

# AUVs for Marine Geodatabases: Toward an Automated Conversion Script

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# Introduction

- One of the key themes of geography is the communication of ideas and information.
- Communication requires that both the presenter and the audience express themselves using the same concepts and definitions.
- For oceanography, the goal is to discuss temporal and spatial variations of the properties of seawater in the same terms.



# The Red Sea

- Located in between Africa and the Arabian Peninsula and is an extension of the African Rift Valley system.
- Narrow basin with a length of 2200 km and a maximum width of 300 km and a maximum depth of 2500 m.
- The Red Sea is very saline as well with the least saline water coming in through Bab el- Mandab in the south, from the Gulf of Aden and the Indian Ocean.

# The Red Sea

- One of the least explored large marine ecosystems in the world.
- In the past eight years there has been a concentrated effort from King Abdullah University of Science and Technology (KAUST) to better understand the biological and physical properties of the Red Sea.
- This unique climatic features of the Red Sea make it an ideal field laboratory.

# Purpose

- To create an automated workflow to enable the processing of data collected from AUVs.
- The workflow is designed to automatically transfer files into ArcServer and then run a series of high precision conversions.
- These conversions transfer the raw collected data from the AUVs into a format that is acceptable for publication and analysis.

# TEOS 10

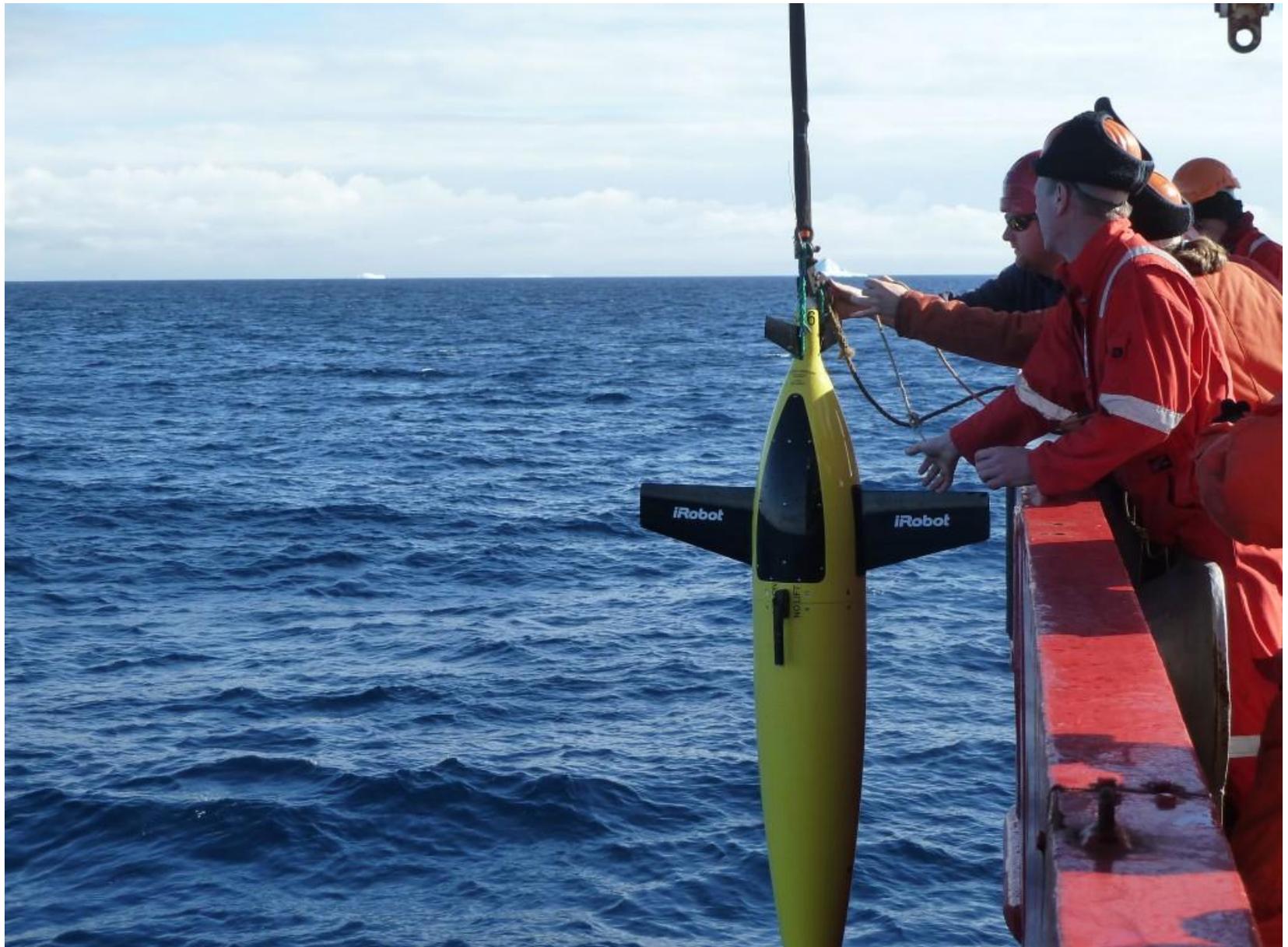
- Thermodynamic Equation of Seawater 2010
- Adopted as a standard by the Intergovernmental Oceanographic Commission at its 25<sup>th</sup> Assembly in 2009.
- TEOS 10 is a series of equations that converts field collected oceanographic data into the correct format for the International System of Units (SI).

