

A satellite with a large rectangular antenna array is shown in orbit above the Earth's atmosphere. The satellite is gold-colored with two solar panels extended. The background is the blackness of space with stars, and the Earth's blue and white horizon is visible at the bottom.

ESDIS Standards Coordination Office (ESCO)



EARTHDATA
EOSDIS NASA'S EARTH OBSERVING SYSTEM
DATA AND INFORMATION SYSTEM



Why Standards and Standardization Are Important

- Standards come into play at all stages of the data lifecycle
 - The acquisition, processing, storage, distribution, interpretation and reuse of data all depend on established technical specifications
- The Value of Standards
 - Enables interoperability amongst disparate parties
 - Sets community expectations and fosters trust
 - Fosters development of ecosystems of tools, services

Standards are critical enablers of community development.

So Many Standards...



The nice thing about standards is that there are so many of them to choose from.

[Andrew S. Tanenbaum](#)

ESCO History



- 2003 SEEDS - Strategic Evolution of Earth Science Enterprise Data Systems
 - Standards Process Working Group initiated
- 2004 Chartered as ESDS Standards Process Group (SPG)
 - Permanent working group that operated as a part of Earth Science Data System Working Groups (ESDSWG)
- 2013 “Graduated” to become ESDIS Standards Office (ESO)
 - Assist the ESDIS Project in formulating the standards policy for NASA ESDS,
 - Coordinate standards activities within ESDIS and
 - Provide technical expertise to standards related ESDSWG tasks
- 2020 ESO Staff expanded
 - Added staff from several DAACs
- 2022 ESO becomes ESDIS Standards Coordination Office (ESCO)
 - Expanded role to include tracking emerging standards

ESCO Role



- ESCO maintains a [list of standards approved for use](#) in NASA Earth Science Data Systems, as well as related technical information and useful ESDS references and periodically reviews and updates the list of tools and other user resources associated with standards.
- ESCO manages the [ESDIS Standards Process](#) for identification of appropriate standards and practices and their subsequent adoption for use in NASA Earth science data systems.
- ESCO leads the formation of technical working groups that are responsible for reviewing candidate standards and technical notes that may be brought forward by ESDSWG, ESDIS, or others in NASA's Earth science community
- ESCO works with ESDIS and external standards organizations to identify future candidate standards.
- ESCO also leads the ESCO Standards Interest Group (SIG) to facilitate discussion about data systems standards, conventions, and best practices relevant to NASA's Earth Observing System Data and Information System (EOSDIS).
- ESCO is responsible for communicating information about approved and emerging standards to the ESDIS community through appropriate means.

Current ESCO Team



- ESDIS Steve Olding
- ESDIS Jenny Hewson
- PO.DAAC Ed Armstrong
- ASDC Beth Huffer
- LP DAAC Treva Houska
- CDDIS Nathan Pollack
- ORNL Michelle Thornton
- SEDAC Bob Downs

ESDIS Standards Process



EARTHDATA
EOSDIS NASA'S EARTH OBSERVING SYSTEM
DATA AND INFORMATION SYSTEM

What is RFC (Request for Comments)?



- RFC (stands for **Request For Comments**) is a document that describes the standards, protocols, and technologies of the Internet and [TCP/IP](#). Since 1969, about 2400 Requests for Comments (RFCs) have been published on various networking protocols, procedures, applications, and concepts.
- Internet and TCP/IP standards are generated by consensus rather than by committee. Any member of the Internet Society ([ISOC](#)) can submit an RFC for consideration, although submission is usually done through the Internet Engineering Task Force ([IETF](#)).

