Adaptation of High Resolution Ikonos Images to Googleearth for Zonguldak Test Field

Umut G. SEFERCIK, Murat ORUC and Mehmet ALKAN, Turkey

SUMMARY

At the present time, remote sensing technologies are being improved and day by day, by launching new satellites with new developed techniques, images can be obtained faster with high resolution. The satellites which had been launched recent years for example; Ikonos, Quickbird and Orbview-3 have 1m and better resolution, continue their missions with quite success.

For a few years the computer users have been achieving information for every area just by using a computer via the GoogleEarth (GE) technology generated by America with the contribution of several countries. GE was improved for displaying the images which are obtained with remote sensing techniques, transforming to mosaic form for any area and describing the topography and cartography of this area. But, day by day, the various information has begun to be offered by Geographic Information System (GIS) integration to the GE and the GE has started to develop by this way. Now, the users can provide all types of information for any area after the integration of Geographic Information System to GE. For example; they can decide their strategy which they will follow in a probable disaster (earthquake, flood etc.) or even, they can select a restaurant to eat something.

In this study, Zonguldak city which is located in North-West part of Turkey is selected as the test field. The high resolution (1m) images of American IKONOS satellite are used as pads. Besides, 1:1000 scale digital topographic maps are used for the extraction of details like the roads and buildings with cartography and to provide the currency of the satellite images. The data which are acquired from satellite images and cartography have been integrated in each other in GIS. In GE, the information from high resolution satellite images and cartography do not exist for Zonguldak region that's why the results obtained from this study have been planned for the integration to the GE in Zonguldak city. At the end of the study, the results are the high resolution satellite images and cartographic data which are in GIS environment and they are harmonious with GE.

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1. INTRODUCTION

The availability of high resolution optical imagery appears to be interesting for geo-spatial database applications, namely for the capturing and maintenance of geodata. Recent works show that the geometry of QuickBird or Ikonos imagery are accurate enough for mapping purpose up to scale of 1:5000 (Büyüksalih and Jacobsen, 2005). High resolution satellite imagery data has a lot of advantages and they can be used for updating the available maps. This can be applied specifically to follow the road networks and verify them in the topographing database.

Nowadays, one of the application area GE and Virtual Earth for of high resolution imagery. Everyone can visualize current study sites (and select future ones) on GE (URL-1, 2008), increasingly with a spatial resolution that shows individual objects. The enormous success of GE in integrating 2D satellite imagery into online mapping has demonstrated a massive impact of remote sensing on online mapping and brought remote sensing applications into our daily life. End users can see earth images online in a variety of scales, from the overview of a region to individual houses, trees and even cars (Scot att all, 2008)

Currently, new technologies are quickly developed to integrate the available earth images and DEM data for online mapping. The enormous success of GE in integrating 2D satellite imagery into online mapping has demonstrated a massive impact of remote sensing on online mapping and brought remote sensing applications into our daily life. End users can see earth images online in a variety of scales, from the overview of a region to individual houses, trees and even cars. Recently, Microsoft's Virtual Earth has unveiled a new online mapping system with 3D capacity. GE has also started the campaign to extend its 2D image mapping with 3D features. However, the 3D generation technologies involved require manual extraction of 3D models of selected 3D objects (such as buildings and large constructions) and collection and paste of ground images onto the 3D models. Such a 3D process is costly, time consuming, difficult to update, and not practical for generating 3D images of small objects (such as trees and family houses). It is also difficult for the application to environmental monitoring of the earth's surface. (Zhang att all, 2007 ; Zhang, 2002)

In this study, Zonguldak city which is located in North-West part of Turkey is selected as the test field. The high resolution (1m) images of American IKONOS satellite are used as pads. Besides, 1:1000 scale digital topographic maps are used for the extraction of details like the roads and buildings with cartography and to provide the currency of the satellite images. The data which are acquired from satellite images and cartography have been integrated in each other in GIS. In GE, the information from high resolution satellite images and cartography do not exist for Zonguldak region that's why the results obtained from this study have been

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planned for the integration to the GE in Zonguldak city. At the end of the study, the results are the high resolution satellite images and cartographic data which are in GIS environment and they are harmonious with GE.

