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A stable isotopic approach to estimate the contribution of evapotranspiration to the precipitation over coastal region of eastern India

Archana Josy and Prasanta Sanyal

Indian Institute of Science Education and Research Kolkata, Department of Earth Sciences, Nadia, India (archanajosy21@gmail.com)

Hydrological cycle over continents has input from precipitation and losses to the atmosphere through evaporation and transpiration. Satellite-based observations, pan evaporation data, and moisture tracking method showed that ca. 40 % of the terrestrial precipitation are contributed from the land derived evaporation. However, the extent of moisture production by evaporation may differ from the global average value; mainly due to variations in the land-cover and geographic location of the monitoring station. It is important to quantify the relative contribution of different moisture sources to the regional precipitation; especially in Southeast Asia as the agro-economic growth of this densely populated region is largely dependent on the precipitation. Analysis of the backward trajectories of the moist air-parcel showed that Bay of Bengal (BoB) is the dominant moisture contributor to the precipitation over Southeast Asia. The existing climate models from this region lack in direct isotopic measurements (δ^{18}O and δD, hereafter referred as δ only) of precipitation and atmospheric moisture, resulting in an uncertainty in the predictions. In this context, daily moisture and precipitation samples (n = 55) were collected simultaneously from a coastal station (22˚ 57.815' N, 88˚ 31.589' E) in the eastern India during 2016-17. The difference between the δ^{18}O values of the moisture and precipitation is 9.4 ‰ which is close to the equilibrium fractionation between vapor and liquid (10.2 ‰) calculated for a condensation temperature of 10 ˚C. In the present study, the atmospheric moisture over the sampling station is assumed to be a mixture of oceanic and recycled moisture. The evaporation from the land surface and transpiration from the terrestrial vegetation are the two sources of the recycled moisture, which can be traced using the distinct isotopic composition of each source. The δ value of the evaporated moisture (δ_{EV}) has been calculated using Craig-Gordon model. In the studied site, the average $\delta^{18}O_{EV}$ value is -21.82 $\pm$ 0.7 ‰ (1 σ) . The average $\delta^{18}O_{EV}$ value is further used in this study to estimate the ratio of transpiration and evapotranspiration (i.e., T/ET). According to our study, the T/ET for the studied site would be 0.84.