

Exploring methods to forecast national energy variables at sub-seasonal to seasonal timescales

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Contact information

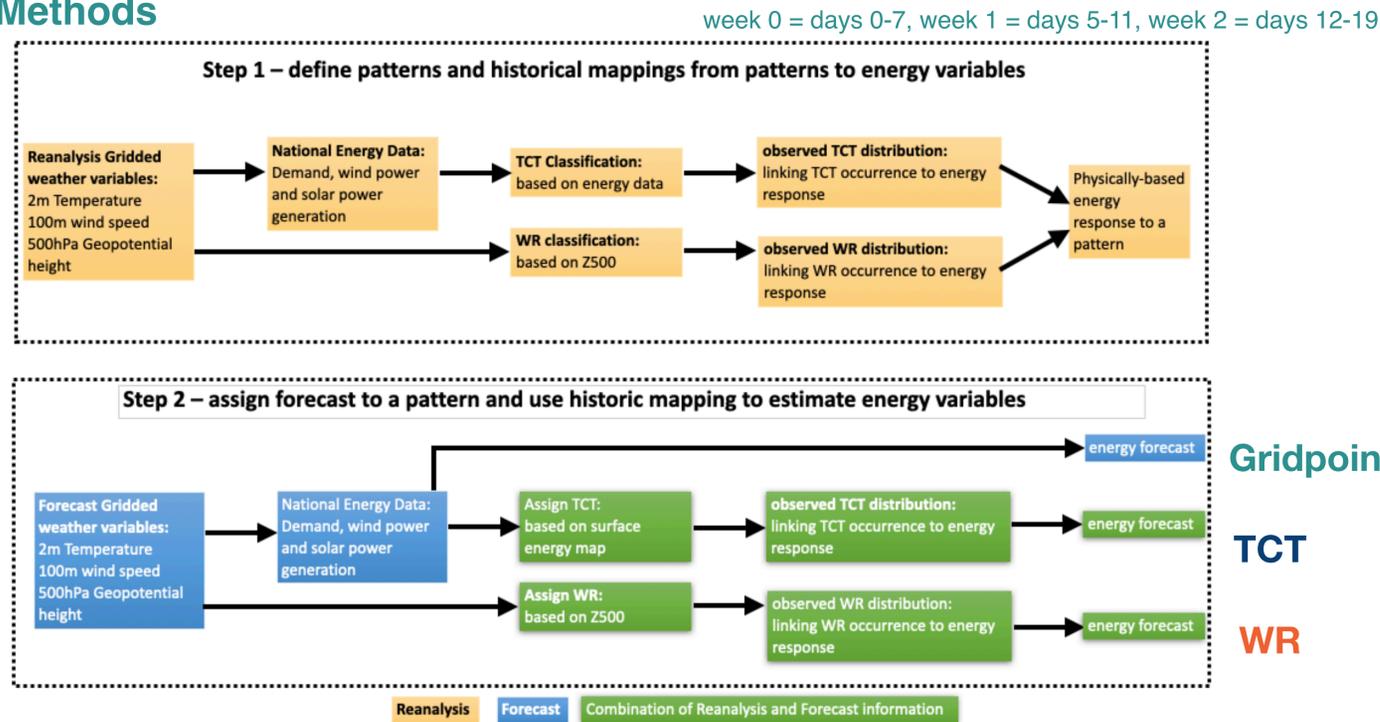
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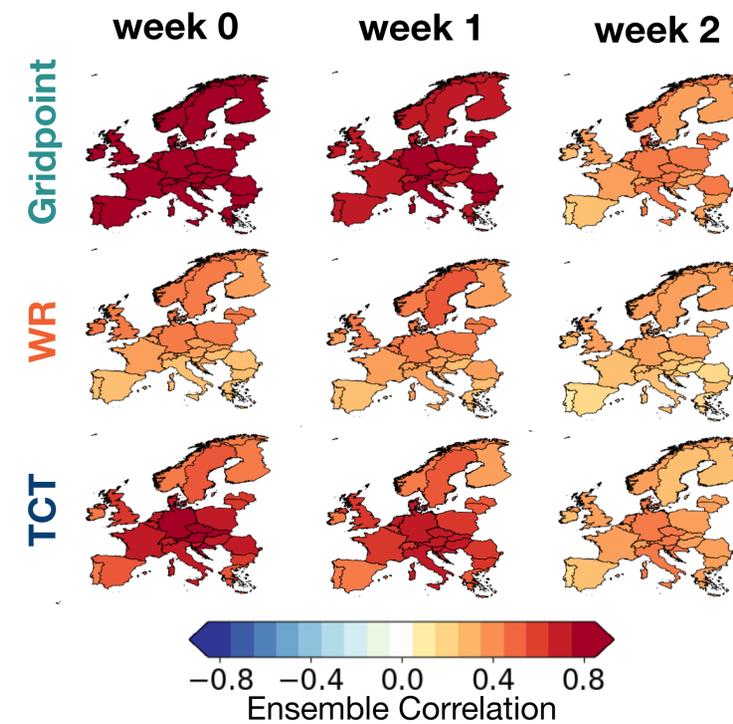
Motivation

There is wide-spread belief that pattern based methods add value to weather forecasts at sub-seasonal timescales. A recent S2S4E webinar survey found that 60% of users were either using pattern based methods in their work. We therefore investigate two pattern based methods: weather regimes (WRs, Cassou, 2008) and Targeted Circulation Types (TCTs, Bloomfield et al., 2020) and compare to traditional 'grid point based' forecasts of European energy variables to quantify this difference in value.

