Temporal variation of stable isotopes in precipitation based on the intermittent sampling for 1998-2018 at Tiksi, northeastern Siberia

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Recent global warming affects significant impacts on air temperature and sea ice extent through the atmospheric hydrological cycle in the Arctic region. Stable water isotopes are useful tracer for estimating the moisture source and transportation pathway in the atmospheric hydrological cycle. From 1998 to 2018, daily precipitation samples were intermittently collected at Tiksi, northern Siberia, Russia. Totally 1,519 samples for $\delta^{18}O$ and 1,024 samples for $\delta^{2}H$ were analyzed by the Isotope Ratio Mass Spectrometry (IRMS) by the 10th September 2007 and by the Cavity Ring-Down Spectroscopy (CRDS) after 11th September 2007. At the last JpGU meeting (abstract ID; AHW34-P10), we reported the depleting trend of deuterium excess (d-excess) in precipitation. Comparing with another isotopic data from July 2015 to June 2017 observed at Samoylov Island near Tiksi (Bonne et al., 2020), annual mean values of surface air temperature, $\delta^{2}H$, and $\delta^{18}O$ were matching well. However, annual mean d-excess at Samoylov Island was more than 10‰ higher than the observation at Tiksi. This fact indicates the depleting trend of d-excess at Tiksi might be caused by the insufficient quality check of observation data. Therefore, new quality control method by using relationships between $\delta^{18}O$ or $\delta^{2}H$ in precipitation samples analyzed by the IRMS and surface air temperature at Tiksi were adapted to the samples analyzed by the CRDS. The temperature effects for $\delta^{18}O$ and $\delta^{2}H$ by the IRMS were 0.47‰ and 3.15‰, respectively. Finally, 1,257 samples for $\delta^{18}O$ and 820 samples for $\delta^{2}H$ were selected to calculate monthly mean values. From the monthly mean surface air temperature at Tiksi from 1998 to 2018, long-term increasing trends in March, April, October, and November were significant (0.24-0.42℃/month within 5% statistically significance). Furthermore, the difference in air temperature, evaporation, and 850hPa winds fields between first 5 years (1998-2002) and last 5 years (2014-2018) of the observation period were investigated by using the NCEP reanalysis. The positive anomalies in air temperature, evaporation, and southwesterly (northerly) wind anomalies were found in the northern Siberian continent (along the coast of the Arctic Ocean) in March and April (October and November). On the other hand, the relationships between surface air temperature and $\delta^{18}O$ in precipitation were found only in April (0.50‰/℃) and October (0.73‰/℃) within 5% statistically significance. The difference in temperature effect between April and October might be caused by the difference in moisture source evaporated from land and open water in the Arctic Ocean.

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