



An Efficient Tool for Making Algorithm Theoretical Basis Documents Easy to Author, Locate and Access

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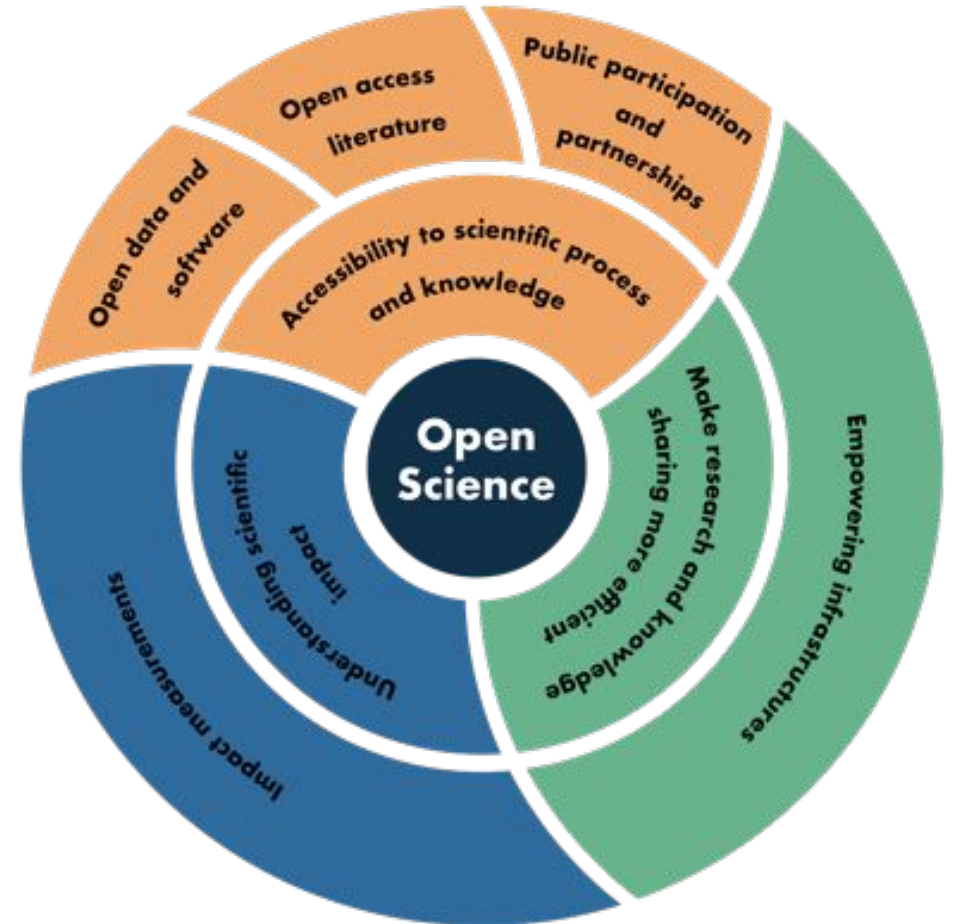
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Accelerating Open Science

- Open science is a collaborative culture enabled by technology that empowers the open sharing of data, information and knowledge within the scientific community and the wider public to accelerate scientific research and understanding
- **Algorithm Theoretical Basis Documents** (ATBDs) are an important component to open, reproducible science that makes the scientific process more accessible

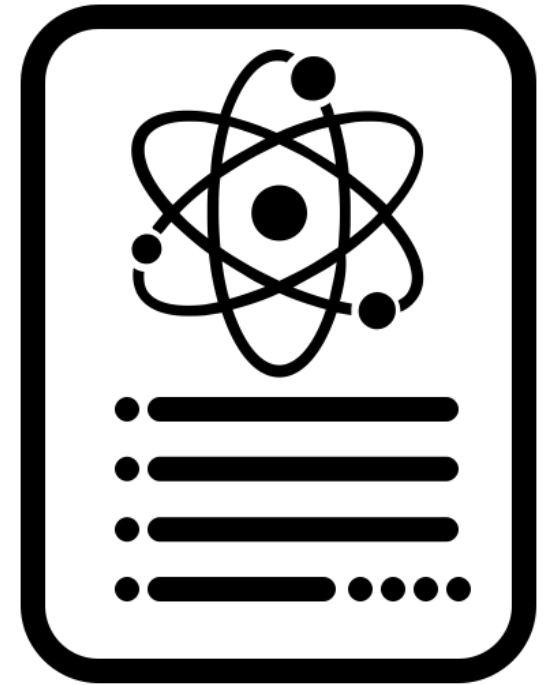


R. Ramachandran, K. Bugbee, and K. Murphy, "From Open Data to Open Science," Earth and Space Science Open Archive, 2021, <https://doi.org/10.1029/2020EA001562>

