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Nearshore Impacts of Dredging for Beach Nourishment

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Abstract: A methodology is presented for predicting the impacts of nearshore dredging on shoreline change, using numerical models for waves, currents, and shoreline change. The dredge pit, outside of the surf zone, was assumed to be steady state, but alters waves reaching the surf zone. The methodology accounts for the transformation of directional wave energy spectra due to spatial gradients in both mean currents and bathymetry, wind inputs, and energy dissipation via several mechanisms. The wave transformation model SWAN (Simulating Waves Nearshore) was used to simulate waves at Folly Island, S.C., which served as the test case. Wave model results were validated using short-term field measurements at three locations. Longer-term (1 year) simulations were driven using hindcast wave and wind data. Velocity fields and tidal stages were simulated using the hydrodynamic model Environmental Fluid Dynamics Code in two-dimensional mode, after calibrating with field measurements. Wave model results were used to estimate longshore sediment transport and shoreline change due to longshore gradients of the longshore sediment transport rate. Empirical sediment transport coefficients were chosen to match model results to measured beach volume changes derived from beach profile data. The calibrated model was then used to predict impacts of dredging on long-term shoreline change. Results reproduced observed trends of erosion and accretion along approximately 90% of the shoreline.

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