3D Visualization of Glider Data through Eigenmode Expansions

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Visualizing Glider Data

Temperature

- Cold Pool

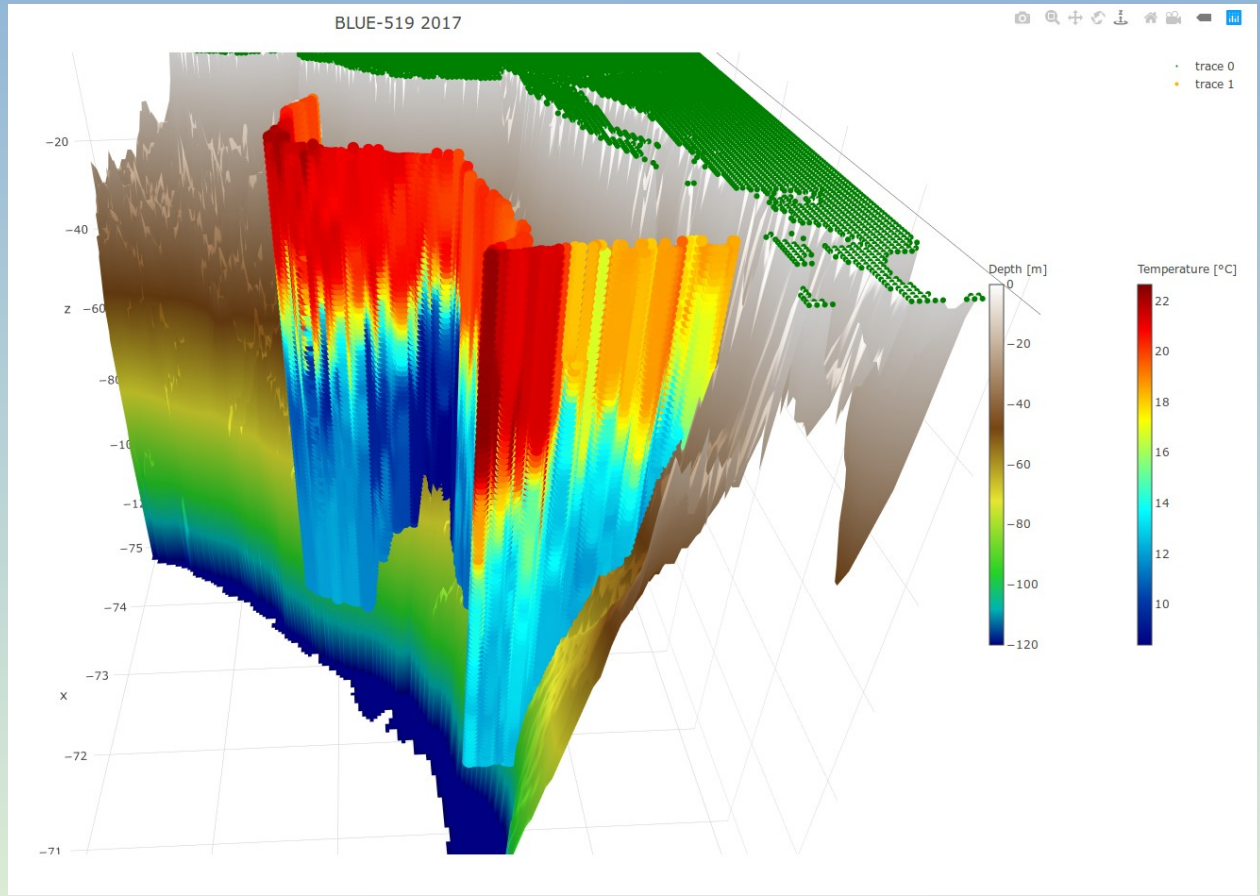
Profiles

Transects

Decomposing