Categorization of Requests For Comment (RFCs)



Documents submitted for consideration under the Standards Process are called Request for Comment (RFC) documents. Broadly, these submitted RFCs can fall into one of five categories:

- **Standard** - specification approved by a recognized standards body such as OGC, ISO, IETF
- **Convention** - specification in common use among some members of the NASA ESDS community
- **Suggested Practice** - guidance on how to apply a particular standard or convention within the NASA ESDS community
- **Lessons Learned** - document describing the use of software, protocols or processes that may be helpful to others
- **Administrative Document** – used to manage the standards process

Topics covered in the documents can include:



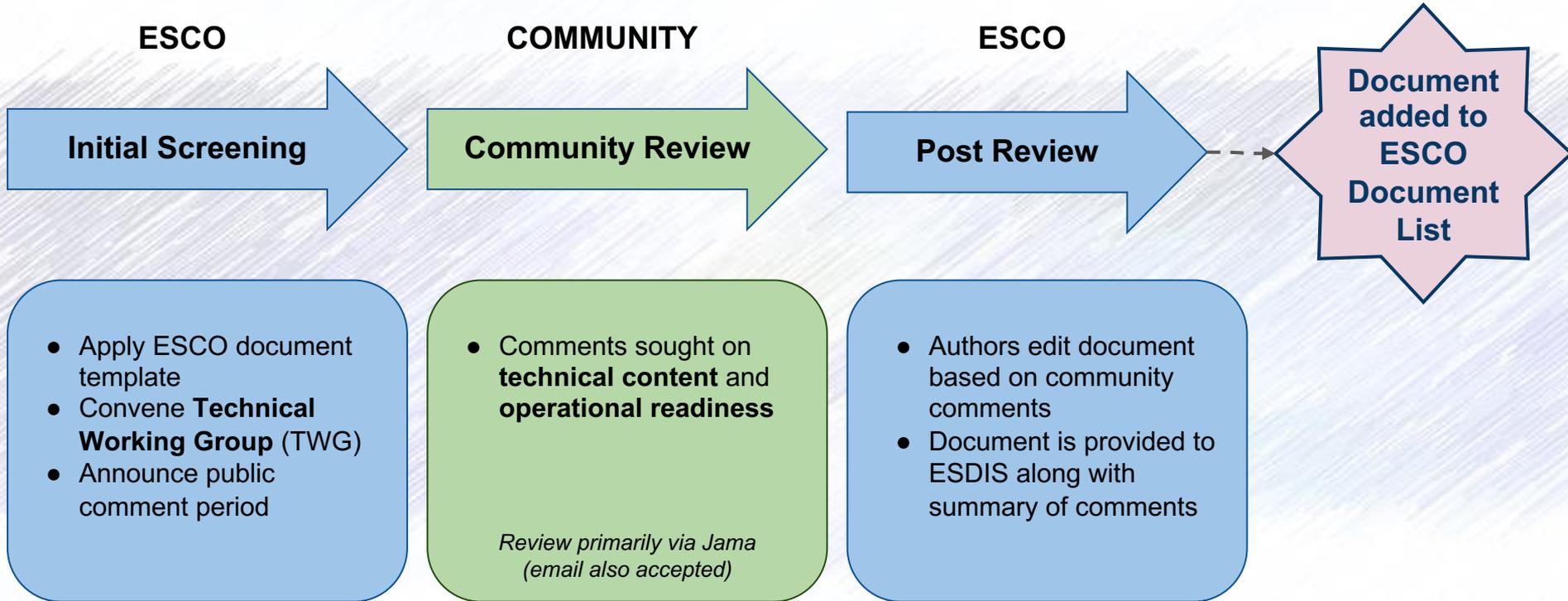
- **Software** - library or toolkit available for use
- **Specification** - document describing a format or protocol in sufficient detail that it can be independently implemented in software
- **Process** - steps that can be followed to reach a desired result
- **Technical Note** - other technical document of interest to the community

Document Submission



- The idea for drafting and submitting a document into the standards process can originate with the authors who would like to promote the use of a standard, convention, or process, or who might wish to publish information of value to the Earth science community in the form of lessons learned (typically about the particulars of implementing something, e.g. deploying standards compliant software at a data center).
- Potential authors should contact the ESCO prior to drafting an unsolicited RFC document. This is to ensure the topic is relevant to the needs of ESDIS and is not already being worked on by other authors.
- The document should conform to a simple template described in the Instructions to Authors document.
- It is also very important to identify as many implementations of the standard, specification, or process as possible and to list these in a document known as Evidence of Use. Evidence of use is required for Standards and Conventions, highly recommended for Suggested Practice and not required (but welcome) for Lessons Learned RFCs.

