

Marine Meteorology at DMN

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Introduction

Operational Marine activity at DMN:

- Operational wave forecasting
- Prediction of tides
- Oil spill drift forecasting
- Container drift forecasting

Operational wave forecasting

- VAG model
- WAM model (North Atlantic version)
- WAM model (nested version)
- Coastal model (Lâayoune version)

VAG model

- VAG is a second generation model. Wave energy is discretized in 18 directions and 12 frequencies. The global version has a resolution of $1^\circ \times 1^\circ$.
- VAG is used operationally by Météo-France. We receive, at DMN, output maps of wave parameters over Atlantic and Mediterranean sea. In addition outputs are received on selected points.

WAM model (WAVEWATCH III)

- This third generation model is implemented at DMN since 2001.
- The model accounts for growth of waves due to wind input, dissipation of energy by breaking waves, and transfer of energy between spectral components by non-linear interactions.
- The model takes into account some shallow water aspects such as bottom friction.
- Wave energy is discretized in 24 directions and 25 frequencies.
- The model is implemented in two versions: North Atlantic and nested version which covers Atlantic waters near Morocco and Mediterranean sea.
- Bathymetry is extracted from ETOPO 5 database.
- The model is run twice daily from 00 UTC and 12 UTC data times.
- Each run starts from the wave conditions of 12 hours earlier.
- The North Atlantic version has a broad resolution of $1^\circ \times 1^\circ$. Winds are provided, each six hours, by the ARPEGE model with a spatial resolution of $1^\circ \times 1^\circ$. The model forecast is run to four days ahead.
- WAM nested version has a spatial resolution of $0.25^\circ \times 0.25^\circ$. Winds are provided, each three hours, by the Moroccan NORAF model at a spatial resolution of $0.25^\circ \times 0.25^\circ$. This version covers Atlantic waters near Morocco and the entire Mediterranean sea. The model forecast is run to three days ahead.

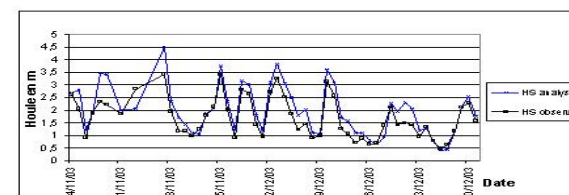
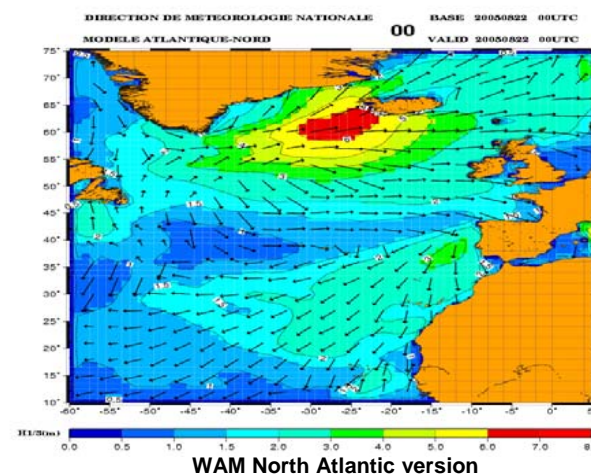
Coastal model (SWAN)

- SWAN is a third generation model adapted to shallow water.
- Two versions are implemented at Lâayoune and Mohammedia with a resolution of $0.016^\circ \times 0.0166^\circ$.
- Bathymetry is extracted from GEBCO database.
- Winds are provided, each three hours, by the Moroccan ALBACHIR model at $0.15^\circ \times 0.15^\circ$ resolution.

References

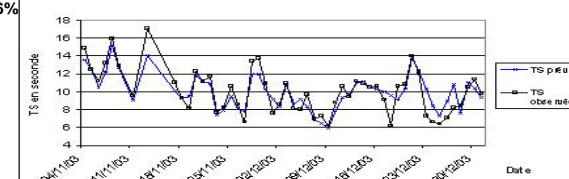
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- ECMWF WAVE-MODEL Documentation: Part VI. Downloaded from the ECMWF web site.
- Hendrik L. Tolman, 1999: User manual and system documentation of wavewatch. Downloaded from polar.ncep.noaa.gov web site.
- Hendrik L. Tolman, 1999: User manual and system documentation of wavewatch.

Wave model implementations

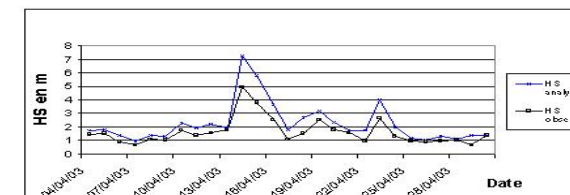
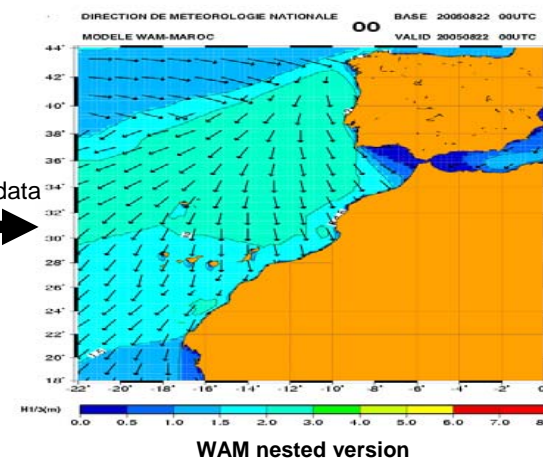


RMSE=46cm

COR=96%

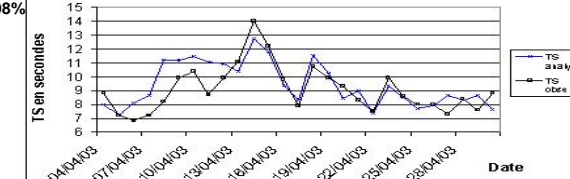


Comparison between observed and modelled (from WAM nested version 24 H forecasts) significant wave heights (top panel) and wave periods (bottom panel) for Mohammedia site. Observed Data are provided by ODEP buoy moored near Mohammedia.

