EGU21-16438
https://doi.org/10.5194/egusphere-egu21-16438
EGU General Assembly 2021

Investigation of long-term changes of coastal wave directionality patterns and their connections with NAO climatic index: UK case study

Antonia Chatzirodou

The effects of climate change are at the spotlight of scientific research. In coastal science the effects of sea-level rise (SLR) on coastal areas, mainly as a result of melting of ice sheets and thermal volume expansion consist an intensive area of research. As well the changing ocean wave field due to greenhouse effect and interactions of atmospheric processes is under investigation. Researchers have placed focus on significant wave height changes and their associated impacts on the coastal environment, with evidence suggesting that the number, intensity and location of storms will change. It is suggested that equal attention should be placed on the mean wave direction changes and the effects that these changes may have on the coastlines and surrounding coastal infrastructure. Following that, this study investigated the changes in wave direction data since 1979 to 2019 covering 40 years' time period at 11 offshore UK coastal locations. The selected locations lie close to WaveNet, Cefas' strategic wave monitoring network points for the UK. Stakeholders use the data to provide advice and guidance to all involved parties including responders and communities about coastal flood risk. On a longer timescale the data provide evidence to coastal engineers and scientists of the wave climate change patterns and the implications this may have on coastal structures and flood defences design. Based on this initiative, this study investigated UK offshore wave climate changes by performing a longer timescale analysis of changes of wave direction patterns. The wave direction data were taken from ECMWF ERA5 6-hour hind cast data catalogue which covers 40 years' time period from 1797-2019 (Copernicus Climate Change Service (C3S), 2017). MATLAB software coding was primarily utilized for data processing and analyses. Following that, inferential statistics were applied to map inter-decadal statistical changes in wave direction patterns, suggesting that wave directionality patterns have presented changes at 11 offshore locations tested. The connections of wave directions with North Atlantic Oscillation (NAO) Climatic Index are currently investigated through use of machine learning approaches. The results of this study can be confidently used in wave transformation computational models coupled with hydro-morphodynamic models to downscale offshore wave direction changes to UK coastal areas. This can help identify susceptible coasts to offshore wave climate change. Susceptibility is regarded in form of coastal erosion and accretion rates changes as a result of altered offshore wave conditions, which might affect coastal flood risk with potential impacts on critical infrastructure.