Algorithm Theoretical Basis Documents (ATBDs)

ATBDs describe the physical theory, mathematical procedures and assumptions made for developing algorithms which convert radiances received by remote sensing instruments into geophysical quantities

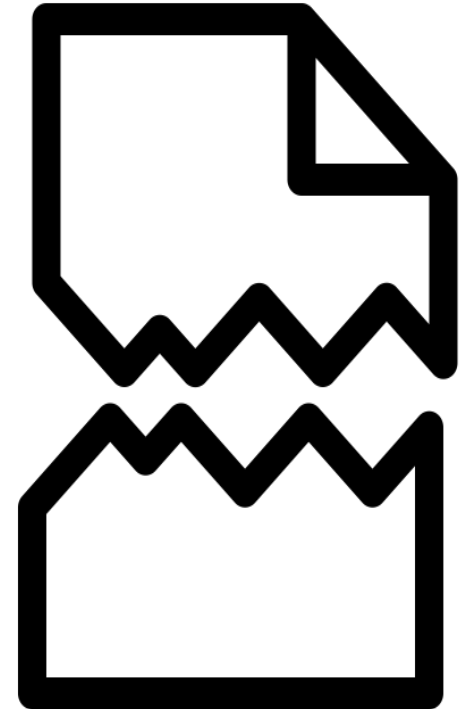
ATBDs are *required* for every NASA Earth Observing System instrument product



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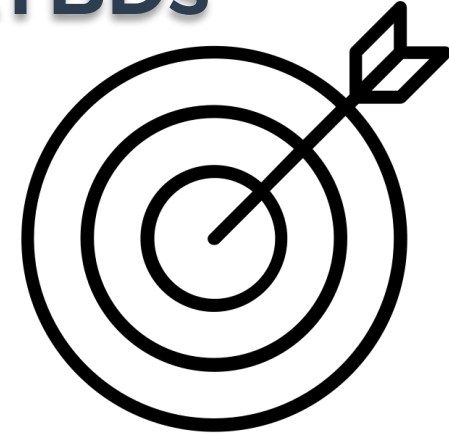
Historical Problems with ATBDs

- No standard ATBD template used
 - every ATBD was different; inconsistent structure and information
 - scientists writing ATBDs were uncertain as the requirements
- ATBD content was not searchable
 - not search engine optimized
 - most often Word or PDF documents
- ATBDs were difficult to discover
 - important for scientific reproducibility, but not easy to locate
 - no central repository for search and discovery of ATBDs
 - not consistently referenced in a dataset's metadata
- ATBDs were difficult to update/maintain once written
 - stewardship activities varied in quantity and quality
 - no consistent versioning process used



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Goals Set for Standardizing and Managing ATBDs



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Goal 1: Establish standardized policies and processes for ATBDs

- Develop ATBD template
- Establish standard review process
- Identify and communicate requirements and guidelines

Goal 2: Develop and utilize standardized ATBD best practices

- Develop ATBD stewardship requirements (citations, versioning, preservation, metadata)

Goal 3: Make ATBDs openly available and easily discoverable by all users

- Provide ATBDs in human and machine-readable format
- Provide a discovery portal for ATBD access
- Ensure a PID (i.e. DOI) is assigned to ATBDs
- Provide an open access license for ATBDs in line with ESDS data and information policy

