An Ocean Observing System for Coastal Oceanography Applications: Progress and Opportunities for UCSC Marine Science, Engineering, Robotics, Data Science and Open Source Initiatives

The Monterey Bay Aquarium Research Institute is developing and deploying an ocean observing system optimized for building a better understanding of the health of our ocean's coastal zones. The in-water measurement platform for this system is an autonomous, coastal profiling float (CPF) optimized for work in the coastal zones and upper 350 meters of the world's ocean. The CPF supports the full suite of Biogeochemical-Argo sensors: conductivity, salinity, temperature, pH, nitrate, dissolved oxygen, chlorophyll a, suspended particles and down-welling irradiance. Profiles start at the seafloor or at a user specified depth and proceed to the surface with samples taken every few meters. Profiles can be taken at a user specified rate from continuous profiling to 100s of hours between profiles. Data from each profile is telemetered to shore at the end of each profile using the Iridium satellite network. Our goal is to support 200 profiles spread over as much as 1 year with no operator intervention.

One of the goals for this seminar is to identify potential opportunities to move the CPF system into UCSC research or academic programs. One obvious opportunity is to run CPF missions acquiring data in support of UCSC research programs. A second opportunity is using the CPF as an economical, at-sea test platform for new sensor development. Less obvious, but equally exciting opportunities include improving the functionality of the CPF hardware, software and data subsystems. Observing systems using profiling floats are arguably the most effective global observing systems on the planet, e.g., Argo, SOCCOM and GO-BGC, providing essential ocean variable data at the lowest cost per data point of any competing technology. There are dozens of opportunities to improve the current state of the art for profiling floats. For example, improving the energy efficiency of any profiling float directly drives the cost per data point. If some bright team of engineering students can cut the energy consumption of the CPF in half, the number of missions will double and the cost per data point will be cut in half. The CPF uses standard closed loop control algorithms for depth and profiling velocity that will be familiar to most Robotics and EE student. Re-designing these loops to weight energy efficiency over performance can also reduce the cost per data point. The current global data centers processing profiling float data are overwhelmed with an ever-increasing volume of data. A bright team of data and computer scientists could develop an open source, citizen science based approach to processing CPF data. In fact, the potential exists to open source the entire CPF observing system.