

# WIND WAVE FORECAST IN THE ADRIATIC SEA – A TOOL FOR BETTER TIDAL FORECAST IN THE NORTHERN ADRIATIC SEA

Luciana Bertotti <sup>1\*</sup>, Paolo Canestrelli <sup>2</sup>, Luigi Cavaleri <sup>1</sup> and Franca Pastore <sup>2</sup>  
<sup>1</sup> Institute of Marine Sciences, Venice, Italy - luciana.bertotti@ismar.cnr.it  
<sup>2</sup> Istituzione Centro Previsioni e Segnalazioni Maree, Venice, Italy

## Abstract

The present tidal forecast system in Venice has been operational for more than 20 years. The present average accuracy is of better than ten cm for forecasts up to 6-hours. In highly severe storms wind waves contribute substantially to the tide level in the Venice lagoon via the set-up effect. Therefore ISMAR and IPSM are jointly managing an operational wave forecast system for the Adriatic Sea. The driving is given by the surface winds produced by ECMWF as input to the WAM wave model with 1/12 degree resolution. The results are validated using the data collected at the ISMAR oceanographic tower, 15 km offshore the Venice lagoon

**Keywords:** *Models, Adriatic Sea*

## The area of interest

Large scale wave modelling are openly available. For instance, the European Centre for Medium-Range Weather Forecasts (ECMWF, Reading, U.K.) provides ten day forecast worldwide. However, these large models, while very accurate in the open oceans, fail to provide comparably accurate results in the inner seas, like the Mediterranean or, at greater extent, the Adriatic Sea. This led to the development of systems as NETTUNO, a combined product of the Italian National Meteorological Service and ISMAR, and HENETUS, here described, a system devoted to the Adriatic Sea [1] with the aim, among others, of improving the tidal forecast in the Northern Adriatic Sea. The grid used for our purposes has 1/12 degree resolution. A higher resolution can be used in front of the Venice lagoon to take into proper account the coastal effects of breaking waves (see below).

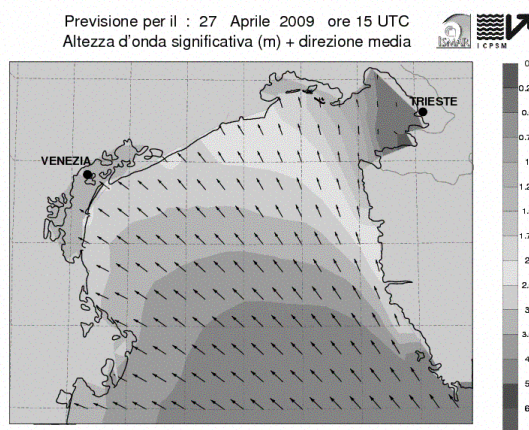


Fig. 1. Wave field forecast in the Northern Adriatic Sea

## Input information

The input to the model is the daily forecast provided by ECMWF. However, the ECMWF winds on the Adriatic are strongly underestimated. Therefore, before passing them to the wave model, the wind speeds are corrected with an objective procedure based on long term comparison between the ECMWF winds and the extensive data available from the QuikSCAT scatterometer [2].

## Modelling

The WAM wave model [3] is used for the daily application. WAM has been the first advanced, so-called third-generation wave model. The ECMWF wind data are daily received by ICPSM and passed to ISMAR. The wave results are available early in the day and transferred immediately to ICPSM. Tidal forecast by ICPSM has been operational for more than 20 years with ever increasing accuracy, presently between 5 and 10 cm at 6-hour distance. However, to avoid an underestimate during the most severe sirocco storms associated to set-up, wave effect on coastal sea level needs to be taken into account.

## Model results

The output of the model is available both as numbers and graphics. The

graphical output for the most northerly part of the Adriatic Sea is shown in Figure 1. It represents a strong event of sirocco happened in April 2009. The use of shading plus the arrow pointing to wave height and direction provides a clear and intuitive representation of the situation. These maps are available at 3-hour intervals for the next 72 hours. These forecasts in front of the Venice coastline are verified by the data recorded at the ISMAR oceanographic tower. The statistics is shown in Figure 2, showing the results for the later analysis (AN) and for the forecasts at 1 (F1), 2 (F2) and 3 (F3) day distance. The comparison shows clearly the high quality of the forecasts, more than enough for any practical use.

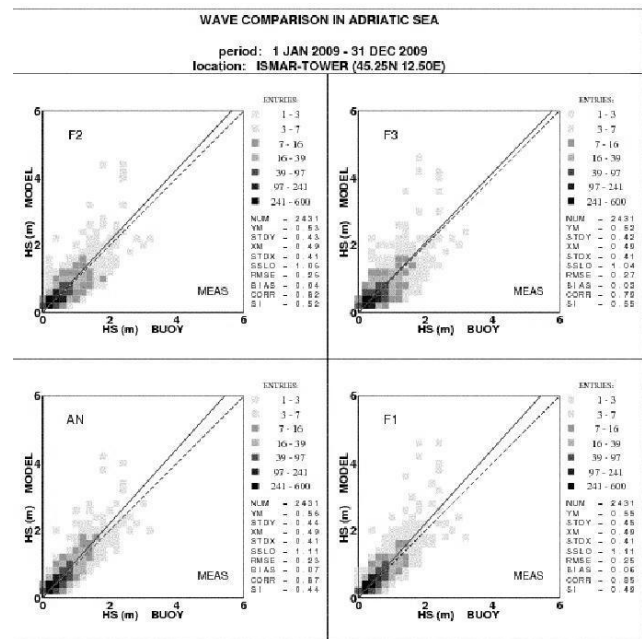


Fig. 2. Comparison between analysis and forecast wave heights versus the measured values on the "Aqua Alta" ISMAR oceanographic tower.

## References

- 1 - Bertotti L. and Cavaleri L., 2009. Wind and wave prediction in the Adriatic Sea, *J.Mar.Sc.*(available online).
- 2 - Cavaleri L and Bertotti L., 1997, In search of the correct wind and wave fields in a minor basin, *Mont.Weat.Rev.*, 125, 8, 1964-1975.
- 3 - Komen G.J, Cavaleri L., Donelan M., Hasselmann K., Hasselmann S. and Janssen P.A.E.M., 1994. Dynamics and Modelling of Ocean Waves, Cambridge Univ. Press, 532pp.