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Predictability assessment of climate predictions within the context of the New European Wind Atlas project (NEWA)

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Introduction

Climate predictions deal with forecasts at different future time scales ranging between: up to one month (sub-seasonal forecast), slightly longer than 1 year (seasonal forecast) and up to 30 years (decadal prediction). Climate predictions have considerably improved during the last decade demonstrating that there is useful information contained with the forecasts that can improve upon the climatological mean, at some spatial and temporal scales (Doblas-Reyes et al., 2013).

Climate predictions don't have useful skill in forecasting on which day a locality will have storms, temperature extremes, frontal passages, and so forth. This is consistent with the rapid drop-off of skill after several days that also affect weather forecast after 5-6 days (Lynch et al., 2014). However, climate predictions have nonetheless some skill in predicting anomalies in the seasonal average of the weather i.e., anomalies of the climate. This skill is present regardless of the daily timing of the major weather events within the period. This level of skill for longer time periods (from weeks, months, seasons to several years) may be useful for sectors impacted by climate variability, such as energy.

Approach

The aim of this work is the identification of the main skill sources in the state-of-the-art climate prediction systems at different scales: sub-seasonal (medium-term predictability), seasonal and decadal (long-term predictability). The first step in the predictability assessment is the comparison of the forecasts with the reanalysis by means of different skill scores, each one developed to capture a particular aspect of the forecast system. The second step is related with the detection of the strength of the relationship between wind speed and its various sources of predictability. These predictability assessments of near surface wind speed will be used to complement the probabilistic model chain developed under the New European Wind Atlas (NEWA) project.

Main Body of abstract

A wind atlas is useful for the planning phase of wind energy development, which can last several years: from strategic spatial planning, to site prospecting, to wind farm design and financing. Detailed and robust information about the characteristics of the wind resource across an area is crucial for the commercial evaluation of a wind farm.

While the energy sector has routinely been using weather forecasts out up to 15 days (Dubus, 2010), beyond this time horizon, climatological data (typically 30-years averages) are used. A common assumption in this method is that future conditions will be similar to past conditions. This assumption entails two inherent shortcomings. The first one is that past conditions can be highly variable, which can make them of limited use when guessing the future. The second one is that climatology cannot predict events which have never happened before, i.e. extreme events, which can be particularly harmful and whose prediction is of special interest for stakeholders. Our knowledge of climatology is based on a finite sample of past events. This sample is limited in time, and it doesn't need to be fully representative of what can happen. Moreover, a climatological approach does not take into account changes in atmospheric dynamics, such as those caused by climate change. Climate change may render past conditions useless for predicting future events, as they may no longer hold true.

Until now, the uncertainty of how winds could vary over future time-scales has not been addressed. This creates a risk to the profitability and cash-flow of project stakeholders and grid operators, both of whom increasingly rely on robust predictions of wind power to drive down costs and increase certainty. Wind availability, and its variability over time is thought to be the same overall each year, but in practice this is often not the case; variation in wind regimes from one month, season, year or decade to the next can result in power generation that is considerably lower, or higher than anticipated. The objective of this work is to help decision maker to answer the question: what can they expect on the use of wind forecast at different time horizons? How predictable the wind resource is at the site of interest?

Conclusions

Following several European-funded projects, state-of-the-art climate science and technology can now minimise the uncertainty and risk of future wind resource variability and extremes, by seamlessly predicting wind speeds over monthly-to-decadal time-scales (1 month to 30 years).

Learning objectives

This work will illustrate the value of climate predictions. Improved forecasting beyond the first two weeks of renewable energy power generation can improve the strategic and operational management of wind power during the pre- and post-construction phases.

References:

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