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# 3DSeaVizKit: An Interactive Spatiotemporal Visualization Toolkit for Ocean Data

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De Florez Award Category:  
Graduate, Science

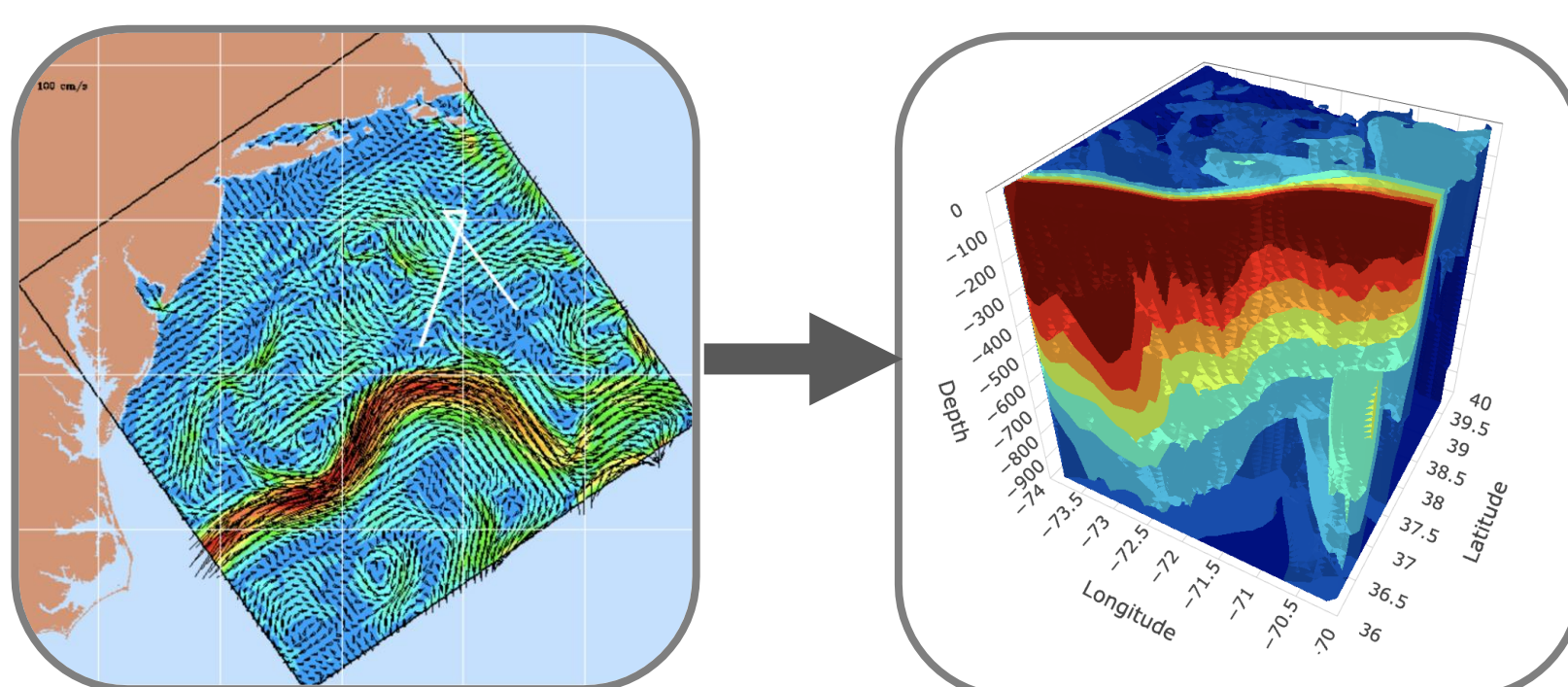
## Overview

### Need:

A 3D visualization tool to assist researchers and scientists in exploring 3D multivariate ocean and geoscience data fields.

