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North Atlantic Climate Regimes and Extreme Events

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Society is increasingly impacted by natural hazards which cause huge damages in economic and human terms. Many of these natural hazards are weather and climate related. Here I show that North Atlantic atmospheric circulation regimes affect the propensity of extreme wind speeds and storms in Europe. These regimes are identified by a Hidden Markov Model and are closely related to the North Atlantic Oscillation (NAO) and the East Atlantic (EA) teleconnection patterns. The frequency of occurrence of the regime states exhibits pronounced interannual and decadal-scale fluctuations.

The regime states are associated with distinct changes in the storm tracks and the frequency of occurrence of cyclonic and anticyclonic Rossby wave breaking. Consequently, the regime states also affect the occurrence of extreme events and also favor the serial clustering of storms. Serial clustering means that storms come in bunches and, hence, do not occur independently. This suggests that traditional extreme value statistics can no longer reliably be applied to estimate return periods of extreme events.

In my presentation I will discuss (i) possible reasons for the clustering of storms, (ii) a possible feedback mechanism for explaining the existence of the regime states, (iii) the role of the Atlantic Multidecadal Oscillation (AMO) in causing the interannual and decadal variability of the regime states frequency of occurrence and (iv) the effects of global warming.