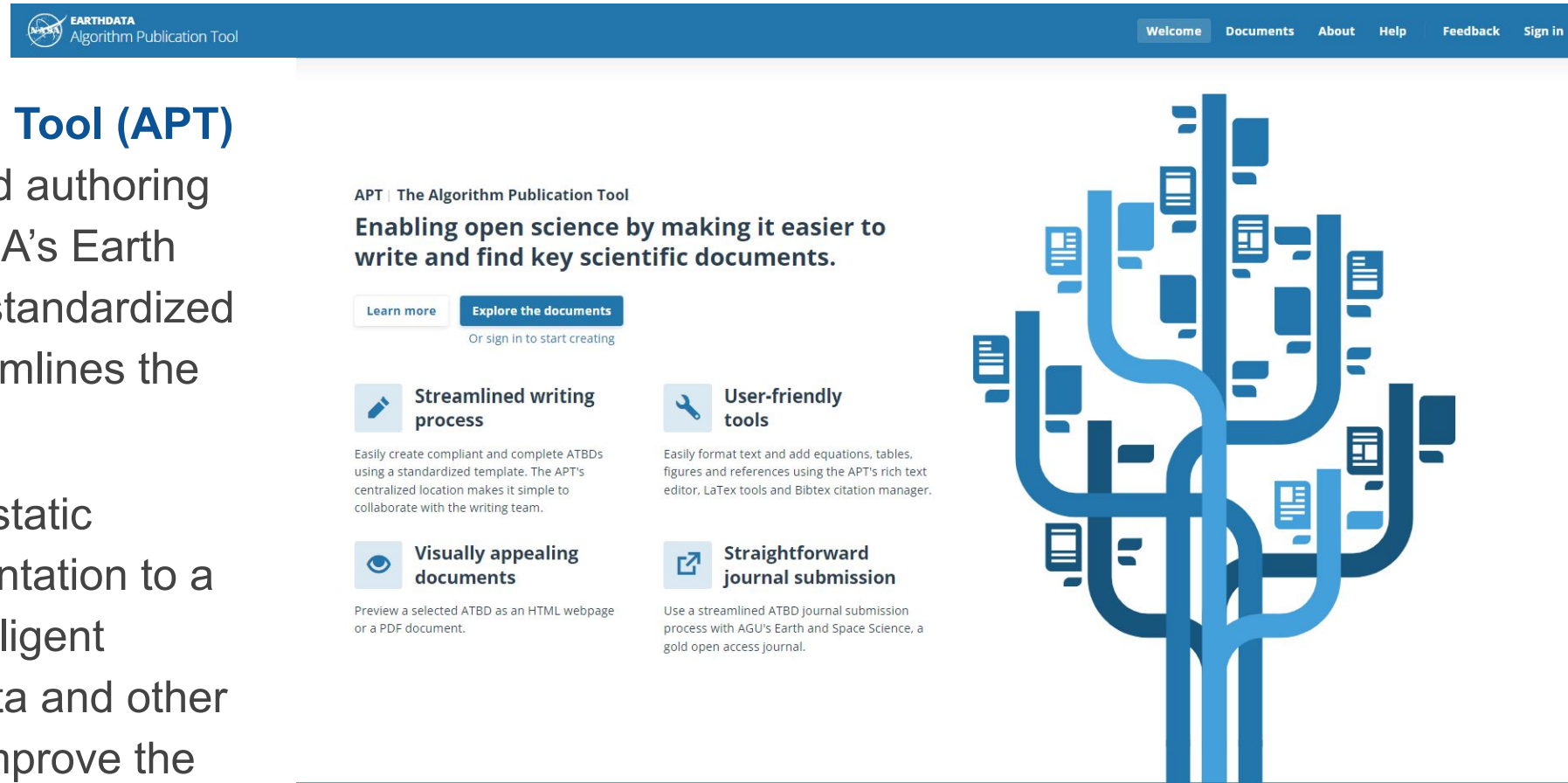
Algorithm Publication Tool (APT)

The Algorithm Publication Tool (APT)

is a centralized, cloud-based authoring and publication tool for NASA's Earth Science Division that uses standardized ATBD template(s) and streamlines the authoring process.

The goal is to move from a static approach for ATBD documentation to a dynamic approach with intelligent connections to software, data and other supporting resources that improve the transparency and reproducibility of science.

