Extratropical prediction skill of the subseasonal-to-seasonal (S2S) prediction models

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The extratropical prediction skill of the subseasonal-to-seasonal (S2S) prediction models are evaluated for the nine operational models that participated in the S2S prediction project. In terms of mean squared skill score (MSSS) of geopotential height poleward of $30°$, overall prediction skill and its inter-model spread during the common forecast period of 1999-2010 are 9.92 ± 1.94 days at 500 hPa and 11.22 ± 4.16 at 50 hPa in the northern extratropics. An enhanced prediction skill in the stratosphere is mainly due to the persistent polar vortex. In summer season, stratospheric prediction skill becomes comparable to or even worse than tropospheric prediction skill. A poor prediction skill in the summer stratosphere, however, is not physical meaning but largely caused by mathematical form of MSSS which is significantly influenced by weak internal variability.

It turns out that model errors in both the troposphere and stratosphere are primarily caused by eddy errors rather than zonal-mean flow errors. In particular, the eddy error associated with eddy phase difference is a key factor. This result suggests that S2S prediction could be improved by better representing wave propagation in the zonal and vertical directions. A strong linear relationship between stratospheric and tropospheric predictions skills in the winter hemisphere further suggests that the tropospheric prediction could be improved by better constraining stratospheric circulation in the model.