

Adaptation of Turkish Geographical Database at the 1:1 million Scale to European Geographical Database and Publishing on the Internet/Intranet Environment

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Key words: Web Cartography, EGM,

SUMMARY

Since the necessity of the spatial information in human life has been increasing, governments are encouraged to make cooperation with each other in order to form geographical data structure and standardize the collected data. Particularly, joint studies are carried out by various organizations or governments worldwide (as GlobalMapping). The main objective of these projects is to construct a common data structure and present it for the benefit of associated organizations and societies. The distinction between the common data structure constructed within these kinds of projects and commercial spatial data sets is that the common data structure is validated on accuracy, completeness, up-to-dateness and reliability. One of these projects is EuroGlobalMap (EGM) which takes part under the frame of EuroGeographics (EG) and aims to construct 1: 1M (1:1.000.000) scaled European Spatial Data Infrastructure and thereafter present it. Point, line and polygon features built up the basis of the vector data model used in this study are edited properly with respect to EGM standardization, scale and the geography of the study area. Besides, it is investigated that how the attribute information is used in the data base and reflection to the final product. General structure of the database includes scale information, coordinate system and datum information, coding information and explanation of the features and attributes, topological rules and metadata structure. The generated is presented on the internet by using ASP technology on client/server architecture. Dynamic map service is used in order to show the properties of EGM data structure and present them.

ÖZET

Son yıllarda, coğrafi (mekansal) bilgilerin bireylerin yaşamındaki öneminin artışı, devletlerin de bu konuda ortak çalışmalar yapmasına neden olmaktadır. Bu çalışmalar özellikle dünya çapında ya da aynı örgüt içinde yer alan birçok devlet tarafından (GlobalMapping, EuroGlobalMap gibi) ortak çalışmalar ve projeler şeklinde yürütülmektedir. Bu projelerin temel hedefi, ortak bir coğrafi veri altyapısını kurmak ve bunu ilgili devletlerin kurum ve kuruluşları yanında bireylerin de hizmetine sunmaktır. Bu çalışmaların ticari amaçlı coğrafi veri kümelerinden farklılığı, devletlerin ulusal haritacılık kuruluşları tarafından toplanan coğrafi verilerde istenilen özelliklerin (doğruluk, tamlık, güncellik ve güvenilirlik) sağlanabilmesidir. Bu projelerden biri, Avrupa Ulusal Haritacılık Kuruluşları Birliği (EuroGeographics – EG) bünyesinde yer alan ve 1:1.000.000 ölçeğe Avrupa Temel Veri

Altyapısının oluşmasına katkı sağlayan ve sonrasında bunun sunulmasını amaçlayan EuroGlobalMap (EGM)'dir. Bu çalışmada; EGM kapsamında verilerin toplanması, yapılandırılması ve veritabanı yapısı ile Türkiye'nin aynı ölçekteki bu yapıya uyumlandırılması süreci araştırılmıştır. Vektör veri modeli kullanılan bu çalışmada, veri modeli; çalışma ölçeği ve çalışılan alanının coğrafyasına uygun olarak, EGM standartlarına göre düzenlenmiştir. Ayrıca öznitelik bilgilerinin veritabanı içerisinde nasıl kullanıldıkları ve sonuç ürüne yansımaları incelenmiştir. Veritabanı genel yapısı; ölçek bilgilerini, koordinat sistemi ve datum bilgilerini, detay ve öznitelik kodlama bilgilerini ve açıklamalarını, topolojik kurallar ile metaveri yapısını içermektedir. Tüm bu işlemlerden sonra, oluşturulan haritanın internet üzerinden sunumu tasarlanmış ve uygulama istemci/sunucu mimarisinde ASP teknolojisinin kullanımı ile gerçekleştirilmiştir. EGM veri yapısının özelliklerini ortaya koymak ve bu verilerin harita ortamına taşınarak sunumunu gerçekleştirmek amacıyla, dinamik harita sunum yöntemi kullanılmıştır.

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1. INTRODUCTION

Being the art, science and technology of map making and map use and the study of maps in all its aspects, cartography has evolved in response to theoretical developments, technological changes, and changes in society's information needs. Developments in computer, communication technologies and internet access to electronic datasets have changed the trends in cartography by means of moving away from analog methods of mapmaking and toward the creation of increasingly dynamic, interactive maps that can be manipulated digitally (Cartwright W., Peterson M. P., Gartner G.F.,1999). Computer mapping systems have evolved into geographic information systems which are widely used in planning, resource management, and facilities management applications. However, the developments in cartography call into question how to collect digital geographical data, store them in the databases, make standardization and exchange. Besides, necessity of the spatial information in human life has been increasing rapidly, governments are encouraged to make cooperation with each other in order to form geographical data structure and standardize the collected data. Particularly, the main objectives of these joint studies or projects are to construct a common data structure and present it for the benefit of associated organizations and societies. A regional joint project namely EuroGlobalMap (hereinafter referred to as EGM) through out the Europe was started in 2000 under the frame of [EuroGeographics](#), the association of the European National Mapping and Cadastral Agencies, whose data production is coordinated by the National Land Survey (NLS) of Finland. The EGM project is initiated on the background of previously implemented projects MapBSR and GlobalMap in order to create a pan-European digital data base and mechanisms for its maintenance, to create common licensing and pricing policies to this European wide data (Ursin H., Mikkola A., 2005). The aim of the EGM project is to cover all of Europe with harmonized data and to produce digital Europe map comprising themes below for business and private use. Turkey attended the EGM project in 2002.

