GENERAL COMMAND OF MAPPING

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TURKEY

NATIONAL REPORT

(2007-2011)

15th General Assembly
International Cartographic Conference
Paris – FRANCE, 03-08 July 2011

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INTRODUCTION

This report, describing cartographic activities of General Command of Mapping (GCM) (Turkey) carried out during the 2007-2011 period are briefed under the following headings;

1. Production Activities,
2. Research Projects,
3. Relations with other organizations.

1. PRODUCTION ACTIVITIES

According to her law of foundation, GCM is responsible for the production of maps needed for defense 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 from base scale maps, 1/250.000 scale Joint Operations Graphics (JOG) series maps and Low Flying Charts (LFC), 1404 series 1/500.000 scale maps as well as 1301 series 1/1.000.000 maps covering Turkey are under the responsibility of GCM.

Beside these products, GCM 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 Topographic Map Production

Base scale of Turkey's topographic maps is 1/25.000 and the country is covered with about 5547 sheets. The production of all sheets with conventional method is completed. From the end of 1999, more than 4050 sheets (≈ %73 of total), are produced digitally.

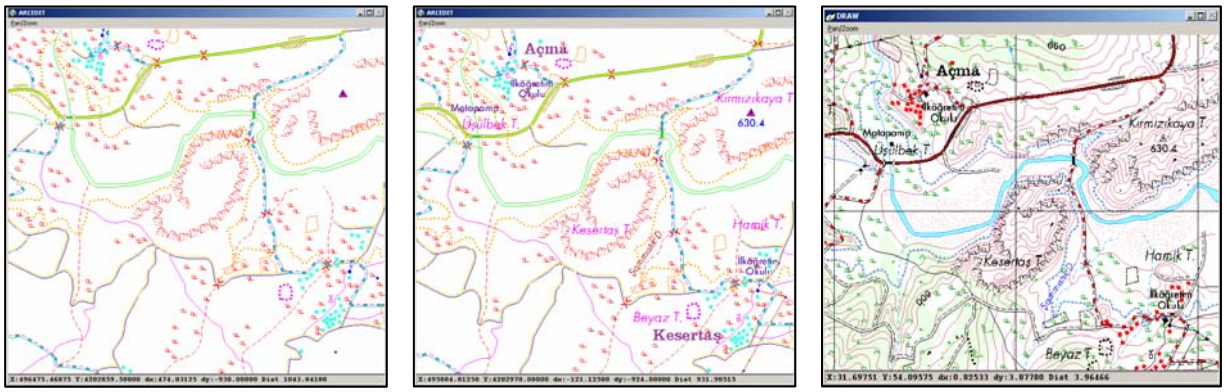
1/25.000 scale digital topographic map production is carried out with Arc/Info (workstation) software. Data is collected in vector format under 9 classes. These classes are shown in Table-1. At the end of the production, two products are obtained, one is vector and the other is a raster product. The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

No	Abbreviation	Themes
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 base scaled maps have been produced with WGS-84 ellipsoid instead of International-1909 and a digital seamless library have been used for archiving these maps in UTM projection system after a quality control process performed. Maps added to this 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 2010, 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.

