The Sun's role in decadal climate predictability in the North Atlantic

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Despite several studies on decadal-scale solar influence on climate, a systematic analysis of the Sun's contribution to decadal surface climate predictability is still missing. Here, we disentangle the solar-cycle-induced climate response from internal variability and from other external forcings such as greenhouse gases. We utilize two 10-member ensemble simulations with a state-of-the-art chemistry–climate model, to date a unique dataset in chemistry–climate modeling. Using these model simulations, we quantify the potential predictability related to the solar cycle and demonstrate that the detectability of the solar influence on surface climate depends on the magnitude of the solar cycle. Further, we show that a strong solar cycle forcing organizes and synchronizes the decadal-scale component of the North Atlantic Oscillation, the dominant mode of climate variability in the North Atlantic region.