Reconstruction

3D Perspective

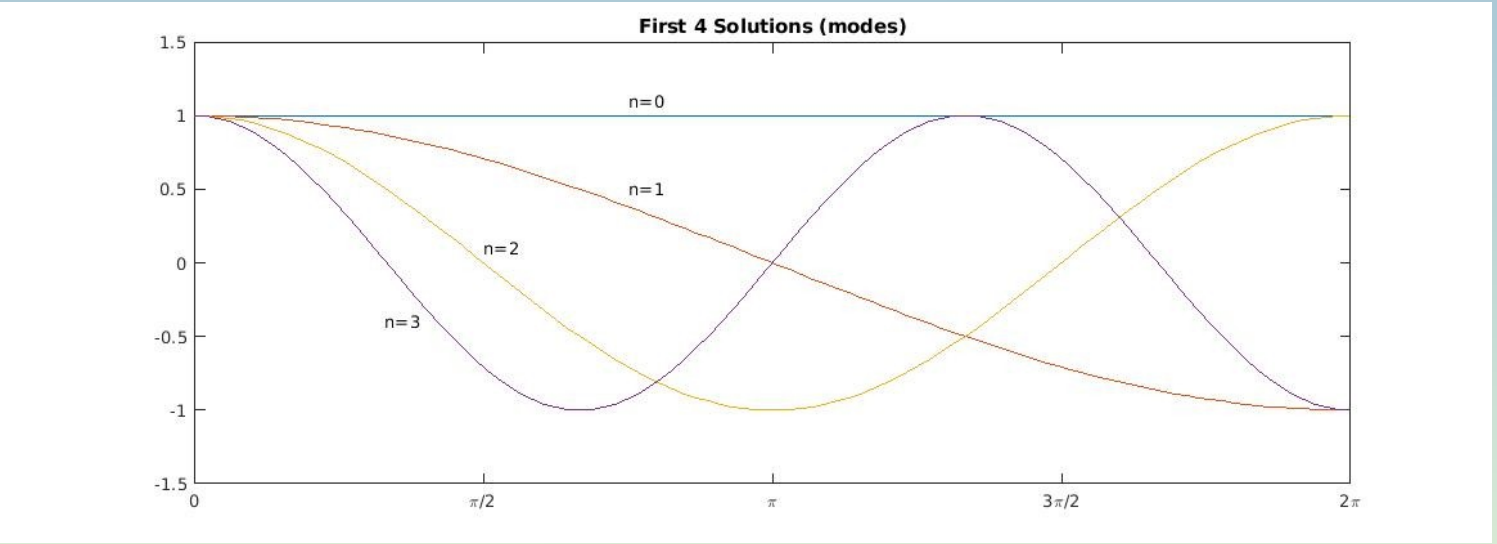


Eigenmode Basics: 1D

$$\Delta T = -\lambda T \quad \Omega$$

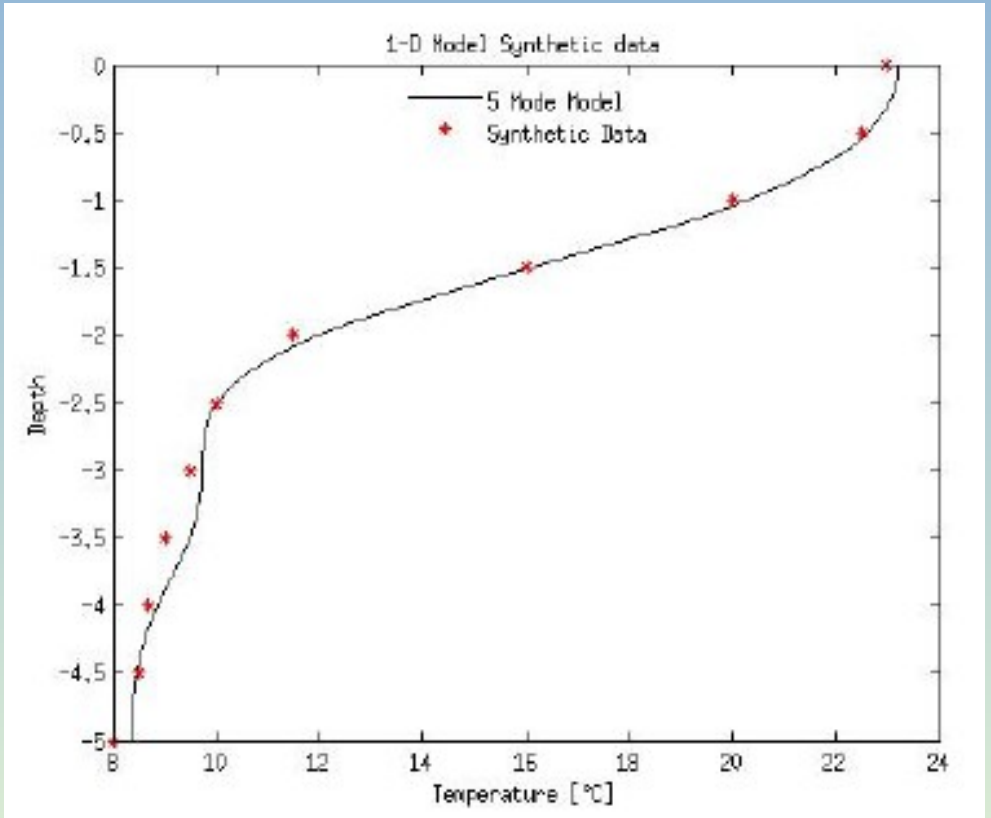
$$\frac{\partial T}{\partial \vec{n}} = 0 \quad \Omega_B$$