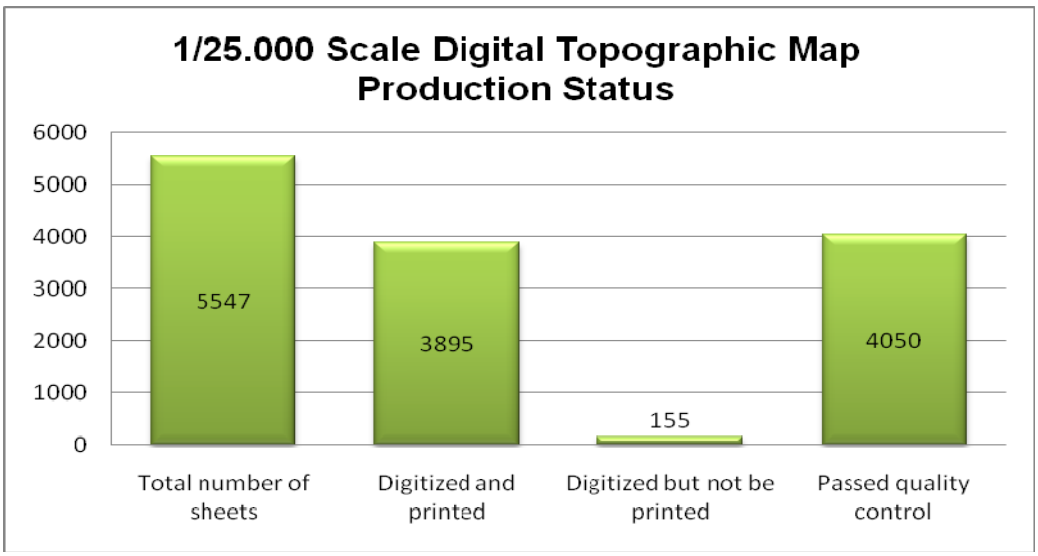


Figure-2: Current Status of 1/25.000 Scaled Digital Topographic Map Production

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

Conventional cartographic productions 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 %.

To accomplish this project, following aims were realized.

- 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 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). With this production line, which is still improved by the project group, more than 602 1/50.000 and 165 1/100.000 scaled maps have been produced up to now (Figure-3).

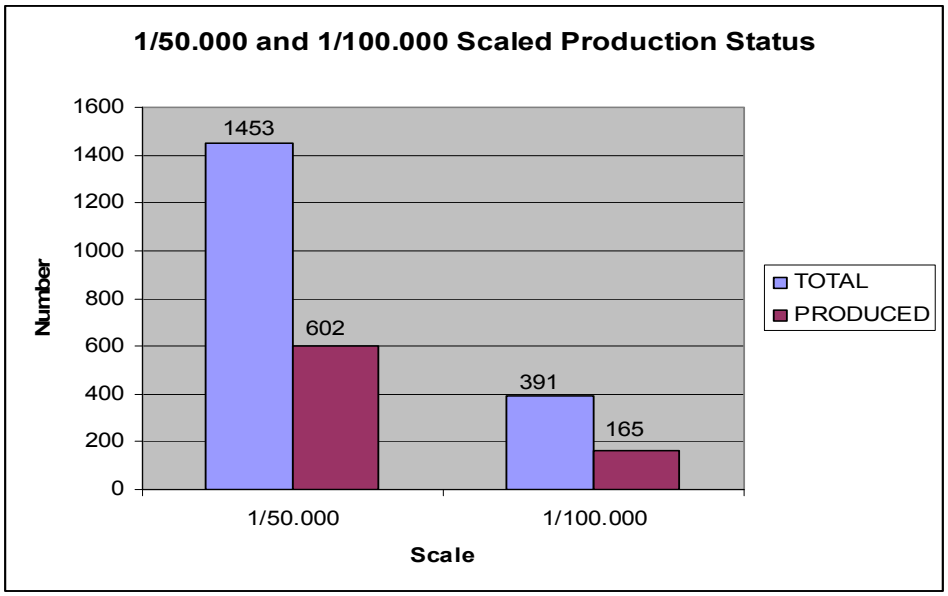
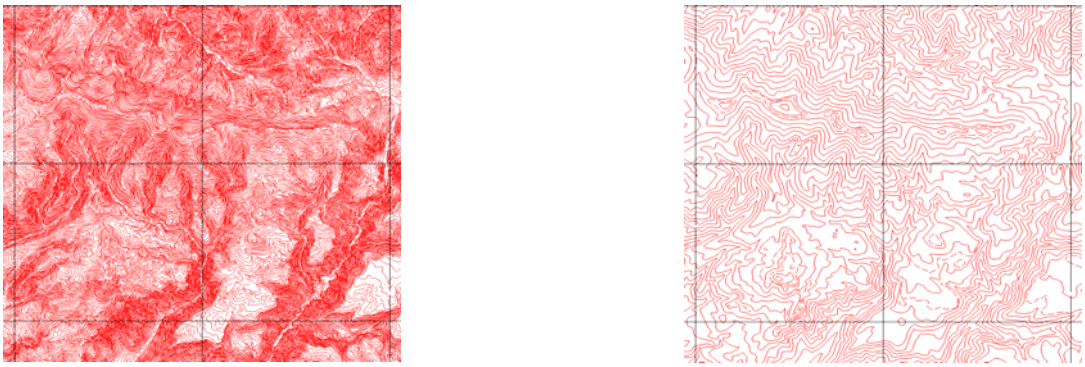
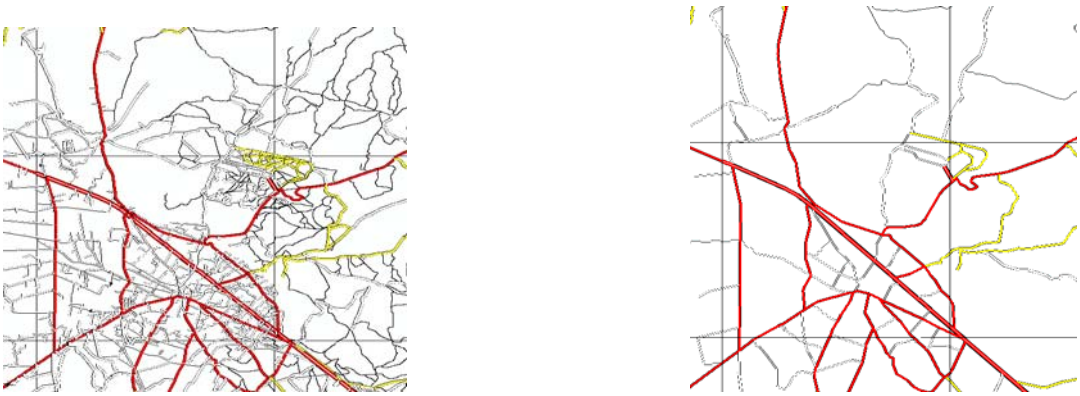


