

Decadal variability in springtime snow over Eurasia: Relation with circulation and possible influence on springtime rainfall over China

Zhiyan Zuo[†]; Renhe Zhang

[†] China Meteorological Administration, China, People's Republic of

Leading author: zyzuo@cma.cma.gov.cn

The relationship between decadal variability in springtime (March-May) snow water equivalent (SWE) over Eurasia and springtime rainfall over China is investigated for 1979-2004 using satellite-observed SWE, rainfall observations from 595 stations, and NCEP/NCAR reanalysis data. Decreasing springtime SWE in Eurasia corresponded to reduced springtime rainfall over southeastern and Northeast China, and more rainfall over southwestern and northwestern China. This relationship was supported by the feedback effect of snow in high-latitude areas to changes in background atmospheric circulation. A decadal shift in springtime Eurasian SWE occurred in the late 1980s, marked by a change from persistent positive phases in 1979-1987 to frequent negative phases. The reduction in Eurasian SWE resulted in reduced upward surface heat flux to the atmosphere and thereby a higher boundary layer height due to increased downward heat flux into subsurface soil. These changes resulted in reduced upward and poleward wave flux activity, which corresponded to anomalous negative heights/pressures in the Arctic and anomalous positive heights/pressures in mid-latitude regions from the upper-level troposphere to the surface. There was an anomalous anti-cyclonic circulation over Siberia and the western Pacific subtropical high was weakened, accompanied by an anomalous northerly in eastern China and westerly in northwestern China. The anomalous northerly resulted in reduced water vapor convergence in southeastern and Northeast China, and reduced water vapor export for southwestern and northwestern China. Thus, negative rainfall anomalies developed over southeastern and Northeast China, and positive rainfall anomalies appeared over southwestern and northwestern China.