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Spatial and temporal distribution of aquatic vegetation and chlorophyll-a in East Lake

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Objectives

To maintain the healthy water ecosystem of East Lake Taihu is of great significance to the safety of drinking water for Wujiang District of Suzhou City and aquatic ecology and environment of the Yangtze River Delta eco-green integrated development demonstration zone.

Methods

Sentinel-2 satellite images were selected to interpret aquatic vegetation coverage, with a threshold being established to distinguish open water and aquatic vegetation by using NDVI index. An inversion model of chlorophyll-a in open water was established by intergration of satellite, manual optical spectrum instrumentation (ASD FieldSpec HandHeld2) and water quality *in situ* to analyze the spatio-temporal variation of aquatic vegetation and chlorophyll-a concentration in East Lake Taihu from 2017 to 2022.

Results

(1) The area of aquatic vegetation showed the decreasing trend, with the lowest value of 41.49 km^2 in 2022, which decreased by 33.55% compared with the maximum of 62.43 km^2 in 2018. In terms of spatial distribution, the area of aquatic vegetation in the former East Jiaozui girth network decreased most significantly. Almost all the aquatic vegetation in area A disappeared, while the aquatic vegetation in areas B and C gradually shrank to the inner bank.

(2) From 2017 to 2022, the mean annual Chlorophyll-a concentration in the open water of East Lake Taihu was 8.05 μg/L, and that in Miaogang and Tingzi Port intakes were 11.11 μg/L and 10.30 μg/L, respectively. In the period of cyanobacteria outbreak in the East Lake Taihu, cyanobacteria gathered from the center of the lake to the shore. The mean concentration of Chlorophyll-a in the southwest water was higher than that in the northeast lake, and that in the south of the horn mouth of Taipu River was higher than that in the north. On August 17, 2019, the concentration of Chlorophyll-a in the intake of Miaogang and Tingzi Port water source exceeded the "major event" limit (60 μg/L), and the maximum concentration of Chlorophyll-a in the intake reached 108.93 μg/L and 95.41 μg/L, respectively.