Methods



Results: Comparison between patterns and grid point hindcasts

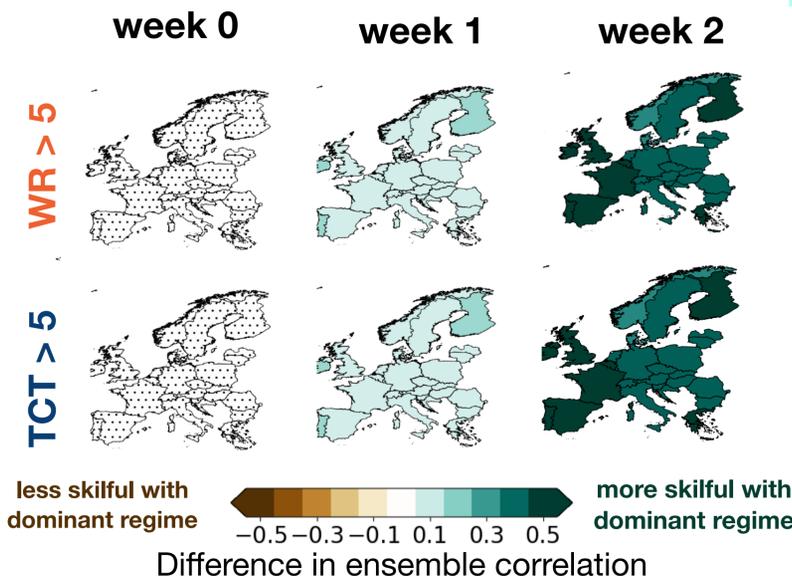


- There is high skill in the grid point based forecasts in a number of forecast metrics for both ECMWF and NCEP hindcasts.
- At all lead times pattern based skill is less than grid point skill
- TCTs provide a better prediction of demand than WRs due to their comparable hit rate and increased relationship to surface energy variables (see pattern assignment section)

CONCLUSION

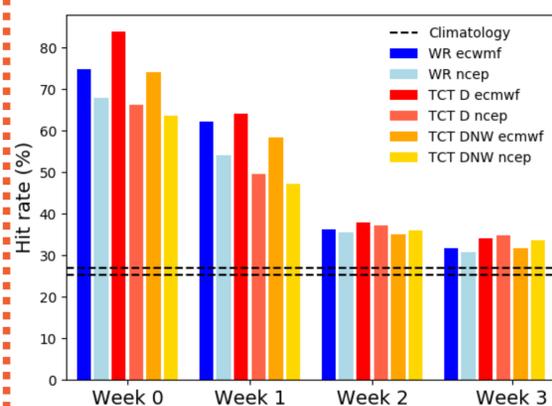
We have shown that pattern-based methods (widely believed to increase forecast value) offer limited benefit over grid point forecasts. However, there are opportunities for their use when considering conditional predictability

Results: Windows of opportunity

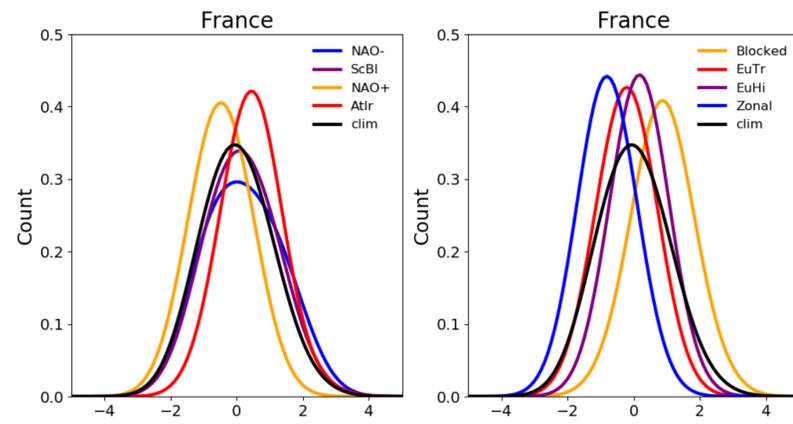


- In week 0 there is no significant gain through conditioning the demand forecasts based on a dominant pattern in the ensemble
- In weeks 1 and 2 significantly increased skill is seen when grid point forecasts with a dominant pattern are compared to all forecasts.
- Skill gains are similar for dominant threshold of 5 - 9 ensemble members

Pattern Assignment



Percentage of correct pattern assignments vs ERA5 in each forecast lead week



Normalised PDFs of demand anomalies during the 4 Weather regimes (WR, left) and Targeted Circulation Types (TCTs, right)

References

- Bloomfield et al., (2020) Characterising the winter meteorological drivers of the European electricity system using targeted circulation types [doi/10.1002/met.1858](https://doi.org/10.1002/met.1858)
- Cassou (2008) Intraseasonal interaction between the Madden-Julian Oscillation and the North Atlantic Oscillation [doi: 10.1038/nature07286](https://doi.org/10.1038/nature07286).
- Bloomfield et al., (submitted ESSD) Sub-seasonal forecasts of demand, wind power and solar power generation for 28 European Countries (contact for a copy)

Access Our Data

- ERA5 derived time series of European country-aggregate electricity demand, wind power generation and solar power generation: hourly data from 1979-2019 <https://researchdata.reading.ac.uk/272/>
- Sub-seasonal forecasts of European electricity demand, wind power and solar power generation <https://researchdata.reading.ac.uk/275>
- Operational forecasts from the S2S4E project: <https://s2s4e-dst.bsc.es/#/>