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Wind gust estimation by combining numerical weather prediction model and statistical post-processing

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The continuous rise of off-shore and near-shore activities as well as the development of structures, such as wind farms and various offshore platforms, requires the employment of state-of-the-art risk assessment techniques. Such analysis is used to set the safety standards and can be characterized as a climatologically oriented approach. Nevertheless, a reliable operational support is also needed in order to minimize cost drawbacks and human danger during the construction and the functioning stage as well as during maintenance activities.
One of the most important parameters for this kind of analysis is the wind speed intensity and variability. A critical measure associated with this variability is the presence and magnitude of wind gusts as estimated in the reference level of 10m. The latter can be attributed to different processes that vary among boundary-layer turbulence, convection activities, mountain waves and wake phenomena.
The purpose of this work is the development of a wind gust forecasting methodology combining a Numerical Weather Prediction model and a dynamical statistical tool based on Kalman filtering. To this end, the parameterization of Wind Gust Estimate method was implemented to function within the framework of the atmospheric model SKIRON/Dust.
The new modeling tool combines the atmospheric model with a statistical local adaptation methodology based on Kalman filters. This has been tested over the offshore west coastline of the United States. The main purpose is to provide a useful tool for wind analysis and prediction and applications related to offshore wind energy (power prediction, operation and maintenance). The results have been evaluated by using observational data from the NOAA's buoy network. As it was found, the predicted output shows a good behavior that is further improved after the local adjustment post-process.