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CIRCULATION AND SEDIMENT TRANSPORT IN THE HUDSON SHELF VALLEY, OFFSHORE OF NEW YORK CITY

Currents measured in the Hudson Shelf Valley in the winter of 1999-2000 transported sediments up-valley

Introduction

The U.S. Geological Survey completed a field experiment during the winter of 1999-2000 to investigate the transport of sediments and associated pollutants in the coastal waters offshore of the New York - New Jersey metropolitan region (see figure 1). The experiment was designed to observe sediment transport and circulation in the vicinity of the Hudson Shelf Valley, a 20-m deep valley that extends from the shelf edge across the continental shelf to water depths of about 20 m, terminating near several historical dumpsites. Geochemical evidence (for example, elevated lead concentrations) indicates that contaminated sediments have dispersed seaward along the axis of the Valley over the last 50 years. The experiment consisted of six instrumented tripods (figure 2) and two moored instrument arrays deployed along the axis of the valley and on the adjacent shelf.

Currents in the Hudson Shelf Valley

The observations show episodic down-canyon flow driven by storm winds from the northeast (downwelling). These winds also cause large surface waves that resuspend the bottom sediments, resulting in down-canyon transport of sediment during these events. Over the entire experiment however, the transport of sediments was dominated by up-valley currents driven by winds from the northwest. These currents were also sufficiently strong, 20-40 cm/s near the bottom, to resuspend the bottom sediments and resulted in net up-valley transport. Although the observations are only for the winter season, the unexpected up-valley transport has major implications for the long-term dispersal of fine-grained sediment and associated contaminants in the New York Bight region. Further analysis and 3-dimensional modeling with a coupled circulation and sediment transport model are planned.

For more information:

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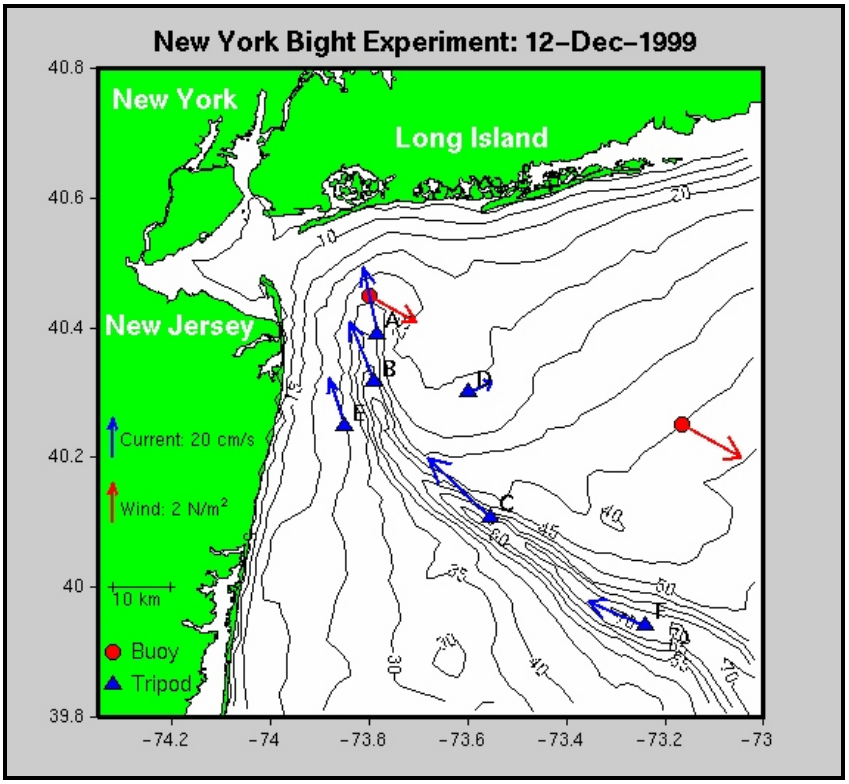

Figure 1: Location of USGS instrument sites (triangles). Eight USGS instrument packages were deployed; tripods were located at sites A- F and moored instrument arrays were located at sites B and C. Blue arrows indicate near-bed current velocities during a representative up-valley flow event. Red arrows represent wind stresses inferred from wind measurements at National Oceanographic and Atmospheric Administration buoys (circles). Depth contours are in m. Over the 5 month winter deployment, net sediment transport was up-valley.

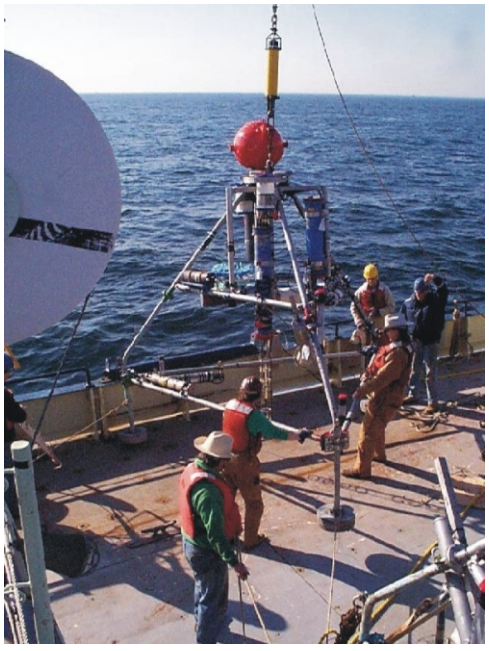

Figure 2. Bottom tripod system being launched from *RV Oceanus*. The tripod rests on the sea floor and measures near bottom current, waves, temperature, and backscatter intensity (a measure of suspended sediment concentration), as well as currents throughout the water column at 2 m intervals with an Acoustic Doppler Current Profiler. Four tripods were deployed along the axis of the Hudson Shelf Valley and two on the adjacent shelf between December 1999 and April 2000 to measure currents and near-bottom sediment movement.

Harris, C.K. and R.P. Signell (1999) Circulation and sediment transport in the vicinity of the Hudson Shelf Valley. Estuarine and Coastal Modeling; Proceedings of the Sixth International Conference. M.L. Spaulding, H.L. Butler (editors), American Society of Civil Engineers. 380-394.