$$T(x) = c_n \cos \sqrt{\lambda_n}\, x \qquad \lambda = \left(\frac{n\pi}{L}\right)^2 \qquad n = 0, 1, 2, \ldots$$



$$\int_0^{2\pi} sinnx * sinmx\, dx = 0 \qquad m \neq n$$

1D Test Case



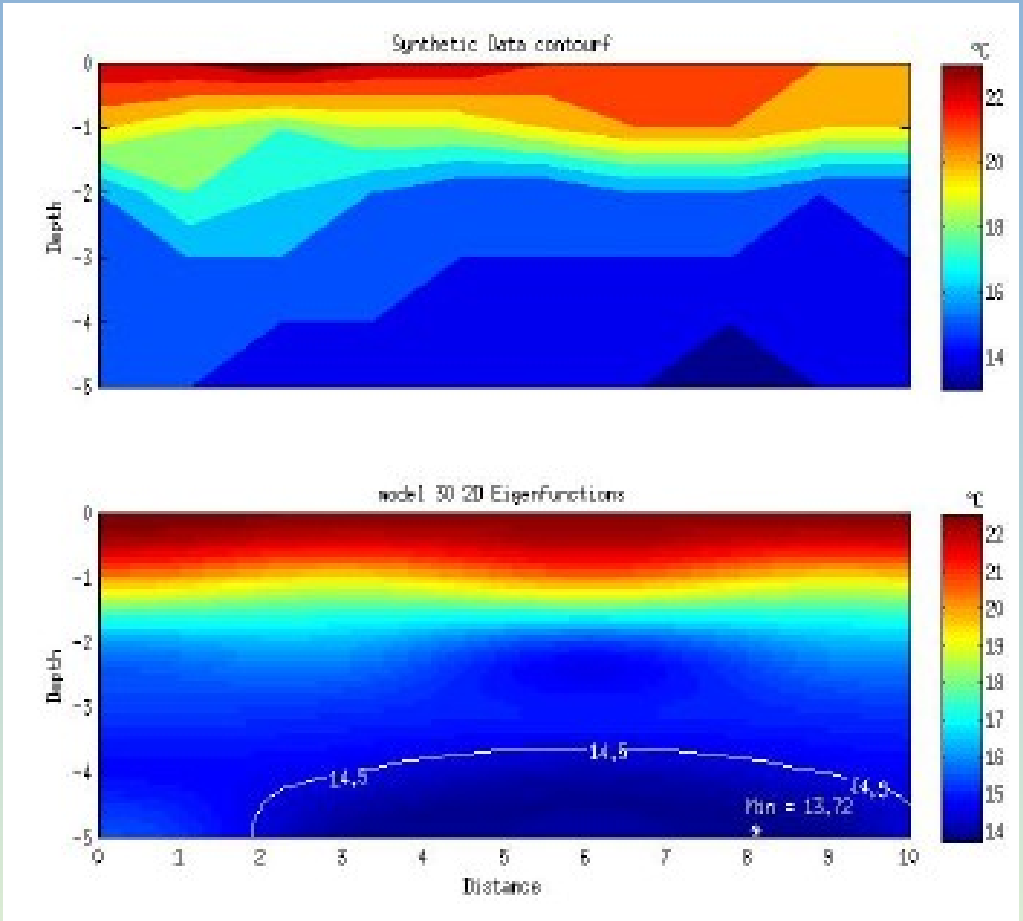
Synthetic data of a stratified profile

5 mode representation

SMAST test tank ~6 m depth

The solution becomes exact as $n \rightarrow \infty$

2D Test Case



