Expected Results (Deliverables)
The results of a project that seeks to reduce error in an ocean model are the amount of error reduced in those models. \( J(x) \), the cost function we are seeking to reduce, is a function of many variables. We are able to control a single variable in that cost function, \( x_{\text{obs}} \) (a vector that contains observed values, including salinity, temperature, current velocities, etc.)

Equation:

\[
J(x) = (x - x_{\text{obs}})^T \cdot O^{-1} \cdot (x - x_{\text{obs}}) + (x - x_b)^T \cdot B^{-1} \cdot (x - x_b)
\]

Hypothesis
The hypothesis for this work is less of a question than a statement: Determine the method (algorithm) that best reduces the cost function, \( J(x) \), in a given amount of time (i.e., we can only obtain a certain number of \( x_{\text{obs}} \)).

Independent and dependent variables
Of the variables in \( J(x) \) above, we can collect and observe \( x_{\text{obs}} \). The \( O \) and \( B \) represent covariance matrices – essentially a multiplier or weight of either the observed or the background data, respectively. The variable \( x_b \) is background data – preexisting data that goes into the first iteration of an ocean model simulation.

Measures
I plan to measure the results of my experiments by comparing the total amount of error reduced in each simulation by grabbing \( x_{\text{obs}} \) in different places. Because we cannot grab every \( x \) in a simulation (a simulation consists of thousands of potential data points, each with a certain amount of error), we have to create a path that collects the \( x_{\text{obs}} \) in the most efficient manner and in a manner that produces the best results.

Experiment Protocol
Because the initial data (\( x_b \)) for the experiment is available, I plan on conducting the experiment by writing a Java program that searches for the best path to reduce error. This can be executed by using offline search methods (depth and breadth first), and online search methods (best first, A*), and examining the paths that produce the best results.