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Assessment of long-term changes in modelled significant wave steepness based on HIPOCAS and COPERNICUS wind wave data for southern Baltic and the Gulf of Gdańsk

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With high variability in wind patterns over the Baltic Sea, statistical characteristic of prevailing wave conditions at chosen sites are essential. Most authors agree that no long-term trend in wind speed and wave characteristics was present in this area during the second half of the XXth century. However, in some regions, probably in relation with higher frequency of the positive NAO phase around 1980s and 1990s, there seem to be an increase in wind speed and wave height in that period. Most analysis of wave climate focuses separately on significant wave height (H_s) and mean wave period (T_z). In this work, we direct our efforts to look at their relation in the form of significant wave steepness.

This parameter, used to describe state of the sea, is particularly important in the context of ship accidents caused by extreme waves. It may also be used to determine the sea roughness and the Charnock parameter, both playing an important role in physics of momentum exchange between the atmosphere and the ocean, and thus in ocean and climate modelling.

This work aims to analyse spatiotemporal variability of the significant steepness in the Gulf of Gdańsk using long-term modelled wave data for the Baltic sea as well as to examine differences between model and measurement in the southern Baltic. The data, modelled for years 1958–2001, has been produced within the EU-funded project HIPOCAS, and is described by Cieślikiewicz et al. (2005). In this project, based on wind velocity fields hindcast produced with the REMO model (Feser et al., 2001), wave data have been generated with wave model WAM in a rectangular grid in spherical rotated coordinates with the resolution 5'×5' and 1-hour time step.

In comparing steepness generated by the model with the one from measurements taken at the southern Baltic and acquired through the COPERNICUS website, a similarity between both data sets was found. As for the spatiotemporal distribution of steepness in the Gulf of Gdańsk, some "noise" resulting from the presence of smaller waves due to sheltering effect of Hel Peninsula and proximity to land is clearly visible in joint distribution of H_s and T_z. The wave steepness for waves of different return periods as well as the joint probability distribution of H_s and T_z has also been computed and will be presented at the conference.

This study has been conducted using EU Copernicus Marine Service Information. Numerical computations were carried out at the Academic Computer Centre (TASK) in Gdańsk.

References

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