

# Research on Ecological Water Replenishment Scheme of Yilong Lake Based on Mike21 Model

Qin Yinhui<sup>1</sup>, Yang Zhi<sup>2</sup>, Ma Wei<sup>2,3</sup>, Chen Xin<sup>1, 2</sup>, Zhou Yun<sup>2</sup>, Shu Guobiao<sup>1</sup>, Luo Yuehui<sup>1</sup>, Peng Fei<sup>1</sup>

(1. Yunnan Water Resources and Hydropower Survey and Design Institute Co., Ltd, Kunming 650021, China; 2. Yunnan Institute of Water & Hydropower Engineering Investigation, Design and Research, Kunming 650021, China; 3. Institute of Water Ecological Environment, China Institute of Water Resources and Hydropower Research, Beijing 100038, China)

## Objectives

Yilong Lake is the lake that is the most easily disturbed by human activities with the smallest area and the least water amount among the nine plateau lakes in Yunnan Province. Due to obvious fluctuations of its water quality in recent years, it is in urgent need of improvement. In view of the lack of hydrological and water quality data in Yilong Lake basin and the obvious disturbance of water quality by climate and human activities, it is necessary to simulate and invert the evolution process of water dynamics and quality in Yilong Lake Basin by using numerical simulation technology.

## Methods

In this paper, the GPS-based tracking buoy, acoustic Doppler current profiler and intensive monitoring of the water quality of incoming rivers and the lake are used to monitor the hydrodynamics and water quality in Yilong Lake before and after ecological water replenishment, so as to concretely analyze and demonstrate the improvement effect of water replenishment quality and build a two-dimensional coupling model of hydrodynamic and water quality based on Mike21.

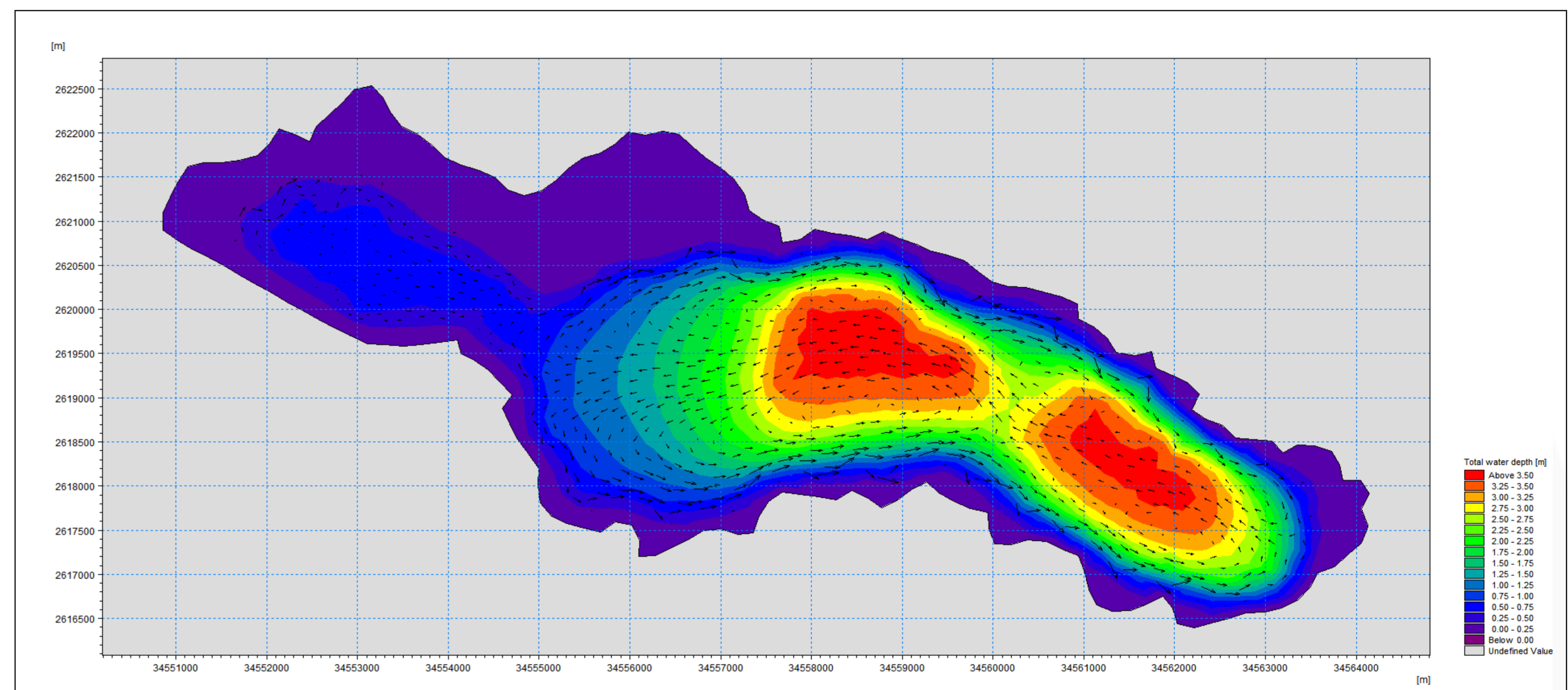


Figure 1 Flow Field with Dominant Wind Direction (SW)

