Study on Macroscopical Dynamic Monitoring of Newly Added Construction Land Based on Remote Sensing Data

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Abstract—**Analyzing the significance of macroscopical dynamic monitoring of new increased construction land, considering the influence of various factors, this paper selects Yinchuan Plain for a typical experimental zone, builds knowledge base of remote sensing images interpretation, uses multi-temporal remote sensing images, carries through interactive interpretation of change patterns of new add construction land and field validation. Interpretation results of 30m scale remote sensing image show that the minimum spot average area of new construction land change monitored by 30m scale remote sensing data is about 9 acres, larger area new construction land in monitoring area, especially new construction land area average more than 10 acres has certain ability to monitor.**

Index Terms—**Yinchuan Plain, new increased construction land, dynamic monitoring, remote sensing interpretation**

I. Introduction

With the further development of economic construction and the transformation of macroscopic land administration requirement, Xi'an Bureau of State Land Supervision needs to obtain the macroscopic change information of new increased construction land as quickly as possible to offer target range for supervised points. Therefore, on the basis of using high resolution remote sensing images to supervise the situation of the new increased construction land in some key zones, it's necessary to use wide covered and relatively cheap middle resolution remote sensing images to supervise the macro situation of the new increased construction land in the whole range. In this way, it could further complete the dynamic remote sensing supervision system of new construction land increase in flatland zones of northwestern five provinces, meanwhile, the macro supervision and micro supervision could compensate each other to offer just-in-time and comprehensive data for macro decision making and land supervision administration in five provinces of the northwest[1-6].

Hence, it's necessary to conduct an experiment about the change detection of new increased construction land with the middle resolution remote sensing images in some flat zones. Then, based on the experiment results, the paper analyzes and discusses the ability of middle resolution remote sensing images in supervising and discovering the change of new increased construction land, in order to offer experience and reference to the further work of change detection for new increased construction land, especially for which is changed from plow land.

II. Experimental Zones and Data Processing

A. Choosing of Experimental Zone

This research chose Yinchuan Plain as the experimental zone. Yinchuan Plain has a large area, so it's a heavy work to use middle resolution images to supervise the whole zone. Considering the quality of existing high resolution images, this experiment only chose some counties of Yinchuan Plain to conduct the dynamical supervision.

This experiment chose Xixia district, Jinfeng district, Xingqing district(the total area of three districts is 9491 km^2), Helan county (1600 km^2) and Yongning city(1020 km^2). The total area is 12111 km^2.

B. Data Preparation

1)Middle Resolution Images

The collected middle resolution images of Yinchuan Plain were produced in 2007 and 2008. This experiment used the BJ-1 multiple spectral images as the representative image, its resolution is 32 m, and it had blue, green, red, near-infrared four bands.

2)High Resolution Images

The collected high resolution images of Yinchuan Plain were produced in 2007 and 2008. This experiment used these images to verify and evaluate the correctness of the new increased construction land which was extracted from middle resolution images.

C. Data Pre-processing

1)Geomatic Correction

①Found out identifiable points from reference images, meanwhile considering the uniform distribution of these points.

② Found out corresponding points from image for corrective, and used the remote sensing processing software to enter the coordinate values of these points one by one.

③ Conducted adjustment calculation with controlling points by quadratic polynomial fitting method, resample pixels by double linear interpolation method, and deleted those points which had exceptional RMSE values, meanwhile ensured these deleted points did not influence the geometric correction results. The number of controlling points were controlled between the theoretical minimum number (n+1)(n+2)/2 and the recommended maximum number (n+1)(n+2)/2 to satisfy the requirement of geometric accuracy[7-10].

2)Image Registration

As images that used to identify and extract information of new increased construction land were obtained from different sensors and different time of two experimental zones, they were required to match well with each other on spatial locations in the same zone. It meant image registration technologies were needed.

The CBERS Pan images, obtained in Dec 2007, were taken as the reference image, to register the 30 m middle resolution images in the experimental zone of Yinchuan Plain.

3)Image Enhancement

It was a complex process to obtain remote sensing images, and the quality of images were influenced by atmosphere, optical system, sensor, electronic lines as well as the flight of the satellite etc., so it was necessary to recover images' immanent texture and geometric features through the following method: first, using the point spread function (PSF) of the imaging formation system to express the quality reduction; second, using the Fourier transformation on PSF to obtain the modulation transfer function (MTF) of the imaging formation system; after that, based on the inverse process of satellite imaging process, using the Wiener filtering to recover and compensate the MTF; finally, the sharpness of images was enhanced. Meanwhile, in order to sharpen useful information and amplify the difference of features, which would improve images' ability of interpretation and analysis, the gray values of pixels were transformed to make the image features identified and distinguished.

D. Extraction of New Increased Construction Land in Experimental Zones

1)Establishment of New Increased Construction Land Interpretive Marks

The establishments of new increased construction land interpretive marks were mainly on multiple spectral images. Pattern spots of new increased construction land change of different data types were selected based on the reference of high resolution images, at the same time described and categorized by their features:

①Interpretive knowledge of the transformation from farm land to construction land.

② Interpretive knowledge of the transformation from unused land to construction land.

2)Extraction of New Increased Construction Land Pattern Spots

①Partition of grids

To avoid pattern spots of change were missed or repeated during the extracting process, the experimental zones were partitioned into several equi-spaced grids, and each grid was a work unit. The size of the grid was 1 km×1 km for panchromatic high resolution images and 2 km×2 km for middle resolution images.

