

# Technical Procedures Bulletin

Series No. 426

Subject:  
Ocean  
Surface  
Waves

Program Requirements and Development Division,

Silver Spring, Md. 20910

**SIGNIFICANT CHANGES FROM LAST  
BULLETIN ON THIS SUBJECT #388**

July 17, 1995  
W/NMC21:HSC

This bulletin, prepared by Dr. H. S. Chen of the Marine Prediction Branch, Development Division, National Meteorological Center, describes automated ocean wave guidance for deep water provided in both graphic and alphanumeric form. This guidance was implemented on October 12, 1994.

The new ocean wave guidance incorporates the changes in bulletins and graphics that have been implemented since TPB No. 388 came out. More importantly, the second generation wave model (NOW model), which was used to compute the wave spectra, has been replaced by a third generation model (NOAA/WAM) which explicitly computes nonlinear wave-wave interactions and places no artificial limitations on wave growth or decay.

The bulletins and graphics of the new guidance follow the same formats shown in TPB No. 388, except for the following differences:

- (1) The new wave frequency (period) values and their corresponding bandwidth are different from those in TPB No. 388. The number of new wave frequencies is 25 (compared with 15 for the NOW model).
- (2) In the new guidance, the mean wave direction and mean wave period are used. This is because these parameters are more stable and are closer to what an observer reports than those previously used.
- (3) There are fewer alphanumeric bulletins on the 1200 UTC cycle than the 0000 UTC cycle because of limitations on AFOS and agreements reached between the NWS Eastern and Western Regional Headquarters and the NWS National Headquarters.

The ocean wave guidance will continue to be generated twice daily based on the 0000 and 1200 UTC cycles of the Aviation run of the Global Spectral Atmospheric Model but using data supplied by the NOAA/WAM.

Technical Procedures Bulletin No. 388 is now operationally obsolete.

  
Joseph R. Bocchieri  
Chief, Services Evaluation Branch





# OCEAN SURFACE WAVES<sup>1</sup>

by H. S. Chen

## 1. INTRODUCTION

Since it was implemented on October 12, 1994, the NOAA version of the Wave Model (WAM) (hereafter referred to as the NOAA/WAM) replaced the NOAA Ocean Wave (NOW) model which was developed from Greenwood et al (1985) as the National Meteorological Center (NMC) global wave model.

During the last five decades, wind wave forecasts have improved significantly from the empirical approaches based on Sverdrup and Munk (1947) and Bretschneider (1958) to the spectral approaches based on the radiative transport equation (e.g. SWAMP Group 1985). At present, the most advanced spectral model for research and forecast is the so-called third generation<sup>2</sup> wave model of which the WAM is an example (WAMDI Group 1988). The Ocean Products Center (OPC) has continuously made systematic efforts to test and develop models based on prediction accuracy, computational efficiency and sound wave dynamics, and to employ them to produce operational forecasts. The NOAA/WAM is a third generation spectral wave model. In contrast the NOW model is a second generation<sup>3</sup> spectral wave model.

This TPB describes the NOAA/WAM briefly and the wave guidance products which are being disseminated. This guidance consists of significant wave height,  $H_s$ , which combines sea and swell; mean wave direction; mean wave period; and directional wave spectra at selected grid points. Guidance is available in both graphic and alphanumeric form. The reader is referred to *World Meteorological Organization (WMO) Report No.702* (1988) for wave definitions, measurements and modeling.

The bulletins and graphics of the new guidance follow the same formats shown in TPB No. 388 (Esteva and Kidwell 1990), except for the following differences:

- (1) The new wave frequency (period) values and their corresponding bandwidth are different from those in TPB No. 388. The number of new wave frequencies is 25 (compared with 15 for the NOW model).
- (2) In the new guidance, the mean wave direction and mean wave period are used. This is because these parameters are more stable and are closer to what an observer reports than those previously used.
- (3) There are fewer alphanumeric bulletins on the 1200 UTC cycle than the 0000 UTC cycle because of limitations on AFOS and agreements reached between the NWS Eastern and Western Regional and the NWS National Headquarters.

---

<sup>1</sup>OPC Contribution No. 92

<sup>2</sup>A third generation wave model uses the most updated wave dynamics in wave generation, wave dissipation, and nonlinear energy transfer with no limitation on wave growth.

<sup>3</sup>A second generation wave model uses dynamics in wave generation, but the nonlinear energy transfer mechanism is oversimplified, and the wave growth is artificially limited by the Joint North Sea Wave Project (JONSWAP) spectrum.