

Wave Climate and net sediment transport direction along South Cape Beach in Vineyard Sound

Shoreline change, in the form of coastal erosion and deposition, is a major and increasing concern for almost all coastal communities. The net movement of sediment along the coast is the governing process that determines what areas will lose and gain. However, the obstacle to local prediction of sediment motion has been that, for a number of physical and practical reasons, it is very difficult to characterize the complex hydrodynamic environment that exists in the near-shore zone. At the regional scale, though, long-term erosion rates for various sections of the shoreline and geomorphological features such as spits and barrier beaches are believed to be strong indicators of long-term net sediment transport.

For example, to explain many of easterly extending barrier spits along the east-west trending south-facing shoreline of Cape Cod on Vineyard / Nantucket Sounds, the prevailing southwesterly winds are thought to set up a wave climate that forces a net long-shore transport from west to east (Strahler; Oldale). However, there are a number of coastal landform counter examples along this same shoreline (e.g., Waquoit Bay's west-trending Dead Neck). More critically, the wave climate of Vineyard / Nantucket Sounds, either short-term (storm events) or long-term (years), has never been actually calculated to test the hypothesis.

We are now carrying out a small pilot project that is: 1) using available National Buoy Data Center hourly wind records from nearby stations for the period 2001-2008 to hindcast the wave climate in eastern Vineyard Sound that impinges the south-facing three-mile section of barrier beach in front of Waquoit Bay; 2) using these wave climate results to estimate potential long-shore sediment transport and its direction (using a standard coastal engineering model); and 3) comparing these sediment transport estimates with a detailed record of shoreline change along this same three-mile section of beach for the same period (2001-2008) using data from Waquoit Bay NERR's citizen-monitoring Coastwatcher Program (measurements made four times annually at 70+ stations).

The goal of this project is to develop and demonstrate a simple approach for estimating wave-driven long-shore sediment transport along sandy coastlines within small enclosed basins like Nantucket Sound.