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Navy Nearshore Ocean Prediction Systems

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Abstract

Knowledge of the nearshore ocean environment is important for naval operations, including military and humanitarian applications. The models used by the US Navy for predicting waves and circulation in the coastal regions are presented here. The wave model of choice for coastal regions is the Simulating WAVes Nearshore (SWAN) model, which predicts wave energy as a function of frequency and direction. SWAN is forced by winds as well as waves at the offshore boundaries. For coastal circulation, Delft3D, composed of a number of different modules that can be coupled with each other, is presently used. Most applications for daily operational predictions use only the Delft3D-FLOW module, which predicts currents, mean water levels, temperature, and salinity. Inputs to the model include winds, tides, general ocean circulation, waves, daily river discharges, temperature, and salinity. Delft3D-FLOW is coupled with the Delft3D-WAVE module for areas where wave effects are of importance. A four-dimensional variational assimilation (4DVar) system based on SWAN, the SWANFAR system, is under development for nearshore wave predictions. It will improve wave predictions by using regional wave observations. We present several case studies that illustrate the validation and diverse applications of these models. All operational systems are run at the Naval Oceanographic Office.

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