



# Impact of Extreme Drought Event on Poyang Lake by Using Sentinel-1 SAR and Multispectral Satellites



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## ABSTRACT

During November 2022, Poyang Lake suffered from a severe drought disaster, and the water level at Xingzi Station receded to 6.48 meter, which set a new record low water level. In order to explore the impact of this extreme drought event on the hydrological patterns of Poyang Lake, we constructed a dataset of the water area in different periods by utilizing Sentinel-1 Synthetic Aperture Radar (SAR) images, with the advantages of high spatial-temporal resolution and all-day and all-weather working capacity. The relationship model between lake area and water level was constructed based on the data from hydrological stations in Poyang Lake. We found that the water level and water area showed strong correlation in recent years, especially at Xingzi station ( $R^2=0.88$ ). Therefore, we can make an early warning of the overall drought condition of Poyang Lake through the real-time water level of Xingzi Station, especially the change of food and environment of migratory birds' habitats. For purpose of assessing the drought disaster in Poyang Lake more accurately, we carried out the research on the precise classification of land cover. Afterwards, the algorithm was applied to estimate the yield of oilseed rape in Poyang Lake. Our research results can provide decision support for the relevant management departments for disaster early warning and assessment of Poyang Lake.

## INTRODUCTION

Poyang Lake is the largest freshwater lake in China, which plays an irreplaceable ecological service function in terms of water conservation, regulating Yangtze River floods, adjusting the climate, and providing biological habitats. Due to the complex relationship between rivers and lakes, Poyang Lake has always been one of the most serious areas of flood and drought disasters in China.



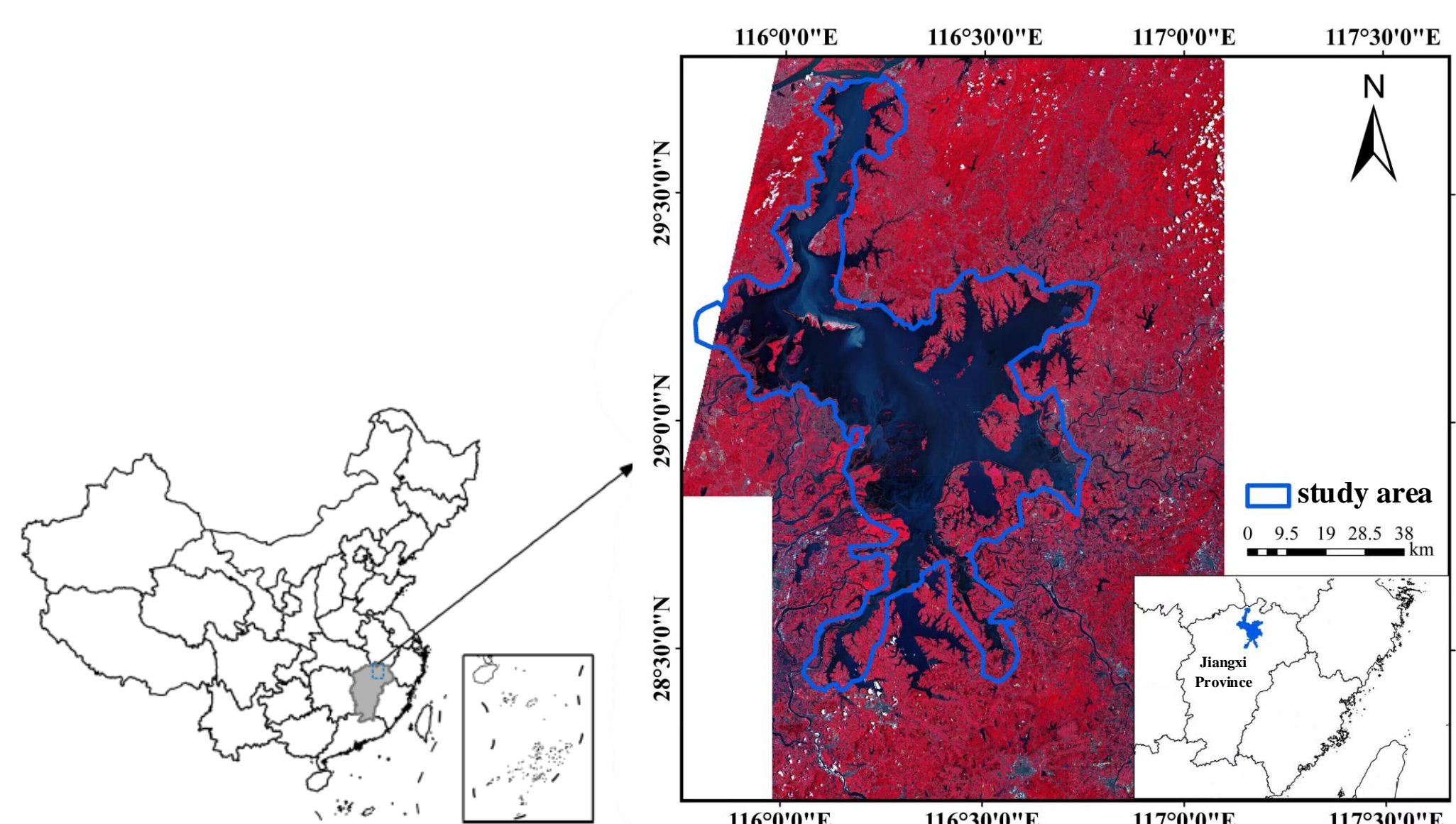
### Impact of the current drought:

