAC. The ESDIS Project collects metrics from the XDSs according to the interface control document (423-47-01) between the XDSs and the ESDIS Metrics System (EMS). Appendix A shows the metrics that the Project routinely uses.

The ESDIS Project supports and maintains a number of cross-EOSDIS infrastructure components that together, along with XDS components, define the EOSDIS enterprise. These include:

EOSDIS Component	Current Implementation
Commercial cloud system	Earthdata Cloud (EDC)
Cloud-hosted ingest, archive, and distribution system	Cumulus
Metadata management system	Common Metadata Repository (CMR)
User account management	Earthdata Login
Data search	Earthdata Search
Browse imagery system	Global Browse Imagery Services (GIBS)
Browse imagery viewer	Worldview
Disaster recovery data backup system	Level Zero and Repositories Data Store (LZARDS)
Operational recovery data backup system	Operational Recovery Cloud Archive (ORCA)
Metrics management system	ESDIS Metrics System (EMS)
Community development system	Earthdata Code Collaborative (ECC)

Although the current implementations listed may change and evolve, XDAACs are expected to leverage these EOSDIS components for their XDSs where applicable. ESDIS may grant waivers in some cases. As new infrastructure components are developed, the XDAAC is expected to participate in the development by providing unique requirements, participating in systems reviews and, in some cases with ESDIS approval, taking on the role of system maintainer for components where the XDAAC was a principal contributor. XDAACs may also collaborate with each other, and it is incumbent on them to provide all necessary interfaces between collaborating XDS systems at each XDAAC.

As per Earth Science Data Systems (ESDS) Open Source Software Policy, all software developed is to be made available to the public as Open Source Software. This includes all software developed with ESDS funding used in the production of data products, as well as software developed to discover, access, analyze, visualize, and transform NASA data. See https://www.earthdata.nasa.gov/engage/open-data-services-and-software/esds-open-source-policy.

2.2   Commercial Cloud

1. The XDAACs shall only utilize ESDIS-approved commercial cloud systems for their XDSs. The XDAACs shall comply with associated ESDIS processes for cloud application development, maintenance, and operations.
2. It is an ESDIS policy that data for all new missions be archived in the ESDIS-approved commercial cloud system as the online primary archive system. The XDAACs shall coordinate with ESDIS on the transition of all other data and operations to the cloud from on-premises systems to the maximum extent possible.
3. It is an ESDIS general policy that XDAACs use only an ESDIS-approved cloud-based ingest, archive, and distribution system for cloud-hosted data.

2.3   Data Ingest

ESDIS policy is that data ingest is completed only when the data are available to users and the metadata are in the ESDIS-approved metadata management system (MMS).

1. The XDS shall ingest data from each provider in accordance with the interface specification documented in the applicable ICD.
2. The XDS shall be capable of ingesting data from multiple providers.
3. The XDS shall ensure data integrity (e.g., using checksums) of data upon ingest into the XDS in order to satisfy interface requirements with external systems.
4. The XDS shall perform an appropriate data quality and consistency assessment upon ingest for each unique data set.
5. The XDS shall provide ingest metrics to the ESDIS Metrics System as described in Appendix A.
6. The XDAAC shall support the ESDIS-approved browse imagery system by providing browse imagery for all appropriate higher-level data products where imagery can be generated. ESDIS will approve the XDAAC products for which browse imagery will be generated and the methods used for generation and delivery to the browse imagery system. ESDIS may grant waivers for some products. Browse products may be delivered directly from the Science Investigator-led Processing System (SIPS) or be simply passed through the XDAAC to the browse imagery system.

2.4   Data Archive and Distribution Function

Each XDAAC has the responsibility for archiving and distribution of assigned data products. This includes EOS and other missions' standard and special mission output products, metadata, and any ancillary/auxiliary or correlative data sets necessary for the production and validation of those output products, as well as data set documentation. Data sources may include SIPSs, EOS Data and Operations System (EDOS), Flight Dynamics System, NASA Sentinel Gateway, Science Data Segments, other agency interfaces (e.g., NOAA), other DAACs, designated external data providers, and others as appropriate.

