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Lake area change and its response to climate change in QiangTang Plateau

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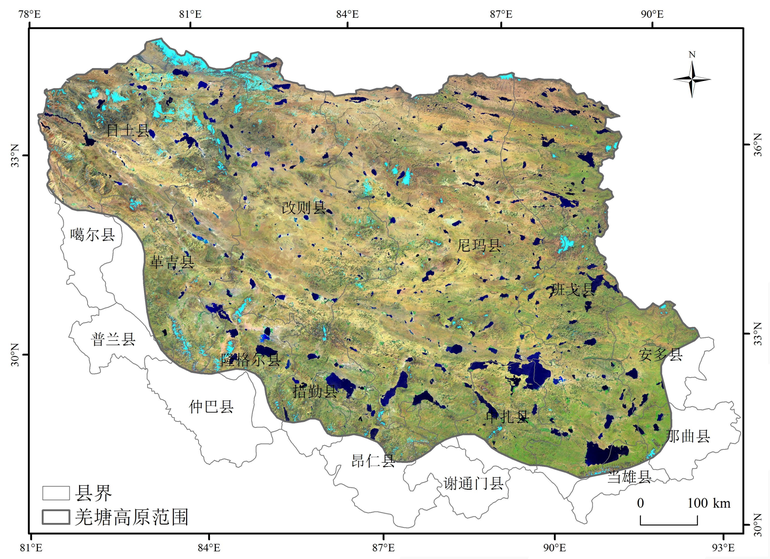
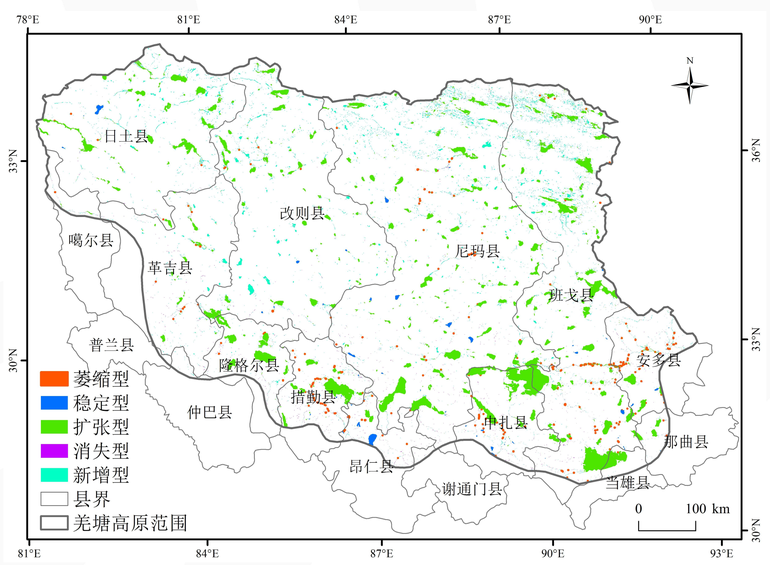
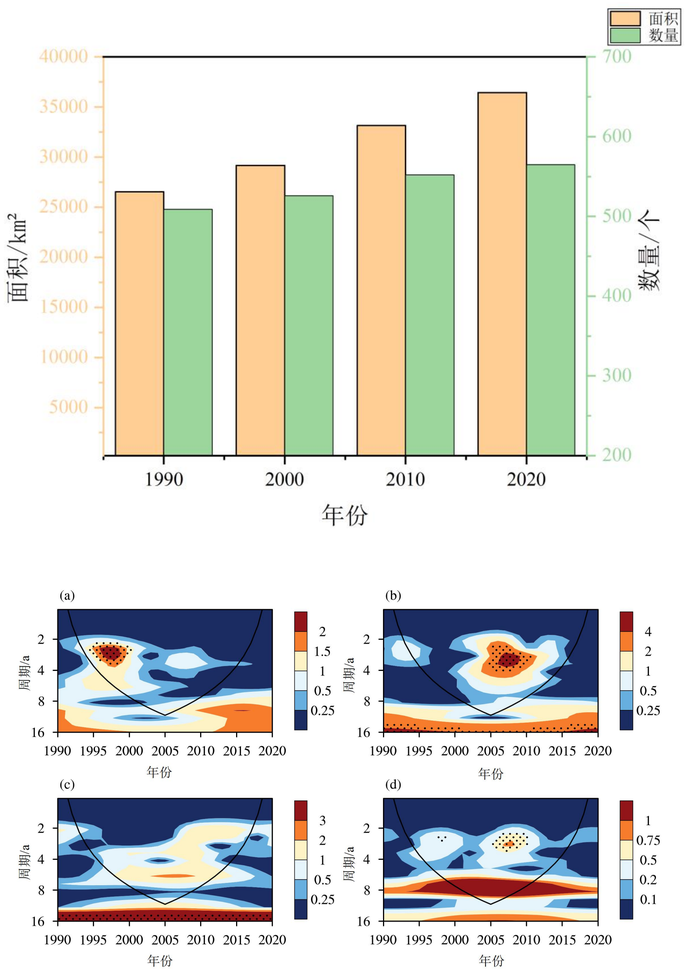
Objectives

