Optical Constituents Along a River Mouth and Inlet: Variability and Signature in Remotely Sensed Reflectance

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LONG-TERM GOALS

The goal of our research is to to improve our ability to assess and predict the distribution of optical properties in the coastal region.

OBJECTIVES

Our research in the New River Tidal Inlet had three primary objectives:

1. Measure the variability of optical properties in-space along a river mouth/inlet and observe the variability in time at a single position over a tidal cycle;
2. Relate this variability to the concentration and dynamics of dissolved and particulate materials, including variability in the particle size distribution;
3. Relate the optical properties to the ocean reflectance, so algorithms to invert surface color to in-water constituents can be tested and improved.

APPROACH

Our work on in situ optical and particle properties was coordinated with the work being carried out on physical processes and remote sensing in the New River in North Carolina during the RIVET project. Our sampling effort consisted of deploying 2 instrument packages to measure particle size and optical properties at a series of stations located along the New River and through the mouth. The first package used to profile water column particle size distributions consisted of a LISST 100x Type C, Digital Floc Camera (DFC), and RBR CTD. The second comprised a WETLabs ac-s, BB-9, a CDOM fluorometer and a Seabird CTD (IOP package) and was used to determine backscattering and absorption

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coefficients of particulate and dissolved substances. A third drifting package was deployed to measure hyperspectral upwelling radiance and downwelling irradiance. Water samples were collected and filtered for analysis of particulate mass and organic carbon. Finally, a size settling velocity camera was deployed on the bottom over a tidal cycle.

WORK COMPLETED

We conducted 5 days of sampling of which the last three days with the IOP package at the New River Inlet using the two profiling packages. Measurements were done as follows: In days 1 and 2 samples were collected at different locations along the river. In day 3 we anchored the R/V and performed profiles ~once every half an hour at one location. In Day 4 we followed a dye patch as it was advected with the tide. Finally in day 5 we sampled out at sea and in the Inlet to characterize the end members of the inlet (see Fig. 1 for station locations).

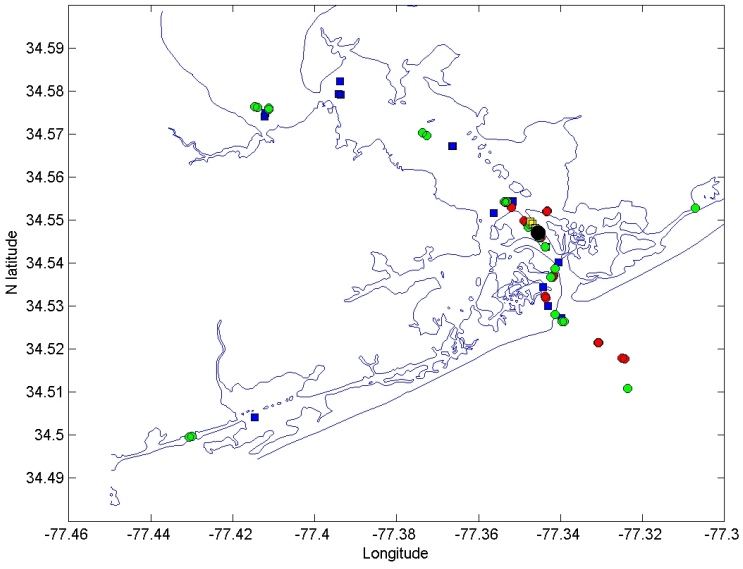

Figure 1. Site map for sampling effort in New River Inlet, North Carolina. Different colors and symbols represent different sampling days.

The data collected were processed in accordance with standard protocols, including the assignment of uncertainties. Full particle size distributions were determined using data from the LISST and DFC following the protocols developed in the OASIS project (Hill et al., 2011). Mass normalized backscattering and absorption of particles, crucial inputs into ocean-color inversion models in the coastal ocean, e.g. Nechad et al., (2010), were derived.

Radiative transfer modeling using Hydrolight was used to test for closure between radiometric measurements and in-situ optical properties (e.g. Mobley et al., 2002) and the degree of disagreement contrasted with the uncertainties in measurements (e.g. Wang et al., 2003).

RESULTS

We are in the analysis phase and have no results, other than the data collection, to report as of yet.

RELATED WORK

The in-situ measurements of particle size, beam attenuation (c_p), and settling velocity from this project are being combined with those from the ONR funded OASIS and Tidal Flats projects to increase our understanding of optical properties in coastal waters. The two LISSTs used in this project were purchased with Canadian funds, one from a project on oil-mineral aggregation (NSERC, Hill) and one on particle transport away from finfish aquaculture sites (DFO, Law).

IMPACT/APPLICATIONS

This proposal seeks to improve our ability to assess and predict the distribution of optical properties in the coastal region. Such information is needed to assess underwater visibility of relevance to both diving operations and underwater communication.

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