CARTOGRAPHY IN HUNGARY 2007-2011

Prepared by the
Hungarian National Committee (HNC) of ICA

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CONTENTS

1. National (government) topographic and cadastral mapping in Hungary

The beginning of topographic mapping goes back to the fourteenth – fifteenth centuries in Hungary although the oldest map in existence (Lazar-map) was produced in 1528. The first detailed topographic mapping was ordered by Maria Theresa in the 18th century. Until the 20th century maps were produced by military surveying and after the Second World War topographic mapping was divided into two branches: civilian and military mapping.
Maps of large scales (equal to or larger than 1:10 000) fall under the responsibility of the Ministry of Rural Development (MRD) (its supervisory at this Ministry is the Department of Land Administration (DLA).
Topographic mapping at scales smaller than 1:10 000 up to 1:250 000, as well as production of maps for defence requirements including those for NATO are controlled by the Ministry of Defence (MoD) (its supervisory body is the Geoinformation Service of the Hungarian Defence Forces (GEOS HDF).
Division of the tasks has been prescribed in Act No. LXXVI of 1996 on Surveying and Mapping Activities (later on: the Act on Surveying and Mapping).

Organizational Structure of Civilian Mapping

Within the meaning of the Act on Surveying and Mapping Activities the civilian lands and mapping organisation is responsible for establishing, maintaining and supplying of the geodetic control networks, the large scale base maps including the cadastral ones, the land registry, land protection, utilization and valuation, the topographic maps of selected scales and the remote sensing.

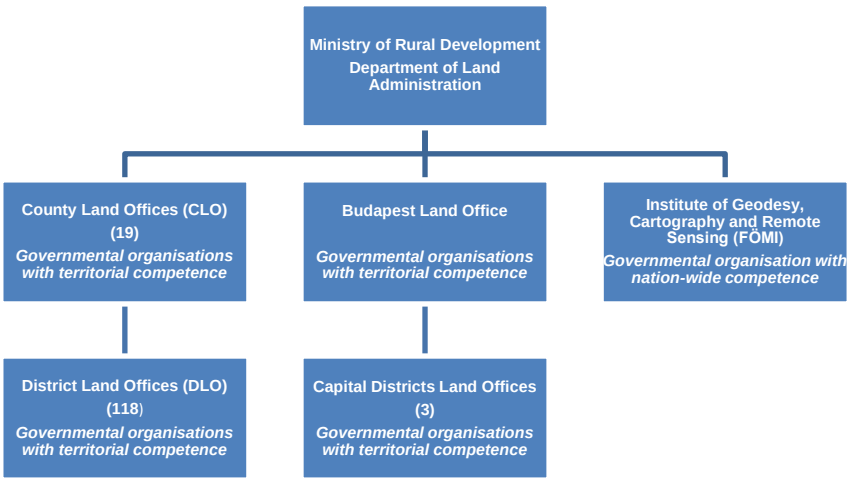


Fig. 1. Ministry of Rural Development and its institutions

The Cadastre System and Land Affairs

Land book, land registration and cadastral maps have continuously been operated in Hungary for over 150 years. This system was totally based on paper records, which consisted of cadastral maps (boundary information) and property sheet records (property description, ownership information, and all financial or other burdens on the property, i.e. both legal and administrative records). The records were continuously maintained.
The cadastre system was unified in 1972 by the Act on Land Registry and later on by the Act CXLI (1997) on Land Registry. Recently, for registration of land parcels and other real properties (e.g. buildings) a full cadastre system is in force in Hungary, identical with the concept introduced by FIG. It is a unified, multipurpose legal system, an integration of the cadastral maps and the registration records including the traditional Land Records (Grundbuch).

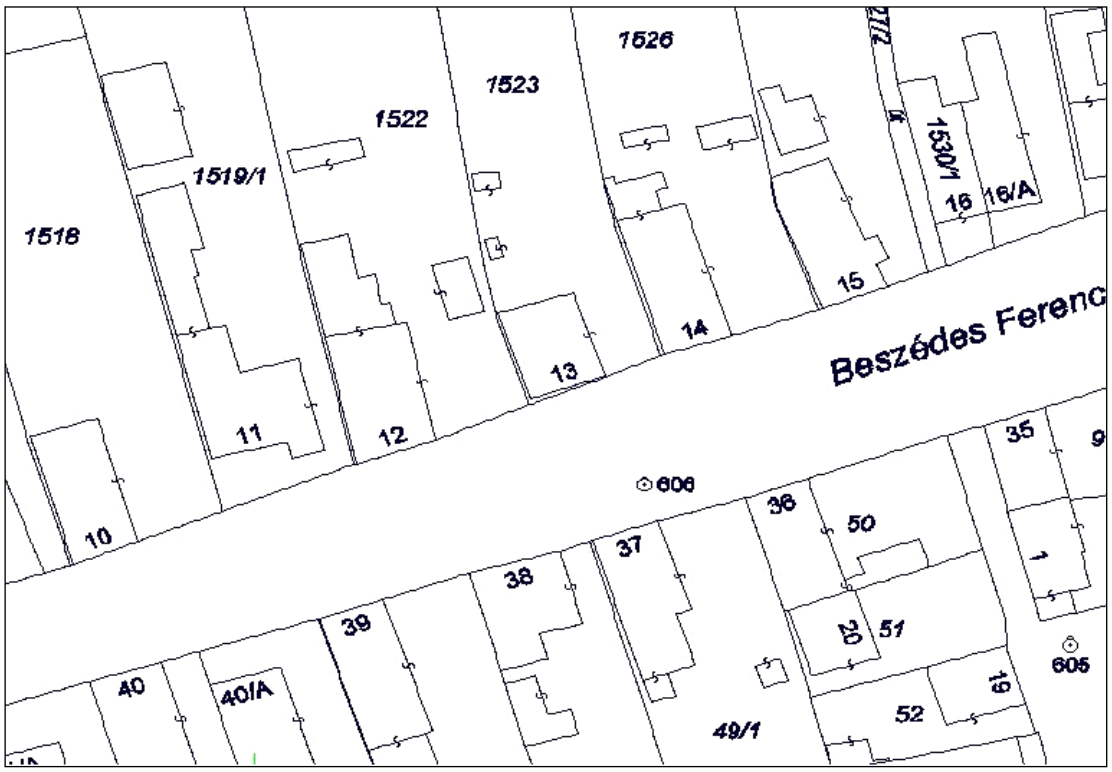


Fig. 2. Fragment of cadastral map

The Hungarian Unified Land Registration System is operated by the District Land Offices and the Budapest District Land Offices. (Fig. 3.)

Fig. 3.County Land Offices and District Land Offices, Hungary

The National Cadastral Programme Non-profit Company

In 1997 production of cadastral maps in digital form started under the National Cadastre Programme. By the end of 2007 digital cadastral maps were available for the total area of the country. The programme has to go on for a long time, however. On one hand the credit, which financed the earlier digitalization has to be repaid from sales of digital maps. A long-term programme for the gradual quality improvement has also to be drawn up, as most of the digital maps had been obtained through vectorisation of analogue maps based on older surveys.
The National Cadastral Programme Non-profit Company (NCP Non-profit Co.) continues to oversee this twofold activity.

Quality Management in Civilian Lands and Mapping Administration

The ministerial executive order of the Act LXXVI of 1996 on Surveying and Mapping Activities says that all the surveyors creating so-called national base geodata must have a quality management system, which corresponds to the International Quality Standards. The Act also says that the Land Offices managing the land surveying and maintaining maps and data must also have their own quality management system matching the International Quality Standards. The task of quality control of cadastre belongs to the responsibility of Institute of Geodesy, Cartography and Remote Sensing (FÖMI) as a central surveying organisation.
The quality management system (QMS) of FÖMI based on the Standard ISO 9001:2000 was certified in 2003 by the Bureau Veritas Quality International Hungary Ltd. (BVQI). The validity of the certification expired in 2006.
In 2004 FÖMI created an Information Security Management System based on the Standard BS 7799 certified by Société Générale de Surveillance Hungary Ltd. (SGS). In consideration of expiring the validity of the QMS Certification, the Management Board of FÖMI decided the integration of the two (ISO & BS) management systems in order to operate them easier, more cheaply and more effective. The integrated management system (IMS) was certified in 2006 for three years also by SGS.
International Standardisation Organisation has accepted ISO 27001 Standard on information technology, security techniques, and information security management systems. The Standard is nationalised by the Hungarian Standardisation Board. That is why no more possibility to certify an information security management system by the BS 7799 British National Standard in Hungary. In 2006 FÖMI has revised the IMS by the new International Standard & the certification organisation (SGS) successfully certified the modified management system in May 2007.

The last revision-audit was successfully over in 2008, so FÖMI is preparing for renewal of the certification next year.
At the end of the year 2000 FÖMI got the certification of the Gödöllő Base Line as an accredited calibration laboratory (K-GEO). The Hungarian National Accreditation Board (HNAB) issued the certification. In possession of the certification FÖMI is authorised to calibrate distance measuring devices and total stations used for creation of national basic geodata. The activity of the Calibration Laboratory was extended in 2002 for calibration of GPS devices. HNAB issued the certification of the Calibration Laboratory for the extended activity. Certification of K-GEO was renewed by HNAB in 2007 for three years again.

Quality Management in Defence Mapping Administration

In defence mapping, great emphasis has traditionally been laid on the high- level quality assurance of its products. Accordingly, ISO 9001 and ISO 14000 systems were audited at the MoD Mapping Company on 19 April 2004 followed by the ceremonial presentation of the certifications on 7 May 2004. An integrated command system developed and continuously perfected by the MoD Mapping Company is applied to all activities of the Company, except the activities in the Open Skies contract, i.e. map compilation, creation of traditional and digital mapping databases as well as production and distribution of printed materials.
The system of state (quality) inspection is supposed to guarantee for the adequacy of basic data produced through carrying out basic tasks and work. The state inspection of basic data – primarily of topographic maps – produced by the Ministry of Defence Mapping Company is carried out by the Geoinformation Service of the Hungarian Defence Forces.

Development of Human Resources

The modernisation tasks listed above are dependent on further development of human resources. High priority should be given to this duty as the civilian Lands and Mapping Administration sector has more than 4000 employees. The training for the employees parallel with the daily activity can only partly be organised within the Land Offices themselves, so other forms of education also should be involved.

Permanent training courses/education programmes:

- Launch of LIME – Land Information Management for Executives (2001);
- Launch of Land Registration Managers' Training Course at Székesfehérvár, College offering college degree training for land registration management staff (2001);
- Training for Land Office employees in using META system (from 2002);
- Training for external users (public notaries, jurists etc.) in using TAKARNET (from 2002).

Administrative Boundaries Database of Hungary

FÖMI initiated the compilation of the Hungarian Administrative Boundary Database (MKH) in 1998 for two reasons. Firstly, to find another application and new market to a part of data collected and owned by the Land Offices of the country, and secondly, to facilitate the integration process to the European Union. Data collection of the database was finished in 1999. The continuous update is provided in the co-operation between FÖMI and Land Offices.
For development of the database, in co-operation with the Land Offices, FÖMI has started the data collection of the boundaries between built-up and rural areas of the settlements. Now, 100% of these boundary data have been collected too, and the update is provided together with MKH.
The source of the database is the national cadastre, the directly measured co-ordinates of those boundary points, which represent at the same time administrative boundaries too. The output products are databases of different resolutions gained by generalisation. The list of standard products of the administrative boundaries and their characteristics are shown in the following table:

Resolution	Approximate scale	Precision of coordinates
1 m	1 : 5 000	1 m
2 m	1 : 10 000	1 m
5 m	1 : 25 000	1 m
10 m	1 : 50 000	1 m
20 m	1 : 100 000	10 m
50 m	1 : 250 000	10 m
70 m	1 : 350 000	10 m
100 m	1 : 500 000	10 m
200 m	1 : 1 000 000	100 m
500 m	1 : 2 500 000	100 m

Products of the Hungarian Administrative Boundary Database (MKH)

To satisfy users' requirements some attributes, like statistical codes, area of units, elements of hydrography etc. are attached. The pricing is polygon-based. The data can be purchased separately for every administrative unit, in case of purchasing more units the buyer can achieve discounts.

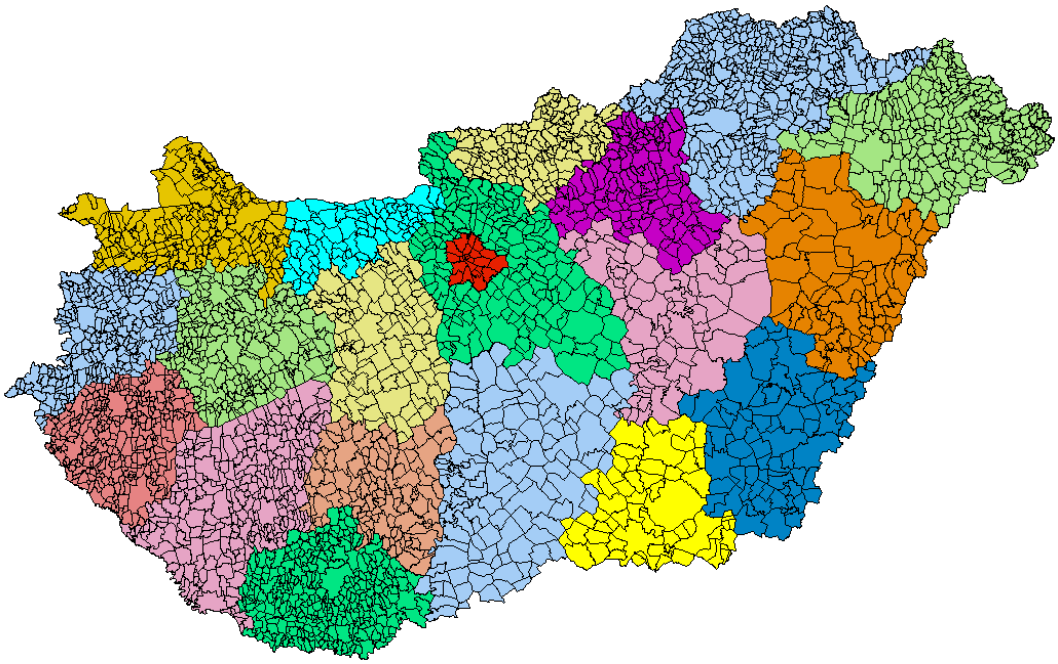


Fig. 4. Administrative Boundary Database of Hungary

Topographic Mapping at the Civilian Lands and Mapping Administration

Analogue Topographic Map Products

The recent status of the analogue topographic map sheets of the civilian Lands and Mapping Administration is as follows:

Scale	Number of EOTR sheets
1:200 000	23
1:100 000	84
1: 25 000	267
1: 10 000	4098

The production of EOTR topographic maps at scale 1:25 000 was terminated earlier. At scale 1:10 000, the production and updating was finished and restarted in 2000. The products at scales 1:10 000 and 1:100 000 have been supplied for the users continuously.

Digital Topographic Map Products

Recently, the following products of the 1:10 000, 1:100 000 and 1:200 000 Digital Topographic Map series of EOTR are available:

Scale 1:10 000					
raster data (DRTA-10)		vectorised data (DITAB-10 v.0)		Database (DITAB-10 v.3)	
contour lines	4098 sheets (100%)	contour lines	4098 sheets (100%)	contour lines	4098 sheets (100%)
planimetry	4098 sheets (100%)	planimetry	4098 sheets (100%)	planimetry	4098 sheets (100%)
hydrography	4098 sheets (100%)	hydrography	4098 sheets (100%)	hydrography	4098 sheets (100%)
colour prints	4098 sheets (100%)				

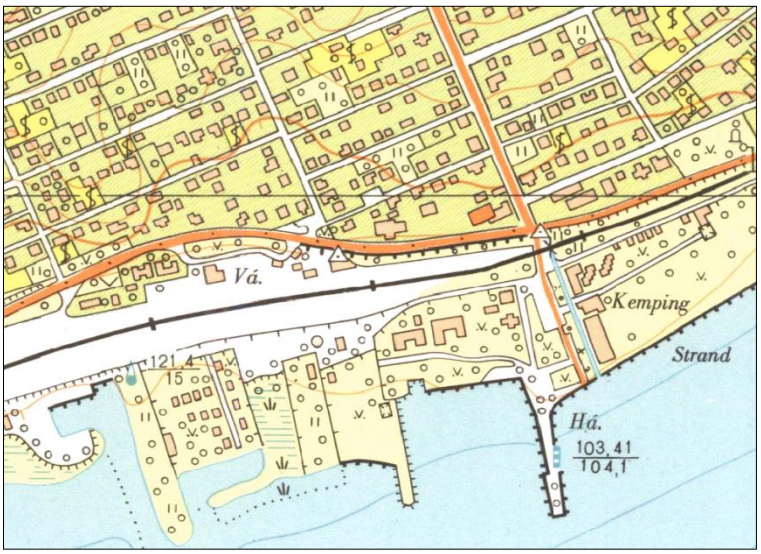


Fig.5. Fragment of the 1:10 000 Digital Topographic Map (© FÖMI)

High-resolution *digital elevation model* (HUNDEM-5), based on vectorized contour lines of 1:10 000 scale topographic maps and stereophotogrammetric measurements for the whole country.

At the end of 2006 FÖMI finished the vectorization of planimetric- and hydrographic layers of topomaps at scale 1:10 000, constructing a *vectorized data base* for the whole country (DITAB-10v.0).

In 2010 FÖMI converted the vectorised data into object oriented database of topographic maps at scale 1: 10 000.

Scale 1:100 000			
raster data DRTA-100		vectorised data DVTA-100	
contour lines	84 sheets (100%)	contour lines	84 sheets (100%)
planimetry	84 sheets (100%)	planimetry	84 sheets (100%)
hydrography	84 sheets (100%)	hydrography	84 sheets (100%)
colour prints	84 sheets (100%)		

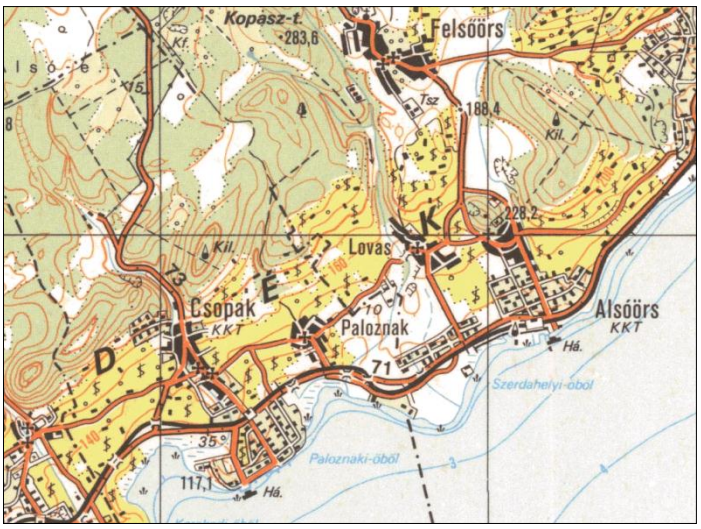


Fig. 6. Fragment from the 1:100 000 Digital Topographic Map (© FÖMI)

The *digital elevation model* of Hungary in scale 1:100 000 (DEM-100): DEM with 100m x 100m regular grid interval (84 sheets 100%).

Scale 1:200 000	
raster data (DRTA-200)	
colour prints	23 sheets (100%)

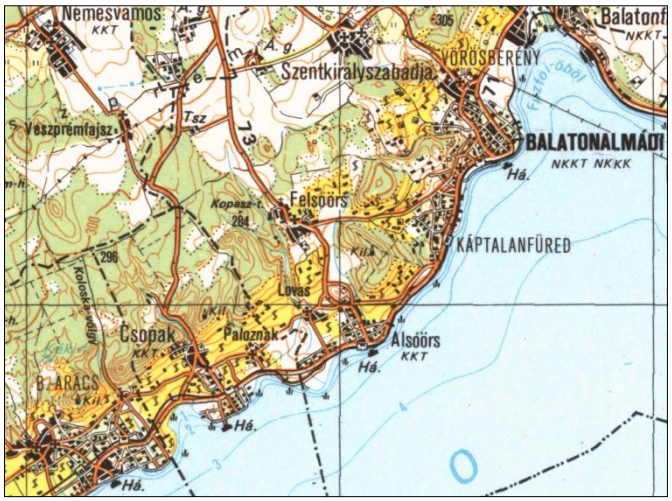


Fig. 7. Fragment from the 1:200 000 Digital Topographic Map (© FÖMI)

Characteristics of the Hungarian topographic map series

Characteristics	New topographic map series	Civilian topographic map series
Datum	WGS-84 (EUREF-89) a = 6 378 137 m b = 6 356 752 m	IUGG67 a = 6 378 160 m b = 6 356 774 m
Projection	Universal Transverse Mercator (UTM)	Unified National
Prime meridian	Greenwich	St. Gellért Hill, Budapest
Spherical longitude of centre point of the projection	0º (Equator)	47º06' (St. Gellért Hill, Budapest)
Type of projection; Projection zones	Equatorial (transverse), Tangential, conformal, cylindrical. Sixty 6º ellipsoidal bi-angles, each of which forms an independent co-ordinate system	Oblique, secant, conformal, cylindrical. One co-ordinate system for the whole territory of Hungary
Way of projection	At each 6º for every ellipsoidal bi-angle	'Double projection' i.e. from IUGG67 through Gauss sphere to the plan
Projection co-ordinate system	Portray of the Equator: N: Y = 0; S: Y = 10 000 000 m X = Parallel to the portray of the central meridian and 500 km West thereto	Y = 0; 200 km South to the centre point of the projection X = 0; 650 km South to the centre point of the projection
Height datum	Baltic (Kronstadt)	Baltic (Kronstadt)
Geodetic Datum	Unified Geodetic Network ED-50 or WGS-84 – EUREF-89	Hungarian Datum (HD-72); independent, relative
Sheet size	1:25 000 / 7'30" x 5' 1:50 000 / 15' x 10' 1:100 000 / 30' x 20' 1:200 000 / 1º x 40' 1:250 000 / (2º x 1º)	1:10 000 / 6 x 4 km 1:25 000 / 12 x 8 km 1:100 000 / 48 x 32 km 1:200 000 / 96 x 64 km
Number of sheets covering the territory of Hungary	1:10 000 ———— 1:25 000 ———— 1:50 000 319 sheets 1:100 000 ———— 1:200 000 ———— 1:250 000 13 sheets	1:10 000 4098 sheets 1:25 000 1066 sheets 1:50 000 ———— 1:100 000 84 sheets 1:200 000 23 sheets

Gazetteer of Hungary

The gazetteer-database under the responsibility of FÖMI contains 41 types of geographical names including the names of settlements, parts of settlements, landscapes, large units of the land, woods, nature conservation areas, relief and hydrography, names of point of interests (ruin, lookout tower etc.) as well as the names of the most important objects of traffic. Its name is: Database of Geographical Names (in Hungarian: FNT – Földrajzinév-tár).
The database has two versions. The first one (FNT1) corresponds in quantity of names approximately to a topographic map in scale 1:50 000. This database was produced by using of 300 sources (maps, geographical literature, economical, statistical sources), and each municipality had the chance to complete or modify the database reflecting the local use of name. FNT1 covers the whole territory of Hungary, and changes are continuously updated.
The second version (FNT2) corresponds in quantity and in the types of names used roughly to the topographic map scale 1:10 000, with a readiness of 60% (Fig. 25). It covers the names of the database FNT1 with additional names collected directly on the spot, taken from large-scale topographic maps, cadastral maps, and other sources. In this version localisation and feature of geographical names are indicated by geometrical figures (polygon, line, point). Digital processing is aided by orthophotos since 2008. The two parts of the database comprise about 200 000 records.