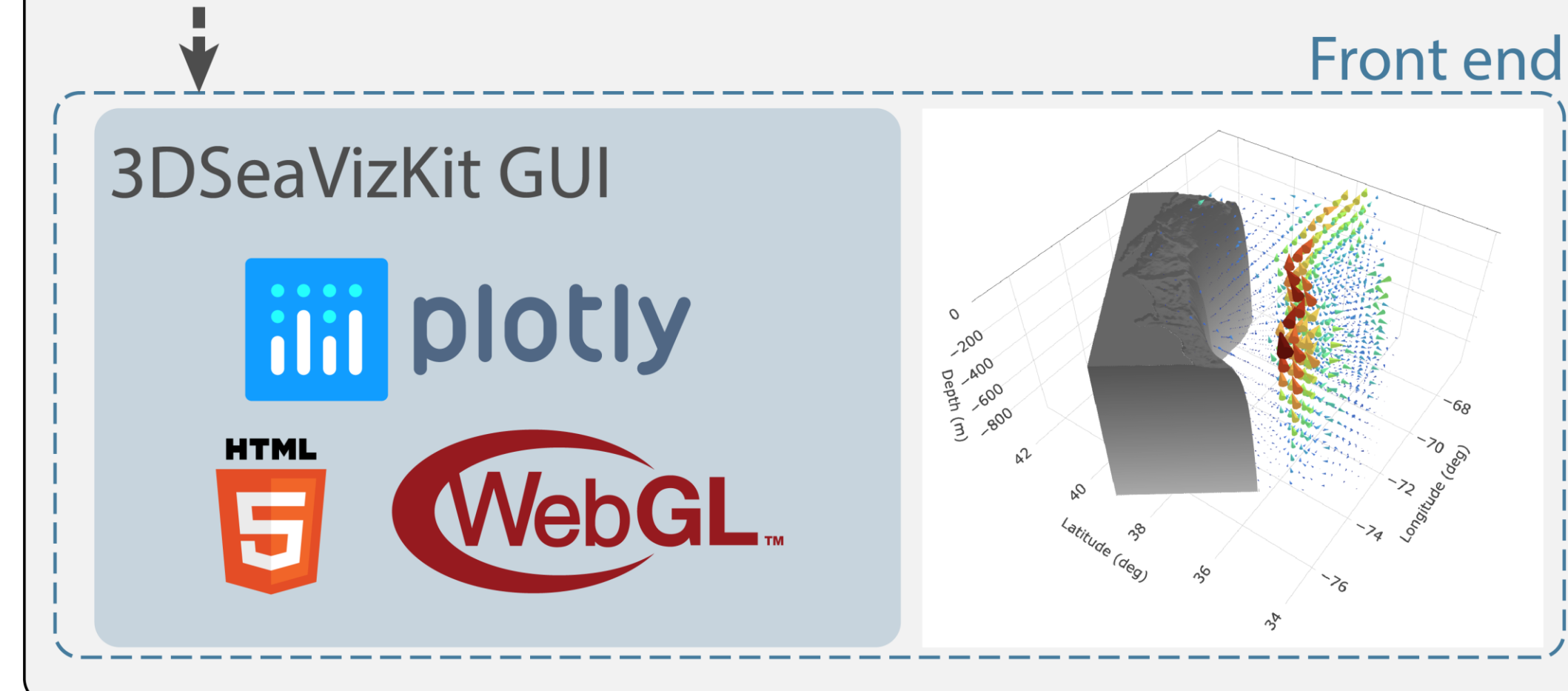
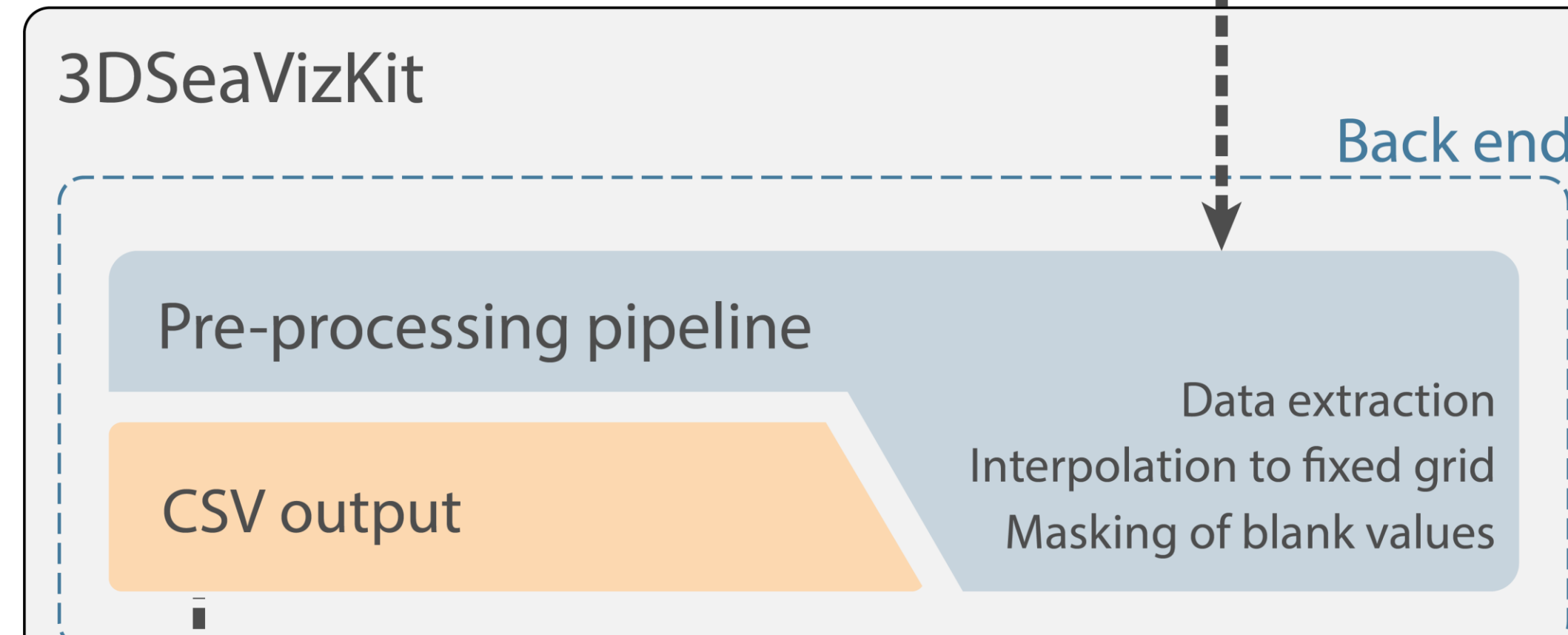
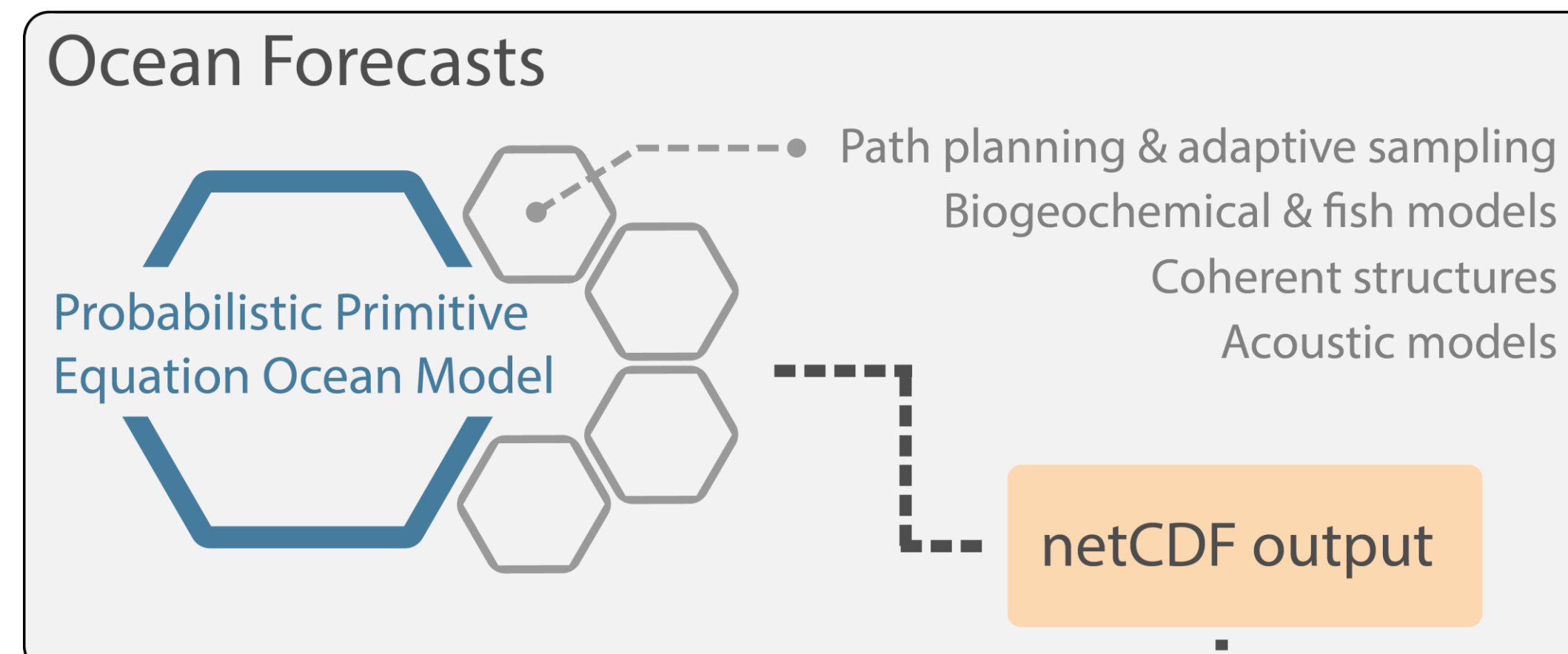
### Solution:

