Highlights

Introduction

KNMI has been active in the field of maritime meteorology since its establishment in 1854. Ocean waves generated by wind are a typical maritime meteorological phenomenon. In the Second World War it became apparent that detailed knowledge of ocean waves is essential for both military and civilian operations. For instance, ship routing services became available based on wave forecasting. KNMI was also involved in this from 1960 until 1988.

The closure of the Suez Canal in 1967 stimulated the use of very large crude carriers, sailing around Africa from the Middle East to Western Europe. The draught of such ships is close to the water depth in the southern North Sea on the way to Rotterdam. For this reason a channel was dredged in the shallow approaches of Rotterdam harbour. The passage through this so called Eurochannel determines a fixed course of a deep-draught ship for some time, making her vulnerable for long-period waves from northerly directions with periods of the order of the rolling period of the vessel. The only way of observing and predicting this kind of swell is in terms of the wave spectrum: even when some risk criterion has been exceeded – e.g. low-frequency wave height greater than 0.5 metres, the associated wave steepness is too small for visual observation. On the other hand, the swell components are clearly visible in spectral presentations of digitised measurements. In 1968, real-time presentation of wave spectra was not yet available because of the limited capacity of computers. Nevertheless, ocean wave research at that time - e.g. JONSWAP 1) was successful in paving the way to spectral wave models, which are needed for predicting low-frequency swell. Starting around 1970 with relatively simple manual methods based on spectral modelling, KNMI at present is using NEZWAM which is a North Sea version of the internationally well-known WAM 2) model.

Objectives

Until recently, a group of marine forecasters was situated in Hook of Holland, at an office of Rijkswaterstaat which is the agency in the Netherlands responsible for wave observations in the North Sea, see Figure 1 3). Real-time presentation of wave spectra was available directly from the database of the measuring network in the North Sea. Due to several changes in the operational service both at KNMI and Rijkswaterstaat the site at Hook of Holland was closed, and another way of presenting observed wave spectra as a tool for the marine forecasters in De Bilt was needed. In addition to this logistic reason, also the present state of technology has made it relatively easy to display NEZWAM spectra together with simultaneous spectra from observations.

Figure 1. Wave measuring network operated by Rijkswaterstaat 3)
A web-oriented presentation system has been developed, of which a few examples are shown here. One of the options is to display forecasted model spectra, see Figure 2. A similar presentation of the observations only is also available, with a polar representation of the full directional wave spectrum. This requires a two-dimensional (frequency, direction) spectrum, which is determined from the heave spectrum, mean direction and directional spread using the Cauchy distribution function, see Figure 3.

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Results
A web-oriented presentation system has been developed, of which a few examples are shown here. One of the options is to display forecasted model spectra, see Figure 2. A similar presentation of the observations only is also available, with a polar representation of the spectrum. This requires a two-dimensional (frequency, direction) spectrum, which is determined from the heave spectrum, mean direction and directional spread using the Cauchy distribution function, see Figure 3.

Outlook
The present status of this presentation tool is still ‘experimental’. The system is to be evaluated by operational marine forecasters. On the basis of their feedback, decisions can be made on future operational use.

1) Hasselmann, K., et al., 1973, Measurements of wind-wave growth and swell decay during the Joint North Sea Wave Project (JONSWAP), DHZ, Reihe A(8°), nr.12.
3) From: www.actuelewaternlodulenig/kaart.html (Rijkswaterstaat)