



## **Extreme waves from Nortes and climate change in the Gulf of Mexico**

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Extreme ocean waves in the Gulf of Mexico are a result from the incidence of tropical cyclones and anticyclone systems known as Nortes. While the waves derived from tropical cyclones have devastating consequences but a low probability of occurrence, Nortes are a frequent phenomenon producing disruptions of maritime activities during autumn/winter months. In this study we present an assessment of the waves generated by Nortes and the effects of a warming climate. To do so, we first developed a methodology to identify Norte events and classify them according to their effect over the sea state. A new index is proposed to identify events, which was used to identify events in the present and future climates. A third generation wave model was run for each of the events identified in the CFSR reanalysis and the CMIP5 model CNRM-M5 under the RCP 8.5 scenario. Nortes were classified into 5 types, using both principal component analysis and a cluster analysis by k-means over the computed wave power of the individual events. An assessment of the effect of climate change was performed over the different Norte types, which indicated that climate change will result in less frequent events of higher intensity and more frequent mild events. This may provide a relief for coastal and marine operations, in relation to downtimes due to extreme wave conditions, so that the operational design of maritime structures could consider a lower occurrence of extreme events as a result of Nortes. While the results are not conclusive due to the uncertainty imposed by Global Circulation Models, this study provides the methodology to perform the assessment on other models to reduce uncertainty.