Moisture sources and transport control year-round variations of stable isotopes in precipitation over Bangladesh

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Abstract

Indian summer monsoon (ISM) has profound impact on water resources over the Asian Water Towers (AWTs) and surroundings. Stable isotopes in precipitation ($\delta^{18}O$ and δD) are crucial tracers of ISM moisture transport processes. Here we presented spatiotemporal variations of stable isotopes in precipitation at three stations over Bangladesh in 2017-2018 to evaluate the influence of moisture sources and transport on intra-seasonal variations of stable isotopes in precipitation, combined with local meteorological data, ERA5 reanalysis data and HYSPLIT model. We found Bay of Bengal (BoB), tropical Indian Ocean (TIO) and Arabian Sea (AS) were the primary moisture suppliers throughout the year and moisture uptake process primarily occurred over BoB. The most enriched $\delta^{18}O$ and δD values exist in the pre-monsoon season, associated with >50% contributions from BoB, and gradually decline throughout the monsoon and post-monsoon seasons due to increased contribution of moisture from AS (~30%) and IO (~40%), and reach to their lowest values by the end of the post-monsoon season when >25% contributed from BoB and ~20% from TIO. The strongly positive $\delta^{18}O$-OLR and negative $\delta^{18}O$-humidity relationships were found at all three stations showing a decreasing pattern from south to north.$\delta^{18}O$-temperature ($\delta^{18}O$-precipitation) relationship was only found at southern stations at local scale. Convective activities over the AS, BoB and northern IO primarily regulate the $\delta^{18}O$ depletion, and a weak (strong) flux-$\delta^{18}O$ relationship for northward (eastward)

transport was found. This study could improve understanding of moisture transport by the ISM for our societies to promote the water resource management over AWTs.