2. STUDY AREA

2.1. General Description of the Study Area Zonguldak

The Study area Zonguldak City is located in north-west part of Turkey. The City is famous with being one of the main coal mining areas in the world. Although losing economical interest, there are several coal mines still active in Zonguldak. Figure 2-1. shows the study area's location on the world map.

Figure 2-1: Location of the study area

2.2. Characteristic of Study Area

Zonguldak has very rough and mountainous topography that's why terrain inclination has a big influence on the accuracy of the results. Figure 2-2. shows the Ikonos space image of study area. At the upper side of the image, in the white circle, the city centre and harbour can be seen. The mountainous topography is obvious and the narrows show the highest terrain.

The mountainous topography is obvious and the narrows show the highest terrain. the elevations reach 1646m and the average terrain inclination is %23. Figure 2-3. shows the three dimension colour representation of the study area and the frequency distribution of terrain inclination can be seen in Figure 2-4.

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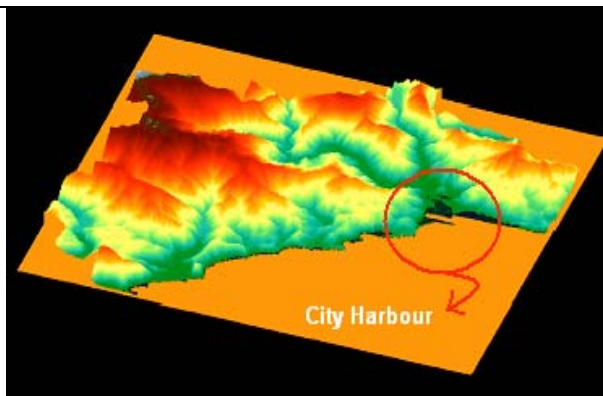Fig. 2-2: Ikonos image of Zonguldak testfield.

Figure 2-3: 3D colour version of Test Field
Red: Highest terrain
Green: Sea level
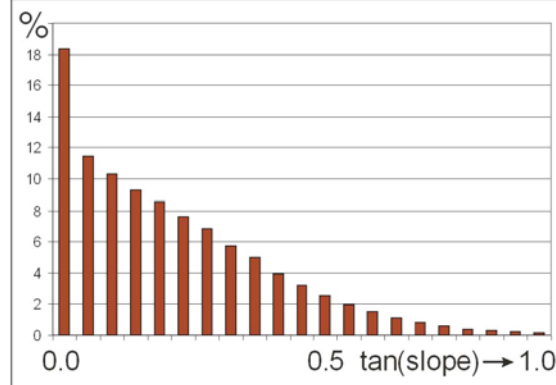

Figure 2-4: Frequency distribution of terrain inclination (Sefercik and Jacobsen, 2006)

3. STRATEGY and APPLICATION

3.1 Used Data Sets

3.1.1 High Resolution Satellite Image (IKONOS)

In the Study, the data which are acquired from satellite images and cartography have been integrated to GE. On the first step; the high resolution (1m) image of American IKONOS satellite which covers the study area is used. Figure 3-1. shows the high resolution Ikonos image of the study area.

Figure 3-1: High resolution Ikonos image of the study area

Although Ikonos imagery has been commercially available since early 2000, the use of this imagery and especially the scientific investigations on its potential use in various applications have been restricted due to various reasons, related to the closed policy of Space Imaging (SI). The Ikonos image which is used in this study was taken in October 2002. The general information about Ikonos can be seen in Table 3-1.

Table 3-1: General Information of Ikonos

Ground track revisit time	11 days
Revisit time for imaging	3.2 days at 1m resolution; 1 day at 2m resolution
Altitude	682 km sun-synchronous orbit
	98.1∘
Inclination angle	98 min
	Nadir
Orbit time	11 km
View angle	
Swath width	

