

Risk mitigation and control of harmful algal blooms (HABs) in Chaohu Lake

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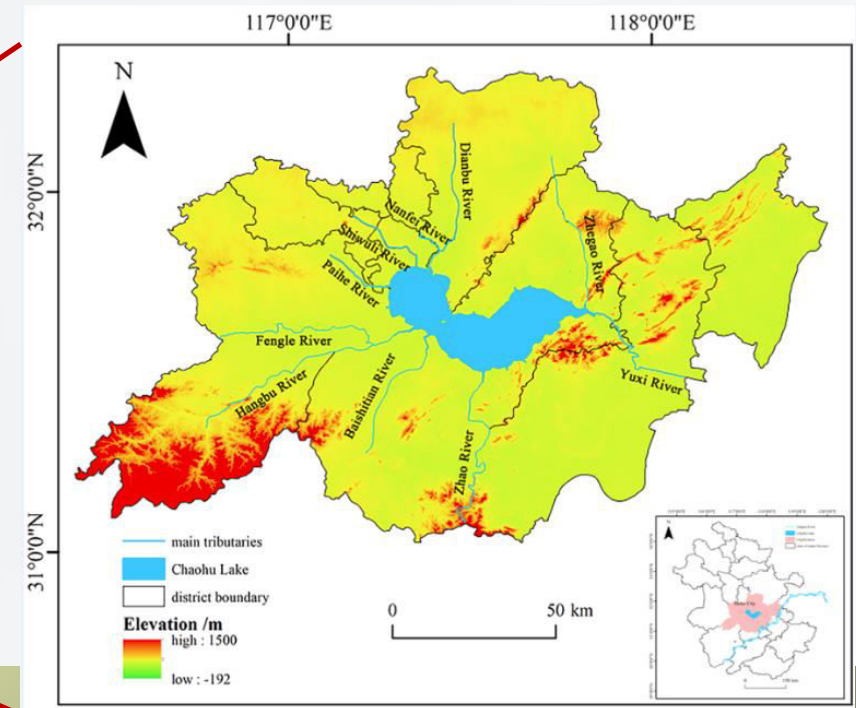
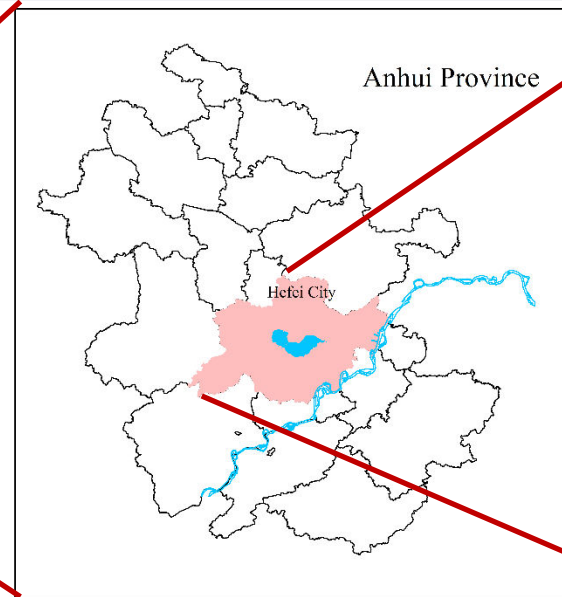
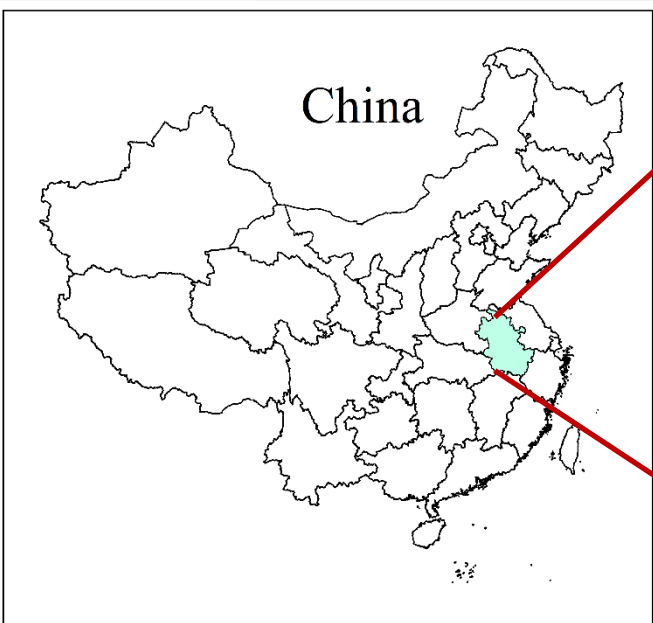
Content