Figure-3: Current Status of 1/50.000 and 1/100.000 Scaled Digital Topographic Map Production

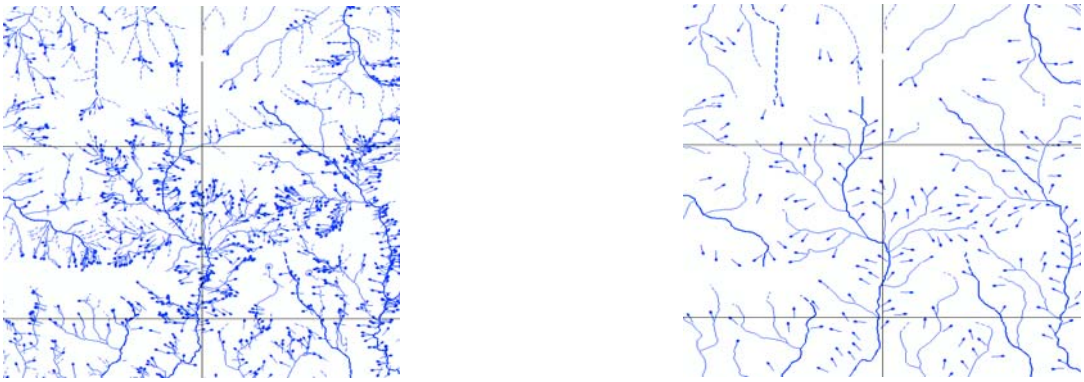
Generalization samples of 1/100.000 scale maps including different feature classes are given in figure-4.