# TEOS 10

- The equations are a basis to provide a thermodynamically consistent method to convert collected values of seawater.
- The input values for TEOS 10 include measurements of temperature, pressure, and conductivity.
- These input values are typically set up as a vertical profile taken from a single location.

# AUVs

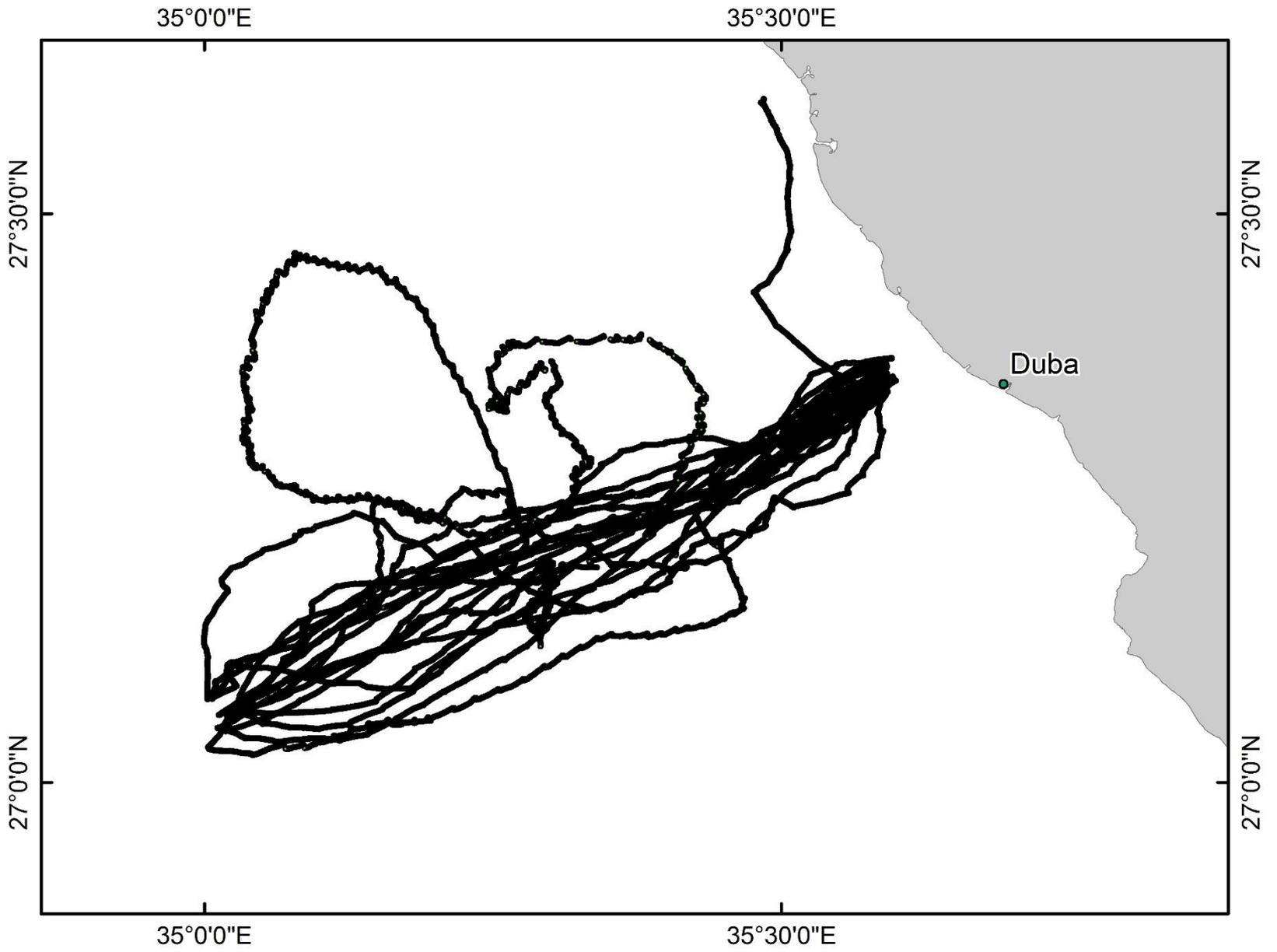
- The AUVs used for this project are Seagliders, a buoyancy operated submersible vehicle initially developed at the University of Washington.
- The AUVs collect data in a series of saw tooth dives that can dive down to 1000 m across 3-5 km over the space of 2-8 hours.
- In this project, over 205,000 data points were collected from 900 dives over the course of 4 months.



