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THE PROCESSING AND FUSION METHOD OF CBERS-1 IMAGES

Long Jing
Academy of Forest Planning, State Forestry Administration
Beijing, 100714, P.R.China
Tel: 86-10-84238305, Fax: 86-10-64237735

ABSTRACT: The purpose of this paper is to study the method for CBERS-1 images processing and fusion with SPOT data, to evaluate images quality and ability for application. In this research, 4 scenes CCD data were selected. Image enhancement processing and geometric correcting were done. SPOT panchromatic band (10 meter resolution) was used for fusion with CBERS-1 data. Through the registration and fusion processing, we got high quality image that is both including multi-spectral information of CBERS-1 data and including spatial information of SPOT data. As a result, the image processing methods for CBERS-1 data has been summarized.
Keywords CBERS-1, Image processing, Fusion

1 INTRODUCTION

The first China & Brazil Earth Resources Satellite (CBERS-1) was launched in 1999 in China and acquired observation data of the earth surface successfully. CBERS-1 images cover large area and have a good resolution. As a Chinese own remotely sensed data source, CBERS-1 data can be gained easily and at low-price. So, it has a broad prospect for application.

In this research, 4 scenes CCD data of Inner Mongolia Autonomous Region are selected. Image enhancement processing and geometric correcting are done. Then the evaluation of CBERS-1 data is given. SPOT panchromatic data is used for spatial registration and fusion with CBERS-1 data. The results show that CBERS-1 data can be used in ecologic environment and resources dynamic monitoring with a broader application prospect.

2 CHARACTERISTICS OF CBERS-1 DATA

There are three sensors on the CBERS-1. They are CCD，IRMSS and WFI. The main technique indicators of these sensors are show in table 1.

Table 1 The main technique indicators of CBERS-1 sensors

Sensors	**CCD**					**IRMSS**				**WFI**	
Bands	1	2	3	4	5	6	7	8	9	10	11
Spectral Range (μm)	0.45-0.52	0.52-0.59	0.63-0.69	0.77-0.89	0.51-0.73	0.5-1.1	1.55-1.75	2.08-2.35	10.4-12.5	0.6-0.69	0.77-0.89
Resolution	19.5m					78m			156m	256m	
Cover Width	113km					119km				898km	
Cover Cycle	26 days										

3 PROCESSING OF CBERS-1 IMAGES

Four CCD images were got from China CBERS-1 Application Center. Their path/row numbers are 1/51,1/52,2/51 and 2/52, acquired on Aug.16, Jun.9, Oct.14, and Oct.14 of 2000 in proper order. One SPOT image and the map in 1:50000 scales were used also.

Three processing steps are completed on four CBERS-1 CCD data sets:

Registration processing of five bands images Registration was done with linear computation model**,** errors were controlled under 0.3 pixels.

Geometric correction processing Control points were selected on the map in 1:50000 scales, geometric correction was performed using linear model, the average error is 0.5 pixels.

Image mosaic processing Four scenes images used in the research belong in two orbits of the satellite and three dates. It is difficult to mosaic them. First, histogram matching must be made for different dates images. Then, mosaic areas should be selected on each image. Through blending border along the mosaic lines, four images were mosaicked to an image of whole research area.

4 DATA FUSION OF CBERS-1 WITH SPOT

The fusion of remotely sensed data is a technique that same area images acquired from different sensors on different satellites are integrated to produce a new image by some algorithms through spatial registration. The purpose of this method is to integrate or fuse the dominant information from each image to increase availability of images and reduce indefinite information.

The fusion process of multi-sources images data includes spatial registration and data fusion.

The spatial registration is the base of images data fusion. Images must be registered accurately before fusion. Two registration steps were completed:

Maps in 1:50000 scales were used as reference data to correct SPOT image with 0.5 pixels average errors.

Using corrected SPOT image as reference data, CBERS-1 images were registered. Resample image is the same pixel size as SPOT (10 meters). Because control points were selected between two images, the correct accuracy is satisfied (errors of all points are lower than 0.5 pixels).

Fusion process of CBERS-1 image (Figure 1) with SPOT panchromatic band (Figure 2) was done using Brovey transfer formula. New image were produced. We got a high quality image (Figure 3) that is both including multi-spectral information of CBERS-1 data and including spatial information of SPOT data.

5 CBERS-1 IMAGE EVALUATION

The following evaluation are given for CBERS-1 data depending analysis:

CBERS-1 CCD images can provide more spectral information about terrestrial objects, especially about vegetation. The images can show more detail information because of higher resolution (19.5 meters), so can be used in many fields e.g. dynamic monitoring of forest and other natural resources. Figure 4 is an image of agricultural area. Shelterbelt is very clear on the image. Some belts is only under 10 meters width, can be interpreted easily.

CBERS-1 data has a good geometrical precisions, the error of geo-correcting is only 0.5 pixels. It can be used for mapping in 1:50000 scales, or larger scale mapping in special field.