Synthetic data of a ‘typical’ glider transect

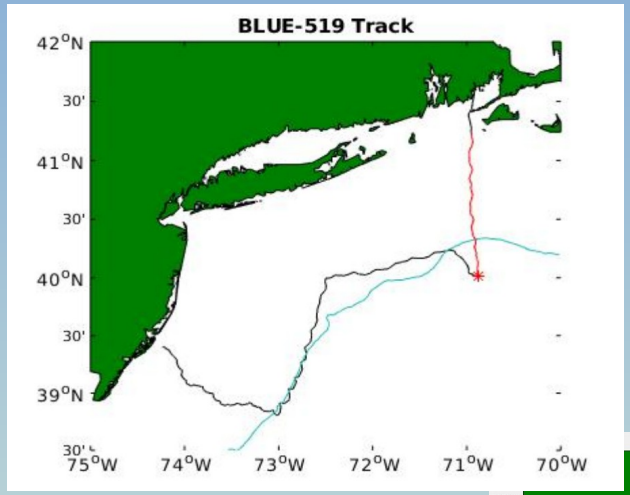
Stratified summer conditions

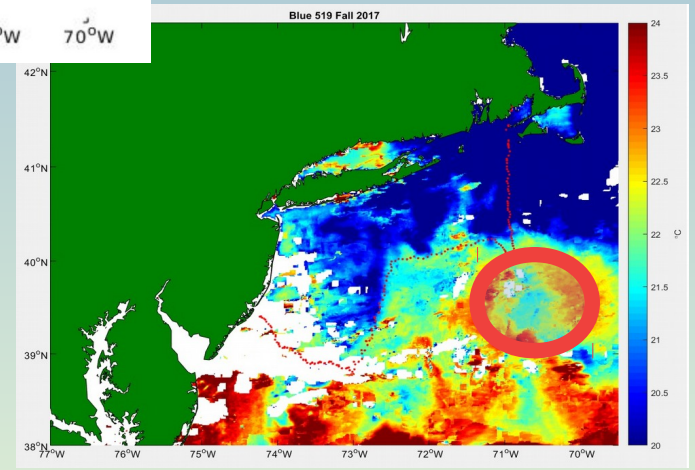
30 Mode representation

14.5 °C Isotherm contour

Indication that the cold pool can be represented with this method

Real Data





Temperature data from August 2017

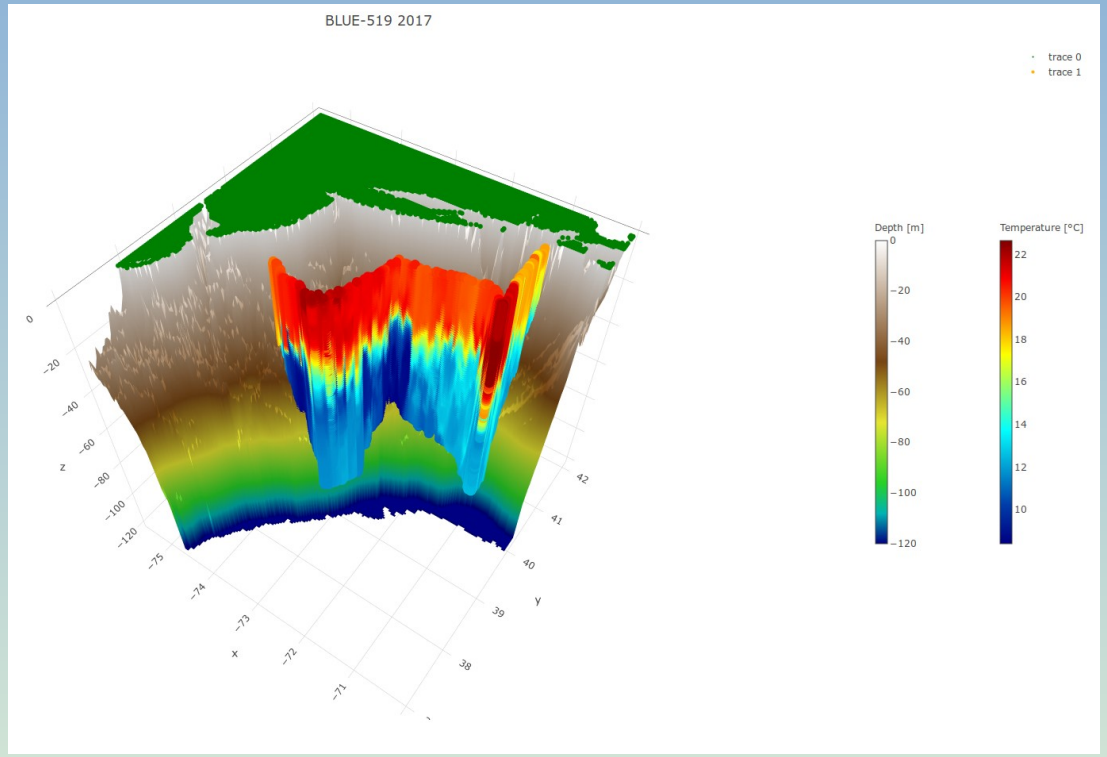
Warm core ring encounter

Change of course