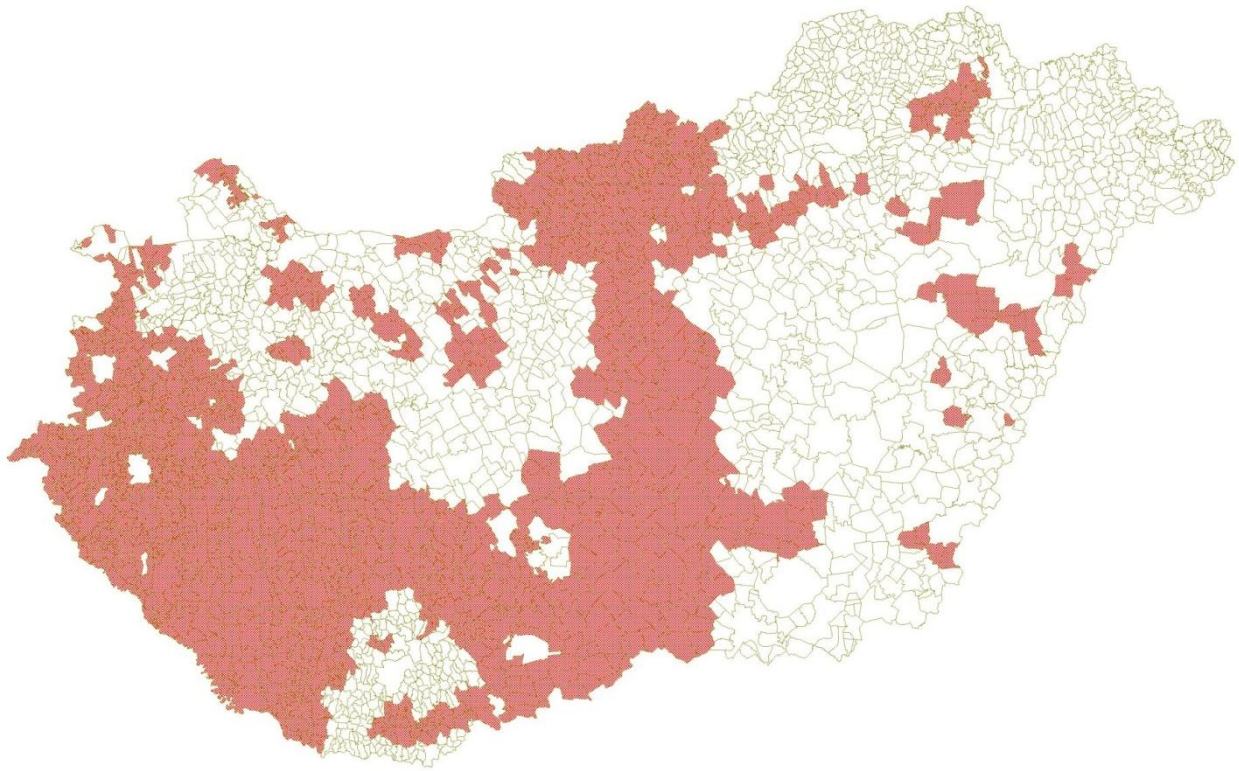


Fig. 8. Readiness of FNT2

Fig. 9. Official geographical names of parts of the village Felsőörs

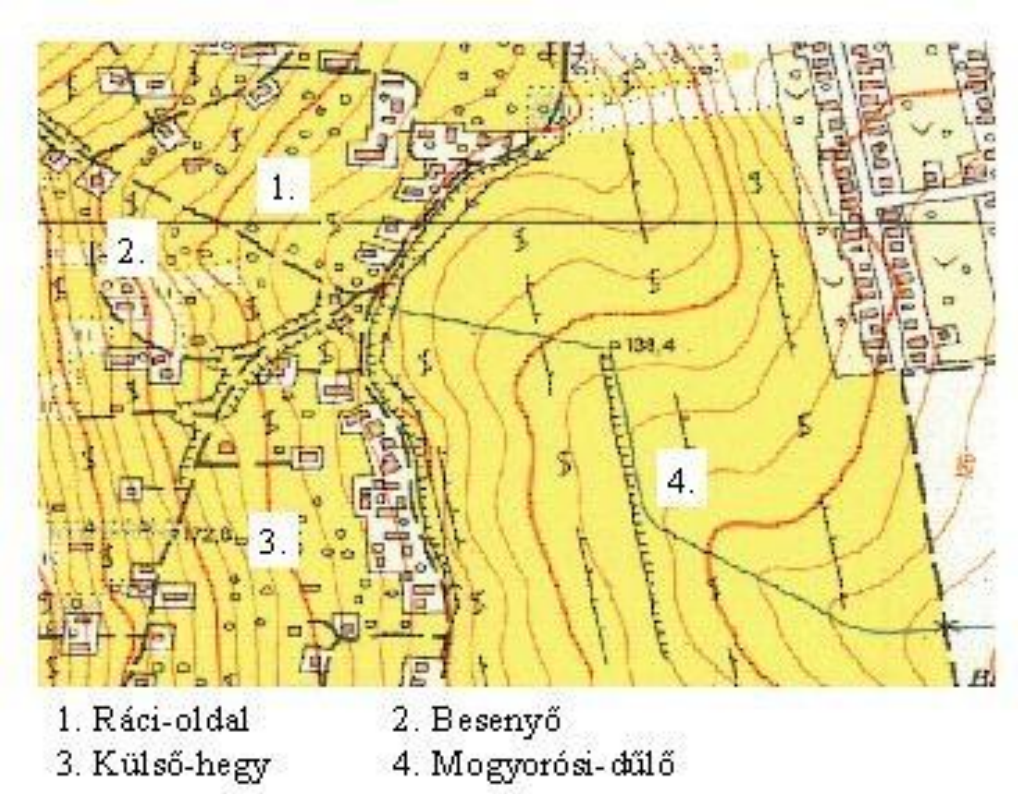


Fig. 10. Completion of map with collected geographical names

Defence Mapping Activities in Hungary

Defence mapping activities, including all state mapping operations at scales smaller than 1:10,000, are carried out by two military organisations in Hungary; the Geoinformation Service of the Hungarian Defence Forces (GEOS HDF) is responsible for the management and technical supervision while the Ministry of Defence Mapping Company (Mapping Co. MoD) is in charge for the actual map making. Nevertheless, carrying out some geo-related (however, not merely mapping) tasks, such as the EuroRegionalMap (ERM) project or the creation of military geographic products, falls within the responsibility of GEOS HDF, too.

Topographic and Thematic Mapping Activities

Analogue Topographic Maps

Hungary has been producing standard military topographic map series according to NATO STANAGs, i.e. in UTM projection, on WGS 84 datum and with a Hungarian-English bilingual marginalia, since 2004. The base of the 1:50,000 scale map series, a mandatory scale in NATO, is the DTATM-50 Digital Mapping Database. A civilian version of the above map series supplemented with EOV Hungarian (civilian) national standard grid is also available.

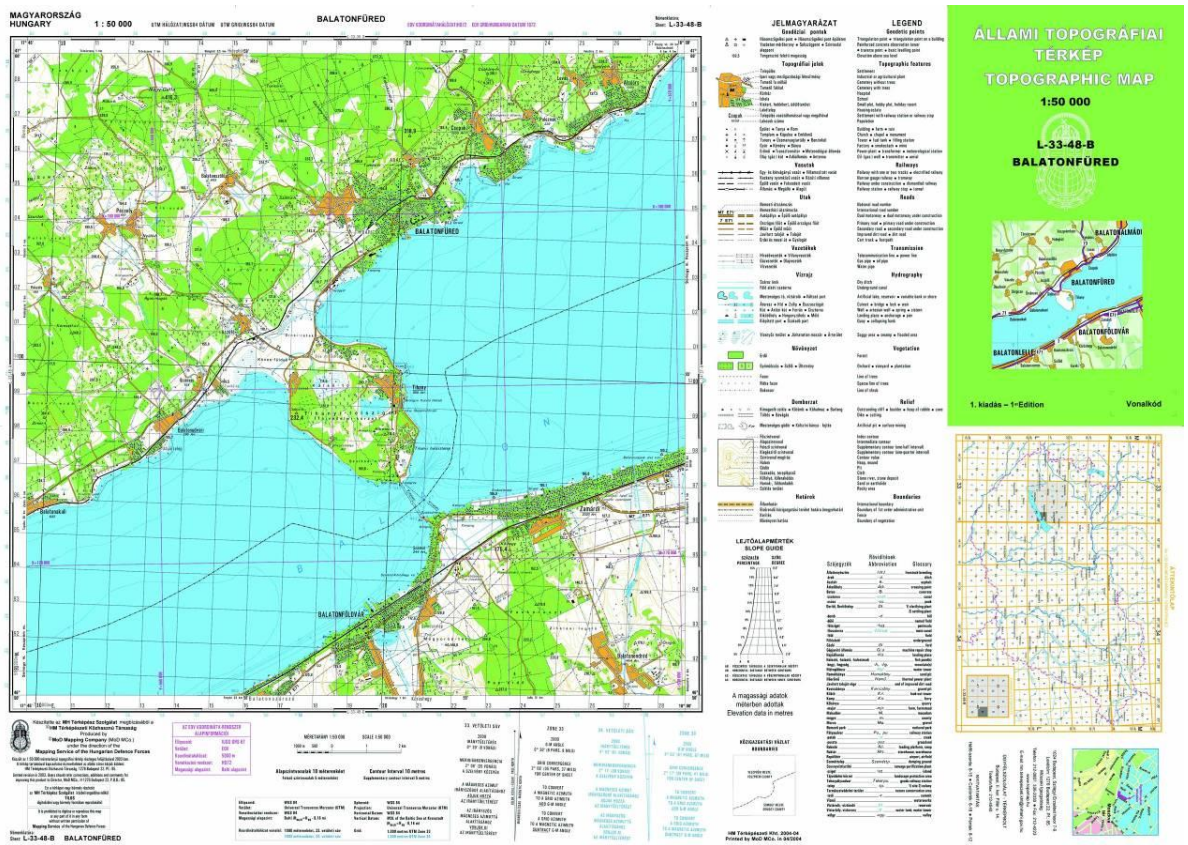


Fig. 11. 1:50,000 scale topographic map (civilian version) in UTM projection, enhanced with EOV grid

Digital Databases

The legal ancestor of the Geoinformation Service HDF started establishing digital databases in the early 1980's. As a result of this activity, a number of databases and elevation models have been produced and made available for the users in various sectors, e.g. governmental, defence and public, by now.

DTATM-200 - Digital Mapping Database

Creation of the DTATM-200 database with a data content equivalent to the 1:200,000 scale topographic maps commenced in 1988. Since that time DTATM-200 has been used by several institutions as grounds for their individual thematic databases. The updating of the content of the database is carried out constantly.

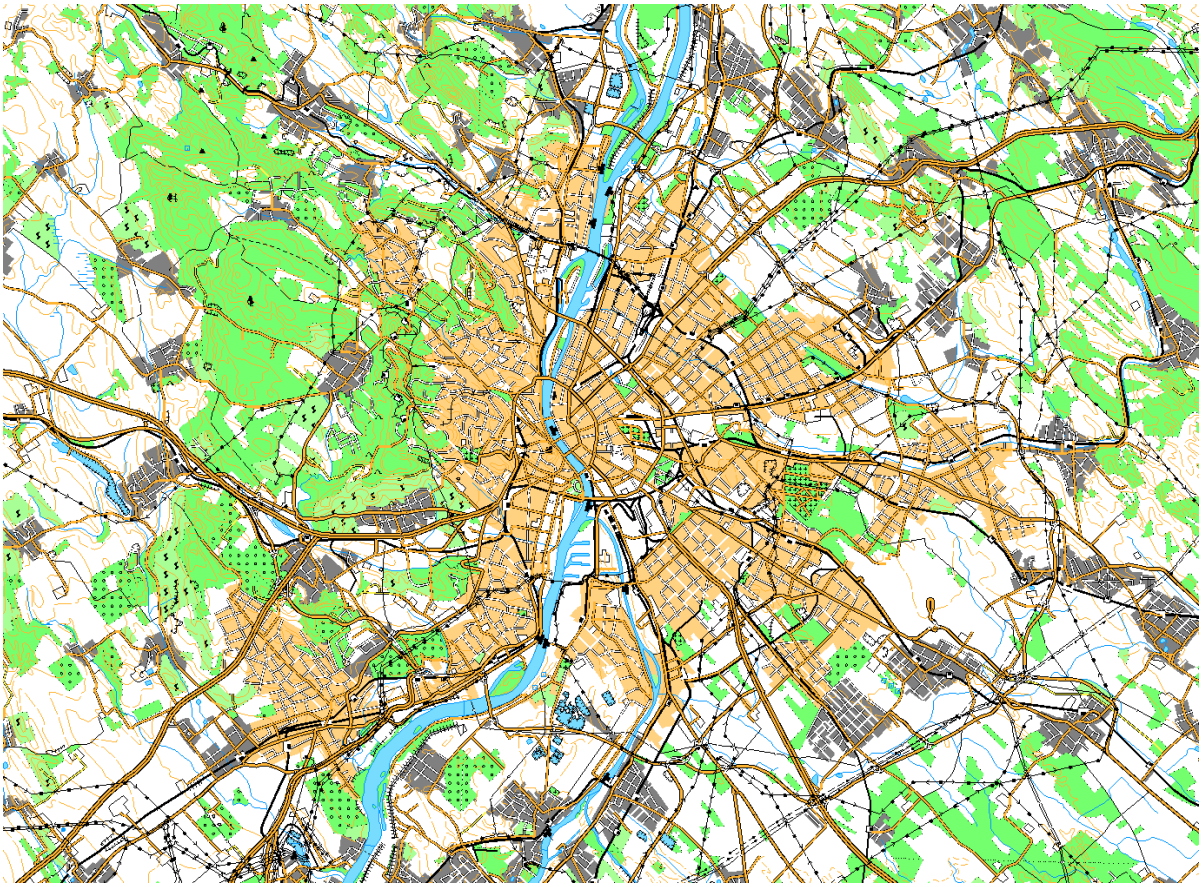


Fig. 12. Extract from DTATM-200 database, new version

DDM-10 and DDM-50 - Digital Elevation Models

DDM-10 and DDM-50 Digital Elevation Models hold elevation data for the territory of Hungary in grid format with 10×10 m and 50×50 m density, respectively. The total size of the data file is 2.5 GBytes for DDM-10 and 100 MBytes for DDM-50. The database is available in NATO standard DTED Level 1 and Level 2 formats as well.

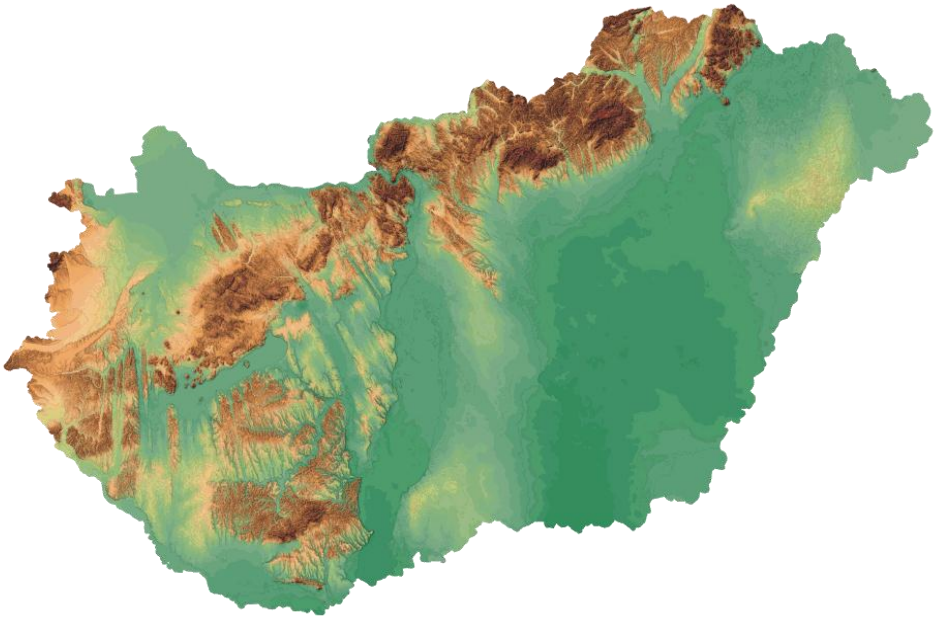


Fig. 13. Representation of the Digital Elevation Model

DTATM-50 - Digital Mapping Database

DTATM-50, considered the most significant digital military mapping database in Hungary, was created using the 1:50,000 scale military topographic map series. As a general skeleton map, containing some 900 features in ten categories, it renders possible the automatic processing of topographic maps on one hand and can become a base of future GIS applications on the other. The database can serve as foundation for the representation of planimetry and legend of topographic maps, too.

Fig. 14. Extract from DTATM-50 v. 2.0, Digital Mapping Database

The aim of the updated and enhanced version (V2.0) of DTATM-50 database was to provide grounds for the new 1:50,000 scale military topographic map series by which a full harmony in content between analogue maps and digital mapping databases can be reached. The updating of the database is carried out continuously.

DTATM-500 and DTATM-1000 Digital Mapping Databases

DTATM-500 and DTATM-1000 vector databases, depicting Hungary and its environments, equivalent in content to the 1:500,000 and 1:1,000,000 scale maps, respectively, have also been completed.

