SESSION: (A4) S2S forecasts for decision making

(A4-05)

Stratospheric influences on European month-ahead wind power generation and its predictability on subseasonal time scales

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Wind power is playing an increasingly important role in Europe's electricity generation. Accurate forecasts of wind-power output on various spatial and temporal scales are therefore of high interest for the energy industry. However, predictability of near-surface wind particularly on subseasonal timescales has received relatively little attention. The stratosphere is an important source of subseasonal predictability in winter. We thus investigate how the lower-stratospheric circulation affects month-ahead wind electricity generation in European winter and how this effect influences the skill of subseasonal numerical weather forecasts. In a first step, we use the ERA-Interim reanalysis and the wind-power dataset Renewables.ninja to demonstrate a strong correlation between the strength of the lower-stratospheric circulation and month-ahead wind electricity generation in different regions of Europe. This relationship exists due to episodes of troposphere-stratosphere coupling, which lead to prolonged periods of either the positive or negative phase of the North Atlantic Oscillation (NAO). Since these persistent NAO periods are associated with strong surface wind anomalies, they have an important impact on wind electricity generation, in particular in Northern Europe. Motivated by this empirical relationship, we develop a simple statistical forecasting approach based on the strength of the lower-stratospheric circulation, which provides skillful forecasts of month-ahead wind electricity generation in Europe. In a second step, we investigate the skill of different subseasonal forecast models from the S2S database in predicting month-ahead 10-m wind speed as a proxy for wind electricity generation. The skill of the S2S models is generally higher than the skill of the simple statistical forecast, particularly for short lead times. It is substantially driven by the strength of the lower-stratospheric circulation at initialization time and the associated state of the NAO throughout the forecast, which reflects the empirical relationship from the reanalysis data also in the models. However, there are substantial differences in the skill between different European regions as well as models, with implications for both the energy industry and the numerical modeling community. In a future step, the study will be expanded on other meteorological fields relevant for the energy industry.