②Extracting method of new increased construction land pattern spots

Currently, the accuracy of auto classification by computer still cannot satisfy the work requirements, thus this experiment used the human-computer interactive interpretation way to extract pattern spots of change.

Through the exchange between two periods' multiple spectral images, the change information of the spectrum, and interpret the pattern spots of new increased construction land grid by grid on 30 m scale middle resolution images were found. According to the color, size, shape, texture, structure, height, and shade of images, the changed land was identified, the new increased construction land was drawn, and the changed information was recorded.

In the same way, pattern spots of new increased construction land on the panchromatic images were extracted, and the changed information was recorded for setting reference of the verification in the fieldwork.

III. Extracting and Analysis Results of New Increased Construction Land in Experimental Zones

A. Supervising Results of New Increased Construction Land by 30 m Scale Middle Resolution Multiple Spectral Images

In Yinchuan Plain experimental zone, 90 pattern spots of new increased construction land were extracted through multiple spectral images of Beijing No. 1 small satellite. The area in all was about 19,194 acres. Through satellite images, the new construction land is mainly located in the urban expansion fringe in Yinchuan city, which in Helan County, Jinfeng district and Xingqing district, the spot distribution was shown in Fig. 1. In new construction land change spots, the largest pattern spot was 2100 acres, and the smallest one was 9 acres. From the area distribution of view, areas of these pattern spots were mainly between 10 acres to 50 acres and 100 acres to 500 acres.

B. Supervising Results of New Increased Construction Land by High Panchromatic Images

On five cities and counties test area of Yinchuan Plain, the results were extracted as validation data for reference by high panchromatic data. High panchromatic data test area used are two phase ALOS and CBERS 2.5m high resolution panchromatic data separated phase for a year. 129 pattern spots of new increased construction land were extracted by High panchromatic images in test area of Yinchuan Plain, a total area was about 11509 acres, the spot distribution of new increased construction land was shown in Fig. 2. In new construction land change spots, the largest area was about 830 acres, the minimum area was about 5 acres. From the area distribution of view, areas of these pattern spots were mainly between 10 acres to 50 acres and 100 acres to 500 acres.

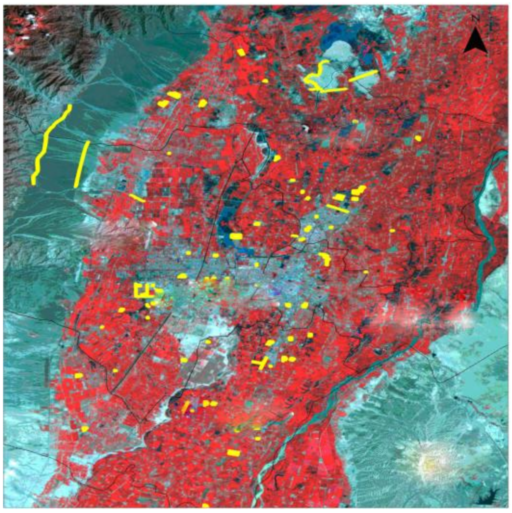

Fig. 1. Change spot distribution map of BJ-1 multiple spectral data new increased construction land in Yinchuan plain experimental zone

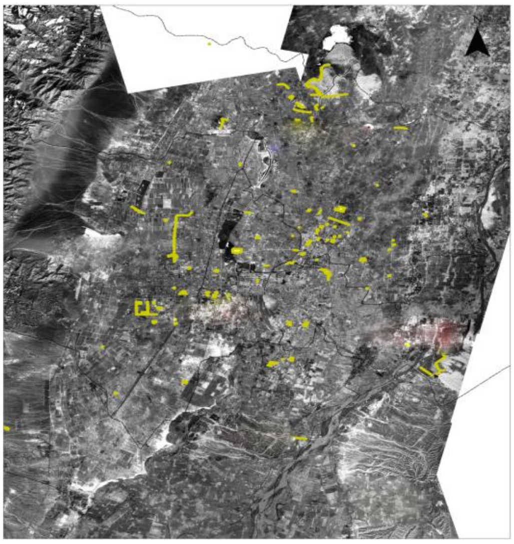

Fig. 2. Change spot distribution map of high panchromatic data new increased construction land in Yinchuan Plain experimental zone

C. Comparative Analysis of Monitoring Results

From Table 1 and Table 2, while overlap new construction land change spots were only 58, theirs size was 4m most new construction land change spots area, it is not difficult to understand the spots missing 71, business precision can reach 72.3%.

Table 1. Comparative analysis of the new increased construction land supervision results in Yinchuan Plain experimental zone

Analysis item	**Number**	**Area (acre)**
4 m pattern spots of new increased construction land	129	11509
32 m pattern spots of new increased construction land	90	19194
Overlapped pattern spots of new increased construction land	58	8320
Missed pattern spots	32	10874
Misjudged pattern spots	71	3189

Table 2. Representative pattern spots of the new increased construction land correctly extracted from 30 m scale remote sensing data

Analysis item	**Percentage of number**	**Percentage of area**
Image extracting accuracy	64.4%	43.3%
Business operation accuracy	45.0%	72.3%

IV. CONCLUSIONS

Through the research on test area of Yinchuan Plain, the minimum spot average area of new construction land change monitored by 30m scale remote sensing data based on BJ-1 multispectral data as the representative was about 9 acres. Analysis on the precision meeting business of change spots number and change total area, combined with field investigation analysis, spatial resolution of 30m scale middle resolution data using BJ-1 multispectral data was coarse, although the image can not reflect the area is small, or new construction is broken land change information, through change detection, larger area new construction land in monitoring area, especially new construction land were average more than 10 acres has certain ability to monitor.

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