A fast, interactive, easy-to-use, and flexible visualization toolkit: **3DSeaVizKit** [1].



POSDON Real-time Sea Experiment [2].

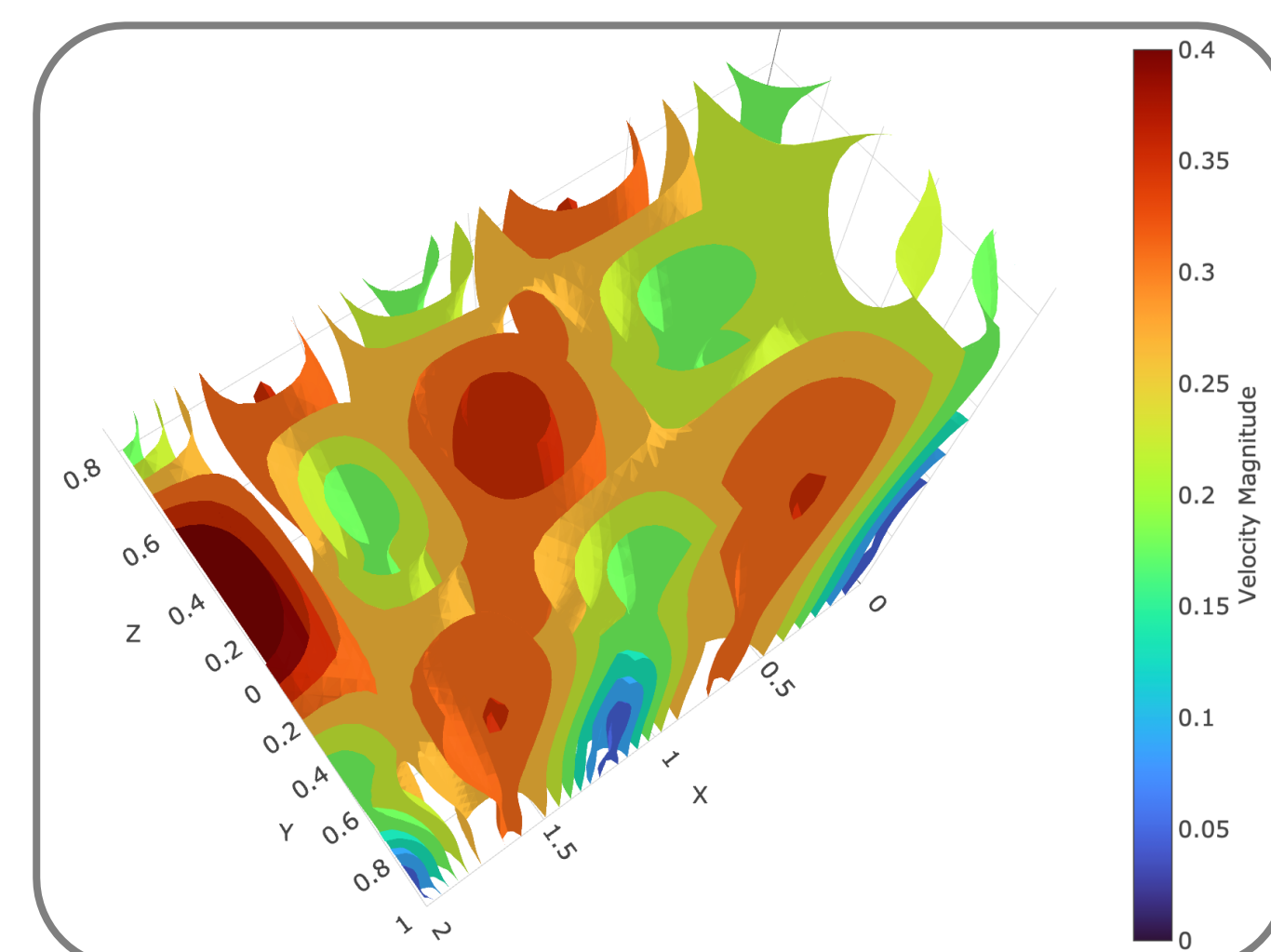
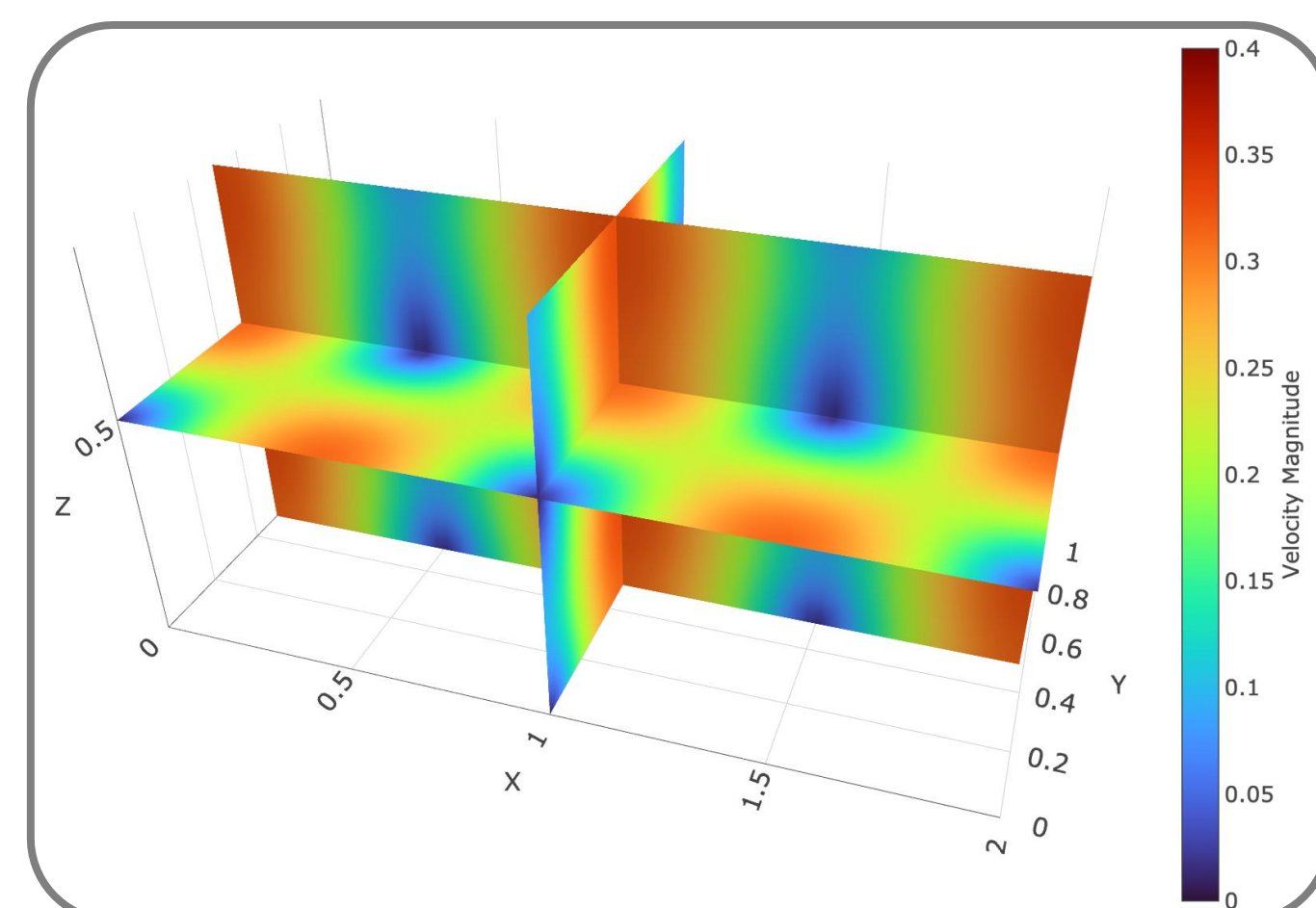
## 3DSeaVizKit Software Pipeline



