

# Discussion on the Practice of Remote Sensing Technology in Hydrogeological Exploration

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**Abstract:** In the development of modern information technology, remote sensing technology is an important part. Remote sensing technology is mainly based on remote detection, perception of the essence of things, with the help of this technology to achieve data collection and collation, and more systematic analysis and processing of these data, through this analysis of some information, and its rational judgments, to promote its decision-making can be more accurate. Remote sensing technology plays a very important role in hydrogeological investigation and has achieved good results. This article is mainly combined with the method of application, steps, the actual application of measures were discussed.

## 1. Introduction

Remote sensing technology emerged in the 1960s, most of the time is used to help satellites, aircraft and other aircraft use, but for target detection. Through remote sensing technology can also get periodic, real-time information, in the meteorological observation, map observation and other aspects of use. Under the condition of the rapid development of remote sensing technology, a series of remote sensing geological disciplines have been derived, it can more accurately express the characteristics of the object, position, change law and so on, which can be used in the study of hydrogeology. On the whole, the introduction of remote sensing technology can promote the hydrogeological investigation to a great extent.

## 2. Overview of Remote Sensing Technology

In the light of the development of remote sensing technology in our country, the whole start is relatively late, and the rapid development of science and technology and the appearance of various new technologies prompt the rapid development of remote sensing technology, it is not just limited to the area of telecommunication network transmission as before, it is used in more different fields. In the popular sense, the so-called remote sensing technology, which can sense the essence of things by means of remote detection, can realize the collection of all data through the application of this technology, and the analysis and processing of these data, with the help of the corresponding analysis can be obtained in some parts of the existence of relevant information, thereby bringing other information processing judgment corresponding information basis, this ultimately leads to better precision in decision making<sup>[1]</sup>. Since this technical term is comprehensive, it can be used to make corresponding judgments with the help of the wavelengths of different objects, so as to understand their own properties, and to judge the appearance of faults and other terrain conditions underground, with the help of this kind of information, we can get the corresponding underground information, which is very important for the underground exploration. With the aid of this technology, the quality of groundwater exploration can be enhanced and the cost of exploration can be reduced to a great extent.

## 3. The Significance of Applying Remote Sensing Technology in Hydrogeological Exploration

China has a large population and a huge demand for basic resources such as water resources. In order to meet the basic needs of people's daily life and production, most enterprises can maintain normal operation and development, there is a need to pay more attention to hydrogeology, mainly because of the increasing contradictions and increasing trends in water resources and the current development and utilization of water resources, both need to ensure that the water resources themselves are in a relatively adequate state for a long time, and efficient use, so as to promote economic development<sup>[2]</sup>. In the work of hydrogeological investigation, the application of remote sensing technology has the following significance: (1) from the aspect of hydrogeological surveying and mapping, we can use remote sensing technology to precisely determine the geological boundary; In addition, it can further analyze and grasp geological features more comprehensively, and obtain more complete surveying and mapping information, and can also develop corresponding applications for different data, to promote its accuracy can be greatly improved. The use of remote sensing technology enables a comprehensive understanding of groundwater conditions, leading to a clearer picture of the topography and information on groundwater distribution, thus providing useful assistance to the surveyors themselves<sup>[3]</sup>. With the help of remote sensing technology, it can bring relatively sufficient resources for the whole surveying and mapping work, which can effectively optimize its own mapping capacity; (2) for the distribution of groundwater resources, in the process of systematic investigation, it is necessary to use remote sensing technology to carry out correlation analysis on the actual acquired remote sensing images and to understand the relevant status of the water layer<sup>[4]</sup>. At the same time, with the help of the current hydrological data, we can understand the current distribution of groundwater resources from a more comprehensive point of view, more efficient use of the current distribution of groundwater resources. Moreover, the application of remote sensing technology can bring very critical information to the staff and systematically process the relevant soil layers through these information. In order to use remote sensing technology to a greater extent, technicians should improve their cognitive ability, in the use of remote sensing strategies will be related to the use of instruments, the need to use the right method of operation. At the same time, for the application of remote sensing technology, especially in the infrared image research can better obtain the situation of shallow buried zone, which can play a better role for the distribution of water resources;(3) in the field of geological hazard surveys, the use of remote sensing techniques enables a more comprehensive analysis of the situation of hydrogeological hazards and a more comprehensive judgement of them, especially from the point of view of hydrology as a whole; The use of 3D methods, but the application of remote sensing technology, can effectively predict the majority of geological hazards<sup>[5]</sup>. Therefore, in the process of carrying out the actual investigation, it can provide the corresponding support, and can combine the previous historical data, and carry out a more comprehensive analysis and integration, so as to get a more complete analysis, promote the subsequent hydrogeological exploration activities to carry out more efficient.

