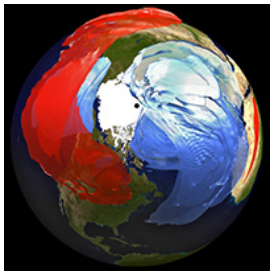

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Downward Influence of the 2018 and 2019 SSW events in S2S Models

Using the real-time predictions before the February 2018 and January 2019 stratospheric sudden warmings (SSWs) from 11 sub-seasonal to seasonal models, this study analyzes the prediction of the downward propagation and surface impact of these two SSWs. These two SSWs differed both in the type of SSW warming (2018: vortex split; 2019: displacement), and in their magnitude (the former being stronger). With a large sample size (>2200) of multi-model ensemble forecasts, it is revealed that the most important factor determining the magnitude of the downward impact is the strength of the SSW, with strong SSWs more likely to propagate downward than weak SSWs. Therefore, based on the probabilistic forecasts, the observed strong SSW in February 2018 was more likely to have a downward and surface impact, than the January 2019 SSW. The relationship between the 10-hPa SSW type and the 100-hPa NAM is weak, implying that the SSW type is not the primary factor determining the downward propagation of SSWs. Hence, the negative NAM response in the lower stratosphere and troposphere following the February 2018 SSW is mainly attributed to its strong intensity rather than the split morphology. Further, the predicted near surface air temperature anomaly pattern differs between the two SSW events. In particular, the 2-m temperature anomaly pattern following the January 2019 SSW is weak due to its lack of downward propagation, whereas the 2-m temperature in North Eurasia, Middle East, South China and Eastern US could be forecast for the downward propagating February 2018 SSW. On the other hand, regional rainfall anomalies were poorly forecasted (both in a deterministic and probabilistic sense) for both SSWs.

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