<http://www.istar.ac.uk/about-istar/making-it-happen/>

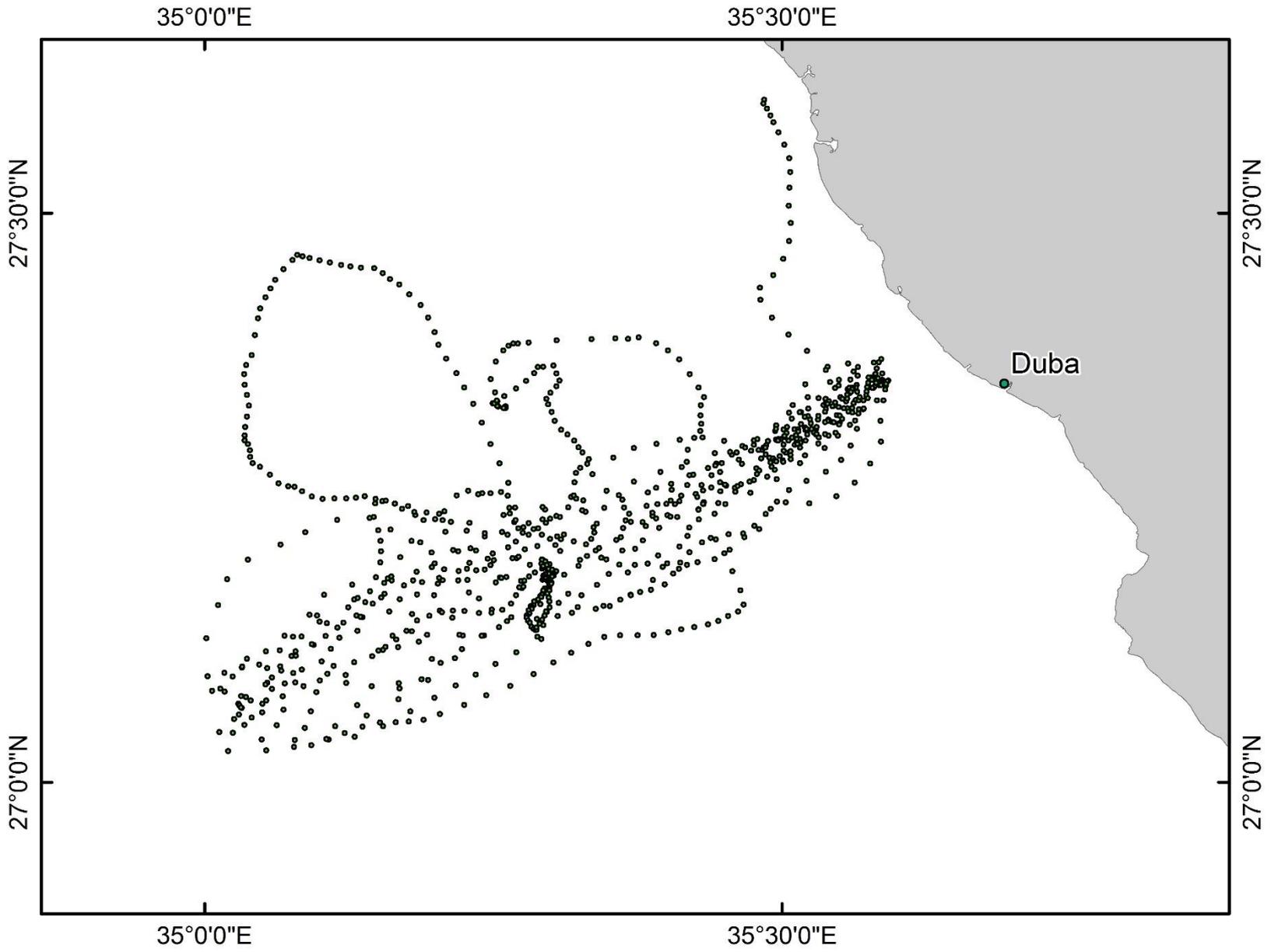
# AUVs

- Remotely directed platforms that are able to control their own sampling missions with a minimum of human input.
- The AUVs can be equipped with a number of different sensors, this project focused on converting data collected from a CTD (conductivity, temperature, and depth).



# Data Conversions

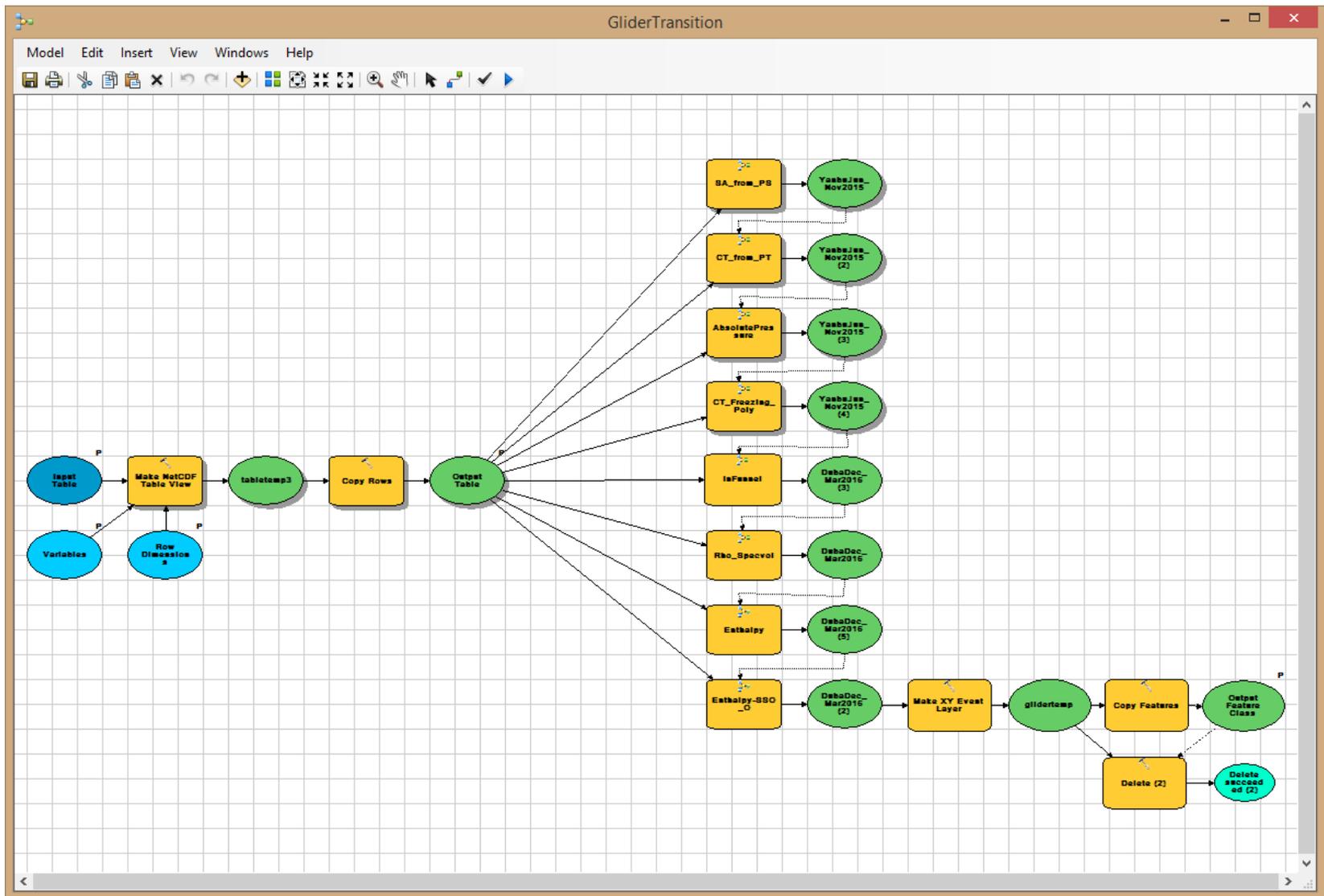
- Data must be converted in two ways: the correct scientific units and then into a set of vertical profiles.
- As a part of TEOS 10, a series of Matlab functions were created to convert raw collected variables into the appropriate SI units.
  - Conductivity                      Absolute Salinity
  - Temperature                      Conservative Temperature
  - Pressure                              Absolute Pressure

