# ASSESSMENT OF THE BLACK SEA WAVE CLIMATE EVOLUTION OVER LAST 37 YEARS

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**Abstract**
In this paper the analysis of storm activity in the Black sea over the past 37 years with the help of mathematical modeling is presented. It is shown that the wave activity was experiencing long-period oscillations, and throughout the whole basin this variability is most evident in the Western part of the sea. Also, the current trends in the wave energy potential changing for the entire Black sea are shown.

*Keywords: Waves, Black Sea, Models*

The purpose of this study is the analysis of storm activity in the Black sea, and the identification of climate trends on interannual fluctuations of wave energy. The main method of investigation is mathematical modeling. The spectral wave model, DHI MIKE SW is used [2]. The atmospheric pressure and the horizontal components of wind speed, obtained from the dataset of global atmospheric reanalysis ERA-Interim over the period 1979 to 2015 are used as atmospheric forcing fields. Spatial resolution in latitude and longitude is 0.25 degrees, the time step is 3 hours. The model is verified according to all available direct instrumental and satellite observations of wind wave parameters [1]. Output estimated parameters of the model, the spatial distribution of wave heights (significant and maximum), mean periods, periods of maximum range, direction, excitement, power, wind waves and two-dimensional (frequency-directional) spectra of wind waves. The vast array of data, consisting of spatial fields of the calculated parameters of wind waves in the Black sea with a time step of 1 hour and covering a period of 37 years (from 1979 to 2015) is obtained.
In comparison with other waters of the World ocean wave activity of the Black sea is rather moderate. Despite the fact that in certain storms, the wind wave power can reach 1000 kW/m, the average indicators of the wave power can be about 8-9 kW/m in the Western part of the sea and 2-3 in the Eastern division.
Fig. 1 shows that long-period variability of the wave power field is most pronounced in the Western part of the sea becomes apparent as quasidecades cycles of a sharp increasing in wave activity. The Eastern part of the sea is more homogeneous and is characterized by minor fluctuations.

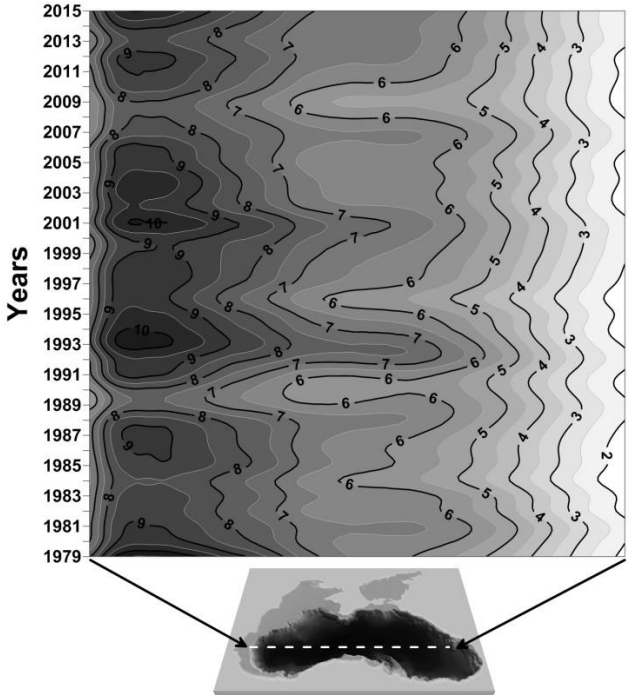


Fig. 1. The meridional crosssection of the average annual wind wave power (in kW per meter of wave front) for the period from 1979 to 2015

Fig. 2 illustrates the spatial heterogeneity of the climate wave field variability, which shows the normalized difference (in percent) wave capacity, averaged over the last decade, to an average wave power for the period 1979-2015.

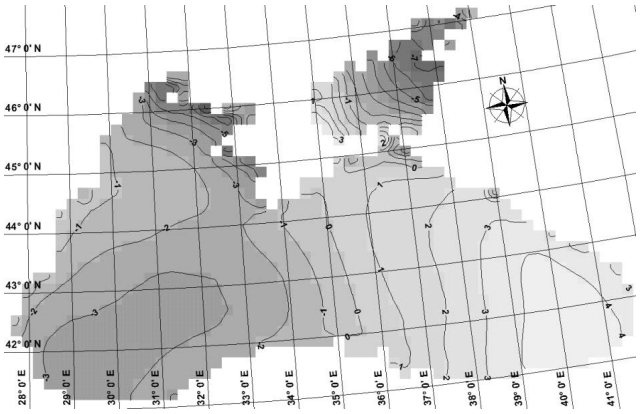


Fig. 2. The normalized difference (in percent) wave power, averaged over the last decade (2006-2015), the average wave power for the period 1979-2015

It is possible to note the increase in the contribution to the total wave energy from storms of moderate from the East. The contribution of the winter seasons most significant in the Western regions, in the Eastern part of the Black sea in the framework of the annual cycle increases the influence of the summer months.
The Western part of the sea, being the most stormy, the least studied by means of direct instrumental observations. Our calculations show that in this area it is not so rare situation that lead to the development of storms with significant wave heights of about 8-10 meters.
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## References

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