- **Profile of Chaohu Lake and its algal blooms (HABs)**
- **Spatio-temporal dynamics of HABs in Chaohu Lake**
- **Driving forces of the HABs of Chaohu Lake and significance**

1. Profile of Chaohu Lake and its algal blooms (HABs)

Chaohu Lake

- Located in mid-eastern China (117° 16'54"-117°51'46"E,31° 43'28"-31° 25'28 " N)
- China's fifth largest shallow inland lake
- average depth of 2.67 m
- Numerous inflow tributaries and only one outflow main tributary



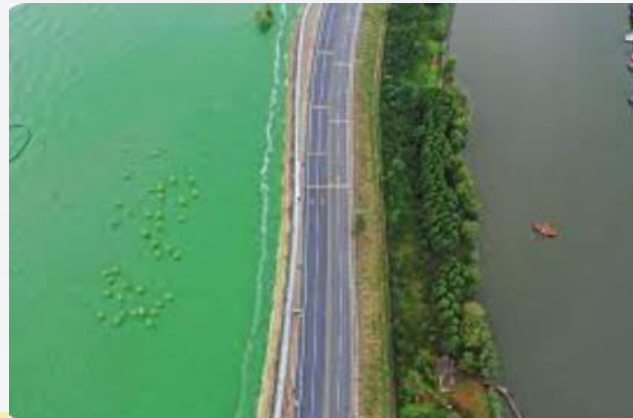
1. Profile of Chaohu Lake and its algal blooms (HABs)

Chaohu Lake is famous for its algal blooms:

- HABs broke out since 1990s
- An average of 6.1 times per year
- encountered a fast increasing after 2006

Reason:

- Shallow freshwater lake
- Favorable temperature (25-35°C)
- Slow water exchange
- Fast socio-economic development



2. Spatio-temporal dynamics of HABs in Chaohu Lake

Data source

- MODIS remote sensing data
- Frequency: 1-2 day
- Spatial resolution: 250 m
- Observation duration: 2000-2021

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Image amount	312	365	365	365	366	365	365	365	366	365	365
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Image amount	365	366	365	365	364	367	365	365	362	369	309

Data

- 7926 remote sensing images

HABs indicator

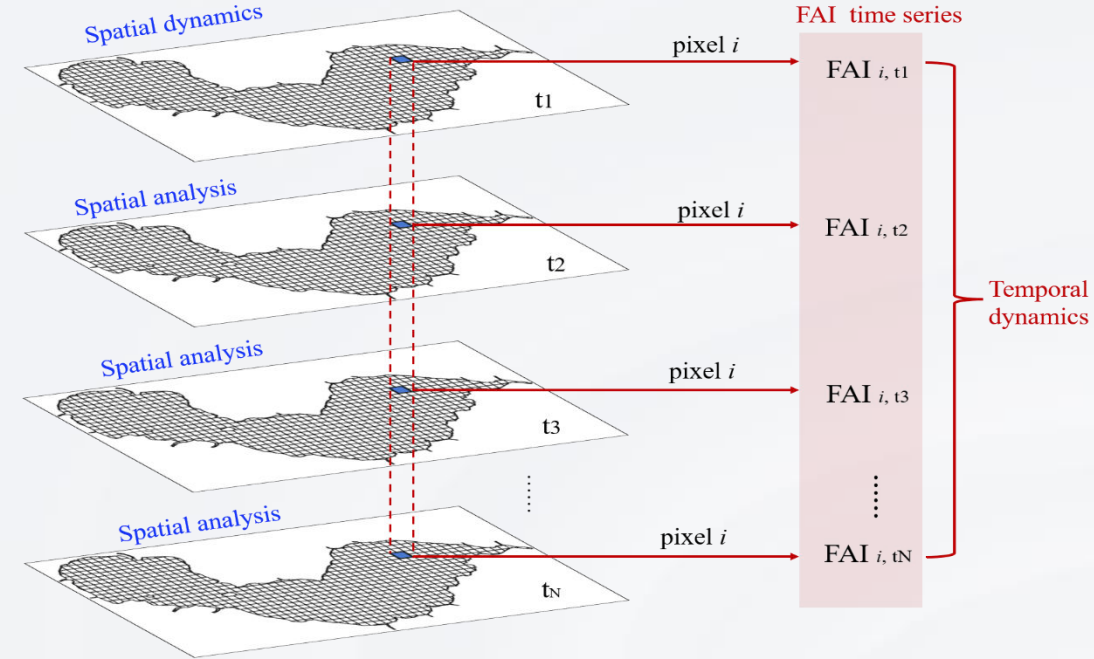
- Floating algae index (FAI)
- Threshold: -0.0026 (pixels with FAI value greater than -0.0026 is regarded as algae coverage)

