EGU22-9869
https://doi.org/10.5194/egusphere-egu22-9869
EGU General Assembly 2022

Space-time statistics of extreme ocean waves in crossing sea conditions during a tropical cyclone

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In recent years, the study of extreme ocean waves has gained considerable interest and several theoretical approaches have been developed for their statistical prediction. However, a full understanding of the main mechanisms responsible for the occurrence of extreme waves has not yet been reached in the relatively common case of a crossing sea, where a local wind sea system coexists with a system of swell. In this context, we investigate how the space-time extreme-value statistics of realistic crossing sea states differs from the statistics of the corresponding short-crested wind sea and long-crested swell partitions during tropical cyclone Kong Rey (2018) in the Northwestern Pacific Ocean (Yellow Sea and East China Sea). The investigation is carried out using an ensemble of numerical simulations obtained from a phase-resolving wave model based on the high-order spectral method (HOSM) and focuses on the maximum sea surface elevation (crest height). The reliability of the numerical model outputs has been assessed with space-time measurements of the 3D sea surface elevation field collected from a fixed offshore platform in the area of interest. Our results highlight the different roles that linear and nonlinear effects have in the formation of extreme waves for different combinations of wind sea and swell systems.