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Identification of wind fields for wave modeling near Qatar

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Due to the development of coastal and offshore infrastructure in and around the Arabian Gulf, a large semi-enclosed sea, knowledge of met-ocean factors like prevailing wind systems, wind generated waves, and currents etc. are of great importance. Primarily it is important to identify the wind fields that are used as forcing functions for wave and circulation models for hindcasting and forecasting purposes. The present study investigates the effects of using two sources of wind-fields on the modeling of wind-waves in the Arabian Gulf, in particular near the coastal regions of Qatar. Two wind sources are considered here, those obtained from ECMWF and those generated by us using the WRF model. The wave model SWAN was first forced with the 6 hourly ERA Interim daily winds (from ECMWF) having spatial resolution of 0.125°. For the second option, wind fields were generated by us using the mesoscale wind model (WRF) with a high spatial resolution (0.1°) at every 30 minute intervals. The simulations were carried out for a period of two months (7th October-7th December, 2015) during which measurements were available from two moored buoys (deployed and operated by the Qatar Meteorological Department), one in the north of Qatar ("Qatar North", in water depth of 58.7 m) and other in the south ("Shiraouh Island", in water depth of 16.64 m). This period included a high-sea event on 11-12th of October, recorded by the two buoys where the significant wave heights (Hs) reached as high as 2.9 m (i.e. max wave height H $\sim$ 5.22 m) and 1.9 (max wave height H $\sim$ 3.4 m) respectively. Model results were compared with the data for this period. The scatter index (SI) of the Hs simulated using the WRF wind fields and the observed Hs was found to be about 30% and 32% for the two buoys (total period). The observed Hs were generally reproduced but there was consistent underestimation. (Maximum 27% for the high-sea event). For the Hs obtained with ERA interim wind fields, the underestimation was of the order of 50% (on average) for the entire duration. The study therefore suggests the use of a mesoscale weather forecasting model such as WRF, for deriving the wind fields for a large but marginal semi-enclosed sea where small scale phenomena dominate, and when used as forcing in the wave model, it provides wave-climate predictions with less error.