

1 ACCURACY ASSESMENT OF HIGH RESOLUTION SATELLITE IMAGES

L. Iscan ^{a,*}, O. Aksu ^a, M. Onder ^b, V.O. Atak ^a, O. Lenk ^c, M.A. Gurdal ^c

^a General Command of Mapping, Photogrammetry Department, 06100 Mamak Ankara, Turkey – (liscan, oaksu, oatak)@hgk.mil.tr

^b General Command of Mapping, Chief of Technical Departments, 06100 Mamak Ankara, Turkey –monder@hgk.mil.tr

^c General Command of Mapping, Geodesy Department, 06100 Mamak Ankara, Turkey – (olenk, agurdal)@hgk.mil.tr

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ABSTRACT:

High resolution satellite images (Ikonos, Quickbird, etc...) supply a lot of opportunities in mapping, GIS and many other applications by means of the improvements in Remote Sensing technologies. A test study has implemented in Turkey by General Command of Mapping (GCM). Golbası case study area near Ankara, which is 10kmx10km and already used for kinematic GPS supported aerial triangulation test project in 1996, has been selected for accuracy assessment of high resolution satellite images. 12 ground control points were revised and signalized before the recording of images.

Stereo-pair IKONOS (dated August 4th, 2002) and mono QUICKBIRD (dated 26th May, 2002) images covering test area have been provided by Inta Uzay Sis.A.S (Turkey) and Eurimage (Italy) free of charge. Various orthophotos have been produced from aerial photograph, IKONOS and QUICKBIRD images with;

- photogrammetric DEM
- cartographic DEM
- with/without ground control points
- polynomial constants (rpc file)

Well-distributed 27 checkpoints such as junction of roads, field corners have been defined and planimetric coordinates were measured on all orthoimages. GPS measurements of checkpoints and calculations of orthometric heights have also been implemented. Obtained results and comments are given in that paper.

1. INTRODUCTION

New opportunities in photogrammetry and remote sensing applications have been initiated by launching of IKONOS in 1999 and QUICKBIRD in 2001. These high resolution satellite image are being used widely day by day in various fields for various purposes both in Turkey and abroad.

Considering the accuracy assessment for geographical information provided by those images, a test study has implemented in Turkey by General Command of Mapping (GCM) and obtained results have been given in that paper.

2. PROJECT AREA AND INPUT DATA

Golbası case study area near Ankara, which is 10kmx10km and already used for kinematic GPS supported aerial triangulation test project in 1996, has been selected for accuracy assessment of high resolution satellite images. 12 ground control points (in figure 1) were revised and signalized before the recording of images.

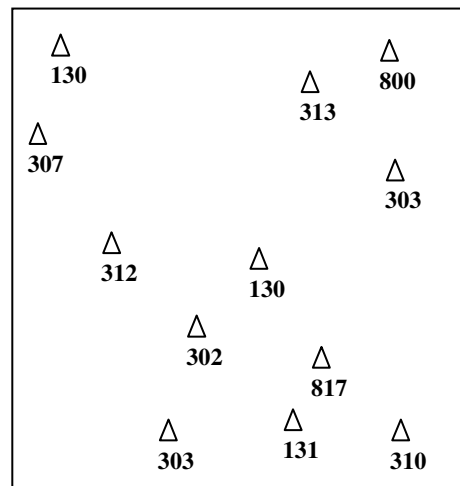


Figure 1. Distribution of GCP's in project area

Aerial photographs in 1:16.000 scale have also been taken by GCM on August 29th, 2002 as five strips (figure 2).

* Corresponding author.

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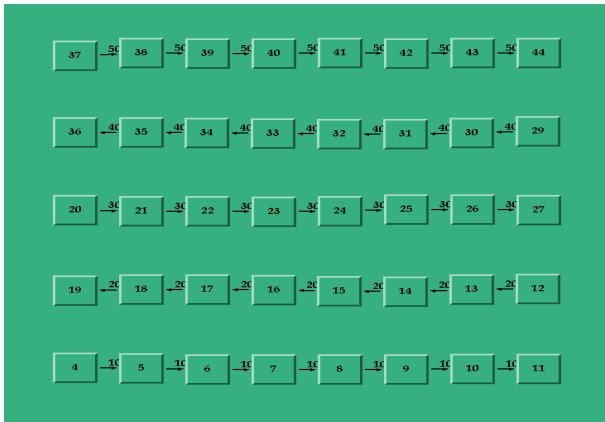
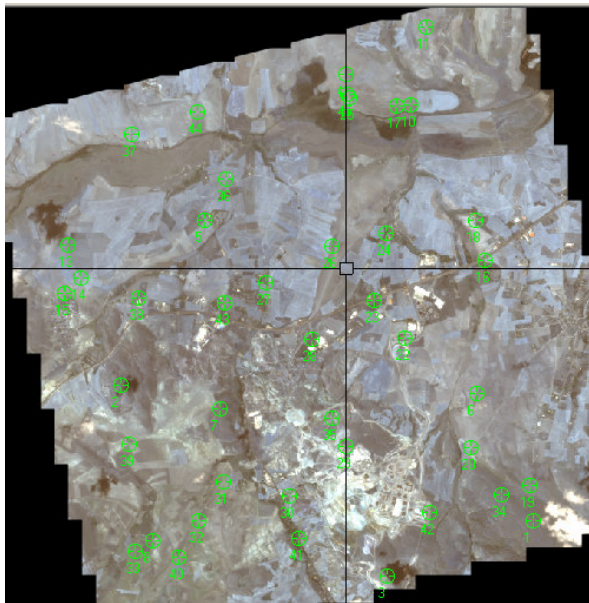