2.4.1   Overview

The XDAAC archives designated data products and distributes them to users. Some products will be created for distribution through an on-demand processing system and are subject to the same data distribution requirements as products that are stored in the archive. The XDAAC distributes data electronically over designated Mission Support Networks and Science Support Networks as defined in the Networks Interface documentation (ICD between EOS Networks and EOSDIS Elements (423-ICD-002). Electronic data transmission must comply with all applicable NASA security standards.

2.4.2   Data Archive

1. The XDS shall store all designated data products in an online primary archive system (on premises, in the cloud, or hybrid) or create products on demand. The XDAAC shall assure that products generated on demand (virtual products) are identical to the corresponding standard products that would otherwise be archived, having undergone initial and periodic ongoing operational and scientific quality assessment. Designated products will be established by the ESDIS Project for each XDAAC and listed in a separate document to be provided to the ESDIS Project by the XDAAC.

2. The XDS shall provide the capability of retrieving any data granule stored in the storage system.

3. The XDS shall have the capability to archive multiple versions of selected archive data as designated by the ESDIS Project.

4. The XDS shall ensure the continued data integrity (e.g., using checksums) of data archived in the XDS in order to satisfy interface requirements with external systems.

5. The XDAAC shall obtain and maintain a Digital Object Identifier (DOI) for all standard data product collections distributed to users via the ESDIS provided process.

6. The XDAAC shall maintain and curate the metadata for all products that are available from the XDS. The metadata content shall comply with the Unified Metadata Model (UMM) and conform to a format supported by MMS ingest.

7. The XDAAC shall maintain archiving, distribution, and user services functions for designated data products until notified by ESDIS to stop maintaining these functions.

8. As part of the EOS missions data flow for some missions, EDOS maintains a backup of the Level 0 data at their offices in White Sands, NM. For those missions where White Sands is the Level 0 backup, the XDAAC shall be able to interface with the EDOS system and recover Level 0 data (when necessary) from the back-up archive in White Sands, NM.

9. The XDAAC shall maintain an off-site backup copy of all other data that would be impossible or difficult to recover in case of loss. For cloud-hosted data, ESDIS provides a disaster recovery (DR) backup system (a backup of last resort) for data that could be used, in the event of a disaster, to regenerate other data. The XDAAC shall adhere to ESDIS processes for seeking approval for datasets to be backed up into the DR system. ESDIS also provides an operational recovery (OR) backup system for any cloud-hosted data. For data archived in on-premises systems, XDAACs are responsible for implementing their own DR and OR backup systems. For all data, the XDAAC shall be aware of the locations of all backup copies of data.

10. The XDS shall have the capability to restore its archive to avoid permanent loss of archived data.

11. The XDS shall allow for new technology integration and scalable systems for archival data.

12. The XDS shall allow old versions of data to be removed from the archive.

13. The XDS shall provide archive metrics to the ESDIS Metrics System. The metrics are described in Appendix A.

2.4.3 Data Distribution

1. The XDS shall distribute data to users in accordance with the NASA Earth Science Data and Information Policy (https://www.earthdata.nasa.gov/data-and-information-policy) that promotes the full and open sharing of all data with the research and applications communities, private industry, academia, and the general public. Data includes standard and special data products, metadata, ancillary/auxiliary data, calibration data, science software source code, browse data, and documentation. The ESDIS Project may grant exceptions to this requirement via waivers for individual data products.

2. The XDAAC shall provide data product access on a non-discriminatory basis so that all users are treated equally except where there are restrictions for data products as required and approved by the ESDIS Project.

3. The XDAAC shall implement the ESDIS-approved user account management system, following ESDIS procedures, for applications where data from data products are retrieved by humans or machines. This includes direct downloads of data files (e.g., via http/https) as well as retrievals of data through data services such as OPeNDAP. Waivers to this policy shall be approved by the ESDIS Project. User access to some data (such as metadata, science software, browse data, and documentation) shall not require users to log into the user account management system.

4. The XDS shall be capable of responding to users' requests for data. The XDS shall be capable of providing subscriptions to appropriate datasets.

5. On an XDS that supports an order-based system, the XDS shall provide automated status information to users regarding their data orders.

