

ROGUE WAVES 2004

ABSTRACT

On the shape of large waves in the central and southern North Sea

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Within the past two decades, a large amount of super carriers have been lost at sea. In some cases the losses are likely to be related to severe weather conditions. "Freak" or "rogue" waves are sometimes mentioned as probable cause. These terms are used to point at individual waves of exceptional wave height or abnormal shape. And it is, in particular, their shape that is of great importance for the design and operation of ships and offshore structures, as it can lead to significant impact damages. The present paper provides results of deterministic analysis concerning wave front steepness and horizontal asymmetry that was carried out on data collected at the Ekofisk field, central North Sea (operated by ConocoPhillips) and at several locations off the Belgian coast during a period of 6 months.

The Belgian data are collected from different locations and water depth off the Belgian coast, using non-directional buoys, operated by the Ministry of the Flemish Community. Wave records have been recorded continuously at the sample frequency of 2 Hz since January 2003. The Ekofisk data analysed here consist of one-dimensional time series of wave profile, also collected at a sampling frequency of 2 Hz. Data from a Waverider buoy and two down looking lasers are used.

Time domain parameters are calculated using a zero down-crossing analysis over a time period of 20 minutes. Concern is taken on the quality control of the data, since shape parameters are quite dependent on how small variations on larger waves are handled. Shape parameters during extreme conditions are compared to average values, and variations from finite to infinite water depth are demonstrated. Recent work (i.e. Olagnon and Magnusson, 2004) indicate that extremes occur due to changes on smaller time scales than 20 minutes, so variations of shape parameters over smaller time scales are also analysed here. Results on i.e. horizontal asymmetry are compared to literature (Olagnon and Krogstad, 1998, Myrhaug and Kjeldsen, 1986, Stansell et al., 2003).

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Stansell P., Wolfram J., Zachary S., 2003: "Horizontal asymmetry and steepness distribution for wind-driven ocean waves from severe storms". Applied Ocean Research 2003; 25, pp137-55