Geometric Correction

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Abstract

Geometric Correction Technique (GCT) compiles information from multiple satellite images and information from three different systems (i) Optical Panchromatic image with resolution of 2 meters from THEOS, (ii) geographical coordinate of city grids from Ground Control Point (GCP) and (iii) actual 1:50,000 landscape map from Royal Thai Survey Department. Both images information are mapped with geographical coordinate from GCP systems and compared against geographical coordinate from Global Positioning System (GPS) using image registration and first Order Polynomial Transformation for Bang hen district in Bangkok Thailand. Project extends the use of GCP in regular landscape map which makes ease of estimating geographical coordinate of city grids for before actual landscape survey. Calculate GCP error of THEOS image by root mean square error formula.

Introduction

GCP information is gathered over 22x22 square Kilometers area based on optical Panchromatic image with resolution of 2 meters taken by THEOS on 1st December 2011 referring with the geographical

coordinate read from GPS sensor model Garmin 60CsX provided by Geo-Informatics and Space Technology Development Agency (GISTDA) (Public Organization). Initial GCP information is consisted of roughly 16 positions collected by a surveyor walking over city blocks. The GCP positions are overlaid on THEOS satellite image. In addition, any GCP positions located outside the image are also removed. The process is done using "Georeferening" tools or "Geoprocessing Warp" tools with more than 4 GCPs from ARCGIS10 software. The following topic shows that a method of georeference rastering transforms two geographical images with 4 closed neighborhood GCPs automatically. Images are rescaled to match actual GPS information. With the GCP, information is used instead of regular maps because the GCP provides higher geographic accuracy especially for updated infrastructure. This is the reason why methods linking actual ground positions with positions from maps are very important. The GCP can be measured using Latitude and Longitude or Universal Transverse Mercator (UTM) standards. Therefore, the information from GCP provides higher accuracy data compared with maps made in years 2004 which lacking of updated infrastructure.