Inside the Process



Initial Screening



- A completed draft RFC is reviewed by ESCO staff to ensure that it conforms to the needs of ESDIS and the requirements in the Instructions to Authors
- The ESCO then recruits a 3-4 member Technical Working Group (TWG), including an ESCO staff person, that will carry out the rest of the process.
- The TWG reviews the RFC for completeness and to ensure the RFC is ready to be reviewed more broadly.
- If Evidence of Use is required, it must be submitted before the process continues.
- The TWG then tries to identify a pool of potential reviewers, including the people listed in the Evidence of Use.

Phase 3 – Community Review

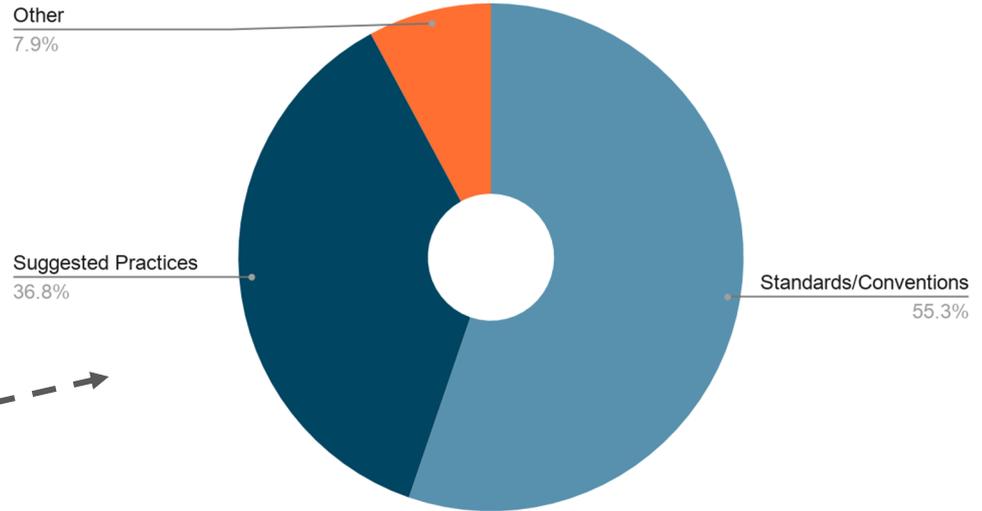


- TWG develops a review strategy.
 - Technical content reviews are required only for specifications that were developed outside of a standards organization. These reviews are meant to address whether the specification is well-documented and is technically implementable.
 - Operational readiness reviews address whether the standard or convention is suitable for operational use and how organizations that have already implemented it have benefited from it.
- TWG develops a set of questions meant to discover the strengths, weaknesses, applicability and limitations of the contents of the RFC.
- The review questions are sent to the potential reviewers.
- Once the reviewers have provided answers to the survey questions, the TWG analyzes the results and makes a recommendation to ESDIS whether to approve the RFC.
- During the third phase, comments received are shared with the RFC authors who are then given the opportunity make clarifications and correct any errors found.
- If the recommendation of the TWG to ESDIS is positive, and if ESDIS concurs, then the RFC is considered “final” and is tagged with one or more recommendation tags.