VTopo-25 Programme

Another venture is the VTopo-25 digital topographic project. Following international standards, the VTopo-25 topographic map database is under development based on the experiences of the Hungarian state mapping. The 2D vector dataset has well-defined topology and has a wide selection of attributes including elevation. This database corresponds to the former military topographic map at the scale of 1:25,000 both in content and accuracy, but the data structure, and the set of database objects and attributes meet present requirements. Database elements are stored in their place and refer to real-word objects. Starting from VTopo 25 database, cartographically enhanced, printed maps (also including generalized map sets at different scales) can be produced in a later workflow. Due to the insufficiency of the financial sources the implementation of the programme has slowed down to a great extent

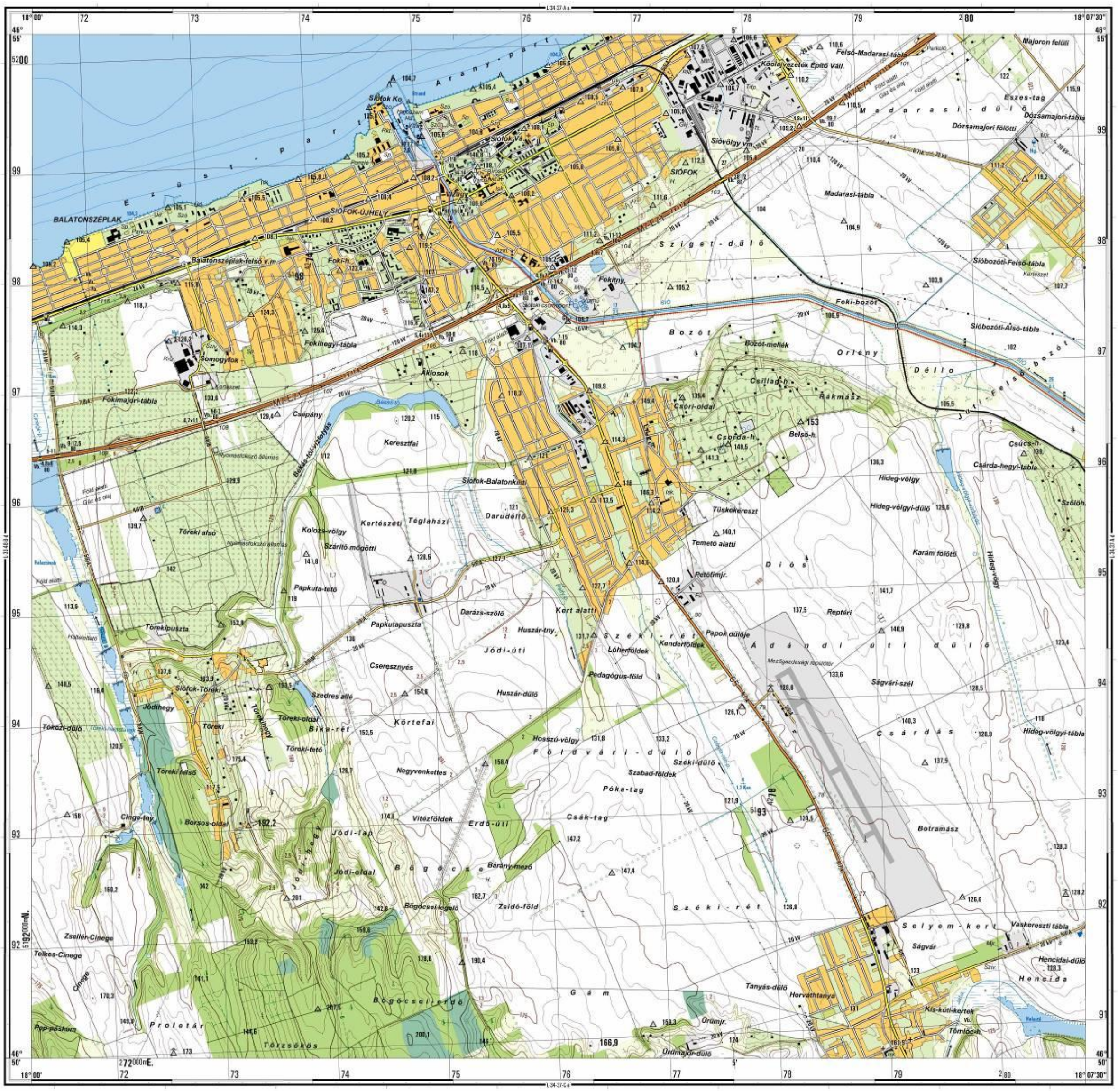


Fig. 15. Extract from VTopo-25

Multinational Geospatial Co-production Programme (MGCP)

The MGCP was called into existence on the initiation by the USA National Geospatial-Intelligence Agency (NGA) in 2003. The aim of the program was the creation of an up-to-date, modern, digital database to satisfy the emerging national and international needs, the fight against terrorism and other global tasks, built up by 1×1 degree cells of geographic coordinates at scales 1:50,000 and 1:100,000. As a result, a GIS database, unified in content and accuracy requirements, will be at the participating governments' disposal in proportion of their participation for nearly the whole territory of the world.
Hungary has assumed the creation of 29 cells.

EuroRegionalMap (ERM)

EuroRegional Map, a joint project of 43 European countries, was initiated to produce a common GIS database at scale 1:250,000 for Europe in 2001. Hungary joined the EuroRegionalMap programme as an active member in 2008, however, has taken an active role for a number of years. The ERM specification issued by EuroGeographics was adopted and a Hungarian ERM technical specification was prepared. In harmony with it, six layers are compiled. The latest version of the ERM, v3.0, was approved in April 2010.

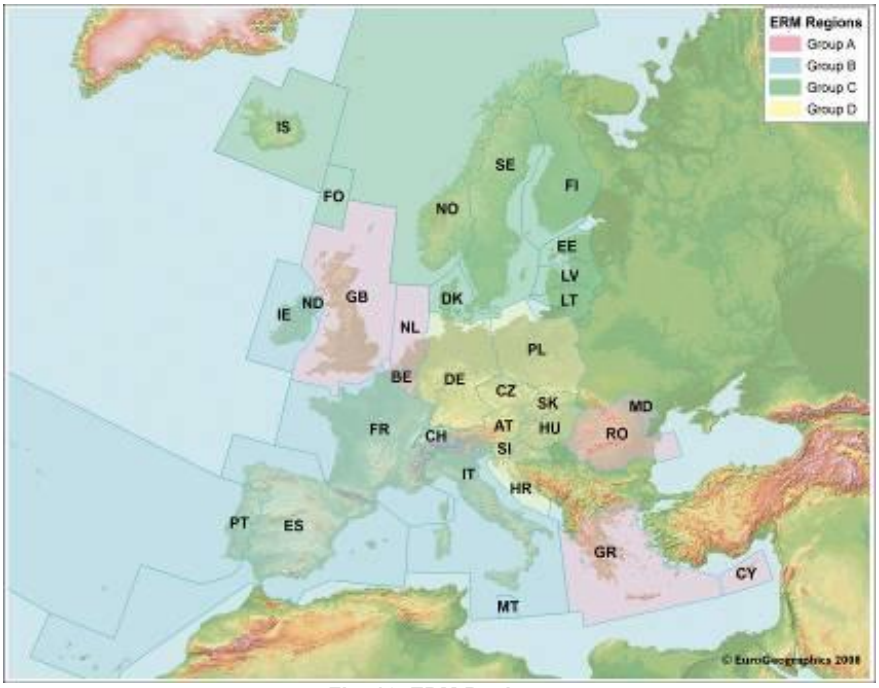


Fig. 16. ERM Regions

Global Map Project)

A spatial vector database of Hungary, equivalent in content of the 1:1,000,000 scale charts, has been completed in the frame of the Global Map project and published on the web.

Digital Raster Maps

For defence and other law enforcement purposes, 1:50,000 and 1:250,000 scale military topographic maps are available in raster format, too. For non-governmental users a number of raster format maps can be obtained of which the civilian version of the 1:50,000 scale topographic map series, the 1:50,000 scale TopoExplorer product and some pre-NATO topographic maps at scales 1:25,000; 1:100,000 and 1:200,000 (called RTA) can be mentioned.

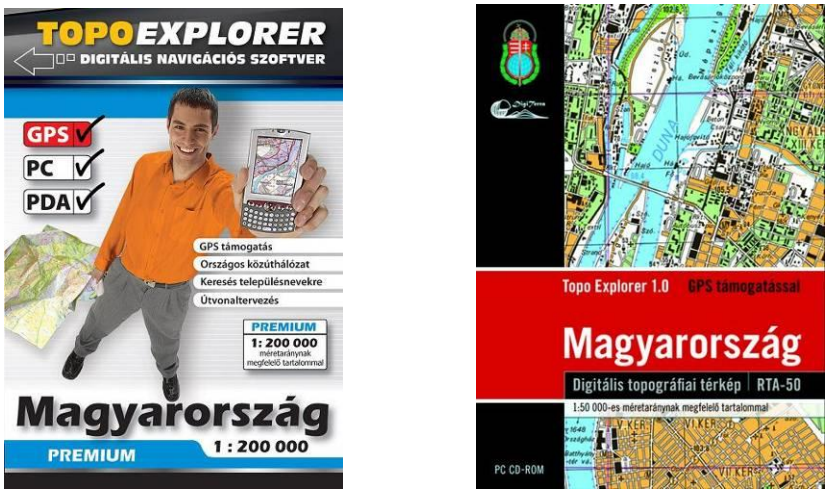


Fig. 17. TopoExplorer products

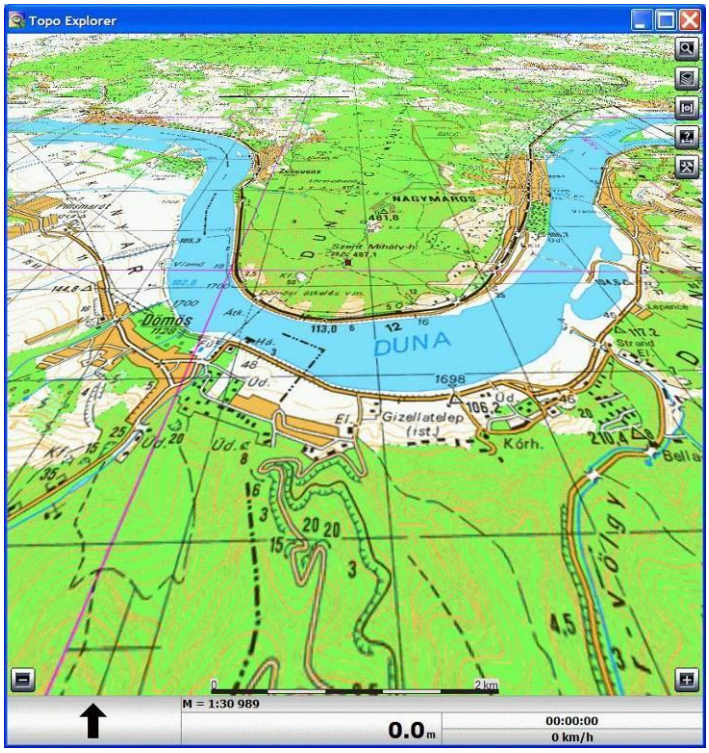


Fig. 18. Extract from TopoExplorer

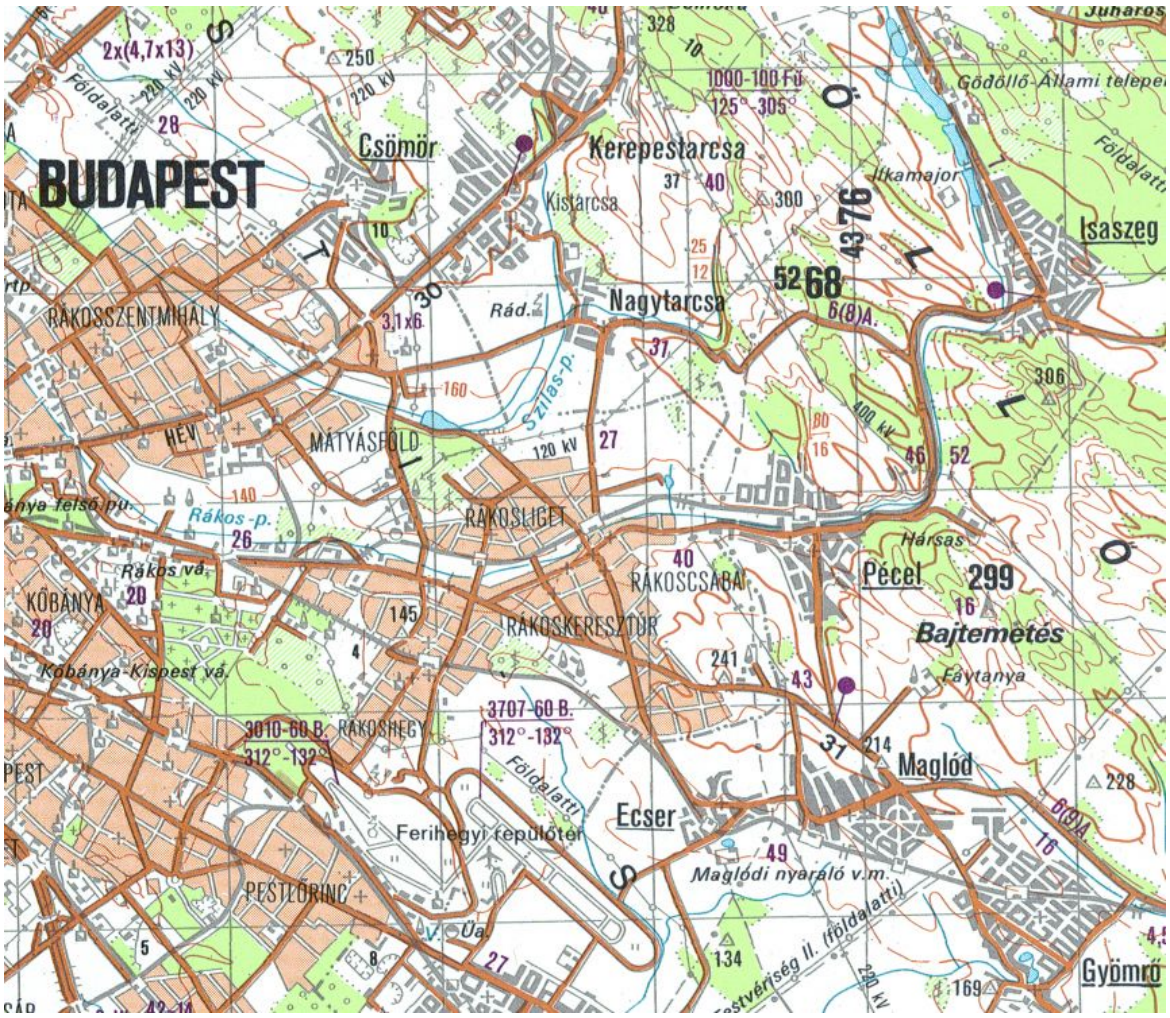


Fig. 19. Example of RTA 200

Thematic Maps

In addition to topographic maps a number of thematic maps and charts, military and civilian ones, are produced every year. NATO standard products such as Low Flying Charts (LFC), Tactical Flying Charts (TFC) and Joint Operation Graphics (JOGs), both air and ground version, are published regularly. A non-NATO product is the 1:200,000 scale helicopter navigational chart, especially designed to the needs of Hungarian helicopter pilots. Among non-military products the ICAO aeronautical chart of Hungary can be mentioned.

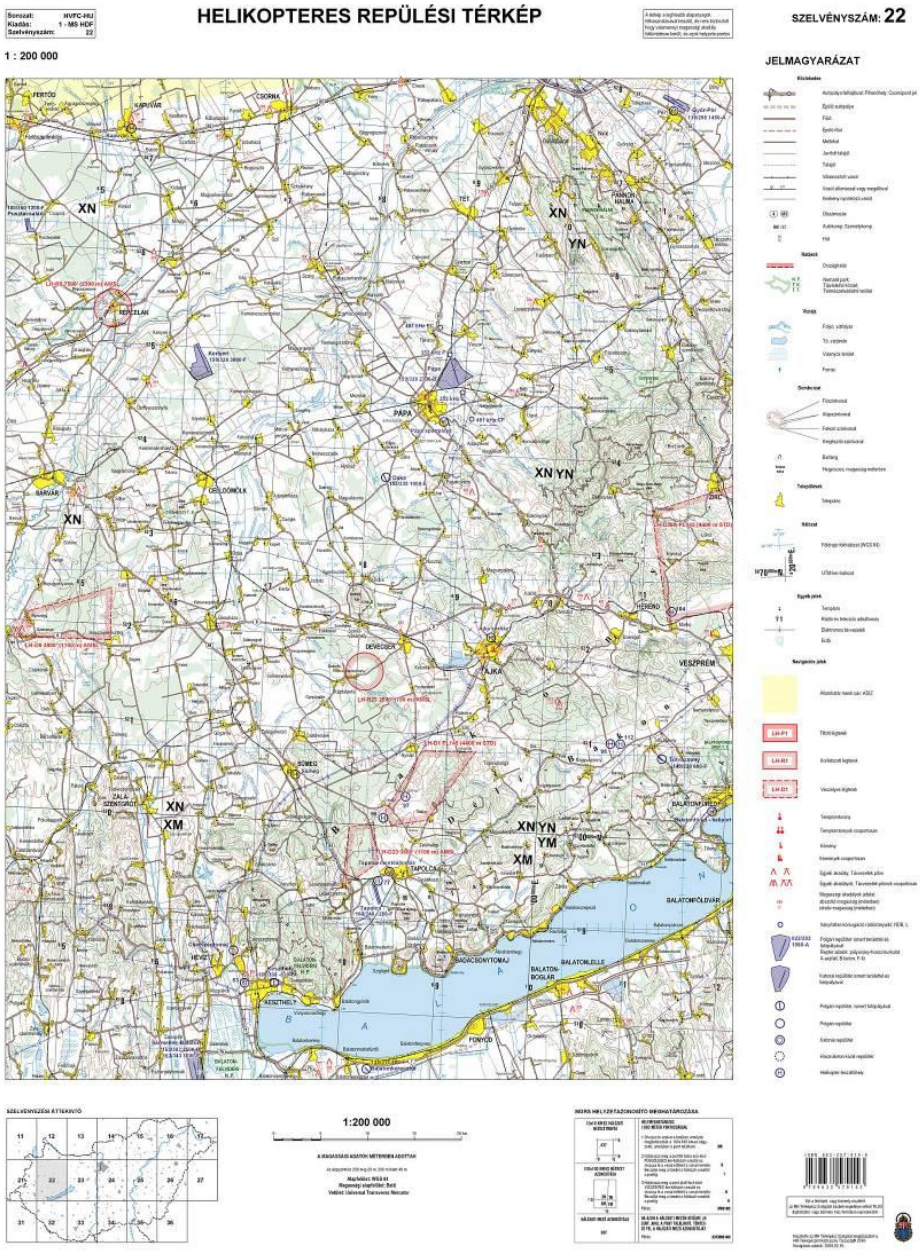


Fig. 20. 1:200,000 scale helicopter navigational chart

Maps for the public and other products

Hungarian defence mapping has long standing traditions in providing the public with various maps and charts. As a continuation of this practice a variety of tourist maps, maps of Budapest and road atlases of Hungary and Europe is maintained.

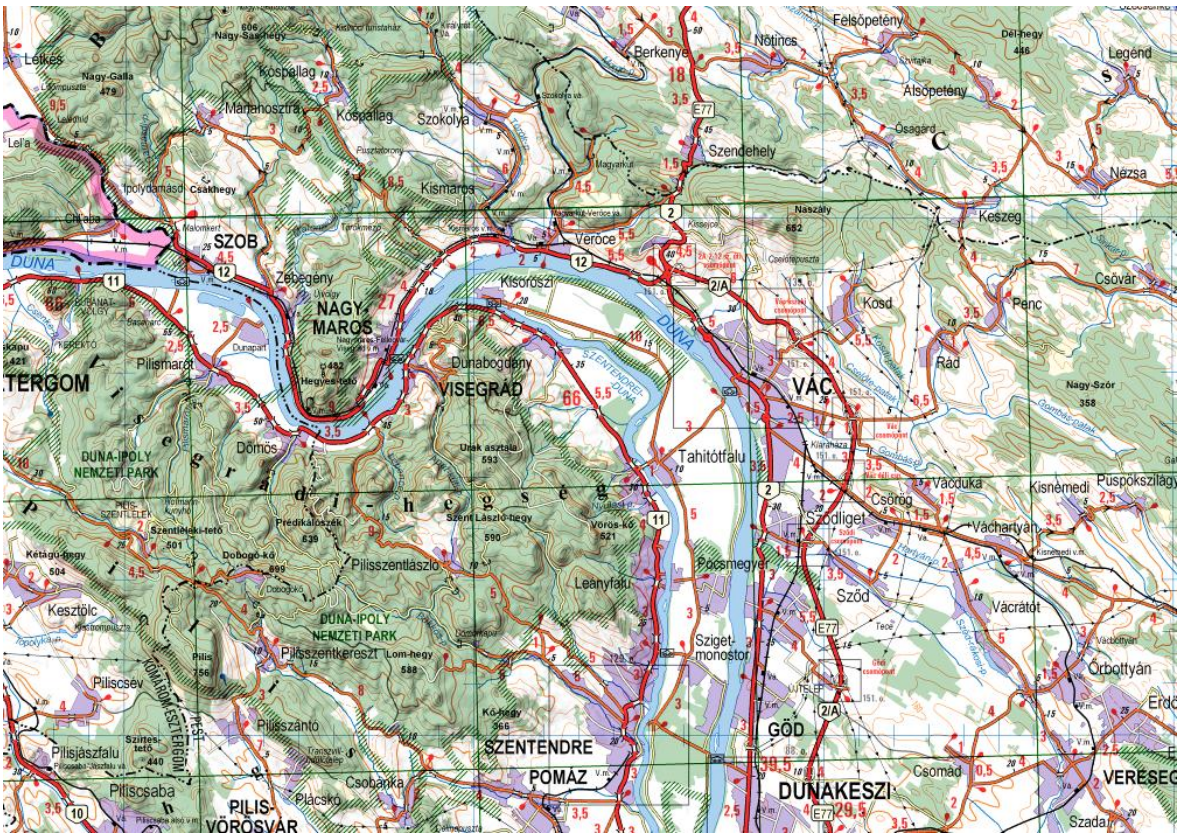


Fig. 21. Extract from the 1:200,000 scale road map

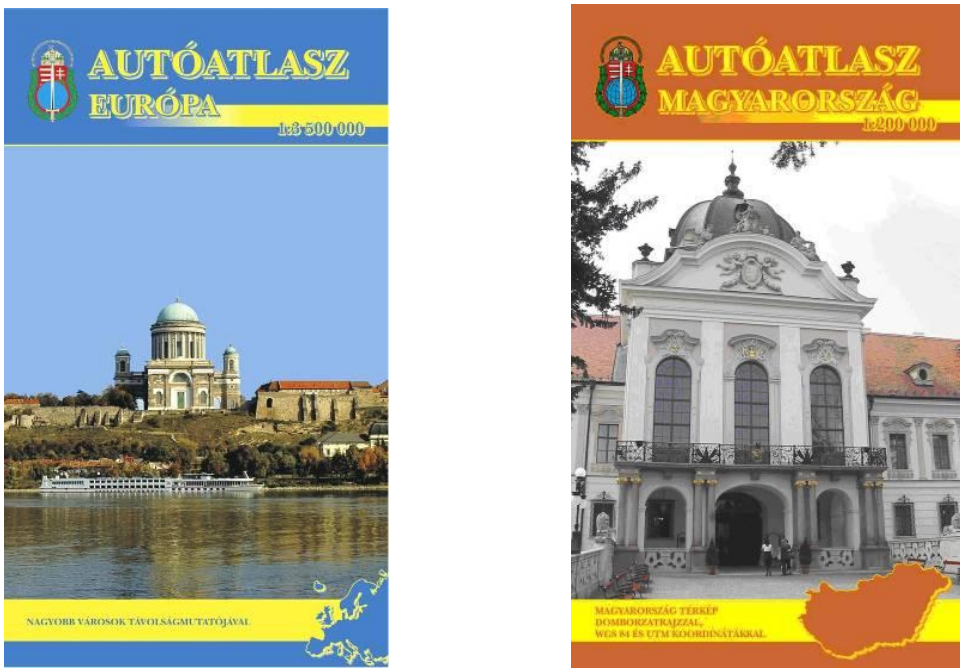


Fig. 22. Road atlases

Other products include relief maps, facsimile maps and calendars having been in production for decades.