RESULTS

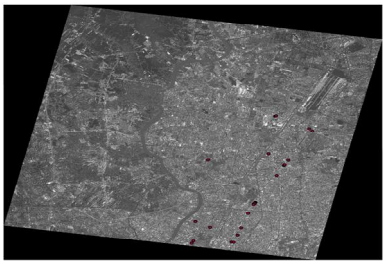

Fig1 BANGKHEN THEOS 1st December 2011

Fig 2 MAP 5136IV Bangkok Thailand 2549

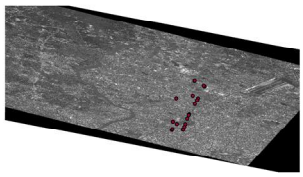

Figure 3 registration-transform

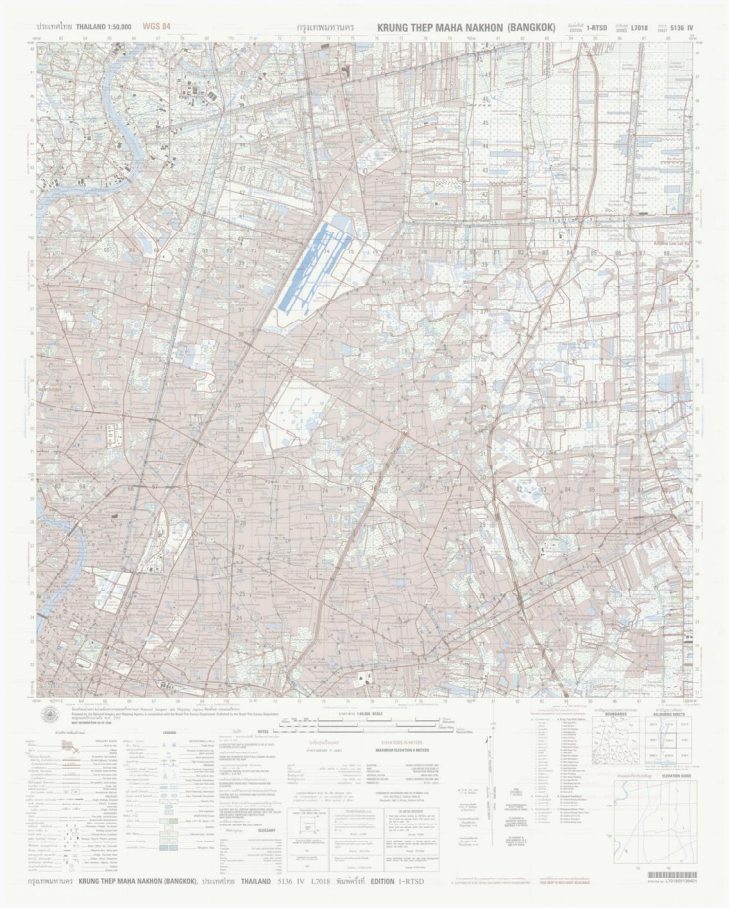

FIG4 MAP 1:50,000 Bankoko Thailand

METHODS AND EQUATION

In this experience we used Notebook Compaq CQ 40 Hard disk 500 GB RAM 3 GB Trumbdrive Kington 16 GB, GPS 60cSX Garmin, satellite image from THEOS in Bang hen District, Jatujak District Phayathai District image size 22x22 Kilometers from GISTDA MAP 5136IV Royal Thai Survey Department in same THEOS area GCP 16 point software ARCGIS 10 . In this case study, we used a note book Compaq pasario cq 40 Hard disk 500GB Ram 3 GB Trumbdrive Kingston 16 GB ,GPS 60cSX Garmin satellite THEOS locator Chatuchak district administrator of 22x22 km of GISTDA the map 1 per 50,000 DWT 5136 IV Royal Thai Survey Department. THEOS satellite images with spatial coordinates, UTM 16 ARCGIS 10-point program of studies, we used the intersection of the road. Large buildings. Invisible on the map to see the

satellite image by finding the pins. Position using GPS with the UTM coordinates for the positioning of the pins are available for comparison with maps that are used to measure how much this weekend is the first bus stop and see the map as a model. UTM (Universal transverse Mercator) just meters to the reading of the coordinates GCP satellite, THEOS was removed with the reading of GPS (Global Position System) is the error of the map and the coordinates of the post to find it. with an RMS error using MATLAB 2011 on windows XP from a study using satellite image data to the image of the Panchromatic THEOS system and marked the area of ground control point GCP (Ground control Point) to the bus stop. Bangkok Metro station on the BTS Saphan Kwai BTS station Ari on blue field goal monumental military subjects. Khen the water front. Home Government facilities. Occupies a corner of the intersection of Sri District by walking away from the GPS coordinates to the coordinates of 16 points on satellite imagery. We connect the GPS to a computer via USB cable. The satellite image. And put the coordinates on the satellite image represents the position of GCP on the THEOS satellite where the GPS coordinates of the match turns out that this position does not match the image such as the GPS to a computer via USB cable. The satellite images. And put the coordinates on the satellite image represents the position of GCP on the THEOS satellite where the GPS coordinates of the match turns out that this position does not match the image such as the GPS satellite to the GCP bus stop next weekend. The garage location on satellite imagery, satellite images show that the BTS sky train to the coordinates provided by the above error.

RMS ERROR

Accuracy Total (Total RMS Error) of each image is not equal. It depends. The image of the selected location. The reference coordinates from the GPS, but it must be minimal. Even less to show the correctness of the position in The root-mean-square deviation (RMSD) or root-mean-square error (RMSE) is a frequently used measure of the differences between values predicted by a model or an estimator. And the values actually observed. RMSD is a good measure of accuracy. [Citation needed] These individual differences are also called residuals, and the RMSD serves to aggregate them into a single measure of predictive power.

The study used satellite images to the image of the Panchromatic THEOS system and marked the area

of ground control point GCP (Ground control Point) meets at the bus stop. Bangkok Metro station on the BTS Saphan Kwai BTS station Ari on blue field goal monumental military subjects. Khen the water front. Home Government facilities. Occupies a corner of the intersection of Sri district by walking away from the GPS coordinates to the coordinates of 16 points on satellite imagery. We connect the GPS to the computer with a USB cable to satellite imagery. And put the coordinates on the satellite image represents the GCP.

