



## Project Overview

Project Title: **Poseidon-Viewer Enhancement and Documentation**

### Project Summary:

The project is to improve software quality, increase functionality, document, and disseminate the Poseidon-Viewer application (see Figure 1). This tool provides easy access to massive ocean circulation model simulations, as part of the Poseidon Project, which runs on the JHU SciServer resource as part of IDIES. The Poseidon Project was initially funded by a CSSI grant from NSF. The grant recently expired, but the Poseidon-viewer development is still incomplete prior to this FOSSProF project.

### Target Audience:

Researchers in oceanography and climate science, plus interested members of the general public.

### Code Repository:

- Visualization tool: <https://web.idies.jhu.edu/poseidon-viewer/viewer/index.html>
- Github repo: <https://github.com/sciserver/poseidon-viewer>
- Documentation: <https://sciserver.github.io/poseidon-viewer/intro.html>

## Project Activities and Progress

### Work Completed:

The project

(1) Improved the Poseidon-viewer software quality by:

- Refactoring the codebase, making public releases, adding unit tests and continuous integration, and adhering to other software development best practices.
- Enhancing functionality for mobile platforms (tablets, smartphones).

(2) Documented the tool via:

- A Jupyter Book site linked to the GitHub repository (see Figure 2).
- YouTube tutorial videos and news posts to the Poseidon Project home page (pending imminent switch from viewer test deployment to live deployment).

(3) Expanded the tool's functionality by:

- Code generalization to handle a larger version of the same dataset (called LLC4320) that it currently supports.



- Supporting the low resolution ECCOv4r4 ocean general circulation model dataset.

Specifically, the interpolation and pre-computation code to accelerate rendering was re-factored. We replaced the original, undocumented code with a wrapper around the Seaduck package. This simplifies the codebase and makes it much easier to maintain, document, and enhance. There was no impact in performance following this re-factoring.

#### Technical Milestones:

Circa 54 Github commits, 5 pull requests, a new Jupyter Book documentation site, 3778 additions, and 2447 deletions to code base. New issues were opened as well.

#### Challenges and Solutions:

We intended to write a peer-reviewed journal paper on the tool, for example, to the *Journal of Open Source Software*. However, this was deemed unnecessary because the tool is now built as a wrapper around other documented software tools, like Seaduck (Jiang et al., 2023<sup>1</sup>). Instead, we spent time enhancing the tool functionality (to handle the ECCOv4r4 model dataset), which had been a reach goal of the project.

#### Outcomes and Impact

##### Project Impact:

The Poseidon-visualization tool provides very easy access to the massive Poseidon Project ocean general circulation model solutions, in particular, the ~4PB LLC4320 global 1km-resolution ocean simulation data. The tool aligns with our vision to “democratize the ocean circulation model data” in the Poseidon Project; namely, to make the data available with minimal barriers to access to anyone with a web browser. The tool is the gateway for users to begin accessing the Poseidon Project data, tools, and resources. Before the project began, the time taken to access the (raw) LLC4320 data was measured in many months and required a background check to access NASA HPC facilities. Foreign nationals and the general public were barred from accessing the data. The Poseidon-visualization tool now provides access to the LLC4320 data within seconds on a smartphone, with no access restrictions (see the link above).

##### Community Engagement:

We held two Town Hall meetings at the international Ocean Sciences Meeting (2024). The Poseidon-viewer was featured during the presentations. As part of these Town Hall meetings, we asked the audience to participate in Qualtrics surveys regarding their experiences with the Poseidon project, data access, and open-source software. Around 50 full responses were received from each survey.

The PI attended a community workshop on Data Commons in ocean, atmosphere, and climate sciences at the National Center for Atmospheric Research (Boulder, CO). The

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<sup>1</sup> Jiang, W., T. W. N. Haine, and M. Almansí. Seaduck: A python package for Eulerian and Lagrangian interpolation on ocean datasets. *J. Open Source Software*, 8(92), 5967, 2023. ISSN 2475-9066. URL <http://dx.doi.org/10.21105/joss.05967>.



Poseidon-viewer tool was discussed and compared to other similar tools aimed to provide very-low threshold interactive access to massive ocean/atmosphere/climate datasets.

#### Sustainability/Future Plans:

The re-factored code base now consists of wrappers around the Seaduck package and a standard web app configuration. This avoids the need for a separate peer-reviewed publication on the Poseidon viewer package, and minimizes the effort required for future maintenance.

Currently, we have plans to enhance the tool functionality, for example, by providing a better two-way interface to detailed technical analysis of the LLC4320 data via the OceanSpy package on SciServer (Almansi et al., 2019<sup>2</sup>). But these enhancements are optional. The Poseidon-viewer tool is now in good shape to be sustained long-term, which was the main goal of this FOSSProF project.

#### Lessons Learned:

Using wrappers around existing software tools, which are well-documented and maintained, significantly reduces the effort required for future maintenance. It greatly simplifies the documentation required too. Making the tool simpler and building it with off-the-shelf tools has made it more robust and sustainable.