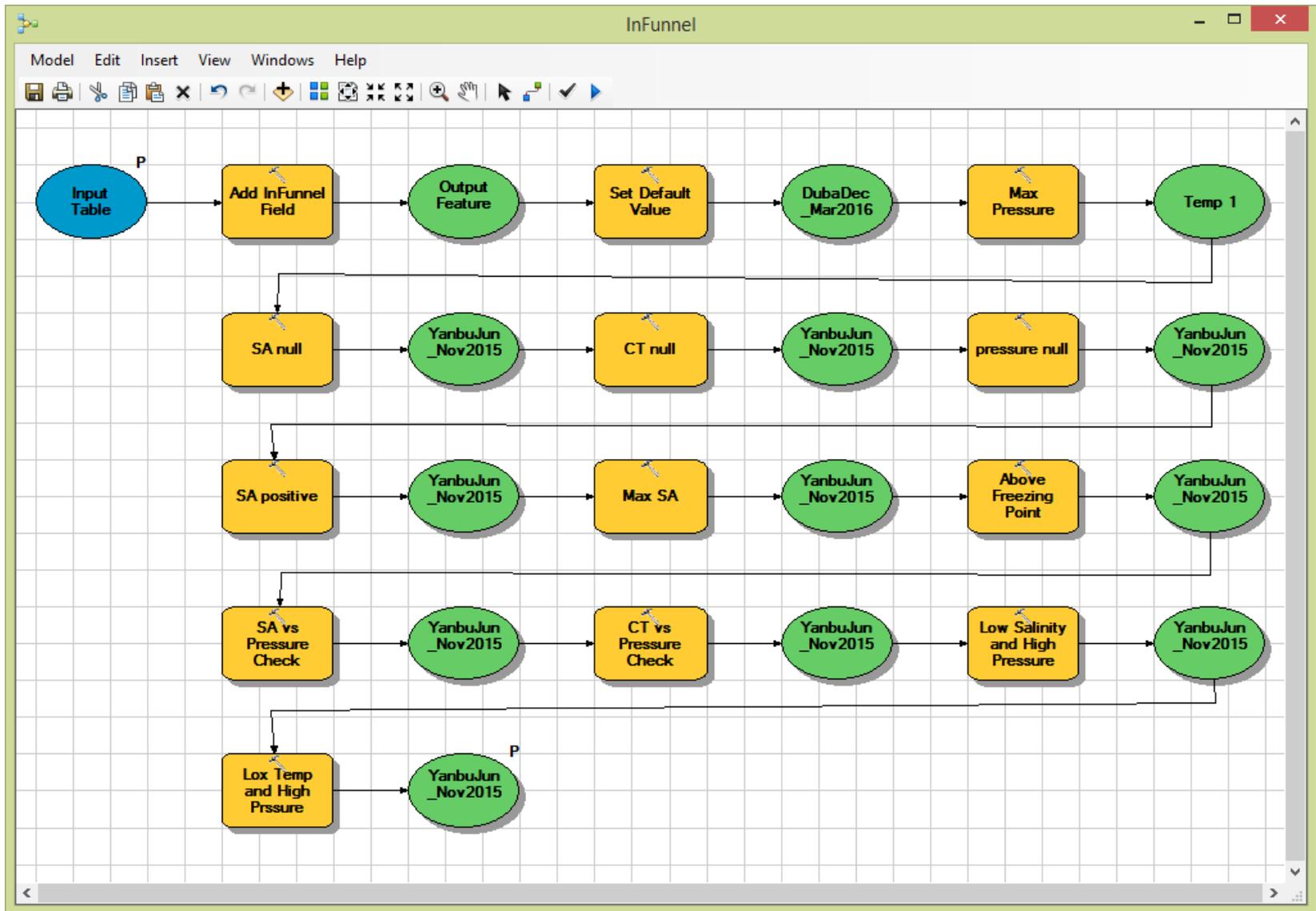


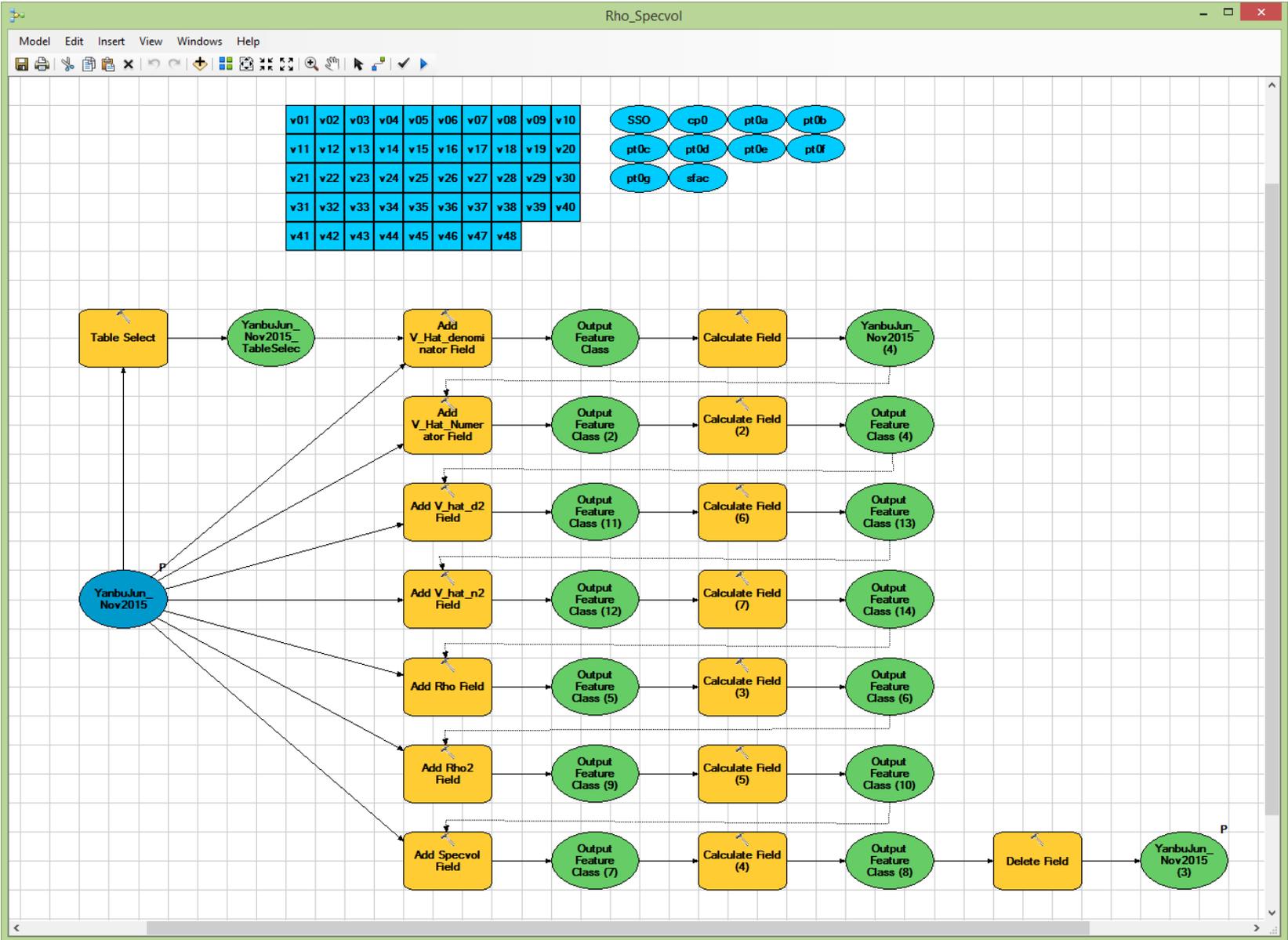
# Results

- Eight functions were converted from Matlab for use in ArcGIS software.
- These functions include:
  - Oceanographic funnel
  - Absolute pressure
  - Conservative temperature/ freezing point
  - Enthalpy