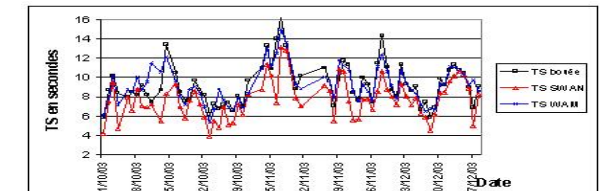
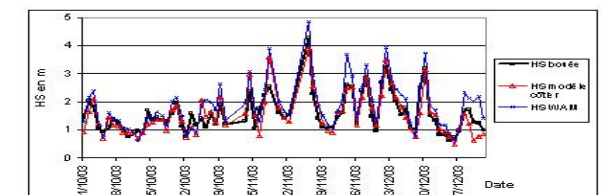
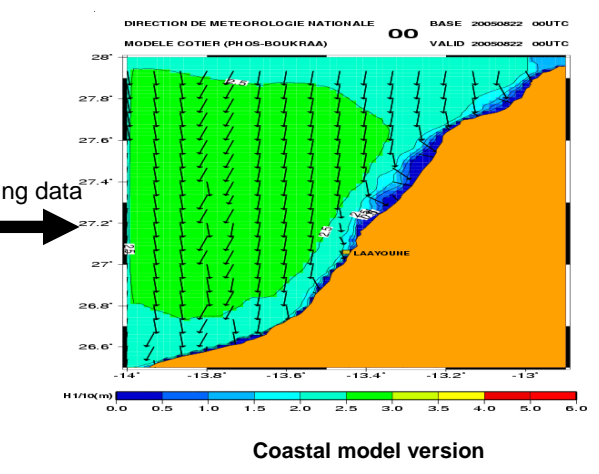


RMSE=67cm

COR=98%



Comparison between observed and modelled (from WAM nested version 24 H forecasts) significant wave heights (top panel) and wave periods (bottom panel) for Casablanca site. Observed Data are provided by DPCM buoy moored near Casablanca.



Comparison between observed and modelled (from 24 H forecasts) significant wave heights (top panel) and wave periods (bottom panel) for Mohammedia site. Model values are provided by coastal and operational WAM model. Observed Data are provided by ODEP buoy moored near Mohammedia.

Oil spill drift forecasting

- DMN is a member of the "Commission Nationale de lutte contre la pollution marine accidentelle" charged to deal with marine pollution. In this context, DMN is charged to provide the necessary meteorological assistance to help authorities to fight against pollution.
- The assistance must include meteorological forecasts over concerned zones in addition to maps of oil spill drift forecasts.
- The Météo-France model MOTHY is implemented at DMN since January 2005.
- MOTHY contains a hydrodynamic ocean model developed to represent as good as possible ocean surface current using surface winds, tide and permanent currents. This oceanic model is combined with an oil spill/container model (see figure below) to simulate the evolution of oil pollution/container.
- The implemented version accounts only on wind fields to estimate surface currents.
- We plan, in near future, to use tides and permanent currents.
- Currents can be derived from climatology, hydrodynamic models (such as MERCATOR) or from satellites.
- For tides we are being to adapt NAO tide model to our domain.

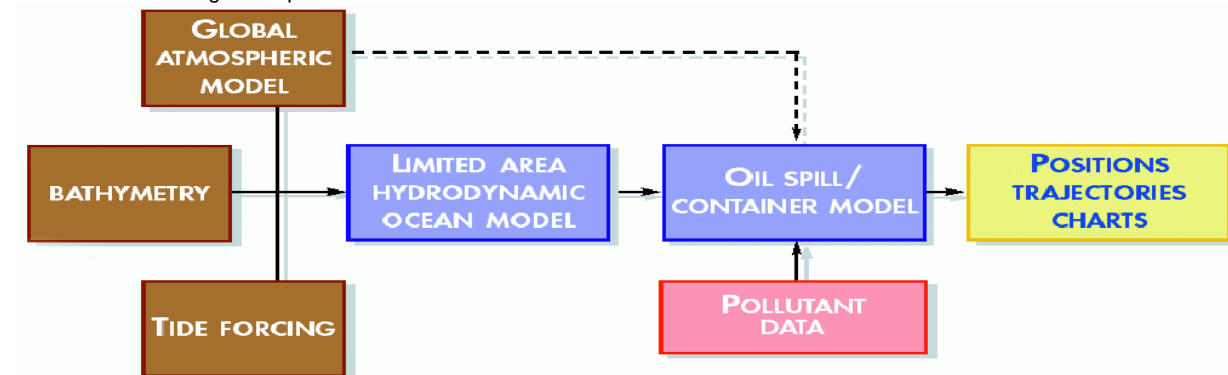


Diagram of MOTHY model (extracted from Météo-France)