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Wave modeling performance using different wind reanalysis

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Despite the importance of wave data for planning, design and management of offshore and onshore resources, the instrumentation of the whole ocean to provide information is not feasible. Therefore, a great deal of effort has been devoted around the world in order to collect historic wave data. In developing countries, as Mexico, the implementation of such monitoring programs is a difficult task. However, with the recent advent of modern computers numerical models allows us both to improve the resolution from the monitoring networks and to provide information on those regions that lack of such instrumentation. The development of third generation (3G) wave models during the last decades has reached a level of definition where wave data derived from such models is highly reliable. With the wind fields being the main driving force, their accuracy has a direct impact on the accuracy of the wave field prediction to the extent that wave models have been used to evaluate wind field data sets. Using historic wind data sets, known as wind reanalysis, historic wave data to be used in projects can be derived. Despite the homogeneity of the analysis technique in wind reanalysis, it is well known that their spatial and temporal resolution will have an effect on the accuracy of wave models. Specifically reproducing extreme wave events, in which wind reanalysis may not provide a satisfactory wind description.
The need for wave data in the coastal zone of Mexico, together with the lack of instrumentation, exemplifies numerical modeling as an ideal tool to provide historic wave data along the coastal area. This work presents the use of three different wind reanalysis (NCEP/NCAR, ERA interim and NARR) in wave modeling of the Gulf of Mexico and Caribbean Sea, as an assessment of the accuracy of wave data during extreme and normal wave events for the 3 wind data sets. The 3G numerical model MIKE 21 SW was used to obtain 3 hourly data sets of 2 simulation periods, 2005 and 2006. The year 2005 was selected as representative of a year characterized by high tropical cyclone activity whereas 2006 as a year with low tropical cyclone activity but with an important presence of synoptic scale events known as Nortes (cold fronts) which generate winds up to 30 ms-1. A statistical evaluation of the resulting wave parameters was performed comparing against historical wave data in the Gulf of Mexico and the Caribbean Sea. The statistical parameters show a good agreement between observed and model results for the 3 reanalysis used. However, Q-Q plots and time series of extreme events revealed the wave model deficiencies to reproduce extreme events using the NCEP data set. A thorough analysis was performed for selected extreme events, where the NARR and ERA interim reanalyses provide accurate hindcast results. A complete discussion of results will be presented.