Climate & Weather Modelling for Energy Production

Wednesday 9th December, 2pm

Register here.

As we move towards decarbonisation of our energy system, renewable energy plays an increasingly important role. Wind and solar power will form a large part of our energy mix and it is crucial that we understand these resources and how they relate to energy production. In this webinar we examine different aspects of wind and solar modelling at different timescales presented by three PhD students approaching the end of their projects. Understanding the accuracy of weather forecasting, or the impacts of climate effects on energy production from renewables, is a key aspect of the SFI-funded Energy Systems Integration Partnership Programme (ESIPP).

Presentations

- ***Importance of evaluating forecasts at relevant heights when selecting optimal model setup for wind energy*** - Seánie Griffin, PhD Researcher, ESIPP
- ***Climate change impacts on wind energy in Ireland*** - Eadaoin Doddy, PhD Researcher, ESIPP
- ***Links between solar energy resources in the UK and Ireland and Euro-Atlantic atmospheric pressure patterns: winter VS summer*** - Joao Monteiro Correia, PhD Researcher, ESIPP

Abstracts

Seánie Griffin - Importance of evaluating forecasts at relevant heights when selecting optimal model setup for wind energy

Weather forecast models contain parameterization schemes, which model the physics of small-scale processes such as turbulence. A forecast model can be configured with many different parameterization schemes and a natural inclination would be to use as much data as possible when assessing their performance for your specific application, such as wind power forecasting. Observations of 10m wind speed are often widely available from national weather services and could be used for forecast evaluation. But it has been found that forecast skill for 10m wind speed, whether forecasting deterministically (single-value) or probabilistically (ensemble), is often not representative of forecast skill at hub height from nearby wind farms. Seanie will discuss some results from forecast simulations he has run, using the Weather Research and Forecasting (WRF) model, for day-ahead wind forecasting.

Eadaoin Doddy - Climate change impacts on wind energy in Ireland

Renewable energy generation, including wind power, is increasing globally. However, its dependency on weather means generation may be intermittent by nature. This poses a problem in keeping a consistent balance between energy supply and demand, particularly since demand is also partially dependent on weather. When planning for future energy systems, it is crucial to consider energy supply in conjunction with demand. This is especially true during weather conditions that enhance discrepancies between supply and demand (i.e. high demand and low supply, or vice-versa). Transitioning to energy supply that depends heavily on wind power in a changing climate requires an understanding of how future projections of relevant weather variables translate to both energy supply and demand. Along with the general changes in power generation, long periods of low-power generation have an impact on the smooth running of the power system, as back-up energy supplies may be needed to meet demand. Eadaoin will discuss the duration and frequency of such low-power events in a future climate, using an ensemble of multiple high-resolution climate models under two RCP scenarios for the mid-century (2041-2060) and the late century (2081-2100).

Joao Monteiro Correia - Links between solar energy resources in the UK and Ireland and Euro-Atlantic atmospheric pressure patterns: winter VS summer

Optimal addition of solar power to existing electricity grids should take account of the natural spatiotemporal variability of atmospheric conditions that affect incident short-wave radiation on a range of timescales. Our work to date (Correia et al., 2020) has shown that the previously established linkages between large scale atmospheric teleconnection patterns (e.g. the North Atlantic Oscillation; NAO) and incident solar radiation across Ireland and the UK are strongly modulated by topographic effects in the winter season. By contrast, the controls on this relationship in the summer months seems to be different, with other spatial patterns emerging, probably linked to convective cloud formation over land and the influence of atmospheric aerosols. When better understood, these results will inform the optimal sitting of future solar PV farms, for example to balance output spatially or to reduce capacity factor risks associated with a seasonal dominance of certain teleconnection patterns in some years.

Correia JM, McDermott F, Sweeney C, Doddy E, Griffin S. An investigation of the regional correlation gradients between Euro-Atlantic atmospheric teleconnections and winter solar short wave radiation in northwest Europe. Meteorol Appl. 2020;27:e1892. https://doi.org/10.1002/met.1892

About the speakers

Seanie Griffin is an ESIPP-funded PhD student in Applied and Computational Maths at UCD. His research focuses on the use of the WRF forecast model for day-ahead wind energy forecasting.

Eadaoin Doddy completed a BSc in Climate and Earth System Science from UCD and an MSc in Applied Meteorology from University of Reading. Eadaoin worked for a company specialising in providing weather risk management services to the insurance industry; her main role was the development and implementation of an operational flood forecasting tool. Eadaoin's current research is based on the use of numerical weather prediction models and statistical models to improve forecasts of renewable energy generation and weather-driven electricity demand.

Joao Monteiro Correia is a PhD researcher focussing on climate's influence on renewable energy resources - meaning non-short term energy production (wind and solar) spatial and temporal variability that can be explained or predicted using climate drivers.

For more information on research in these areas visit the ESIPP website at https://esipp.ie/research/climate and https://esipp.ie/research/weather

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