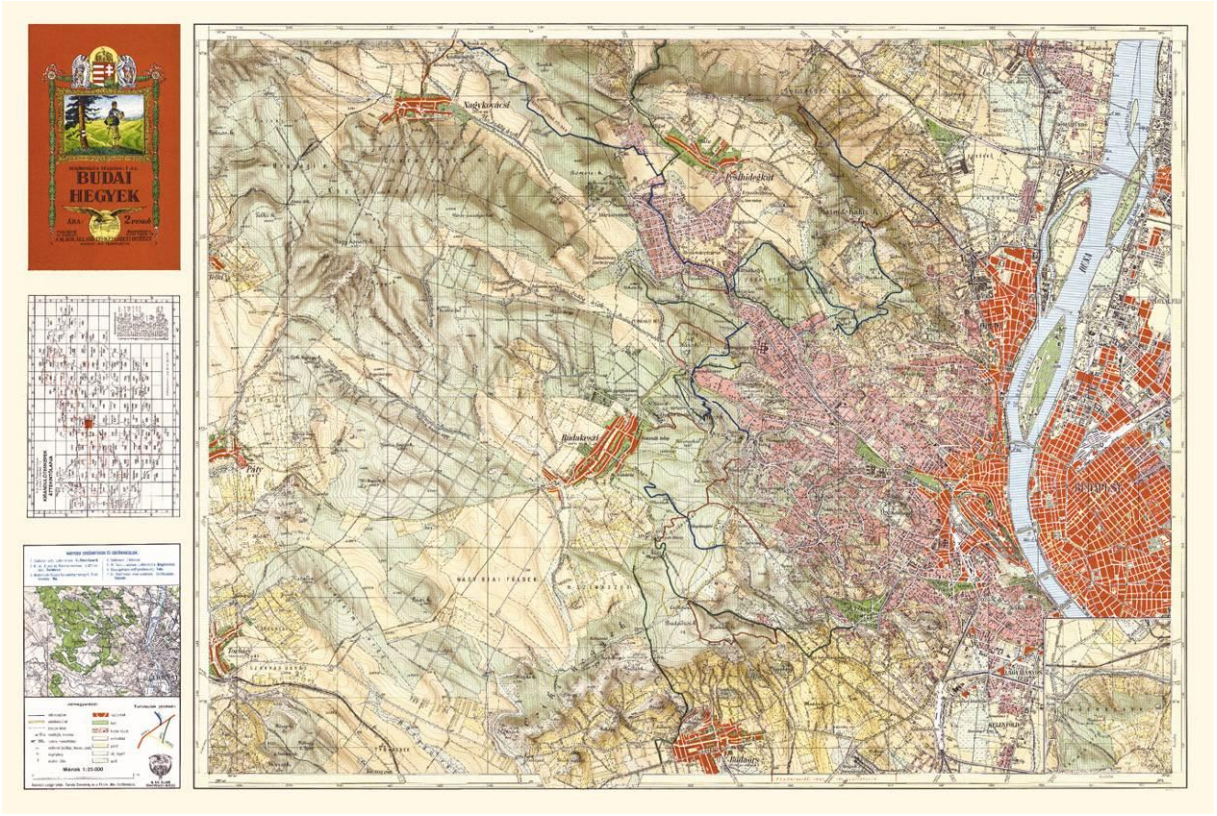


Fig. 23. Facsimile tourist map

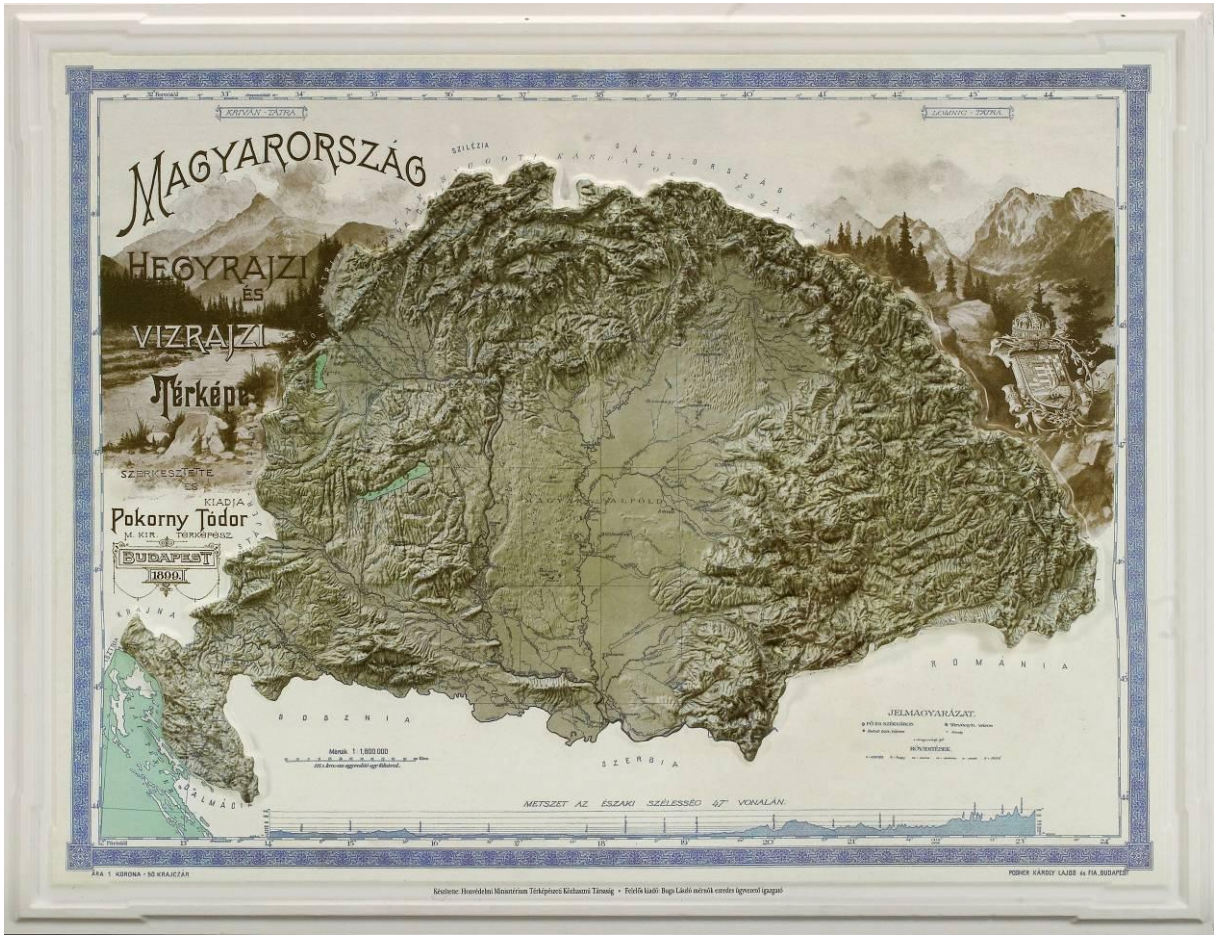


Fig. 24. Relief Map

Bilateral agreements

Hungary maintains extensive relationships not only with its most important strategic partners but also with other NATO and PfP nations. As a consequence, Hungary has concluded bilateral geospatial agreements with 21 countries so far (with another nine in preparation phase) and continues to make efforts to widen its international relationships with other countries, too. We have relations with 32 partner countries by now.

Military geographic products

The production of military geographic information in analogue and digital formats has a two folded goal: first, to train Hungarian soldiers and officers in preparation of their future military career and second, to give them actual and up-to-date support in peace keeping missions. A variety of publications, including 41 country descriptions mostly for the crisis areas, were produced by the end of 2010.

Some products are shown in Figure 24.

Fig. 25. Military Geographic Atlases

Geodetic Control Network

Reference System

A reference system called Hungarian Datum 1972 (HD-72) was introduced in 1972 based on independent adjustment of astrogeodetic network of Hungary. Its reference ellipsoid is the IUGG Geodetic Reference System 1967 (GRS67: a = 6378160m, b = 6356774.516m, f=1/298.247167). The HD-72 is located and oriented relatively at the terrestrial point Szőlőhegy.
Based on HD-72, Hungary established

- the Uniform National Horizontal System (in Hungarian called: EOVA),
- the Uniform National Height System (in Hungarian called: EOMA) and
- the Uniform National Mapping System (in Hungarian called: EOTR).

Projection System

A projection system for civilian use called EOV (Uniform National Projection system) was introduced in 1972. The reference ellipsoid of EOV is the IUGG GRS67. Type of the projection is an oblique-axis reduced (secant) cylindrical projection. The whole territory of the country is represented on one strip of cylindrical projection.
To meet the requirements of the domestic and international professional communities, a Description Directory of Hungarian Reference and Projection Systems has been issued in 1995 by FÖMI. The Description gives an overview on the EOV parameters, the HD-72 definition, the Hungarian vertical system and the relation of HD-72 to the WGS-72 and the EUREF-89 (WGS-84) systems. A revised version of the transformation parameters has been computed and harmonised in the frame of the EUREF WG of EuroGeographics and IAG, as well as disseminated for GI use in 2000. This version became part of the Hungarian GI standard.
Military maps and digital mapping databases are using Universal Transverse Mercator (UTM) and Lambert Conformal Conical map projections on the WGS-84 reference ellipsoid.

Hungarian Geodetic Control Networks

Uniform National Horizontal Network (EOVA)

The EOVA is based on the Hungarian Datum 1972 (HD72), where the network orientation was provided by 40 Laplace-points and the scale was maintained by 23 EDM lines.
Parameters connecting the Hungarian control network to the ETRS89 and ED-87 systems have been established and being maintained.
In order to provide a high order scale a 864 meter length Standard Baseline at Gödöllő (situated about 30 km from Budapest) has been measured in 1987 with Väisälä interferometric method and Kern Mekometer in co-operation with the Finnish Geodetic Institute. The re-measurement in 1999 proved its high stability. The baseline with 5 pillars was accredited for EDM calibrations for national and international use.

The EOVA network *(*Fig. 28.) consists of:

- 163 sites of 1st order (146 points within Hungary and 17 points in the neighbouring countries),
- 1974 sites of 3rd order,
- 4307 sites of principal 4th order,
- 43780 sites of 4th order .
- The 1st, 3rd and principal 4th order sites have 10306 orientation sites. 6080 orientation sites have co-ordinates.

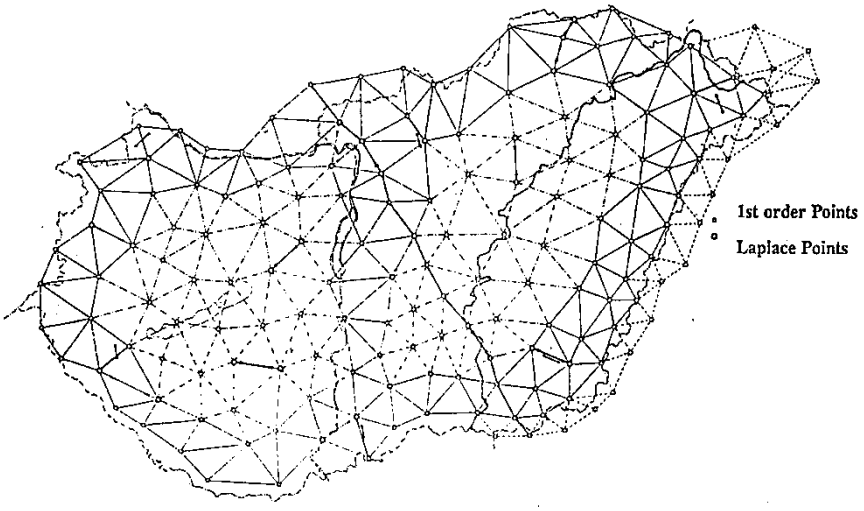


Fig. 26. Sites of the 1st order Uniform National Horizontal Network

An EOVA Database - created and operated by FÖMI - contains position and descriptive data of the horizontal control sites (1st, 3rd and 4th order) as well as their sketching. The database contains the site number, the vertical and horizontal site co-ordinates in the EOV and old projection systems, the location of the sites (county, settlement, sheet number), the sketch of approach, the date of measurement and site checking actions (Fig. 29.).

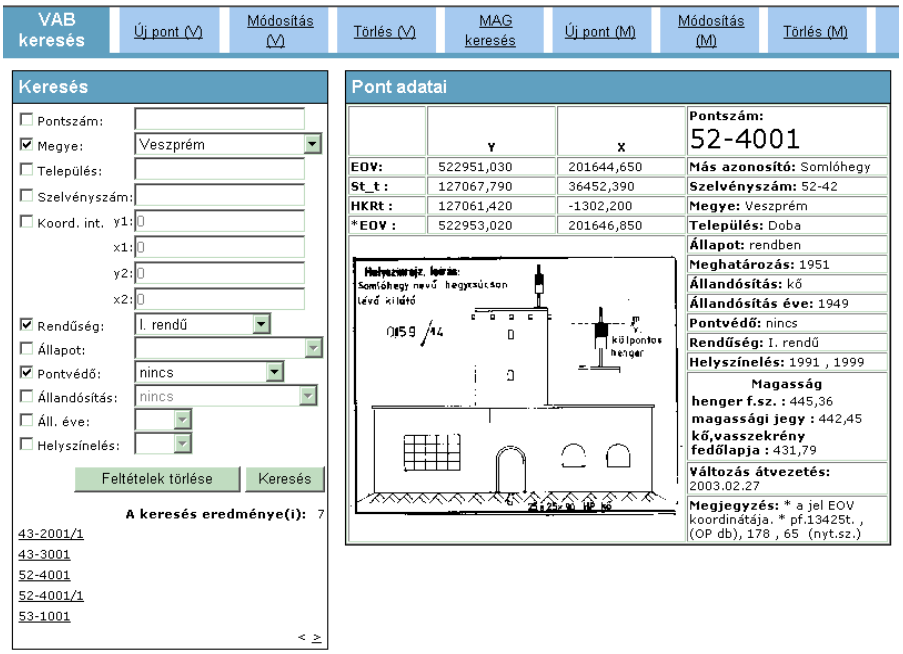


Fig. 27 Sample printout from EOVA Database

The military mapping agency is responsible for the preservation of the points of military geodetic orientation network as well as execution of the tasks related to its maintenance or accidental replacement of points.

Uniform National Height System (EOMA)

The EOMA has normal heights referring to the Kronstadt datum point. The national datum point is Nadap with height in the EOMA system H=173,1638 above Baltic Sea level; (H= 173,8385 above the Adriatic Sea level, in which the height system of Hungary was given earlier.) (Fig. 30.).
EOMA consists of:

- 41 principal fundamental benchmarks (16 established on rock, others are deep-drilled benchmarks situated in sedimentary area),

- 800 of 1st order special benchmarks based in 3-5.5 m deep monumentation,
- 5981 sites of 1st order,
- 5096 sites of 2nd order,
- 13 417 sites of 3rd order (GPS/geoid technique for the replacement of the classical 3rd order levelling was used since 2000),
- about 1100 points along the 1st order levelling lines with repeated measurements to study the surface height variations,
- 23 connecting levelling lines to the neighbouring countries.

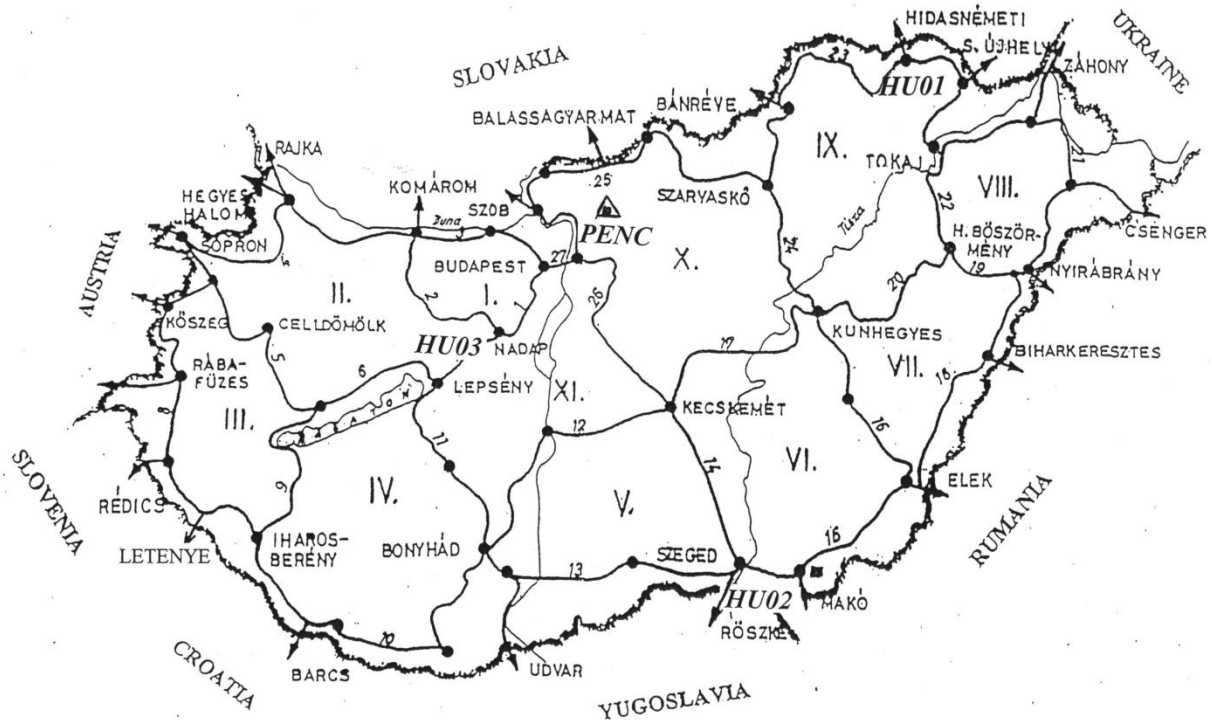


Fig. 28. Sketch map of the 1st order Uniform National Vertical Network (EOMA)

Hungary joined UELN (United European Levelling Network) in 1994 submitting levelling data connecting selected primary benchmarks. The sequential adjustments of the UELN network proved that EOMA is one of the best quality national levelling network in Europe. Our fundamental levelling site, Nadap, has been proposed and selected in 2007 as one of the 13 European datum point of the newly defined EVRS2007 European height reference system. Hungary contributed to EUREF's EUVN Densification Action, measuring and submitting high quality GPS and levelling measurements at 20 selected stations.

An efficient technique has been elaborated at FÖMI for the replacement of the 3rd order levelling with GPS measurements and geoid information. This technique was successfully applied in the practice for the completion of the EOMA 3rd order network in the Transdanubian region in 2000-2005. This work is being continued to provide levelling benchmarks to all Hungarian settlements, which are not yet included into the previous EOMA realizations.

The re-levelling of the EOMA 1st order lines has been started in 2007 at the NE part of the country. The complete re-levelling is planned to complete by 2011.

Preparations for the EOMA modernization also has been started, where the vertical control network is being prepared to better serve and exploit the needs and capabilities of the modern, satellite positioning techniques. Plans for an integrated network are being elaborated, where all physical (levelling, gravimetry) and geometric (GNSS, InSAR) techniques are represented and will provide the long term means of the national geodetic control.

The EOMA database was also created and is operated by FÖMI and involves the following information (Fig. 31.) about the levelling control sites (1st, 2nd and 3rd order): site number, vertical coordinates, site location (county, settlement, and sheet number), date(s) of measurement and site inspection(s), scanned site sketch and description.

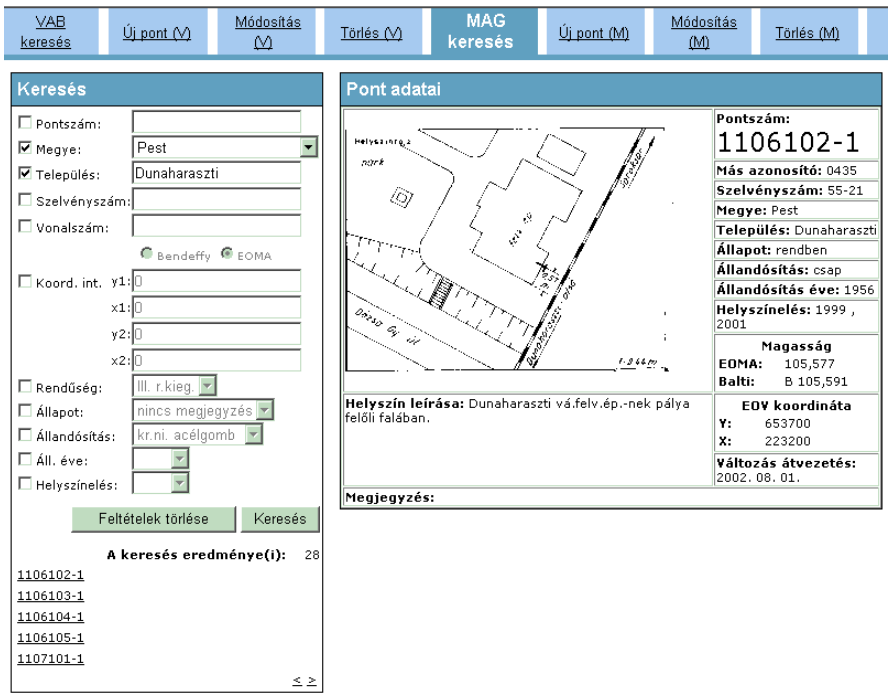


Fig. 29. Sample printout from the EOMA Database

National GPS Network (OGPSH)

The FÖMI Satellite Geodetic Observatory (FÖMI SGO) is responsible for all geodetic GPS developments (techniques and networks) in Hungary. The FÖMI SGO maintains and operates the Hungarian GPS Geodynamic Reference Network (HGRN), the national GPS network (OGPSH) and the Hungarian Active GNSS network.

