ISSN: 2414-1895 DOI: 10.6919/ICJE.202111_7(11).0040

# Research on Water Resources Information Management Technology of Lijiang River Basin Based on Remote Sensing Monitoring

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## Abstract

**In view of the current hydrological and water quality monitoring of the Lijiang River Basin, ground monitoring technology is mainly used, which has the problems of time-consuming and labor-intensive, scattered and isolated monitoring information, and difficulty in quickly obtaining large-scale dynamic information. This project proposes "Research on Lijiang River Basin Water Resources Information Management Technology Based on Remote Sensing Monitoring". Aims to combine the research and development of the Lijiang River Basin hydrological and water quality remote sensing monitoring technology achievements, research the remote sensing data fusion technology of water resources information, the air-space-ground integration hydrological and water quality monitoring information integration technology, and build the Lijiang River Basin water resources management technology framework software platform based on remote sensing technology , To lay the foundation for realizing large-scale, all-weather dynamic monitoring and early warning of the water environment in the Lijiang River Basin.**

## Keywords

**Remote sensing monitoring; automatic information discovery; image database.**

## 1. Research status and development trends at home and abroad

For the field of water resources management technology, remote sensing technology plays an increasingly important role. Foreign remote sensing technology has been well applied to hydrogeological surveying and mapping and water quality evaluation of oceans and inland rivers. For example, the Delft Institute of Hydrology in the Netherlands used remote sensing technology to carry out actual monitoring applications in the Scheldt estuary. The situation and impact of the project are monitored to form a comprehensive information system. The U.S. state of Minnesota uses an airborne remote sensing system to monitor river water quality. Minnesota has a dense river network, but only 10% of the rivers have a fixed monitoring network. The state is using a small plane flying directly over the river to obtain aerial images In order to verify the images, the airborne telemetry system also collected water samples during aerial photography, collected spectral images from six parts of a river, and completed the collection of 39 water bodies telemetry data, which were subjected to water quality and water body research and analysis. Remote sensing technology can help people detect problematic water resources, and can locate them, reducing the blindness of field observations[1].

In recent years, my country has gradually applied remote sensing technology to the monitoring of water pollution in river basins. For example, the water body of the Pearl River Estuary in Guangdong Province and the typical rivers of Zhongshan City used hyperspectral monitoring and simultaneous water quality analysis to analyze the mass concentration of four water quality indicators of total nitrogen, chemical oxygen demand, ammonia nitrogen and dissolved oxygen in the water body, which responded well. Spatial differences in river water quality. In response to the needs of river water

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quality monitoring, Shanghai has used remote sensing images acquired by the multi-spectral imager carried by the Sentinel-2A satellite launched by the European Aviation Agency and quasi-synchronously acquired river surface water quality data in some rivers in Qingpu District and Songjiang District, Shanghai. The five main water quality parameters, including permanganate index and ammonia nitrogen, are monitored, and water quality indicators are obtained to determine water quality categories. Based on GF-2 remote sensing image data, the Jinma Wenjiang section of Chengdu city monitors six indicators of chlorophyll A, total nitrogen and total phosphorus, permanganate, suspended solids concentration and transparency, which proves that the water quality of this section is in a mesotrophic state[2-5].

## 2. Remote sensing monitoring subsystem

### 2.1 Introduction to the remote sensing monitoring subsystem

The remote sensing monitoring subsystem usually includes several large functional modules such as data conversion, image preprocessing, map classification, thematic remote sensing monitoring, and mapping output. It provides us with the current and informatized functions of water resources management supported by remote sensing images. And through the geometric correction of remote sensing images, mosaic registration and other pre-processing, the method of image classification is used to obtain water resources status information. On this basis, the status quo monitoring of the land, water Monitoring of various topics such as resource change analysis, and output of results. The remote sensing monitoring subsystem highly integrates raster and vector data to provide decision support for the planning and compilation of water resources[6].

### 2.2 Image classification

The pre-processed image is analyzed for the spectral characteristics of various ground objects, the feature parameters are selected, the feature space is divided into non-overlapping subspaces, and the pixels in the image are divided into subspaces to achieve classification. Because remote sensing images have the characteristics of large amount of image information, many details, and complex texture changes, we often use different classification methods[7].In addition, the built model library is used to select the appropriate classification method. The traditional classification methods include unsupervised classification and supervised classification. Currently, it is transitioning to the highly intelligent classification methods of BP neural network classification and expert system.

## 3. Automatic discovery of remote sensing monitoring information

The process of remote sensing monitoring of land resources is actually the process of automatic discovery of remote sensing image change information. The automatic discovery of change information refers to the data processing process of fusion, principal component transformation, algebraic operation, image combination, and comparison after classification of the two-temporal remote sensing image of the monitoring area. Because the grayscale, brightness, and color of the changed spots are obviously different from the surrounding environment, through image processing, we can automatically distinguish the changed plots from the complex environmental information, and then it is possible to distinguish the changed information Extract it to realize automatic discovery of monitoring[8].