3.1.2 1/1000 Scale Topographic Maps

1/1000 scale topographic maps have been used in the study to complete the needed database for GE. These maps have been acquired in 1997 by fotogrammetry. Figure 3-2. shows the 1/1000 scale topographic maps combination for the study area.
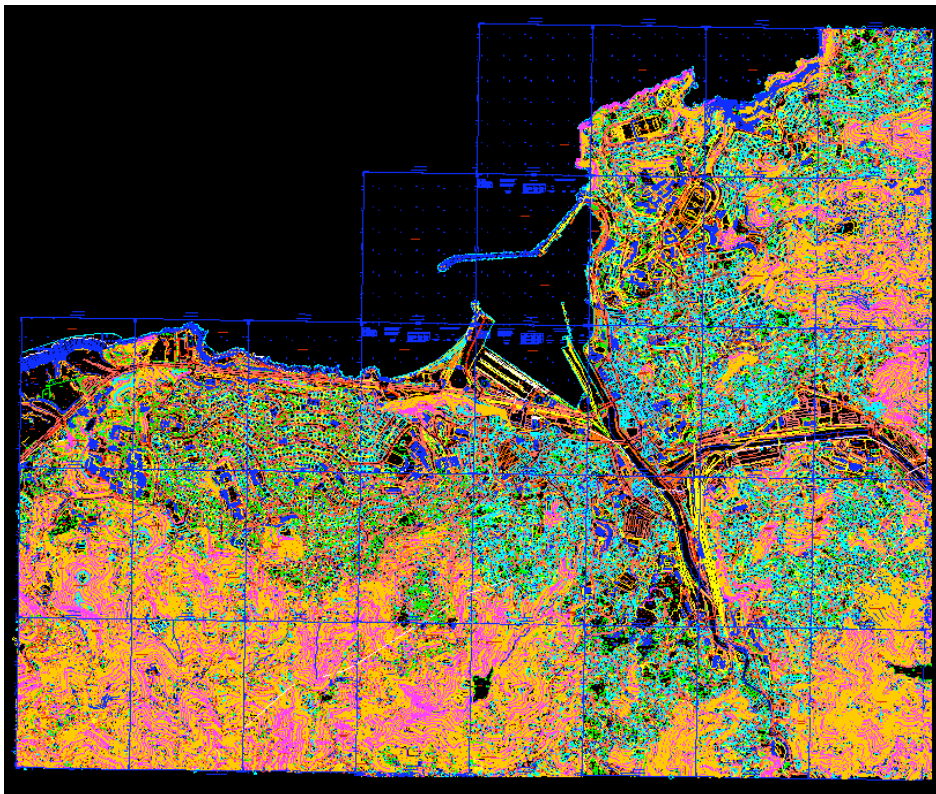

Figure 3-2: 1/1000 scale topographic maps combination for the study area Zonguldak

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3.2. Used Programs

3.2.1. PCI Geomatica V9.1.6

The program PCI Geomatica is used for geometric correction of high resolution satellite image Ikonos with using Ground Control Points (GCPs). After geometric corrections, PCI Geomatica is used for cutting the Ikonos image for superimpose with 1/1000 scale topographic maps coordinate limits.

3.2.2. NetCad 4.02

In program NetCad 4.02, Ikonos image and 1/1000 scale topographic maps are superimpoised, the details have been transferred from topographic maps to Ikonos Raster image and the export file has been transferred to DXF format for using in Program Global Mapper.

3.2.3. Global Mapper V9.00

The program Global Mapper is used for transformation of the vector and raster data to GoolgleEarth format KMZ.

3.3. Application

In the application part of the study, firstly geometric corrections of high resolution Ikonos image has been made and the image is cut from the same frame coordinates with 1/1000 scale topographic maps. The coordinate system of 1/1000 scale topographic maps are ITRF96. Ikonos image has been cut from the limitation coordinates.

The high resolution Ikonos image has been opened in program NetCad 4.02 and the vectorization of the image is made by using the frame coordinates of the image. After the process, superimposition of the raster Ikonos image and 1/1000 scale topographic maps has been made. Figure 3-3 shows the result of superimpose of high resolution Ikonos image and 1/1000 scale topographic maps of the study area.