The 'more classical, stone-monumented' OGPSH network is being built-up from the following components:

- Hungarian part of the EUREF/ETRS89 Network: 9 sites (1991 and re-established in 2007),
- OGPSH frame network: 23 sites (re-measured periodically)
- the OGPSH network: 1153 sites (measured 1995-97, see (Fig. 32.)

The coordinates of the OGPSH sites are available in the ETRS89 (ETRF2000 epoch 2007.4) reference system, as well as in the EOV projection system for mapping purposes.

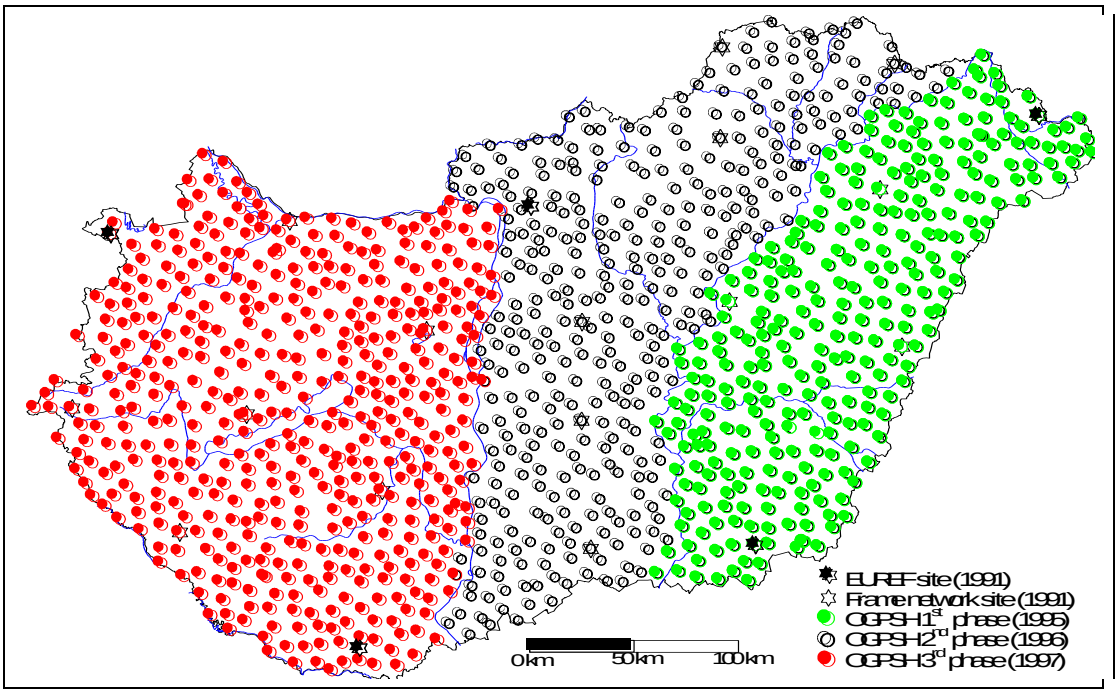


Fig. 30. Sites of the National GPS Network (OGPSH), Hungary

An OGPSH Database was created and is operated by FÖMI. The database contains the most important data of the GPS control sites as site identifier, the EUREF and the EOV vertical and horizontal co-ordinates as well as the site location (county, settlement and sheet number), site-access description and scanned site sketch.
The superior accuracy of the OGPSH allows the analysis of the traditional EOVA network. A comparison and analysis have been performed using a simplified 7-parameter Helmert transformation. The horizontal residuals after transformation are shown in (Fig. 33.) The maximal residuals are about 0.5 meters at the edge of the network.
In order to better serve the surveyors and avoid misuse or misinterpretation of the ETRS89/EOV transformation software tools were made available to perform the cm-accuracy transformation. The free EHT software uses local 7-parameter transformation and may be used for post-processing. A new version of the software has been prepared and may be downloaded from the GNSSNET server (www.gnssnet.hu/downloads/EHT4.1_Setup.exe), where the latest geoid has been built in resulting improved reliability for the transformed height component. The VITEL solution is designed for real-time applications and available for a nominal fee. The software and the integrated database may built in the rover GNSS receivers and provide cm-accuracy transformed coordinates in our national EOV system.

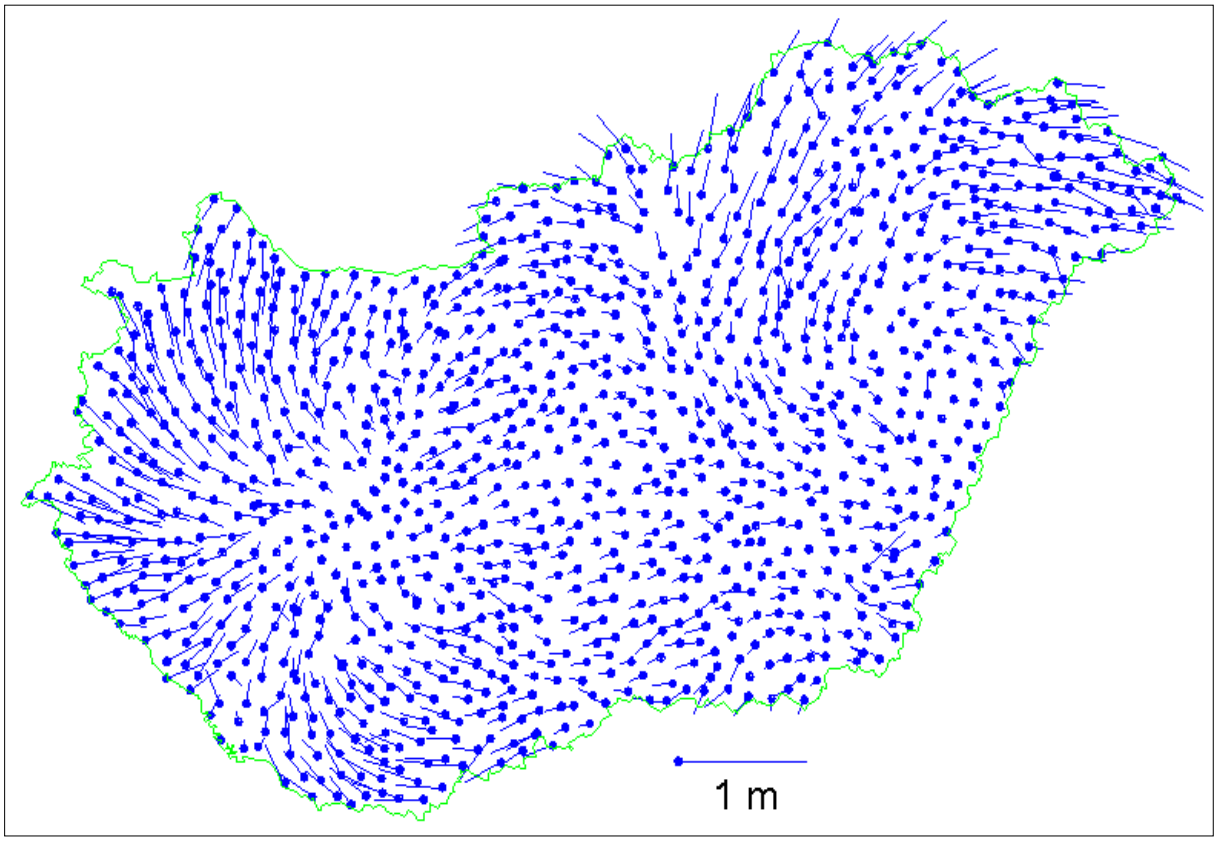


Fig. 31. Horizontal transformation residuals at the OGPSH sites

OGPSH PONTLEÍRÁS 2007

A hálózat pontosított elhelyezésével az ETRS89/ETRF00 vonatkozási rendszerben

GPS SITE DESCRIPTION FORM 2007

Updated ETRS89/ETRF00 reference frame realization

A pont EOV száma: 04-1115 **EOV identifier:**	**Település:** Hegyszentmárton **Settlement:**
Kiválasztotta: Paulik Sándor, 1997 Selected by:	A pont jellege: HP Type of the site:
Pontvédelem: Safety construction:	Special information:

ETRF00(R05)	X= 42300079,291	Y= 2381675,815	Z= 4556995,642
ETRF00(R05) WGS84	46-53-28.4104	= 10-6-2.3514	h= 215,899
EOV	y= 555501,39	x= 22270,24	H_{GPS}= 171,24

Megközelítési leírás (Approach description)

Hegyszentmárton templomától a temető felé DK irányba haladva, 2.3 km után található a pont, az út mellett 7 méterre, a 47-es számú villanyoszlop közelében.

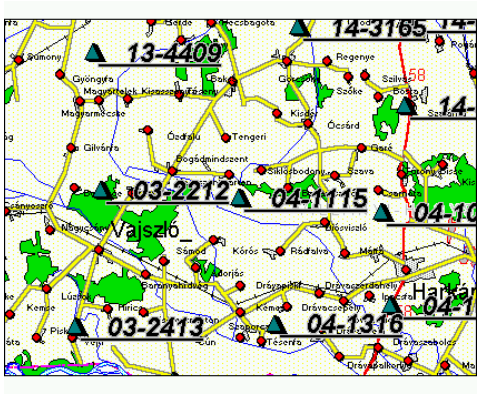
Megközelítési térkép **1 : 200 000** **scale map for approach**	**Helyszínrajz** **Site sketch**
	

Fig. 32. Sample description form of the OGPSH network sites

Integrated National Base Network (INGA)

In order to preserve the classical national geodetic reference networks and reference frames on long term and reflecting to the changing user requirements the establishment of an integrated geodetic network (INGA) has been started in 2009. The planned network will consist about 1500 markers, which attributed with horizontal (EOV), leveling (EOMA), 3D (ETRS89) coordinates and gravimetric measurements. The markers are mostly selected from existing leveling benchmarks suitable for GNSS measurements and well-fitting to the network geometry. As the INGA network is designed for long term maintenance careful site selection and better marker protection is needed. The site selection and GNSS measurements are being done parallel to the advancement of the EOMA re-leveling campaign.

Directorate of Geodetic Networks (DGN)

The Hungarian Active GNSS Network (GNSSnet.hu)

The GNSSnet.hu reference station infrastructure consists of 35 Hungarian and 19 external stations integrated from the neighbouring Austria, Croatia, Romania, Serbia, Slovakia, Slovenia and Ukraine (Fig. 13.) In order to ensure long term cross-border cooperation, FÖMI signed bilateral GNSS data exchange agreements with partner institutions from Romania, Serbia and Ukraine on 19 May 2010 and with the Slovenian Geodetic Authority on 24 November 2010. The consistency of the Hungarian ETRF2000 Epoch 2007.4 solution for the external station coordinates and the solutions of our neighbours meets all practical cross-border surveying requirements. The network extension project has been completed; the current station geometry enables FÖMI to provide cm accurate reference data throughout the whole territory of Hungary in either real time or in post processing mode. The average interstation distance is now less than 60 km, which is considered to be optimal in network RTK (Real Time Kinematic) atmospheric error modelling. In 2010 FÖMI upgraded three of its older GPS-only stations to GPS+GLONASS and is planning to upgrade the remaining two by the end of May 2011. The new hardware installed at these stations is capable of receiving the GPS L5 signal and can also track Galileo and COMPASS satellites. When the upgrade is finished all Hungarian reference stations will be equipped with individually absolute PCV (Phase Centre Variations) calibrated choke ring antennas to guarantee the availability of high quality observation data.

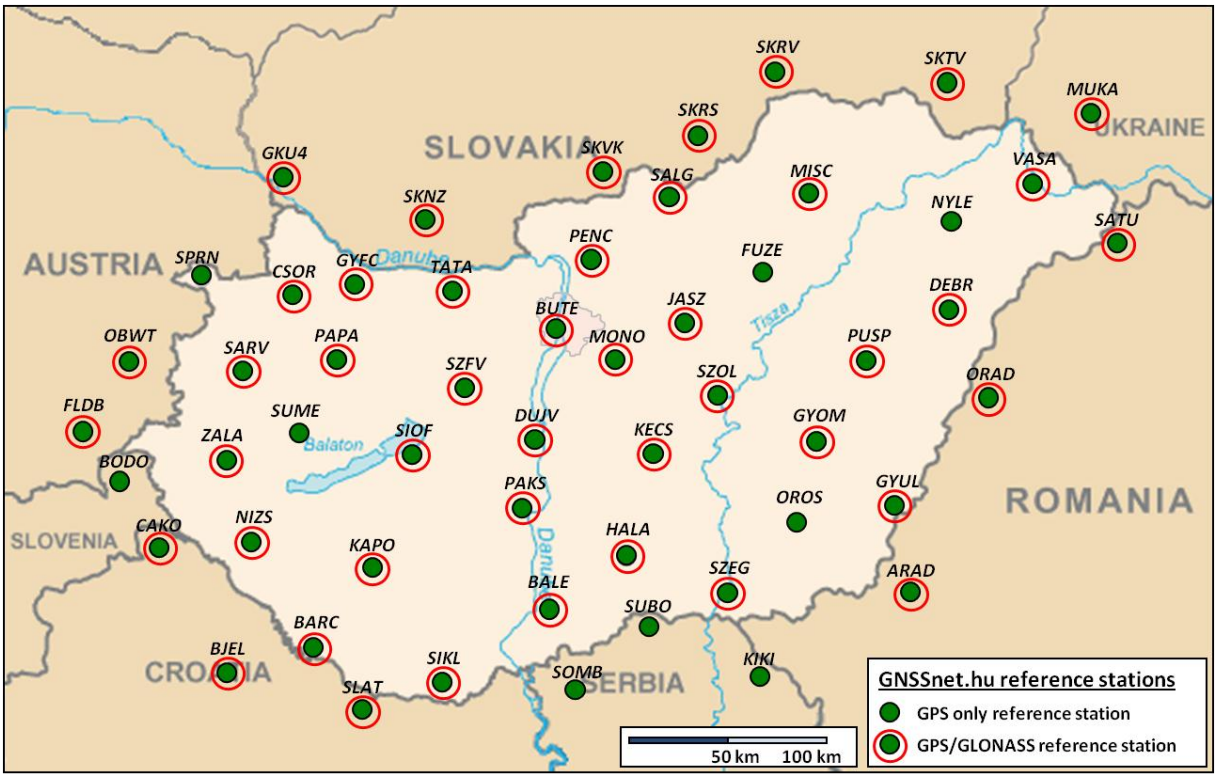


Fig. 33. The Hungarian Active GNSS Network – GNSSnet.hu

Four Hungarian stations are included in the EPN (EUREF Permanent Network): PENC, OROS, BUTE and SPRN, two of which (PENC and BUTE) also provide real-time data in RTCM 3.0 format. FÖMI's GNSS Service Centre operates at the Satellite Geodetic Observatory in Penc and is responsible for the provision of real-time and post-processing GNSS services and customer support. The computing centre is located at the main FÖMI headquarters in Budapest. The Service Centre is committed to providing state-of-the-art services to its clients. It aims to satisfy all user requirements regarding data formats, therefore real-time corrections are available in RTCM 2.3, RTCM 3.1 and CMR (Compact Measurement Record) formats and all major Network RTK concepts (FKP, PRS and MAC) are supported. For post-processing applications RINEX and virtual RINEX data is provided with an update rate of up to 1 Hz. Higher data rate observation files are available on request. During the past one year new network RTK data

processing methods and new real-time service types have been introduced to further improve the quality and diversity of FÖMI's GNSS service.

1. GPS+GLONASS information is now provided for MAC (Master-Auxiliary Concept) data users.

2. A new differential GNSS data stream has been set up primarily for GIS applications in RTCM 3.0 format containing both GPS and GLONASS information.

3. Centimetre accurate real-time transformation from ETRF2000 to the Hungarian EOV grid is now supported directly via the transmitted corrections.

4. A new PDA/mobile phone based service quality monitoring system has been developed to help users monitor the integrity of real-time GNSSnet.hu services while conducting on-site measurements.

5. A complex fleet management system has been developed enabling subscriber companies to follow their RTK rovers online.

FÖMI's GNSSnet.hu service has 950 registered user accounts (of more than 700 organizations), representing the full spectrum of the Hungarian geodetic and GIS community. In order to increase the number of users FÖMI entered the precision agriculture market in 2009 and already has 29 clients from this sector. GNSSnet.hu Network RTK corrections are successfully applied for agricultural machine auto-steering in several farms across the country.
Hungary is a member of the EUPOS initiative and builds its reference station network according to the EUPOS standards. In order to fulfil the standard requirements Hungary makes efforts to improve the reliability of its services. The average availability of our real-time services was 99.6% for 2009 and above 99.7% for 2010. This level can only be increased further by duplicating certain key elements of the data gathering network and/or the central processing. According to current plans a fully automated backup system will be installed in the computing centre to minimize the risk of single point failures. GPS/GNSS technology is being used for two decades in the Hungarian surveying practice; however a legal regulation of satellite technology has not been released so far. In May 2010 a ministerial decree (Nr. 47/2010) has come into force, which regulates the application, documentation, control, verification and acceptance of geodetic point positioning using GNSS technology. Based on the first year's law-enforcement experiences the regulation will soon be revised for the benefit of Hungarian surveying professionals and land administration.

Geoid developments

The latest gravimetric quasigeoid solution (HGEO2000 - Fig. 36.) was computed at the FÖMI Satellite Geodetic Observatory in 2000. It was derived from more than 380 000 gravimetric measurements and the GPM98CR (n=720) geopotential model. The solution refers to the GRS80 geocentric ellipsoid, its estimated relative accuracy is better than 0.5 ppm. The HGEO2000 geoid solution is available in digital form on a 1.5' by 1.5' grid. This solution represents a major improvement both in accuracy and spatial resolution comparing to the previous versions. As the Hungarian gravimetric database has sufficient accuracy new geoid computation is only planned, when new global geopotential models will be available.
Supporting the GPS heighting activities the gravimetric quasigeoid has been combined with levelling and GPS data. The combined HGGG2000 GPS-gravimetric solution is already used in Hungary for the 3rd order densification of the vertical control network.
In the next future we are re-computing the gravimetric geoid solution using the latest global geopotential models (e.g. EGM08) and updated gravimetric and DTM data.
In order to realize a combined geoid solution, as a height reference surface being used for GNSS heighting, a GPS/leveling database is being established. The data collection was started in 2000 and the work is continued in the frame of the INGA project. The 1st version of the homogeneous height reference surface will be released in 2011.

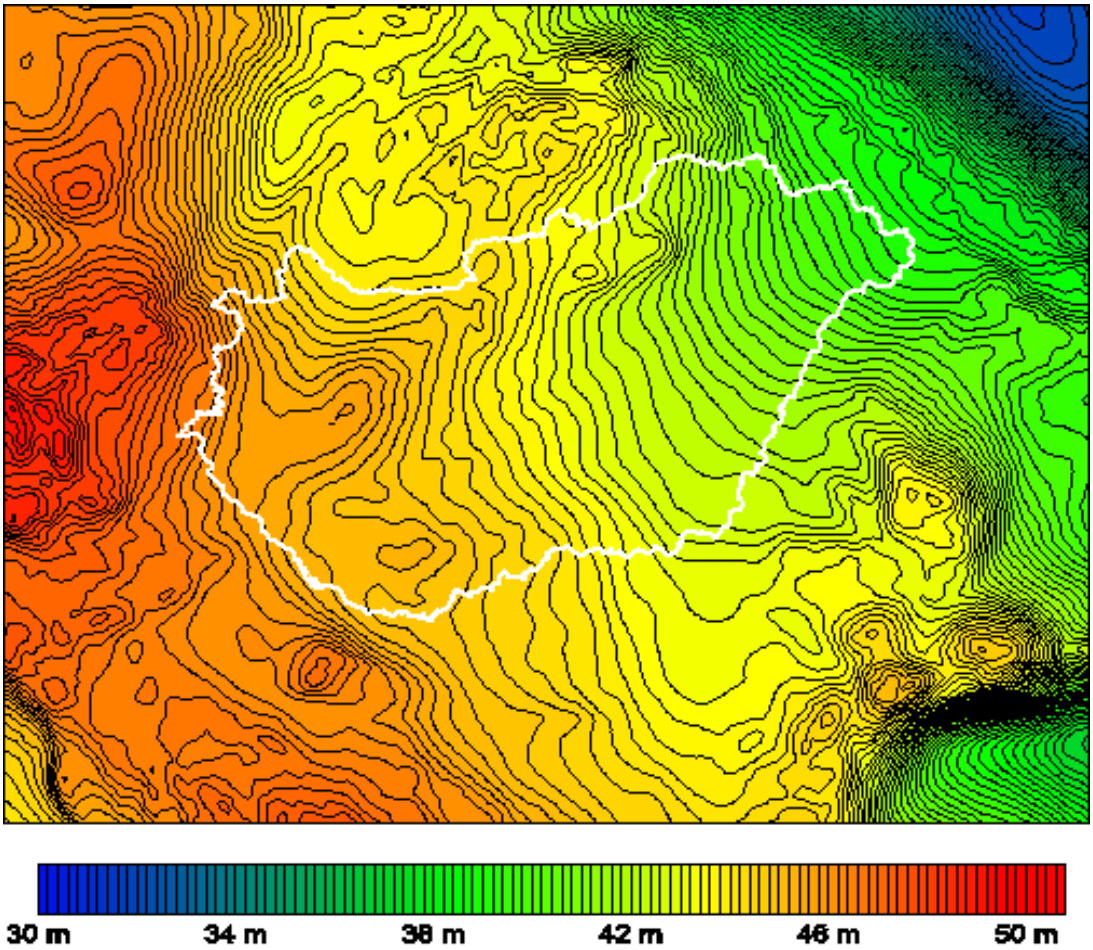


Fig. 34. The HGEO2000 gravimetric quasigeoid solution. Contour interval: 0.1 m

STATE BOUNDARY SURVEYS

The total length of Hungary's boundary lines with seven neighbouring countries is over 2200 km. On these lines more than 50 000 corner points can be found, which are recorded in different co-ordinate and map systems (4 types) that were valid at the time of the peace treaties. The state boundary survey is performed by the Division of State Boundary Survey of FÖMI. The roles of the Division are the followings:

- tasks of surveying, updating and maintaining the state borders co-ordinated by the Police (Ministry for Home Affairs),
- production of detailed technical summaries in boundary documents for jobs accomplished with the experts of the neighbouring countries and approved by competent authorities,
- tasks concerning the obligations of the owners of the border markers.