Community Standards Process



Approved Documents List: Document Types

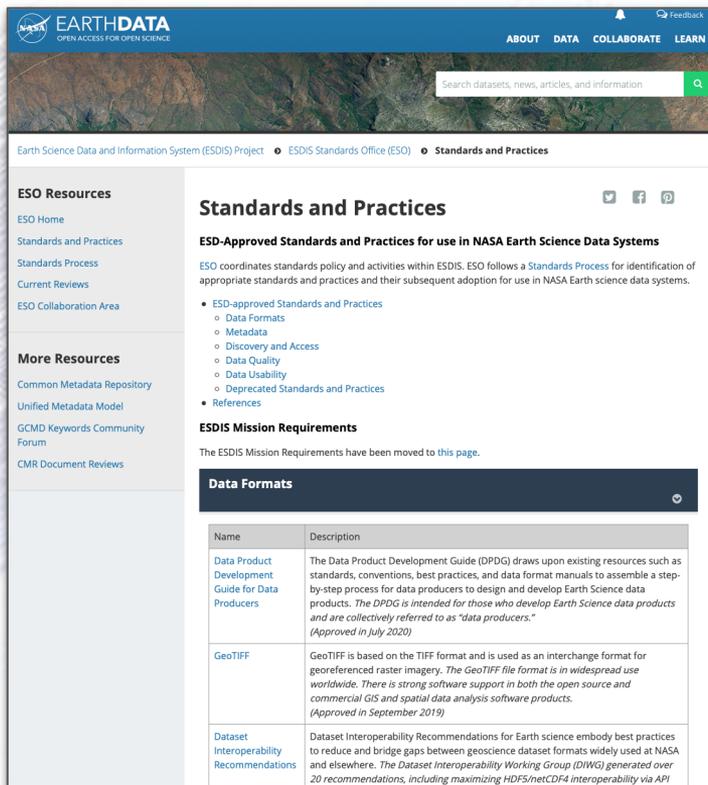


<https://earthdata.nasa.gov/standards>

Document Repository

<https://earthdata.nasa.gov/standards>

Documents by Category



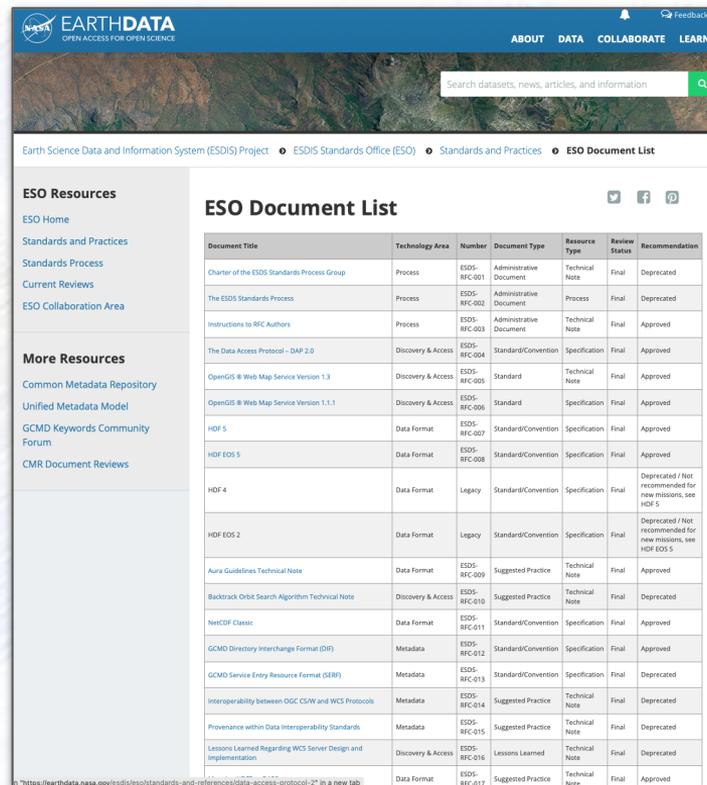
The screenshot shows the 'Standards and Practices' page on the Earth Data website. The page is titled 'Standards and Practices' and includes a search bar at the top. The main content area is divided into several sections: 'ESO Resources' (with links to Home, Standards and Practices, Standards Process, Current Reviews, and Collaboration Area), 'More Resources' (with links to Common Metadata Repository, Unified Metadata Model, GCMD Keywords Community Forum, and CMR Document Reviews), and 'Data Formats'. The 'Data Formats' section is highlighted with a dark blue header and contains a table with columns for 'Name' and 'Description'. The table lists three data formats: Data Product Development Guide for Data Producers, GeoTIFF, and Dataset Interoperability Recommendations.