6. The XDS shall distribute data in standard formats commonly accepted within the user community and approved by the ESDIS Standards Coordination Office (ESCO) for the types of data for which the XDAAC is responsible. Waivers to this policy shall be approved by the ESDIS Project. The ESCO approved standards are listed at https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices.

7. The XDS shall distribute data to users via electronic networks.

8. The XDS shall distribute data to various data processing systems, instrument teams' science computing facilities, SIPS, and other DAACs to support product generation and quality assurance in a timely manner to support production schedules.

9. The XDS shall provide data transformation services (e.g., subsetting data, reprojection, and format conversion) as appropriate to the XDAAC's data holdings to ensure efficient distribution of data to users.

10. The XDS shall provide distribution metrics to the ESDIS Metrics System. The metrics are described in the Appendix A.

11. The XDS shall ensure data integrity (e.g., using checksums) of data distributed from the XDS in order to satisfy interface requirements with external systems.

2.4.4   Performance

The performance requirements are based on current performance at the DAACs and agreements between each XDAAC and ESDIS.

1. The XDS shall be capable of receiving and archiving the data products resulting from forward processing of data simultaneously with those data products resulting from reprocessing.

2. For an XDS that supports an order-based system, the XDS shall make the data available for electronic pickup by the user for at least 24 hours.

2.4.5   Operational Requirements

1. The XDAAC shall notify ESDIS of off-nominal operational instances by the next business day of the occurrence. Off-nominal occurrences include unanticipated downtime of 8 hours or more.

2. The XDAAC shall provide access to network information to ESDIS and shall be IPv6 compliant.

3. The XDS shall operate 24 hours a day, 7 days a week with a minimum operational availability of .96 during any given 30-day period. The XDAAC itself may only be staffed on a 40-hour per week basis, but the XDS shall meet this availability requirement around the clock with the exception of scheduled downtime. (Operational availability is defined excluding scheduled downtime.)

4. The XDS shall be able to clear, within 48 hours, any backlogs accumulated during scheduled or unscheduled downtimes.

2.5   Information Management

A primary role of information management is to give the users efficient access to the XDAAC-held data products, providing them with all of the information and tools to search, locate, select, and obtain those products and services required to perform their science investigations. These products may be stored in the archives or may entail either higher level processing of an archived product or the placement of an acquisition and processing request. Information management may include XDS-specific, stand-alone client(s) in addition to the Earthdata Search. The XDS shall support the export of granule and collection metadata to the ESDIS-approved MMS using appropriate software tools to facilitate cross-XDS access to EOS data holdings. As a best practice, the XDS should use the MMS as its own inventory data discovery system and metadata record of records to enable enterprise tools to work optimally with XDS datasets.

2.5.1   Website Management

1. The XDAAC shall maintain and manage a public website that provides, at a minimum, access to and information on XDAAC data products, services, documentation, user support, and guidance on how to properly cite data.

2. XDAAC websites and web tools shall adhere to NASA and ESDIS guidelines for consistent and coherent user experience.

2.5.2   Metadata Management

1. The XDAAC shall maintain its product metadata in ESDIS-approved MMS. The metadata shall contain all required information according to the applicable UMM schema (e.g., UMM-C for collections, UMM-G for granules) to maximize user discovery, search, and use of data products and related tools. The XDAAC shall work with the ESDIS Project to ensure the currency, correctness, completeness, and quality of XDAAC's metadata in the MMS.

2. The XDAAC shall manage the accessibility to granule- and/or collection-level data and services in the MMS using rules, conditions, permissions, and restrictions as available in the MMS.

3. The XDAAC shall maintain an MMS metadata provider profile and provider policy information.

4. The XDAAC shall support data product access via the MMS, which includes rejecting, accepting, canceling, closing, and tracking orders or access requests.

5. The XDAAC shall work with the MMS support staff and coordinate any significant changes to the peak daily rate of metadata provided to MMS.

6. The XDAAC shall work with the MMS support staff and coordinate any significant changes to product generation workflows utilizing the MMS that might substantially impact its performance.

7. The XDAAC shall work with the MMS support staff to resolve user community problems (e.g., orders/requests, availability of data holdings for search and order/request/access) and identified metadata quality issues within a ESDIS-specified timeframe.

