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Meteorological controls on isotope ratios in rainwater from an inland and a costal station (Bangalore and Thiruvananthapuram) in Southern India

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The isotope ratios in rainwater are controlled by factors such as source water composition and intensity of convective activity (Rahul et al., 2016). In this study, we investigate the atmospheric controls on rainwater δ18O values collected from two Indian stations, Thiruvananthapuram (TRV, n=222 with average of -2.58$\pm$3.06‰ and Bangalore (BLR, n=198 with average of -1.94$\pm$3.94‰ covering the southwest monsoon (SWM) and northeast monsoon (NEM), for the time period of four years. The samples are collected at daily intervals and in some particular cases at intra-event time scales (4 events). It was observed that the seasonal variations are more pronounced over BLR due to its location in the central peninsular India, compared to TRV which is a coastal station. The intra-event based observations indicate amount effect is significant due to post-condensation evaporation during raindrop descent. This is supported by the observed low d-excess values of rainwater and its inverse correlation (r=0.5 to 0.8) with rainfall amount within events. The correlation between rainwater δ18O with the local rainfall amount was low (r=0.2 and 0.3) in both the stations whereas the isotope ratios respond to the monsoonal convective systems on a regional scale. Significant negative correlations of isotope ratios with the moisture convergence were obtained in spatio-temporal scales over parts of the Arabian Sea as well as over the regions of moisture pathways associated with synoptic scale disturbances over the BoB. We observe that the correlation pattern responds to seasonal changes at the moisture source regions during the period of SWM and NEM.

References

Rahul, P., P. Ghosh, S. K. Bhattacharya, and K. Yoshimura (2016), Controlling factors of rainwater and water vapor isotopes at Bangalore, India: constraints from observations in 2013 Indian monsoon, J. Geophys. Res. Atmos., 121, doi:10.1002/2016JD025352.