SWAN WAVE MODEL SENSITIVITY TO VARIATION IN MODEL FORMULATION

Meg Palmsten, University of South Florida

ABSTRACT

Delft University of Technology s SWAN (Simulating Waves Nearshore) Model was implemented to study wave propagation on the inner continental shelf as part of the Southwest Washington Coastal Erosion Study. SWAN has significant flexibility. The modeler may often choose amongst several formulations in describing the physical processes influencing waves or may also choose not to model a process at all. The purpose of this study was to document a suite of over one hundred model runs performed to measure the sensitivity of SWAN to choice of formulation (bottom friction, whitecapping, linear and exponential wave growth), use of triads, form of boundary conditions, wind speed and direction, directional and frequency resolution, and method of quadruplet computation. Three wave states corresponding to waves observed off the Washington coast in fall 1998 were used in this study.

Results were analyzed by calculating mean percent difference in wave height and mean difference in wave direction over the study area and in three smaller coastal areas bounded by the 15 m and the 40 m isobaths. Significant wave height was roughly 2 percent greater in coastal areas when no model wind was present than when a light following wind was blowing. Turning whitecapping off increased significant wave height up to 7 percent in coastal areas and 2-4 percent over the study area. Wave height varied up to 4 percent due to choice of wave growth term. Order of magnitude change in wave growth term coefficients resulted in 3 percent difference in wave height. Model results showed up to a 5 percent difference in wave height in coastal areas due to choice of bottom friction formulation and changes in bottom friction coefficients. Differing the form of boundary conditions resulted in 0-3 percent changes in wave height. Variation in directional and frequency resolution resulted in differences in wave height of less than 2 percent. SWAN wave height was extremely insensitive to several parameters: use of a linear wave growth term, quadruplet numerics, and changes in triad coefficients. SWAN wave direction usually varied less than 3 degrees due to changes in model parameters. The results of this suite of SWAN model runs will be compared with field data to improve wave modeling on Washington s inner continental shelf.