

ASSESSMENT OF LONG-TERM WIND AND WAVE TRENDS IN THE BLACK SEA

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INTRODUCTION

Wind and wave climate variability are among the main factors for marine and coastal planners, coastal structure and infrastructure design, marine transport development, safe navigation as well as ecology. The long-term change of wind and wave climate is triggered by global climate change. The general tendency of annual and multi-annual averages of wind and wave parameters on the Black Sea is investigated in previous studies (Divinsky and Kosyan, 2017, Islek et al 2020). In this study, the possible impact of the climate change on the wind and wave parameters, and the long-term variability of the wind and wave parameters over the Black Sea are discussed.

MATERIALS AND METHODS

In this study, two different wind data were used to reveal the climate anomalies over the Black Sea, which lies between 40°-47°N and 26°-42°E, covering the years 1979-2018. The ECMWF ERA-Interim and NCEP/CFRSR data with respective spatial resolution of 0.25° and 0.5° and temporal resolution of 6-hr and 1-hr were used. To obtain wave parameters, MIKE 21 SW (Spectral Wave) model (DHI, 2008), with flexible and unstructured meshes, was calibrated and validated with the data measured at different parts of the Black Sea in terms of the significant wave height H_s and the mean wave period T_m . The main wind and wave systems are identified by using several statistical techniques to explain their variability throughout the study area.

RESULTS AND DISCUSSION

Figure 1 depicts the mean changes between 1979 and 2018 based on the ERA-Interim data. The variation in the eastern and western Black Sea is somewhat different in all the change graphs. Wind speed, maximum wave height, significant wave height, and mean wave period tend to quite stable in the western Black Sea, while they tend to increase in the eastern part (especially in the northeastern part). However, the intensity of these parameters in the western Black Sea is significantly greater than those of the eastern part. The Eastern Black Sea has been exposed to more change than the other parts from 1979 to 2018. Especially, in the northeastern Black Sea (around the coast of Sochi, Russia), the wind and wave parameters tend to increase (note the positive values in Figure 1). The western Black Sea has remained more stable. Energetic wind and wave conditions with low variability make these regions a proper candidate for wind/wave energy harvesting. Northern (the coasts of Mykolaiv, Ukraine) and southwestern parts (the coasts of Istanbul, Turkey) have relatively low decreasing trends in the intensity of wind and wave parameters (see the negative values in Figure 1). Pronounced difference between east and west reflects the spatiotemporal variability over the Black Sea. The

climatic variability increases from the west to the east. Therefore, the effects of climate change seem to be more intense in the southeastern Black Sea.

A more detailed investigation of the variability of these parameters as well as the evaluation of the NCEP/CFRSR data are in progress.

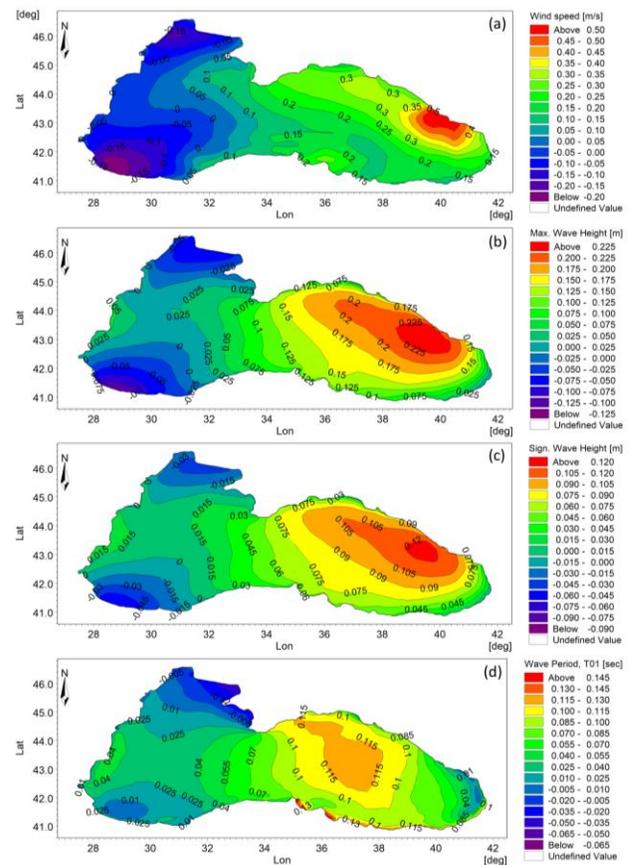


Figure 1 - The long-term trends of wind and wave parameters in the 40-year over the Black Sea (a) Wind speed, (b) Maximum wave height, (c) Significant wave height, (d) Mean wave period. Positive and negative values indicate the mean increase and decrease, respectively.

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