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# Remote Sensing Monitoring of Surface Area Change of Qinghai Lake from 2013 to 2018

**Yuxin Huang, Ting Xu, Yipeng Li, Meng Sun, Weilin Tian**

**School of Resources and Civil Engineering, Liaoning Institute of Science and Technology, Benxi 117004, China.**

***Abstract:*** Qinghai Lake, located on the Qinghai-Tibet Plateau in China, is the highest and largest inland lake in geography. This paper takes Qinghai Lake as the research object and Landsat 8 OLI_TIRS remote sensing image as the data source to obtain image data of Qinghai Lake from 2013 to 2018. NDWI (Normalized Differential Water Body Index) method is used to extract water body information, and then statistics the area change from 2013 to 2018. The experimental results show that the surface area of Qinghai Lake has an overall increasing trend in these five years.

***Keywords:*** Remote Sensing Image; NDWI; Lake Area Change

## Introduction

Water resource is a necessary condition for the survival of human beings and other organisms. Since ancient times, biological communities mostly depend on water, and water resource is an important material resource. With the intensification of human activities, water resource pollution and other situations all reflect the urgency of water resource protection. Qinghai Lake is the largest inland lake in the Qinghai-Tibet Plateau. The Qinghai-Tibet Plateau has a high altitude and little water vapor enters from outside. Qinghai Lake is the main source of water vapor for surrounding precipitation and an important guarantee for maintaining its surrounding ecological environment. In recent years, due to the change of people's living areas and forms, it has a great impact on the change of Qinghai Lake shoreline. With the deepening of people's awareness of environmental protection, Qinghai Lake and its surrounding areas are also the focus of people's attention to protection, and its changes affect the changes of the surrounding ecological environment.

Luo Chengfeng et al. [1] used the remote sensing data of Qinghai Lake obtained by Landsat series satellites to read the information of Qinghai Lake's waterline through artificial interpretation, so as to obtain the water surface area data of Qinghai Lake and conduct comparative analysis of area changes. Lu Shanlong et al. [2] combined the boundary analysis of lake surface buffer zone and the method of determining the segmentation threshold one by one lake to extract water surface information, and solved the extraction of lake surface information without temporal and spatial aggregation. Tong Lixia et al. [3] used object-oriented methods to extract water system information. Liu Baokang et al. [4] combined remote sensing with geographic information system, built a water body identification model of disaster reduction satellite on the data obtained by disaster reduction satellite, and monitored the water area of Qinghai Lake from 2008 to 2011.

## 1. Study area and data source

Qinghai Lake is located in the northeast of the Qinghai-Tibet Plateau, between 99°36 '~ 100°16' east longitude, 36°32 '~ 37°15' north latitude, located in Qinghai Province, is an extremely important part of the Qinghai-Tibet Plateau. Qinghai Lake is the largest inland salt water lake in China. It was initially formed as an outflow lake. In the process of geological changes, due to the surrounding high mountains, which blocked its outflow channel, it became an internal flow lake. The data in this paper are collected from geospatial data cloud (http://www.gscloud.cn). Landsat 8 OLI_TIRS satellites have 11 bands, except for the panchromatic band with a resolution of 15 meters, the resolution of all other bands is 30 meters, Landsat 8 OLI_TIRS series satellites can scan the same area every 16 days to obtain remote sensing image data in the region, and carry out a global coverage of remote sensing data acquisition.

## 2. Experimental results and analysis

### 2.1 Image preprocessing

Remote sensing image preprocessing includes image atmospheric correction, image Mosaic, image clipping and other functions.

Atmospheric correction means that the total radiation brightness of the ground target measured by the sensor is not a reflection of the true reflectivity of the surface, which includes the radiation amount error caused by atmospheric absorption, especially scattering. Atmospheric correction is the process of eliminating the radiation errors caused by atmospheric influence and inverting the real surface reflectance of ground objects.

Image Mosaic refers to the technical process of combining two or more images together to form a whole image. Image Mosaic involves two processes: the Mosaic of geometric position and the Mosaic of gray scale (or color).

The purpose of remote sensing image clipping is to remove the areas outside the study, which can be divided into regular clipping and irregular clipping. This text Because the obtained image data does not need to be too large, the area near the waters of Qinghai Lake is cropped out.

## 2.2 Normalized Differential Water Body Index (NDWI)

Normalized Difference Water Index (NDWI) is a normalized difference processing method that uses specific bands of remote sensing images to highlight water information in the images. Its expression is:

(1)

The index uses the difference of spectral reflectance between green band and near-infrared band to enhance the spectral differentiation between water body and surface plants and soil through the normalization operation combined with band difference and ratio. It can effectively reduce the disturbance of soil and wetland vegetation around the water body.

