In Situ Measurements: Versatility of the C3 Submersible Fluorometer

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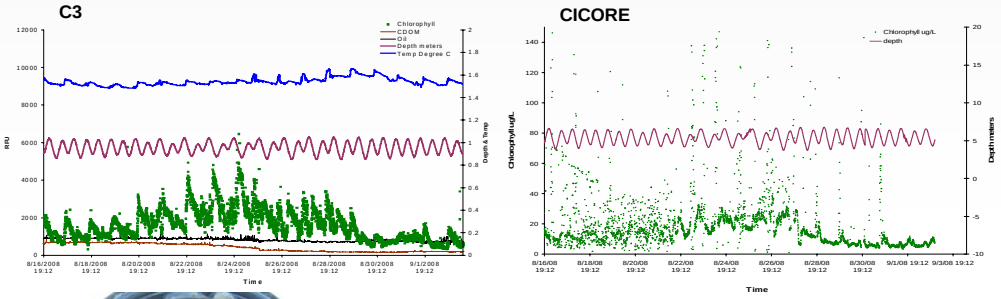
Introduction

The C3 Submersible Fluorometer is an *In Situ* instrument that allows users to accurately collect data from water columns or systems in profiling, mooring, real-time, or other sampling modes. Its fast sampling rate, large internal memory, and integrated pressure sensor make the C3 ideal for helping researchers characterize aquatic systems or determine distributional patterns using water column profiles down to a maximum of 600 meters depth. The corrosion-resistant design and wiper brush allow it to be deployed for long-term monitoring events with minimal maintenance. The many accessories and features offered by the C3 Submersible Fluorometer make it quite versatile in that it can be used in almost any sampling environment with almost any sampling protocol. The following studies are just a few examples of uses for the C3 Submersible Fluorometer.

Monitoring in San Francisco Bay

A C3 Submersible Fluorometer configured with 3 sensors (Chlorophyll, CDOM, and Oil) was deployed in Redwood Creek, a tributary within San Francisco Bay, for 1 month from August to September 2008. Continuous raw fluorescence data were taken at 5 minute intervals and compared to CICORE *in situ* chlorophyll data taken at 6 minute intervals about 6 miles from the C3 deployment, within the Bay.

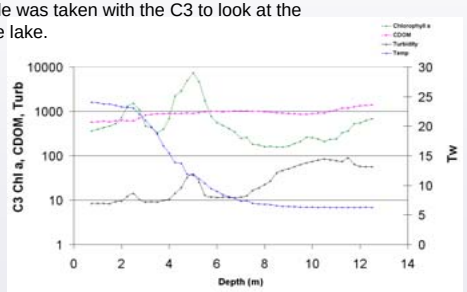


Bio-fouled C3 after 1 month deployment

Un-averaged C3 data plotted above (left) show a tighter, more distinct chlorophyll trace in response to a bloom event with low signal variation, even under heavy bio-fouled conditions. The C3's ability to operate normally and produce good quality data in bio-fouling environments benefits researchers in many ways. One great benefit evident from this monitoring event is that the C3 is self-maintaining. This helps researchers on projects that have limited resources for servicing moored or long-term deployed instruments.

Quick Profiling in Lake Lacawac

Lake Lacawac is a small lake that receives its water source from precipitation and runoff and 50% of its border is sphagnum bog. A quick 20 minute vertical profile was taken with the C3 to look at the distribution of Chlorophyll, CDOM, and Turbidity within the lake.



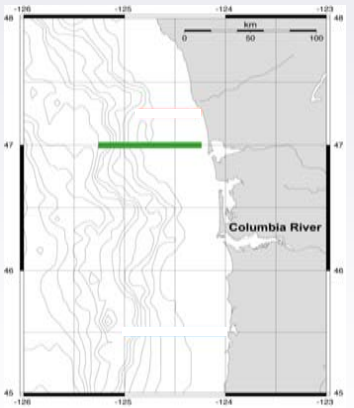
This C3 profile suggests that temperature may control the distribution of algae in this lake. The observed chlorophyll maximums could be niche formations. CDOM fluorescence may also be affected by changes in temperature and may require temperature correcting to more accurately represent its distribution. The benefit of quick profiles is retrieving a lot of data in a short period of time to answer general questions and look at anomalies. This leads to further investigation and a more detailed analysis to better characterize the environment under study.

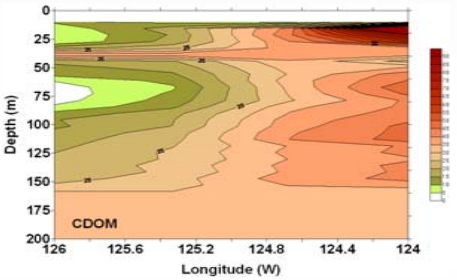
Transect Sampling Off the Coast of Washington

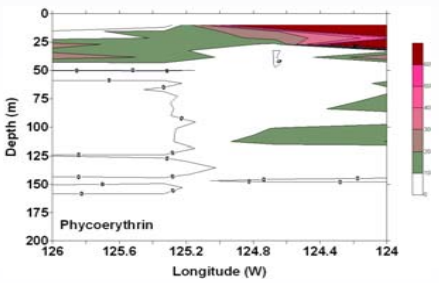
Rivers that drain into coastal areas often expel high concentrations of DOM. Vertical profiles were collected off the coast of Washington along a transect in an effort to analyze the effects from river input.

Results from CDOM distribution are plotted below (left). The highest CDOM concentrations were observed in surface water from 0-25 meters, closest to the shore. The vertical and horizontal dissipation of CDOM showed a specific pattern as indicated by C3 data. A thin layer of mid-low CDOM concentrations at 37 meters is observed up to 50 km offshore. A trace of phycoerythrin-containing algae seemed to be coincidental with the observed thin CDOM layer below (right).

The use of a C3 Submersible Fluorometer greatly enhanced this sampling event. High resolution data obtained during sampling provided researchers with a good understanding of the dynamics of this coastal environment and the impact from river input.

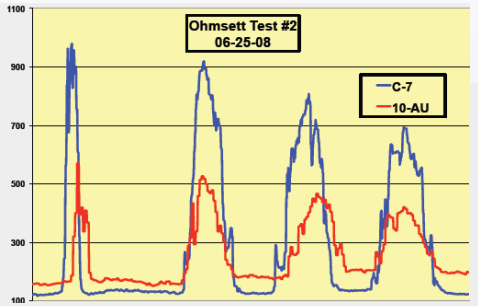






Detection of Oil in Seawater: SMART Protocol

The Special Monitoring of Applied Response Technologies (SMART) protocol is a cooperatively designed monitoring program for *in situ* burning and dispersant applications. The primary instrument used with this protocol is the Turner Designs 10-AU Flow Through Fluorometer. The 10-AU is typically mounted in a fixed location aboard a research vessel and water is pumped from depth through the instrument for continuous measurements. Since its development, the C3 Submersible Fluorometer has gained much interest from SMART's researchers and team members because of its ease of operation, ability to integrate with GPS software, real time data viewing and capture, *in situ* sampling ability, and small package requiring minimal accessories. The Clean Islands Council has been intensely involved with evaluating the C3 Submersible Fluorometer as the next generation fluorometer for the SMART Protocol.



Oil spill response tank test in Leonardo, NJ comparing 10-AU fluorometer with C3 optics used for detecting dispersed oil.

Turner Designs C-3 fluorometer

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