$$FAI = R_{rc,NIR} - R'_{rc,NIR}$$
$$R'_{rc,NIR} = R_{rc,RED} + (R_{rc,SWIR} - R_{rc,RED}) \cdot \frac{\lambda_{NIR} - \lambda_{RED}}{\lambda_{SWIR} - \lambda_{RED}}$$

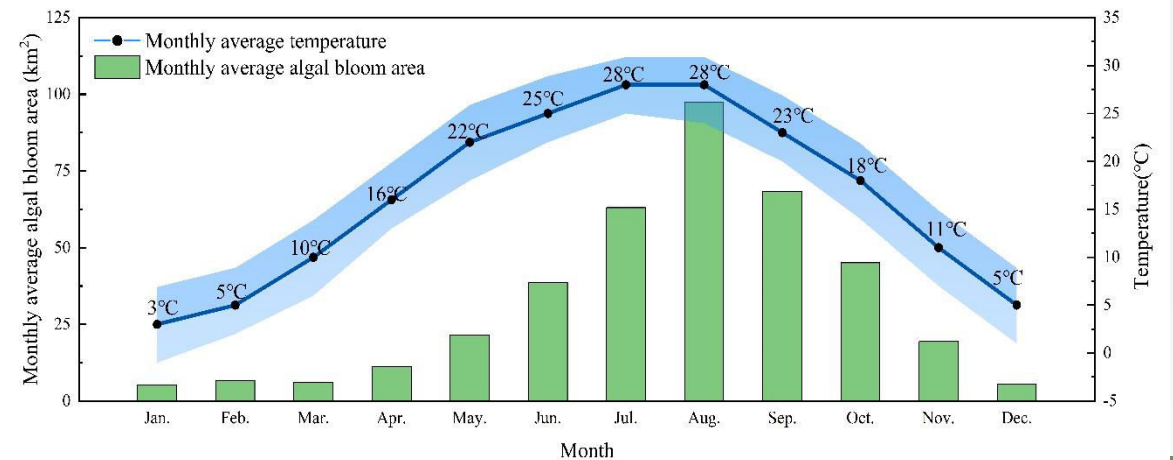
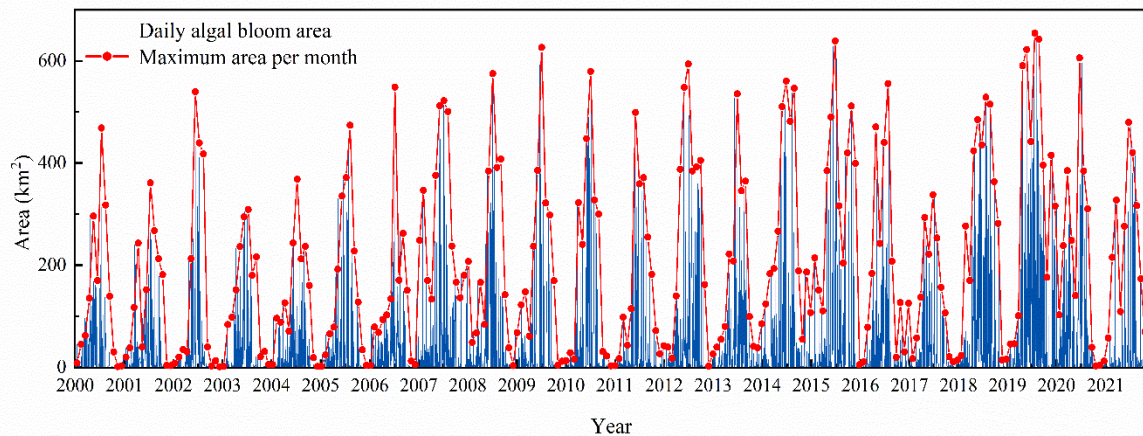
2. Spatio-temporal dynamics of HABs in Chaohu Lake

