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Simulation of wave characteristics in Caspian Sea using SWAN

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Abstract

Wave parameters are necessary for many marine and coastal operations. Different methods such as empirical, numerical and soft computing have been developed for wave hindcasting. In this study, SWAN model has been used for the prediction of wave parameters in Caspian Sea. The comparison of obtained results with the Anzali buoy measurements, indicated that this global modeling yields an accurate estimation of wave characteristics.

1. introduction

Wave characteristics are one of the most important factors in design of coastal and marine structures. For the prediction of wave parameters, different methods have been developed such as empirical methods are mostly accurate in simple and limited cases (e.g. SPM [1], SMB [2], CEM [3] and Donelan [4]), numerical models (e.g. Mike 21 [5], Wavewatch III [6], WAM [7] and SWAN [8]) and soft computing (e.g. Artificial Neural Network, Fuzzy Inference Systems, Decision Trees and Genetic Programming). Numerical models not only show higher accuracy, but also require high speed computers [9]. Until now different numerical models have been investigated for wave hindcasting ([10], [11], [12], [13], [14] and [15]). In this study SWAN was used for wave modeling in Caspian Sea. For calibration and verification of the model buoy measurements were used.

2. Study area and evaluation of the data

Wind is very important in the wave modeling and its quality affects the accuracy of the wave modeling. In this study, QuikSCAT wind data have a spatial resolution of 25 kilometer and temporal resolution of 12 hour, were used. The recorded wave data by Anzali buoy at 49.52° E and 37.549° N were used for calibration and verification of the model. The study area, Caspian Sea, has a laterally-prolonged scale of about 800 kilometer in the west-east direction between 47° E and 55° E. Its width is about 1000 kilometer in the north-south direction between 36.5° N and 47° N. The bathymetry data was obtained from GEOphysical DAta System (GEODAS). Figure 1 shows the considered computational area in the Caspian Sea.