  - Absolute salinity
  - Density/ specific volume
- Additionally, there is a function to convert the data from netCDF format into a feature dataset.



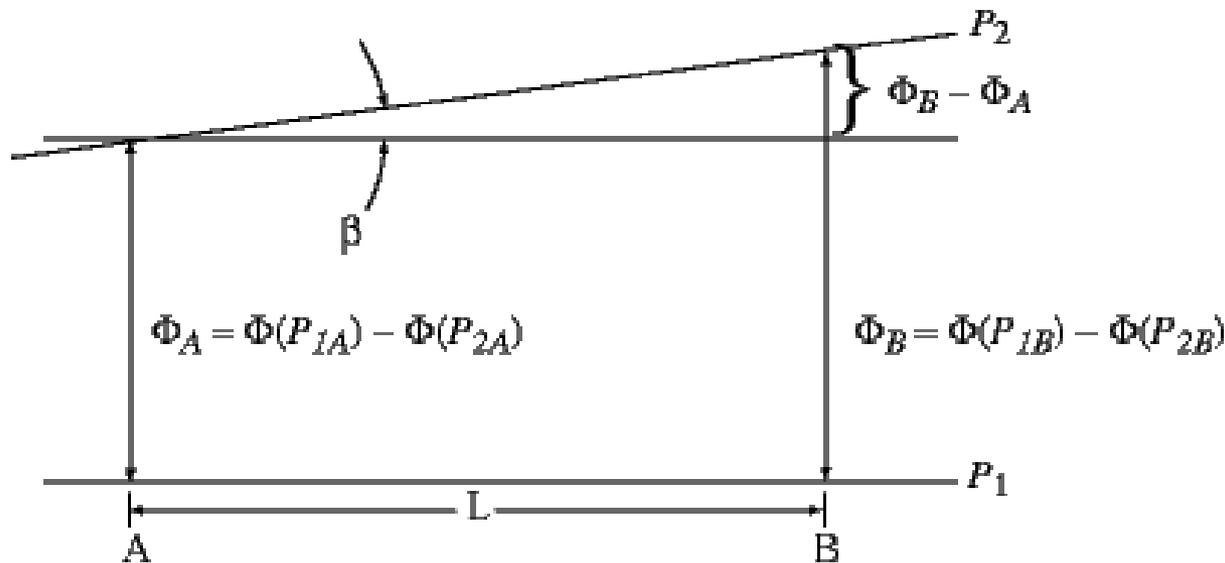






# Next Steps

- Add in additional functions to calculate dynamic height and geostrophic velocities, including creating a slope map of dynamic height for the area.



# Next Steps

- Produce toolbox for publishing to a general audience.
- Examine the spatial and temporal variations of the oceanographic parameters in the Red Sea using the AUVs as a consistent way to collect persistent datasets.