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Long-term variability of extreme storm occurrence and intensity in the western Black Sea

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The study considers potential changes in the storm occurrence and intensity over the western Black Sea through analysis of long term series of wind and wave conditions simulated with relatively high resolution. It is a result of coupling of atmospheric and wave models and spans period of more than 62 years (1948-2009). The wave hindcast is driven with the global reanalysis data produced by ECMWF and NCEP/NCAR for two locations in the western Black Sea shelf, chosen for different patterns of wave transformation. A series of storms of considerable intensity and/or destructive potential are selected out of the continuous dataset. This is done through application of thresholds for leaving out the weak seas. The thresholds are based on storm impact on the coastal environment and principles for statistical representativeness. The climatic variability of occurrence and intensity of the selected extreme events is analyzed using different criteria such as number of stormy days, wind speed and wave height extremes. Of a particular interest are the mean wave energy per storm season and specific storm energy. These are found to be more indicative for comprehension of the storm pattern variability. Trends of wind velocity are considered too. Major types of storms are outlined with respect to phases of growth, full development and decay. The variability of their occurrence is traced out.
Despite of the overall tendency for storminess decrease, there are no incontestable evidences corroborating a marked reduction of the storm intensity. While the total number of stormy hours diminishes, an increase of the mean wave energy is discernible. This is found to be caused by a change of the storm pattern: storms with short growth stage, energetic stage of full development and fast decay are more frequently observed. This storm type still provides significant energy input in the coastal zone and is able of producing considerable morphological impact, including damages. Such storms develop abruptly; therefore, timely prediction and mitigation of hazard effects become more complex to tackle with.