Affected by the disaster 5.4 million people  
Drinking water difficulties 19700 people  
Affected area of crops  $701.3 \times 10^3 \text{ hm}^2$   
Economic losses 7.14 billion yuan



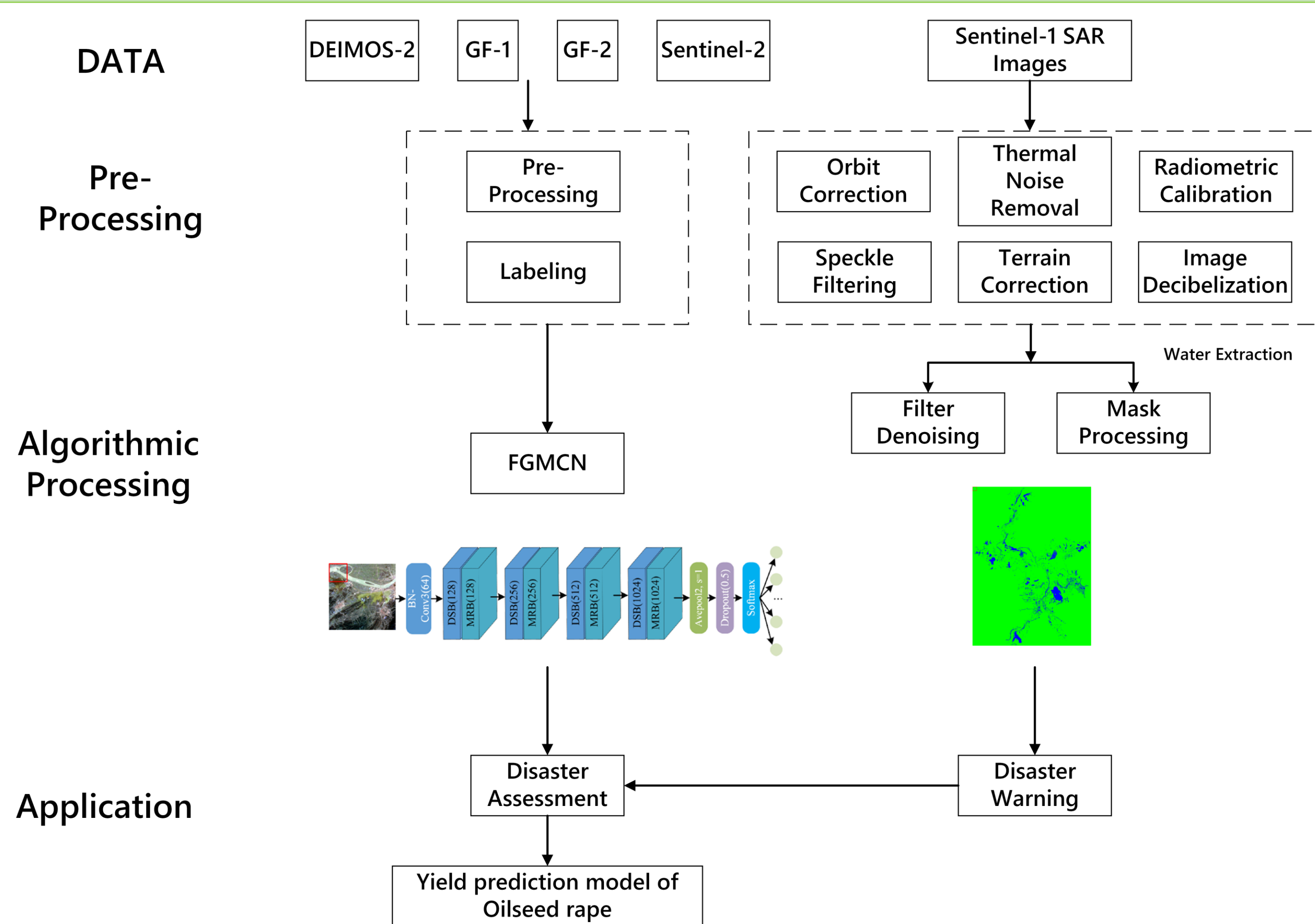
Death of the majority of submerged vegetation as well as mass mortality of benthic animal.  
Migratory birds such as cranes, swans lacked food.