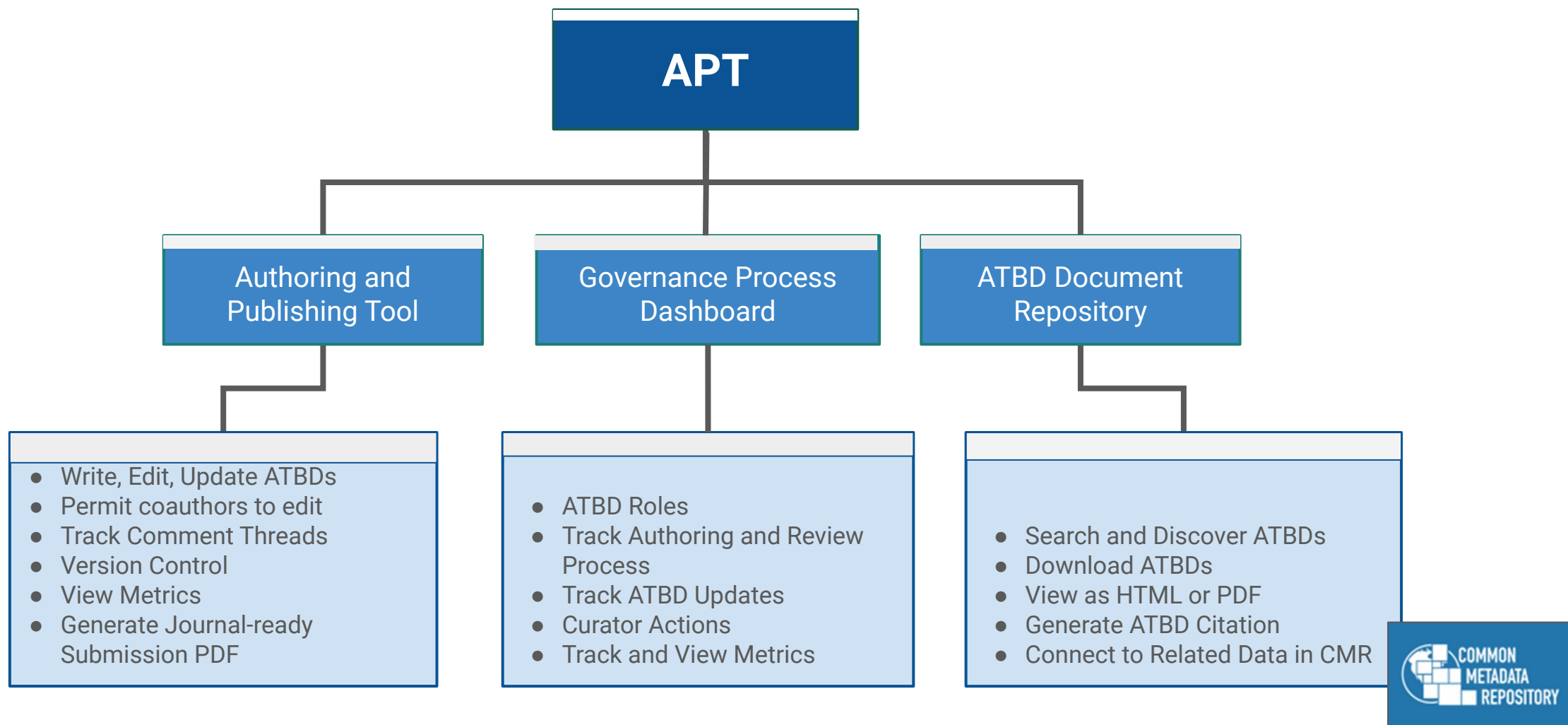
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The screenshot shows the APT website interface. At the top is a blue header with the NASA EarthData logo and the text "Algorithm Publication Tool". Navigation links include "Welcome", "Documents", "About", "Help", "Feedback", and "Sign in". The main content area has a title "APT | The Algorithm Publication Tool" followed by the tagline "Enabling open science by making it easier to write and find key scientific documents." Below this are two buttons: "Learn more" and "Explore the documents", with the text "Or sign in to start creating" underneath. The interface features four key benefits, each with an icon and a brief description:

- Streamlined writing process**: Easily create compliant and complete ATBDs using a standardized template. The APT's centralized location makes it simple to collaborate with the writing team.
- User-friendly tools**: Easily format text and add equations, tables, figures and references using the APT's rich text editor, LaTeX tools and Bibtex citation manager.
- Visually appealing documents**: Preview a selected ATBD as an HTML webpage or a PDF document.
- Straightforward journal submission**: Use a streamlined ATBD journal submission process with AGU's Earth and Space Science, a gold open access journal.

On the right side of the interface is a large, stylized blue tree graphic where the branches and leaves are represented by various document and software icons.