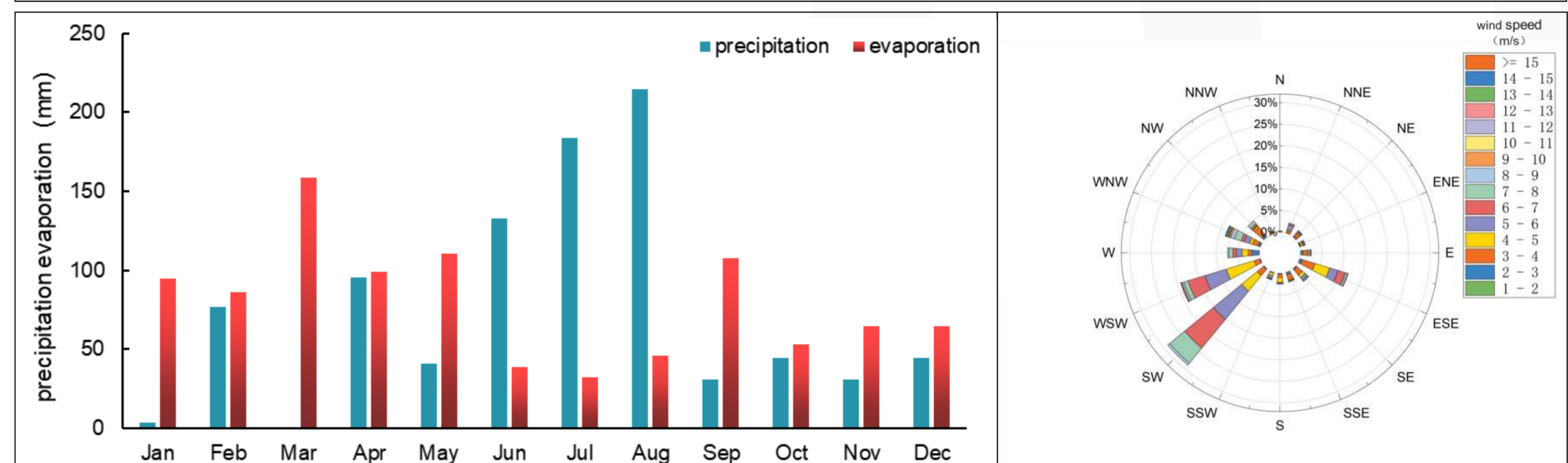


Figure 2 Rainfall and Evaporation

Figure 3 Wind field of the model

## Results

The simulation results show that SW winds are prevalent in Yilong Lake all the year round, with a northwest-to-southeast flow direction at the north and south lakeshores, a clockwise circular current in the center of the lake and a small counterclockwise circular current in the east. Under the conditions of annual replenishment volume of about 35,000,000 m<sup>3</sup> and multiple points and maximum water supplement capacity of 1.95m<sup>3</sup>/s, the average annual COD concentration of three points in the west, middle and east of the lake can be improved by about 27.6%, 24.0% and 18.1% respectively during the dry season (from November to May next year), with significant water quality improvement effect brought by replenishment, which can provide references for decision-making for ecological scheduling and lake water ecology restoration in Yilong Lake.

