

Isotope hydrology of a tropical coastal lagoon: Evaporative loss estimates

GYANA RANJAN TRIPATHY^{1,*}, MOHD DANISH¹, NAVEEN GANDHI², RAJANI PANCHANG¹

¹Earth and Climate Science, Indian Institute of Science Education and Research, Dr. Homi Bhabha Road, Pune-411008, India

²Indian Institute of Tropical Meteorology, Pune-411008, India

(*Presenting Author-grtripathy@iiserpune.ac.in)

Coastal lagoons receive large nutrient influx from surface and groundwater runoffs, and exchange matter and energy with the open ocean. Water balance estimates of these highly-productive lagoons can help in understanding the carbon cycle better. Recognizing this, surface and benthic water samples were collected during June, 2016 from the Chilika lagoon, India's largest coastal lagoon located along the east coast of India. Here we present the spatial distribution of temperature, salinity, oxygen and hydrogen isotopes measured on these samples. Stable isotopic analyses of source waters (rain, river and ground water) contributing to the lagoon were also analyzed. The pear-shaped lagoon receives seawater from the Bay of Bengal mainly at its central region, whereas most of the freshwater influx comes from northern part with sub-ordinate supply also from the south.

The surface salinities varied widely from 7.5 to 37.6 psu, consistently higher than corresponding benthic salinities. Unlike the salinities, the dissolved $\delta^{18}\text{O}$ ratios of the lagoon showed limited depth variation. The $\delta^{18}\text{O}$ ratios of the surface water were significantly enriched than the source waters, attributable to intense evaporative loss. Relatively lower slope of the $\delta\text{D}-\delta^{18}\text{O}$ regression line as compared to that of the local meteoric water line also confirm significant evaporation from the lagoon. Calculations based on Rayleigh fractionation involving $\delta^{18}\text{O}$ ratios were suggestive of evaporation of about 15% of the total lagoonal water volume during the non-monsoon season. These losses were marginally higher in the southern sector and lower in the central part of the lagoon.

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