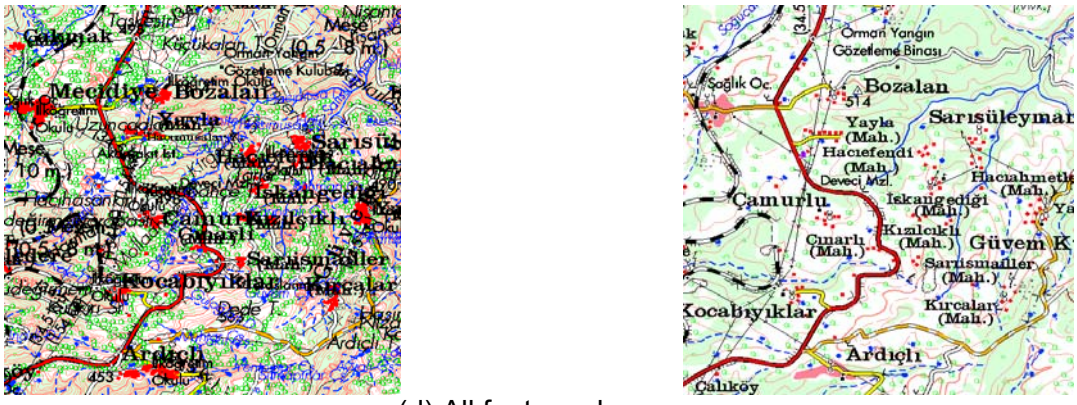
(a) Elevation



(b) Transportation



(c) Hydrography



(d) All feature classes

Figure-4: Samples of Different Feature Classes Before and After Generalization Process

c. JOG Series Map Production

JOG series maps are produced digitally by GCM since 2002. VMAP Level-1 data is used for this production. For the time being, VMAP Level-1 database is generated by collecting data from scanned digital contour lines of 1/100.000 scale digital map data and sources from other databases. Thematic information is collected from JOGs and large scale topographic maps. Aeronautical and other information are taken from AIP, DAFIF, DVOF and General Directorate of State Airport Authority and Turkish Air Forces respectively.

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. Since Digital Landscape Model (DLM) required by Map Production System (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 Digital Cartographic Model (DCM). Model errors, cases contrary to DCM and incompleteness in database schema are determined and removed to final 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 a GIS software and it 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-physiography layers. Datum transformation information between ED50 and WGS84 and magnetic declination at epoch 2010 is taken from GCM Geodesy Department.

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 is 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 GCM the bugs are corrected and the new modules are appended by JOG production team for standard Turkish JOGs. By the end of May 2011, almost 67 sheets of 71 covering Turkey are produced (Figure-6).