#### **4. Application Methods and Characteristics of Remote Sensing Technology in Hydrogeological Exploration**

##### **4.1 Application of Remote Sensing Technology in Hydrogeological Exploration**

###### **4.1.1 Thermal Infrared Monitoring Method**

The thermal infrared monitoring method is a method to judge whether there is groundwater or not through the thermal infrared remote sensing image obtained from the ground temperature measurement. Through the surface humidity changes, temperature changes and other aspects of the existence of groundwater resources for accurate grasp. During the day, the Sun will shine directly on the ground, and the temperature will rise significantly. You can tell whether there is groundwater by the humidity of the ground objects. The higher the humidity of the ground objects, the greater the heat capacity of the image because of the slower warming, there is a cold anomaly; conversely, there is a heat anomaly. In general, this method can also be used to measure and draw a more accurate map of the underground, and make corresponding marks. Groundwater is an important

water resource in areas where rainfall is insufficient, even in arid areas, and is a minimum indicator of human survival and well-being. For some non-arid areas, groundwater and agriculture are closely related. Therefore, thermal infrared monitoring method can be more effective for groundwater exploration.

#### **4.1.2 Remote Sensing Model Method**

The remote sensing model is mainly the organic combination of remote sensing technology, digital technology and model, and the analysis of groundwater. Under normal circumstances, after obtaining the corresponding remote sensing images by using remote sensing technology, a corresponding quantitative evaluation model can be built based on the actual hydrological situation, which is mainly used for exploration, analysis and monitoring of groundwater, scientific and accurate assessment of groundwater resources information, and combined with different levels of wavelength data information chart drawing.

#### **4.1.3 Environmental Remote Sensing Information Analysis Method**

It is a method of inferring environmental information closely related to groundwater. For example, the information of underground vegetation and underground lakes can be detected by using the method of environmental remote sensing information analysis, mainly because these environmental information can be fully reflected in remote sensing images, therefore, in the process of actual use, some of the environmental information need to be removed. The principle of environmental remote sensing information analysis method and thermal infrared monitoring method is almost the same, mainly through the use of remote sensing images, and extract some information about vegetation, terrain, environment and so on, some factors, such as surface humidity and temperature, are analyzed in depth and detail to determine the existence of groundwater. In some non-arid areas, there is little correlation between environmental information and groundwater resources, this is mainly because the environmental information of the area is easy to be affected by climate, humidity, people's activities and other factors, and is not accurate, lack of reference. In some arid areas, because of the scarcity of artificial irrigation and precipitation, the impact of environmental information is not too great, so remote sensing image mapping technology can be used to determine the relevant information of groundwater resources; In some semi-arid areas, as long as the external environment does not occur sudden and drastic changes, but also through the analysis of plants, animals, survival of the basic situation, to obtain the corresponding groundwater information.

### **4.2 Application characteristics of remote sensing technology in hydrogeological exploration**

#### **4.2.1 Remote Sensing Technology is Not Limited by the Space Factor**

In the traditional hydrogeological survey, the collection, arrangement and analysis of relevant information are usually realized by manual means. Staff need to obtain the corresponding data through field survey operations, but in such cases, it is easy to be affected by the natural environment, climate and other factors, it is difficult to ensure the integrity and accuracy of the data, at the same time, the harsh field environment is also very easy to bring a certain risk to the staff. Under normal circumstances, remote sensing technology has lower overall requirements for geographical and spatial conditions, and can quickly survey the geological features of most areas in a very short time, thus making data collection more accurate, it can provide more accurate data for hydrogeology and improve the quality of hydrogeology investigation and research.