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<sup>2</sup> Almansi, M., R. Gelderloos, T. Haine, A. Saberi, and A. Siddiqui. OceanSpy: A Python package to facilitate ocean model data analysis and visualization. *J. Open Source Software*, 4(39), 1506, 2019. ISSN 2475-9066. URL <http://dx.doi.org/10.21105/joss.01506>.

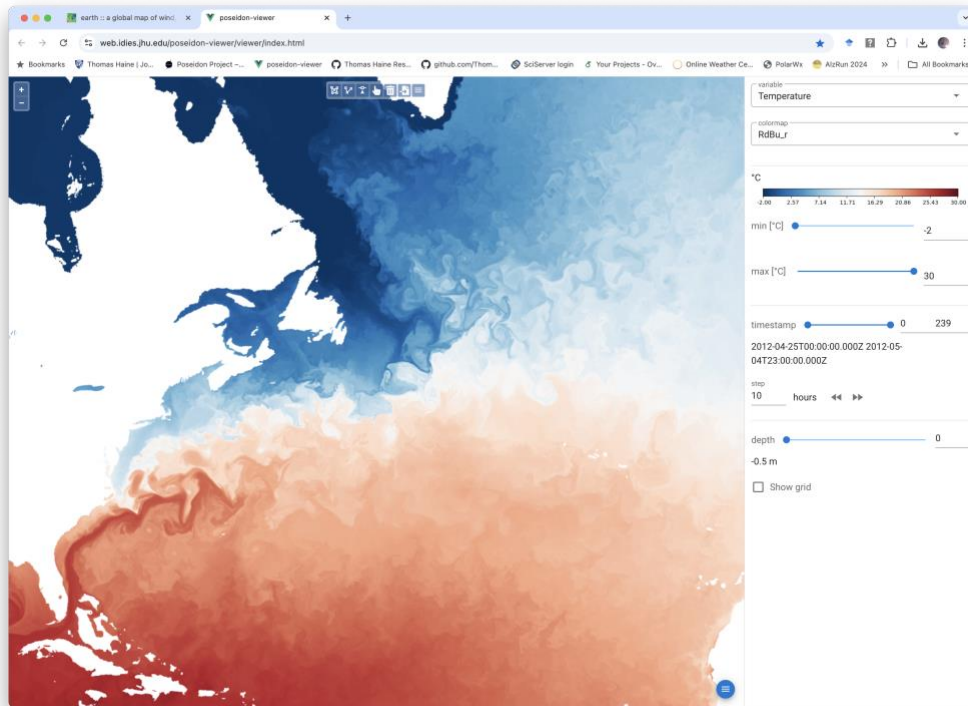


Figure 1. Screenshot of Poseidon-viewer tool showing sea-surface temperature in the North Atlantic Ocean.

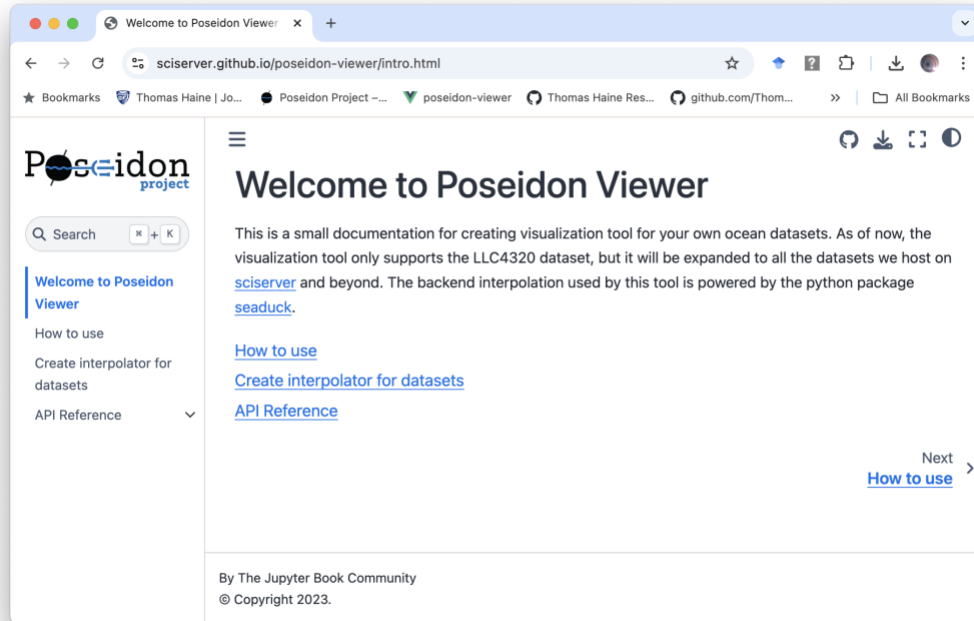


Figure 2. New Jupyter Book documentation site.