### 3.1 The history of remote sensing monitoring in my country

The research on remote sensing dynamic monitoring in my country began in the 1970s. Throughout the history of remote sensing dynamic monitoring in my country, the monitoring methods have gone from manual field surveys to mainly aerial photograph survey data, and then to the use of multiple sources and multiple resolutions[9]. The process of combining rate satellite imagery with field inspection; in image information extraction, it has experienced from early manual visual interpretation, manual editing and area measurement, to mid-term manual interpretation, manual editing, computer digitization and measurement summary , And then to the current stage of remote sensing and integrated human-computer interaction interpretation and computer measurement summary.

### 3.2 Research methods for automatic discovery of remote sensing monitoring change information

At present, there are many researches on the automatic discovery of land and resources remote sensing monitoring change information, but in general it is still in the exploratory stage. The main methods are:

(1) Spectral feature variation method

The spectral feature mutation method uses multi-source data fusion technology to fuse remote sensing data from different sensors, so that the changing area presents special image characteristics.

(2) Difference method

The difference method is the most widely used change monitoring method. It subtracts the remote sensing image of the two-time phase pixel by band according to the band to generate a new difference image representing the spectral change between the two-time phases. The principle is that the unchanging land types in the image generally have the same or similar gray values on the remote sensing images of the two time phases, and when the land types change, the gray values of the corresponding positions will be quite different. Therefore, the gray value of the part of the land type change in the difference image will be quite different from the background value, so that the change information will be revealed from the background image.

(3) Multi-band principal component transformation

Multi-band principal component transformation, firstly combines the bands of the two-phase image to form a new image twice the number of bands of the original image, and then performs principal component transformation on the image. Since the first few components of the transformation result concentrate the main information of the two images, and the latter components reflect the difference information between the two images, the latter components can be extracted for band grouping[10].

Together to extract change information. For example, two SPOT5 images 2, 1, 3 are used to form an image combination with 3 bands. The principal component transformation produces three components. The first one and two components contain the main information of the original image, while the latter components reflect the change information of the two-phase image.

(4) Principal component difference method

The difference between the principal component difference method and the difference principal component method is that the order of the principal component transformation and the difference processing of the image is different. It is required to perform the principal component transformation on the images of the two phases first, and then make the difference of the transformation result, and take the absolute value of the difference as the processing result. When performing principal component transformation on the two images separately, the previous components concentrate the main information in the image. Therefore, when doing the image difference, the corresponding difference between the previous components also reflects the corresponding change information in the original image. Using these difference components as a band combination can also show the current law of images of different sun phases.

## 4. Lijiang River Hydrology and Water Quality Remote Sensing Monitoring

Although many aerospace remote sensing monitoring researches and applications have been carried out in the field of water resources at home and abroad, but the remote sensing monitoring of the Lijiang River in Guilin is rarely involved except for the team. As of September 2020, Guilin City has built 47 automatic water quality monitoring stations, including 5 state-controlled water stations, 18 district-controlled water stations, 12 drinking water source water stations, and 1 Lijiang active test dam water station 1, Qingshitan Reservoir Tangjia tail water station, 10 small water stations in the urban area, these ground monitoring stations are the mainstream means of monitoring the hydrological water quality of the upper reaches of the Lijiang River. However, the traditional ground monitoring technology has disadvantages such as time-consuming and laborious monitoring, scattered monitoring information, difficult data sharing, and difficulty in quickly obtaining large-scale hydrological and water quality information in the basin[11].

Combining the team's early technical foundation in the Lijiang River hydrology and water quality remote sensing monitoring, this project intends to break through the existing hydrological and water quality ground monitoring technology in the Lijiang River Basin. It is feasible to develop and build the Lijiang River Water Resources Information Management Technology Framework Software Platform, which can be used to realize the Lijiang River Basin. Large-scale, all-weather dynamic monitoring and early warning of the water environment lay the foundation.

Based on the investigation and analysis of the existing hydrological and water quality data of the Lijiang River ground monitoring station, this project first acquires multi-source satellites and drones to monitor the Lijiang hydrological and water quality images, comprehensively uses ENVI, python, etc. to study multi-source remote sensing image fusion technology, and then conducts multi-source remote sensing image fusion technology. Research on the information integration database of source remote sensing data and ground data, and build a software platform for Lijiang water resources information management technology framework based on remote sensing technology to realize the large-scale hydrological and water quality information such as Lijiang water level, chlorophyll A, and suspended solids. Lay the foundation for dynamic range monitoring and early warning.

The problem to be solved: The Lijiang River water resources management technology framework software platform based on remote sensing technology is created to solve the problems of scattered and isolated monitoring information in the existing surface hydrology and water quality monitoring technology of the Lijiang River, and it is difficult to obtain large-scale dynamic information. Lay the foundation for environmental dynamic monitoring and early warning.

## 5. Conclusion

The construction of the remote sensing monitoring subsystem aims to enhance the application value of the Lijiang water resources remote sensing monitoring result data and promote the management of water resources. This article has done some research and exploration on the system's framework construction, technical process, automatic monitoring discovery, and application and solution of key issues.

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