



Satellite data for systematic validation of wave model results in the Black Sea

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The Black Sea is with regard to the availability of traditional in situ wave measurements recorded by usual wave buoys a data sparse semi-enclosed sea. The only possibility for systematic validations of wave model results in such a regional area is the use of satellite data. In the frame of the COPERNICUS Marine Evolution System for the Black Sea that requires wave predictions, the third-generation spectral wave model WAM is used. The operational system is demonstrated based on four years' systematic comparisons with satellite data. The aim of this investigation was to answer two questions. Is the wave model able to provide a reliable description of the wave conditions in the Black Sea and are the satellite measurements suitable for validation purposes on such a regional scale? Detailed comparisons between measured data and computed model results for the Black Sea including yearly statistics have been done for about 300 satellite overflights per year. The results discussed the different verification schemes needed to review the forecasting skills of the operational system. The good agreement between measured and modeled data supports the expectation that the wave model provides reasonable results and that the satellite data is of good quality and offer an appropriate validation alternative to buoy measurements. This is the required step towards further use of those satellite data for assimilation into the wave fields to improve the wave predictions. Additional support for the good quality of the wave predictions is provided by comparisons between ADCP measurements that are available for a short time period in February 2012 and the corresponding model results at a location near the Bulgarian coast in the western Black Sea. Sensitivity tests with different wave model options and different driving wind fields have been done which identify the appropriate model configuration that provides the best wave predictions. In addition to the comparisons between measured satellite data and wave model data, the time variability of different computed integrated wave parameters have been analysed and although during a four years period there are no trends to detect, interesting features as different predominant wave directions for the western and eastern part of the Black Sea could be verified. Finally with regard to a coupling of the wave model with a hydrodynamic model new parameters have been calculated, amongst others the wave-induced velocity or Stokes drift that may contribute significantly to the total mean surface currents in the ocean.