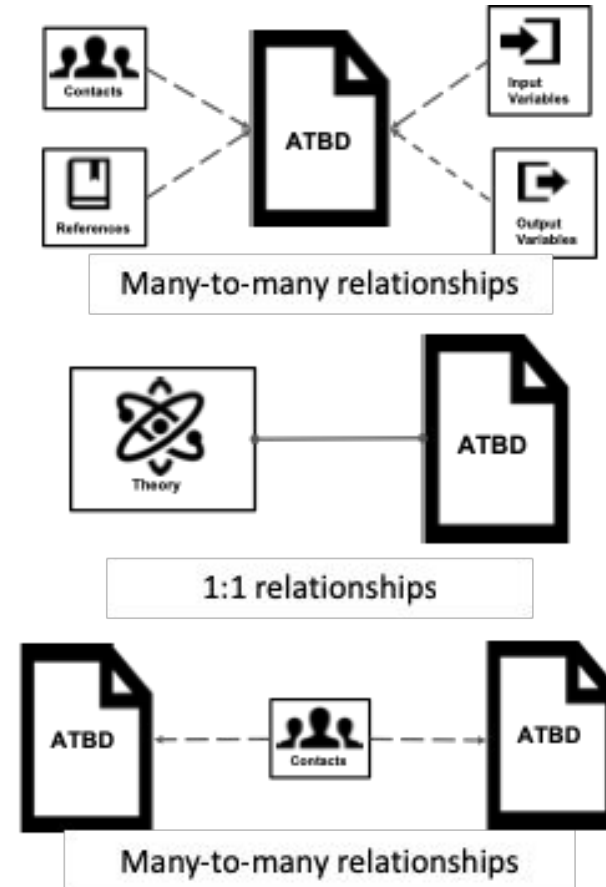
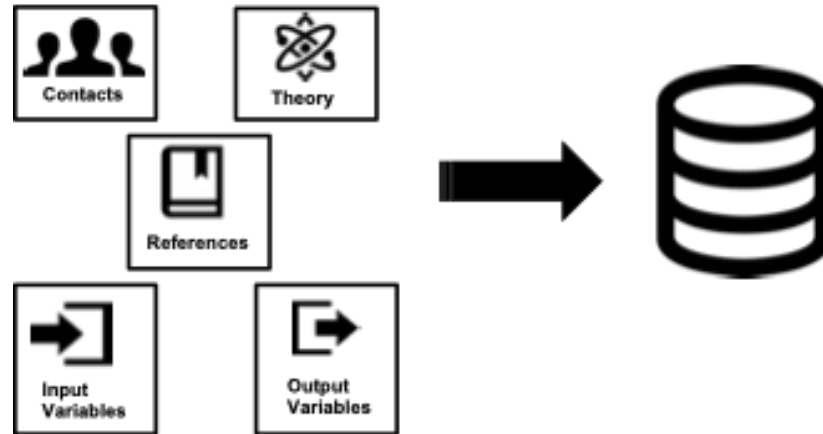


Researchers and scientists will soon be required to use the APT in future solicitations.

Algorithm Metadata Model

Consists of:

- Standardized & simplified ATBD content
- Traditional metadata - information about the document (author, keywords, etc)
- Well defined definitions for included content, validation rules, and content specifications



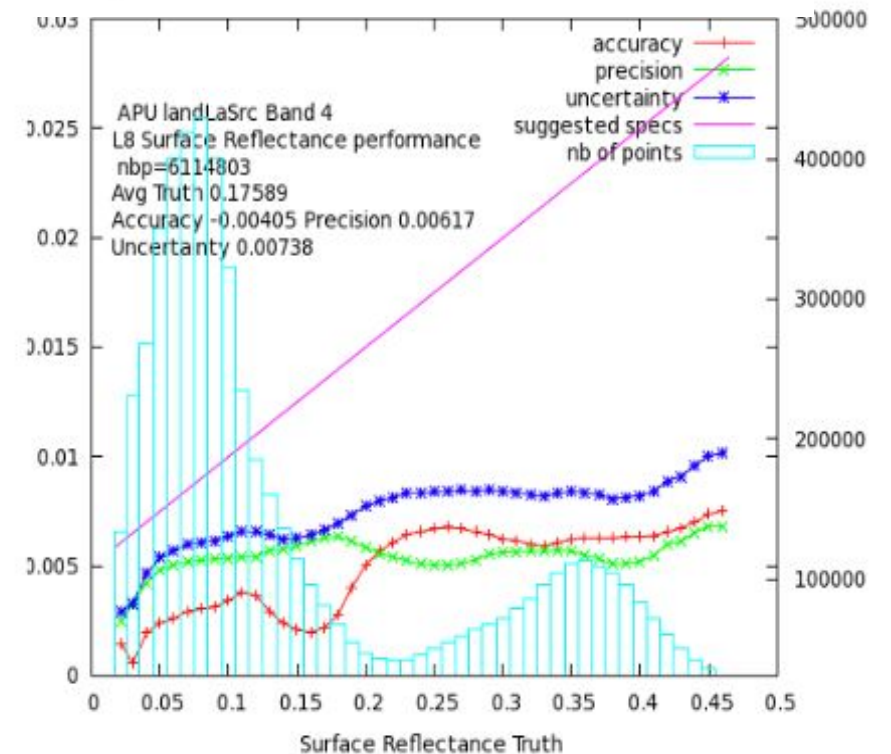
Prevents authors from having to write the same content over and over