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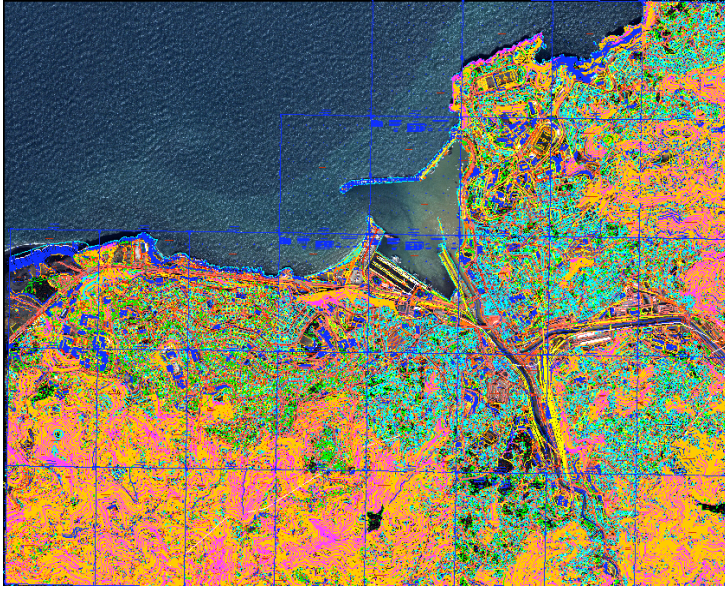FIG Working Week 2008
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Figure 3-3: Superimpose of Ikonos image and 1/1000 scale topographic maps

Figure 3-4 shows the buildings, official buildings, roads, touristic and historical places, accomodations, schools, sport centers and constractions of the study area Zonguldak and the Central Campus of Karaelmas University (Red square) and Figure 3-5 shows the University campus from close range.
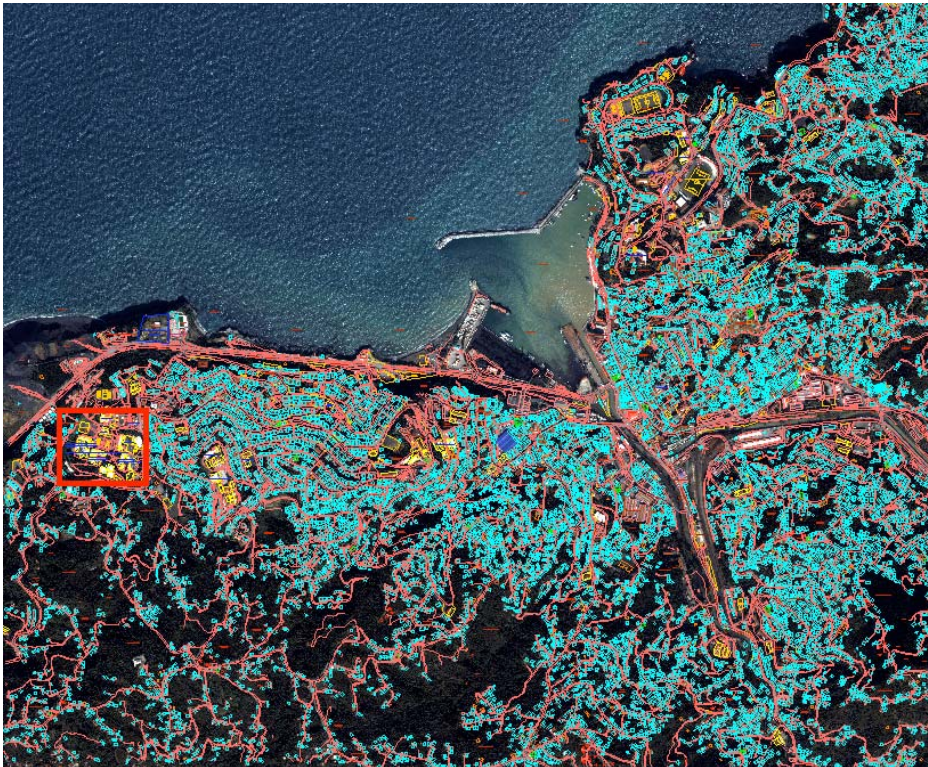
Figure 3-4: The buildings, official buildings, roads, touristic and historical places, accomodations, schools, sport centers and constractions of the study area Zonguldak

Figure 3-5: The Central Campus of University

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After the superimposition process in program NetCad 4.02, the vector and raster data have been transferred to DXF format for using in program Global Mapper. In Global Mapper, the file which has been transffered from NetCad 4.02 is opened in Universal Transverse Mercator(UTM) 36° in World Geodetic System of 1984 (WGS84) datum. The vector data from 1/1000 scale topographic maps and raster data from high resolution Ikonos imagery have been transferred into GE format 'KMZ' with using program Global Mapper. Figure 3-6 shows an image from the transformation process level in Global Mapper.