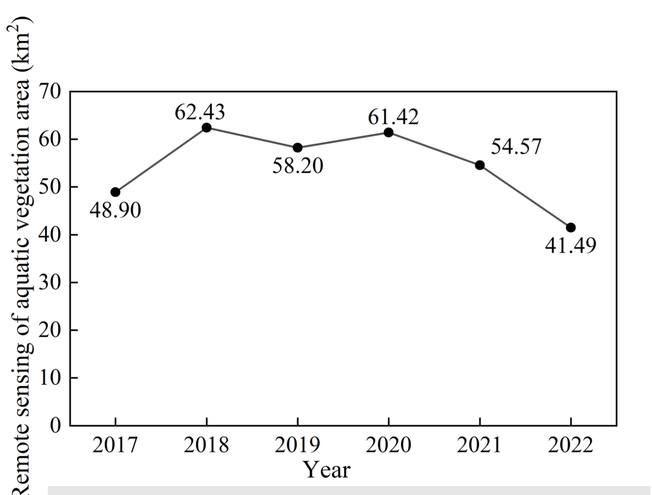

Figure 1 Interannual variation of aquatic vegetation in East Lake Taihu

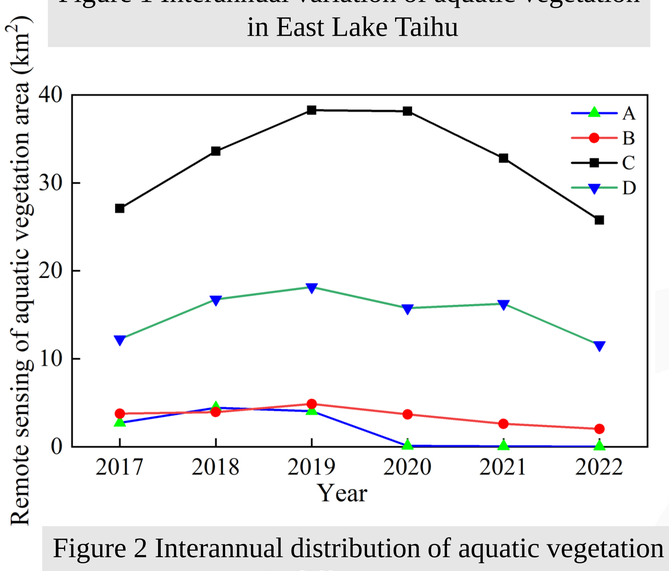

Figure 2 Interannual distribution of aquatic vegetation in different zones

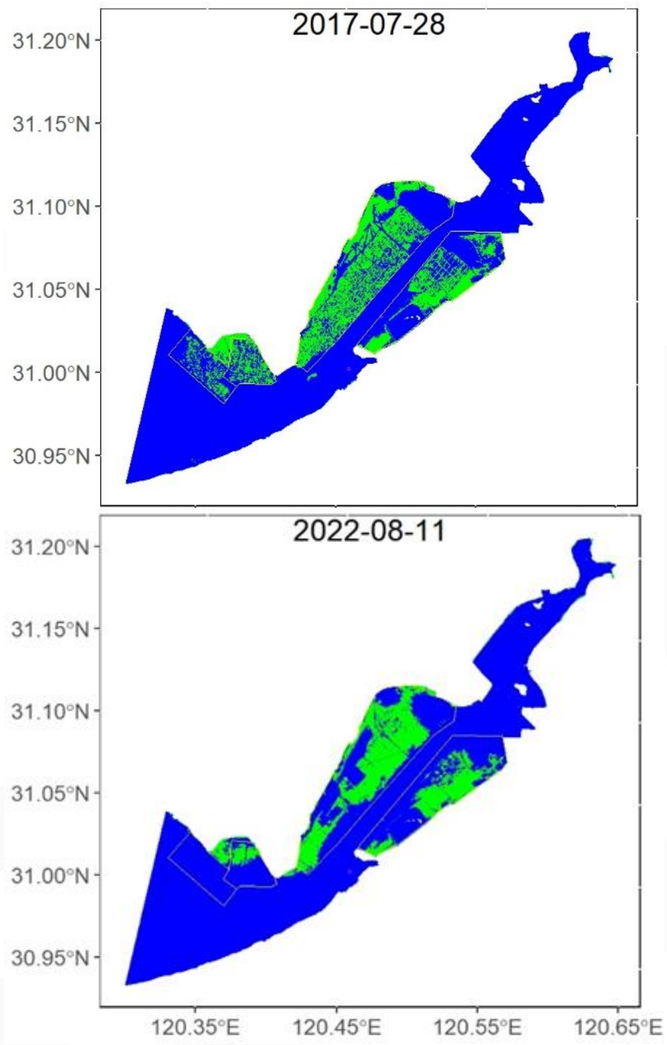

Figure 3 Summer aquatic vegetation distribution in East Lake Taihu monitored by remote sensing

Conclusions

In this study, a classification model of aquatic vegetation and water bodies in East Lake Taihu was proposed, and a chlorophyll-a inversion model was established. From 2017 to 2022, the distribution of aquatic vegetation in East Lake Taihu has obvious spatiotemporal heterogeneity. In the long run, the concentration of chlorophyll-a in open water is mainly affected by the concentration of nutrient, the intra-annual concentration of chlorophyll-a is mainly determined by temperature and precipitation, and the algae source, light and wind field are the main factors affecting the spatial distribution of chlorophyll-a in the short term.

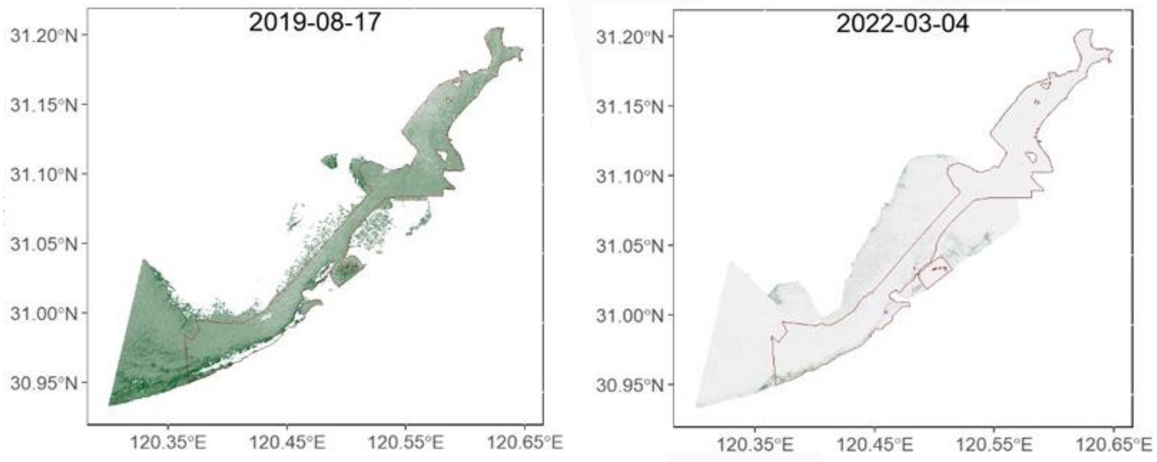

Figure 4 Spatial distribution of chlorophyll-a concentration in Eastern Lake Taihu during the cyanobacteria outbreak period