Predictability of Sudden Stratospheric Warmings in Sub-Seasonal Forecast Models

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We analyze the skill of the Arctic stratospheric retrospective ensemble forecasts (hindcasts) of sub-seasonal forecast models from the s2s database with a focus on the predictability of the major sudden stratospheric warmings (SSWs) during the period 1981-2013. Predictability is assessed in both deterministic, based on ensemble-mean forecasts, and probabilistic sense (see Karpechko [2018] for details of the method). To estimate forecasted SSW probability we use the spread of ensemble members. We show that some SSWs can be predicted with high (>0.9) probability at lead times of 12-13 days if a difference of 3 days between actual and forecasted SSW is allowed. Focusing on SSWs with significant impacts on the tropospheric circulation we find that, on average, the forecasted SSW probability is small at lead time of more than two weeks and then increases rapidly to nearly 1 at day 7 before SSWs. The period between days 8-12 is when most of the SSWs are predicted by the models with a probability 0.5-0.9 which is considerably larger than the observed SSW occurrence frequency. Therefore this period can be thought of as an estimate of the SSW predictability limit. We also find indications that predictability limit for some SSWs may be longer than two weeks; however more studies are needed to understand when and why such long predictability is possible.

Key words: sudden stratospheric warming, predictability, s2s, polar vortex

References

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