



A predictive relationship between early season North Atlantic hurricane activity and the upcoming winter North Atlantic Oscillation

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The winter North Atlantic Oscillation (NAO) is linked strongly to European winter climate including windstorms. Predicting the winter NAO is key to making successful seasonal predictions of European winter climate. We observe that in recent decades there are many instances of an inverse relationship between the strength of the North Atlantic hurricane season and the strength of the subsequent European winter windstorm season. Stormy European winter seasons often follow quiet Atlantic hurricane seasons and calm European winters follow active hurricane seasons. We explore the strength and temporal stability of this inverse relationship, consider a facilitating physical mechanism, and briefly discuss the implications of our findings for end users, in particular global reinsurers.

We find there is a statistically significant link between North Atlantic hurricane activity and the upcoming winter NAO. The relationship is established by the midway point of the hurricane season in early September. The link is strongest when hurricane activity is in the upper or lower tercile and when summer ENSO (El Niño Southern Oscillation) is neutral. The relationship works well going back 40 years to the mid 1970s. The early winter (October-November-December) NAO is predicted best but since the early 1980s the predictive link extends to the main winter (December-January-February) NAO.

The inverse link can be facilitated by a persistence and slow evolution of atmospheric circulation patterns and sea surface temperature anomalies over the North Atlantic between the summer and the winter. This persistence is best when hurricane seasons are more extreme and when summer ENSO is neutral. Our findings offer the potential for predicting the early winter and winter NAO from early September. The implied inverse relationship between US hurricane activity and European windstorm activity may enable more effective offsetting of risks between territories.