Spatial dynamics & Temporal dynamics

- spatial dynamics: image by image
- temporal dynamics: merging time series of each pixel



Temporal dynamics



2. Spatio-temporal dynamics of HABs in Chaohu Lake

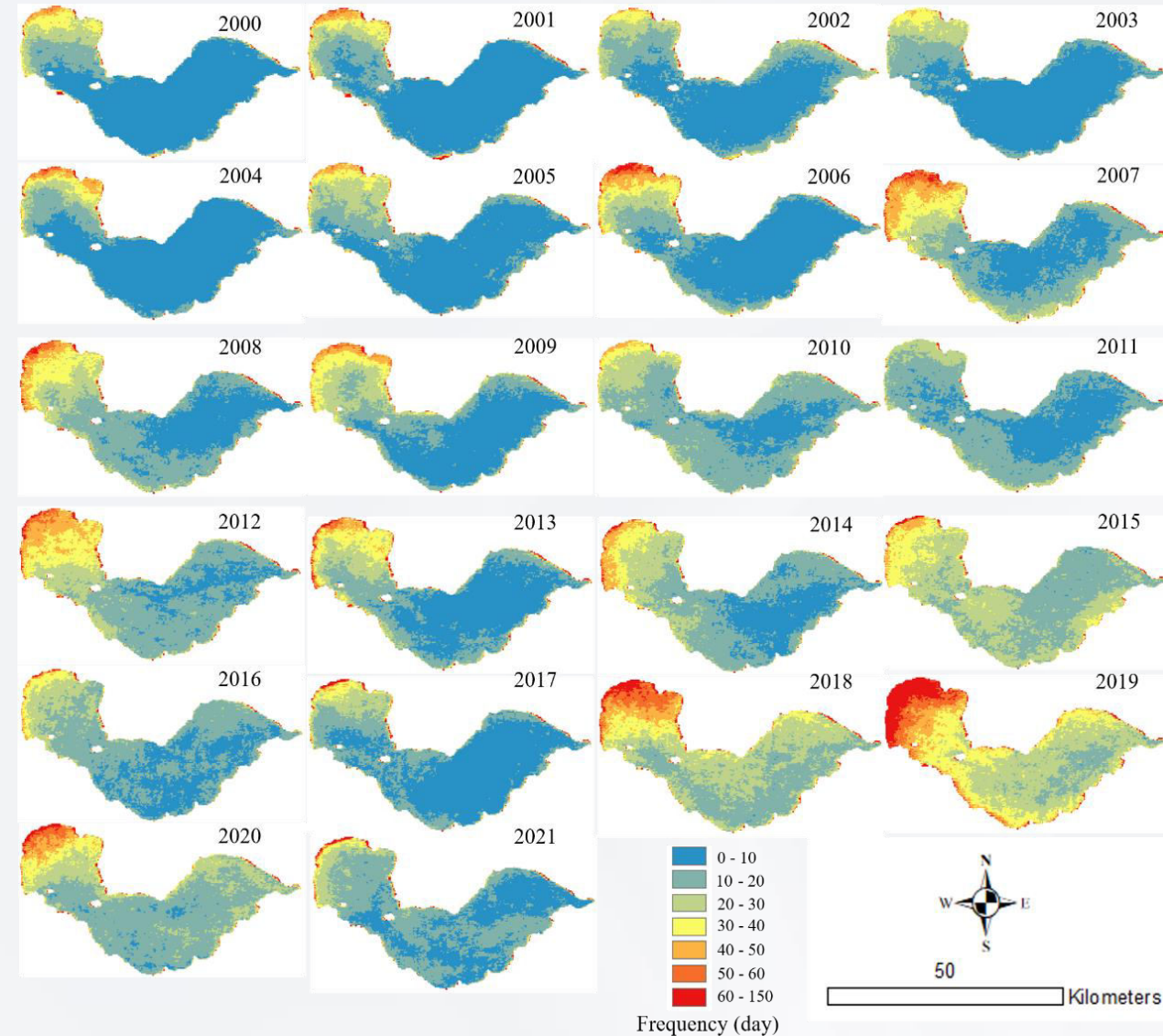
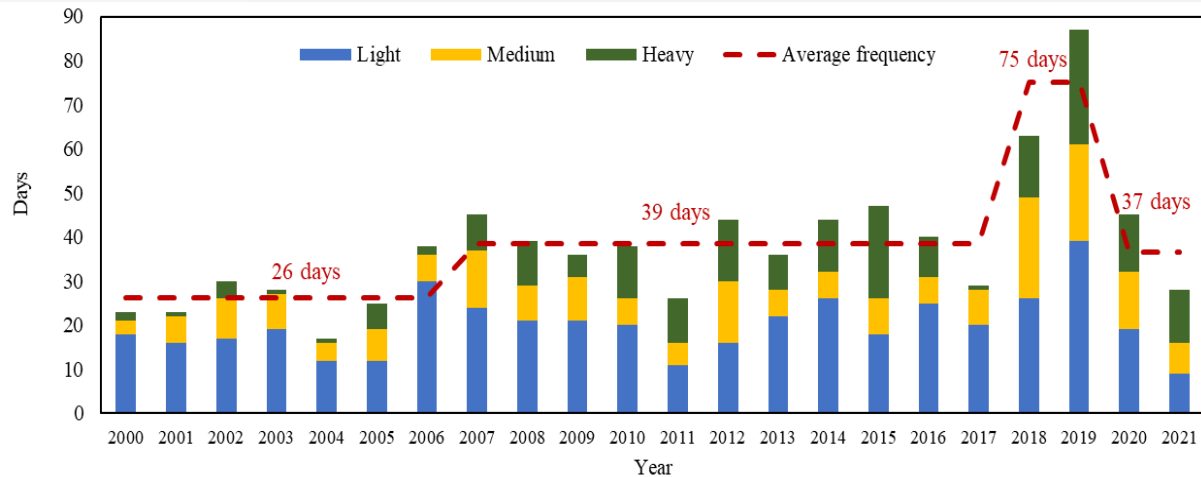
Spatio-temporal dynamics

