



Extratropical cyclones as a driver of wind wave extremes over the last century

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We analyse decadal scale variability of the characteristics of extratropical cyclones in the North Atlantic – European sector using results of numerical storm tracking of NCEP-NCAR and ERA-40 reanalyses for the last 50-60 years and of 20 century reanalysis for the last 100 years. Cyclone activity is characterized by cyclone numbers and frequencies as well as by numerous characteristics of the cyclone life cycle such as propagation velocities, deepening rates and intensity. For the off-shore European regions we performed a composite analysis to quantify conditions associated with the most extreme cyclones. There has been identified growing number of moderately deep and extreme cyclones which affect Northern Europe during the last decades. In the next step we associated leading modes of cyclone activity and characteristics of the cyclone life cycle with the parameters of extreme wind waves in the off-shore European regions. Wind wave characteristics were derived from 100-year archive of visual wind wave observations. Extreme wave statistics were quantified through the application of IVD and POT approaches to the analysis of probability density functions. Joint consideration of cyclone activity and wind wave characteristics allowed for the identification of wind wave patterns associated with extreme cyclones and for accurate capturing of synoptic patterns leading to extreme storms in the North Atlantic including off-shore European regions. Some insights on the impact of wind wave storminess on European storm surges are provided.