



EXPLORE EARTH

YOUR HOME, OUR MISSION

Earth Information System (EIS) Monthly Highlights October 2022

Project objectives

EIS integrates NASA's existing Earth science observations and modeling capabilities to produce new actionable science. EIS work is currently organized around four multi-disciplinary thematic areas.

- Demonstrate innovative and integrative science and applications enabled by emerging cyberinfrastructure for cloud computing and collaborative development
- Improve transparency and accessibility of data and methods in support of NASA's Transition to Open Science



Setting the agenda in research

Comment



Flooding of coastal regions in Bangladesh has increased soil salinity and killed off plants and trees.

Avert Bangladesh's looming water crisis through open science and better data

Augusto Getirana, Nishan Kumar Biswas, Asad Sarwar Qureshi, Adnan Rajib, Sujay Kumar, Mujibur Rahman & Robin Kumar Biswas

Intensive irrigation and climate change are depleting groundwater reserves in this fast-developing nation. To improve its water security, researchers need more information on water use, quality, flows and forecasts.

Bangladesh is home to a network of hundreds of rivers and the world's largest river delta, the Ganges Delta. Historically, the nation has been water rich. But that is changing owing to declining rainfall, more intensive irrigation and heavier use of water upstream. Contamination from arsenic and sewage is also on the rise.

To feed our future planet, it is crucial that water is used more sustainably in agricultural regions such as Bangladesh. Other agricultural hotspots face similar water stresses, including the Western and Central United

States, northern India and Brazil^{1,2}, where falling water tables punish farmers and grab headlines.

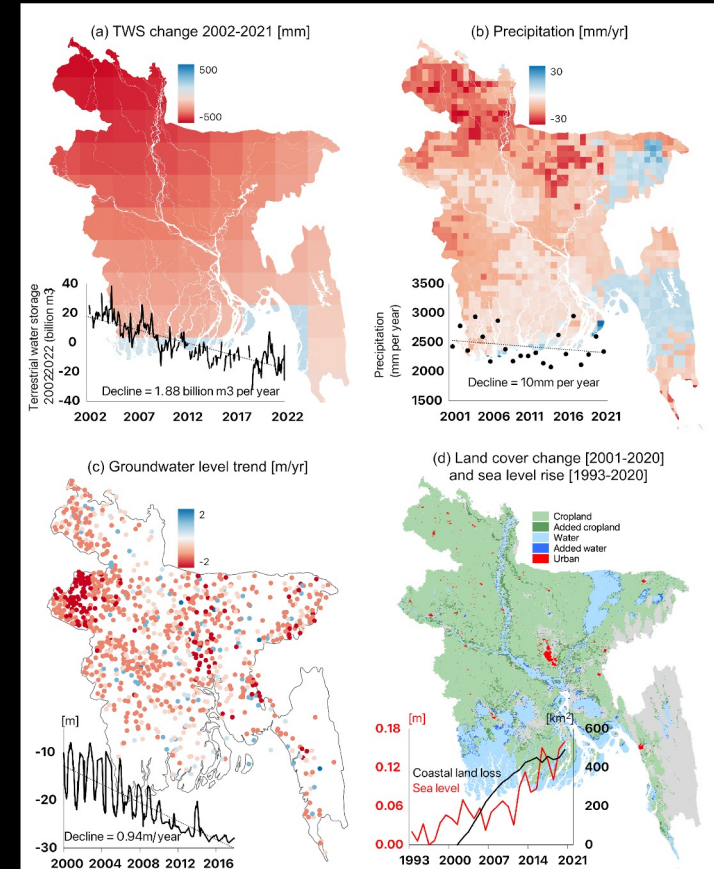
Bangladesh has taken some steps to address the problem. In 2018, its Ministry of Planning published the Bangladesh Delta Plan 2100 (BDP; see go.nature.com/5s2eanc). This outlines a long-term strategy for the country's sustainable and resilient socio-economic development in a changing climate. Water security is a key part of this plan. Although the BDP rightly identifies the main issues facing the nation's water, it is vague on effective actions. These will require heavy investments and more supporting research.

Open science initiatives such as EIS highlighted as a significant need for solving looming water resource issues

“New open-science initiatives, particularly NASA’s Earth Information System, launched in 2021, can help by supporting the development of customized data-analysis and modelling tools.”

EIS synthesis reveals the looming water crisis in Bangladesh

- The demands of a growing population of Bangladesh have driven intensified agricultural practices putting significant strain on available water resources.
- GRACE data shows that 37.5 billion m³ of terrestrial water storage have been lost across the country since 2002, mainly from groundwater depletion.
- GPM data shows that rainfall rates in Bangladesh have fallen by 10 mm/year.
- Radar altimetry data shows that sea levels have been rising at a rate of ~5 mm/year; this, combined with land subsidence and other issues, has led to the loss of 490km² of coastal land since 2001, according to MODIS data.