## OBJECTIVE



1. How is the hydrological pattern of Poyang Lake in recent years?
2. How to realize the precise classification of land cover in Poyang Lake?

## METHODS

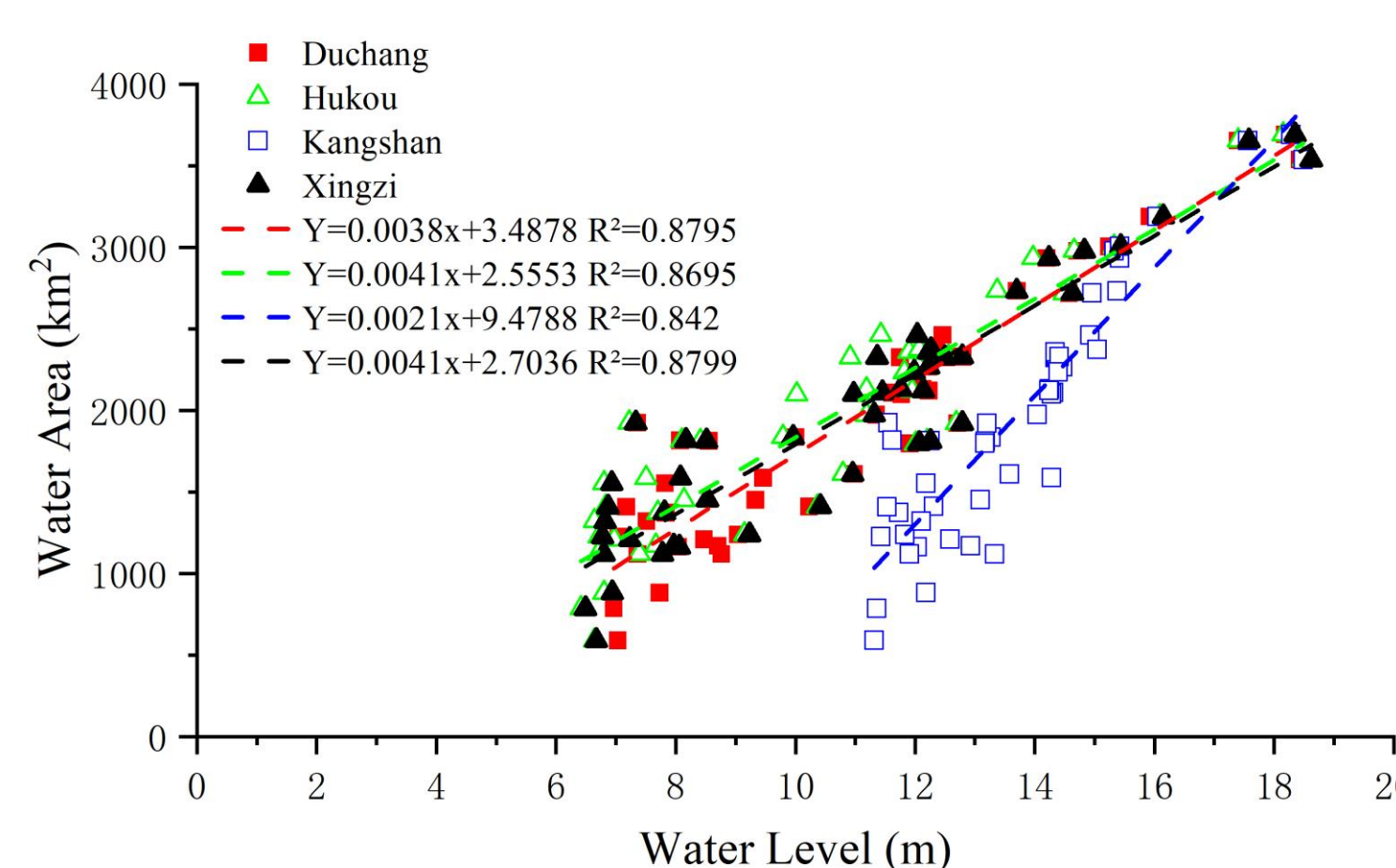
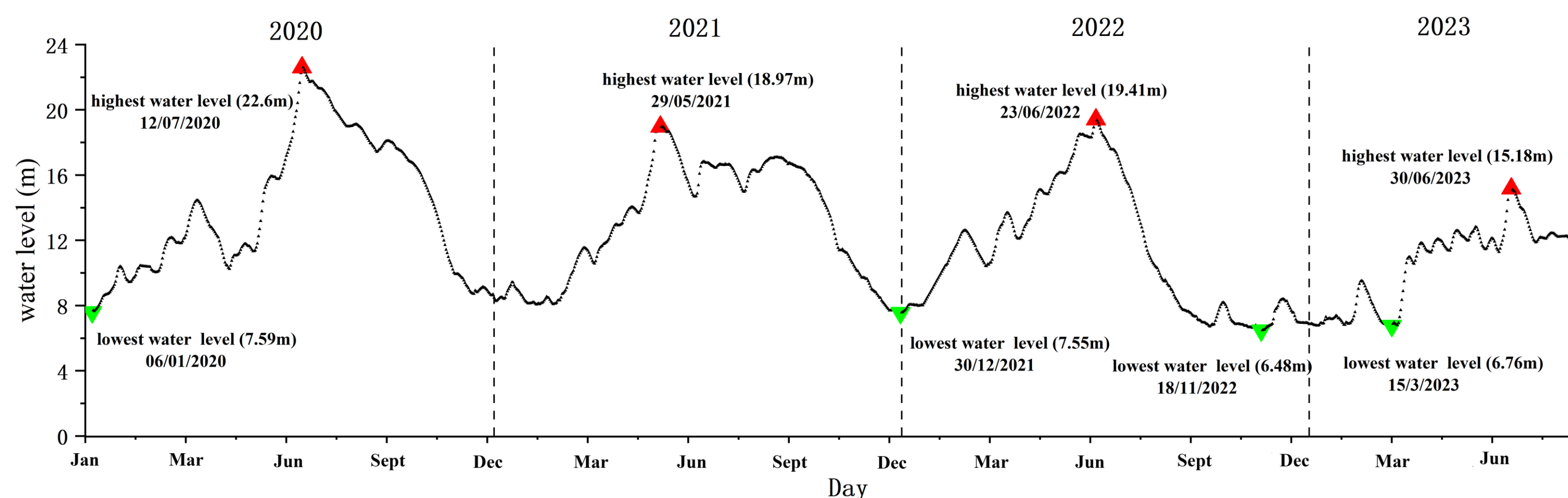


## MAJOR REFERENCES

1. Yang H, Wang H, Lu J, et al. "Full lifecycle monitoring on drought-converted catastrophic flood using sentinel-1 sar: A case study of poyang lake region during summer 2020." Remote Sensing 13.17 (2021): 3485.
2. Y. Liu, B. Fan, L. Wang, J. Bai, S. Xiang, and C. Pan, "Context-aware cascade network for semantic labeling in vhr image," 2017 IEEE International Conference on Image Processing (ICIP), pp. 575-579, 2017.

