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Impact of WRF PBL schemes for renewable energy forecasting in Ireland

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Weather forecasts are widely used by transmission system operators and energy market traders for predicting renewable energy production. Physics paramaterisation schemes in forecast models, especially planetary boundary layer (PBL) schemes, have been shown to influence the skill of wind speed forecasts at wind turbine hub-heights. In this study six PBL schemes within the Weather Research and Forecasting (WRF) model have been compared for renewable energy forecasting in Ireland. These forecasts have been run at 2.25km grid-spacing and driven by ECMWF IFS forecast data for each PBL scheme, as well as a novel adaptive forecasting system with a horiztonal resolution of 750m.

One year of 2.25km forecasts have been compared to mast observations from a selection of wind farms around Ireland, along with surface observations at Irish synoptic weather stations. The 24-48 hour forecast horizon is chosen as this is the most relevant time period for day-ahead energy markets. The overall forecast skill is examined to determine the most accurate PBL scheme for the forecasting of renewable energy output. The ability of the PBL schemes to accurately simulate high impact events, such as wind ramping, are also analysed.

Although a single PBL scheme may have the best overall skill score, previous studies have found that the relative performance of different PBL schemes can vary depending on weather conditions, e.g. atmospheric stability. We therefore propose a forecasting system with adaptive physics, whereby the PBL scheme for a single high-resolution (750m) forecast is dynamically selected based on the recent performance of the 2.25km forecasts. These adaptive forecasts are compared to 750m forecasts run with a static PBL scheme.