#### **4.2.2 Work Efficiency Has Been Significantly Improved**

In the work of hydrogeological investigation, it will involve the content of degree, the use of traditional manual investigation methods, the overall efficiency is low, and it will limit the progress of project development to a large extent, but the remote sensing technology mainly uses the satellite and so on some aerospace equipment to carry on the survey, therefore, the actual survey efficiency obtains the rapid promotion. At the same time, in the work of hydrogeological investigation, remote

sensing technology mainly uses visible light wave, ultraviolet light wave and infrared light wave, etc. , also has certain anti-interference. Thus, the remote sensing technology will not be affected by the weather, terrain and other conditions, regardless of day or night, can carry out the survey work, and the accuracy of the survey has a certain guarantee.

## **5. The Application Steps of Remote Sensing Technology in Hydrological Investigation**

### **5.1 Data Acquisition and Selection**

In hydrogeological exploration, remote sensing technology can be used to acquire hydrogeological images, and usually can be used to fully interpret the image features of different wavelengths produced by regional imaging. Because there are many kinds of remote sensing data and a large amount of information, it is necessary to take into account the shape of part of the wavelength to extract more useful information so as to obtain more accurate information. In the practical use of remote sensing technology, the environment is a very important influence factor, and the environment will change significantly with the change of time, the information obtained by the use of remote sensing technology will also have an obvious new year message. Because of the diversity of targets, the requirements for different targets are obviously different, but it is more accurate to analyze object images by reasonable scale. In the process of remote sensing information exploration, data acquisition and selection is the first step, do this part of the work, to lay a foundation for other follow-up research.

### **5.2 Data Processing**

In the process of hydrogeological investigation, if affected by the weather, climate and other external environment, the image and information transmitted back from the actual will easily appear the phenomenon of distortion, will have a significant impact on the interpretation of the results. Therefore, when this kind of phenomenon occurs, the remote sensing image information must be processed immediately, which can use a variety of processing methods, such as: geometric correction processing, radiation correction processing. Specific as follows: (1) geometric correction processing. It is mainly through the establishment of special ground mathematical coordinates, careful analysis of the obvious changes in the image, such as a careful analysis of the deformation of each location, and carried out one by one correction; (2) radiation correction processing. It is mainly aimed at dealing with the radiation of some substances and sensors existing in the atmosphere at present, and effectively solving the problems arising therefrom, it is usually possible to use the parameters of the sensor to correct the abnormal position of the positive remote sensing image effectively, these changes in the position of correction, you can get more accurate images.

### **5.2 Interpretation of Geomorphologic Information**

After getting the corresponding information and data, we can get the processing image of the ground surface, we can interpret the processing image and get the corresponding terrain and geomorphology information. On the remote sensing image, the geomorphology information is very intuitive, and can judge the distribution of vegetation resources, water resources and other basic characteristics by different color, color depth, etc. , can Be More intuitive way to observe and interpret the terrain, geomorphology and other relevant information.

## **6. Practical Application of Remote Sensing Technology in Hydrogeological Exploration**

### **6.1 Application of Hydrogeological Surveying and Mapping**

In the work of hydrogeological investigation, surveying and mapping is one of the more complicated contents, mainly because this work itself has obvious specialty, the operation has certain complexity, the comprehensive ability and professional and technical level of the staff have relatively high requirements. It can be seen that the traditional hydrogeological surveying and mapping work is relatively complex and time-consuming, and the overall surveying and mapping