Name	Description
Data Product Development Guide for Data Producers	The Data Product Development Guide (DPDG) draws upon existing resources such as standards, conventions, best practices, and data format manuals to assemble a step-by-step process for data producers to design and develop Earth Science data products. The DPDG is intended for those who develop Earth Science data products and are collectively referred to as "data producers." (Approved in July 2020)
GeoTIFF	GeoTIFF is based on the TIFF format and is used as an interchange format for georeferenced raster imagery. The GeoTIFF file format is in widespread use worldwide. There is strong software support in both the open source and commercial GIS and spatial data analysis software products. (Approved in September 2019)
Dataset Interoperability Recommendations	Dataset Interoperability Recommendations for Earth science embody best practices to reduce and bridge gaps between geoscience dataset formats widely used at NASA and elsewhere. The Dataset Interoperability Working Group (DIWG) generated over 20 recommendations, including maximizing HDF5/netCDF4 interoperability via API

<https://earthdata.nasa.gov/esdis/esco/standards-and-references/eso-document-list>



Documents by Number



The screenshot shows the 'ESO Document List' page on the Earth Data website. The page is titled 'ESO Document List' and includes a search bar at the top. The main content area is divided into several sections: 'ESO Resources' (with links to Home, Standards and Practices, Standards Process, Current Reviews, and Collaboration Area), 'More Resources' (with links to Common Metadata Repository, Unified Metadata Model, GCMD Keywords Community Forum, and CMR Document Reviews), and a table of document entries. The table has columns for 'Document Title', 'Technology Area', 'Number', 'Document Type', 'Resource Type', 'Review Status', and 'Recommendation'. The table lists various documents, including 'Charter of the ESDS Standards Process Group', 'The ESDS Standards Process', 'Instructions to RFC Authors', 'The Data Access Protocol - DAP 2.0', 'OpenGIS & Web Map Service Version 1.3', 'OpenGIS & Web Map Service Version 1.1.1', 'HDF 5', 'HDF EOS 5', 'HDF 4', 'HDF EOS 2', 'Aura Guidelines Technical Note', 'Backtrack Orbit Search Algorithm Technical Note', 'NetCDF Classic', 'GCMD Directory Interchange Format (DIR)', 'GCMD Service Entry Resource Format (SER)', 'Interoperability between GOC, CSW and WCS Protocols', 'Provenance within Data Interoperability Standards', 'Lessons Learned Regarding WCS Server Design and Implementation', and 'Lessons Learned Regarding WCS Server Design and Implementation'.