2.6   User Services

1. The XDAAC shall assist users with search and access of data in XDAAC or EOSDIS services.

2. The XDAAC shall support users with the interpretation and use of data products.

3. The XDAAC shall provide scientific expertise to assist users with the use of the data. The XDAAC shall strive to maximize the usefulness of the data to users and make recommendations to ESDIS on ways to enhance usefulness (e.g., formats new data products, services).

4. The XDAAC shall assist ESDIS in conducting user satisfaction surveys. The ESDIS Project conducts an annual survey of users to obtain the "American Customer Satisfaction Index (ACSI)" for the services users receive from the EOSDIS. The ACSI is a metric that NASA reports annually to the Office of Management and Budget. The goal of the performance requirements below is to maintain or increase the ACSI. The XDAAC shall participate in the ESDIS ACSI survey. The XDAAC may propose alternative measures to document customer satisfaction metrics in addition to the survey. The ESDIS Project conducts an annual survey of users to obtain ACSI for the services users receive from the EOSDIS. The ACSI is a metric that NASA reports annually to the Office of Management and Budget. The goal of the performance requirements below is to maintain or increase the ACSI.

2.7   Information Security

1. The XDAAC and XDS shall comply with all of NASA's current information technology and information security requirements as in NASA Procedural Requirement (NPR) 2810.1A (Security of Information Technology and NASA Policy Directive (NPD) 2810.1 (NASA Information Security Policy). The XDAAC shall provide copies of security documentation to appropriate NASA officials and the ESDIS office. The latest versions of all documents should be used.

2. The XDAAC and XDS shall maintain confidentiality of user product requests and accounts per the ESDIS Privacy policy guidelines.

The XDS shall comply with all applicable guidelines for website and outreach communications as established by NASA.

Appendix A   Performance Metrics in use by ESDIS Project

1. Ingest rates and statistics on all products by XDAAC, Level, Discipline, Mission, Instrument, by time period (including volumes, numbers of granules).

2. Archive rates and statistics on all products by XDAAC, Level, Discipline, Mission, Instrument, by time period (including volumes, numbers of granules).

3. Product latencies on Near Real-time products by instrument, time period.

4. Data distribution metrics by XDAAC shall include volumes, number of files, number of products, number of users, types of products, types of users for given time periods. Various groupings of these metrics are used, for example by: IPhost internet domain (.com, nasa.gov, noaa.gov, umd.edu, etc. as well as individual email addresses used for user satisfaction survey), instrument, mission or campaign, discipline, country, distribution type, registered users.

5. Number of user accesses to XDAACs and grouping by user characterization such as country, internet domain.

6. Deleted products from archive (by XDAAC, granule, product, mission, instrument, product version, time period).

Appendix B   Abbreviations and Acronyms

ACSI	American Customer Satisfaction Index
API	Application Programming Interface
CCB	Configuration Change Board
CCR	Configuration Change Request
CMO	Configuration Management Office
CMR	Common Metadata Repository
DAAC	Distributed Active Archive Center
DCN	Document Change Notice
DOI	Digital Object Identifier
DR	Disaster Recovery
EDOS	EOS Data and Operations System
EMS	ESDIS Metrics System
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
ESCO	ESDIS Standards Coordination Office (formally, ESDIS Standards Office)
ESDIS	Earth Science Data Information System
ESDS	Earth Science Data Systems
GIBS	Global Imagery Browse Services
GSFC	Goddard Space Flight Center
HTTP	Hypertext Transfer Protocol
HTTPS	HTTP Secure
ICD	Interface Control Document
LZARDS	Level Zero and Repositories Data Store
MMS	Metadata Management System
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
OPeNDAP	Open-source Project for a Network Data Access Protocol
OR	Operational Recovery
ORCA	Operational Recovery Cloud Archive
SIPS	Science Investigator-led Processing System
TBD	To Be Determined
UMM	Unified Metadata Model
UMM-C	Unified Metadata Model for Collections
UMM-G	Unified Metadata Model for Granules
URL	Universal Resource Locator
XDAAC	X Distributed Active Archive Center
XDS	X Data System