

Wintertime cooling trend over Eurasian continent and Arctic sea ice decline

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Cooling tendency is observed over wintertime Eurasian continent after 2000s. Many of recent studies attribute this cooling trend to the recent decline of Arctic sea ice (e.g., [1]), while some studies argue that the tendency is due to natural variability (e.g., [2]). The aim of this study is to evaluate not only the influence of the Arctic sea ice decline, but also that of long-term sea surface temperature (SST) changes, on Eurasian continent through a set of atmospheric general circulation model (AGCM) ensemble experiments. The first set of experiments (Exp. A) is forced with observed varying SST and sea ice. The second set (Exp. B) is forced with observed SST and daily-climatological sea ice, while the third set (Exp. C) is with climatological SST and observed sea ice. Climatological SST and sea ice are given to the fourth experiment (Exp. D). Each of experiment consists of 15 ensemble members and the period is from 1982 through 2013. Note that the radiative forcing is constant. DJF-mean 2-meter temperatures averaged over (40-60N, 60-120E) is used as winter-mean temperatures over Eurasian continent.

Out of 15 ensemble members, only 4 members show cooling trend over Eurasia continent in Exp. A. Particularly, none of members show cooling trend in Exp. B, which suggests that observed SST changes tend to warm up Eurasia. While in Exp. C, 11 out of 15 members show cooling trend, which suggests tendency of the observed sea-ice decline lowering temperatures over Eurasian continent. We can confirm that model bias should not affect the simulated tendency because Exp. D does not show a particular trend. Our results suggest that the recent sea ice decline should induce cooling over Eurasia to a certain degree, while observed SST change should bring temperature rise over Eurasian continent, which may overcome the sea ice effect.

Keywords: Arctic sea ice, Eurasian continent