## 3DSeaVizKit Features

- Illustrated using the 3D canonical double-gyre flow field.
- **Scalar-valued Data visualization:**

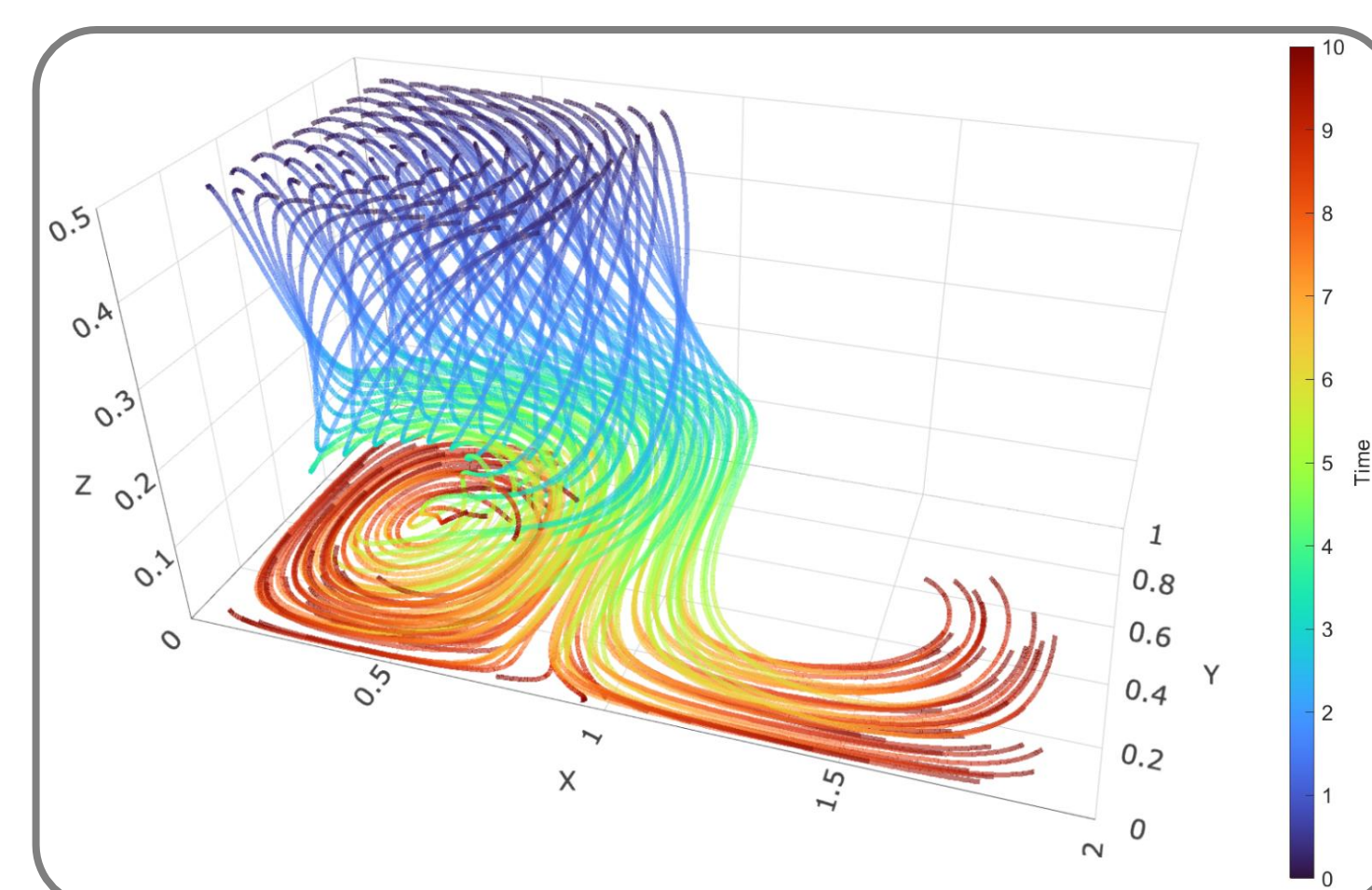
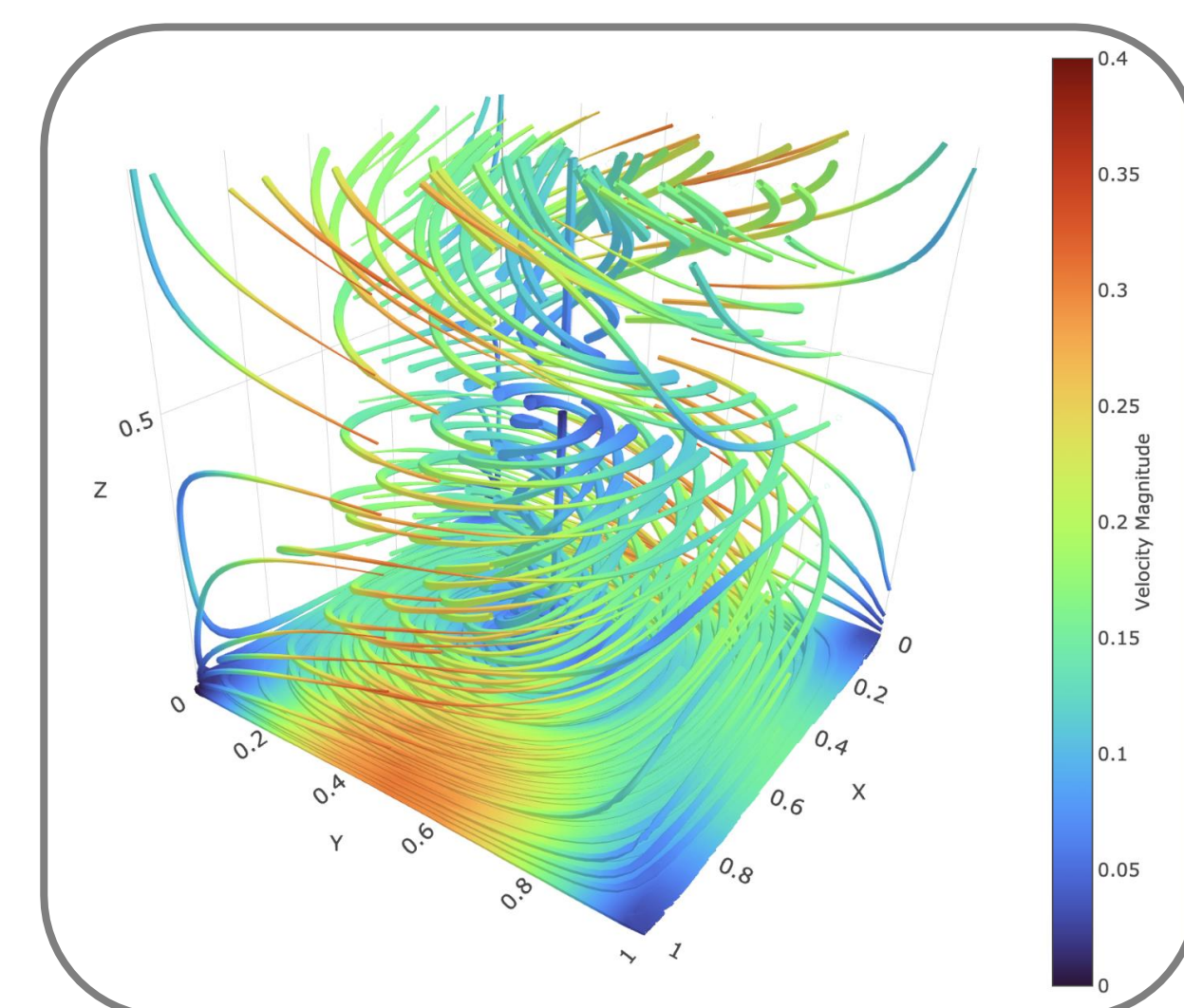
### Cross sections



