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The Relationship Between Autumn Snow Cover over Tibet Plateau and North America Winter Surface Air Temperature

Qifeng Qian and Xiaojing Jia
Zhejiang University, Hangzhou, China (qqf1403321992@hotmail.com)

The relationship between the autumn snow cover over the eastern Tibet Plateau (TP) (ASCETP) and the North America (NA) surface air temperature (SAT) during 1979-2014 is investigated in this work. A climate transition of ASCETP is noticed in the year 1994 and the data is divided into two subperiods correspondingly: 1979-1994 (P1) and 1995-2014 (P2). The climate impact of the ASCETP variation on the NA winter SAT in P1 and P2 are discussed and compared.

During P1, more ASCETP induces negative geopotential height anomalies over the northeastern Tibet Plateau, which impose an anomalous vorticity perturbation near the East Asia westerly jet (EAWJ) core. This anomalous vorticity perturbation propagates downstream along the EAWJ in a Rossby wave train form, which penetrates the North Pacific Ocean and arrives NA and results in increasing and decreasing of SAT over west and east part of NA in winter respectively. Besides, observation analysis results show that the wave train associated sea surface temperature (SST) decline in the North Atlantic Ocean boosts the propagation of the wave train and extends it to the Eurasia continent. In contrast, during P2, the climate impact of ASCETP changes on the winter SAT over NA is not as significant as P1 probably due to the relatively weak local cooling effect and the corresponding weak vorticity forcing in the vicinity of EAWJ.

The difference between P1 and P2 can be traced back to the formation of snow cover anomalies in autumn. During P2, ASCETP anomalies are related to a SST-induced Rossby wave train from North Atlantic Ocean while ASCETP anomalies in P1 tend to be caused by local processes.