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An evaluation of a high-resolution operational wave forecasting system in the Adriatic Sea

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Abstract

The SWAN (Simulating Waves Nearshore) wave model using wind inputs generated by the ALADIN 8-km, operational high-resolution, atmospheric model was run in real-time to provide surface waves forecast for the semi-enclosed Adriatic Sea in support of the â€œDynamics of the Adriatic in Real-Timeâ€ (DART) field experiments. Together with predictions from other wave and wind models, the successful prediction of a high sea-state event by this model led to a real-time shifting of planned operations while at sea, allowing five ADCP moorings to be deployed just before a bora storm and associated storm waves arrived. The model was also able to simulate the spatial gradients in significant wave height observed by in-situ and remote-sensing measurements for a particular sirocco storm case study, providing an additional perspective in aiding interpretation of the model output of features. To further quantify prediction skill, the

wave forecast performance over a 12-month period was evaluated against in-situ and altimeter measurements over the region. Correlation coefficients between forecast and in-situ measured significant wave heights were from 0.82 to 0.91 for the 24-h forecast and from 0.78 to 0.88 for the 48-h forecast. However, best-fit slope comparisons with in-situ wave data at five coastal locations show the forecast wave heights were underpredicted by 10% to 30%. Best-fit slope comparisons between modeled wind speeds, U_{10}, and significant wave heights, H_s, and altimeter-derived measurements show that model U_{10} was about 4% underpredicted, but H_s was underpredicted by an average of 30%. The underprediction of SWAN H_s has a very significant location-dependent geographical variation ranging from 10% to over 50%. In addition, the wave model comparison with altimeter H_s shows a broad region of scatter index exceeding 0.4 along and offshore of the central Croatian coast. Elsewhere the scatter index is generally around 0.3. Compared to previous studies we found that using higher-resolution wind forcing with realistic orography decreased the U_{10} underestimation bias, but the magnitude of H_s underestimation bias did not correspondingly decrease, suggesting that wave model dynamics or windâ€“wave coupling deserves further investigation.

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Keywords

Adriatic Sea; Atmospheric forcing; Model validation; Operational forecasting; Wave forecasting; Wave modeling

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