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Seasonal forecasts of sudden stratospheric warming and their role in surface predictability

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We analyze here the probabilistic forecast on seasonal timescales of sudden stratospheric warmings (SSW events) and polar-night jet oscillation (PJO) events in 30-member ensemble from the MPI-ESM seasonal prediction system. We show that the forecast ensemble demonstrates clear potential for predictability in that the rate of these stratospheric extreme events depends on the initial conditions in November from which the forecasts are initialized.

More specifically, we consider a simple three-level forecast of the state of the vortex in which the rate of occurrence of extreme events is either enhanced, neutral, or reduced. The analysis suggests skill in forecasting observed events: during enhanced years as identified by the forecast system, the observed rate is 9-13 SSW events per decade, compared with about 8 events per decade in neutral years. For PJO events, the enhanced rate is between 3.4 to 8 events per decade compared with 3.2 events per decade in neutral years. There are corresponding reductions in the rates during reduced rate years.

Somewhat surprisingly, no single precursor in November stands out as responsible for this skill; rather it seems to arise from a variety of factors. This skill can also be connected to enhanced predictability of the troposphere during years with enhanced rates of stratospheric extreme events.