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A hybrid downscaling approach for short-term forecasting offshore surface atmospheric variables in coastal areas

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The estimation of a forecast that provided the short-term atmospheric conditions near coastal areas is a requirement for a wide range of coastal and offshore activities. The offshore activities near to the coast request high resolution over the study area. A dynamical modelling forecast system however for a time horizon of several days and with high spatial resolution requires a high computational effort. To reduce the computational effort a suitable methodology bases on a hybrid downscaling approach (statistical and dynamical) is developed.
In this study we propose a method to obtain a short-term forecasting offshore near-surface atmospheric variables at high spatial resolution, the variables that are estimated are the wind speed at 10 m, air temperature at 2 m and sea level pressure. The study area is the Biscay Marine Energy Platform (BiMEP) that is located 2 kilometers offshore in the north coast of Spain in the Cantabrian sea. The method consists of: (i) application of a data normalization and Principal Component Analysis (PCA) method to atmospheric reanalysis data to get the Principal Components (PCs); (ii) to get the PCs from a global atmospheric forecast using the previously estimated parameters; (iii) to apply the analog method to select the PCs from the atmospheric reanalysis analogous to the PCs from the global atmospheric forecast and calculate the weights and, finally (iv) to apply the selected analogs and weights to a high-resolution atmospheric hindcast database providing a forecast at high-spatial resolution.
The method has been validated with instrumental measurements available in the study area. A calibration is also showed in order to find the optimal number of analogs using standard error metrics. In addition, the skill of the hybrid downscaling is analyzed by comparing against the standard dynamical downscaling using the WRF model.