Stage 1 (2000-2006): **Light and stationary.**

Stage 2 (2007-2017): **Increasingly worsened.**

Stage 3 (2018-2019): **Sharp increase.**

Stage 4 (2020-2021): **Sharp decrease.**



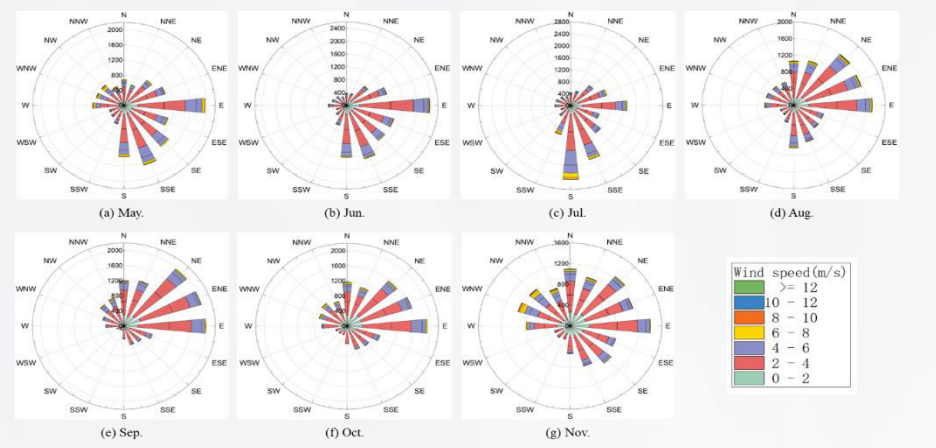
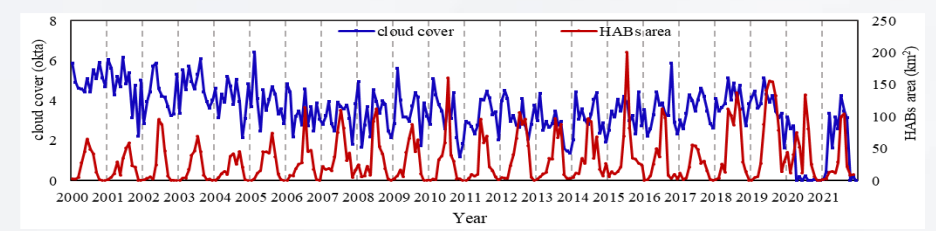
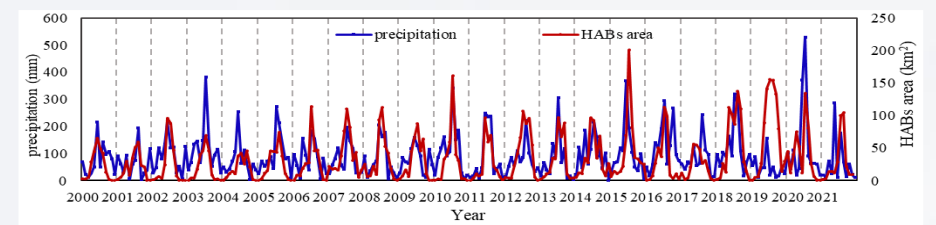
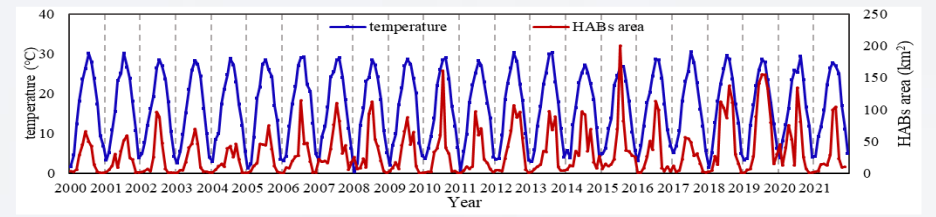
3. Driving forces of the HABs of Chaohu Lake and significance

