AUTOMATIC AND HIGH-PRECISE EXTRACTION OF WATER INFORMATION USING A HIERARCHICAL ITERATIVE METHOD

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1. INTRODUCTION

Remote sensing information extraction is the key step of remote sensing application, and water body is one of its main targets. Thus, the automatic and high-precise extraction of water information from remotely sensed images is of great significance and urgently required in research fields of water resources investigation, natural disaster evaluation, even global ecological environment evolution, etc. Due to the various influencing factors of water, such as suspension, chemistry component, imaging condition and so on, water information extraction methods only using fixed models on whole image are always with low accuracy and aren't suitable for complex conditions. This paper presents a step-by-step iterative transformation mechanism to extract water information, which uses spatial scale transformation mechanism of "whole-local" based on Normalized Difference Water Index (NDWI) first, and then fuses the hierarchical knowledge of water extraction and achieves the gradually approach of the water body's optimal margin iteratively by combining the segmentation and classification at whole and local scales respectively. Experiment of plateau lake information extraction demonstrates its higher accuracy and efficiency.

2. METHODOLOGY

2.1 Work flow

According to the characteristic of remotely sensed image and the need of water information extraction, we give the method implementation and work flow according to Figure 1, and by this procedure we can extract water body in different forms and conditions.

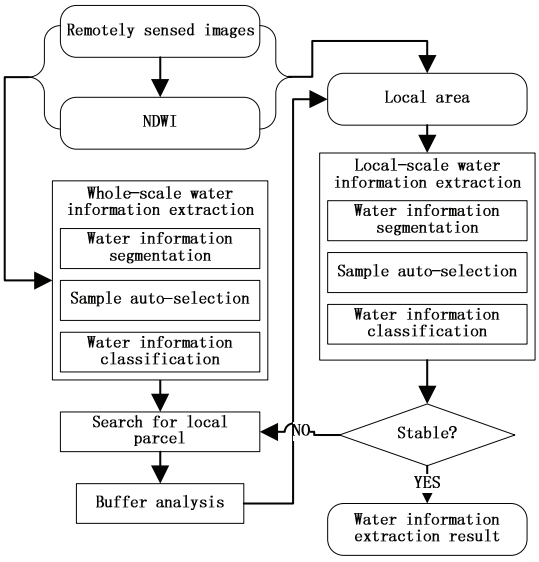


Fig.1 Flow chart of water body information extraction

2.2 Computation of NDWI

NDWI index can enhance the difference of water and land in spectrum, which makes the extraction more precise. The following processes are mainly based on NDWI image which is gained through the computation of NDWI index.

2.3 Whole-scale water information extraction

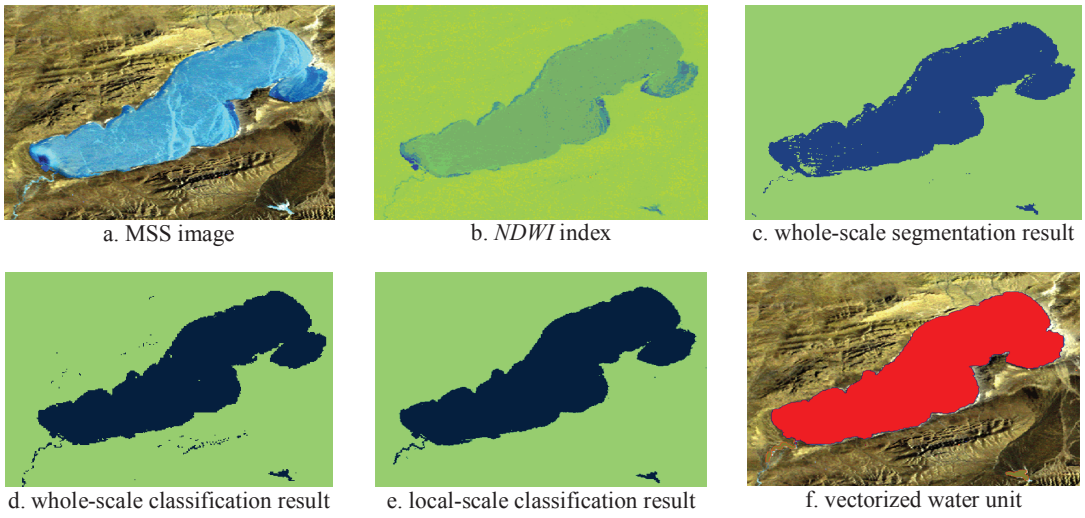
Through segmentation of NDWI image and the following classification with additional multispectral images on the whole image, we can get the preliminary separation of water and land. Then search for and select local areas, and create buffer zone of them, in order to execute local process on this basement.

2.4 Local-scale water information extraction

Within each local area, the spatial extent and spectrum are more purified, and the influence of the surroundings is relatively less. Thus, doing local segmentation and classification is more specified. Besides, the iterative algorithm also makes water extraction result more and more precise gradually.

3. EXPERIMENTS

Here we select a MSS image of a lake on Tibetan plateau as the experiment image (Figure 2(a)), and implement the method according to that showed in Figure 1. The results are listed below (Figure 2(b) - (f)).



a. MSS image b. *NDWI* index c. whole-scale segmentation result

d. whole-scale classification result e. local-scale classification result f. vectorized water unit

Fig.2 Result of water body information extraction

According to Figure 2, water body can be basically extracted from background information through the procedure of computation of NDWI, whole-scale segmentation and classification, but there still exist some misclassifications and noises. The following process of local-scale segmentation and classification can solve this problem effectively, and obtain water body's optimal margin finally.

4. CONCLUSIONS

This paper presents a new idea of water information extraction, which not only considers the spectral information, but also uses the spatial distribution and variation pattern. Thus, results using both of the two fundamental elements of geosciences are more reliable and precise than using anyone of them alone in complex environment. What's more, it is nearly automatic that manual operation is hardly needed. This idea can also be used to the automatic and high-precise extraction of other different objects, such as vegetation, desert, wetland and so on.

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