Document Title	Technology Area	Number	Document Type	Resource Type	Review Status	Recommendation
Charter of the ESDS Standards Process Group	Process	ESDS-RFC-001	Administrative Document	Technical Note	Final	Deprecated
The ESDS Standards Process	Process	ESDS-RFC-002	Administrative Document	Process	Final	Deprecated
Instructions to RFC Authors	Process	ESDS-RFC-003	Administrative Document	Technical Note	Final	Approved
The Data Access Protocol - DAP 2.0	Discovery & Access	ESDS-RFC-004	Standard/Convention	Specification	Final	Approved
OpenGIS & Web Map Service Version 1.3	Discovery & Access	ESDS-RFC-005	Standard	Technical Note	Final	Approved
OpenGIS & Web Map Service Version 1.1.1	Discovery & Access	ESDS-RFC-006	Standard	Specification	Final	Approved
HDF 5	Data Format	ESDS-RFC-007	Standard/Convention	Specification	Final	Approved
HDF EOS 5	Data Format	ESDS-RFC-008	Standard/Convention	Specification	Final	Approved
HDF 4	Data Format	Legacy	Standard/Convention	Specification	Final	Deprecated / Not recommended for new missions, see HDF 5
HDF EOS 2	Data Format	Legacy	Standard/Convention	Specification	Final	Deprecated / Not recommended for new missions, see HDF EOS 5
Aura Guidelines Technical Note	Data Format	ESDS-RFC-009	Suggested Practice	Technical Note	Final	Approved
Backtrack Orbit Search Algorithm Technical Note	Discovery & Access	ESDS-RFC-010	Suggested Practice	Technical Note	Final	Deprecated
NetCDF Classic	Data Format	ESDS-RFC-011	Standard/Convention	Specification	Final	Approved
GCMD Directory Interchange Format (DIR)	Metadata	ESDS-RFC-012	Standard/Convention	Specification	Final	Approved
GCMD Service Entry Resource Format (SER)	Metadata	ESDS-RFC-013	Standard/Convention	Specification	Final	Deprecated
Interoperability between GOC, CSW and WCS Protocols	Metadata	ESDS-RFC-014	Suggested Practice	Technical Note	Final	Deprecated
Provenance within Data Interoperability Standards	Metadata	ESDS-RFC-015	Suggested Practice	Technical Note	Final	Deprecated
Lessons Learned Regarding WCS Server Design and Implementation	Discovery & Access	ESDS-RFC-016	Lessons Learned	Technical Note	Final	Deprecated
Lessons Learned Regarding WCS Server Design and Implementation	Data Format	ESDS-RFC-017	Suggested Practice	Technical Note	Final	Approved

Document Landing Pages



The screenshot shows the Earth Data website interface. At the top, there's a navigation bar with 'ABOUT', 'DATA', 'COLLABORATE', and 'LEARN'. Below it is a search bar. The main content area features the title 'Data Product Development Guide for Data Producers' and a 'Summary' section. A sidebar on the left lists 'Standards Categories' and 'More Resources'. A table at the bottom provides metadata for the document, including its DOI and citation information. A section titled 'NASA Earth Science Community Recommendations for Use' lists 'Strengths'.

Data Product Development Guide for Data Producers

Summary

This Data Product Development Guide (DPDG) for Data and Information System (EOSDIS) by the DPDG Working Groups (ESDSWGs) to aid in the development of Earth Science Data Systems in July 2020.

The DPDG is intended for those who develop Earth Science data products and are collectively referred to as "data producers." This guide is primarily intended for developers of Earth Science data products derived from remote sensing data, and particularly for the development of Level 1B through Level 4 products (see Data Processing Levels). However, developers of related data products including Level 0 and 1A satellite data, airborne and ground-based data products, and modeling data will also find useful guidance.

Status

The Data Product Development Guide (DPDG) for Data Producers was approved as a Suggested Practice for NASA Earth Science Data Systems in July 2020.

Suggested Practice Document

[Data Product Development Guide \(DPDG\) for Data Producers](#)

NASA Earth Science Community Recommendations for Use

Strengths

The Data Product Development Guide (DPDG) draws upon existing resources such as standards, conventions, best practices, and data format manuals to assemble a step-by-step process for data producers to design and develop Earth Science data products. With the evolution of these protocols in the design and development of Earth Science data products.

Weaknesses

This guide is a broad snapshot bringing together best practices, standards, data formats, and metadata utilized today in the design and development of Earth Science data products. With the evolution of these protocols in the design and development of Earth Science data products.

Applicability

This guide is primarily intended for developers of Earth Science data products derived from remote sensing data, and particularly for the development of Level 1B through Level 4 products. However, developers of related data products including Level 0 and 1A satellite data, airborne and ground-based data products will also find useful guidance.

Limitations

This guide provides a thorough process for designing and developing Earth Science data products that require essentials such as organizational commitment, staff resources, and computing power that some data producers may not be able to launch and maintain. It may be advantageous for data producers to establish a cohesive



EARTHDATA Find a DAAC - Feedback ?

