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Discussions

Interactive comment on "Evaluation of extreme wave probability on the basis of long-term data analysis" *by* Kirill Bulgakov et al.

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1st comment from Referee

If I understand the paper of Chalikov and Bulgakov 2017 correctly than are the eta in the definition of H-tilde (H-tile = eta/H_s) on line 35 op p.2 and the wave height h in formula 3 on page 3 the same variable. However in the paper it looks like h is the wave height (crest to through or through to crest) and eta is the height above mean water level and h is the wave height. As the authors state clearly in the introduction on p.2 (lines 12-24), the statistical properties of trough-to-crest wave height are quite different from those of the wave height above mean level. Please clarify and correct where necessary.

Authors' response

h- is the wave height above mean level. It was said on lines 25-26 of p.25 of primary text. To clarify it fully, the addition in the text was made:

Authors' change in manuscript

In paper (Chalikov and Bulgakov, 2017) an algorithm for estimation of cumulative probability of waves exceeding a specific value of wave height above mean level (P(h) and h below) was developed using long-term data on Hs.

2nd comment from Referee

The authors do not mention the limitations of formula 2 (on page 2). It is not clear to me, if differences in directional distribution, multi-peak spectra (wind-sea and or 1 or more swell components) are taken into account. As far as I can see in a quick scan of the Chalikov and Bulgakov 2017 paper, equation (2) is only valid for a JONSWAP spectrum with a typical directional distribution and a typical peak enhancement factor. The authors should elaborate on this and make this clear in the introduction and/or discussion of the paper. In my opinion, the current analysis is not the ultimate answer to the probability of extreme waves, which does not mean that it does not contribute to the discussion. Therefore it is important to state the limitations of the current analysis.

Authors' response

Approximation of cumulative probability (formula 2) was made for spectrum, which is similar to JONSWAP spectrum, but somewhat different since JONSWAP spectrum was used as initial condition for 3-D model of potential wave. and spectrum of wave field was changing a little during the numerical experiments. Initial spectrum undergoes the nonlinear transformation: it obtains a discrete nature (Chalikov et al, 2014) and changes the angle distribution. Naturally, it is impossible to take into account a great variety of situations and it is unclear how it can be done. However it is widely accepted that JONSWAP spectrum reflects the main features of wind wave field. It is quite likely

that for realistic statistics of extreme wave the wave field should contain sufficiently large number of modes, propagating in relatively narrow range of angles. It is unlikely that swell (if it is not too high) can influence the wave statistics. However, this problem deserves further investigation many models

Authors' change in manuscript

Abstract. A method of calculation of wind wave height probability based on the significant wave height probability is described.

Chalikov and Bulgakov (2017) suggested the algorithm for estimation of cumulative probability of waves exceeding a specific value h (P(h) below) using climate data on significant wave height . The algorithm was based on results of 3-D model of potential waves. The model used spectral definitions of fields, finite differences for vertical derivatives calculation, fourth-order Runge–Kutta scheme for time integration. Fourier resolution is 256X64 wave number, resolution in physical space is 1024*256 (more detail in (Chalikov et al., 2014)). (more detail in (Chalikov et al., 2014)). The calculations were done for 350 units of nondimensional time, i.e., for 70,000 time steps. The initial conditions were generated on basic JONSWAP spectrum. Totally 50 experiments were made (more detail in (Chalikov and Bulgakov, 2017)).

Currently, this approximation is considered as universal for wind waves fields where cases of freak waves are most likely. Waves of other types of spectrum (swells) have a small steepness and don't influence on extreme wave generation.

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