Key APT Features

- Cognito for authorization; multiple author use
- Standardized ATBD template
- HTML layout and navigation
- Comment capability during construction and review
- Clearly developed prompts and help materials
- Blind review with easy author/reviewer communication
- Built to make tables, figures, and equations easy to complete
- Global save and reminder prompts
- Dashboard for approved users to track workflow
- Versioning - create new major and minor versions from existing, published ATBDs
- Completeness Tracking - mark sections as done
- Journal Integration - easy submission
- Curator role; information / metrics of ATBD and tool
- User interface for discovery of archived ATBDs

$$\rho_{TOA}(\theta_s, \theta_v, \varphi, P, \overbrace{\tau_A, \omega_0, P_A}^{A_{cr}}, U_{H_2O}, U_{O_3}) = Tg_{OG}(m, P) Tg_{O_3}(m, U_{O_3})$$

Eq. 1



User Documentation

APT

This is the **Algorithm Publication Tool** prototype for use in writing, submitting, and discovering ATBDs. We have endeavored to make it as easy as possible to create and edit new ATBDs, and welcome your feedback.

APT has been developed by a diverse team at NASA IMPACT and Development Seed. Please use the [feedback form](#) to send us your questions, thoughts, and comments.

FAQs

What is the APT?

The APT is an authoring tool that streamlines the writing, publishing and maintenance process of Algorithm Theoretical Description Documents (ATBDs) for NASA's Earth Science Division. The APT is also a centralized repository of submitted ATBDs for Earth Science users. Researchers and scientists are required to use the tool to standardize the ATBD content and make it searchable for all interested data users.

Why should I use the APT?

If you are a user, this is where you will find an ATBD you are looking for. Historical ATBDs are not available at this time. If you are a scientist, this tool provides you a means to write and submit your algorithm description so that it can be located by others and even aids in journal submission.

Can the public use the APT?

The public can not use the APT to write an ATBD, only to access submitted NASA Earth Science ATBDs. Users can view a selected ATBD as either a PDF or an HTML page.

How does the APT work?