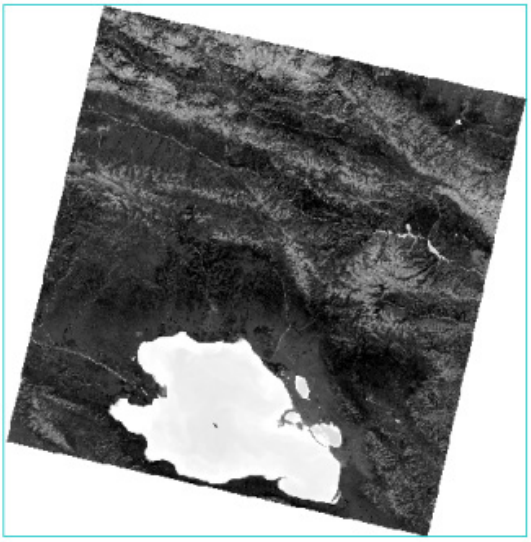


Figure 1. NDWI Extract Results

Then binary processing is carried out to distinguish between drainage and non-drainage.

## 2.3 Analysis of surface area change of Qinghai Lake

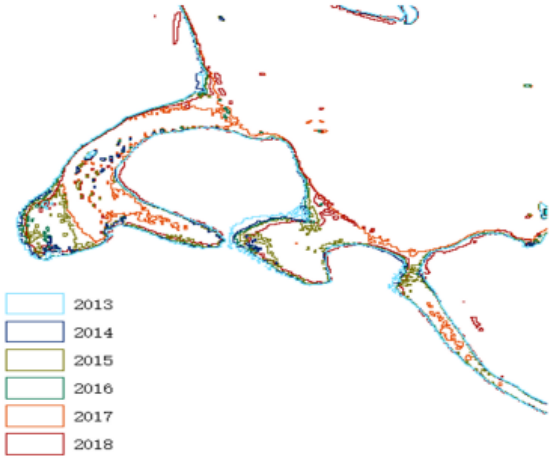
After extracting water body information from the remote sensing image of Qinghai Lake, the image data was converted into vector data, and then the field of calculating area was added to the ArcGIS attribute table, corresponding attributes were set, and area calculation was selected, and Table 1 was obtained, as shown below:

Table 1. Lake surface area (km2) of Qinghai Lake from 2013 to 2018

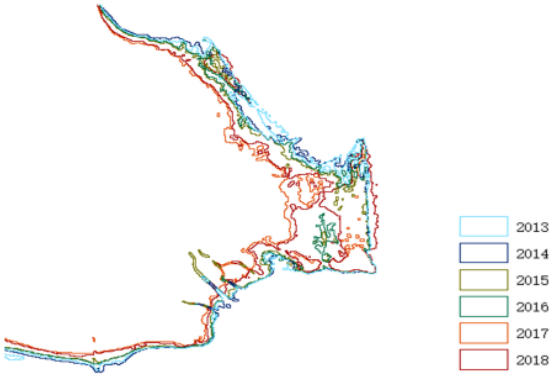
| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Area/ square kilometre | 4391 | 4395 | 4430 | 4413 | 4507 | 4467 |

In order to display the changes of the area more intuitively and express the trend of the increase or decrease of the area in each area, vector extraction was carried out on the changes of the shoreline of Qinghai Lake. As shown in Figure 2, the changes of the east, west and

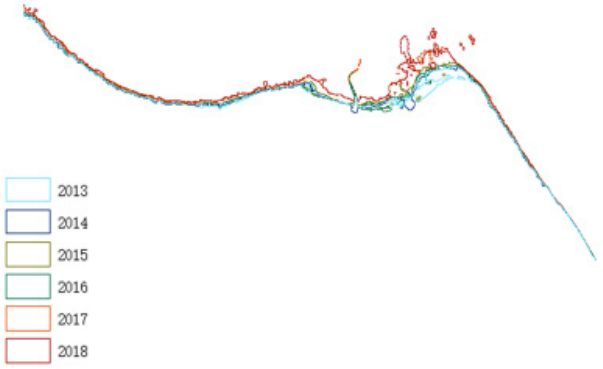
north banks of Qinghai Lake could be seen.




(a) East coast lake shoreline change




(b) West coast lake shoreline change




(c) North coast lake shoreline change

Figure 2. Lake shoreline change

## 3. Conclusion

In this paper, Landsat 8 OLI_TIRS remote sensing image is used as the data source, and through image processing and analysis, the results show that the area of Qinghai Lake has an overall expanding trend from 2013 to 2018. The changes of Qinghai Lake shoreline are main-

ly concentrated in the east bank, west bank and north bank, and the area has increased in these three directions, and the shoreline is extending outwards. Monitoring the area change of Qinghai Lake is an important means to protect the ecological environment of Qinghai Lake, which is conducive to the protection of the water area of Qinghai Lake.

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About author: Huang Yuxin(2003-), female, undergraduate. Corresponding author: Xu Ting(1988-), female, master's degree, lecturer.