ABSTRACT

This study examined the hydrography and bottom boundary-layer dynamics of two typical storm events affecting coastal North Carolina (NC); a hurricane and the passages of two small consecutive extratropical storms during November 2005. Two upward-looking 1200-kHz Acoustic Doppler Current Profilers (ADCP) were deployed on the inner shelf in northern Long Bay, NC at water depths of less than 15 m. Both instruments profiled the overlying water column in 0.35 m bins beginning at a height of 1.35 m above the bottom (mab). Simultaneous measurements of wind speed and direction, wave and current parameters, and acoustic backscatter were coupled with output from a bottom boundary layer (bbl) model to describe the hydrography and boundary layer conditions during each event. The bbl model also was used to quantify sediment transport in the boundary layer during each storm. Both study sites exhibited similar temporal variations in wave and current magnitude, however, wave heights during the November event were higher than waves associated with the hurricane. Near-bottom mean and subtidal currents, however, were of greater magnitude during the hurricane. Peak depth-integrated suspended sediment transport during the November event exceeded transport associated with the hurricane by 25-70%. Substantial spatial variations in sediment transport existed throughout both events. During both events, along-shelf sediment transport exceeded across-shelf transport and was related to the magnitude and direction of subtidal currents. Given the variations in sediment type across the bay, complex shoreline configuration, and local bathymetry, the sediment transport rates reported here are very site specific. However, the general hydrography associated with the two storms is representative of conditions across northern Long Bay. Since the beaches in the study area undergo frequent renourishment to counter the effects of beach erosion, the results of this study also are relevant to coastal management decision-making. Specifically, these issues include 1) identification of municipalities that should share the cost for renourishment given the likelihood for significant along-shelf sand movement and 2) appropriate timing of sand placement with respect to local climatology and sea-turtle nesting restrictions.