

Water level variation and its driving factors in Lake Dianchi, Fuxian and Yangzong during 1988–2015

HE Kediao^{1,2}, GAO Wei¹, DUAN Changqun¹, ZHU Yuangao², PAN Ying¹, LIU Chang'e¹, ZHANG Wei¹ & YANG Guiying^{1,3}

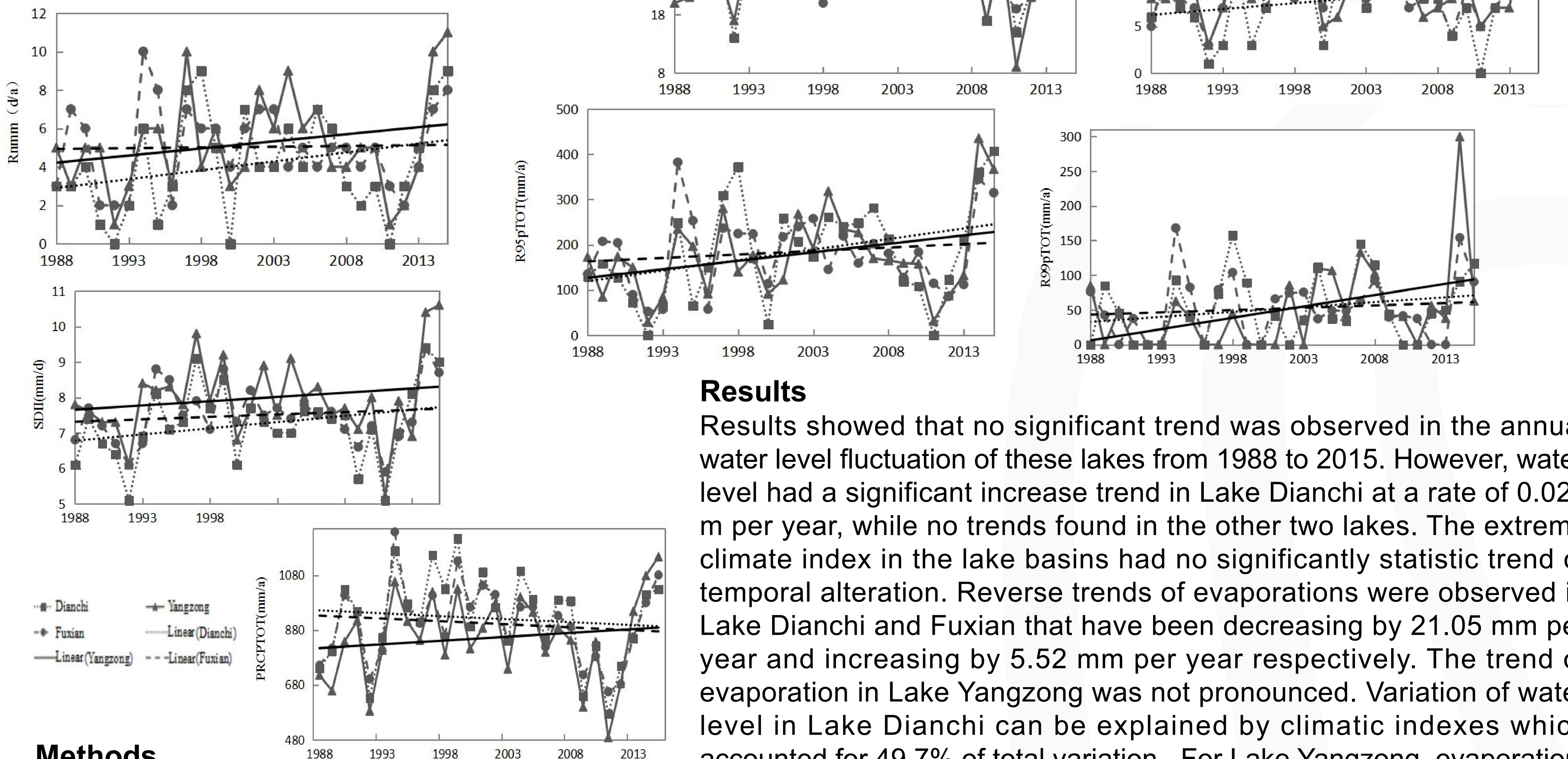
(1: School of Ecology and Environmental Sciences & Yunnan Key Laboratory for Plateau Mountain Ecology and Restoration of Degraded Environments, Yunnan University, Kunming 650091, P.R.China)

(2: Yunnan Hydrology and Water Resources Bureau, Kunming 650106, P.R.China)

(3: Southwest Forestry University, Kunming 650224, P.R.China)

Objectives

As an emerging research topics of limnology, variations in water level play a key role in regulating water quality, volume and ecosystem function of lakes. However, the characteristics of plateau lake group located in central Yunnan of China have not been well studied. Taking Lake Dianchi, Fuxian, and Yangzong as the study cases, the trends of water level were analysed in order to provide scientific basis for water resources management and water ecological protection of lakes in the middle Yunnan Plateau.



Methods

The trends of water level were analysed based on Mann-Kendall statistic approach, and an index system related to fluctuations of water level were established with extreme precipitation index generated from ReClimDex and other metrological index. Coupling multiple linear regression and principal factor model, a model for water level alteration of plateau lakes was built to distinguish main driving factors and their effects.

Results

Results showed that no significant trend was observed in the annual water level fluctuation of these lakes from 1988 to 2015. However, water level had a significant increase trend in Lake Dianchi at a rate of 0.025 m per year, while no trends found in the other two lakes. The extreme climate index in the lake basins had no significantly statistic trend of temporal alteration. Reverse trends of evaporations were observed in Lake Dianchi and Fuxian that have been decreasing by 21.05 mm per year and increasing by 5.52 mm per year respectively. The trend of evaporation in Lake Yangzong was not pronounced. Variation of water level in Lake Dianchi can be explained by climatic indexes which accounted for 49.7% of total variation. For Lake Yangzong, evaporation, amount of precipitation and days of consecutive precipitation accounted for 93.3% of variation of water level. Index of precipitation and dry spell can explain 64.5% of variation of water level in Lake Fuxian.

Conclusions

Variation of water level in Lake Dianchi can be ascribed to the combined effects of anthropogenic activities and climatic conditions. By contrast, water level variations of Lake Fuxian and Yangzong were mainly influenced by climatic conditions. Extreme precipitation indices play an important role in explaining water level change in plateau lakes.