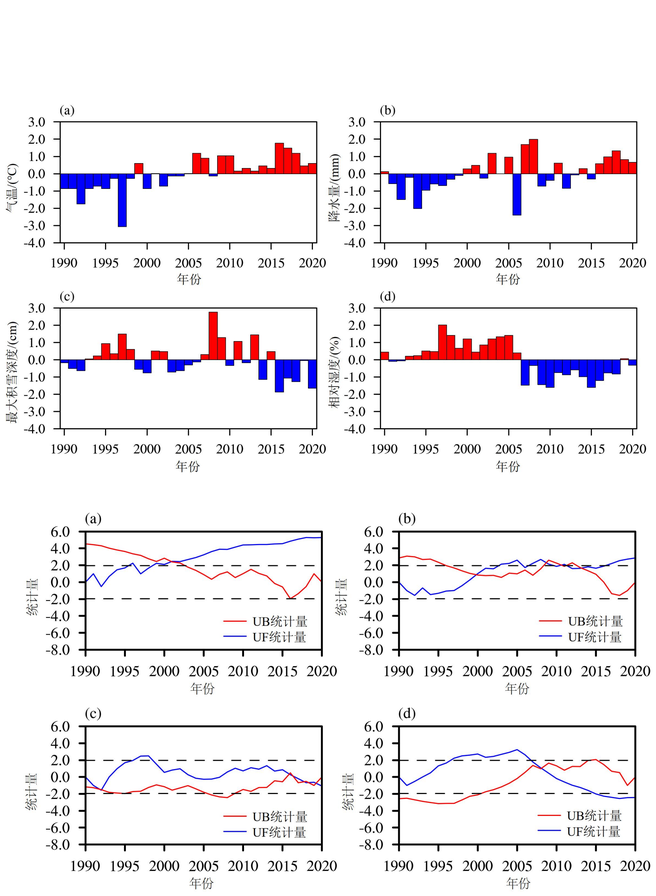
In the context of global climate change, the Qinghai-Tibet Plateau is warming significantly, and the Qiangtang Plateau studied in this paper is located in the hinterland of the Qinghai-Tibet Plateau, which is densely populated with lakes and plays an important role in the natural water cycle and water balance. In this paper, we take Qiangtang Plateau as the study area, extract water body information by using threshold method (Normalized Difference Water Index and Modified Normalized Difference Water Index) and supervised classification method (Maximum Likelihood Method, Support Vector Machine, Neural Network Method, Decision Tree), analyze the advantages and shortcomings of different water body extraction methods through human-computer interaction, select the most suitable method for the region, and analyze the characteristics of lake area and climate change and the correlation between them by combining meteorological data in the basin The relationship between the lake area and the climate change characteristics and the correlation between them was analyzed with the meteorological data in the basin.

Research method	Classification accuracy	Kappa coefficient
NDWI	90.81%	0.813
MNDWI	93.24%	0.861
Support Vector Machine	96.09%	0.94
Maximum Likelihood	**97.49%**	**0.96**
Neural Network	97.25%	0.95
Decision Tree	97.30%	0.95









Conclusions

(1)the maximum likelihood method has the highest accuracy of water body extraction among the various methods, and the lake areas of Qiangtang plateau in the four time periods of 1990, 2000, 2010 and 2020 are 26543.2 km², 29179.4 km², 33158.7 km² and 36439.6 km², respectively, with a total increase of 9896.4 km² in lake areas which shows a sharp increase and then a slow increase.

(2)The largest increase in lake area was recorded between 2000-2010 (3979.2 km²), followed by 1990-2000 (3280.9 km²) and the least between 2010-2020 (2636.2 km²).

(3)the climate of Qiangtang Plateau in the past 30 years is generally warm-wet and then warm-dry, and the area of lakes is significantly correlated with the increase of temperature and the decrease of snow depth in the cold season ($P<0.001$), while the correlation with relative humidity and precipitation is not significant ($P>0.05$), Therefore, the significant increase in temperature, especially in the cold season, makes the increase in snow and ice melt water the main reason for the increase in lake surface area.