In this study, we have reviewed the common data structure accepted for the EGM project, and adapted the Turkish National Geographical Database into EGM, and lastly present the data on the internet/intranet by developing a program which consists of basic mapping tools (zoom in/out, full screen, identify), layer management (adding layer, zooming selected sheet, zooming selected city), road analysis (finding the specified road), spatial analysis function (finding shortest path).

2. DATA USED

The current version of EGM data released in 2006 which consists of 23 ESRI Geodatabase format has been used for the application carried out in this study. EGM dataset is a digital, seamless 1:1 million scale database formed by the contributions of many individual European National Mapping Organizations. The dataset can be used for spatial analysis, as a geographic ground for presentation and visualization or as a geographical interface to ground related data in Europe. Currently the EGM database covers 36 European countries. The EGM data set is made up of 6 themes (Administrative Boundaries, Hydrograph, Transportation Networks, Settlements, Elevation, Named Location) including 23 layers in total and this harmonized dataset specifications synchronized with Digital Geographic Information Exchange Standard (DIGEST), Feature and Attribute Coding Catalogue (FACC) and also with ISOTC 221/19126 Geographic Information-Profile-FACC Data Dictionary.

In this study, taking into account the geographical structure of Turkey some of the layers are removed from Hydrograph and Transportation Networks themes (e.g. there is no iceland in Turkey) and all of the layer names and descriptions are translated into Turkish. After removing the dispensable layers there remain 16 layers. The data which was collected in coverage format at the beginning of the project are transformed into ESRI Geodatabase format in ArcCatalog environment which has been accepted for the EGM community recently. Range and coded value attribute domains are created and attributes that are specified in EGM specification are assigned to each domain. Whenever a domain is associated with an attribute field only the values within that domain are valid for the field. In other words the field will not accept a value that is not in that domain.

While the attribute values, topological rules and data structures for the application are similar with the structure of EGM, the datum and coordinate information are completely different. The geographical coordinates in ETRS89 datum are transformed into WGS84 and Lambert Conformal Conic projection is selected for the projected coordinate system. Because this coordinate system is the fastest one tested in “finding shortest path” spatial analysis application carried out in this study by using AspMap technology.

Since AspMap supports ESRI Shape vector format for presenting the interactive map on internet environment, the layers in geodatabase structure are converted into ESRI Shape vector format. Dynamic mapping method which is one of the most popular techniques at the present time used for presenting GIS applications through internet and which provides to produce user demanded maps at any time is applied for presenting the outcome mentioned at the end of the introduction part (Plewe B., 1997).

3. APPLICATION

The components of ArcGIS Desktop 9.1 version (ArcMap, ArcCatalog and ArcToolbox) are used during the process of data visualization and preparation of database (ESRI, 2002). The outcome is presented on the internet by using ASP technology on client/server architecture.

The developed web page that can be accessed by the users and shown in Figure 1 has some parts for making some analysis or assisting to visualize the map. These parts can be entitle as layer management part, map part, map visualization part, legend part, sheet query part, road analysis part and finally finding shortest road part.



Figure 1: Interactive map web page

3.1. Layer Management Part

This part contains five layers (roads, airports, rivers, point and area features of administrative areas layers) ready to be displayed on the map simultaneously when the corresponding box is checked. Selected layer(s) are added by a routine written in Vb Script.

3.2. Map Part

This part includes the scale information displayed bottom-right corner of the map, the selected layers coming from layer management part and the 1:100.000, 1:50.000 and 1:25.000 index layers which appear when the scale gets larger. Scale and index layers will change simultaneously when pressed zoom in or zoom out buttons.

Properties of layer visualization like color, size, scale, etc. are adjusted and changeable size of the names displayed on the map according to the scale and distinctive colors between the administrative areas are also provided with a routine written in Vb Script.

3.3. Map Visualization Part

Map visualization tools perform six functions that help map display in full screen scale, zoom in, zoom out, identify a place clicked on the screen and zoom to a city selected from the city

list box. The identify tool gives information about the 1:25.000 scaled sheets covering the place clicked on which is read from related file and written onto the screen.

3.4. Legend Part

Legend information of the selected layers is provided in this part. Legend information about the administrative area, lakes/dams and administrative boundary are always displayed and they are added automatically when the page is initialized. With this dynamic structure of legend part, only the legend information of selected layers is displayed.