Meteorological driving forces:

- precipitation
- temperature
- cloud cover
- wind direction and velocity

	Temperature	Precipitation	Cloud coverage	HABs area
Temperature (°C)	1			
Precipitation (mm)	0.49	1		
Cloud coverage (okta)	0.09	0.21	1	
HABs area (km ²)	0.70	0.49	0.10	1

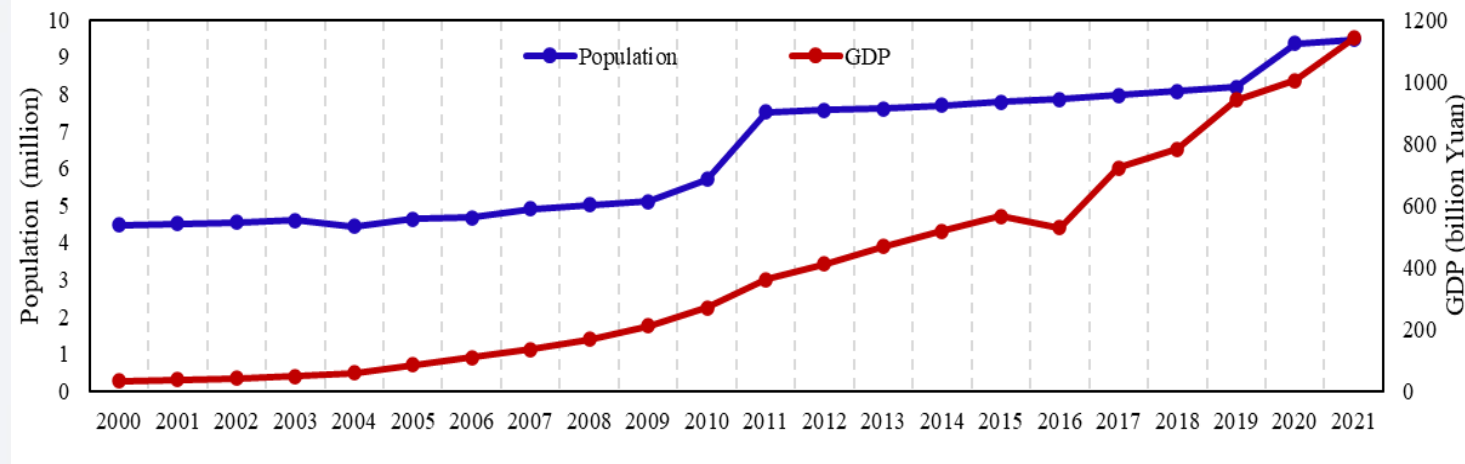
- Temperature is the primary meteorological driving force of HABs
- Precipitation is the second important driving force