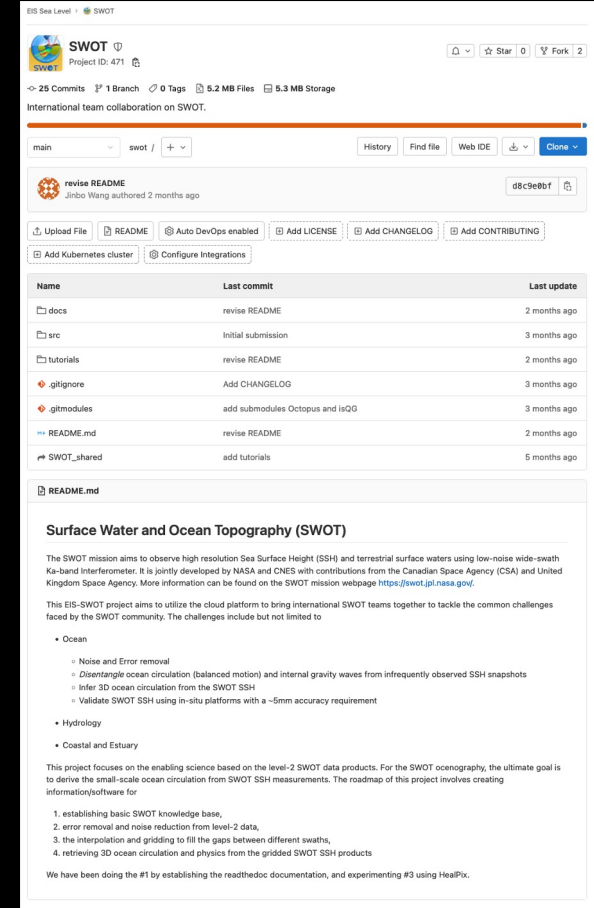


EIS enables analysis on the cloud for future missions

EIS is building foundational tools, creating a knowledge base, and developing capacity within the research community around cloud computing that will be critical for enabling analysis on the cloud for future missions such as SWOT. Specific capabilities include:

- Creating knowledge base for SWOT via platforms such as GitHub
- Developing fundamental tools by creating a collection of core analytical tools to bridge data archive and science/applications
- Building a SWOT community using cloud platform, identifying roadblocks, and documenting best practices
- Enhancing teamwork and cross-team collaborations (e.g., SWOT AdAC, SWOT ocean team leads, CNES/French SWOT collaborators)

See more at: <https://git.mysmce.com/eis-sealevel/swot/>



The screenshot shows the GitHub repository for SWOT (Surface Water and Ocean Topography). The repository is owned by EIS (Earth Information System) and has 471 projects. It includes 25 commits, 1 branch, 0 tags, 5.2 MB files, and 5.3 MB storage. The repository is described as "International team collaboration on SWOT." The main branch is selected, and the file explorer shows the repository structure. The README file is open, displaying the project's purpose and goals.

SWOT
Project ID: 471

<- 25 Commits 1 Branch 0 Tags 5.2 MB Files 5.3 MB Storage

International team collaboration on SWOT.

main swot / +

History Find file Web IDE Clone

discbebf

Upload File README Auto DevOps enabled Add LICENSE Add CHANGELOG Add CONTRIBUTING

Add Kubernetes cluster Configure Integrations

Name	Last commit	Last update
docs	revise README	2 months ago
src	Initial submission	3 months ago
tutorials	revise README	2 months ago
.gitignore	Add CHANGELOG	3 months ago
.gitmodules	add submodules Octopus and isQG	3 months ago
README.md	revise README	2 months ago
SWOT_shared	add tutorials	5 months ago

README.md

Surface Water and Ocean Topography (SWOT)

The SWOT mission aims to observe high resolution Sea Surface Height (SSH) and terrestrial surface waters using low-noise wide-swath Ka-band Interferometer. It is jointly developed by NASA and CNES with contributions from the Canadian Space Agency (CSA) and United Kingdom Space Agency. More information can be found on the SWOT mission webpage <https://swot.jpl.nasa.gov/>.

