Impact of Eurasian Spring Snow Decrement on East Asian Summer Precipitation

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In this study, the relationship between Eurasian spring snow decrement (SSD) and East Asian summer precipitation and related mechanisms were investigated using observational data and the Community Atmospheric Model, version 3.1 (CAM3.1). The results show that a west–east dipole pattern in Eurasian SSD anomalies, with a negative center located in the region between eastern Europe and the West Siberia Plain (EEWSP) and a positive center located around Baikal Lake (BL), is significantly associated with East Asian summer precipitation via triggering an anomalous midlatitude Eurasian wave train. Reduced SSD over EEWSP corresponds to anomalously dry local soil conditions from spring to the following summer, thereby increasing surface heat flux and near-surface temperatures. Similarly, the increase in SSD over BL is accompanied by anomalously low near-surface temperatures. The near-surface thermal anomalies cause an anomalous meridional temperature gradient, which intensifies the lower-level baroclinicity and causes an acceleration of the subtropical westerly jet stream. The forced wave 2 and 4 further have constructive interference with the counterpart climatological waves, leading to an enhanced and maintained Eurasian wave train. Additionally, the atmospheric response to changed surface thermal conditions tends to simultaneously increase the local 1000–500-hPa thickness, which further enhances the Eurasian wave train. Consequently, significant wave activity flux anomalies spread from eastern Europe eastward to East Asia and significantly influence the summer precipitation over China, with more rainfall over northeastern China and the Yellow River valley and less rainfall over Inner Mongolia and southern China.

Keywords: Spring snow decrement, East Asian precipitation, Land-surface interaction, constructive interference