Revisiting the Influence of Solar Variability on North Atlantic Winter Climate

Laura Endres[*1], William T. Ball[2], Adam Sykulski[3], and Gabriel Chiodo[1]

[1]Institute for Atmospheric and Climate Sciences [ETH Zürich] – IAC, ETH Zürich, Universitätsstrasse 16, 8092 Zürich, Switzerland
[2]Delft University of Technology – Postbus 5 2600 AA Delft, Netherlands
[3]Lancaster University – Bailrigg, Lancaster, LA1 4YW, United Kingdom

Abstract

Variations of solar irradiance due to the 11-year solar cycle are thought to influence the North Atlantic winter climate and specifically the North Atlantic Oscillation pattern. However, some controversy still exists since the separation of the solar signal from internal atmospheric variability remains challenging and the reported correlations, often a primary method of analysis, are not significant over the entire 20th century. Moreover, as typically only an individual climate model is assessed, model biases are difficult to determine. In this work, we revisit the connection between the Sun and the North Atlantic oscillation by carefully assessing the statistical methods we apply to observations and two independent chemistry-climate models. We use transient model simulations of the 20th century as well as idealized time-slice simulations both with and without the solar cycle to obtain better constraints of the strength and character of the solar influence on the North Atlantic winter climate. Using robust error estimates and advanced spectral methods such as multitaper and wavelet coherence, we provide improved measures of uncertainty related to the solar signal. The robust component of the signal could be potentially applied to enhance the prediction of European Winter climate, given the near-periodic behavior of the solar forcing over the 11-year solar cycle.

Keywords: solar cycle, spectral methods, North Atlantic, climate variability

---

[*]Speaker