X'org, Yorg' : map X',Y' : image THEOS

$$\text{RMS error} = 1/n\sqrt{\sum}(X'-X'org)^2+(y'-y'org)^2$$

Table 1: LATITUDE LONGTITUDE AND MAP 1:50,.000

THEOS Image EARTH NORT		MAP EARTH NORT	
1524767.597	663280.532	1524534.794	663408.349
1523906.407	664532.831	1,523,974	664471.159
1522254.05	664532.831	1522451.196	666186.48
1523047.802	666455.538	1523079.583	666682.575
1524106.137	666852.414	1523840.261	666980.232
1525561.349	667381.582	1525427.765	667509.399
1526386.881	667908.245	1526619.684	667778.458
1527016.56	668043.042	1526651.465	668038.567
1529662.399	669630.545	1529594.96	669725.289
1530853.026	670159.712	1530686.369	670320.603
1531249.902	670424.296	1531249.902	670424.296
1532043.653	668836.793	1531976.215	669096.903
1536541.579	669498.253	1536110.338	669659.143
1534821.784	672144.091	1534754.346	672205.763
1534689.492	667614.924	1534522.835	672437.247
1530059.274	676906.601	1530289.493	676935.199

Rms error= 3016.2998

Table Residule earth-North

Y-Y'	x-x'
232.803	-127.817
-67.593	61.6720

-197.1460	-1653.649
-31.7810	227.0370
265.8760	-127.8180
133.5840	-127.8170
-232.8030	129.7870
365.0950	4.4750
67.4390	-94.7440
166.6570	-160.8910
0	0
67.4380	-260.1100
431.2410	-160.8900
67.4380	-61.6720
166.6570	48222.323
-230.2190	-28.5980

54197.24	16337.1855
4568.813649	3803.43558
38866.55	2734555.52
1010.032	51545.7994
70690.05	16337.1855
17844.69	16337.19
54197.24	16844.6654
133294.4	20.025625
4548.019	8976.42554
27774.56	25885.9139
0	0
4547.884	67.657.2121
185968.8	25885.91
4547.884	3803.43558
27774.56	2325392436
53000.79	817.845604