### Isosurfaces

- **Vector-valued and Trajectory Data visualization:**

### Streamtubes



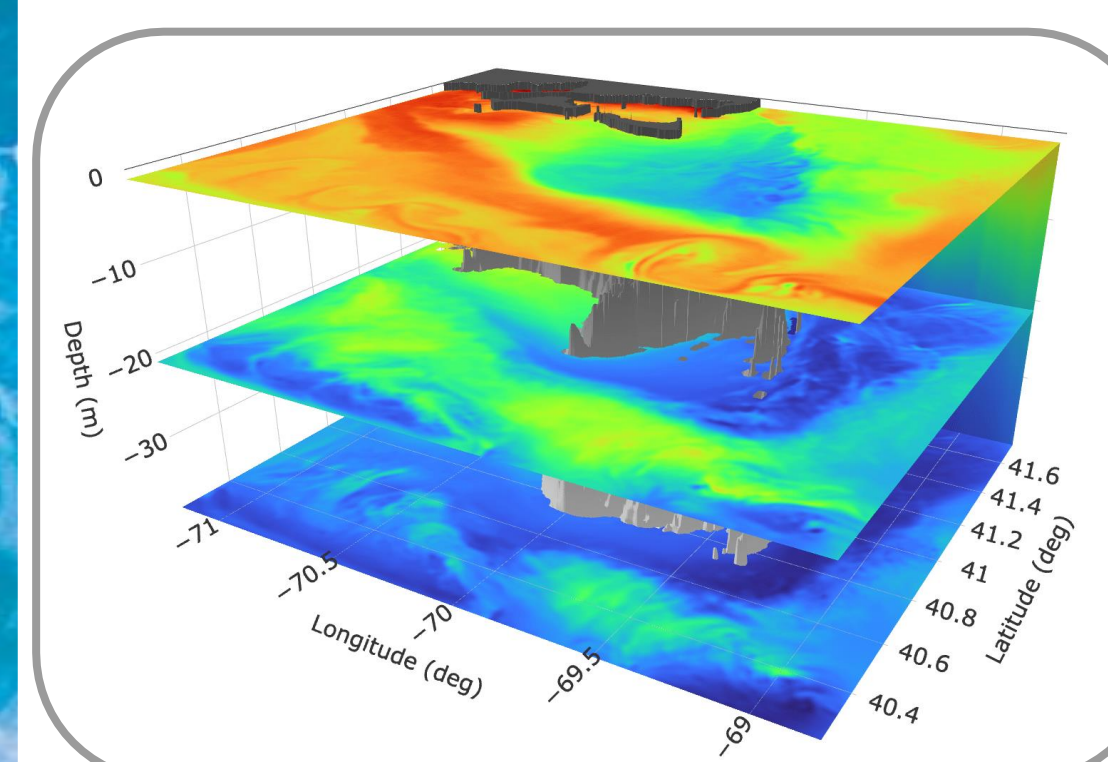
### Particle Trajectories

Additional features include time-dependent visualization and a highly interactive GUI.

