PRocess-based climate sIMulation:
AdVances in high-resolution modelling
and European climate Risk Assessment

THE WINTER NORTH ATLANTIC OSCILLATION, WIND AND ENERGY OVER EUROPE

Almost all aspects of national and global energy systems are exposed to some form of climate risk attributable to scales ranging from extreme weather to long term climate change. The impact of climate is further exacerbated with the growing use of weather-dependent renewable generation, the output from which cannot be directly controlled in the same way as traditional power stations.

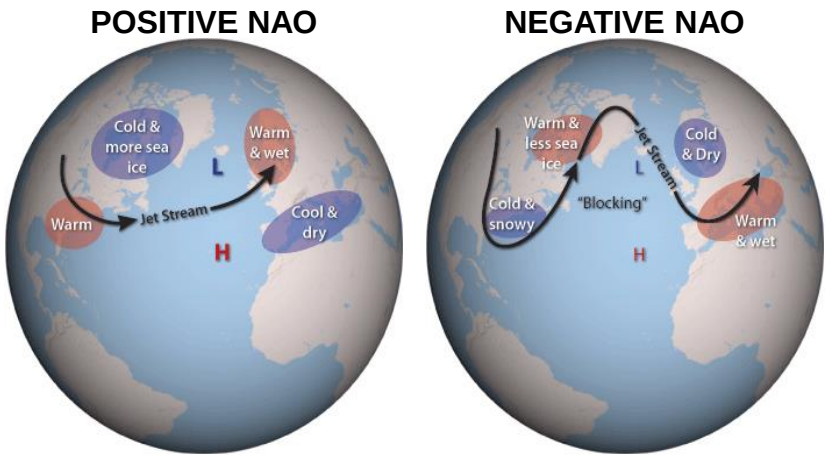
During winter, the North Atlantic Oscillation (NAO) is the dominant mode of climate variability affecting Europe and is associated with damaging events such as large snowstorms, cold spells and drought that impact the energy sector significantly. Further insight into the evolution of NAO and its inherent impacts are of utmost relevance for climate risk management in the energy sector.

What is the NAO?

The North Atlantic Oscillation is the dominant mode of winter-time climate variability in the Atlantic/European region on seasonal to decadal time scales. The 'oscillation' corresponds to a weakening and strengthening of the atmospheric pressure difference between the polar low and the subtropical high pressure systems.

Changes in the NAO strongly influence the large-scale circulation, including the latitude of the jet stream, which acts as a 'guide' for the weather systems moving across the Atlantic. Therefore, NAO has significant impacts on regional climate over Europe.

Typical NAO climate impacts



The North Atlantic Oscillation (NAO) is associated with changes in the large-scale atmospheric circulation that impact climate over Europe and therefore the regional energy system, particularly in winter. Source: Met Office, UK

Funding

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Info

PRIMAVERA is a collaboration between 19 leading European research and technology organisations with complementary expertise in climate science, climate change modelling, and high performance computing.

The project is led by the Met Office and the University of Reading.

Media

www.primavera-h2020.eu

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PRIMAVERA

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Likely impacts of the NAO on the European energy sector

It has been shown that because the NAO has an impact on the position of the jet stream and the storm track (shifted north during positive phase), it has strong impacts on wind, temperature and precipitation over Europe during winter. Some examples are listed here:

Over the UK and northern Europe

- **Positive NAO phase** → windy, wet and mild winters → increase in wind-power and hydropower generation and decrease in energy demand
- **Negative NAO phase** → cold and dry winters and potential for strong snowstorms → decreased wind-power and hydropower generation, but increase in energy demand

Over the Mediterranean

- **Positive NAO phase** → cool and dry winters → increased solar PV potential and increase in energy demand

NAO has direct impacts across the European energy sector. Source: Flickr/Creative Commons.

How can the PRIMAVERA project help?

The PRIMAVERA project is developing a new generation of advanced high-resolution global climate models, capable of simulating and predicting regional climate with unprecedented fidelity.

The increased model resolution of the PRIMAVERA models (typically around 25km) has the advantage of allowing a better global representation of large-scale physical processes. Since these large-scale phenomena have significant local impacts, the PRIMAVERA models have the potential to generate a much better representation of regional climates, that are less reliant on the mathematical formulations used to represent physical processes occurring within each grid-box (e.g., clouds).

Furthermore, PRIMAVERA constitutes the first inter-comparison project between high-resolution global models, which will allow to identify and characterize robustly the physical processes controlling current and future climate over Europe and those processes associated with climate risk.

References

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