Found <10 °C along shelf break

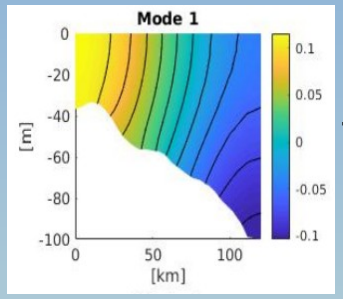
Objective:
Model transect (red) 2D & 3D perspective

Blue 519 Course August 2017



http://www.smast.umassd.edu/CODAR/blue_519_flight.html

2D Real Data



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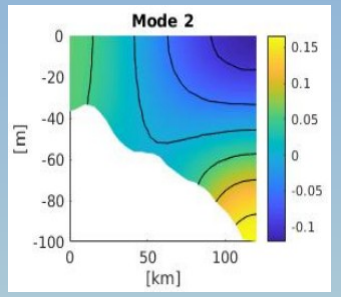

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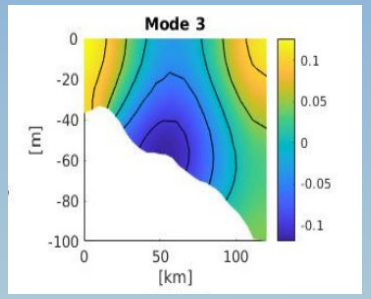