The accurate technical border documentation edited by the Division, verified by international agreements and kept at FÖMI, contains the co-ordinates of the corner points and their descriptions. Thus, these serve as a technical (surveying) basis of any international contract related to the state boundaries.

Fig. 35. Hungarian-Rumanian-Ukrainian triplex state boundary mark

Besides the daily routine, the Division is responsible for a unified co-ordinate and map system covering the whole Hungarian state border and for regulations which will meet the current demands and will be compatible with future surveying jobs in Hungary.

DIGITAL ORTHOPHOTO PROGRAM OF HUNGARY (MADOP)

In the frame of European Harmonisation Programme of the Department of Land Administration at the Ministry of Rural Development, three nation-wide connected projects were launched by FÖMI in 2000 to be carried out during 3 years.
These are:

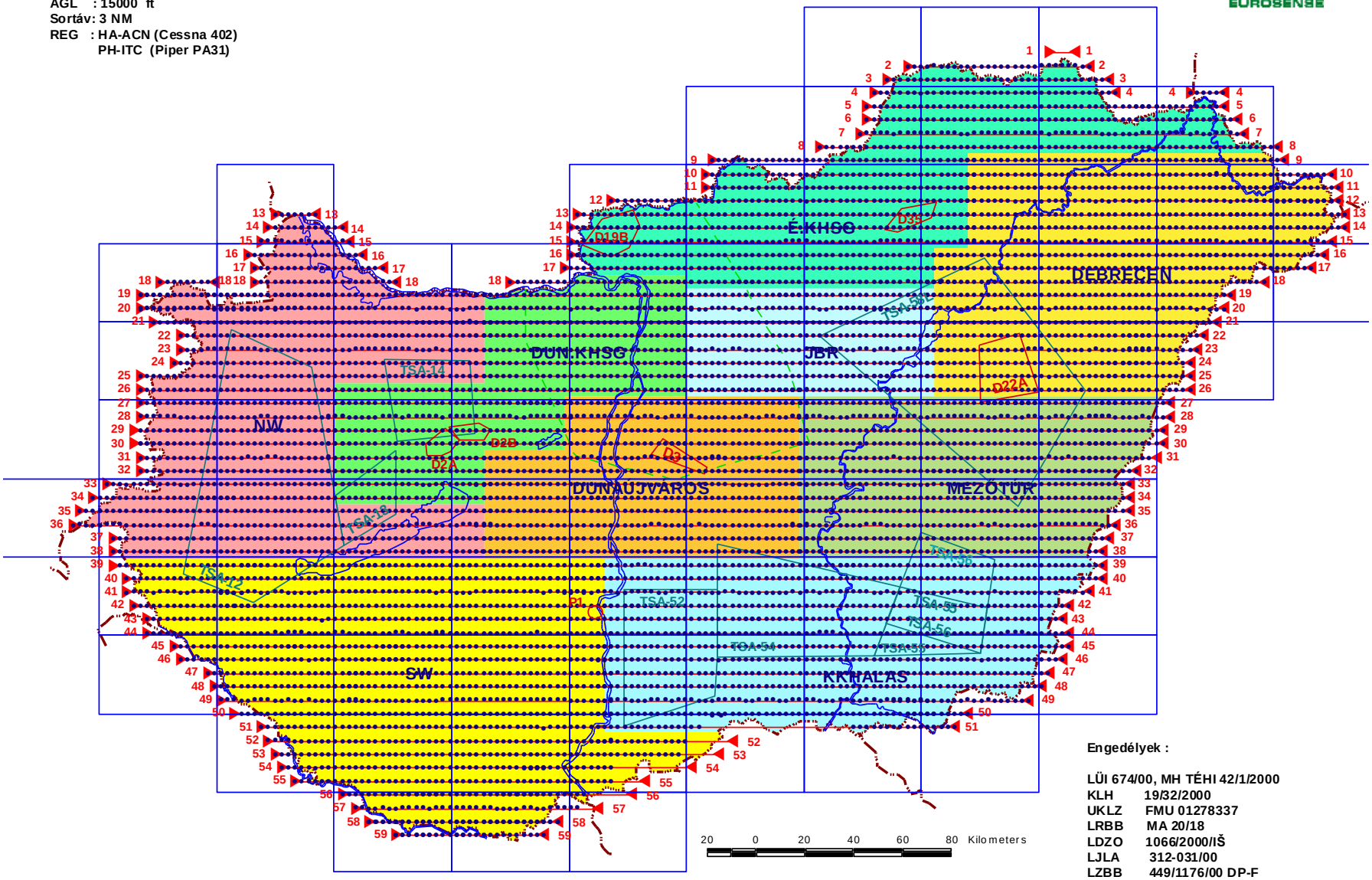
- "Wall to wall aerial photography of Hungary";
- Creation of 5 m x 5 m resolution DEM of the country;
- Set up of full digital orthophoto coverage of Hungary.

The project "Aerial photography of Hungary 2000" was finished successfully during the time period between March and June 2000. It resulted about 7000 aerial analogue colour diapozitive photos at scale 1: 30 000 (camera – RC-30; f=152 mm, H = 4500 m). The analogue aerial photos were scanned with an aperture 21 μm. The ground resolution of scanned images - ~ 0.60 m.
For the production of digital ortophotos we needed digital elevation model. As a result of almost 20 years project – ended in 1999 – Hungary is covered by ~ 4098 topographic map sheets at scale 1:10 000 in analogue form. The estimated and overall quality controlled accuracy of contour lines of these topomaps is between ± 0.5 - ± 1.5 m, depending on the interval of contour lines of a given map-sheet according to the national standard. In the national archives of FÖMI, the colour prints, the individual layers of contour lines, planimetry and hydrography of 4098 sheets (altogether 4 x 4098 sheets) are available. During one year period, the colour prints and three layers (hydrography, planimetry, contour lines) of 1:10 000 scale topomaps were scanned and geo-referenced. The layers of contour lines of topomaps were vectorised in the period 2000-2003.
The vectorised contour lines served as the basis for creation of 5 m raster size and 0.7 m accurate in Z DEM for the whole country. The 5 m x 5 m DEM of Hungary (HUN-DEM, consisting of about 4 billion points) is archived according to map grid of 1:10 000 and is available for the user community, too.
A complete photogrammetric technology was elaborated for analytical and digital aerial triangulation to use the existing high accurate 4th order national triangulation network for determination of orientation elements of aerial photos taken in 2000.
The technology took into consideration the creation of orthophotos on the base of HUN-DEM and the orientation elements of aerial photos adjusted for the whole country. During the ortophoto processing the pixels of the scanned analogue images were resampled which resulted 0.5 m ground resolution digital ortophoto for the whole country.

MAGYARORSZÁG LÉGIFÉNYKÉPEZÉSE

AGL : 15000 ft
Sortáv: 3 NM
REG : HA-ACN (Cessna 402)
PH-ITC (Piper PA31)

EUROSENSE



Engedélyek :

LÜI 674/00, MH TÉHI 42/1/2000
KLH 19/32/2000
UKLZ FMU 01278337
LRBB MA 20/18
LDZO 1066/2000/IŠ
LJLA 312-031/00
LZBB 449/1176/00 DP-F
LYBA -

Frissítve: 2000.06.21

Gyetvai József, T: 30/ 9492-857

Fig. 36. Aerial photography of Hungary in 2000

An overall quality control was applied during the whole procedure and for every map sheets of digital orthophotos. The accuracy of aerial triangulation can be characterised with ± 0.25 m in X and Y ground co-ordinates. The "MADOP 2000" project was finished in June 2003.
The high resolution and quality checked orthophotos were archived (about 2.5 terabyte) as part of meta database, according to the 1:10 000 map grid and FÖMI started to distribute among end-users of several professions. The average accuracy of the orthophotos is characterised by 0.7 m in X, Y on the ground.
In year 2005. the "wall to wall aerial photography of Hungary" was repeated in the time period June – September 2005. The program "aerial photography of Hungary 2005" was carried out according to the parameters of "aerial photography of Hungary 2000". (It means, that the scale was 1:30000; H = 4500 m; camera – RC-30; film – colour diapozitive; scanning aperture – 21 µm.) . Due to GPS navigation the co-ordinates of focal points of aerial camera during photography were the same as in year 2000 with accuracy about 50 m. The digital ortophoto with accuracy ~ 0.7 m was produced based on the same 4th order national triangulation network and 5 m grid digital elevation model – HUN-DEM, used for MADOP-2000. The MADOP-2005 now available for use since January 2006.
In year 2007 new project for creation of digital orthophoto of Hungary was launched. The territory of Hungary was divided into four parts and year by year one of these parts is covered by aerial photos (see Fig. 39.).

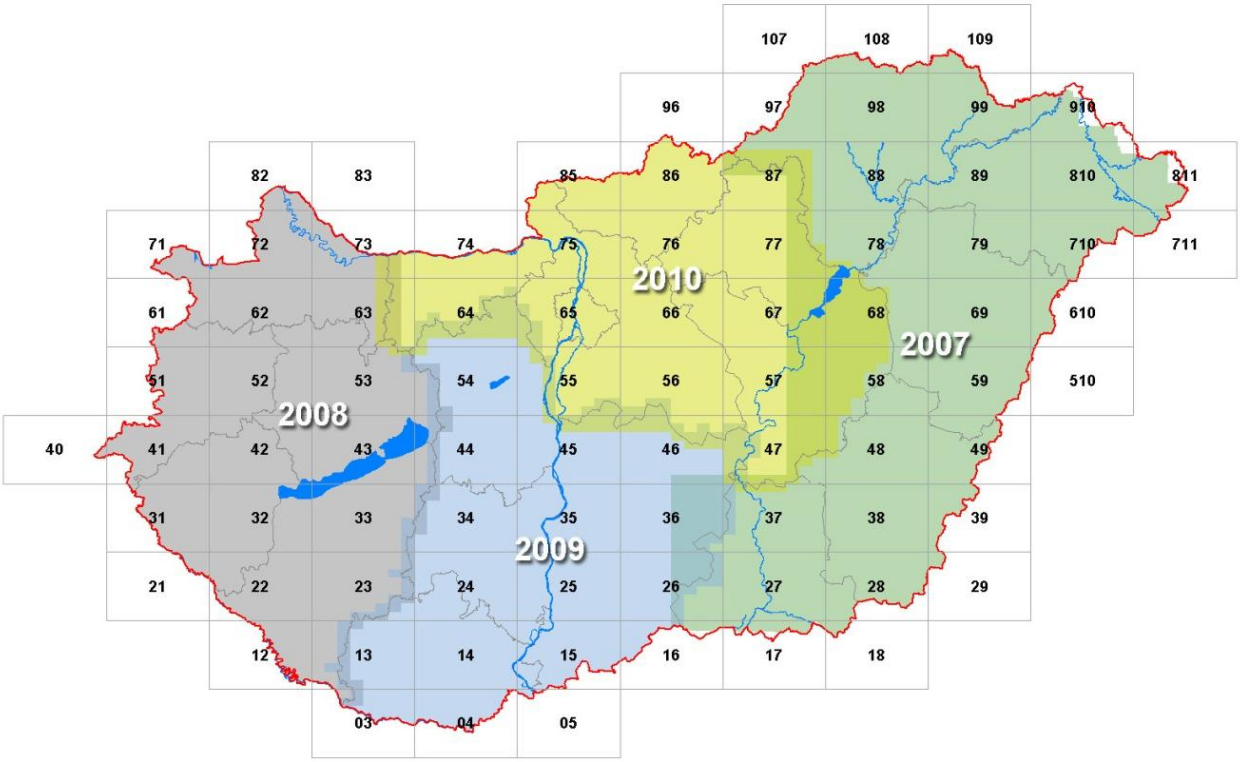


Fig. 37. Orthophoto coverage for the years 2007-2010

Starting from year 2007 instead of analogue camera digital camera is applied for aerial data acquisition. The type of digital frame camera: Vexcel UltraCam. Ground resolution of the digital images 50 cm/pixel. As an advantage among others of the digital cameras at the same times panchromatic, colour and colour-infrared images are taken and available for end users. For the production of the ortophotos we applied the technology of MADOP 2000 and 2005. It means that for aerial triangulation of the frames, eg. for ground control points we used the same 4th order national triangulation network. The ortophotos were created on the base of orientation elements resulted from the aerial triangulation and on the base of HUN-DEM.
The time periods of aerial data acquisition of the last four years (see Fig. 39):

- 15th July – 22nd September 2007;
- 2nd August – 11th August 2008;
- 6th July – 21st July 2009.
- 8th July – 21st August 2010

The frames of aerial photos, the orientation elements of the frames, the high resolution and quality checked orthophotos were archived and are available for end-users of several professions.
The orthophotos geo-referenced with high accuracy that are easy to handle on PC-s – among several other applications – can serve as common spatial reference for the Hungarian GIS and RS systems.

The digital orthophotos are suitable for several applications, such as

- Creation Hungarian Land Parcel Identification System,
- Topographic mapping,
- Recording of statement of several agricultural plants,
- Establishing of land use categories,
- Delineation of wastelands,
- Surveying of soil map contents,
- Delineation of soil erosion areas,
- Mapping of inland waters,
- Regional planning,
- Archaeology,
- Forest inventory, management etc.

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REMOTE SENSING ACTIVITY IN THE INSTITUTE OF GEODESY, CARTOGRAPHY AND REMOTE SENSING (FÖMI)

Directorate of Remote Sensing (DRS)

The main activities of the Directorate of Remote Sensing in FÖMI are:

- research and development of technologies for the applications of remote sensing, mainly in the areas of agriculture and environmental protection/nature conservation;
- providing an efficient service as National Distributor in the distribution, processing, archiving and utilization of satellite and aerial remote sensing data, and consultation for the entire Hungarian user community in their Remote Sensing projects;
- operation and development of the Hungarian Land Parcel Identification System (LPIS-Hu) and Control with Remote Sensing (CwRS) which play an important role within the IACS system of direct agricultural area-based payments in Hungary.

FÖMI DRS distributes different satellite images and has contracts with EURIMAGE, SPOTIMAGE, EUROMAP and the INTA Spaceturk. FÖMI DRS has been maintaining the national archive of satellite images too. The territory of Hungary is completely and repeatedly covered by SPOT, Landsat TM and IRS images. FÖMI DRS serves also as the basic institution of the Hungarian Space Office in Earth Observation.
Under the direction of FÖMI DRS, complete aerial photography coverage of Hungary is executed every five years (2000, 2005 and 2010 (see previous chapter)). Ortho photography of the country at scale 1:10 000 was completed on the basis of these countrywide acquisitions.

Scientific activities, results and applications

Maintaining and further development of the physical block based Hungarian Land Parcel Identification System (LPIS-Hu) for IACS

Past years justified the significance and advantages of a continuously evolving scientific and technological background of using remote sensing methods for agricultural purposes. The Land Parcel Identification System (LPIS-Hu) and Control with Remote Sensing (CwRS) play an important role in the system of the direct agricultural area-based payments in the EU Member States. The preceding R+D phase and the operational years of the National Crop Monitoring and Production Forecast program (NCMPF, 1997-2003) that had been carried out by FÖMI provided a good basis for the establishment of LPIS-Hu and CwRS.

The LPIS-Hu ('MePAR' in Hungarian) is one of the main ongoing activities of FÖMI DRS since 2002. After DRS completed the orthophoto background and the GIS database of the LPIS-Hu, the system was integrated into the Integrated Administration and Control System (IACS) as one of its main components, and it has been the basis of the area-based agricultural subsidies since 2004. As a pillar of the IACS, it provides GIS and administrative support for the farmers during the procedure of area-based subsidy applications, and for the IACS institutes during the administration and different control procedures.

Fig. 38.: Illustration of the LPIS-Hu (MePAR) GIS database with orthophoto background

Basic data

The system is based on physical blocks with natural boundaries (Fig.38.), which was found to fit most appropriately the country's agricultural utilization characteristics. In 2010, the entire territory of Hungary was covered by approximately 372 000 physical blocks. The average size of blocks is 25 ha, including all land cover categories. The base and background of the vector data set-up are orthophotos and occasionally HR satellite images. The boundary of physical blocks and the 'areas non-eligible for the single area payment scheme' (SAPS) are graphically represented if they are larger than 0.1 ha.

The LPIS provides geographic information, with fixed physical block boundaries and the area of eligible land that is necessary to apply for subsidies for some 200 thousand farmers who participate in the SAPS. In this framework, the farmers indicate the agricultural lands they use. The LPIS gives the GIS background for the full administrative crosschecks prior to the subsidy payment and the physical (classical on-the spot and remote sensing) checks of the applications selected by risk analysis and at random.

By relatively fast recording of land-use changes, the GIS system of the LPIS is a quality development in the field of national GIS service, agriculture, rural development and environmental management and the control of existing national GIS data. The LPIS is a unique GIS-result based on remote sensing. Its products and services are used by more than two hundred thousand users only in agriculture and also have been used for years by officials of institutes that participate in the subsidy payment and control process.

Quality assurance

Failure of the LPIS in unambiguous localization of each agricultural parcel induces risks the double declaration of land, whilst inadequate quantification of eligible area renders the crosschecks ineffective prevention and identification of over-declarations by farmers, both involving financial risks for the EU Funds.

Therefore the European Commission introduced a quality assurance framework, a series of tests assessing compliance for each specified quality requirement by the EC Regulation No 1122/2009, calling all Member States for an annual reporting on seven prime quality elements.

All prime quality elements have been developed into quantitative measures and the test results therefore represent an objective and comparable information on the different LPIS. The main application of this quantitative information is to provide an instrument for achieving business process improvement.
In 2009, Hungary volunteered to participate in a pilot project, helping the EC with the ongoing development and refinement of the test.

From 2010, execution of the LPIS test is compulsory for every Member State. However, first year is still considered to be trial. Preliminary results of the first year's execution showed some weaknesses of the Hungarian LPIS system, none of which was unknown for the DRS. No remedial actions were needed.

As for the specialties of physical block system, the current version of the documentation on LPIS tests does not take them into account as much as needed. During the execution of the test we defined waivers for this type of LPIS, which were introduced at the LPIS workshop in Amsterdam in April 2011 and are still to be approved by the JRC.

The current year's detailed findings are to be reported by 30 April 2011.

Subsidy scheme specific thematic layers of the LPIS

The Community's agricultural policy – especially after CAP reform – puts an emphasis on efficient agri-environmental and rural development actions for sustainable development. In the framework of these actions, the farmers are compensated by subsidies if they observe certain restrictions and follow some technological instructions.

The LPIS includes additional thematic layers contributing to the management of the area-based agri-environmental and rural development subsidies.

The thematic layers of the LPIS are a subgroup of data which is part of the LPIS GIS and which includes data of logically connected subsidy schemes. The thematic layers are derived from LPIS database or the data transmitted by the Agricultural and Rural Development Agency. The thematic layers are created by GIS methods based on a national standards. These thematic layers are:
Condition of 2003 (GAEC -Good Agricultural and Environment Condition- non compliance with the conditions on 30. June 2003) – from 2008.
Afforestation –EAGGF from 2008.
Afforestation –EAFRD from 2009.
Reedbeds –from 2009.

Since 2004 the LPIS has included data to identify the Less Favoured Areas and the Environmentally Sensitive Areas. In 2005 according to the Community's Directive, the thematic layers of vulnerable water bases and nitrate sensitive areas were integrated into LPIS GIS.

In 2008, subsidies for NATURA 2000 areas were introduced. This affected about 1.9 million hectares in Hungary. The application and control of this scheme are supported by a thematic layer integrated to LPIS GIS.

The thematic layers of High Natural Value Areas – those affected by wind erosion and floodplains – designate the eligible areas for agri-environmental subsidies starting in 2009, in the framework of 'New Hungary Rural Development Program".

The preparation of thematic layers (Cumanian mounds and sweep-pole wells) for preserving landscape elements had been finished, and they are used in Hungary to expand the system of conditions of GAEC with the arrangements from 2010.

