The Studies on Remote Sensing and Their Applications of Islands and Offshore Region Features from IKONOS Images

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Abstract: Satellite IKONOS images are one of important remote sensing data sources as today because of their very high spatial resolution. Their detections for islands and offshore oceanic features with multi-dimension and multi-scales information, specially some small islands, are of great potential. Their application abilities in islands and offshore detections are addressed at the first of the paper. And image processing technologies and the information extracting methodologies are described. Some results on remote sensing of the islands and their nearby object features are shown in details. Discussions and conclusions are carried out simply at the final.
Keywords: IKONOS Images, Islands, Shore-off, Remote Sensing and Applications, Studies

1. Introduction

Recently, a series of remote sensing satellites with high spatial resolution are launched in the world. For examples , IKONOS, IRS, QUICKBIRD and SPOT-5 and so on. Here IKONOS images are only studied.

The islands and offshore areas are complex objects with multi-dimension and multi-scales, and there are special requirements for their detections. IKONOS images are an ideal satellite information sources for islands and offshore areas. The studies show that remote sensing of the detail local areas with large scales are very significant.

Nanji islands and their offshore areas are chosen as the demonstrating area studies because the islands are national marine nature reserve that is a famous in China, It was established on September 1990. In December 1998, Man and biosphere program of UNESCO affiliated it as the only marine nature reserve. Its areas are about 200 km^2.and coastline length is about 33km. This preserve is a marine ecology system reserve, which mainly protect shellfish, algae and their ecology environment. There are 421 species of shellfish, 174 species of macro-benthic-algae, 459 species of macro-algae, 397 species of fishes and so on. The kinds of biological resources exist mainly at tidal zone areas.

The results indicate that it is of great potential to detect islands and offshore natural and manmade and so on marine objects.

2. The studied technologies

IKONOS imagery processing and the extraction of key information is very important in order to achieve the islands and offshore features and their parameter estimations.

The geometric correction of IKONOS remote sensing images include the choice of transfer Schemes and correcting methods, achievement of the controlling points, the boundaries of output images, pixel sizes of images and re-samples of image grey etc.

The transfer schemes are divided into both directing and indirect methods. The indirect method is chosen in the studies.

The decision of transfer method is a key step. Second-order multinomial is chosen. More than 6 control points are required because there are 12 unknown data in the multinomial. The studies show that the more the control points are, the better the geometric precision of the images are.

There are a lot of approaches for imagery fusion, for example, HIS transfer, essential component analysis, wavelet transfer and so on. Here HIS transfer combines with other methods. The fusion is carried out after image enhance and its grain.

The image fusion has been perfected by choice of IKONOS black-white band with its multi-spectral bands. Multi-spectral are chosen as the groups of 432,342 and 321 respectively, and then the excellent images with rich information are obtained.

The directional spectra of sea surface waves are gotten by Fast Fourier Transfer (FFT) method and then their parameters, including wavelength and the effective wave height as well as their direction, are estimated.

In the studies Envi software and supervised classification is applied to extract various information, including coastline, man-made buildings, some objects from offshore areas and so on.

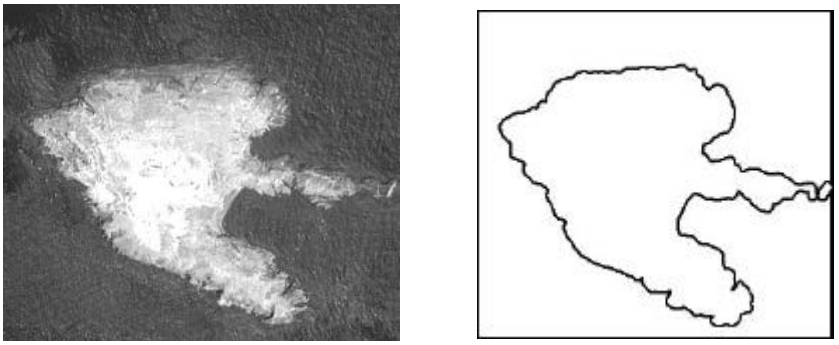
The analysis of the detecting differences of islands and offshore objects has done. The remote sensing results are compared with the field investigating data and then test and analyze their differences.

3. The results of the studies

The interesting results on information exaction of the island coastline, man-made buildings and the detail

objects with the smaller sizes are obtained by using IKONOS satellite images. The examples for some results are shown. Fig.1 (a) is IKONOS subimage and Fig.1 (b) is the coastlines of the dominant island.

The coastline is directly separated by threshold method. Fig.2 gives their construction distribution. The type classes of coast zones are rock coast, sand coast and man-made coast and so on. The man-made buildings are along coast zone from Nanji Island. For examples, the seawall, the way around the island, bread aquatics boxes and so on man-made buildings are obtained from IKONOS images. Fig.3 shows the typical seawall, the way and another object information.



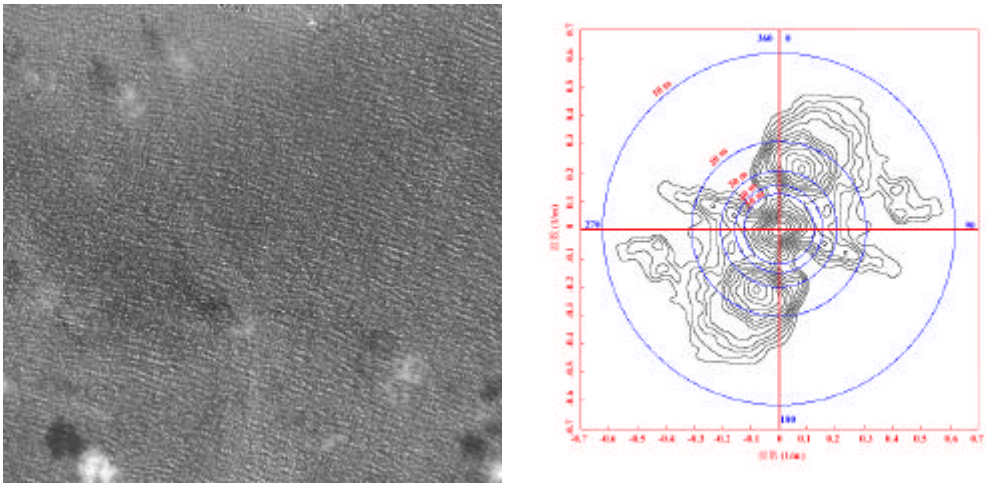
(a) IKONOS subimage (b) The coastline of the dominant island

Fig.1 IKONOS subimage (a) and coastline information extracted(b)

Rock coast sand coast man-made coast

Fig.2 The coastal constructions for Nanji islands

Fig.3 Seawall, the way along the islands and bread aquatics from IKONOS images



(a) 512*512 IKONOS sub-image (b) Dominant wave spectral by FFT

Fig.4 Sea surface wave spectrum got by IKONOS image

4. Discussion and conclusion

Some good results for choosing demonstrate areas from IKONOS images have been gotten. There are natural and manmade coastlines in the islands, and their constructions class as rock coast, sand coast and manmade coast and another projects. The manmade buildings are mainly seawall and shipside. The objects of offshore region include the boats and breed aquatics net-boxes etc. The results indicate that it can detect the detail constructions of the islands and offshore object features and so on marine objects with larger scales.

The studies indicate that application developments of IKONOS images to various regions may be to solve some difficulties. The first of them is that so smaller area is difficult to find a lot of ground control points that affects their application areas. The second is distributions of those control points don't uniformity because there are lacks of big scale marine maps.

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