



Monitoring and understanding of water quality changes in an large urban lake based on long-term Landsat observations

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Lakes are highly valuable natural resources for water supply, fishing, transportation and recreation. Specially, urban lakes are highly valued by local residents. However, due to near-lake development, lake ecosystems are being threatened by human intervention including nutrient pollution, increases in populations and intensification of land use. The ability to continuously monitoring and understanding water quality changes in lakes is important for sustaining lake ecosystems. This study developed a framework to monitor and analyze water quality variables based on long-term Landsat observations, including Landsat 5 TM, Landsat 7 ETM+ and Landsat 8 OLI. Lake Donghu, the largest urban lake in China, was selected as the study area. This lake is fully located within urban area of the Wuhan city and covers an area of 30.7 km². It is a typical shallow lake with limited contamination purification capabilities. The framework employs a set of machine learning algorithms to establish relationships between the in-situ measurements obtained from the Lake Donghu and remote sensing bands reflectance. Then the relationships were used to model spatial distributions of water quality variables where in-situ measurements were unavailable. The machine learning algorithms employed include support vector machine, random forest, artificial neuron network and others. The modeled water quality variables include chlorophyll-a, turbidity and dissolved oxygen. The framework was used to estimate these water quality variables during the period from 1990-2016. It was found that the framework provides a reliable way to monitor and estimate water quality states and to detect possible water quality changes.