UDK 528.8

DIGITAL RECTIFICATION OF THE KOMPSAT 3A SATELLITE IMAGE AND ACCURACY ASSESSMENT

G.Z. YAKUBOV, PhD student
(*National University of Uzbekistan named after Mirzo Ulugbek*)

Satellite images with very high spatial resolution are very important source of information, especially in large-scale agricultural mapping. Images obtained by different satellite sensors are subject to distortion and require adjustment during processing. In the process of pre-processing, the images are given radiometric, sensory, geometric correction and are brought into a standard cartographic projection. However, images that have undergone only preliminary processing cannot always meet the requirements for compiling large-scale maps and plans. To do this, satellite images are geometrically corrected with the help of additional data (metadata). Such data include rational polynomial coefficients (RPC), coordinates of control points (GCPs), and, if necessary, digital elevation models (DEM). As a result of geometric correction with the additional data determines the relationship between the coordinates (pixel coordinates) of the digital image and the coordinates of points on the ground, and the images are brought to the required cartographic projection. In some literatures this process is called rectification or orthorectification.

In the course of the study, a Kompsat 3A satellite image with a high spatial resolution of the Republic of Korea was rectified by rational polynomials method (spatial resolution 0.4 m and 1.6 m; deviation angle from nadir - 12°; processing level - 1R). For this, 23 evenly distributed ground control points were selected on area of interest (Tashkent region, Buka district), the horizontal and vertical position of which was determined with high accuracy from GNSS observations in RTK mode using a Trimble R4 GNSS receiver. Some of the points are designated as ground control points (GCPs) which participated in the rectification, the rest of the points were used as check points (CHPs), which served to assess the accuracy of the rectification of the satellite image.

The rectification of the Kompsat 3A satellite image was performed in the PCI Geomatica 2016 software by the method of rational polynomials (0-2 order), the results of which are shown in Table 1.

The adjustment results show that the Kompsat 3A satellite image can be accurately oriented using the rational polynomial method using RPC coefficients. This requires a different combination of GCPs and CHPs. For 0-order rectification, it is enough to have one or two control points on the image in order to achieve a more accurate result. When the number of GCPs is from 3-8, a sharp increase or worsening of errors is not observed.

Table 1. – Satellite image rectification by the method of rational polynomials

Order of RPC rectification	Number of GCPs	Number of CHPs	RMSE, м			
			GCPs		CHPs	
			dx	dy	dx	dy
0-order	1	22	0,03	0,01	0,72	0,52
	2	21	0,25	0,12	0,54	0,60
	3	20	0,31	0,12	0,43	0,59
	4	19	0,34	0,28	0,38	0,52
	5	18	0,31	0,28	0,39	0,50
	6	17	0,32	0,43	0,38	0,46
	7	16	0,31	0,41	0,39	0,47
1-order	3	20	0,21	0,09	0,44	0,56
	4	19	0,26	0,15	0,38	0,50
	5	18	0,26	0,25	0,38	0,46
	6	17	0,35	0,23	0,43	0,46
	7	16	0,36	0,28	0,37	0,41
	8	15	0,47	0,35	0,24	0,39
	9	14	0,44	0,34	0,25	0,38
2-order	6	17	0,19	0,19	0,49	0,38
	7	16	0,19	0,20	0,48	0,39
	8	15	0,21	0,29	0,47	0,34
	9	14	0,36	0,30	0,31	0,36
	10	13	0,34	0,29	0,32	0,36
	11	12	0,34	0,29	0,34	0,37
	12	11	0,34	0,29	0,33	0,36

RPC 1-order adjustment also provides accurate results. Here, the minimum number of GCPs must be at least 3. The most accurate results are observed with 3-5 points.

Rectification using 2-order RPC coefficients are applicable for 6 or more GCPs. More accurate results were observed with the number of GCPs from 6-8. With the number of points from 9-12, the standard error of determining the position of GCPs and CHPs is almost similar.

BIBLIOGRAPHY

1. *Chermoshentsev, A. Yu.* Evaluation of the measurement properties of high-resolution satellite images. PhD Dissertation Abstract. Novosibirsk, 2012. 23 p. (in Russia).
2. *C.Vincent Tao and Yong Hu.* A Comprehensive Study of the Rational Function Model for Photogrammetric Processing. Photogrammetric Engineering & Remote Sensing. Vol. 67, No. 12, December 2001, - P. 1347-1357.
3. *Titarov P.S.* Study of the geometric characteristics of the remote sensing product Cartosat-1 Stereo Orthokit. Spatial Data, 2007. №2. - P. 32-38 (in Russia).