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Stable isotope ratios of atmospheric moisture and rainwater over the tropical semi-arid region, Bangalore, Southern India: insights into sources, regional water cycle and storm events during 2016

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The sources of atmospheric moisture can be determined using stable isotopes (δ18O and δ2H) of water vapour and rain water. In this study, an attempt has been made to decipher the sources of water vapour, and to account for the secondary processes like evaporation and/or transpiration that control the atmospheric moisture characteristics over the vegetated region in Bangalore, South India using stable isotopes as a tracer. The study area has been classified as tropical semi-arid region (with clear wet and dry seasons), and experiences annual rainfall of about 850 mm with relative humidity ranging between 40 and 80 %. Sampling of water vapour (n = 150) has been carried out for a period of ten months between February 2016 and November 2016 covering the ENSO year. The results for stable isotopes of water vapour shows that δ18O ranges between -18.9 ‰ and -8.5 ‰ with an average of -14 $\pm$ 2.1 ‰ while the δ2H is between -135.9 ‰ and -62.3 ‰ with an average of -91.2 $\pm$ 15 ‰The study shows that the δ18O and δ2H of water vapour varies seasonally with sudden isotopic depletion (-4‰ drop in δ18O) under extreme weather events (record of 2 cyclones and 4 depressions) observed at the oceanic moisture source regions (Arabian Sea and Bay of Bengal). The role of terrestrial moisture fluxes to atmosphere through evaporation and/or transpiration, and control of extreme climatic conditions over the ocean, on the atmospheric water vapour is discussed in this study. The present study gains significance as it helps in monitoring the climate variability as well as the land use-land cover change, particularly in the tropical semi arid region like Bangalore, South India.
Keywords: Water vapour, Stable isotopes, Evapotranspiration, Storms, Tropics, South India.