efficiency is relatively underground, the accuracy is obviously insufficient, and it is difficult to get the expected goal of the project. In hydrogeological surveying and mapping work, through the rational application of remote sensing technology, can be more intuitive interpretation of the region's topography, geomorphology and other basic features, it is advantageous for the investigators and researchers to have a more accurate and comprehensive grasp of the hydrogeological conditions in the investigated area. Current remote sensing techniques can be used to monitor precipitation, usually by combining remote sensing with satellites and radars to collect spatial and distributed data on water volume, and according to these data to obtain specific information of local precipitation. Satellites are also commonly used to detect large areas of precipitation, but radar monitors relatively small areas and is more accurate. By monitoring the effect of precipitation particles in the air on electromagnetic waves, we can further monitor precipitation, but when the precipitation particles are too dense, radar detection is difficult to provide accurate data, in this case, usually combined with satellite equipment for auxiliary detection. In hydrogeological surveying and mapping, the application of remote sensing technology is mainly embodied in the following aspects: (1) through the use of remote sensing technology, the location boundaries can be delineated more clearly and accurately, which can help the researchers to achieve a more accurate control of features such as landforms, active faults, hidden faults, etc. , especially for the Quaternary boundary of the geological characteristics of the analysis, remote sensing technology analysis better; (2) In general, researchers can use remote sensing technology to more accurately obtain the corresponding groundwater, water bodies, water systems and other parts of the clear image, through the analysis of these images, researchers can understand the relationship between the two more fully, the groundwater itself runoff, drainage, recharge and so on more effective assessment; (3) Through the use of remote sensing technology, it is possible to carry out a general survey of the basic conditions of hydrogeology, especially in areas with extremely complex environments and inadequate transport facilities, and to carry out surveys using remote sensing technology, it can promote the efficiency of survey greatly and ensure the reliability and validity of the data more fully.

## **6.2 Application of Groundwater Resources Distribution Survey**

In general, the distribution of groundwater is mostly directly affected by the water and rock strata, and the water and rock strata are distributed over a large area. It is difficult to investigate the distribution of groundwater resources in the corresponding area by using conventional exploration tools and methods, but remote sensing technology can effectively solve this problem, whether it is loose rock accumulation area, or bedrock mountain areas and other more complex geological conditions, the use of remote sensing technology can achieve better exploration results. In general, when using remote sensing techniques to investigate the basic situation of groundwater resources, remote sensing images can be used to obtain a full and intuitive understanding of the distribution of water-rich structural zones and water-bearing rock formations, and can be combined with relevant information, scientific calculation is made on the information of groundwater distribution range and quantity. In addition, the infrared image measured by remote sensing technology can also accurately describe the location of groundwater overflow zone and shallow buried zone, so as to accurately determine the distribution of groundwater resources.

## **6.3 Application of Engineering Construction Address Exploration**

With the development and application of remote sensing technology, geological prospecting has been frequently used in engineering construction. For example, in the construction of hydraulic engineering, the use of remote sensing technology allows for a more comprehensive analysis of the basic characteristics of the ground address, combined with the results of other parts of the ground exploration, this can help researchers quickly understand the reservoir in the shortest time along the region and reservoir rock trend, permeability and other basic characteristics, through these data, the researchers will be able to determine the location of possible leaks more accurately and provide a more useful design basis for subsequent construction projects. In addition, the use of remote sensing technology can also be more accurate river valley and groundwater images for the mapping, not

follow-up engineering integrated geological images to provide adequate information to support. There is also a lot of important information on the surface, which has a great impact on the living creatures and their living environment on the surface, and has a relatively close connection with people's daily life, it is very important to strengthen the monitoring of surface features. Remote sensing technology is very direct. It can display more directly the complex features of the surface, such as surface temperature, terrain height and soil type, and it can also identify water bodies to a certain extent, effectively improve the utilization rate of land. For the construction of some hydraulic engineering, remote sensing technology is indispensable. It can be used to understand the surface conditions of the construction area and the quality of groundwater, or to understand the general trend of groundwater distribution, so that these data can be used to measure regional precipitation, evaporation, surface soil moisture, and so on, once there are some weather changes, the monitoring data can be directly used to take corresponding response measures in order to minimize the loss of property.

## 7. Conclusion

Combined with the work of hydrogeological investigation, we can know that remote sensing technology can greatly improve the efficiency of geological investigation. The use of remote sensing technology can not only accelerate the progress of geological exploration, but also effectively enhance the comprehensive capacity of hydrogeological exploration, which can effectively promote the further development of hydrogeology in our country. In the light of the development of remote sensing technology at present, there are still some deficiencies, and it is necessary to continuously improve and update remote sensing technology, so as to effectively solve various problems existing at present, promote the accuracy of the address investigation work to be further improved.

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