

Shelf-Slope Physical/Biological Response to Monsoonal Wind Forcing and Riverine Inflow - 4D Sampling with Towed Profilers and Autonomous Gliders off Vietnam

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LONG-TERM GOALS

Our overarching long term goal is to understand the coupling of bio-optical processes and properties with physical processes in ocean regions of strong physical forcing. Strong physical forcing studied here is that associated with wind forcing and frontogenesis.

In addition, we desire to understand the relationship between optical signatures and the components of the water column (e.g. sediments, phytoplankton and dissolved organic material) that create these signatures. Biological, chemical, geochemical, and geological processes contribute to these signatures.

OBJECTIVES

The primary goals of this study are to understand:

1. The three-dimensional distribution of inherent optical properties in the South China Sea, a relatively unexplored region of the world ocean for which relatively little optical data exist.
2. The coupling of bio-optical properties with the physical processes.
3. Relationship between the surface expression of three-dimensional ocean processes and the interior processes near the ocean surface.

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4. The contribution of dissolved and particulate matter to in-water optical properties and their effect on ocean color remote sensing.

APPROACH

Our field approach to achieving the above objectives consistent of four observational components:

1. Three-dimensional physical/bio-optical mapping is carried out in regions of the where strong physical dynamics are expected. Optical sensors are mounted on the UW-APL towed undulating vehicle for mapping 3-dimensional distributions of inherent optical properties that should respond to the physical processes of the straits. We deploy a Wetlabs ACS hyperspectral absorption/attenuation meter, a Wetlabs BB9 9-wavelength backscatter sensor, and fluorometers for the measurement of CDOM and chlorophyll.
2. Continuous nearsurface underway measurements of inherent optical properties are obtained from the ship's underway seawater flow system. These measurements include unfiltered and filtered hyperspectral absorption/attenuation measurements using either Wetlabs ACS instruments. These are important for interpreting remotely sensed ocean color observations.
3. Station based high resolution vertical profiles of physical, inherent optical, and radiometric optical properties are obtained with a bio-optical profiler. These measurements are made in conjunction with CTD-rosette casts to provide verification and interpretation of the in situ towed observations and the remotely sensed apparent optical properties.
4. Deployment of profiling floats with optical sensors to resolve upper ocean dynamics and coupling to biology over seasonal time scale.

WORK COMPLETED

Due to a variety of constraints the sampling work last spring has been changed to the waters South and Southwest of Taiwan.

We have participated in the last two legs of the April/May 2013 cruise (5/7-16/2013 and 5/18-27/2013) of the R/V Ravelle conducting continuous in-line measurements (for an example see Fig. 1).

RESULTS

We are currently in the analysis phase and planning for the next year cruise.

IMPACT/APPLICATIONS

The observations from this effort will facilitate interpretation of physical processes and structure from remotely sensed ocean color in the region. The results will also be useful for assimilation and verification of numerical modeling efforts that include circulation, inherent optical properties, and particle dynamics.

RELATED PROJECTS

We are closely collaborating on this program with the following ONR principal investigators:

Dr. Craig Lee from the University of Washington on the analysis of the optical data from the towed vehicle, and with:

Dr. Kipp Shearman from Oregon State University on the analysis of the optical data from the autonomous vehicles.

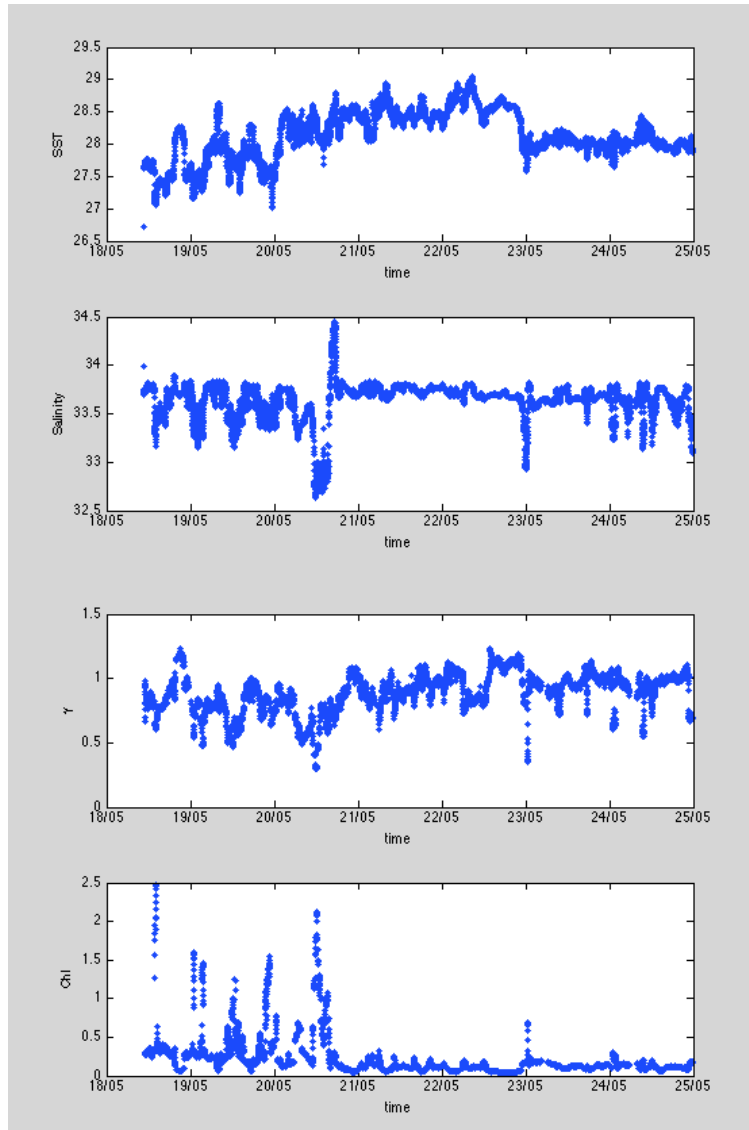


Figure 1. Time series of hydrographical (Temperature and salinity, top panels) and optically derived (Chlorophyll and size parameter, bottom panels) particle parameters during the 3rd leg of the R/V Ravelle cruise Southwest of Taiwan. Note the strongest biological variability at locations where both temperature AND salinity exhibit strong spatial gradients.