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Variations in wind-solar correlations across multiple datasets

Seanie Griffin (0), Conor Sweeney (1), and Frank McDermott (2)

(0) ESIPP, Energy Institute, University College, Dublin, Dublin, Ireland (seanie.griffin@ucdconnect.ie), (1) School of Mathematical Sciences, University College Dublin, Dublin, Ireland (conor.sweeney@ucd.ie), (2) School of Earth Sciences, University College Dublin, Dublin, Ireland (frank.mcdermott@ucd.ie)

Combined wind and solar (PV) power generation has potential to offer a stable supply of energy. This is done to lessen the problem of intermittency by making use of any possible negative correlation between wind speed and solar radiation. Preliminary site assessment for a combination of wind and solar power generation is commonly done by making use of reanalysis data. In this study, two popular reanalysis datasets, ERA-Interim from ECMWF and MERRA2 from NASA, have been compared to wind and pyranometer data from a number of synoptic stations at representative locations around Ireland.

Correlation coefficients are calculated between wind speed and shortwave radiation for reanalysis data and these are compared to the correlations from observational data. These relationships between wind and solar radiation are examined at different timescales, including daily mean values and seasonal variability. For example, correlations in reanalysis during spring of daily mean wind speed and daily mean solar radiation have been found to differ from observed correlations. In this case, reanalysis has a tendency to overestimate the strength of the relationship between wind speed and shortwave radiation, producing a larger negative correlation. The influence of specific weather types, such as wind direction, on the correlation values are also analysed.

Time series analysis is performed to identify the largest differences between reanalysis and observations. These are investigated to identify systematic errors. These errors will be post-processed with the aim to improve the correlations so that they agree better with observations. A WRF-downscaled version of ERA-Interim at 3 km resolution will also be analysed to investigate the effect of using higher resolution data and it's impact on the correlation between wind and solar radiation.