The MSC50 Wind and Wave Hindcast of the North Atlantic Ocean

Abstract

The AES40 wind and wave hindcast (Swail et al., 1998) has been shown to be a good description of the wave climatology of the North Atlantic Ocean (Caries et al., 2004). This hindcast has been widely used in wave climate engineering studies for the North Atlantic, particularly for the areas offshore the east coast of Canada. It has been recently been extended to 50 years in length (Cox et al., 2004). The present project, the MSC50 hindcast takes advantage of all of the high quality inputs to the AES40, and introduces some important enhancements, particularly for the Canadian east coast offshore regions. These include a finer grid, 0.5 degrees coarse over the entire North Atlantic, and 0.1 degrees fine over the northwest Atlantic, shallow water effects in the fine mesh area, better bathymetry and sea ice information, increased use of scatterometer wind data, and storm track information. The initial period of coverage for the MSC50 is July 1954 to June 2004.

Project Methodology

MSC50 consists of two new wave model grids that define the North Atlantic basin. The coarse model is a 0.5 degree implementation of the UNIWA model over the same domain as the AES40 hindcast (0 to 75N, 82W to 20E). Total numbers of active grid points in this model are 18,637 (compared to 9023 for the AES40 model). This model will be run in deep-mode (no shallow water effects) and applied 3G-52 physics (same as AES40). The GROW global model provided spectral inputs along the equator. The goal of the coarse model is twofold: 1) to provide boundary spectra to the high-resolution nest and 2) to increase the resolution of the basin-scale hindcast from the original AES40’s 0.625 by 0.833 degree implementation.

The second wave model applied in this hindcast is the fine 0.1-degree implementation of the UNIWA model. The domain of this model was developed in keeping with the requirements of MSC and selecting spectral boundaries between the coarse and fine models in deep-water. This model was run in shallow mode and applies 3G-52 physics. The total number of active points in this model is 18541. Bathymetry for this model was provided from the GEBCO 1-arc second digital database.

Improvements to the AES40 also include additional reanalysis of the winds on the fine grid domain. These improvements apply QUIKSCAT data to reduce systematic bias in the source NCEP/NCAR reanalysis fields and will be dynamically updated in the wave model daily using 5-day running median ice concentration data derived from DMSP satellite data (in the later periods).

Validation and Preliminary Results

Validation of the MSC50 models for the period January-December 2002 was performed using adjusted TOPEX altimeter measurements and buoy data collected by NOAA and MEDS. This buoy list incorporates locations previously ignored in the AES40 hindcast due to either their water depth or proximity to the shoreline. Overall the hindcast is very similar, the MSC06 does have a smaller overall bias and lower scatter index for wave height. Overall bias for the MSC50 hindcast vs. TOPEX measurements is just 1 cm. A time series comparison at 44251 (Figure 3.3) shows several events over-estimated by the AES40 hindcast that are better predicted in the MSC50. Similar differences are seen at buoys 44255 and 44528. A comparison of TOPEX wave bias over the basin shows the MSC50 hindcast generally in better agreement. However, it should be noted that the validation set of TOPEX observations have been box-averaged to a 1/4 degree grid that is closer to the resolution of the AES40 model.

Selected Publications


