

Materials and Methods

- We develop a statistical model to predict extremes of wind and precipitation in Western Europe based on 2m temperature in North America and strength and location of the Polar jet.
- We apply a new statistical method, Quantile Generalised Additive Models (QGAMs, Fasiolo et al., 2021), to study Pan-Atlantic compound climate extremes, namely wintertime climate extremes occurring on the two sides of the Atlantic.
- ► We use ERA5 data NDJF 1959–2020: daily 2m temperature anomalies over North America $(30^{\circ} - 45^{\circ} \text{ N}, 100^{\circ} - 70^{\circ} \text{ W})$, largest zonally averaged wind anomalies at 250hPa over the North Atlantic ($30^{\circ} - 75^{\circ} \text{ N}$, $70^{\circ} - 5^{\circ} \text{ W}$), and daily mean 10m wind speed and daily precipitation anomalies over Iberia and Western France.

Results

North American cold spells are associated with larger than average anomalies in daily mean 10m wind speed and daily precipitation in Western Europe.



Daily mean 10m wind speed and daily precipitation anomalies in Western Europe in conjunction with a North American cold spell: Left, a-c climatological distribution (blue) and distribution of events two days before (a), the same day (b), and two days after (c) a cold spell (red); Right, d-i mean $(\mathbf{d}-\mathbf{e})$, 95th quantile $(\mathbf{f}-\mathbf{g})$ and 99th quantile $(\mathbf{h}-\mathbf{i})$ 15 days before and after a cold spell.

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A Quantile Generalised Approach to Compound Climate Extremes: Pan-Atlantic Extremes as a Case Study

Based on our models, QGAMs can predict extreme quantiles of daily mean 10m wind speed and daily precipitation anomalies more accurately than conventional peak-over-threshold (POT) models. **QGAM vs POT performance**



Pseudo F

Pseudo R

Estimation of 95th quantile (**a,c**) and 99th quantile (**b,d**) of daily mean 10m wind speed (**a-b**) and daily precipitation (**c-d**): comparison between QGAM and POT model in terms of Pseudo R2. Stippling indicates that QGAM performs worse than POT.

North American cold spells are a useful predictor of subsequent wet or windy extremes in Western Europe, even when accounting for relevant mediators and confounders (strength and location of the Polar jet, NAO).

To know more

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