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Particle Size Distribution and Optical Volume Scattering Function in the Mid and Upper Water Column of Optically Deep Coastal Regions: Transport from the Bottom Boundary Layer

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LONG-TERM GOAL

Our long-term goal is to understand the processes that contribute to the establishment of the vertical structure of suspended sediment size-distribution and concentration with the bottom boundary layer acting as the principal source.

OBJECTIVES

In the HYCODE experiment, the focus is on understanding the processes that establish the color of the water. Besides dissolved substances, a principal factor determining the spectral signature of the water-leaving radiance is the particulate content of the water column. The source for particulate in shallow water (though optically deep) is the bottom boundary layer, and subsequent diffusion and advection by processes that include upwelling. Our objective in this program is to examine the relative importance of these processes by simultaneously observing the vertical distribution of particles, and the advective-diffusive mixing processes. Simultaneously, the instruments that measure particle size-distribution will also provide measurements of the small-angle volume scattering function of water at the wavelength of the diode lasers, 0.67 micron.

APPROACH

Measurements of suspended sediments (size distribution and concentration) shall be carried out throughout the water column using a LISST-100 instrument on a profiler. In addition, 2 LISST-100 instruments will measure the same parameters from a bottom-mounted tripod. The settling velocity distribution of the particles – a key parameter that establishes the diffusion-settling balance – shall be measured using a LISST-ST instrument. The ‘reference concentration’ of sediments – concentration at a small distance above the bed - will be observed with an MSCAT (Miniature Scattering and Transmissometry Instrument). These constitute the set for sediments. The velocity field will be measured with a set of velocimeters mounted on the tripod. All sensors will be synchronized. Data will be stored on-board the instruments and transmitted to shore via the node at the site.

WORK COMPLETED

In this first year of the program, the principal work is to complete instrument preparation. This is proceeding. To take advantage of an early opportunity, a LISST-100 instrument suitable for use on a profiler, and the profiler were constructed. The instruments were installed to transmit data on the node at Rutgers University’s LEO-15 site, off the New Jersey coast.

Work on the preparation of the other sediment sensors and velocimeters is continuing. A field experiment is planned for the summer of 2000.

Initial analysis of the vertical structure of water-column size-distribution will be carried out shortly.

RESULTS

At this early stage in the program, there are no results from this work.

IMPACT/APPLICATION

Again, due to the early nature of this report, there are no impacts to be reported from this work.

TRANSITIONS

None.

RELATED PROJECTS

1 – In a program funded by NSF, we are examining the rate and kinematics of the dissipation variable in the lowest few centimeters of the bottom boundary layer. This region, the wave boundary layer, is the most critical in determining resuspension or settling of particles. Similar sediment sensors as in use in this program will also be employed, besides a laser dissipation rate sensor.

2 – In an unfunded separate program, a new optics principle has been discovered that permits the use of 2 specially shaped detectors placed in the Fourier plane of a receiving lens, for observing the concentration and mean size of suspended particles. This new principle circumvents the difficulty of changing calibrations of prior transmissometers and optical scattering sensors. This program is internally funded from the Company's resources.

PUBLICATIONS

Agrawal, Y.C., and H.C. Pottsmith, Instruments for Particle Size and Settling Velocity Observations in Sediment Transport, *Marine Geology*, (*submitted*), 1999.

Agrawal, Y.C., P. Traykovski, and A.J. Williams, Particles in the Bottom Boundary Layer: Concentration and Size Dynamics through Events, *Jour. Geophys. Res.*, (*submitted*), 1999.