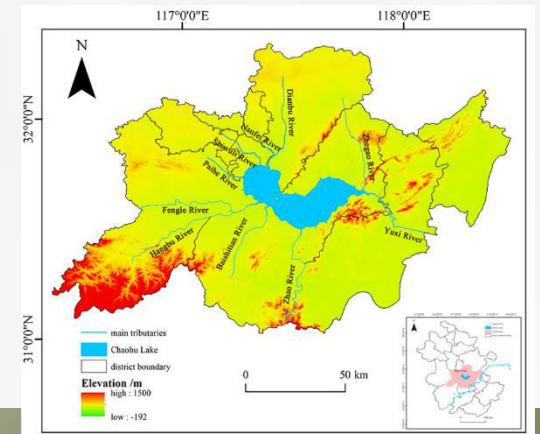
3. Driving forces of the HABs of Chaohu Lake and significance

Socio-economic driving force

- Population
- GDP
- Policy



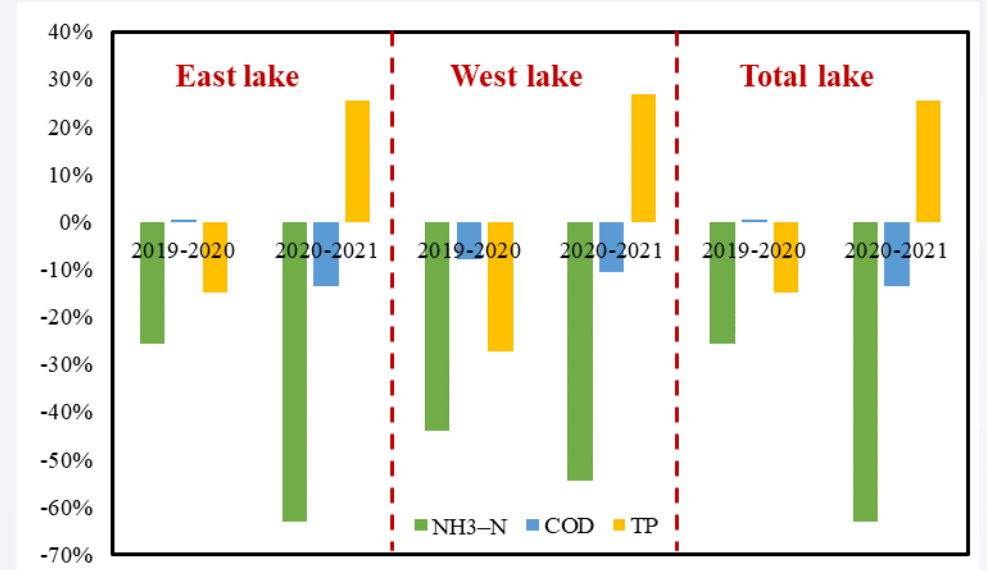
- The fast-growing stages of GDP and population were almost synchronized: increased slowly before 2009 but rapidly since 2010 and have maintained at high speed since then.
- Fast wastewater discharge to the Chaohu Lake through its northwestern tributaries, such as Shiwuli, Pai, and Nanfeihe rivers



3. Driving forces of the HABs of Chaohu Lake and significance

Sharp decrease of HABs occurred since 2020

- Population and GDP: increasing
- Temperature: increasing
- Precipitation: extreme flood in 2020
and extreme drought in 2021



Reason ----- Systematic management countermeasures

- Pollutant control
- Ten wetland parks surrounding lake
- Ecological flow of water diversion projects

urrent Position: English > Local News

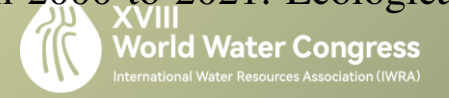
Ten Wetlands Around Chaohu Lake Fully Completed

Updated:2022-08-08 09:07 hits:28

A lake-surrounding wetland group rarely seen in China made its debut. Recently, Hefei announced that the ten wetlands around Chaohu Lake with a total area of 100 square kilometers and a cumulative investment of RMB 5.85 billion have been completed.



Zhou, T., Li, Y., Jiang, B., Alatalo, J.M., Li, C., Ni, C., 2023. Tracking spatio-temporal dynamics of harmful algal blooms using long-term MODIS observations of Chaohu Lake in China from 2000 to 2021. *Ecological Indicators* 146, 109842. <https://doi.org/10.1016/j.ecolind.2022.109842>



Thank you !

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