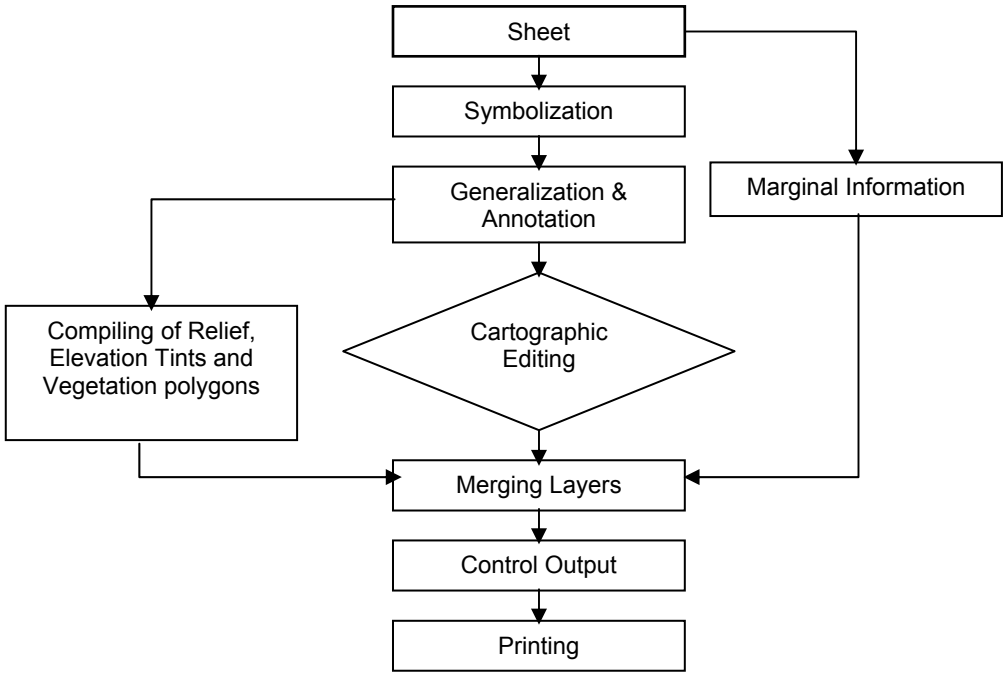


Figure-5: Flow Chart of JOG Series Map Production

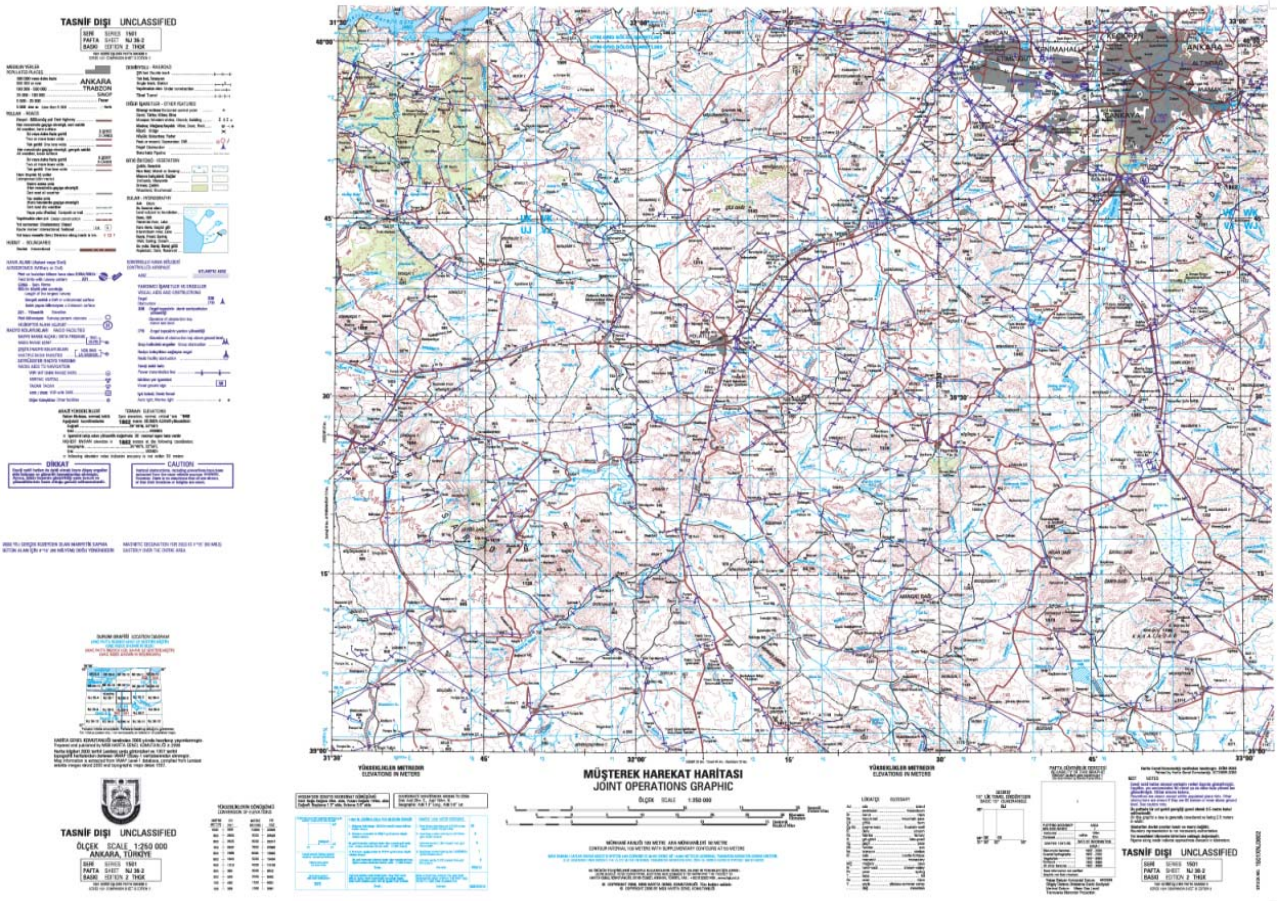


Figure-6: JOG Series Map

d. Low Flying Chart (LFC) Production

Standard JOG-Air series charts do not fit the needs of some users (especially in low flying heights). In 2009 GCM started a new project which is called 1/250.000 scaled Low Flying Chart Production Project to meet user's requirements. In the first step GCM arranged some meetings to learn much more about the user requirements. Then the project continued with a pilot chart production. Finally production line was established and the products were distributed to the users.

The differences between standard JOG-Air and LFC are as follows;

- LFC has much more vertical obstacles than JOG-Air,
- LFC has aeronautical information (which deriven from Turkish AIPs)
- LFC has heliports,
- The font sizes are different from JOG-Air (user requirements)
- The color representation in LFC is different form JOG-Air both in some feature types and in heights.

A sample of standard JOG-Air chart is given in Figure-7 and a sample of LFC chart is given in Figure-8.

Figure-7: Sample of 1/250.000 scaled JOG-Air Chart

Figure-8: Sample of 1/250.000 scaled TFC Chart

e. 1/500.000 Scale Topographic Map Production

Currently GCM is able to produce small scale topographic maps and air charts at scale 1/250.000. GCM is also responsible to publish topographic map series at scale 1/500.000 and 1/1.000.000 namely World Series 1404 and 1301 respectively. This production covers creating digital landscape models at smaller scales in addition to cartographic visualization in both topographic maps and aeronautical charts.

By the end of May 2011, almost 11 of 19 1/500.000 scaled topographic maps are produced (Figure-9).

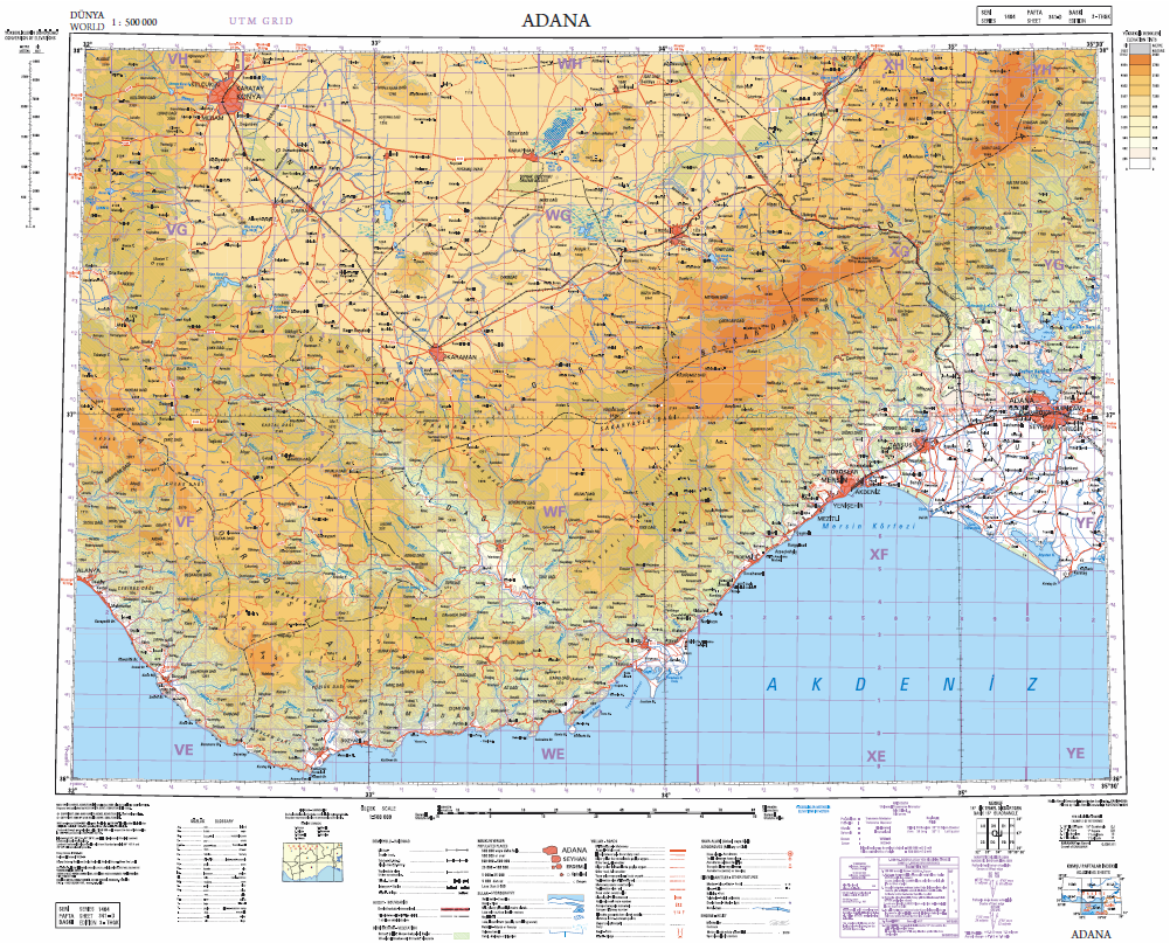


Figure-9: 1/500.000 Scale World Series Map Sample

f. Thematic Map Production

Thematic map productions in GCM are going on in various scales (Figure-10). Samples of the thematic maps produced in this period (2007-2011) are as follows;

- Physical Map of Turkey (in scales 1/1.000.000, 1/1.800.000, 1/3.500.000),
- Administrative Units Map of Turkey (in scales 1/1.000.000, 1/1.800.000),
- Physical and Political Map of the World (in scale 1/30.000.000)
- Physical Plastic Relief Map of the World (in scale 1/24.000.000)
- Political and Physical Map of Turkey and Surroundings (in scales 1/13.000.000, 1/3.500.000)
- Physical Plastic Relief Map of Turkey and Surroundings (in scales 1/1.000.000, 1/3.000.000, 1/4.250.000)
- Physical and Political Map of the Balkans (in scale 1/2.200.000)
- Physical Plastic Relief Map of the Balkans (in scale 1/2.700.000)
- Physical and Political Map of the Caucasus (in scale 1/1.500.000)
- Physical Plastic Relief Map of the Caucasus (in scale 1/2.000.000)

Figure-10: "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.)

g. 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 GCM.

First version of Mid-scale Gazetteer at scale 1:250.000 (Gazetteer-250-v1) containing features rendered on JOG maps at scale 1/250.000 was accomplished in-between 1997-1998 consisting of almost 45.000 names. This Gazetteer-250-v1 is produced according to standards put forward by NATO STANAG 2213.

The second version (Gazetteer-250-v2) is created by means of extracting natural features and populated places from Gazetteer-250-v1 and Integrated Populated Places Database of Turkey (PPDB) respectively in July 2006. This gazetteer comprises of approximately 53.000 geographical names. The Gazetteer is being continuously updated by using produced JOGs which covers more than two thirds of Turkey and released from GCM's web site (www.hgk.msb.gov.tr).