This EIS-SWOT project aims to utilize the cloud platform to bring international SWOT teams together to tackle the common challenges faced by the SWOT community. The challenges include but not limited to

- Ocean
 - Noise and Error removal
 - Disentangle ocean circulation (balanced motion) and internal gravity waves from infrequently observed SSH snapshots
 - Infer 3D ocean circulation from the SWOT SSH
 - Validate SWOT SSH using in-situ platforms with a ~5mm accuracy requirement
- Hydrology
- Coastal and Estuary

This project focuses on the enabling science based on the level-2 SWOT data products. For the SWOT oceanography, the ultimate goal is to derive the small-scale ocean circulation from SWOT SSH measurements. The roadmap of this project involves creating information/software for

1. establishing basic SWOT knowledge base,
2. error removal and noise reduction from level-2 data,
3. the interpolation and gridding to fill the gaps between different swaths,
4. retrieving 3D ocean circulation and physics from the gridded SWOT SSH products

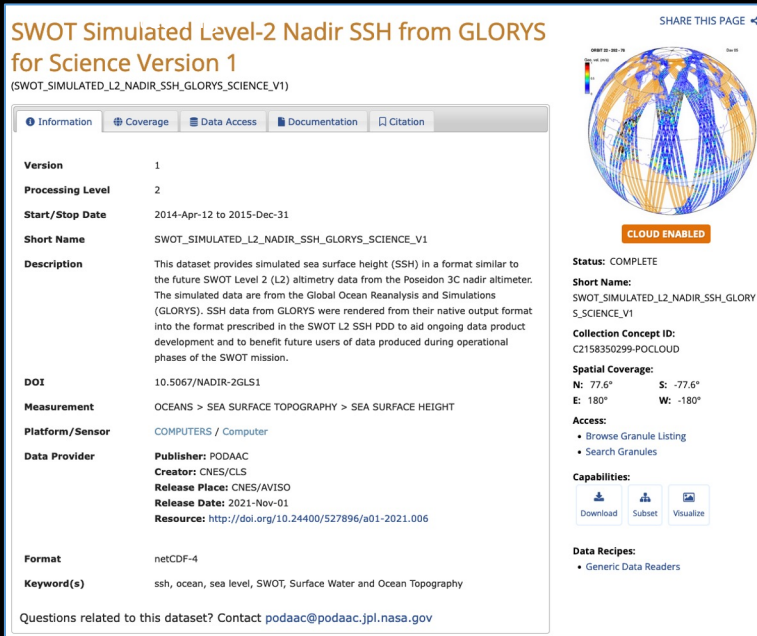
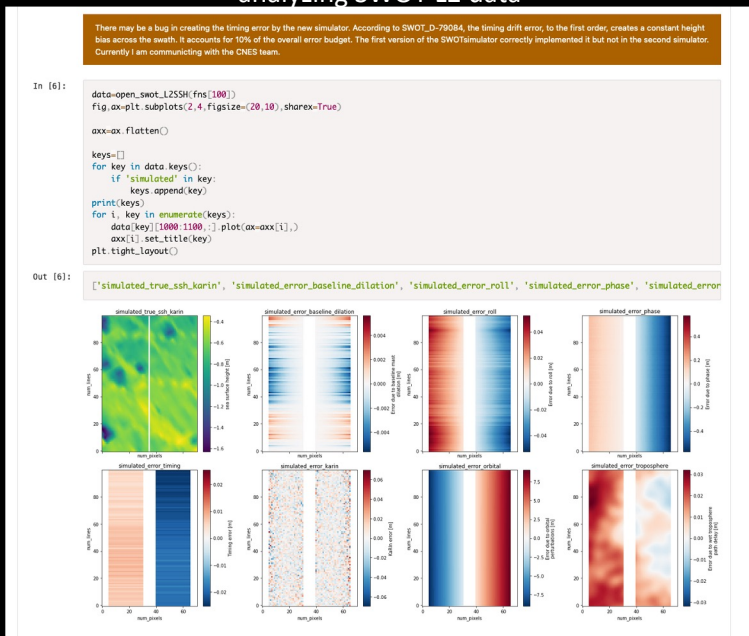
We have been doing the #1 by establishing the readthedocs documentation, and experimenting #3 using HealPix.

Enabling SWOT analysis on the cloud

Creating SWOT knowledge base. The goal is to distill mission ATBDs for community consumption, with interactive notebook tutorials that can access and process simulated SWOT data products (already available).

Interactive notebook tutorial for understanding and analyzing SWOT L2 data

Synthetic SWOT L2 SSH products for



Mining NASA's rich catalog of GHG Products

- Through programs like NASA's Carbon Monitoring System and Science Team for the OCO Missions, NASA has supported the development of dozens of high-quality datasets that characterize emissions and concentrations of greenhouse gases.
- EIS focuses on integrating these multiple satellite-based products to provide a comprehensive assessment of GHGs during the past several decades and to improve delivery of information on recent changes.

