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Attributing the role of sudden stratospheric warming events in surface weather extremes and their impacts: insights from SNAPSI Working Group 2

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Sudden stratospheric warming events (SSWs)–in which the westerly polar vortex rapidly breaks down during winter–are some of the most dramatic examples of dynamical variability in Earth's atmosphere. It is now well established that SSWs are, on average, followed by large scale anomalies in near-surface circulation patterns, including an equatorward shift of the eddy driven jet that can persist for several months. These anomalies have, in turn, been related to an increase in the likelihood of a variety of high impact weather extremes. However, not all SSWs are followed by impactful weather events; equally, most winter weather extremes are not preceded by SSWs.

Here we will discuss the extent to which the occurrence of individual extreme weather events and their impacts can be attributed to polar stratospheric variability, drawing upon new results from the Stratospheric Nudging And Predictable Surface Impacts (SNAPSI) project (Working Group 2). This project involves a set of controlled subseasonal hindcast experiments, targeted at three SSW case study events, in which the stratospheric state can be either freely-evolving or nudged towards a climatological or observational state. These simulations reveal that the stratospheric evolution can more than double the regional risk of extreme temperature, rainfall, and snow events. We will go on to explore the attribution of the subsequent impacts of these weather extremes, including on the energy sector, health, and wildfires.

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