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INTEGRATION OF GEOLOGIC FRAMEWORK AND OCEANOGRAPHIC STUDIES TO DEVELOP PREDICTIVE MODELS OF COASTAL CHANGE

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Coastal erosion and habitat loss are major concerns along the U.S. Atlantic coast, which has experienced rapid population growth over recent decades. Changes that occur along a particular segment of shoreline are dictated by waves, currents, and sediment supply that act within the overall constraints of the regional geologic setting. Understanding all the variables and their interactions that drive coastal evolution is key to effective management of coastal and ocean resources. For example, the type and distribution of benthic marine habitats are strongly controlled by geologic factors (bathymetry, substrate type) and oceanographic processes (current velocity, sedimentation). In return, marine communities such as seagrass beds can provide a measure of protection to the coastline against storm waves and erosion.

A primary objective of the USGS Coastal and Marine Geology Program is to better understand the influence of geologic framework and oceanographic processes on coastal evolution. Through the interpretation of high-resolution geophysical data (swath bathymetry, sidescan sonar, seismic-reflection profiles), bottom samples and cores, we can form conceptual models of sediment flux in the nearshore area, and validate them using site-specific measurements of nearshore marine processes. The results of geologic mapping and oceanographic experiments are fed into three-dimensional models that aid us in refining regional sediment budgets and projecting coastal behavior under different scenarios of sea-level rise and increased storminess that will likely accompany global warming. Examples will be presented from recently completed and ongoing studies along the U.S. Atlantic coast, including South Carolina, North Carolina, and Massachusetts. These studies illustrate the importance of a multidisciplinary approach to increase our basic understanding of inner-shelf processes and coastal evolution/behavior. The information provided by these studies supports resource-management decisions, such as fisheries, beach nourishment, and offshore development, and can be used to advance predictive capabilities (i.e., prediction of coastal change) for the coastal planning/engineering community.

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