



## Long-term statistics of wind wave parameters for the Gulf of Gdańsk over years 1958–2001

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The information required for modern coastal management and engineering design needs a statistical characterisation of the impact of storms on the shoreline or coastal structure. The impact is related to the combined influence of waves and surges, which are the hydraulic parameter inputs into functional relationships that describe the loading and response of the structure. Changes in global weather climate will naturally influence storm climate, which will induce consequential changes in the severity and frequency of regional coastal extremes.

For the first time, the long-term stochastic properties of wind wave field over the Gulf of Gdańsk, located in the southern Baltic Sea, are being analysed based on modelled data spanning almost half a century. Those properties cover not only basic statistics of significant wave height  $H_S$  including its maximum value and 95<sup>th</sup> and 99<sup>th</sup> percentiles, as well as the mean and peak periods  $T_z$  and  $T_p$ , respectively, and mean direction of wave propagation  $\theta_0$ , associated with extreme  $H_S$ . In addition, the analysis of spatiotemporal distribution of significant steepness is performed. We also examine whether it remains, with changing wind patterns, in an interval between 1/16 and 1/20 that is typical for stormy waves (see Tucker & Pitt 2001).

The wave steepness is a very important wave parameter as it may be used to determine the sea roughness and the Charnock parameter, which play an important role in physics of momentum exchange between the atmosphere and the ocean, and thus in ocean, weather and climate modelling. The scaling of the sea roughness, based on the wave steepness, is one of two basic approaches to this important scientific problem. There is an alternative scaling based on wave-age parameter, which is also examined in this work.

The temporal distribution of storminess was looked at as well, including relation to wind direction and presence of trends visible in analysed period 1958-2001. Those trends are analysed against the atmospheric indices, such as NAO, since there is a possibility of a positive correlation (see Cieřlikiewicz et al, 2005).

The modelled data, used in this study, is the result of an EU-funded project HIPOCAS (Cieřlikiewicz et al. 2005, Cieřlikiewicz & Paplińska-Swempel 2008), which generated long-term statistical information about, among others, wind waves over the Baltic Sea for years 1958–2001. An important aim of this study is to determine the most characteristic features of extreme storms that had significant impact on the Gulf of Gdańsk during the last half-century.

### References

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