2. RESEARCH PROJECTS

Holographic Map Production System

A new R&D Project was conducted at 2008, to research the applicability of Holography on Cartographic Map Production System. The term "Holographic Cartography", a new field of science and discipline, was proposed for the first time by General Command of Mapping at International Cartography Association Conference (ICC) 2009 in Chile.

The main objectives of this project are listed below:

- To research the applicability of holography on cartographic map production principles and rules.

- To build a Holographic Map Production Laboratory.
- To construct a Holographic Map Production System to manufacture massive amounts of map sheets.
- To develop software that converts, edits and generalizes 2D Topographic Vector Map Data into 3D Digital Holographic Map Data.
- To build a database that serves 3D Digital Holographic Map Data to end-users.

Several prototypes of the Holographic Maps (Figure-11) have been developed and exhibited at some national and international conferences. Due to the project timeline, some new and advanced techniques are planned to be implemented until the end of 2014. Also field tests will be conducted after development of the new prototypes.

Consequently, it can be said that with the capability of depicting 3D data on a 2D material could open a new era for the cartography in the near future. The need for real 3D cartographic digital data is the main handicap of this project. It is essential that to develop complex software to do tasks such as convert, edit and generalize 2D digital data in 3D space. This is the main purpose of this project.

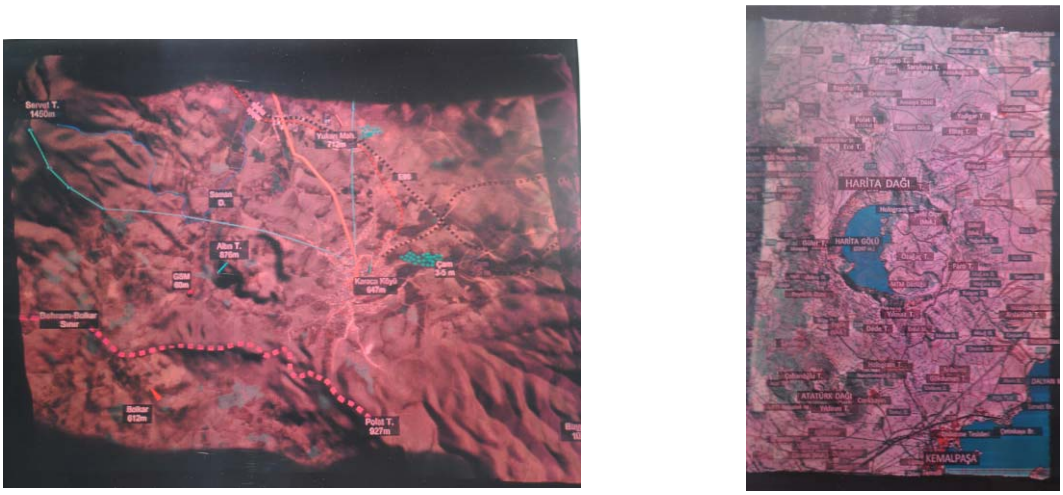


Figure-11: The prototypes of holographic maps

3. RELATIONS WITH OTHER ORGANIZATIONS

To contribute to the national/international cooperation and collaboration, to catch up with the latest technological developments and benefit from international expertise and provide the staff with fast and updated information, GCM having been National Mapping Agency (NMA) for Turkey is eager to work closely with national/international organizations and national mapping agencies.

Geographic activities in NATO have been carried out in accordance with the decisions taken by "NATO Geographic Conference (NGC)" and "NATO Standardization Agency (NSA)". GCM participates in the relevant meetings regularly.

Apart from its active participation in geographic events in NATO, GCM is a member of Turkish Board of Experts on Geographical Names. This board is subordinated to the Ministry of Interior General Directorate of Provinces. The board is working on standardization of geographical names and also is responsible to represent Turkey in UN Geographic Names Conference and United Nations Group of Experts on Geographical Names (UNGEGN).

Besides International Cartographic Association (ICA) and the UNGEGN mentioned above, GCM is also a member of European Spatial Data Research (EUROSDR) and EuroGeographics.