In order to prevent soil-erosion and agricultural nitrate pollution, the Good Agricultural and Environmental Condition criteria system requires farmers not to plant row crops on slopes steeper than 12% and not to use fertilizer replenishment. Two layers were set up to indicate steep areas supporting to fulfil the requirements. A 5-metre resolution digital terrain model was the base of both layers. First, a slope-category map (Fig.39.) was created and then a vector-graphical map which indicates areas with more than 12% and 17% steep slopes.

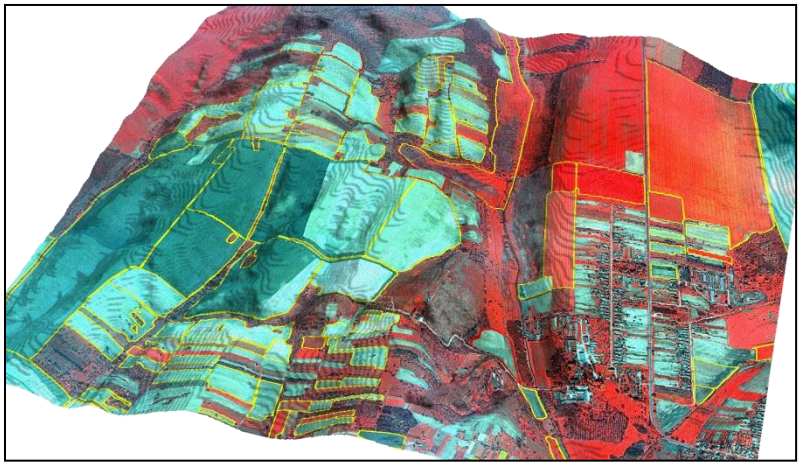

Fig.39.: Illustration of the raster slope category maps

The boundaries and identification numbers of the rural cadastre parcels are displayed as an informative graphical layer in the LPIS maps. At time of LPIS introduction, only hard copy cadastre maps were available for the half of Hungary. In 2006, a vector database of rural cadastre parcels was completed to cover the whole country. This contributed to renewal of the cadastral layer of the LPIS.

These spatial data provide information for the farmers about the areas under restrictions concerning farm-management, as well as the eligible agricultural areas.

Systematic LPIS update and change management

The ministerial order (115/2003. FVM.) on the LPIS provides for the maintenance of the parcel identification system up-to-date. In 2005, the second year of operation, we updated the GIS of the LPIS. Around 300 thousand physical blocks and non-eligible area boundaries were reviewed based on new orthophotos covering the territory of the whole country. The 5 years between the set-up in 2000 and the updating bore significant changes in objects on the land-surface which affected the formation of physical blocks. Either the physical block or the non-eligible area boundaries had to be modified in 30% of the physical blocks. In order to reduce the amount of work, a mid-term scheme was set up in 2007. In this scheme, data recording and updating the physical block system are completed annually for 25% of the country. The physical block system was updated in Eastern Hungary in 2007, in Western Hungary in 2008, in South-central Hungary in 2009 and in North-central Hungary in 2010. The applied Vexcel digital camera (visible and infra red) (Fig.40.) recordings contributed to a good database at 0.5 meter resolution during the rotational update (from 2007).

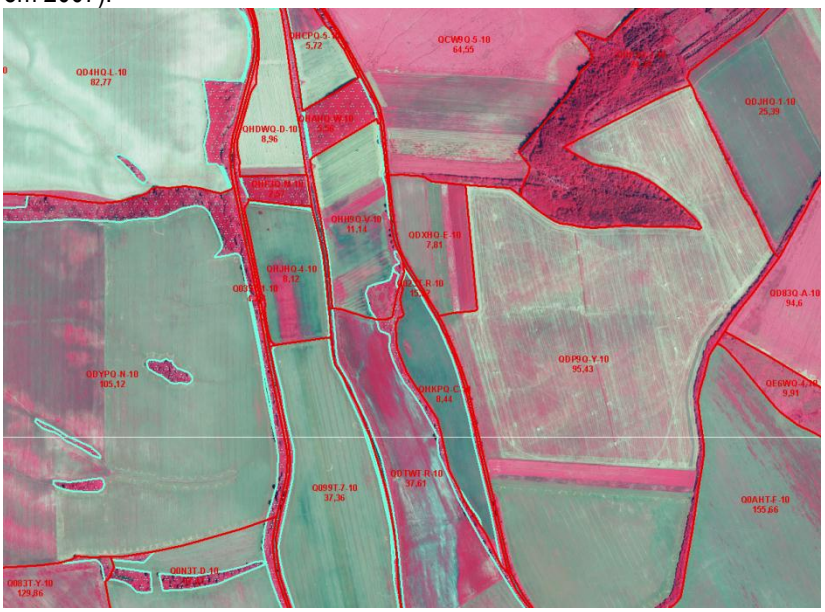

Fig. 40.: Illustration of the LPIS-Hu (MePAR) GIS database with infra red orthophoto background

During the LPIS update with 0.5 m resolution colour orthophoto background, we checked the LPIS blocks one by one. If it was necessary, we used satellite images to identify the land cover. If the surface changes (e.g.: meadow turned to forest, an industrial building was built on an agricultural area) compared to the previous update, we change the block boundaries of the reference system or the separation of eligible/non-eligible areas. In each case it is necessary to consider the national and the Community legislations regarding the eligible agricultural areas. FÖMI developed a process-controlled GIS software that integrates the aerial, satellite images and vector data. This software supports the one-by-one review of LPIS physical blocks and also provides a recording of the changes.

The database and the registration system must not result in any disadvantages for the farmers. The fulfilment of this Community principle is provided by the process in which each farmer can initiate the modification of the LPIS data connected to the cultivated agricultural area if he can verify that he suffers disadvantages. We check these applications by remote sensing methods and on-the-spot measurements. We create technical records of the checks that serve as a basis for the paying agency‘s decisions. Annually, some 4500 of these applications are received, half of them are eligible.

Technical solutions of publicity and issuing

Until 2007, farmers had received their own application packages by post before the submission of applications was opened. As an attachment, every package included an A3 colour map of the physical block cultivated by the farmer. In each year, around 1 million single block-maps were created to support the application. Starting from 2008, every farmer applies via internet and the maps are received electronically. Farmers draw the applied parcels electronically as well.

A well-trained expert network helps to fill out the application forms in a right way. We operate a Browser for the access to the LPIS in order to technically support these experts (local advisers, regional experts, integrators) via internet. Through this Browser, the physical blocks are available by orthophotos, land registration numbers and name of settlements. The Browser contributes to fill up and submit the application forms.

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The database and the registration system can not cause the farmers disadvantages. The fulfilment of this declared Community principle is provided by the process in which any of the farmer can ask the modification of the LPIS data connected to the cultivated agricultural area if he can verify that he suffers disadvantages. We check these applications by remote sensing method and ground measurements. We create technical records of the checks which are the bases of the paying agency‘s decisions. Annually some 2000 of these applications are received, half of them are eligible.

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Area-based Subsidy Control with Remote Sensing (CwRS)

The methodology and technology basis of the NCMPF can be used not only for information extraction at county and regional level, but also to extract information on the agricultural areas at parcel level. This allows the control of agricultural subsidy claims with the use of satellite images.
Using FÖMI DRS's operational remote sensing technology, the remote sensing control of national area-based subsidies was performed on the sample of 4-6% of all the dossiers (160-180 000) between 2000 and 2003. During this period of time, the reference system for the applications and the control was the cadastral system.
Since the EU accession, the Agricultural and Rural Development Agency (ARDA) is responsible for the administration and control of applications of area-based subsidies. The legal basis has also changed; the Integrated Administration and Control System (IACS) had to be fitted to the very strict EU regulations.
2004 was the first year for FÖMI when the remote sensing control ran on the new Land Parcel Identification System (LPIS-Hu), which is a physical block-based reference system. The new reference system, the technical requirements, specifications and recommendations of Directorate General, Joint Research Centre (EC DG JRC) needed some reconsideration of the previously used GIS technique of CwRS.
In the EU system, the applications for area-based agricultural subsidies consist of tabular forms and block maps with the drawing of agricultural parcels inside the physical blocks. Since 2008, subsidy claims can be submitted only electronically, via an Internet application, eliminating the need to input alphanumerical and vector data from paper. The remote sensing control of selected claims (dossiers) is the task of FÖMI. The core task is actual remote sensing control using satellite images, called Computer-Aided Photo-Interpretation (CAPI). The aim of CAPI is to answer three questions for every declared parcel: whether the declared crop can be observed in the parcel, whether the declared area is correct, and whether the parcel complies with the standards of Good Agricultural and Environmental Conditions (GAEC). High resolution (HR) image time series are used to determine crops, while exact area measurement is done using very high resolution (VHR) images or current ortho-photographs. Some standards of GAEC can also be checked with remote sensing. CAPI is carried out on several (25-30 in the previous years) graphic workstations, with a central database and automatic task distribution. The results of control are delivered to ARDA in digital form, containing tabular and geographical data. ARDA carries out follow-up checks based on the control results before the final decision on the acceptance or rejection of a claim. The overview of the control procedure is shown in Fig.41.
Since 2004, remote sensing controls have undergone some methodological improvements and changes. Extra care has been paid to the proper handling of so-called joint cultivation, a special Hungarian property of cultivation structure. In Hungary, most area-based subsidies consist of two parts: SAPS (Single Area Payment Scheme) and Top-Up (Complementary National Direct Payments), with somewhat different conditions. Regarding SAPS, the farmer is obligated to cultivate his parcel only and not to violate GAEC conditions, comparing with Top-Up, where above these requirements, only a few kinds of crops are subsidized with specific regulations. The definition of agricultural parcel and the GAEC regulation has also changed; in 2010, seven standards of GAEC were monitored during the CAPI instead of the former two.
The format and structure of control documents – i.e. electronic database and vectors in GIS – have also been improved to allow the most effective implementation of follow-up checks.
In the EU system, the total number of submitted claims in Hungary is between 185 000 – 190 000. Of these, about 12 000 is controlled with remote sensing every year. This can be considered as a rather big sample as compared to other member states. The successful control of this amount of dossiers (4-6%) within a very short period of time

proved that the only feasible solution to carry out on-the-spot checks is the use of remote sensing and GIS techniques for the majority of the claims.

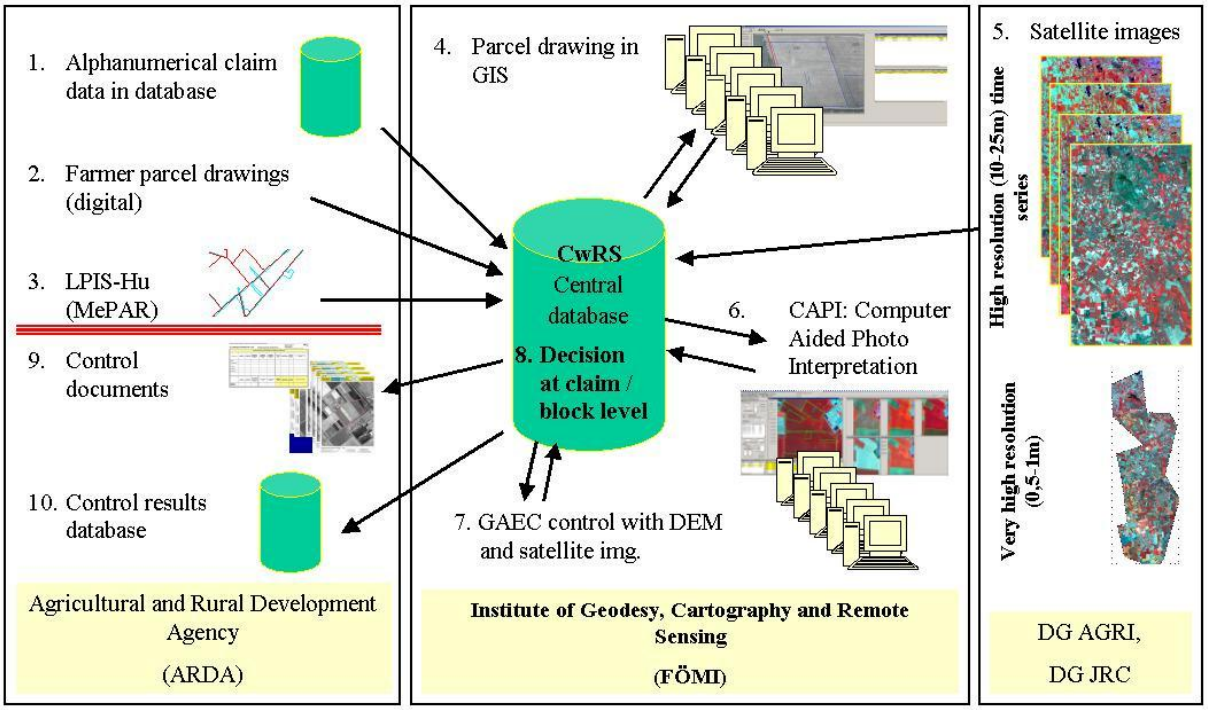

Fig. 41.: Basic Elements of Area-based Subsidy Control by Remote Sensing

Remote Sensing Applications Supporting the National Ragweed Control Program

FÖMI provided many services in the past 30 years to the Ministry of Rural Development (MRD) and to the former Ministry of Environment and Water (MEW). FÖMI also accumulated operational experience in the applications of remote sensing. The unique methodology of the operational Crop Monitoring and Production Forecast Program (CROPMON, 1997–2003) provided an excellent methodology basis for further application development. One of the operationally proven programs is the support to the ragweed control in Hungary.

Ragweed pollen-induced allergy has gradually become an important issue in Hungary. The number of people suffering from pollen allergy had been increasing so that there was an imperative need for a National Ragweed Control Program. For the efficiency of this priority program, the government amended the plant protection law in 2005. This allowed the Central Agricultural Office of Plant Protection and Soil Conservation Directorate (CAO PPSCD) to treat the infected areas almost immediately after their detection. This can be done before the pollen exposure. The authorities retrieve this cost from land users and proprietors in the form of fines. In Hungary, some 500.000 – 700.000 hectares were estimated to be strongly infected by ragweed. About 80% of this area can be pinpointed by remote sensing on the arable land.

Ragweed recognition is much more difficult than crop identification. The temporal development assessment of ragweed has fundamental importance. FÖMI produces a countrywide ragweed risk map focusing on the most heavily infected croplands. The ground recording can be done very efficiently by the Land Office Network (LON). Important case-categories are non-cultivated arable spots, stubble-fields of cereals and sunflower fields. These ragweed risk maps are derived from time series of medium and high-resolution satellite images. Based on the characteristics of weeds and the high resolution (HR) images, the delineation focuses on spots larger than 0.8 hectares. The most significant pollen production comes from these infected spots.

In 2005, ragweed risk maps were produced several times. The first risk map was the result of a retrospective analysis of the year 2004. Based on ground data from the PPSCD and satellite images from the previous year, a substantial model validation was carried out. It was found that about an infected area ten times larger (approximately 100 000 ha) could be detected using year 2004 images than based on data collected by the PPSCD in the field, restricting the comparison to ragweed stands reaching 0.8 ha. The operational ragweed monitoring

started to examine the status in 2005. The target of remote sensing detection was non-cultivated arable spots and the stubble-fields of cereals. Some 20 000 spots of 60 000 hectares were identified altogether in Hungary.
The Central Ragweed Information Server (CRIS) was developed in order to synchronize tasks among different authorities. The CRIS has been supporting the operative work from 2006. The ragweed risk maps produced by FÖMI are published in CRIS as input data for the LON's on-the-spot checks, which are exported to the dedicated integrated hand-held GIS-GPS equipment (Fig. 42.). The Server synchronizes 400-500 people's work in the most critical period of July-September.
Certainly, the redesigned Ragweed Control Program primarily builds on the co-operation of land users. To motivate inhabitants, spatial statistics of ragweed infection are available for the public in the form of electronic maps, via the web sites of FÖMI and MRD. After developing the server and providing multi-day trainings for users, the CRIS ensured a more efficient service. Since then, the server has undergone further major improvements, which were driven by the needs arising at different institutions participating in the program.

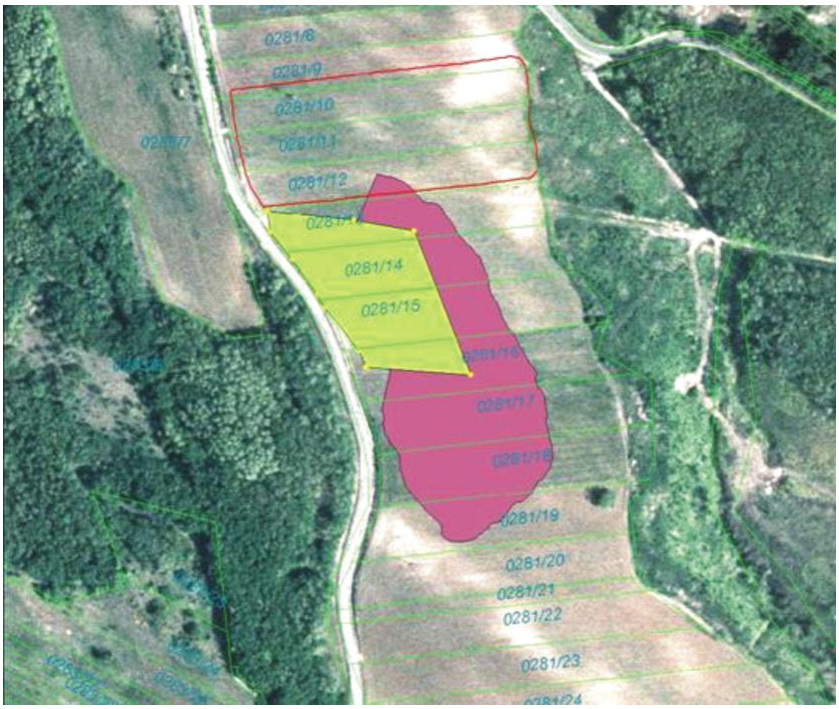

Fig. 42.: In situ recording of ragweed data. The spot is divided by cadastre: it belongs to several different land users.

During the last years, the focus was on the remote sensing based production of risk maps. The aim was to derive maps for the most infected areas 3-5 times from mid-July. The thematic focus was put on cereal stubbles, which are usually strongly covered by ragweed after harvest. LANDSAT TM5, IRS P6 LISS, AWiFS, DMC and SPOT XS/Xi satellite images were used during the remote sensing assessment. The size difference of elementary mapping units of the field measurements and recordings (1-5 m) and that of the remote sensing one (20-60 m) sometimes caused conflicts, together with the improper application and interpretation of the "risk map" notion.
In 2008, the real accuracy and the potential of ragweed risk maps were cooperatively assessed on two test areas. The assessment was carried out by the experts of MRD, FÖMI and LON. Collective on-the-spot checks were carried out within 10 days after the ragweed risk map production. The accuracy of the remote sensing survey was 90%. Based on risk maps, the Land Office experts recorded some 300 hectares of areas that were actually infected with ragweed within two days! These collective checks have proven that the risk maps are so efficient that the total area of ragweed patches that can be recorded and documented in situ is 50-100 times larger if remote sensing-based risk maps are applied properly.
In 2009 we identified high risk ragweed patches on highly infected areas in several time periods for the whole territory of Hungary. The number of patches was more than 3 000, covering about 12 500 hectares. Also, new functions and modules for CRIS have been developed to speed up the administration and documentation of the Ragweed Control Program. Fig.6. shows a map of the spatial distribution of ragweed risk categories in the settlements. These statistics are calculated from the results of the LON's on-the-spot checks (measured infected areas) and the ragweed risk maps derived from satellite data.

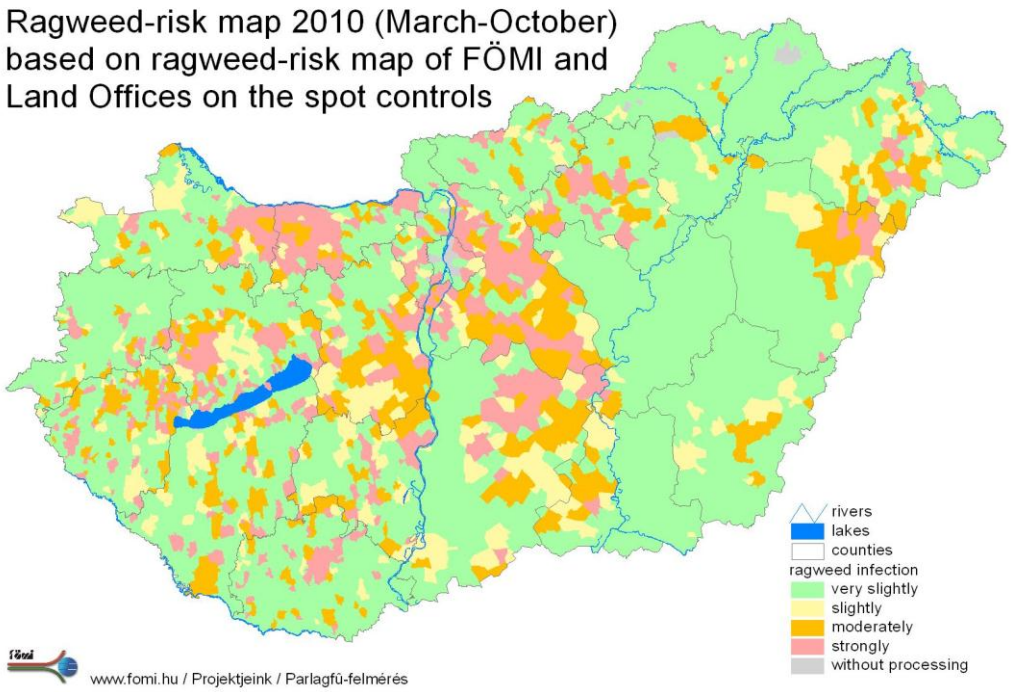

Fig. 43.: Ragweed-risk map of settlements in 2010

The Ragweed Control Program has been operational since 2005 to date, with similar overall technological and administrative background. The implementation of components and the extent of survey have been changed throughout the past years to satisfy the arising needs. Based on the results we can conclude that the immense problems of ragweed and pollen allergy in Hungary could not be efficiently controlled without space technologies. The introduction of four high-tech components (RS+GPS+GIS+web) was inevitable to basically improve the traditional ground-based ragweed control system in Hungary. The remote sensing assessment covers the whole arable land and helps in the optimization of in situ measurements and their documentation. The time requirement of ground based components was dramatically decreased by a productive geo-informational provision (remote sensing), surrounded by GPS and GIS techniques, the data exchange and the new legal provisions of the Plant Protection Law. The administrative tasks were also made much more effective.

