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Spatial pattern and Internal Annual Variability in Observed Snow Depth over China from 1960 to 2014

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Snow is a critical element on ground thermal and hydrological cycle because it could protect the surface from heat loss in winter, and also restore the water in winter and release it in spring. The snow-dependent regions are now suffering the rapid changing under global warming, with the shift from snowfall to rain and the earlier snowmelt. In a warmer climate, the prior studies primarily focused on snow extent variability and distribution in China, largely because of the relative scarcity of snow depth observed data. The contributions of snowfall and the snowmelt to snow depth variability are also less well quantified. Here, we used long-term daily snow depth records in more than 2000 stations released by China Meteorology Administration to investigate the spatiotemporal pattern of snow depth accumulation in China. We also assessed the contribution of snow process to snow depth accumulation by considering the events of snowfall and the fraction of days that air temperature below 0°C during the periods of the snow season (DT<0°C). The observations present that the snow depth accumulation generally experienced an initial increase and then a followed decreasing trend in China from 1960 to 2014. We found that a descending trend especially occurred after the 2000s in the area of Loess Plateau and Eastern Tibetan Plateau, with the fact that the events of snowfall decreased obviously and DT<0°C increased slightly. Conversely, an ascending trend occurred after the 2000s with the area of northwestern and northeastern China, which mainly due to an increase of DT<0°C obviously. The observed interdecadal variability in snow depth would be likely explained by the Arctic Oscillation (AO) pattern due to the statistically significant correlations. The results have the important implication on the soil moisture deficits, melt-streamflow and the future water availability in snow-dominated areas in China.