International Symposium on

Isotope Hydrology

Advancing the understanding of water cycle processes

Vienna, Austria
20-24 May 2019

Organized by the
International Atomic Energy Agency

IAEA Water Resources Programme

CN-271

ID: 147

TRACING SURFACE WATER DYNAMICS AND GROUNDWATER RECHARGE AT INLE LAKE (SOUTHERN SHAN STATE, MYANMAR) USING STABLE WATER ISOTOPES.

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Abstract: An isotopic monitoring (δ^2H, $\delta^{18}O$) of the Inle lake (Southern Shan State, Myanmar) permitted to define the isotopic fingerprint of the lake in the three different seasons (rainy, winter and summer), and to support evidences of groundwater contribution to aquifer recharge in absence of precipitations.

1. INTRODUCTION

The Inle Lake (Southern Shan State, Myanmar) is the main provider of ecosystem services for most of the communities living around its area. However, despite its relevance, several uncertainties related to its water balance and recharge sources hamper the establishment of adequate policies for its protection. This paper aims at improving the state of the art, by discussing the seasonal water dynamics, and to assess the relevance of precipitation and groundwater on lake recharge.

2. METHODS

An isotopic monitoring was conducted over five years (2013 –2018; 1- 2), collecting surface water samples from five study sites in the Inle Lake. Sampling campaigns were performed in the tree different seasons: rainy (June to October), winter (November to February) and summer (March-May). Stable isotopes of the water molecule were determined by Wavelength-Scanned Cavity Ring-Down Spectroscopy (WS-CRDS) at ISO4 s.n.c. laboratory in Italy. Results are reported in the delta (δ) notation versus Vienna Standard Mean Ocean Water (VSMOW), with uncertainties (2σ) of ± 0.2‰for $\delta^{18}O$ and ±1‰for δ^2H.

3. RESULTS

The average isotopic composition of lake waters in the different seasons is shown in Table 1. In the rainy season, all samples show values coherent with the isotopic composition of precipitation in Yangon [3], except for water from the central part of the lake. This still shows sings of the strong evaporation that affects the water body during summer (Figure 1), suggesting a piston-flow movement from N to S, a full replacement of lake water in winter and a residence time of less than one year [2]. The regression line calculated for summer lake waters

crosses the YMWL in correspondence of the average isotopic composition of groundwater, suggesting that, in absence of precipitation, recharge by the aquifer dominates.

Table 1. Average isotopic composition of Inle Lake water in the different seasons.

Season	$\delta^{18}O$	$\delta^{2}H$	*d*
Rainy	-6.41 ± 0.88	-49.86 ± 6.03	1.42 ± 2.77
Winter	-5.84 ± 0.22	-44.49 ± 2.77	2.26 ± 1.80
Summer	-2.58 ± 0.62	-23.57 ± 2.59	-4.19 ± 3.46

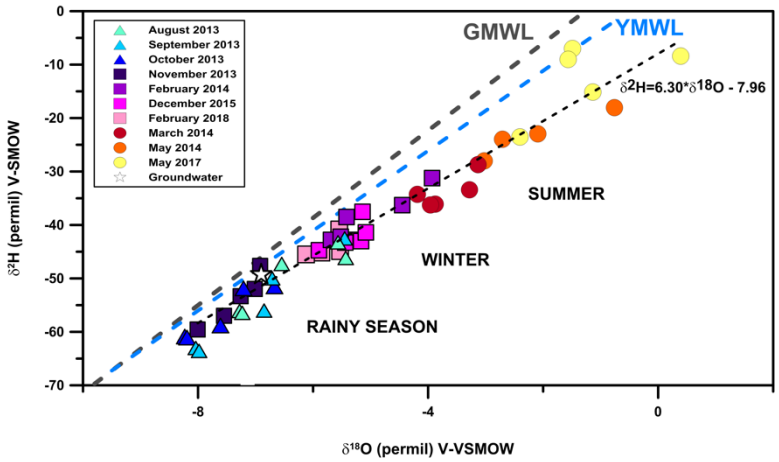

Figure 1. Seasonal variation of the isotopic composition of lake waters, compared to the. Global Meteoric Water Line (GMWL, [4]) and Yangon precipitation waters (YMWL, [3])

4. CONCLUSIONS

Results permitted to define the isotopic fingerprint in the different seasons. supporting the hydrological model of the lake [1, 2]. They should be used to establish a water balance, in conjunction with discharge measurements, in order to assess the vulnerability of the area to climate changes.

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