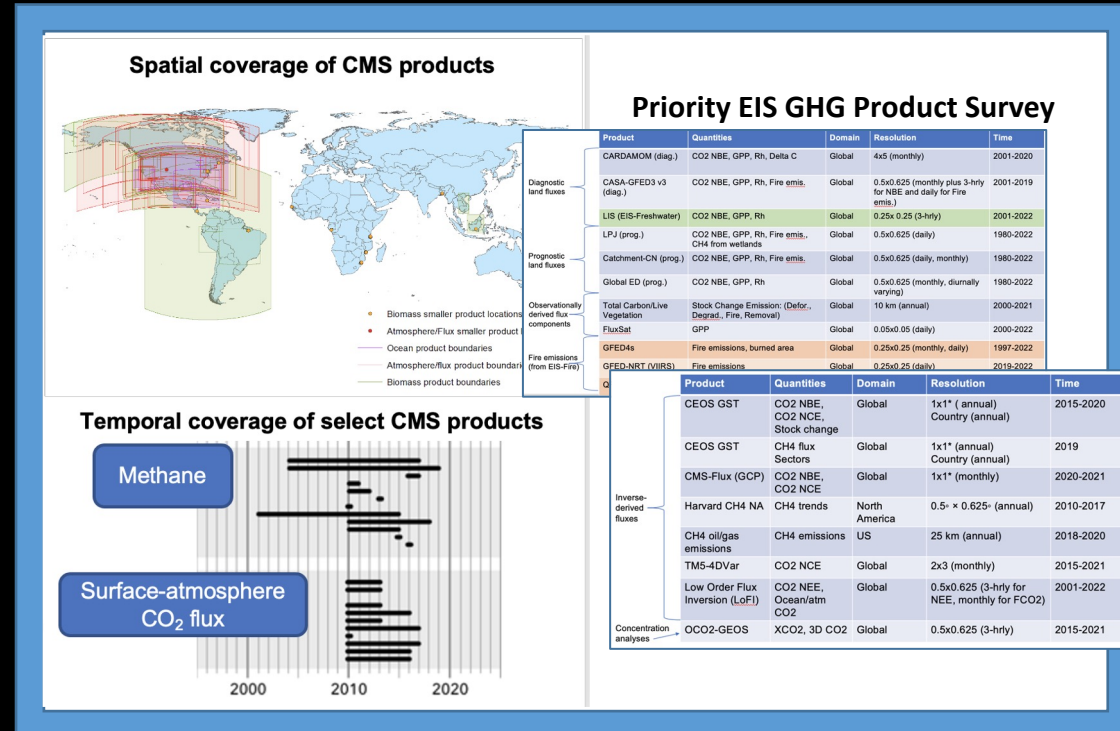
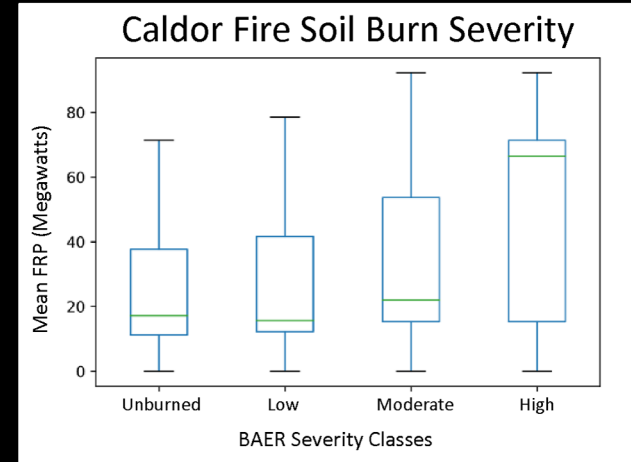


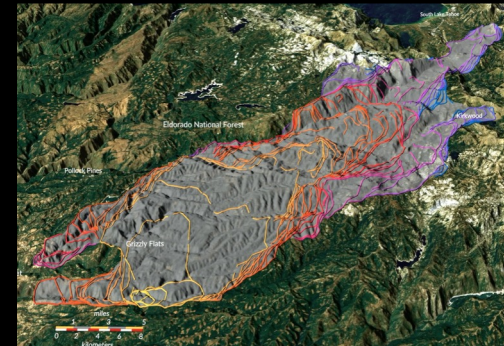
Figure adapted from Hurtt et al., *Env. Res. Lett.*, 2022. doi: 10.1088/1748-9326/ac7407

Post-fire impact assessments from EIS

- EIS analyses quantify a strong relationship between sub-daily fire intensity (measured as fire radiative power, FRP) and soil burn severity for the Caldor Fire, CA, 2021. Higher burn severity conditions in steep terrain are typically associated with higher likelihood of post-fire debris flow initiation.
- Stakeholder engagements include new academic collaborations at the University of Arizona and USGS; partnerships for helping streamline emergency response with USFS and FEMA.



The relationship between sub-daily Fire Radiative Power (FRP) and soil burn severity data (Burned Area Emergency Response, BAER).



EIS on the Road:

Geological Society of America (GSA), NASA Land Cover Land Use Change (LCLUC), NASA Carbon Monitoring System (CMS), ICESat-2 Science Team Meeting, OCO-2 Science Team Meeting, NASA Applied Sciences Program, World Water Week, Digital Twin Workshop.