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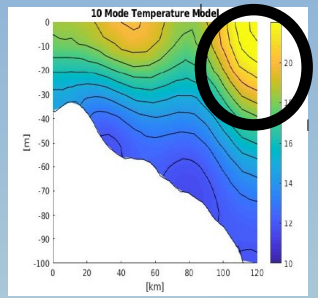
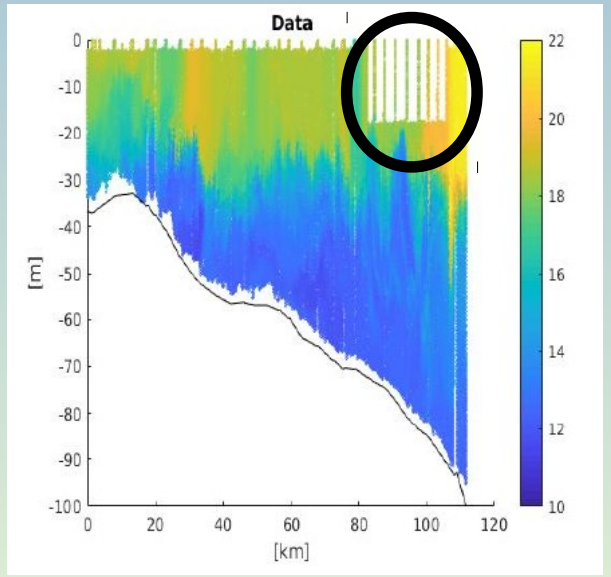
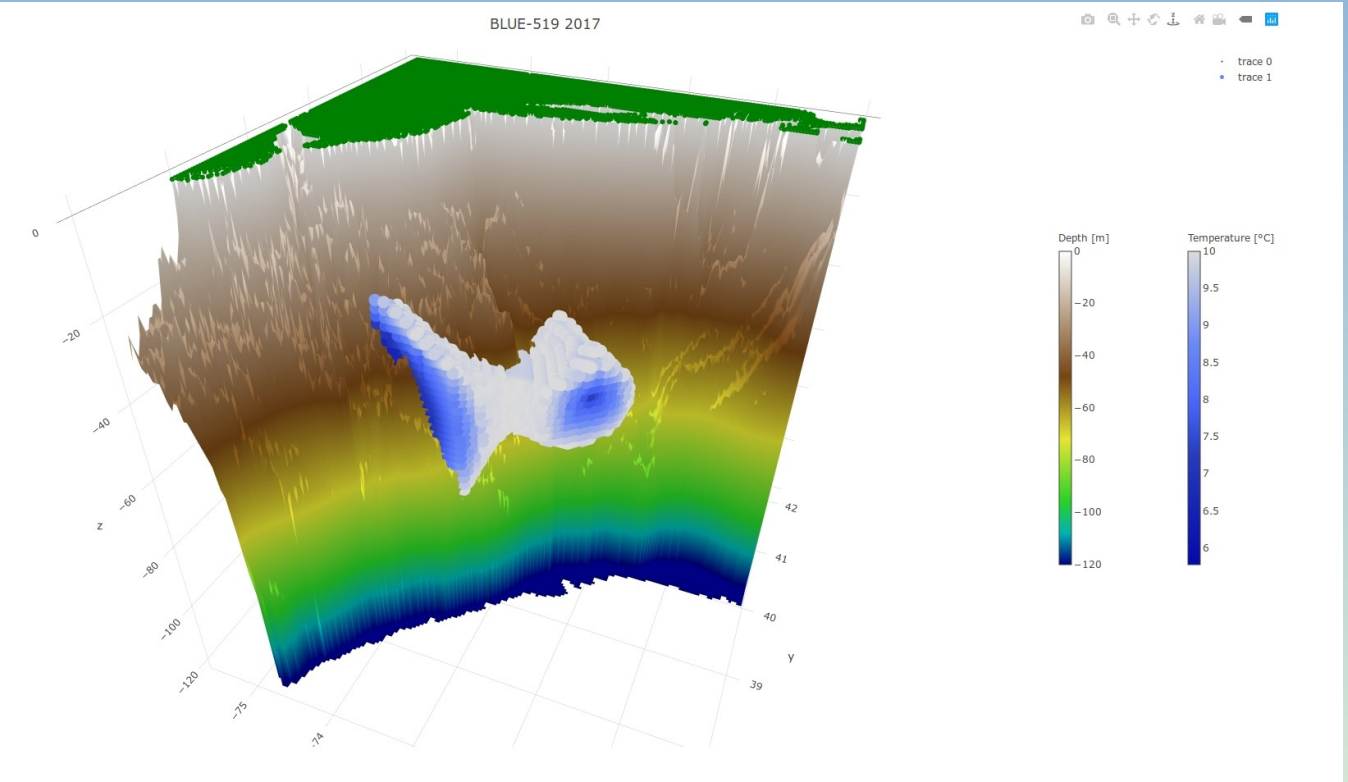




