A41O-1801 Wind prospecting using the Model for Prediction Across Scales with nudging: a sensitivity study

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Abstract

The project of a wind farm requires estimates of the wind resources accessible within the region of interest. For this purpose, typically wind masts are installed to obtain measurements. But such measurements are available only at particular locations, so that for a comprehensive assessment one needs also model simulations to extrapolate measured information. The standard industry tool for such simulations is currently the Weather Research and Forecasting Model (WRF), which allows for high-resolution regional wind estimation by downscaling coarse reanalysis data. WRF does this by means of a nesting strategy, whereby a simulation over a high-resolution rectangular grid located within the target area receives lateral boundary conditions from simulation or analysis data over a similar but low-resolution grid. But this strategy has its limitations: in particular, it is well known that the abrupt boundary transition from high to low resolution can create spurious reflected waves, which may deteriorate results. This limitation is overcome by the Model for Prediction Across Scales (MPAS), whose unstructured mesh permits a smooth resolution transition, which should in principle lead to improved predictions. Further improvement may be achieved by assimilating measurement or reanalysis data into the model to reduce the effect of model error growth. Nevertheless, this procedure can be computationally expensive. Here, we investigate how to obtain both accurate and efficient results with MPAS using nudging, a low-cost and easy-to-implement data assimilation method that slightly perturbs the flow towards some known solution. More specifically, comparing our simulations to observations, we study the sensitivity of MPAS to different grid smoothing and nudging strategies to reveal those that give most accurate and efficient predictions for wind energy applications.

First Author

T

Guilherme L Torres Mendonca

University of Sao Paulo

Max Planck Institute for Meteorology

Author

P

Pedro Peixoto

Universidade de São Paulo

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