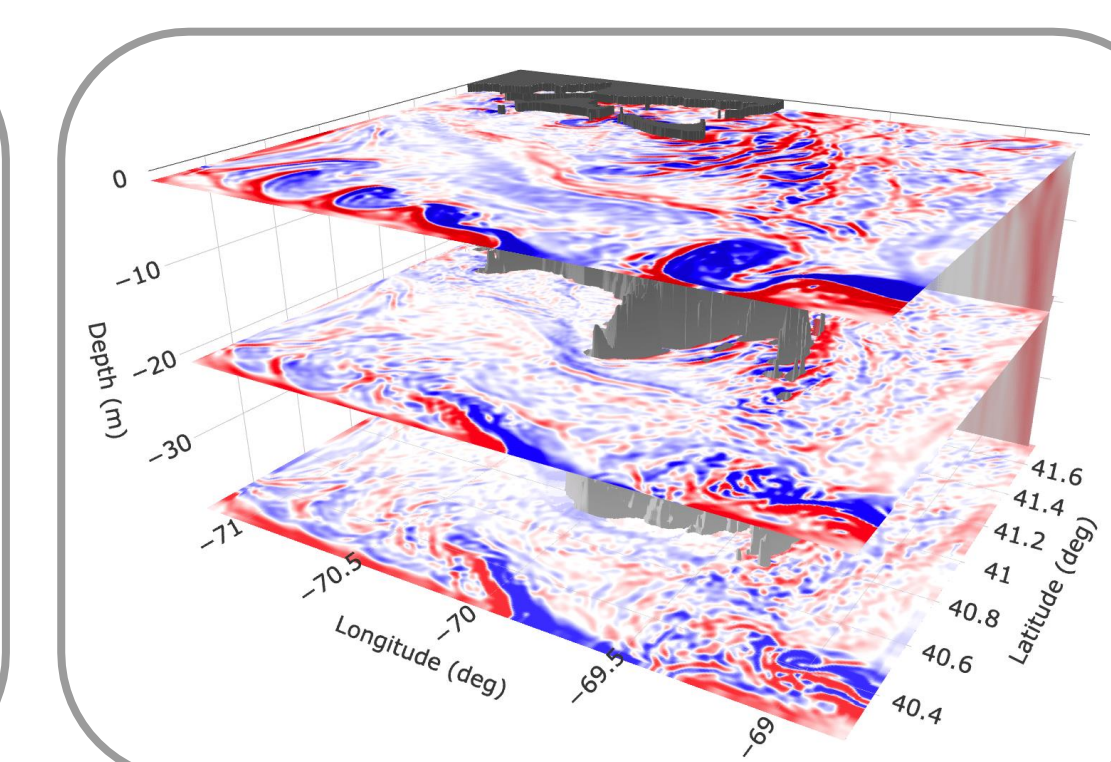
## Use Case I: Martha's Vineyard Forecast Vis.

Use 3DSeaVizKit to:

- Interactively explore scalar fields in 3D.
- Identify tidal and shelf-break effects.
- Explore transport phenomena and interactions with the bathymetry.



Temperature Cross Sections



Vorticity Cross Sections

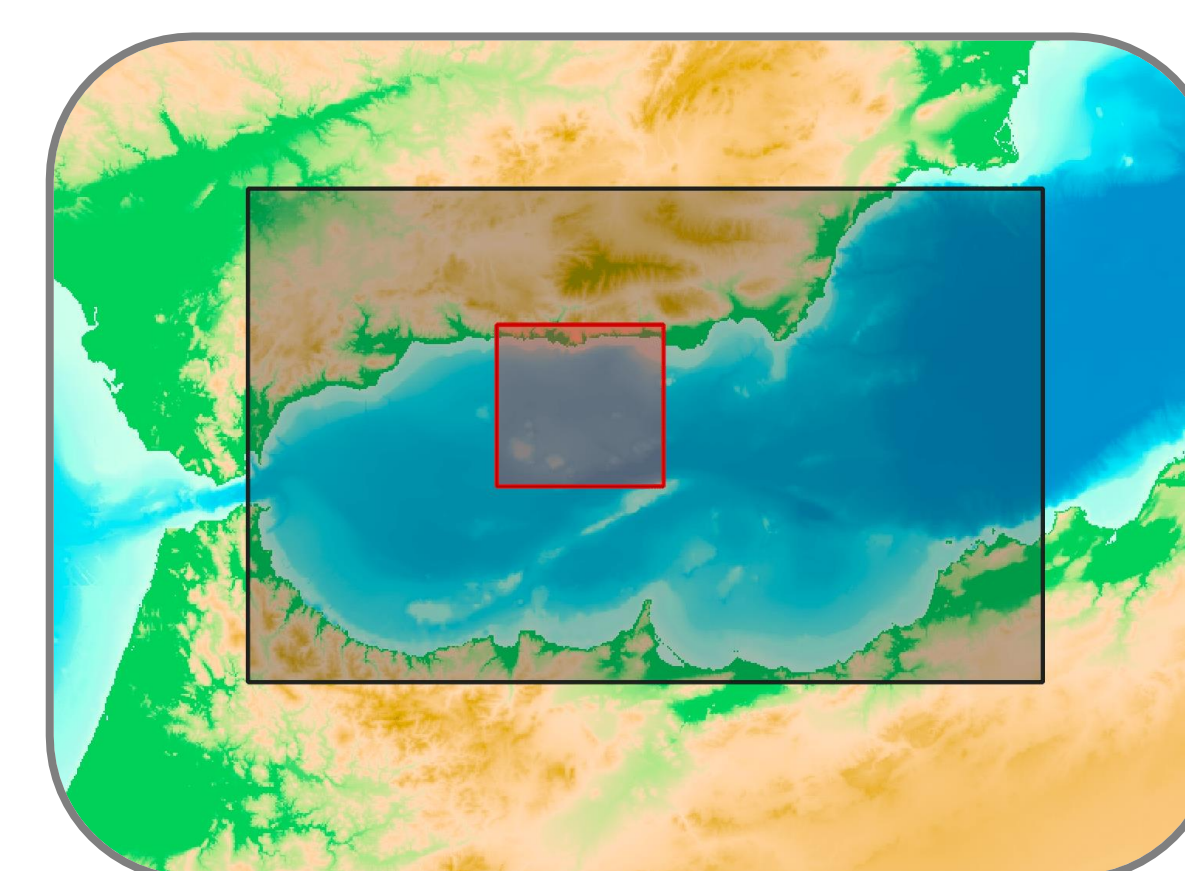
NSF-ALPHA Real-time Sea Experiment [3].

