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THE DEPENDENCE OF SEA SURFACE ROUGHNESS ON WIND-WAVES

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The wave age dependency of the non-dimensional sea surface roughness (also called Charnock parameter) is investigated with data from the new field measurement program at Rødsand in the Danish Baltic Sea. An increasing Charnock parameter with inverse wave age is found, which can be described by a power law relation of the form proposed by Johnson et al. (1998) and others.
Friction velocity is a common quantity in both Charnock parameter and wave age. Thus self-correlation effects are unavoidable in the relation between them. The significance of self-correlation is investigated by employing an artificial 'data' set with randomised wave parameters. It is found that self-correlation severely influences the relation. For the Rødsand data set the difference between real and randomised 'data' was found to be within the measurement uncertainty. By using a small sub-set of the data it was found that the importance of self-correlation increases for a narrower range of wave age values. This agrees with the conclusion of Johnson et al. (1998), that due to the scatter and self-correlation problems the coefficients of the power law relation can only be obtained from the analysis of an aggregated data set with a wide wave age range combining measurements from several sites.
The dependency between wave age and sea roughness has been discussed extensively in the literature with different and sometimes conflicting results. A wide range of coefficients has been found for the power law relation between Charnock parameter and wave age for different data sets. It is shown that self-correlation contributes to such differences, since it depends on the range of wave age values present in the data sets. Also, data are often selected for rough flow conditions with the Reynolds roughness number. It is shown that for data sets with large scatter this can lead to misleading results of the relation of wave age and Charnock parameter. Two different methods to overcome this problem are presented.

Johnson, H.K., J. Højstrup, H.J. Vested, S.E. Larsen, 1998: On the dependence of sea surface roughness on wind waves. *J. Phys. Oceanogr.*, **28**, 1702-1716.