3.5. Sheet Query Part

If anyone happens to select a 1:25.000 scaled sheet names from the listbox under the layer management part, the name selected sheet is displayed zoom to the centre of the screen and some basic information about the sheet (e.g. printing date, revision date etc.) is written on the bottom of the map part.

3.6. Road Analysis Part

Users can query a road by selecting two criteria namely field name (road existence category, location category, intended use of the route etc.) and values of corresponding field names that automatically appears after selecting a field name. For example if anyone selects “road existence category” from the field name, the corresponding values for the selected field names are appears as “under construction, abandoned, operational” etc. The road(s) are displayed according to the two criteria in red color on the map (Figure 2)

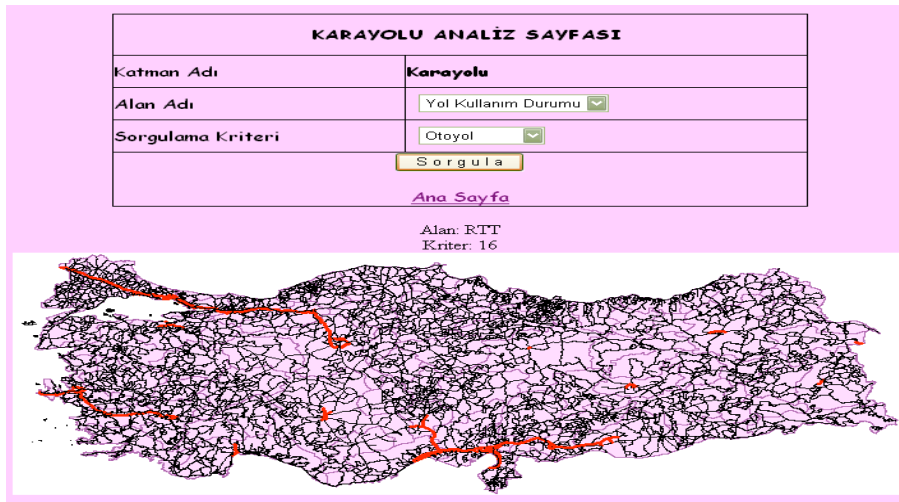


Figure 2: Road Analysis Page

3.7. Finding Shortest Road Part

AspMap creates a topological road network that is a representation of the underlying vector road map. The map must be topologically correct and should be classified by types (e.g. highways, primary roads, secondary roads, etc.). This road network keeps track of what links are connected to which nodes and to other links. To build a road network, the parameters

connected with this network builder must be filled and then building a road network must be executed. Consequently, the file with the same name as the original Shapefile, but with the .rtn extension produced afterwards the execution will be used for finding the shortest route.

The shortest directions between two routing objects can be obtained by selecting a starting and ending point (Figure 3). The detailed maps involved the proper route with the information of distances and times are written to a table at the bottom of the page (Figure 4). The shortest and the quickest paths can be found with AspMap. In this study the shortest path is selected for application. Finding the shortest path in AspMap is done by Dijkstra's Algorithm used commonly in geographical information systems and also in designing the computer networks (Zhan, F. B., and Noon, C. E., 1996). Although it does not work with the negative values, it is known that this algorithm is the fastest one compared to the other algorithms used for solving this problem.



Figure 3: Finding Shortest Road Page

Yol Numarası	Mesafe (Km.)	Detaylı Haritalar Detaylı Haritaları Gizle
N_A D330	0,71	
1: D330	21,7	
2: N_A	0,6	

N_A
Ortalama Süre: 25,6 Dk.
Toplam Mesafe: 37,03 Km.

Figure 4: The detailed maps

4. CONCLUSION AND DISCUSSION

In this study we firstly reviewed the EGM project and adapted the Turkish National Geographical Database. Through the detailed review of EGM, which is one of the joint projects constituted by many National Mapping Agencies through the Europe, we gave some information about the aim and scope, history and the data structure accepted for the project. During the adaptation process of Turkish National Geographical Database into EGM, technical guide and specifications prepared for the EGM database structure was taken into consideration. Some features that are not appropriate for the geography of Turkey were removed from the EGM database which originally consists of 23 layers. After removing the inappropriate features from the database there remained 16 layers suitable for Turkey's geography. Roads, airports, rivers, administrative areas (point and area features) layers were selected for the application study of dynamic mapping. Application study was enriched by adding geographical queries, analysis and 1:25.000, 1:50.000, 1:100.000 scaled index layers. Although the much effort was spent for the road presentation, query and analysis, the developed infrastructure can serve for the use of other layers with respect to users needs. ASP technology developed by Microsoft was used for the presentation of application on internet/intranet. Dynamic mapping was performed by using ESRI shapefile formatted data in the geographic database on the center.

The most important advantage of this internet-based application is that there is a central administration on the data but they are open to everyone and can be accessible easily from everywhere by using only an explorer without any other software unlimitedly and unrestrictedly.

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BIOGRAPHICAL NOTES

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