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# VORTEX project: The role of the polar vortex on the predictabIlity of extreme events in the Northern Hemisphere

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Extreme weather and climate events, marked by unexpected and severe conditions at the edges of historical distributions, significantly impact human health, society, and ecosystems. With global warming driving an increase in the frequency and intensity of these extremes, there is an urgent need to enhance weather prediction beyond the typical 7–10-day range. Among the atmospheric and oceanic components studied for improving predictability, the stratosphere stands out due to its slower and more predictable changes, which can have persistent impacts on surface weather patterns.

Research has highlighted the stratosphere's role in driving weather and climate extremes, particularly in the extratropical Northern Hemisphere. Events involving a weak or strong stratospheric polar vortex can precede the occurrence of surface extremes, making the polar vortex a key link between stratospheric variability and surface climate predictability. While various studies have previously identified this teleconnection, the processes connecting anomalous vortex states to extreme surface events are not yet fully understood.

In VORTEX project we employ a methodology based on advancements in dynamical systems theory to explore the relationship between anomalous polar vortex states and extreme precipitation and temperature events. This approach characterizes each vortex-extreme event's recurrence, persistence, and predictability, providing dynamic insights that traditional methods cannot. By identifying the intrinsic predictability of stratospheric patterns tied to extremes, this methodology offers a pathway to improve sub-seasonal to seasonal climate models, focusing future efforts on better representing critical patterns that influence extreme weather.