American Geophysical Union Fall Meeting
December 1998
San Francisco, CA

Morphologic Length Scales of High Energy Dissipative Beaches

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A regional beach morphology monitoring program, designed to document short to medium-term coastal variability (event - seasonal - decadal scale), is being implemented along the high-energy, meso-tidal beaches of the Columbia River littoral cell. Following the installation of a dense geodetic control network, a nested sampling scheme of detailed three-dimensional surface mapping, cross-shore beach profiles and shoreline change monitoring was initiated in the summer of 1997. Approximately 160 km of U.S. Pacific Northwest shoreline are being examined as part of the Southwest Washington Coastal Erosion Study (Kaminsky *et al*., 1997). Beaches within the littoral cell are highly dissipative, characterized by fine Columbia River sediment, $D_{50} \approx 0.2$ mm, with typical beach slopes between 1:50 and 1:100.

The beach morphology monitoring is conducted via Real Time Kinematic Differential Global Positioning System (RTK-DGPS) surveying techniques. Beach topographic surfaces are generated biannually (to resolve seasonal cycles) at 16 sites, nominally 4-km in length, by obtaining dense three-dimensional beach measurements with a DGPS antennae mounted to a six-wheel drive all-terrain vehicle. Individual measurements are dense enough, O(10 m) spacing, to resolve relatively small scale features such as beach cusps, and exist over large enough alongshore distances to resolve larger scale features such as rip-current embayments and mega-cusps. Cross-shore beach profiles are collected biannually at 47 locations, spaced roughly 3-4 km throughout the coastal corridor, to examine two-dimensional beach change with higher resolution.

Monthly three-dimensional surface maps collected from summer 1997 through summer 1998 at Ocean Shores, WA reveal a highly three-dimensional, rapidly evolving beach. The summer (calm profile) beach surface is characterized by multiple mega-cusps, typically associated with rip current embayments, with dominant alongshore length scales O(400 m). The monthly beach surface time series documents the growth and migration of the mega-cusps towards a winter (storm profile) beach with dominant length scales of approximately 1000 m. These features can maintain their form for several months while moving at rates of approximately 100-200 m/month (3 – 6 m/day). Empirical models relating the seasonal variability of these morphologic features with incident wave conditions are being developed.

Kaminsky, G.M., P. Ruggiero, G. Gelfenbaum, and C. Peterson (1997) "Long term coastal evolution and regional dynamics of a US Pacific Northwest littoral cell," *Proceedings of Coastal Dynamics '97, the International Conference on Coastal Research through Large Scale Experiments,* (pp. 614-623).