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One-Month Lead Predictability of Arctic Oscillation Using a CGCM

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This study assesses one-month lead predictability of boreal winter season (DJF) AO using Pusan National University (PNU) CGCM, a participant model of APEC Climate Center (APCC) Multi Model Ensemble Seasonal Prediction System. The winter hindcasts have been produced for each and every 30-year of 1980 to 2009. The winter hindcasts for Dec., Jan. and Feb. are made from the one-month lead ensemble forecasts with Nov., Dec. and Jan. initial conditions of each year, respectively.

In this study, AO is defined as the first mode of EOF analysis of geopotential heights anomalies from troposphere to lower stratosphere (1000 $\sim$ 10 hPa). PNU CGCM reasonably replicated the observed spatial feature of AO characterized by vertically meridional dipole structure with node centered near 55°N. The predicted AO index can capture the time variation of observation. The temporal correlation skill of the first PC time series between hindcast and observation is 0.71, which is significant at 99% level of confidence.

The atmospheric circulation fields such as geopotential heights, zonal wind, sea level pressure, 2m temperature over the northern hemisphere are regressed onto the time variation of AO index. These regression maps enable us to interpret the physical meaning of winter climate relevant to AO over northern hemisphere, which describes the shifted jet stream towards higher latitude, the intensified polar vortex and confined cold air in the polar vortex in positive phase. The stratospheric vortex can alter circulation down to the surface during one-month after the experiment starts. Finally surface pressure map resembles closely the AO pattern and the AO affects 2m temperature over Northern Hemisphere. Also the spatial correlations between the regressed predicted and observed patterns are very high as 0.83$\sim$0.97 depending on variables. It means that the model like PNU CGCM has good capability of predicting global oscillation such as AO with one-month time lead.

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