Mathematical Modeling of Salt Marsh Surface Seawater Acidity

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The large amounts of CO2 generated by human activities results in an increase in ocean acidity on a global scale (Hill, 2018). The ability to determine long-term open ocean acidification trends is limited by availability of data (Hill, 2018). Even less water acidity data is available for coastal areas (Hassoun, 2022). Data collection requires the use of expensive instrumentation. The goal of this project is to find a correlation between coastal seawater acidity (pH) and easily observable environmental factors, such as tides. The advantage of such a correlation is that it allows researchers to predict future pH without the use of expensive sensors or time-consuming experimentation. This correlation can assist with studies of global and local ocean acidification processes. The hypothesis is that coastal seawater acidity correlates to easily observable environmental factors, such as tides. A total of 12960 water samples were collected and 2160 weather observations were recorded from September through December of 2024 over nine continuous 24-hour periods. Linear regression, random forest, and template matching algorithms were applied to find a correlation between seawater pH and environmental factors. Template matching algorithm was found to be most successful in detecting a correlation between pH and the tides. Half of the collected data was used to establish a pH-tide correlation model and the other half was used to validate the model accuracy. The mean error of the predicted pH was 1.2%, while the maximum error was 9.0%.

Awards Won: