GENERAL COMMAND OF MAPPING
HARİTA GENEL KOMUTANLIĞI
TURKEY

NATIONAL REPORT
(2003-2007)

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NATONAL REPORT
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INTRODUCTION

This report, describing cartographic activities of Harita Genel Komutanlığı (General Command of Mapping) (Turkey) carried out during the 2003-2007 period are briefed under the following headings ;

> *a.   Production Activities,*
> *b.   Research Projects,*
> *c.   Relations with other organizations.*

1. PRODUCTION ACTIVITIES ;

According to her law of foundation, Harita Genel Komutanlığı (HGK) is responsible for the production of maps needed for defence and development purposes. Therefore, the production of base scale maps at 1/25.000 and other topographic maps at 1/50.000 and 1/100.000 scale which are generalized by base scale maps, 1/250.000 scale JOG series maps, 1404 series 1:500.000 scale maps as well as 1301 series 1/1 000 000 maps covering Turkey are under the responsİbility of HGK.

Beside these products, HGK is also carrying the production of small scale thematic maps and plastic relief maps. This section is dealing with these production activities.

a. 1/25.000 scale Digital Topographic Map Production : Base scale of Turkey's topographic maps is 1/25.000 and the country is covered with about 5550 sheets. The production of all sheets with conventional method is completed. From the end of 1999, more than 3215 sheets (≈ %60 of total), are produced digitally.

1/25.000 scale digital topographic map production is carried out with Arc/Info (workstation) software. Data is collected in vector format under 9 classes. These classes are shown in Table-1. At the end of the production, two products are obtained, one is vector and the other is a raster product. The vector product is called "1/25.000 scale Cartographic Vector Map" while the raster product is called "1/25.000 scale Cartographic Digital Map". Figure-1 shows different views of 1/25.000 Cartographic Vector Map.

Until the end of 2002 the production was carried out by heads-up digitizing of photogrammetric revision plates. At the beginning of 2003 the system is converted to digital data exchange between Photogrammetry and Cartography departments. Within the frame of this development "Feature Describing and Symbology Specification" is prepared and published in 2002, "Data Dictionary" and "Specification for Annotations" is prepared and published in 2003, "Production Specification" is published in 2006.

Table-1 : Data Classes of 1/25.000 scale Cartographic Vector Map

| No	Abbreviation	Data Class
1	Bnd	Boundaries
2	Ele	Elevation
3	Hyd	Hydrography
4	Tra	Transportation
5	Phy	Physiography
6	Uti	Utilities
7	Pop	Population
8	Veg	Vegetation
9	Ind	Industry

From the beginning of 2003, the production with UTM projection is carried out using WGS-84 ellipsoid instead of International-1909 and a digital seamless library is designed as a new archive. For this purpose, all sheets are undertaken to a quality inspection, transformed to geographic coordinate system in WGS-84 datum and added to the library. Sheets added to the library are also used for generalization purposes.
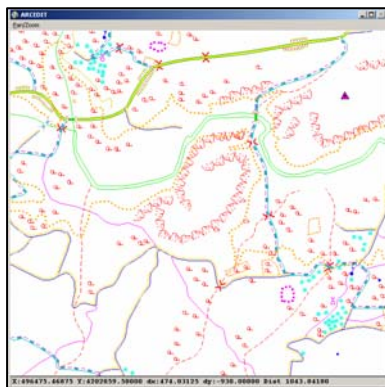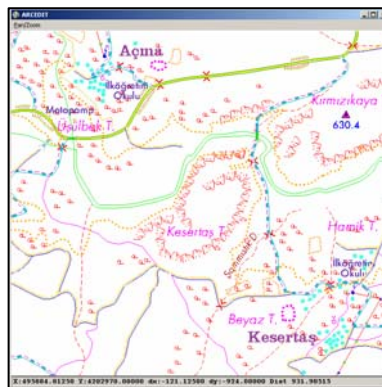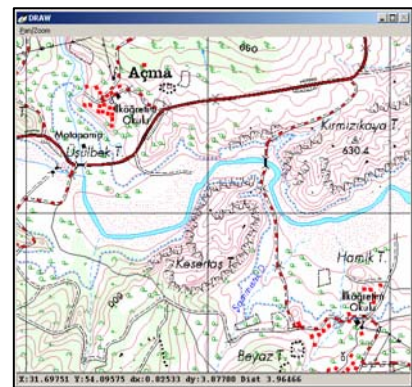
(a)   (b)   (c)

Figure-1 : Different views from 1/25.000 Cartographic Vector Map
(a) Vector data (b) Vector data and annotations (c) Vector Map

Since the end of 2006, works are carried out in order to upgrade this production system to ArcGIS platform.The production status at this scale can be seen in figure-2.
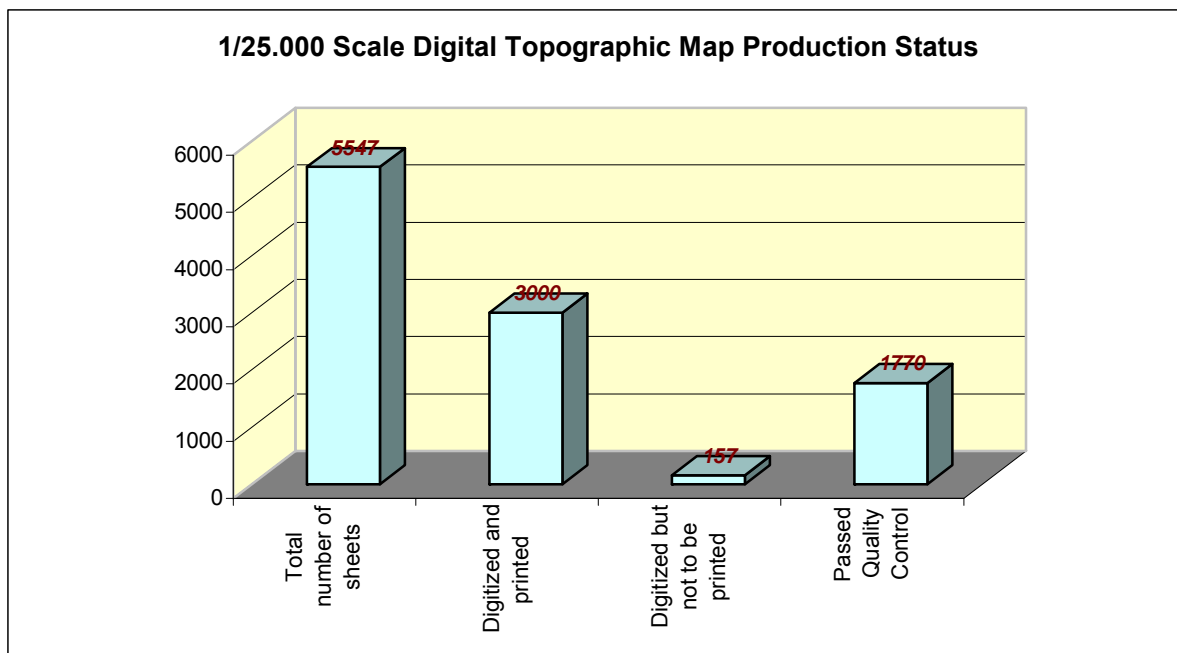
1/25.000 Scale Digital Topographic Map Production Status

Figure-2 : Current status of 1/25.000 Scale Digital Topographic Map Production

b. 1/50.000 and 1/100.000 scale Topographic Map Production by Automated Generalization :

Conventional cartographic production at these scales are stopped by the end of year 2000. A new project called "Computer Assisted Generalization Project" was started in 2002.

Data produced and added to library at 1/25.000 scale is used for this project. The objective of this project was to design 1/100.000 and 1/50.000 scale digital topographic map production system. By the end of 2005, 1/100.000 scale map production system, and by the end of 2006 1/50.000 scale map production system have been realized. According to statistics, 75 % of cartographic processes are carried out automatically and the rest are made interactively. On the other hand, time spent for production decreased to 50 %.

In order to realize this project, short term aims put forward were;

- Obtaining, defining and arranging the needed generalization rules,
- Defining and arranging the feature's importance and priority list,
- Defining the generalization parameters,
- Obtaining the needed generalization algorithms,
- Investigating the present algorithms and their applicability to our needs, and modify and/or improve them or develop a new one, if needed.
- Defining the processes and their orders, and
- Defining the production lines,

As mentioned above, project group has created a semi-automatic production line by developing intelligent and sophisticated generalization tools using ArcGIS and its customization environment (ArcObjects, Visual Basic and C++ Programming languages).
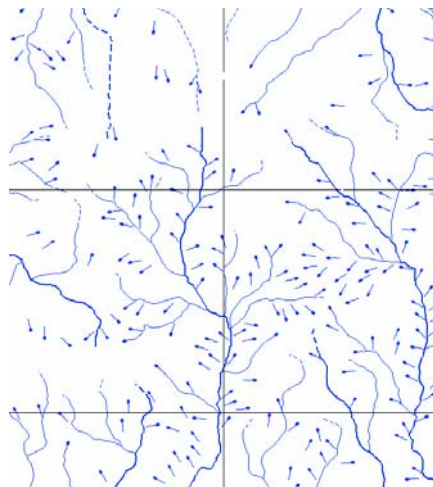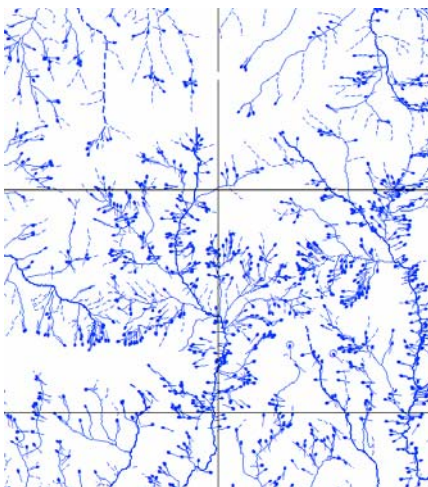
For different data classes, generalization samples for 1/100.000 scale maps production are given in figure-3
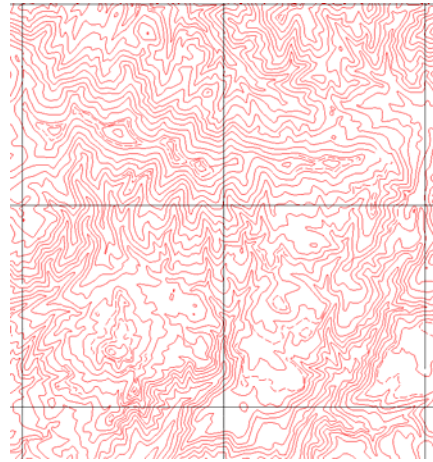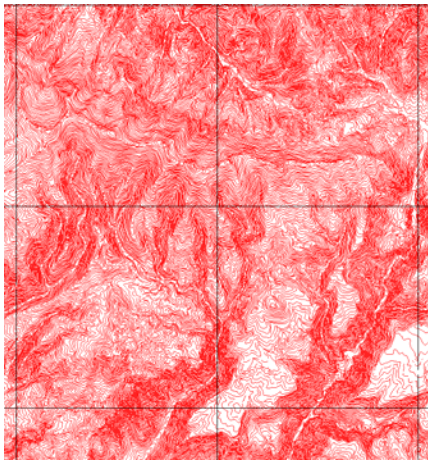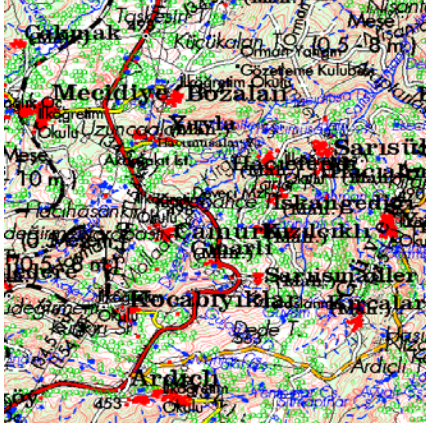

(a)
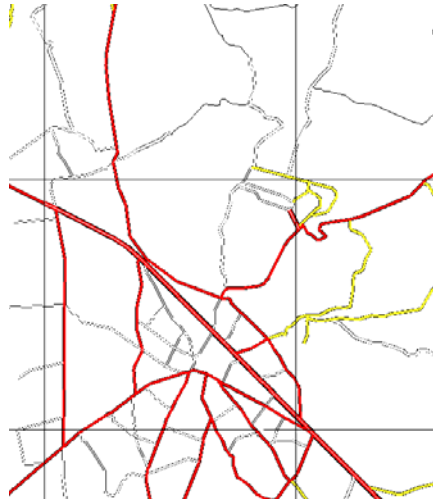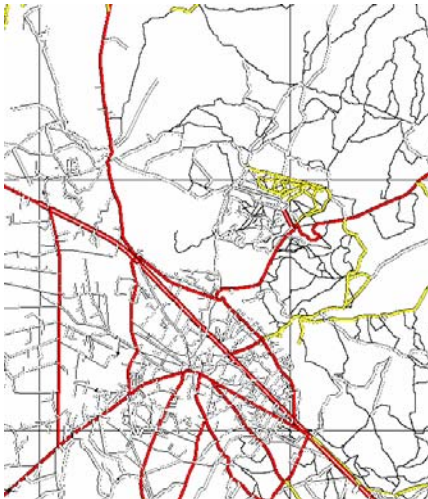
(b)

(c)

(d)

Figure-3 : Samples of different data classes before and after generalization process
(a) Elevation (b) Transportation (c) Hydrography (d) All data classes

c. JOG Series Map Production :

Since 2002, JOG series maps are produced digitally by HGK and data used for this production is VMAP Level-1 data. VMAP Level-1 database is generated by collecting data from scanned JOG sheets, rasterized topographic maps, remotely sensed images, contour lines in digital format and sources from other databases. Geometric data is generally extracted from satellite images. Thematic information is collected from JOGs and large scale topographic maps. And, aeronautical information and other documents are taken from DAFIF, DVOF and General Directorate of State Airport Authority and Turkish Air Forces respectively.

Digital JOG production work-flow from VMAP Level-1 database is given in Figure-4. Firstly, data with extent of a sheet are cut and extracted from VMAP Level-1 data library. Errors due to cut are corrected and data is transformed into UTM projection from geographic coordinates. Descriptive information of the sheet such as name of the sheet, country, vertical unit, producing company, copyright etc. are defined for a project space for that sheet. Since DLM required by MPS is not equivalent to data model of VMAP Level-1, the database schema of VMAP Level-1 is extended. Data is symbolized due to DCM. Model errors, cases contrary to DCM and incompleteness in database schema are determined and removed to finalize editing on database. In order to improve graphic readability and produce a map according to JOG specifications, VMAP Level-1 data is generalized by using graphic generalization operations such as simplification, exaggeration, replacement, classification, aggregation.

ESRI Arc/Info is originally a GIS software which is weak in color separation and graphic processes. These disabilities in pre-press and pressing with process colors (CMYK) are solved with support of Abode Illustrator software which is designed for graphic processing. Overlapping polygon layers such as shaded relief, elevation tints and vegetation hide the layers underneath within abilities of Arc/Info. However, Illustrator enabled to compile those three layers without loss and hiding. After transforming labels coded in ASCII into Turkish, the base map is formed.

Control of data editing process is done by taking print-outs of layer which are closely related to each other. Consistency of all thematic layers is maintained by

providing consistency of relief-hydrography, population-hydrography-vegetation and transportation-hydrography-physiographic. Datum transformation information between ED50 and WGS84 and magnetic declination at epoch 2000 is taken from Geodesy Department.

Surrounding information is generated after graphic operations. These are descriptive information about sheet, symbol legend, aeronautical symbol legend, location diagram, conversion table for units, referencing information about military grid, bar scale, diagram for horizontal and vertical reliability, colors of elevation tints, glossary, caution and disclaimer notes, georef index, copyright and producer notes. Graphic and surrounding graphics are compiled to generate Postscript graphic file for reproduction. As pressing system of HGK is based on process colors (4 colors-CMYK), the postscript graphic file is color separated into 4 process colors and plotted on films by using Dolev 800 laser film plotter. The films are developed automatically and plotted on plates for reproduction in 4 color Heidelberg printing system.

PLTS/MPS (Production Line Tool Set/Map Production System) software, is used for re-arrangement of VMAP L-1 data, cartographic mapping of the information in the database and direct color separation of graphic files in the JOG production. The steps shown in flow chart are managed by MPS. MPS software is prepared by ESRI for NIMA (National Imagery & Mapping Agency) for immediate production of JOGs. That's why; the software produces a JOG like product. But the program is open for countries for editing in order to produce JOGs in their standards. In HGK the bugs are corrected and the new modules are appended by JOG production team for standard Turkish JOGs. By the end of 2006, almost 48 sheets of 71 covering Turkey are produced.
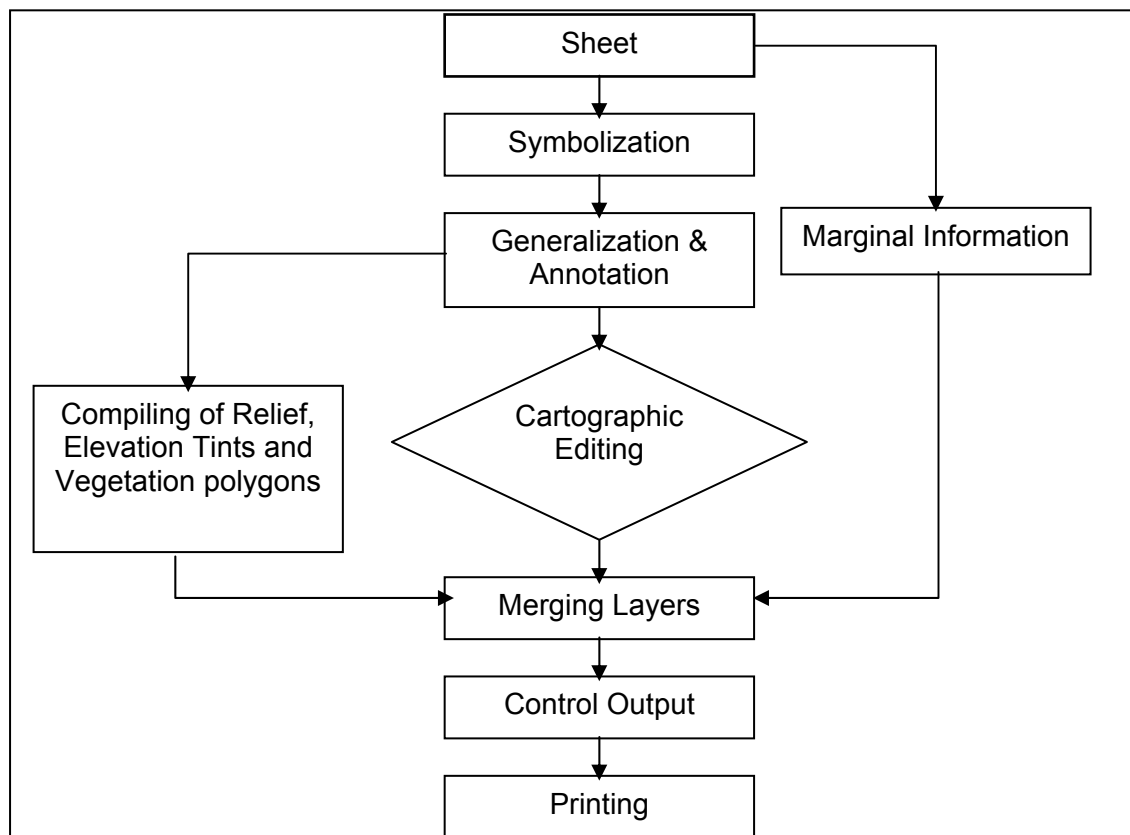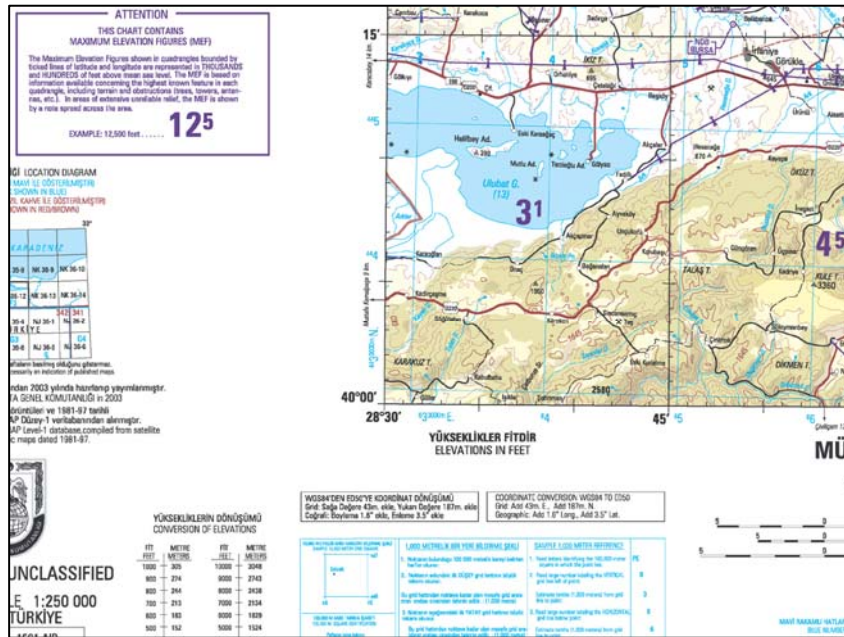

Figure-4 : Flow chart of JOG Series Map Production

(a)

(b)

(c)

Figure-5 : JOG Series Map ;
(a)Vector Data (b) Shade layer (c) Vector Map

d. Thematic Map Production:

Thematic map productions in HGK are going on in various scales. Samples of the thematic maps produced in this period (2003-2007) are as follows;

- 1/1.000.000 scale Physical Map of Turkey (three sheets),
- 1/1.800.000 scale Physical Map of Turkey (single sheet),
- 1/1.000.000 scale Administrative Units of Turkey (three sheets)
- 1/1 800.000 scale Administrative Units of Turkey (single sheet)
- 1/1.000.000 scale Plastic Relief Map of Turkey (three sheets)
- 1/1.000 000 scale Plastic Relief Map of Turkey (single sheet)
- 1/3 500 000 scale Turkey and surroundings (political and physical) (4 sheets),
- 1/4.250.000 scale Turkey and suroundings Plastic Relief Map (4 sheets)
- 1/1.000.000 Turkey and surroundings PlasticRelief Map (16 sheets)
- 1/3.000.000 Turkey and surroundings PlasticRelief Map (4 sheets)
- 1/30 Million, World Political
- 1/30 Million World Physical

Figure-6 "Turkey and Surroundings Plastic Relief Map" at scale 1/1.000.000
(With a total size of 354 x 218 cm. and consisting of 16 sheets.)

e. Gazetteer Production :

In 2005, a concise gazetteer was produced consisting some 3500 names of geographical features extracted from Physical Map of Turkey at scale 1/1 million by HGK.

First version of Mid-scale Gazetteer at scale 1:250.000 (Gazetteer-250-v1) containing features rendered on Joint Operations Graphic (JOG) maps at scale 1/250.000 was accomplished in-between 1997–1998 consisting of almost 45.000 names. This first version of gazetteer (Gazetteer-250-v1) is produced according to standards put forward by NATO STANAG 2213. Integrating Populated Places Database of Turkey (PPDB-Y) and Gazetteer-250-v1, the second version (Gazetteer-250-v2) is created by means of extracting natural features and populated places from Gazetteer-250-v1 and PPDB respectively in July 2006. This gazetteer comprises 52.500 geographical names.The Gazetteer is being continuously updated by using produced JOGs which covers more than two thirds of Turkey.

2. RESEARCH PROJECTS :

a. Determination of Map Accuracy :

A project was initiated at the beginning of 2006 to determine geometric accuracy values of some products which include 1/25.000 and 1/250.000 scaled topographic maps and DTED data. In the project it was aimed to determine closeness of positional information (coordinates) in the dataset to the true position. To test positional accuracy of the data, basically two different source of higher accuracy data is used: geodetic measurement or larger scale maps.

For the accuracy calculation of 1/25.000 scale maps Global Positioning System (GPS) measurement is used. In the test area, about 330 features (fountain, electrical transformer, road junction,electrical line break point, water depot, wall etc.) were selected and measured with GPS during July-August 2006 and their coordinates were obtained from digital map. Two examples of the selected features are given in figure-7. Accuracy analysis of the differences between GPS and map coordinates give as an average 12.3 m horizontal and 5.3 m vertical accuracy values at 90 % confidence level for 1/25.000 scale maps.

Figure-7: Two examples of the selected features in the 1/25.000 scale maps.

For the accuracy calculation of 1/250.000 scale maps, 1/25.000 scale maps are used as source of higher accuracy data. In two 1/250.000 scale maps, coordinates of 120 selected features were obtained from two different scale maps. Pictures of a common feature in two maps is given in figure-8. Statistical analsis of the differences between two data sets result in 95 m horizontal and 52 m vertical accuracy values at 90 % confidence level for 1/250.000 scale maps.
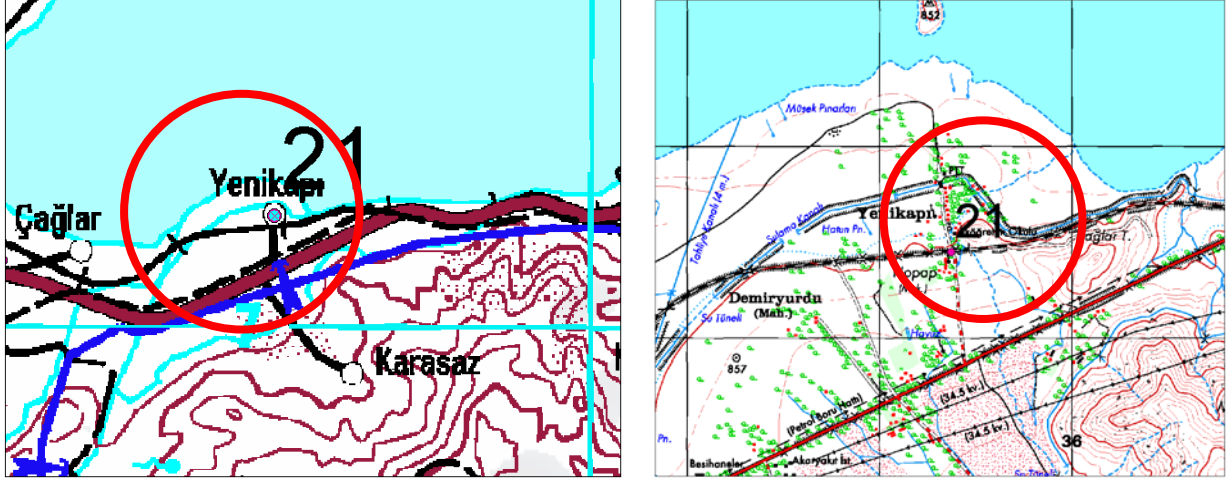

Figure -8: An example of common features selected in both 1/250.000 ve 1/25.000 scale maps (road intersection).

To investigate the DTED2 vertical accuracy, 15 test area cells of 1° x 1° shown in figure-9 were selected. In each cell, available geodetic and photogrametric points whose 3-D coordinates are known with accuracy better than 30 cm are arranged. Height values of those points were predicted from DTED2 data using linear interpolation method. The differences between existing and predicted coordinates are analysed and vertical accuracy value of each cell is calculated. Mean value of the vertical accuracies is found to be 8.8 m.
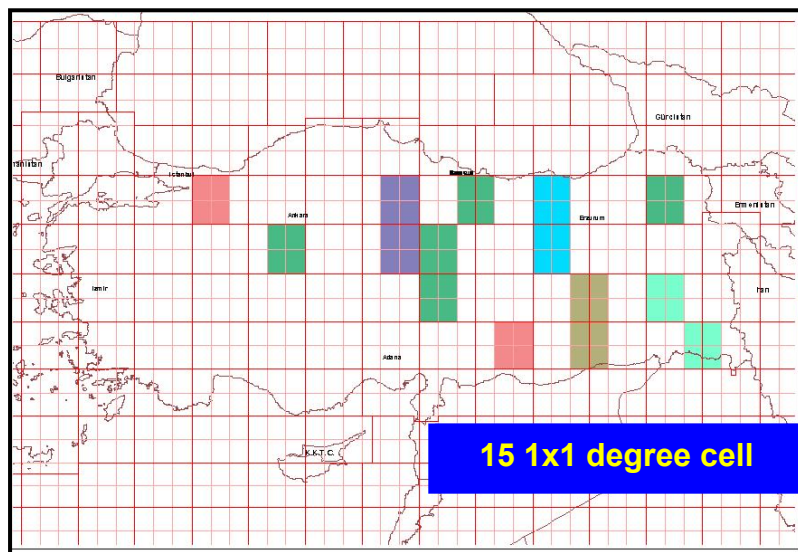

Figure -9: 15 cells selected for test area

Consequently, it can be said that accuracy values of 1/25.000 and 1/250.000 scale maps and DTED2 data satisfy high level of accuracy standart. The project suggest that accuracy computation for 1/25.000 and 1/250.000 maps should be done regulary parallel to the production.

b. 1/500.000 scale Map Production :

HGK is responsible to publish topographic map series at scale 1/500.000 and 1/1.000.000 namely World Series 1404 and 1301 respectively. As geographic coverage Turkish territory is mostly covered by JOG sheets and data as well. Currently HGK is going to be able to produce small scale topographic maps and air charts at scale 1/250.000 and smaller. This has been depicted in 'a project order' which is under evaluation of relevant people and sections. This project covers constructing production lines for creating digital landscape models at smaller scales in addition to cartographic visualization in both topographic maps and aeronautical charts.

3. RELATIONS WİTH OTHER ORGANIZATIONS :

b. Relation with national bodies :

Turkish Board of Experts on Geographical Names has been founded in 2004. This board is subordinated to the Ministry of Interior General Directorate of Provinces. HGK is also a member of this group. The board is working on standardization of geographical names and also is responsible to represent Turkey in UN Geographic Names Conference and UN Geographic Names Divisions.

c. Relation with international bodies :

(1). EuroGlobalMap Project :

This is a project run by EuroGeographics and HGK is an active member of this organization. Project is coordinated by Finland and nine countries are taken part in it. Turkey had a role of East Southern Region coordinator.

EuroGlobalMap data consists of six themes these are;

- Administrative
- Hydrography
- Transportation,
- Urban Areas
- Elevation,
- Named ares.

Turkey has sent her first data in 2003 to Finland. But due to political reasons, data has been withdrawn from dataset. Different views of Turkish data are in Figure –10 and 11

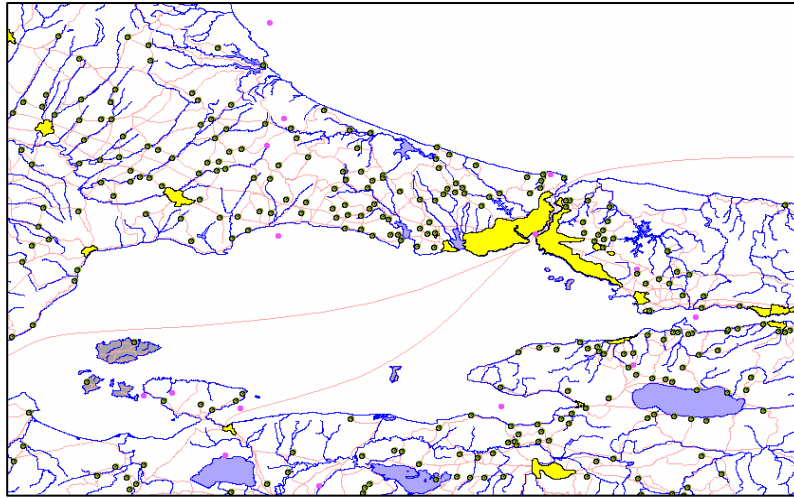Figure-10 : Administrative data of EGM-TR data

Figure-11 : All layers of EGM-TR data over İstanbul and surroundings.

(2) EuroGeoNames Project

This project - EuroGeoNames – has been designed and proposed to Eurogeographics by German-Dutch cooperation. This project addresses critical issues to the implementation of an operational European Spatial Data Infrastructure at European level. EuroGeoNames project is in line with the goals and aspirations of INSPIRE and resolutions of UNGEGN. Turkey is a contributing participant of the project as Reference Group member.