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Wind and wave modelling in the Red Sea

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While wind and wave modelling is nowadays quite satisfactory in the open oceans, problems are still present in the enclosed seas, the more so the smaller the basin and the more complicated the surrounding orography. Run by a continuous flow of vessels of different size, the Red Sea is an extreme example in this respect, especially because of its long and narrow shape. This makes the local conditions very sensitive to even minor changes in the direction of the driving wind fields. As part of developing a forecasting system for Red Sea, we have explored the regional modelling accuracy by hindcasting one year of local wind and waves. The global NCEP wind fields have been downscaled using a high resolution version of the non-hydrostatic WRF meteorological model. Due to the scarcity of locally measuring instruments, the validation has been done versus altimeter and scatterometer data. While the general pattern is reasonably reproduced, the results clearly show the sensitivity of the nested model results to even minor errors in the driving global model. The sensitivity is enhanced by the bordering orography, whose channelling effect is strictly depending on minor differences in the original distribution of the isobars. Depending on the season, opposite wind regimes, one directed to South-East, the other one to North-West, are present and may coexist in the most northerly and southerly parts of the Red Sea. Where the two regimes meet, the wave spectra can be rather complicated and, again, crucially dependent on small details of the driving wind fields. We discuss the general problems and the achievable accuracy of both wind and wave modelling.