The signature of the warm core ring is identified

MAB Cold Pool



Surface plot in Python instead of MATLAB

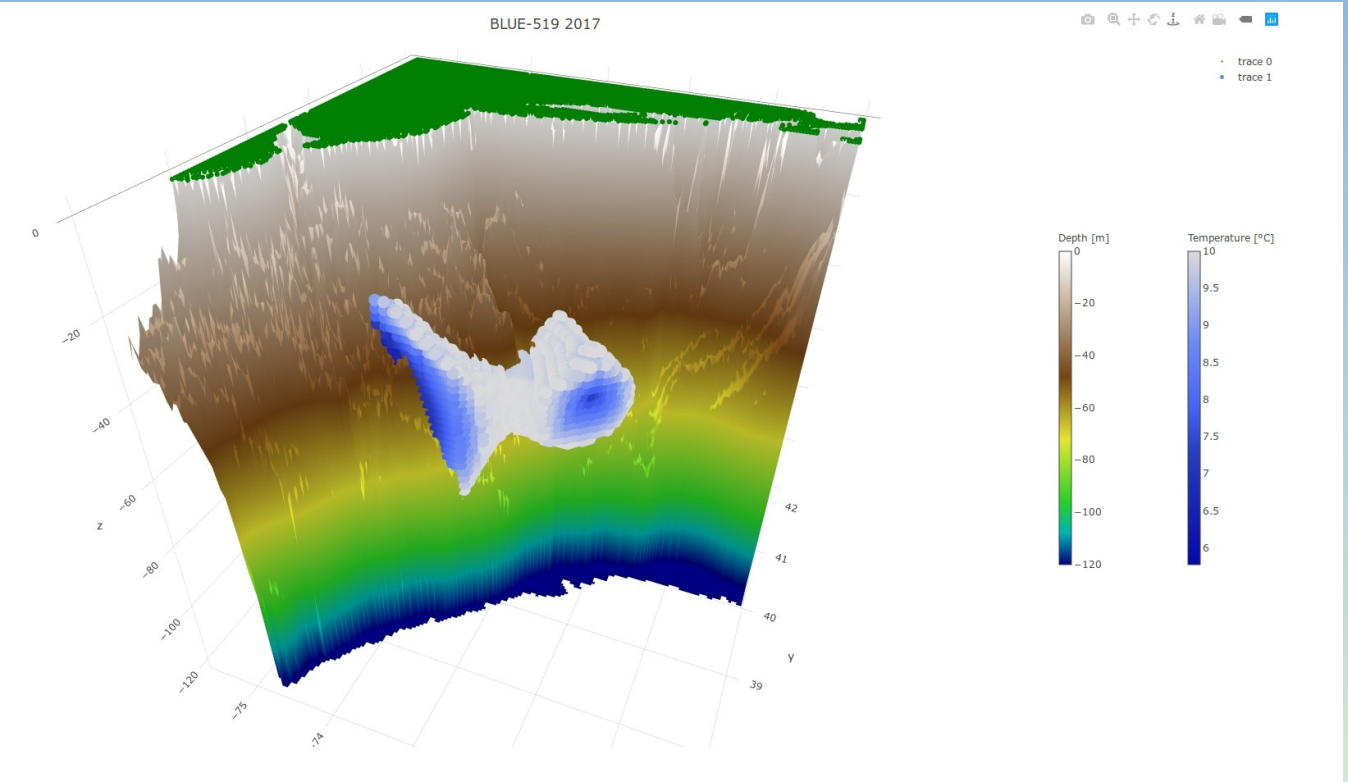
Visualize any perspective

HTML format

More ‘tailoring’ to get a better horizontal perspective.

http://www.smast.umassd.edu/CODAR/blue_519_cold_pool.html

MAB Cold Pool



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/home/rich/Documents/Python/web/blue_519_cold_pool.html

Summary & Next Steps

- Glider data fields can be represented with modes.
- Different perspectives of the data are available.

- Simulate the BLUE-519 mission with numerical model data.
- Compare glider measurements with numerical models. (ROMs, FVCOM)
- Determine the uncertainty associated with representing glider data fields with this method.