Figure 2. Photogrammetric block

3. MEASUREMENTS

Digital Aerial triangulation measurements and combined block adjustment has been implemented by using 1:16.000 scale aerial photographs. Digital Elevation Models (DEM) in $\pm 1m$. accuracy have been produced by manually collected data in 20m. interval. Another DEM in $\pm 5m$. accuracy has also been produced by means of cartographic method from 1:25.000 scale topographic map.

Figure 3. GCP's and check points



Various orthophotos have been produced from aerial photograph, IKONOS and QUICKBIRD images with;

- photogrammetric DEM
- cartographic DEM
- with/without ground control points
- polynomial constants (rpc file)

Well-distributed 27 check-points (Figure 4) such as junction of roads, field corners have been defined and planimetric coordinates were measured on all orthoimages. GPS measurements of check points and calculations of orthometric heights have also been implemented.



Figure 4. Check point

4. CONCLUSIONS

Ground coordinates of Check Points which have ± 1.5 cm. planimetric and ± 3.0 cm. vertical accuracy are compared with orthophoto coordinates. Following table shows the overall results.

	RMSE (Root Mean Square Error) x,y meter	
	IKONOS	QUICKBIRD
7 Control Point and Photogrammetric DEM	0.82 - 1.24	0.88 - 0.82
7 Control Point and Cartographic DEM	0.86 - 1.41	0.94 - 0.86
GCP's from 1:25.000 raster map and Cartographic DEM	6.79 - 6.56	5.20 - 3.50
Polynomial Constants and Cartographic DEM	12.27 - 11.06	40.55 - 15.52

Table 1. Obtained results

3-D coordinates of checkpoints in stereo model of IKONOS are also compared with orthometric heights and r.m.s.e is $\pm 1.18m$.

Considering the above results, following remarks can be concluded;

- DEM accuracy between 1-5m is enough to get eligible results.
- High resolution satellite images can provide 1:2500 and smaller scale orthophoto production when only the image quality is considered, but are eligible for 1:10.000 and smaller scale topographical mapping when the geometrical accuracy is considered (0.5m. geometrical accuracy is needed for 1:5.000 scale cadastral mapping in Turkey, according to the existing specifications).
- Although the better resolution and image sharpness of Quickbird image (figure 5), polynomial constants in May 2002 need to revising.
- Optimum output scale of orthophotos can be seen in figure 6.

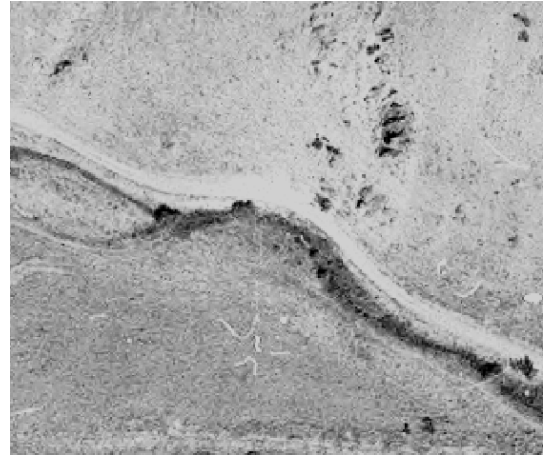


Figure 5(c). Orthophoto from aerial photographs (1:1.000)



Figure 5(a). Orthophoto from IKONOS (1:1.000)



Figure 6(a). Orthophoto from 1:16.000 photograph (1:1.000)



Figure 5(b). Orthophoto from QUICKBIRD (1:1.000)



Figure 6(b). Orthophoto from IKONOS (1:3.000)



Figure 6(c). Orthophoto from QUICKBIRD (1:1750)

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