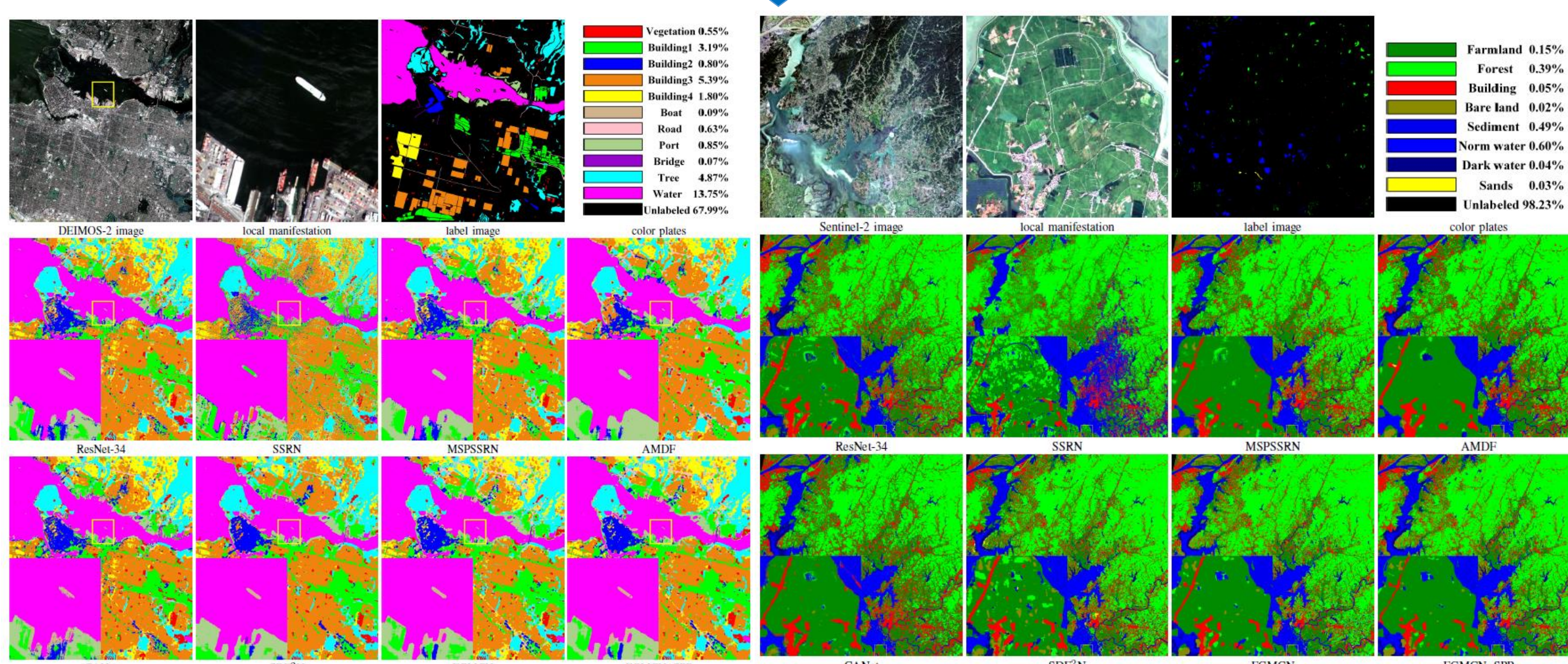
## RESULTS

### Hydrological patterns of Poyang Lake in recent years

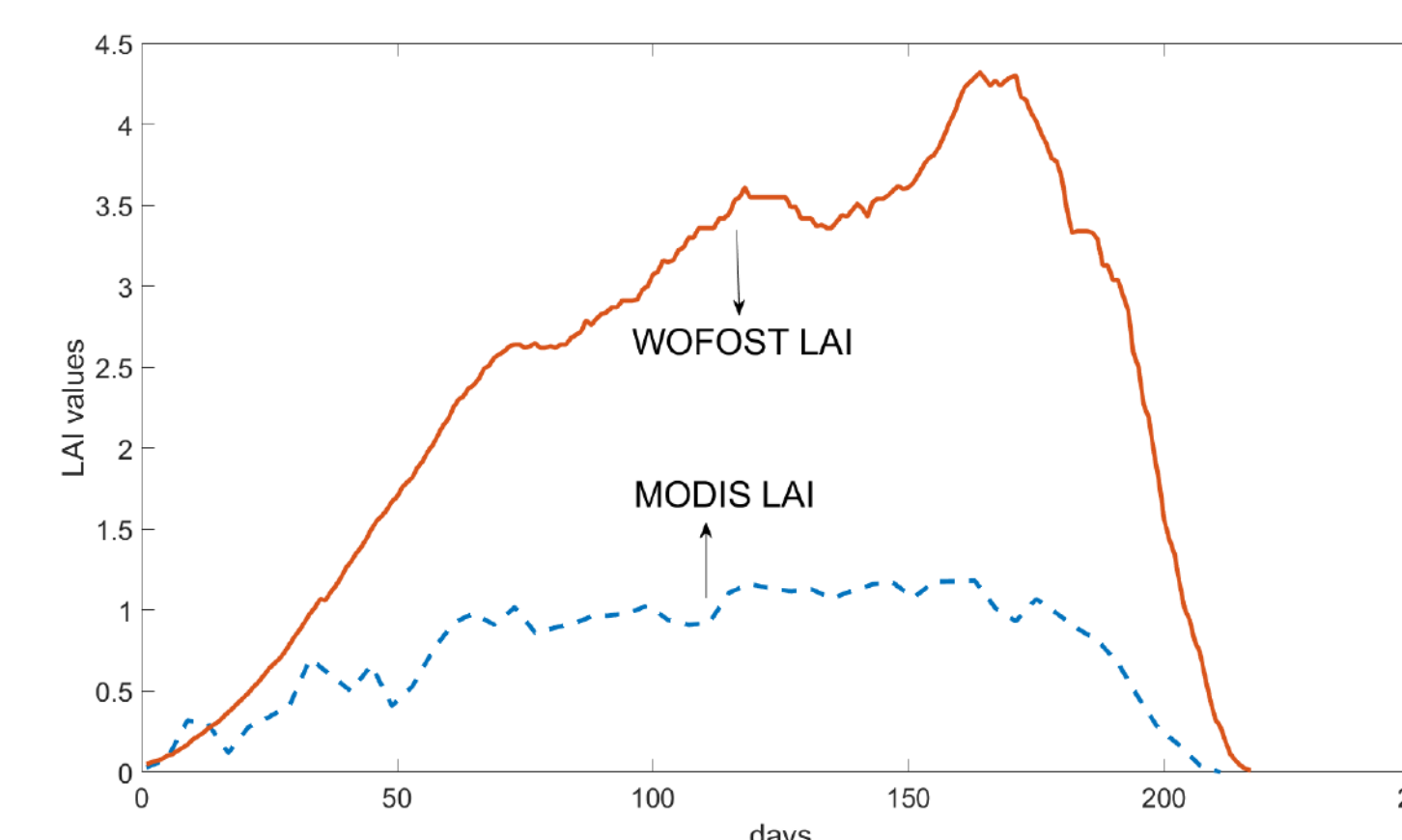


Better classification

More accurate estimation



### Land Use Classification of High-Resolution Multispectral Satellite Images with Fine-grained Multiscale Networks and Superpixel Post Processing



Year	Yearbook Planting Area (km <sup>2</sup> )	Extracted Cultivated Area (km <sup>2</sup> )	Yearbook Yield (tons)	Estimated Yield (tons)	Error Rate (%)
2014	30	31.6	77,318	75,115	2.85
2015	28.86	28.22	73,574	74,674	1.5
2017	27.13	27.81	67,852	71,460	5.32
2018	18.74	18.21	45,531	44,499	2.23
2019	21.23	20.08	51,390	49,770	3.14

### Remote Prediction of Oilseed Rape Yield via Gaofen-1 Images and a Crop Model

## DISCUSSION

### Future work

1. Testing the classification algorithm for land cover changes during drought at Poyang Lake.
2. Evaluating the loss of oilseed rape yield in the case of flood and drought disaster in Poyang Lake.

## CONCLUSIONS

1. The water level of Poyang Lake has been in a low state after the extreme drought disaster. Meanwhile, the water level and water area of Poyang Lake show a strong correlation. We can use this to assist in disaster warning.
2. Comparative experiments show that our method has good classification accuracy for high-resolution multispectral images.

### Publications

1. Y. Ma, X. Deng, and J. Wei, "Land Use Classification of High-Resolution Multispectral Satellite Images With Fine-Grained Multiscale Networks and Superpixel Postprocessing," Ieee J-Stars, Article vol. 16, pp. 3264-3278, 2023 2023, doi: 10.1109/jstars.2023.3260448.
2. Tang, Wenchao, et al. "Remote Prediction of Oilseed Rape Yield via Gaofen-1 Images and a Crop Model." Remote Sensing 14.9 (2022): 2041.