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# Spatiotemporal changes in snow cover from 1987 to 2011 in Northern China

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Snow cover plays an important role in the climate change and hydrological cycle. Particularly in Northern China, snow cover is the main fresh water resource. The spatial and temporal distribution of snow was analyzed using daily snow depth derived from SSM/I and AMSR-E from 1987 to 2011 in Northern China.

The monthly mean snow depths showed that snow depth generally reached at maximum in January and February. The snow cover mainly distributed in mountainous area, and it firstly appeared and lastly disappeared in the Altay and Tien Mountains and Greater Khingan Mountains.

In order to monitor the inter-annual variation of snow, a linear regression model was used to derive the variation of snow cover days (SCD), monthly mean snow depth (MSD), and cumulative snowfall (CS). Their linear slopes and the fluctuation amplitudes (the relative standard deviation, RSD) were also calculated.

The results showed that SCD significantly decreased at the deep snow area (mountainous area) and insignificantly increased at Northeast plain and Junggar basin. But, both the greatest decrease and increase occurred in the boundary between Xinjiang and Gansu provinces and the west end of Inner Mongolia, with the smallest slope of -4 days/year, and the biggest slope of 2 days/year. The RSD varied between 0 and 0.2 in the deep snow area, while it was generally more than 1 in the shallow snow area. The annual MSD insignificantly decreased at mountainous area and increased at Northeast plain and Junggar basin. At most places,

the variation slop of MSD was between -0.1 and 0.1 cm/year, and corresponding RSD was between 0 and 0.2 in the Altay and part area in Tien mountains and 0.2-0.4 in the Greater Khingan, Lesser Khingan and Changbai Mountains.

The annual CS generally increased insignificantly in the west part of this study area except some area in Altay and Tien Mountain, in which the annual CS increased significantly, with the biggest slop of 4cm/year. In the other area, generally it was about between -1 and 1 cm/year, while the smallest slops were about -3.5cm/year. The RSD was about 0-0.2 in mountainous area, but for the most area with very shallow snow depth, it was more than 1.

Northern China was divided into Northwest and Northeast by 105oE. The monthly snow depth variation and corresponding statistical significance were calculated, and the Mann-Kendall method was used, to analyze the snow depth variation characteristics for Northwest and Northeast, respectively. Snow depth generally decreased in the early and end periods of snow season and increased in the middle period of snow season during the 24 years for Northwest. The snow depth change in Northeast were characterized by generally insignificant decrease with great annual fluctuation and several abrupt transition during the 24 years.

In a word, the SCD appeared significant decrease, but the MSD was characterized by insignificant change, in North China. While CS showed significant increase in Northwest, but no significant change in Northeast.