18:00 UTC, August 17, 2018.

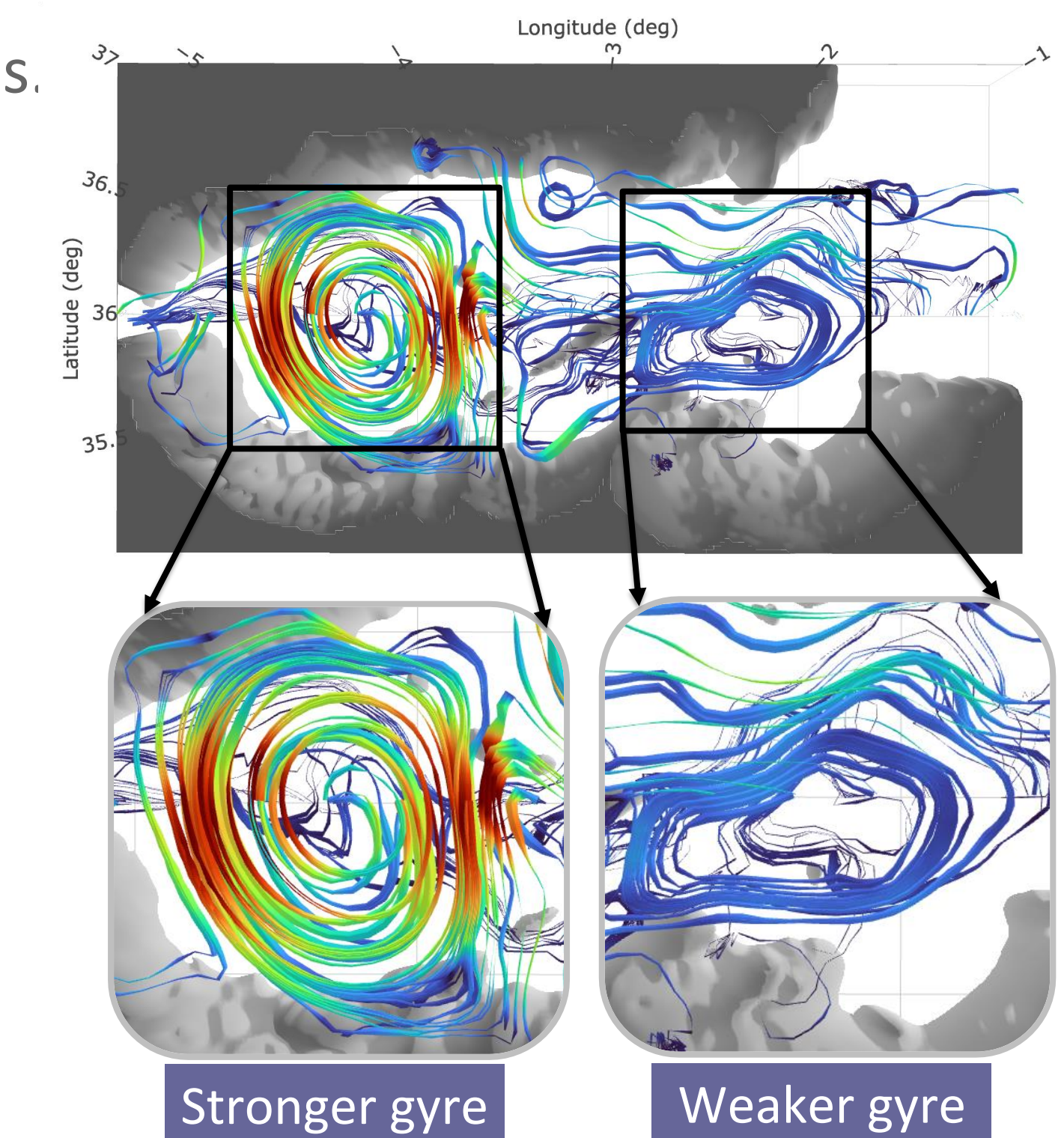
## Use Case III: Mediterranean Forecast Vis. And Subduction Dynamics

Use 3DSeaVizKit to:

- Identify gyres and other circulatory features.
- Discover subduction zones.
- Visualize particle trajectories over time.