Earthdata Wiki Spaces Forums Search Log in

ED ESDIS Standards Office (ESO)

Blog

SPACE SHORTCUTS

- ESO Wiki Home Page
- ESO Earthdata Home Page

CHILD PAGES

Pages

- ESDIS Standards Office (ESO) ...
 - ESO Standards Interest Group
 - ESO Document List
 - ESO Reviews
 - ASCII File Format List
 - ESO Library
 - Potentially Applicable OGC resu...

Dashboard

ESDIS Standards Office (ESO) Work Area

Created by Ross Bagwell, last modified by Allan Doyle on Aug 28, 2020



This collaboration area contains materials related to the work of the ESO and is subject to change as work progresses.

Visit the following pages on the Earthdata website for more information regarding standards at ESDIS:

[ESDIS Standards Office Home](#)

Standards Process: A description of the process for identification of appropriate standards and subsequent adoption for use in NASA Earth science data systems.

Standards and References: List of standards approved for use in NASA Earth Science Data Systems; Related Technical Information; standards under development; and references relevant to those standards.

Contact: eso-staff@lists.nasa.gov

Information about working with this wiki:

[Click here to expand...](#)

Navigate space

Search

- ESO Blog
- ESO Document List
- ESO Reviews
- ASCII File Format List

ESO Private

eso

Identifying Future Candidate Standards



ESCO works with ESDIS and external standards organizations to identify future candidate standards.

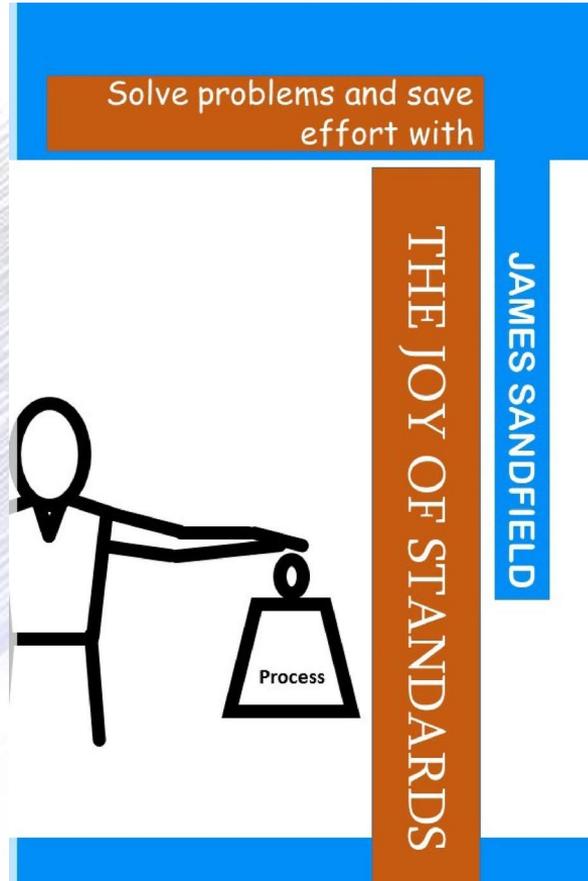
- Emerging standards to focus on in 2022-23
 - Open Source Science
 - AI/ML
 - Cloud Migration
 - Cloud science workflows and analysis
 - Cloud optimized formats and services
 - Analysis Ready Data (ARD)

How to get involved



- Email us at esco-staff@lists.nasa.gov
- Join us at ESIP or ESDSWG meetings
- Let us know about best practices, lessons learned, and specifications that are important to your mission, data providers, data consumers, partner organizations.
- Do you wish there were a spec for something but it's not on the list? Let us know.
- Be a reviewer or volunteer to be on a Technical Working Group. Tell us what your areas of interest/expertise are.
- Use what is already on the list of approved documents
- Join the [#eosdis-standards](#) channel on EOSDIS Slack

The Joy of Standards



- “Use standards in partnership with standardized work to release the potential in your people to improve processes. Standards may sound boring - and they can be if used improperly. However, using the lean processes described in this book, standards will release joy and increased productivity into your organization.”
- <https://www.amazon.com/Joy-Standards-problems-effort-problem/dp/1523372680/>