Rogue waves and extreme events in measured time-series

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Abstract. We report on the wave time-series data used in the MAXWAVE project, with sample time series and statistics of wave height, crest height, and trough depth. Data are included from the Ekofisk and Draupner oil fields, and from Belgian coastal waters. As well as extreme value analysis, wavelet analysis has been were performed. Studies were also made of buoy time series transformed by quasi-Lagrangian correction of the buoy motion, and of laser time series propagated to other locations with up to 220 m separation from the original measurement location using linear and nonlinear techniques.

The main conclusions of the study are as follows:

1. The extreme waves observed do not have an unusual shape: they tend to have sharp crests and round troughs, with a pronounced crest:trough asymmetry.
2. The statistics of individual wave height, crest height, and trough depth, are generally in agreement with Rayleigh or Weibull distributions, although particularly extreme events such as the Draupner 1995 New Year wave are highly unusual according to the normally-accepted Gaussian and non-Gaussian statistical models.
3. The wavelet analysis method can be useful for detecting 'groupiness' and individual large waves.
4. Analysis of the use of the quasi-Lagrangian correction method on Waverider time series for the Stenfjell case indicates that this method is insufficient to transform observational data into time series whose extreme values of crest height and trough depth are equivalent to observations using Eulerian measurement techniques.
5. 'Propagation' of wave observations to hypothetical locations different from where the wave measurements are made, in order to evaluate the risk of extreme waves larger than those actually observed, may be possible, but further study is required to determine the statistical reliability of the linear and nonlinear methods proposed.