

Lake Water Surface Variations and Its Influencing Factors in Tibetan Plateau in Recent 10 Years

Authors : Shanlong Lu, Jiming Jin, Xiaochun Wang

Abstract : The Tibetan Plateau has the largest number of inland lakes with the highest elevation on the planet. These massive and large lakes are mostly in natural state and are less affected by human activities. Their shrinking or expansion can truly reflect regional climate and environmental changes and are sensitive indicators of global climate change. However, due to the sparsely populated nature of the plateau and the poor natural conditions, it is difficult to effectively obtain the change data of the lake, which has affected people's understanding of the temporal and spatial processes of lake water changes and their influencing factors. By using the MODIS (Moderate Resolution Imaging Spectroradiometer) MOD09Q1 surface reflectance images as basic data, this study produced the 8-day lake water surface data set of the Tibetan Plateau from 2000 to 2012 at 250 m spatial resolution, with a lake water surface extraction method of combined with lake water surface boundary buffer analyzing and lake by lake segmentation threshold determining. Then based on the dataset, the lake water surface variations and their influencing factors were analyzed, by using 4 typical natural geographical zones of Eastern Qinghai and Qilian, Southern Qinghai, Qiangtang, and Southern Tibet, and the watersheds of the top 10 lakes of Qinghai, Siling Co, Namco, Zhari NamCo, Tangra Yumco, Ngoring, UlanUla, Yamdrok Tso, Har and Gyaring as the analysis units. The accuracy analysis indicate that compared with water surface data of the 134 sample lakes extracted from the 30 m Landsat TM (Thematic Mapper) images, the average overall accuracy of the lake water surface data set is 91.81% with average commission and omission error of 3.26% and 5.38%; the results also show strong linear ($R^2=0.9991$) correlation with the global MODIS water mask dataset with overall accuracy of 86.30%; and the lake area difference between the Second National Lake Survey and this study is only 4.74%, respectively. This study provides reliable dataset for the lake change research of the plateau in the recent decade. The change trends and influencing factors analysis indicate that the total water surface area of lakes in the plateau showed overall increases, but only lakes with areas larger than 10 km² had statistically significant increases. Furthermore, lakes with area larger than 100 km² experienced an abrupt change in 2005. In addition, the annual average precipitation of Southern Tibet and Southern Qinghai experienced significant increasing and decreasing trends, and corresponding abrupt changes in 2004 and 2006, respectively. The annual average temperature of Southern Tibet and Qiangtang showed a significant increasing trend with an abrupt change in 2004. The major reason for the lake water surface variation in Eastern Qinghai and Qilian, Southern Qinghai and Southern Tibet is the changes of precipitation, and that for Qiangtang is the temperature variations.

Keywords : lake water surface variation, MODIS MOD09Q1, remote sensing, Tibetan Plateau

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