

Optical Dynamics in the Adriatic Sea: Production, Transformation and Transport of Optical Properties from the Coastal Zone into the Open Ocean

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LONG-TERM GOALS

The fundamental goals of this research are to understand the coupling of the optical dynamics of the ocean with physical forcing in both coastal and open ocean environments. We specifically want to better understand these processes by:

- Examining the interaction between physical and bio-optical responses of the upper ocean to atmospheric forcing.
- Observing the details of bio-optical influences of instabilities, secondary circulations and vertical motions associated with upper ocean fronts.
- Examining the role of river inputs into the coastal zone on the dissolved and particulate components that contribute to the optical properties on the continental shelf.
- Studying the exchange between the continental shelf and open ocean through cross-shelf transport processes including filament-related processes that have been observed in coastal regions throughout the world.
- Providing statistically meaningful spatial mapping of optical parameters for ground truthing of optical remote sensors.

OBJECTIVES

The objectives of this effort are to examine:

- The transitions of inherent optical properties across coastal/open ocean boundaries and their effect on apparent optical characteristics of the water column.
- The role of physical processes (river inflow, upwelling, coastal filaments, and frontal processes) in the production, distribution and flux of optical properties between the coastal and the offshore zones.
- The relationship between the surface expression of three-dimensional ocean processes and the interior processes.

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APPROACH

Three primary observational approaches will be used in this effort. A SeaSoar or Triaxus towed undulating vehicle (TUV) will be equipped with a Wetlabs AC-9 or Hi-Star multiple wavelength attenuation/absorption meter, as well as a transmissometer and chlorophyll and CDOM fluorometers for three-dimensional mapping of the optical properties across the shelf/open ocean boundary and frontal regions in the Adriatic Sea. In the mapping mode, a Satlantic Micro-SAS remote sensing radiometer system will be used to provide continuous measurements of remote sensing reflectance. These observations can then be compared with the in situ measurements of inherent optical properties. We will also employ more traditional station mode sampling where optical properties are profiled with a Bio-Optical Profiling package that includes two AC-9 attenuation/absorption meters, one HydroScat-6 optical backscatter sensor, Satlantic radiometers for measuring downwelling irradiance and upwelling radiance at 7 wavelengths, and a CTD equipped with a transmissometer, chlorophyll fluorometer, and CDOM fluorometer.

WORK COMPLETED

Having just begun funding in July 2002, we are still early in project preparation. New instruments (an AC-9 and Satlantic MicroSAS system) have been purchased and are currently being integrated into the existing instrument systems. The WETLabs AC-9 is currently being integrated with the University of Washington APL SeaSoar. We have successfully deployed an AC-9 on the Woods Hole SeaSoar in the Japan/East Sea as part of an effort to study the Subpolar front (shown in Figure 1).

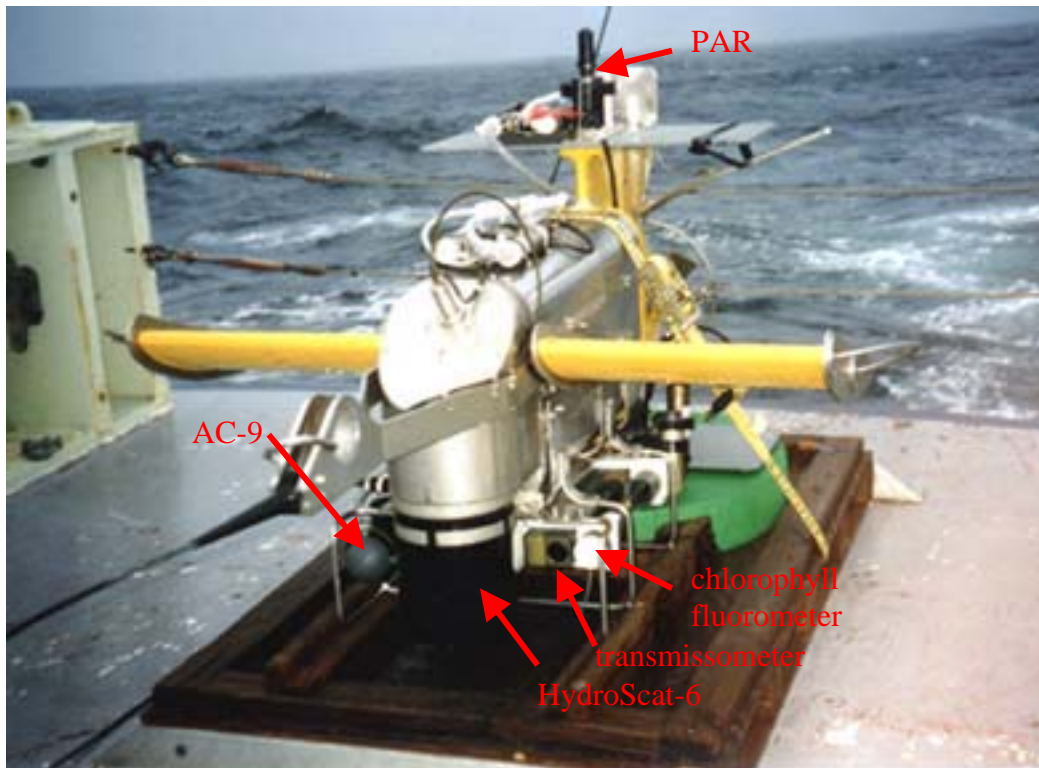


Figure 1. SeaSoar configured on the WHOI SeaSoar for the Japan/East Sea Experiment. Note the payload cage beneath the vehicle. The AC-9 is mounted in a frame underneath the main part of the vehicle. A similar configuration will be used on the UW/APL SeaSoar.

We have also visited with Italian and Croatian scientists to develop collaborations for the two scheduled cruises in the Adriatic. Biological and chemical oceanographers at the University of Ancona and IRPEM in Ancona, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS) in Trieste, and the University of Zagreb in Croatia are expected to participate in the cruise. They will provide complementary measurements including inorganic nutrients, HPLC pigments, SeaWiFS remote sensing imagery, and other supportive data sets.

RESULTS

There are no results from this project yet. Our first research cruise for January-February 2003.

IMPACT/APPLICATION

This research will provide a better understanding of the role of physical processes in generating, transforming and transporting optical properties in the ocean. We expect that significant vertical transport of optical properties is associated with a number of the physical processes that we expect to observe. These are important not only for understanding the role of upper layer and remote sensing optics, but also the extent to which significant levels of optical properties are transported into the ocean interior from the surface.

TRANSITIONS

We expect that the results from this project will result in a better understanding of the relationship of optical properties to physical dynamics in the open sea. We also expect that these results will yield better algorithms for interpreting the remote sensing optics for the Adriatic Sea where there are complex inputs and transport processes occurring.

RELATED PROJECTS

This project is part of the larger program studying the dynamics of the Adriatic Sea. We will directly collaborate with the following investigations:

Adriatic Circulation Experiment – Mesoscale Dynamics and Response to Strong Atmospheric Forcing, C. Lee (UW).

Satellite Characterization of Bio-Optical and Thermal Variability in the Adriatic Sea, B. Arnone, (NRL).

Atmospheric Forcing and its Spatial Variability over the Adriatic Sea, C. Dorman (SIO).

Adriatic Circulation Experiment, H. Perkins (NRL).

Eurostrataform – multiple investigators.

REFERENCES

None.

PUBLICATIONS

None have resulted from this project yet.

PATENTS

None