SPATIAL VARIATION OF BEACH MORPHOLOGY ALONG COASTAL SOUTH CAROLINA

By

Peter Alexander Slovinsky

MS Thesis Advisor: Dr. George Voulgaris

Coastal Processes & Sediment Dynamics Laboratory
Department of Geological Sciences
University of South Carolina
Columbia, SC 29208

ABSTRACT

South Carolina has a sandy shoreline that extends from Daufuskie Island in the south to Waites Island at the North Carolina border. Hydrodynamic conditions vary along the coast, with a tidally dominated southern portion and a mixed-energy to wave dominated northern portion. Gradients of these forcings, in conjunction with other factors (i.e., ebb-tidal deltas, etc.), control beach morphology along the coast.

A regional analysis of beach profile data was undertaken to define spatial variations of beach morphology and relate these variations to hydrodynamic and morphologic constraints. Mean beach profiles and secondary morphology for each island or stretch of beach were defined using empirical orthogonal functions. Several statistical models were applied to parameterize the profiles, and to determine if these expressions were applicable to South Carolina beaches. A double exponential model developed herein ($h=B_1(1-e^{-k1x})+B_2(1-e^{-k2x})$), provided the best and most consistent representations of mean profile shapes. The expression can successfully represent a variety of beach profile shapes, and may have applicability to coastal engineering projects.

The coast was divided into eight different regions based on trends in mean profile shapes, secondary morphology, and longshore variability of parameters defining beach profile characteristics. Boundaries tended to coincide with changes in morphology (e.g., coastline orientation, tidal inlets, and swashes) and hydrodynamic conditions (longshore wave power). Such changes appeared to correspond well with changes in parameter values used to describe the mean profile shapes.

Several parameters were developed that aid in characterizing beach morphology. The Inlet Proximity (IP) ratio, when related to certain beach characteristics, was found to be a useful tool in defining portions of islands outside the influence of adjacent tidal inlets. The depth of minimal profile change (DMC) was developed to provide a morphology-based estimate of the depth beyond which little profile variation occurs.

November 2001