682831.5	2328313586
$(Y-Y')^2$	$(x-x')^2$

2328313586+682831.5=2328996417.5=X+Y

√2328996417.5=**48259.677**

48259.676/16=3016.2998

RMS ERROR =$\sqrt{\sum[(X-X')^2+(Y-Y')^2]/n}$

GCP map compare GCP image THEOS registration-transform

RMS ERROR =3016.2998

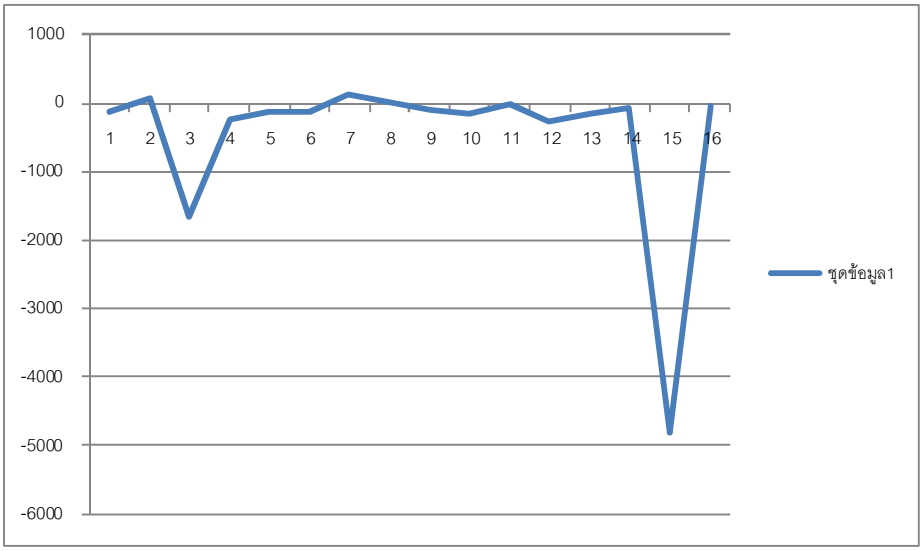

Fig 4. Residual x-x' east

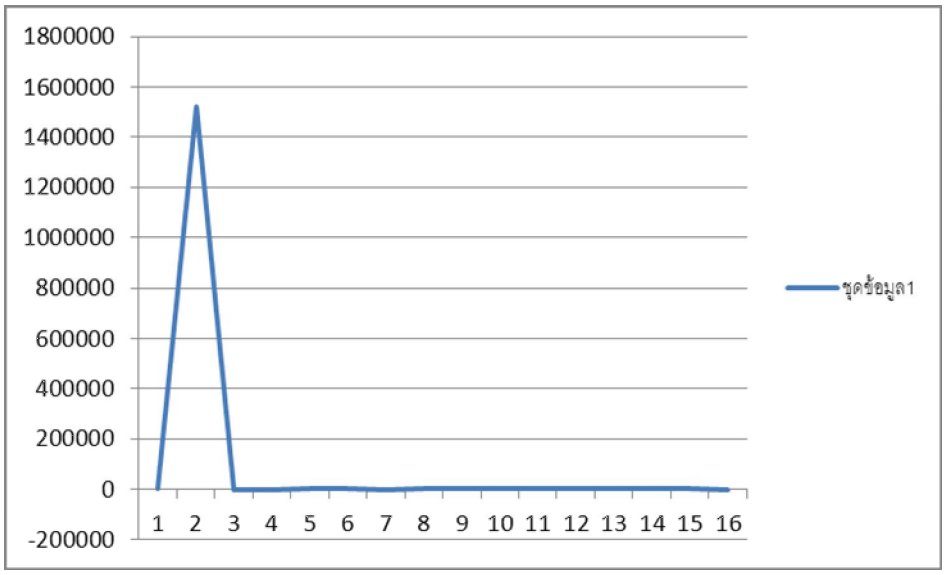

Fig 5 Residual Y-Y' North

Discussion and Conclusions.

Experimental measurement of GCP and read the coordinates on the satellite images are available in a 16-point coordinates of the MAP measuring points on the map and readings compared with the GCP on the THEOS satellite images REGISTRATION, first order transformation. The point is wrong on the GPS to find the error on the rms error matlab7.2 may have more to find the error. Due to an error of GCP on the satellite image. The map does not match the GCP from GPS readings on the Registration first order polynomial transformation. The adjustment will be more accurate.

The comparison with the value or values RMSe mean error of the model is one approach that can make the program operational again as well. It is the source. Make workers aware of the precise position of the expected as well. Of the study. This comparison will see that the results of the calculation. The average margin of error is the RMS ERROR = 3016.2998.

The result is a tool that allows the operator to monitor the implementation of that averages out the errors out. Straight-line distance between the actual and the expected much more. The precision of the error. Position is increased. It may be a model. Increase the number of points or more. The output of the error. For each

position. This is called the residual error (Residual errors) between the predicted and the actual residual error is the square of each salad. This will require a minimum deviation of each point is the more accurate the position. Because of this the point where the image is just 16 gcp. The results. Were found to be good. So we see that At times, the four control points, the picture position may not be appropriate. For the correct geometrical scale of the image data. It also allows images to have a (Shift), which confirm the results obtained from the four programs will be seen that all the images are jumping. In the same direction. If you add a control point in this picture. Might make. The end result is. More accurate

REFERENCE

Online artical

http://en.wikipedia.org/wiki/Root_mean_square_deviation

Example : Transformation Equation from Jensen 1996 p133

Journal article

Vinai , V (2000) Geometric correction by GPS King mongkut institute of technology Ladkrabang, Kasetsart University no38

ว่าที่ร้อยตรีอัครศิต นโรปการณ์ การเปรียบเทียบการปรับแก้ข้อมูลเชิงเรขาคณิต