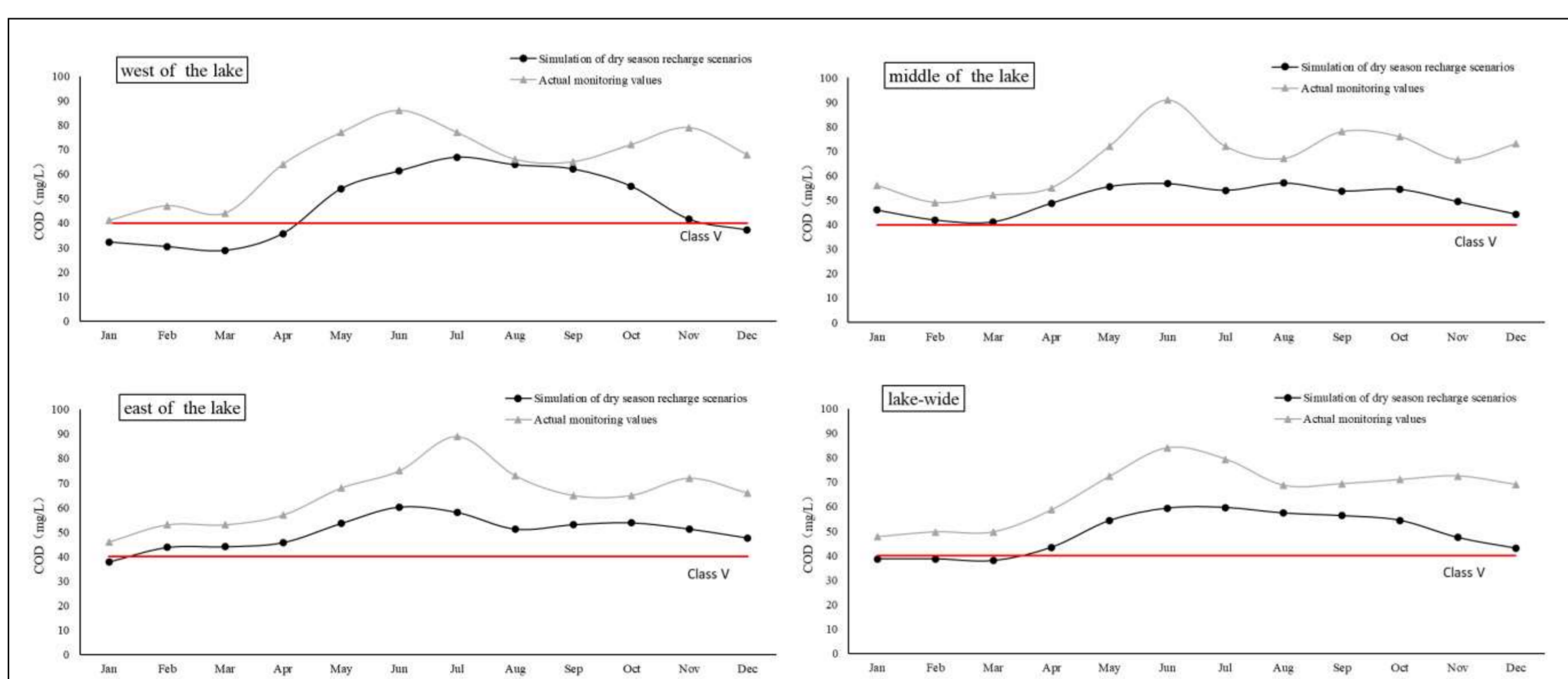


Figure 4 Modeled COD concentrations at monitoring sites under the 1-year dry season recharge scenario

## Conclusions

Under the influence of the dominant wind direction, there are obvious weak current areas in the western part of the lake, which is not conducive to the exchange of water and nutrients between the western part of Yilong Lake and the lake. Among them, the flow velocity in the large circulation areas in the middle and east of the lake is relatively high, while the flow velocity in the weak current area in the east of the lake is relatively minimum, and the flow velocity on the lake bank is greater than that in the lake area.

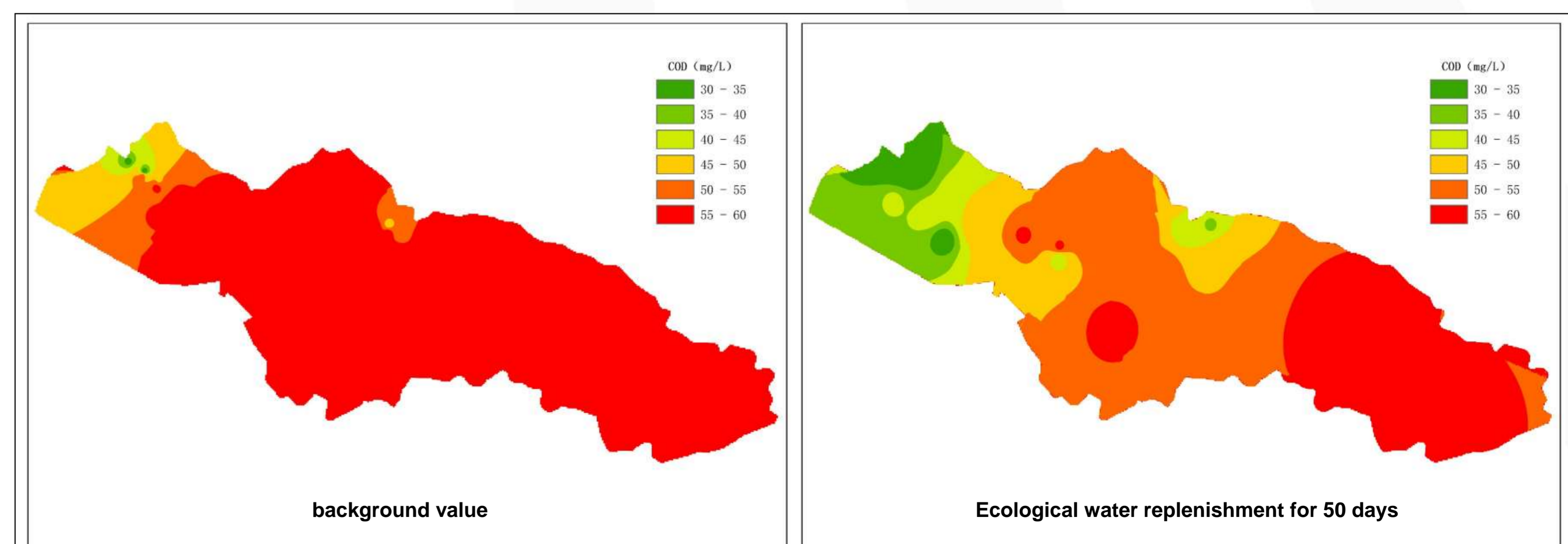


Figure 5 Schematic of ecological water replenishment effect