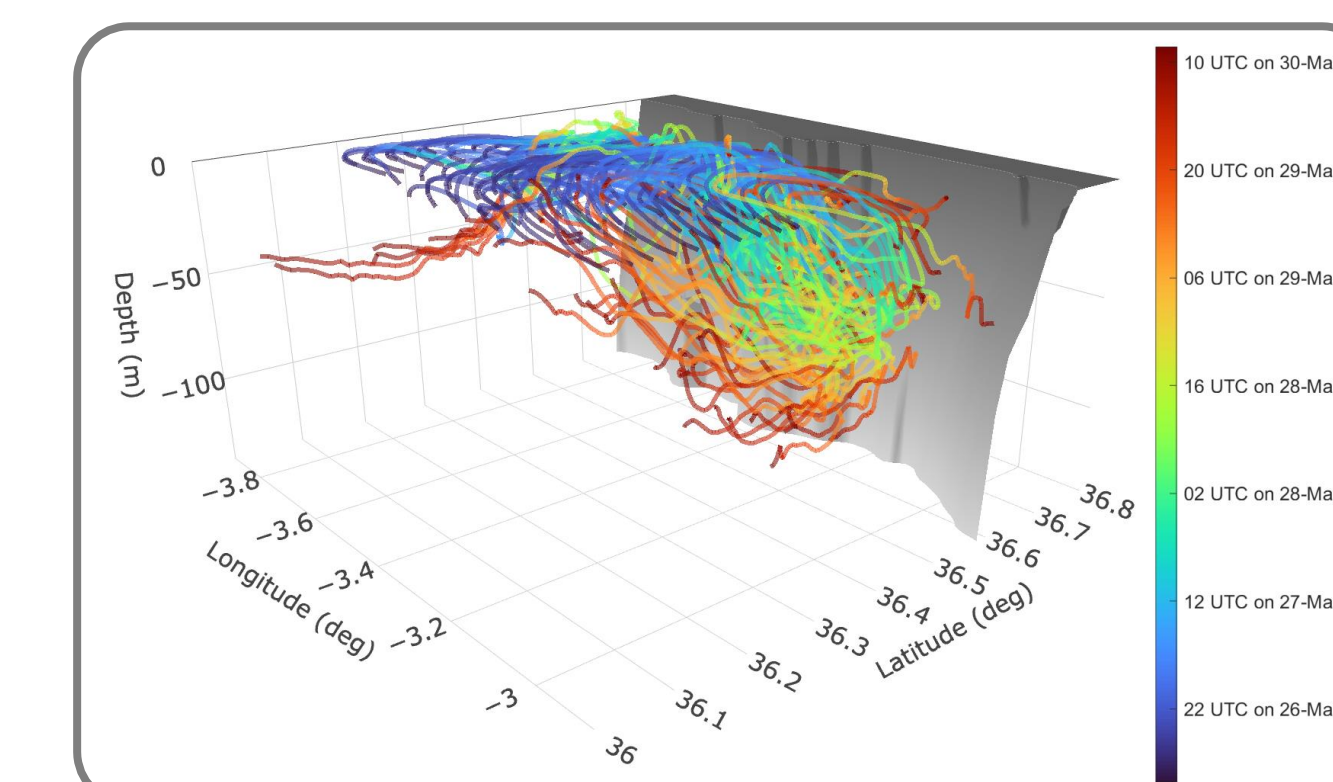


CALYPSO Real-time Sea Experiment [5].  
00:00 UTC, March 26, 2019.



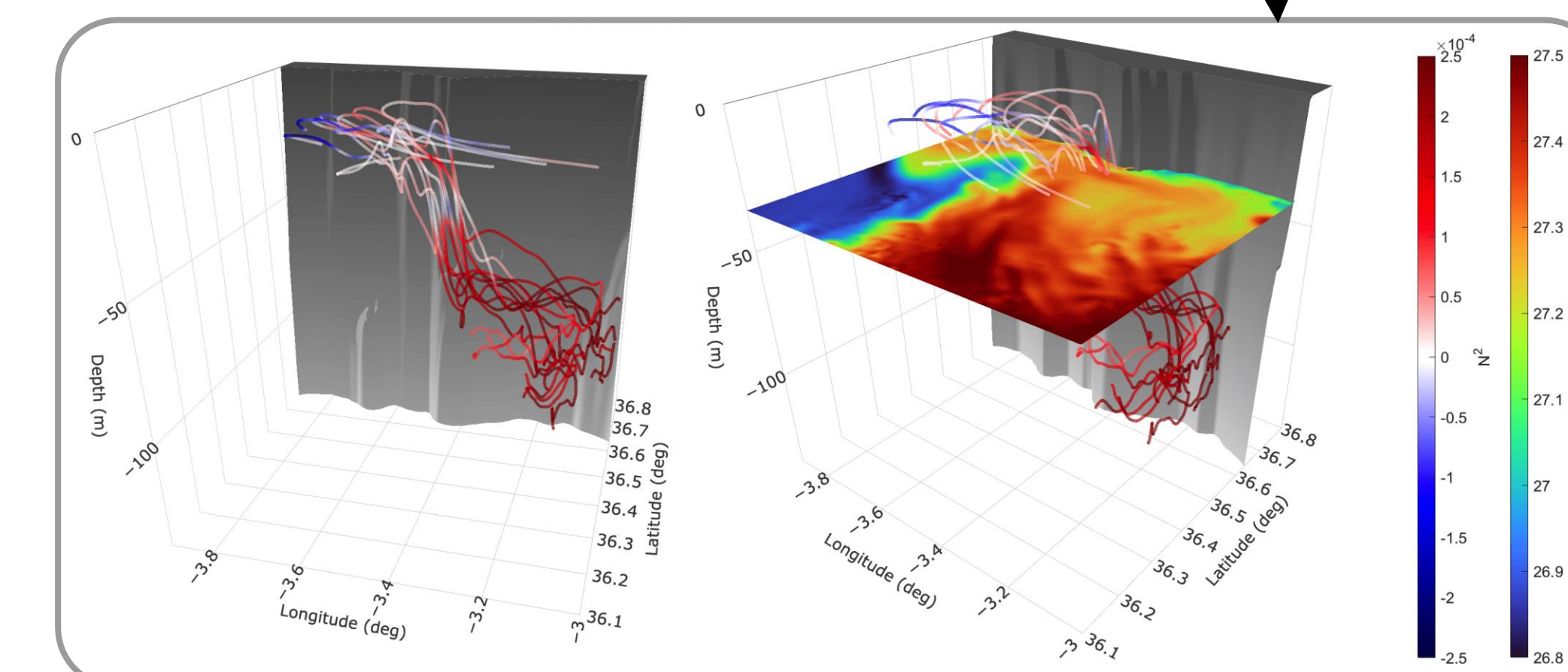
Stronger gyre

Weaker gyre



4-day trajectories of particles released at 12:00 UTC on March 26, 2019.

Filter trajectories that reach 70 m depth



## Conclusion

3DSeaVizKit is a web-based visualization tool that aids researchers and scientists in interpreting their large 3D oceanographic datasets.



Fast



Interactive



Easy-to-use



Flexible

## References

- [1] Gao, Y., W.H. Ali, C. Foucart, C. Mirabito, P.J. Haley, Jr., and P.F.J. Lermusiaux, 2021. 3DSeaVizKit: An Interactive Spatiotemporal Visualization Toolkit for Ocean Data. In: IEEE VIS 2021 New Orleans, sub-judice.
- [2] POSYDON Real-time Sea Experiment: [mseas.mit.edu/Sea\\_exercises/POSDON-POINT/2018/](https://mseas.mit.edu/Sea_exercises/POSDON-POINT/2018/)
- [3] NSF-ALPHA Real-time Sea Experiment: [mseas.mit.edu/Sea\\_exercises/NSF\\_ALPHA/2018/](https://mseas.mit.edu/Sea_exercises/NSF_ALPHA/2018/)
- [4] BIOMAPS Sea Experiment: [mseas.mit.edu/Research/BIOMAPS](https://mseas.mit.edu/Research/BIOMAPS)
- [5] CALYPSO Real-time Sea Exercise: [mseas.mit.edu/Sea\\_exercises/CALYPSO/2019/](https://mseas.mit.edu/Sea_exercises/CALYPSO/2019/)

