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Wind-Waves Forecast Using SWAN with Data Driven Technique

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A quick and efficient wind-waves simulation model is constructed by combining the strengths of physics-based model SWAN (Simulating Waves Nearshore) and a data driven technique, ANN (Artificial Neural Network). SWAN [1] is a comprehensive numerical model developed for computing random, short-crested waves in coastal areas. It takes into account the shallow water effects, i.e., depth-induced wave breakings and triad wave-wave interactions. However, SWAN application to large domains is known to be computationally expensive and time consuming. This characteristic makes it unfavorable for quick operational wave forecasting tasks. In this study a data driven technique, ANN, is proposed to complement the strengths and improve the efficiency of SWAN. ANN is trained to mimic SWAN's wind-waves forecast ability in Singapore Strait. SWAN is first run with various typical scenarios (wind speeds and directions) to obtain resulting wave characteristics; and then the vast information is passed to ANN to extract underlying patterns. Both training and validation results show exceptionally good agreements between ANN simulated and SWAN computed wave characteristics. Through the application of ANN, the research extends efficiency of SWAN for swift operational wind-waves forecasting. Keywords: Wind-waves operational forecast; SWAN; Data driven technique; ANN. References[1] L. H. Holthuijsen, N. Booij, and R. C. Ris et al., SWAN Cycle III version 40.11 (2000), Delft University of Technology, http://fluidmechanics. tudelft. nl/ swan/index. htm.