Interannual variation of summer precipitation and atmospheric water circulation over and around Alaska

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Arctic warming is more apparent than global average. Water cycle in the region is also changing due to the climate warming. The variation of atmospheric water circulation influences terrestrial ecosystems through precipitation and soil water content. Hiyama et al. (2016) revealed the atmospheric circulation associated with the increase in summer precipitation from 2005 to 2008 in eastern Siberia. Ohta et al. (2014) indicated that increased precipitation in eastern Siberia caused waterlogging and damaged the larch forest. On the other hand, a recent observational research indicated that recent increased summer precipitation caused increase in methane emission from the black spruce forest in the interior of Alaska. Therefore, this study investigated interannual variability of summer precipitation and associated atmospheric water circulation in the interior of Alaska using ERA-Interim reanalysis data and rain gauge observation data in Fairbanks from 2003 to 2017. We extracted dry and wet years based on summer precipitation time series and then conducted composite analyses. Geopotential height and horizontal wind at 850 hPa and vertically integrated moisture flux were composited. We found that the change in low-level westerly wind and moisture flux blowing into the interior of Alaska was a primary factor to induce the interannual variation of summer precipitation in the region. This westerly moisture flux is associated with the atmospheric circulation pattern with cyclonic and anticyclonic anomalies around and over the Alaska. Moreover, the anomaly pattern is related to cyclone activity. More cyclones are detected in the region of the cyclonic anomaly, while less cyclones in the region of the anticyclonic anomaly. Sea surface temperature may partly contribute to the cyclone activity. A planetary wave might influence precipitation variability in the interior of Alaska through a teleconnection in these latitudes.

Keywords: Atmospheric water circulation, Summer precipitation, Anticyclonic anomaly, Cyclonic anomaly

