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North Atlantic Oscillation, East Atlantic pattern and jet variability since 1685

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Instrumental records of the leading patterns of variability are short, hampering a proper characterization of the atmospheric circulation beyond the mid-19th century. In this work, recently published in Mellado-Cano et al. (2019), we present the longest (1685-2014) observational-based records of winter NAO and East Atlantic (EA) indices as well as estimates of the North Atlantic eddy-driven jet stream for the same period. They are inferred from wind direction observations over the English Channel assembled in monthly indices of the persistence of the wind in the four cardinal directions. Our NAO and EA series are significantly correlated with traditional indices, showing comparable skill to that obtained between some instrumental indices, and capture their main signatures on European temperature and precipitation.

By identifying winters with different combinations of NAO/EA phases in the 20th century, our results highlight the additional role of EA in shaping the North Atlantic action centers and the European climate responses to NAO. The joint effects of NAO and EA cause European surface climate anomalies that can substantially differ from their canonical signatures, meaning that a proper characterization of regional climates cannot be achieved by the NAO alone. The EA interference with the NAO signal is stronger in precipitation than in temperature and affects areas with strong responses to NAO such as Greenland and the western Mediterranean.

The time series display large variability from interannual to multidecadal time scales, with e.g. positive (negative) EA (NAO) phases dominating before 1750 (during much of the 19th century). The last three centuries uncover multidecadal periods characterized by specific NAO/EA states and substantial variability in the North Atlantic jet stream, thus providing new evidences of the dynamics behind some outstanding periods. Transitions in the NAO/EA phase space have been recurrent and pin down long-lasting anomalies, such as the displacement of the North Atlantic action centers in the late 20th century, besides some disagreements between historical NAO indices.

Mellado-Cano, J., D. Barriopedro, R. García-Herrera, R.M. Trigo, 2019: Examining the North Atlantic

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