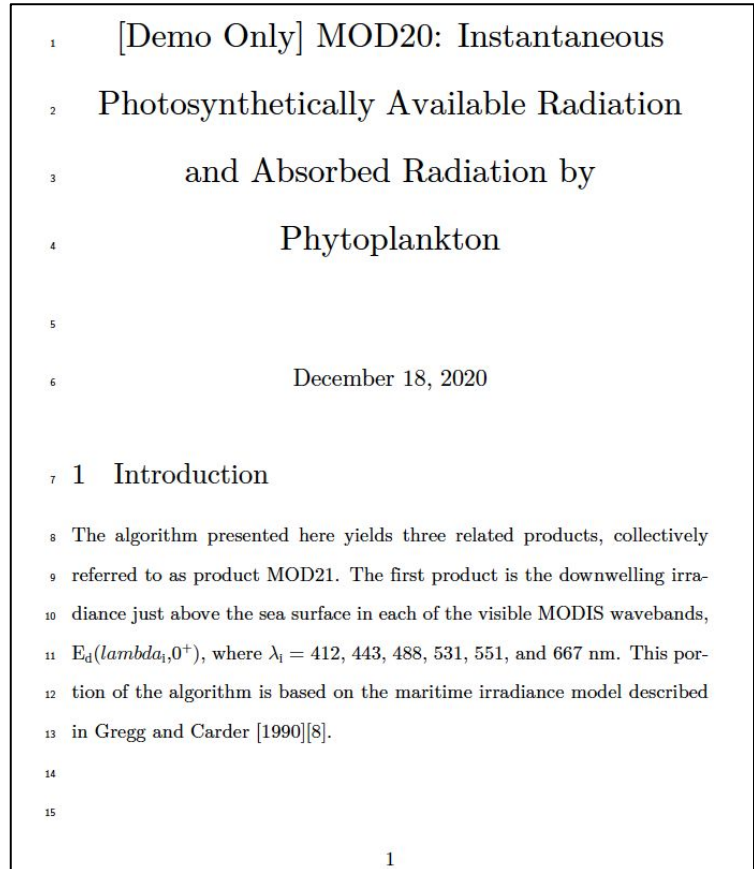
The APT uses a standardized ATBD template that improves communication and sets content expectations for ATBDs. A review process is used to ensure content quality. ATBD content is stored as metadata making it completely machine readable, searchable, and useful in other tools and services.

For more detailed information about APT, please visit the [User Guide for Authoring ATBDs](#) using the

- **User Guide**
 - Steps users through the ATBD authoring process
- **LaTeX Help Guide**
 - Provides basic LaTeX commands to build mathematical equations
- **ATBD Repository User Guide**
 - Describes how to search for and discover ATBDs from the repository

Partnership with AGU Journal

- AGU Earth and Space Science Journal
 - Open access journal focused on instruments, data products, algorithms, and demonstrating applications
- APT Submission Support
 - Easily choose journal publication
 - Modifying template to contain required content
 - Exporting review-ready PDF for submission
 - Providing needed information for submission
- GEDI test case underway
 - Using APT to write the GEDI L2 ATBDs
 - Planning to submit to the AGU ESS journal



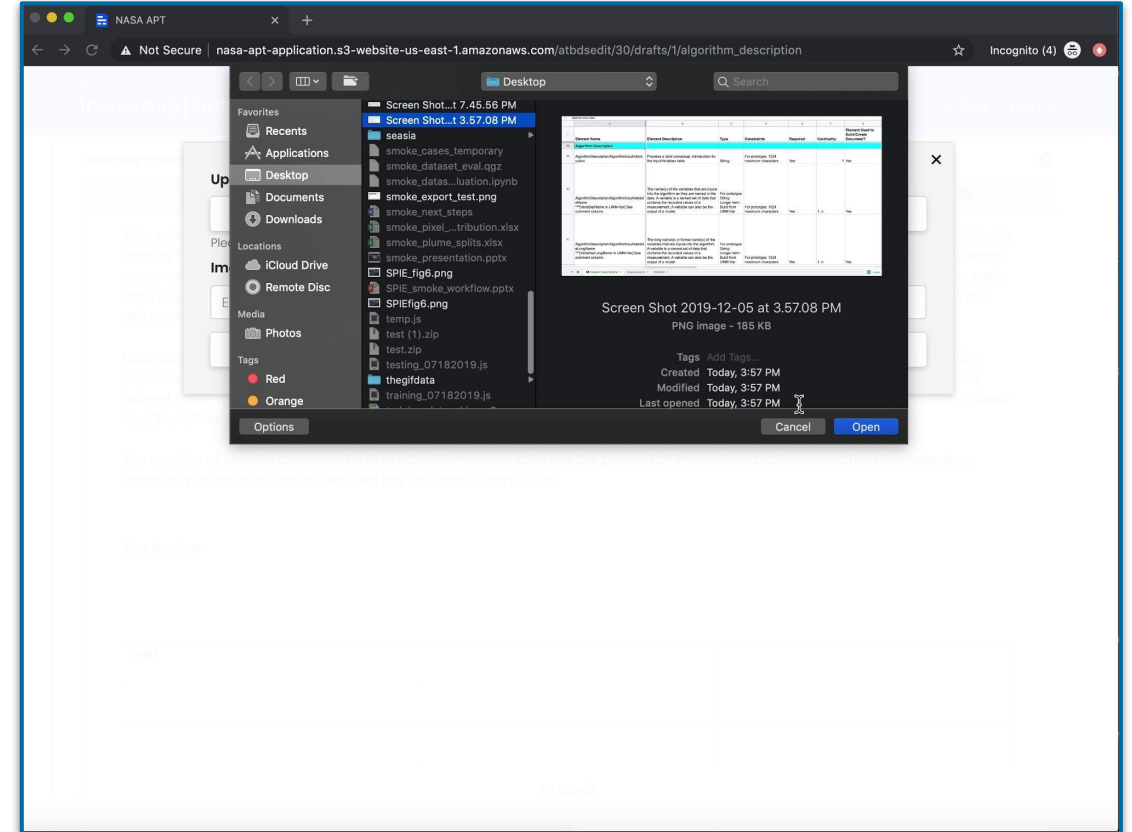
APT automatically generates a PDF with needed title page appropriate for journal submission

