



Assimilation of satellite data to increase the reliability of the wave predictions in the Black Sea

Liliana Rusu and Alina Raileanu

“Dunarea de Jos” University of Galati, Romania, Department of Mechanical Engineering (lrusu@ugal.ro)

In order to improve the wave predictions provided in the Black Sea by a wave modelling system based on the SWAN (Simulating Waves Nearshore) spectral model, a technique for assimilating the satellite data has been implemented and evaluated. For this purpose, an approach based on the Optimal Interpolation method has been considered and its results are discussed in the present work. As a first step, SWAN model simulations have been carried out for a 5-year interval (2004-2008). The assimilation is made in terms of the significant wave height (H_s) for each 24 hours considering data coming from 4 satellites (ERS-2, JASON-1, JASON-2, GEOSAT Follow-On). Subsequently, data provided by two other satellites (ENVISAT and TOPEX) are used for validations.

To assess the improvement brought in the model predictions by the assimilation scheme, a comparison has been performed between the model results with and without assimilation. The statistical parameters evaluated are: bias, mean absolute error, RMS error, scatter index, correlation coefficient and symmetric slope. The results show that the data assimilation procedure induces a significant improvement of the statistical parameters (lower values for bias, errors and scatter index and values closer to the unity of the correlation coefficient and for the symmetric slope). It was found also that an important factor in improving the wave predictions is represented by the value of the correlation length accounted for the H_s prediction errors (L_{max}). Previous studies indicate for this length a value around four degrees in the vicinity of 45 degrees latitude (which corresponds also to the basin of the Black Sea). This value was first considered in the assimilation technique. On the other hand, taking also into account the fact that in the Black Sea the wind-sea waves are dominant, lower values for the parameter L_{max} were tested as well and it seems that the most appropriate value for this parameter is between three and four degrees.

The results provided by the present work show that the data assimilation approach implemented leads to a significant enhancement of the reliability of the numerical wave predictions. The work is still ongoing, and besides the fact that all the satellites are now considered for assimilation, the scheme is also adapted in order to be able to provide forecast products.

Keywords: Black Sea, wave models, SWAN, data assimilation, satellite data.

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