The Predictability of Polar Jet Oscillation Events and their Surface Impacts

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The surface impacts of stratospheric sudden warming (SSW) events tend to extend up to several weeks. It is however unclear which mechanisms lead to the long lifetime and therefore a higher predictability of the surface impacts on seasonal timescales.

About half of all SSW events are associated with so-called Polar Jet Oscillation (PJO) events, which are characterized by an extended recovery of the stratospheric flow and long-lasting temperature anomalies in the lower stratosphere. It is here investigated if this extended recovery may in part be responsible for the extended duration of the surface impact of SSW events (though PJO events may also occur independently of SSW events) – and therefore a possible improvement in winter predictability in the extratropical troposphere.

The hypothesis is tested using a 30-member ensemble of seasonal hindcasts initialized on November 1st of each year from 1979 to 2014 from the seasonal prediction system based on the Max Planck Institute Earth System Model (MPI-ESM). Evidence is found that the ensemble provides improved statistical predictability for both SSW and PJO events in the stratosphere. In addition, the surface impact of PJO events is well represented in the model as compared to reanalysis, and it is significantly stronger and longer-lived than for SSW events. Prediction skill over the North Atlantic and the Arctic is significantly enhanced during years with SSW or PJO events.

Key words: polar jet oscillation, sudden stratospheric warming, sub-seasonal to seasonal predictability, surface impact