Demo Use of APT

Designed to Ease Document Production

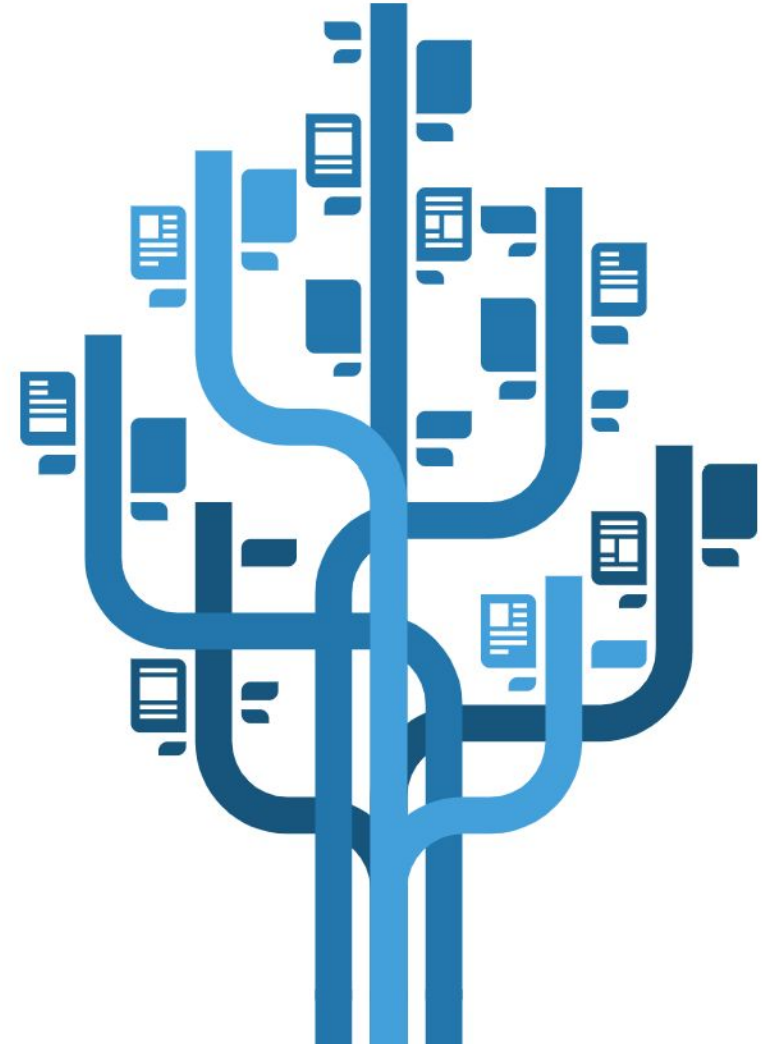
Simplifies generation of rich content

- Equation building with in-line validation
- Building and formatting tables
- Inserting figures and captions
- Automatic formatting of tables, figures and equations
- Database implementation promotes content reuse and consistency



Conclusions

- APT supports Open Science and Science Reproducibility
- APT is making ATBDs
 - more consistent (standardized)
 - easier to obtain (central discovery and access)
 - more accessible (machine readable)
- APT will be available for regular use in 2022
- **Use of APT is not limited to ATBDs...** with template changes this flexible tool could be used for other forms of document creation and governance



Try APT at

<https://impact.earthdata.nasa.gov/apt/>

Thank You!

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and the entire APT team:

Bradley Baker, Ashish Acharya (UAH)

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Workflow for Creating a New ATBD

