Storms Dynamics in the Black Sea in the Context of the Climate Changes

Authors : Eugen Rusu

Abstract : The objective of the work proposed is to perform an analysis of the wave conditions in the Black Sea basin. This is especially focused on the spatial and temporal occurrences and on the dynamics of the most extreme storms in the context of the climate changes. A numerical modelling system, based on the spectral phase averaged wave model SWAN, has been implemented and validated against both in situ measurements and remotely sensed data, all along the sea. Moreover, a successive correction method for the assimilation of the satellite data has been associated with the wave modelling system. This is based on the optimal interpolation of the satellite data. Previous studies show that the process of data assimilation improves considerably the reliability of the results provided by the modelling system. This especially concerns the most sensitive cases from the point of view of the accuracy of the wave predictions, as the extreme storm situations are. Following this numerical approach, it has to be highlighted that the results provided by the wave modelling system above described are in general in line with those provided by some similar wave prediction systems implemented in enclosed or semi-enclosed sea basins. Simulations of this wave modelling system with data assimilation have been performed for the 30-year period 1987-2016. Considering this database, the next step was to analyze the intensity and the dynamics of the higher storms encountered in this period. According to the data resulted from the model simulations, the western side of the sea is considerably more energetic than the rest of the basin. In this western region, regular strong storms provide usually significant wave heights greater than 8m. This may lead to maximum wave heights even greater than 15m. Such regular strong storms may occur several times in one year, usually in the wintertime, or in late autumn, and it can be noticed that their frequency becomes higher in the last decade. As regards the case of the most extreme storms, significant wave heights greater than 10m and maximum wave heights close to 20m (and even greater) may occur. Such extreme storms, which in the past were noticed only once in four or five years, are more recent to be faced almost every year in the Black Sea, and this seems to be a consequence of the climate changes. The analysis performed included also the dynamics of the monthly and annual significant wave height maxima as well as the identification of the most probable spatial and temporal occurrences of the extreme storm events. Finally, it can be concluded that the present work provides valuable information related to the characteristics of the storm conditions and on their dynamics in the Black Sea. This environment is currently subjected to high navigation traffic and intense offshore and nearshore activities and the strong storms that systematically occur may produce accidents with very serious consequences.

1

Keywords : Black Sea, extreme storms, SWAN simulations, waves

Conference Title : ICESCC 2017 : International Conference on Earth Science and Climate Change

Conference Location : Rome, Italy

Conference Dates : December 11-12, 2017