At the end of the application, the output file in KMZ format has been superimposed to GE and the details which are wanted to see on the GE in the study area Zonguldak (the buildings, official buildings, roads, touristic and historical places, accomodations, schools, sport centers and constractions) have been transferred successfully.
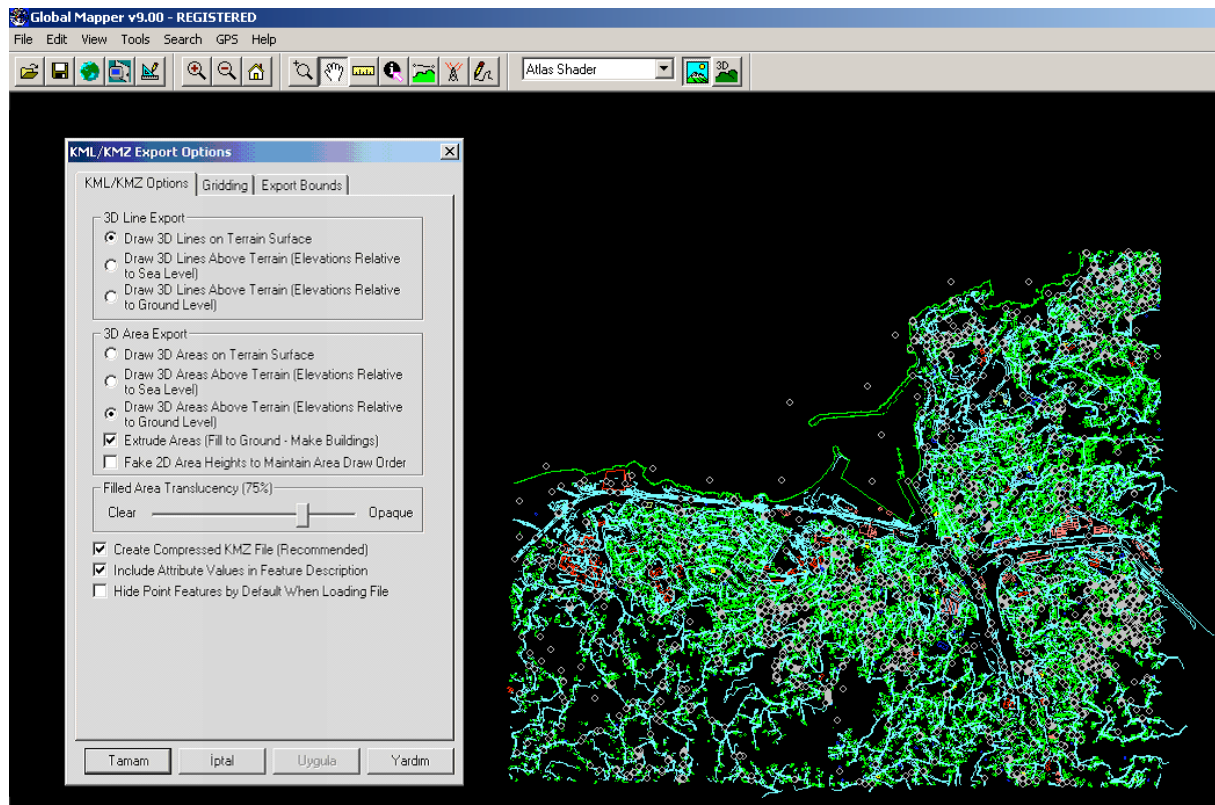

Figure 3-6: The transformation process level in Global Mapper

4. CONCLUSIONS

Nowadays, GE and Virtual Earth technology very important a lot of users. Because, seeing 2D and 3D (some part of the world) of the world, finding address and a lot application is very easy for this technology. The enormous success of GE in integrating 2D satellite imagery into online mapping has demonstrated a massive impact of remote sensing on online mapping and brought remote sensing applications into our daily life.

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In this study, we were determined a requirement analysis for Zonguldak test field. Because there is no high resolution imagery and there is no detail information for Zonguldak in GE platform. After determining, we were georeferenced Ikonos imagery using PCI. Second step is Ikonos image and 1/1000 scale topographic maps are superimposed and change to DXF format. Finally, DXF raster and vector files were changed GE kmz format via using Global Mapper environment.

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