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Wind short-term hourly forecasts at different locations in the Basque Country (Spain)

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In this study, wind zonal (U), meridional (V) and maximum gust hourly forecasts are calculated until 24 hours ahead. The study focuses on three locations of the Basque Country (North of Spain): Bilbao Bizkaia buoy located on the Bay of Biscay, Punta Galea on the coastline and Alegria, an inland location. Three different types of mathematical tools have been used to build the forecasting models: linear regression, analogs and Random Forest (a machine learning algorithm). The results have been compared with persistence (the most obvious forecasting model) and the wind forecasts provided by ERA-Interim at the nearest gridpoint.
In this study, hourly observations from these three different locations are used at 00h and 12h corresponding to the 2007-2014 period. The first half of the records [2007/01/01 00:00 - 2011/02/06 00:00] have been used to train the models and the second one [2011/02/06 12:00 – 2014/12/31 12:00] for testing them.
All the forecasting models have been fed with three types of inputs, i) the last measured observation, ii) the direct forecast by the ERA-Interim numerical weather prediction model at the nearest gridpoint and iii) the Extended Empirical Orthogonal Functions (ExtEOFs) corresponding to several meteorological variables. ExtEOFs have been calculated taking into account reanalysis information of the mentioned numerical model in the chosen domain and the observations during last 24 hours. Models' performance has been evaluated using the square correlation (Rsq) and the RMSE. For models' inter-comparison purposes, all the results have been calculated at a 95% confidence level using bootstrap resampling. The general results indicate that RF tends to perform better than linear regression and analogs models and also better than the plain ERA-Interim forecasts but not overwhelmingly. RF models outperform persistence for predictions beyond 2-4 h ahead. The most influential predictor for predictions between 2-5 h ahead, is the last observation. This indicates that for these short horizons, the system's memory tends to play an important role at making the prediction. For horizons between 6-24 h ahead, the most influential inputs are the ERA-Interim forecasts. ExtEOFs become more influential for medium-range horizons.
It is important to highlight that despite being located at different environments and locations the conclusions mentioned above are valid for the three different locations of this study.