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# The role of the stratosphere for sub-seasonal to seasonal forecasting

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Sub-seasonal to seasonal (S2S) predictions of surface climate are crucial for a wide range of sectors. One of the promising areas that adds predictability on these timescales is the stratosphere, which has been found to play an important role in the predictability of surface weather on S2S timescales. The downward influence of the stratosphere onto the surface can lead to increased persistence and predictability of surface weather. For example, the SSW event in February 2018 led to persistent cold weather over large parts of Europe in late February and early March after an otherwise mild winter. Like the 2018 event, up to two thirds of SSW events are followed by anomalous tropospheric weather patterns that can remain persistent for several weeks. Other types of polar stratospheric extreme events such as strong vortex events or wave reflection events can also have impacts on surface weather. However, skill for extratropical stratospheric events generally only exists at the deterministic level for one- to two- week lead times. Probabilistic skill exists for stratospheric events when including precursor events and teleconnections, though these are often poorly captured by models. These remote effects include El Nino Southern Oscillation and the Quasi-Biennial Oscillation, which themselves hold predictability of several months and can therefore induce persistent forcings of the extratropical stratosphere. This lecture will cover the current ability of models to predict stratospheric events, their precursors, and their surface impacts, and provide an outlook on future efforts to increase the skill arising from stratospheric events.

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