The spatial resolution of CDERS-1 CCD image is satisfied for application on natural resources inventory and monitoring.

The fusion of CBERS-1 and SPOT data given a good result.

Data fusion is an effective method in application of multi remotely sensed data sources and will provide a broader application prospect for CBERS-1 data.

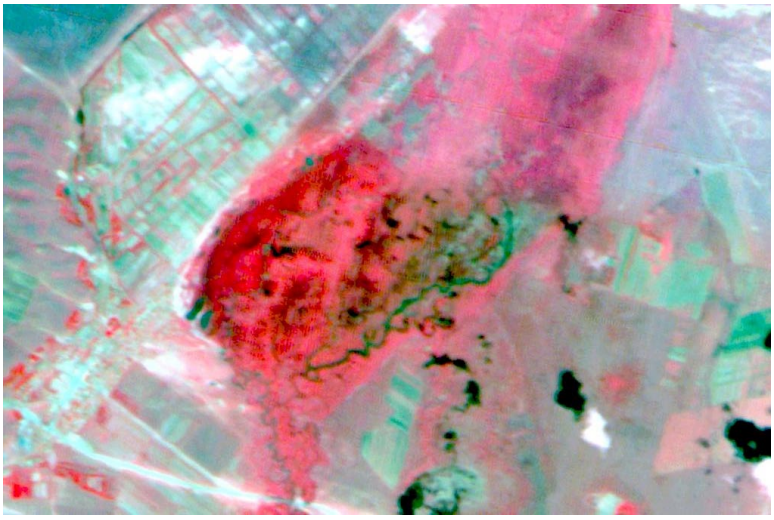

Figure 1 CBERS-1 image with band 4 3 2 (R G B)

Figure 2 SPOT image of panchromatic band

Figure 3 Fusion image of CBERS-1 with SPOT

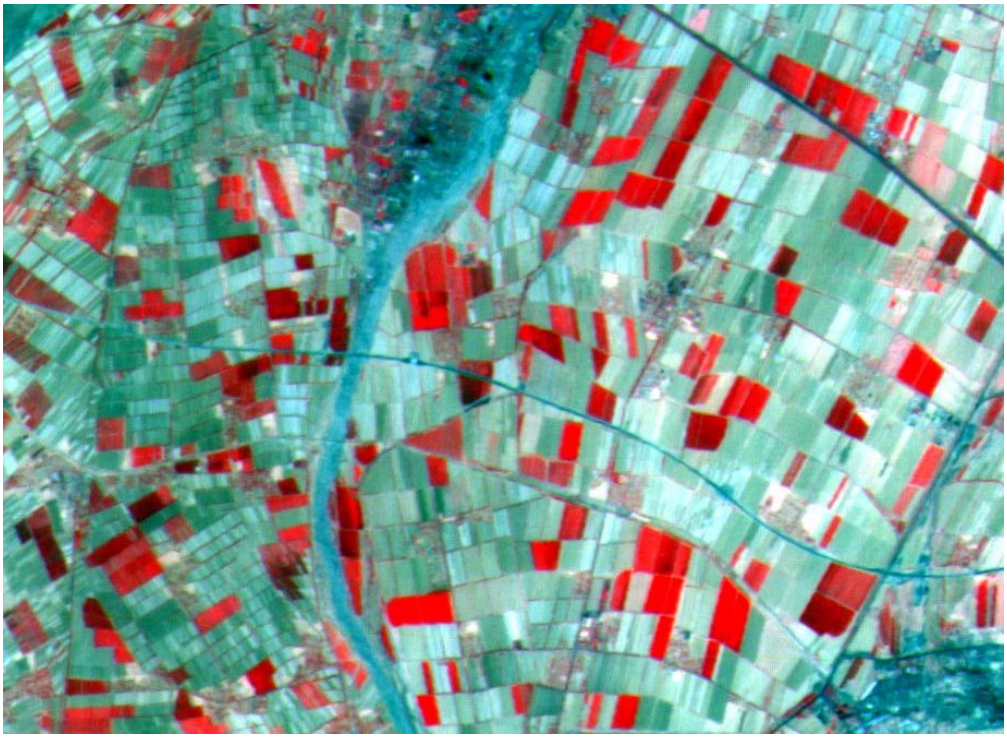

Figure 4 CBERS-1 image of agricultural area (see shelterbelts)

6 CONCLUSION

According to the results of processing and data fusion of CBERS-1, we got following conclusions:

Band design of CBERS-1 CCD sensors is reasonable.

Resolution of CBERS-1 image is suitable for more applications in middle scales.

Geometrical precisions of CBERS-1 data can meet the need of 1:50000 or larger scales mapping.

Data fusion is useful for multi-sources remotely sensed images application, especially for CBERS-1 data.

As a Chinese own remotely sensed data source, CBERS-1 data can be gained easily and at low-price. So, it can be used broadly in future.