This is apparently the only way to implement a system that can be successful for the fight against ragweed in Hungary. Remote sensing determines the effectiveness of the survey, due to its large coverage and the extensibility of statistical image analysis methods. The model can utilize a wide range of satellite images. In Hungary, higher resolution satellite data should be used to find further infected areas and to radically decrease the ragweed area and their health impact.

At the system level, it can influence the decrease of ragweed infected areas and pollen load. It is “spatially fair”, helps to maximize the due counter actions in situ by any authorities or responsible institutions within their limited capacity. The system is also a model for a wide range of integrated thematic applications of remote sensing. The most determining and indispensable subsystem is the ragweed recognition by remote sensing. It is objective, accurate, reliable, and can be used in quite different ways by adjusting the spatial-temporal-spectral image data set to the regional or local needs and possibilities in the same methodology framework. Therefore, the system design is technologically high level and scalable. Actually, much less flexibility can be seen in the cost saving, institutional and political “dimensions”. The system must be operated in hard circumstances: severe limitations and budget constraints affect the possibilities.

The applied remote sensing surveillance can certainly be used alone, for reliable information collection only, without a similar institutional framework and legal procedures. The five years’ operational experience in Hungary (~ 100 000 km2 area) provide a sound basis for adaptation. However, it can be a model to be applied in other areas. All the subsystems can be tailored and adapted to a wide variety of special local and regional needs, terrain and environmental conditions and ragweed stands occurrence. Parts, components or the whole system can be operated in any European region where ragweed infection is an issue.

The Implementation of the Hungarian GIS Register of Vineyards – VINGIS

The Hungarian National Vineyard GIS

Regarding EU and national professional requirements in 2001, the Hungarian Ministry of Rural Development (MRD) designated the elaboration of the Geographic Information System (GIS)-supported Hungarian National Vineyard Register (VINGIS) to the Remote Sensing Directorate of FÖMI.
VINGIS supports vineyard registration and serves as the basis for checking and supervising subsidy allocation of vineyard uprooting, planting and restructuring as well as allocating the subsidies paid on vineyard-basis.
The goals of VINGIS system are the followings:

- to fulfil the CAP requirements
- to utilize the subsidies of the sector for establishing an integrated nation-wide professional register
- to facilitate the discernment and decision-making of institutions and leaders of wine-viticulture sector and agricultural governance
- to create potential to improve the quality of the obligatory statistical reports
- to support the Vineyard Communities in completion of their statutory tasks.

VINGIS has a significant role in improving the quality production and market competitiveness; it assures the protection of the designated origin and takes action against the adulteration of wine. With the GIS-approach, the utilization rate of the actual wine production capability can be analyzed objectively, favourable modifications can be promoted. Furthermore, legal regulation and control are supported.
Since 2005 for each restructuring claim and since 2006 for each grubbing up claim individual maps were printed using VINGIS. Orthophotos complete these individual maps. Besides cartographic information, other technical data supporting the control were added to these documents.
The experience of the controllers unambiguously justified that without these individual VINGIS maps the accuracy of the on-the-spot checks, and the identification of the target area could not be satisfactory.
Since 18th May, 2006 the website is available http://www.vingis.hu (Fig.44).

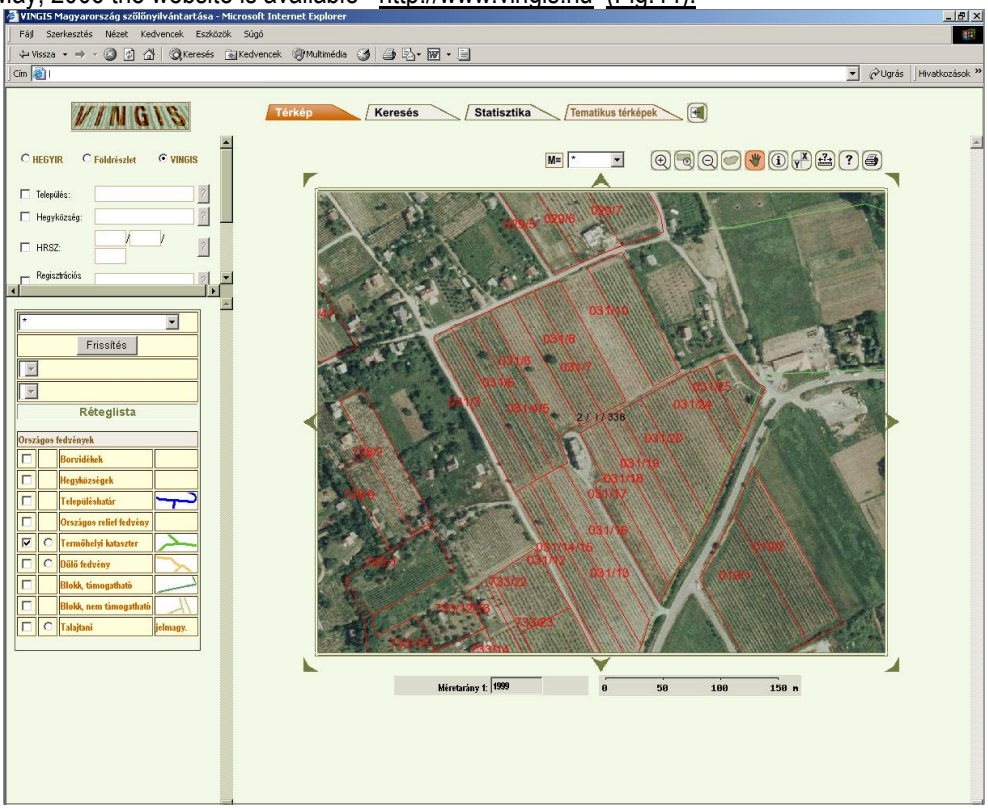

Fig. 44.: Vineyards on VINGIS web server

Since 25th May 2006, the VINGIS web server provides opportunity for the controlling authorities to pre-filter incoming claims and to check specific key information related to subsidy claims.
Currently, VINGIS has about 250 personal users from authorities and professional organizations such as Ministry of Rural Development, Agricultural and Rural Development Agency, Central Agricultural Office, Viticultural and Oenological Research Institute, National Council of Wine Communities and all Wine Communities themselves.

The ecopotential maps for vine-growing

The analogue maps of ecopotential for wine-growing were developed and maintained by the Viticultural and Oenological Research Institute (SZBKI). These maps show the suitability for wine production of the areas (Fig.45.)
The basic goal and the role of mapping the suitability of wine-growing fields are to appoint the best areas for wine production. Marketable and competitive wine production can be promoted by differentiating the quality of the plot. In the background of this process there is a qualification methodology developed by SZBKI, which dates back to several decades.
This qualification methodology contains several essential types of descriptive data to define the value of the vineyard e.g. agrometeorologic data (frequency of winter, spring and autumn frost damage), pedologic data (soil type, soil forming rock, pH and lime content, physical soil type, water management features, humus level, thickness of topsoil, area homogeneity concerning the soil type), information about the water management based on site observation, degree of erosion, relief of the site (slope degree and aspect, elevation above the sea level on hill and mountainside, plain and flat areas, environment proximity of woods, rate of built-in areas), land use, road conditions. Data are summarized by a score that characterizes the suitability.

Fig. 45.: A map on orthophoto background showing the classification of the areas for their suitability of wine-growing

The digitization of these maps and their integration into the VINGIS system is very useful for the administrators of the vineyard communities, because they use the paper versions of these maps in their daily work to draw the certificate of each new plantation. It is also a requirement, because according to law, subsidies can be paid for vineyards only if they are planted on areas suitable for wine production.
This map shows the ecotops (basic units of wine-growing areas characterized with equal ecological marks – i.e. the above mentioned essential descriptive data) contoured by polygons and appraised with numerical values. The maps linked to the attribute tables of the detailed features show the difference between the areas with different numerical values.

Retain terraces

According to the European Council regulation (EC) No 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers, all member states have to make an effort against soil erosion by retaining terraces. In case land owners are subsidized from GAEC, it is their task to preserve the terraces.
In spite of terraces occurring mostly in wine-growing regions, VINGIS provided the layer of terrace holding parcels in Hungary using signs of terraces as identifier from a digitized topographical map (scale 10.000) on orthophoto background. Combining this layer with the cadastral layer, VINGIS provides opportunity for the authorities to pre-filter, check or even cross-check incoming claims and to monitor specific key information (Fig.46.).

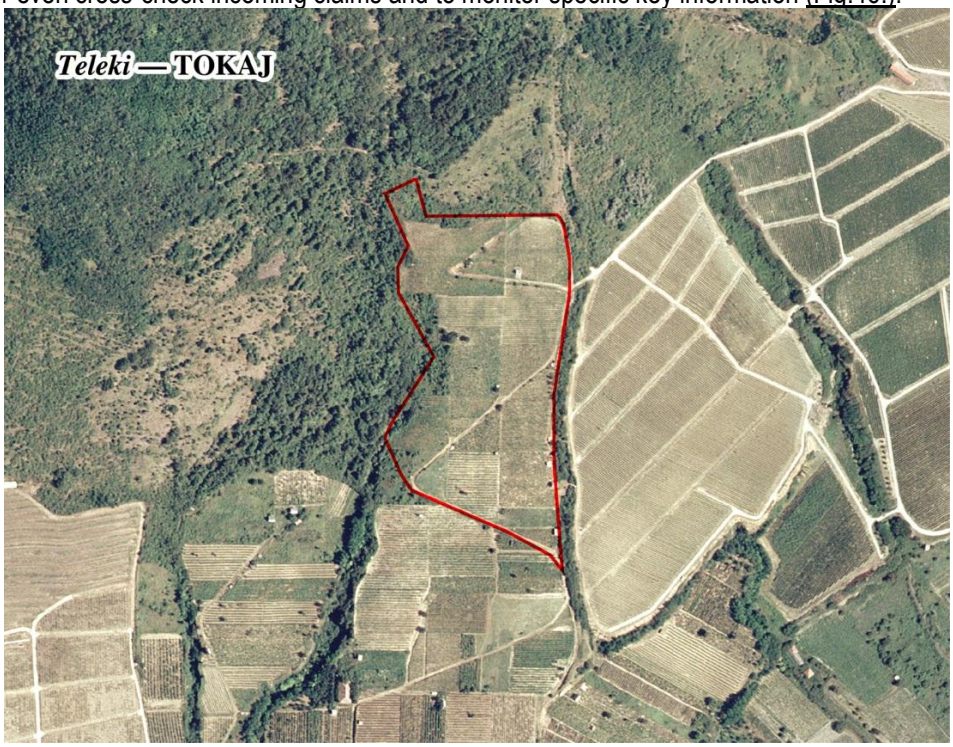

Fig. 46. :Measurement and designation of terraces

Designations of origin and geographical indications

EU regulations to be respected: COUNCIL REGULATION (EC) No 479/2008 of 29 April, 2008 on the common organisation of the market in wine, amending Regulations (EC)No 1493/1999,(EC) No 1782/2003,(EC)No 1290/2005,(EC)No 3/2008 and repealing Regulations (EEC)No 2392/86 and (EC)No 1493/1999
VINGIS has also become part of the system of protecting wines with designated origin and geographical indications. Regulations introduced a universal frame concerning different wine-growing regions. This sort of classification uses product specification that consists of the name to be protected and the demarcation of the geographical area concerned (including lot numbers) documented by VINGIS. Wine with protected origin can be produced only within the designated locations.
The delimitation of the vineyard sites is important for the evaluation of quality and perhaps also for the pricing. Displaying any kind of information on the label concerning geographical origin is allowed only if this information is validated in VINGIS. Each professional state and trade organisation is a VINGIS-user, therefore, monitoring and supervising the wine market has become a realistic possibility.
There are 5 wine-growing regions that have fully completed designations of origin in Hungary and from 22 wine-growing regions geographical indication regulations were achieved.
The drafting of product descriptions (ongoing in the whole of Europe) directed the attention to several problems whose solution cannot be postponed, yet the whole vine-wine sector would benefit from the expected favourable results.
The 40-year-old suitability cadastral maps receive a new form. By the end of this autumn, as the result of the cartographic correction (the border of cadastral is corrected based on ortophotographs (aerial photographs) with

unambiguous accuracy), it could be defined from each plantation if they are included in an area suitable for wine-growing or are not. In some cases, producers have a couple of years to initiate the inclusion of their plots to a wine-growing area and until this time these plantations are assigned temporarily with a score of 190 at the II class.
The process of the deposition and the judgment of requests for community protection of the designation or geographic origin denomination of a wine are regulated by the governmental decree No. 178/2009 based on the European Council regulation EC 479/2008 and the regulation of the European Committee EC 607/2009. (IX.4.) In accordance with this, the VINGIS map must be attached to the request for product description (2§.(1) c.). The wine law defines that VINGIS is the suitable geoinformatic system in conformity with the community regulation of the sectorial vine cadastre which is the base of the payment of subsidies for vineyard uprooting, planting and restructuring as well as of the cartographic control of the geographic delimitation of the wine production sites marked with geographic denomination under protection or protected designation of origin.
One part of the VINGIS map is the smaller geographic unit (vineyard site) which is allowed to be marked. Its name should be written as it is defined in VINGIS [3. §.(2)]. The map production process is regulated by the policy elaborated by FÖMI and HNT (National Council of Wine Communities). The heads and secretaries of wine communities received this instruction on 16th March 2010.
An electronic version of the map will be deposed at the Ministry. In case of affirmation of the product description, the document will refer to that electronic version. In the product description each plantation will be defined unambiguously to which certain vineyard site it pertains. The protected vineyard sites will be also registered in the toponimic maps of the VINGIS system. (Fig.47.)
The deadline of submitting the product descriptions is 31st May 2011. FÖMI produces the map annexes. The minister sends them affixed with the professional reference of the Council of Wine Appellation to the assigned EU experts by 31st December 2011.

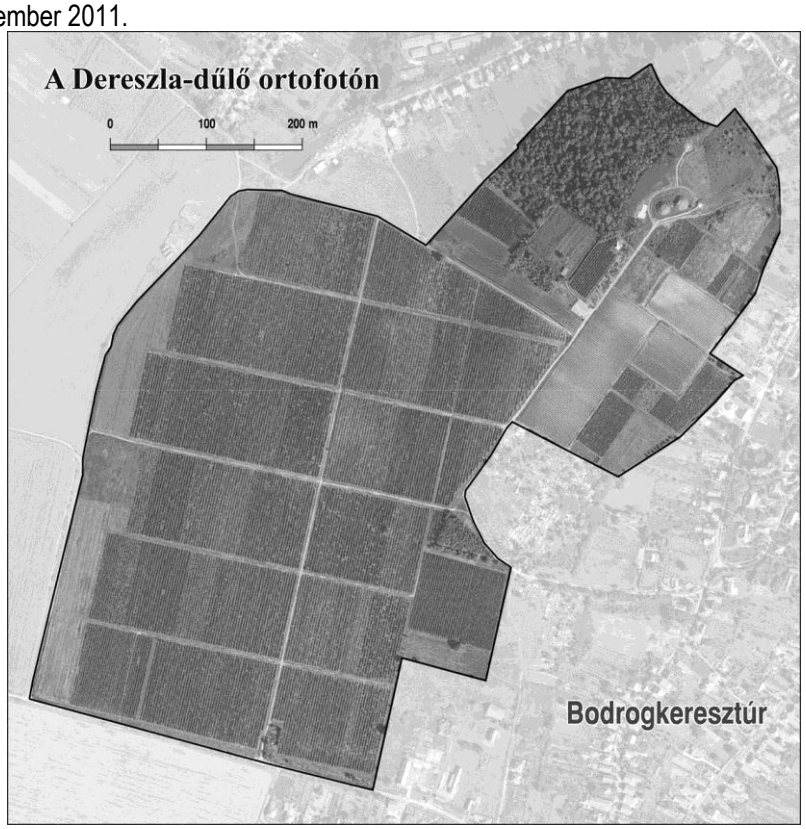

Fig. 47.: Detail of a VINGIS toponimic map: preparatory document of product description at the Tokaj wine–growing region

The Implementation of Corine Land Cover 2006 (CLC2006) in Hungary

This work constitutes the Hungarian component of the GMES (Global Monitoring for Environment and Security) Fast Track Service Land Monitoring Precursor program, managed by the European Environment Agency (EEA). Activities covered 39 European countries (32 EEA member states and 6 associated Balkan countries plus Kosovo).

It was already the third CLC mapping in Europe (1990s, 2000 and 2006). The work consisted of the following main components:

- Centralized acquisition and orthorectification of high-resolution satellite imagery (IRS-LISS III and SPOT4/5).
- CORINE Land Cover change mapping (between 2000 and 2006) along with the correction of CLC2000; GIS-based generation of CLC2006. This was implemented by national teams under central supervision.

FÖMI as National Reference Centre for Land Cover was responsible for implementing the above national tasks for the former Ministry of Environment and Water. The CLC2006 project was finished in June 2009. (Fig. 48.) Altogether 15122 change polygons (larger than 5 ha) were found, covering 2.86 % of the total area of the country.

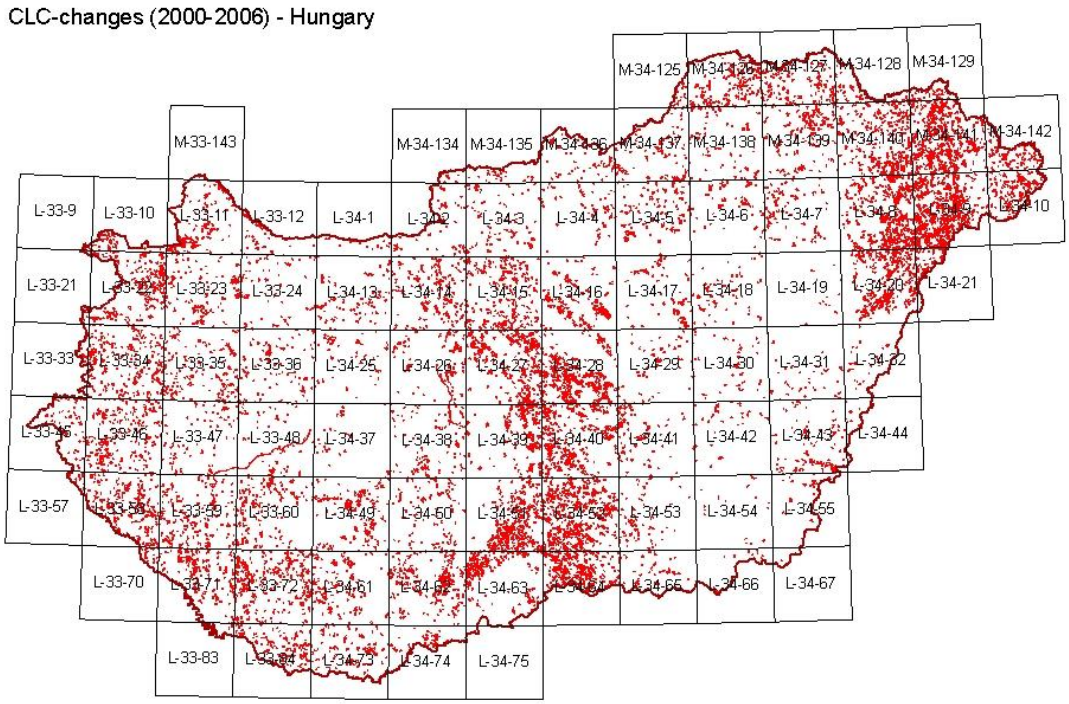

Fig. 48. Map of CORINE Land Cover changes between 2000 and 2006 in Hungary

No.	Dominating change processes
1	Clear cutting of deciduous forest
2	Forest growth (deciduous forests)
3	New forest plantations on former arable land
4	Converting pastures to arable land
5	New fruit trees / orchards on former arable land
6	New forest plantations on former pastures
7	Extensification /abandonment of arable land
8	Clear cutting of mixed forests
9	Clear cutting of coniferous forests
10	New vineyards on former arable land

Fig. 49.: Ten largest CLC change types between 2000 and 2006 in Hungary

One of the applications of the time series of CLC data was related to supporting the Hungarian Meteorological Office in fulfilling reporting obligation regarding Kyoto protocol.

THE HUNGARIAN LAND INFORMATION SERVICES ON THE INTERNET

The aim of this website is to support wide spectrum of customers with land related data and information services on Internet. The address is http://www.fomi.hu. The website is managed by the Institute of Geodesy, Cartography and Remote Sensing. Databases of the Institute are basic components of the information infrastructure in the Hungarian information society.
The site assures open access for public use of land-related, surveying mapping, geospatial and geographical data through their metadata descriptions.

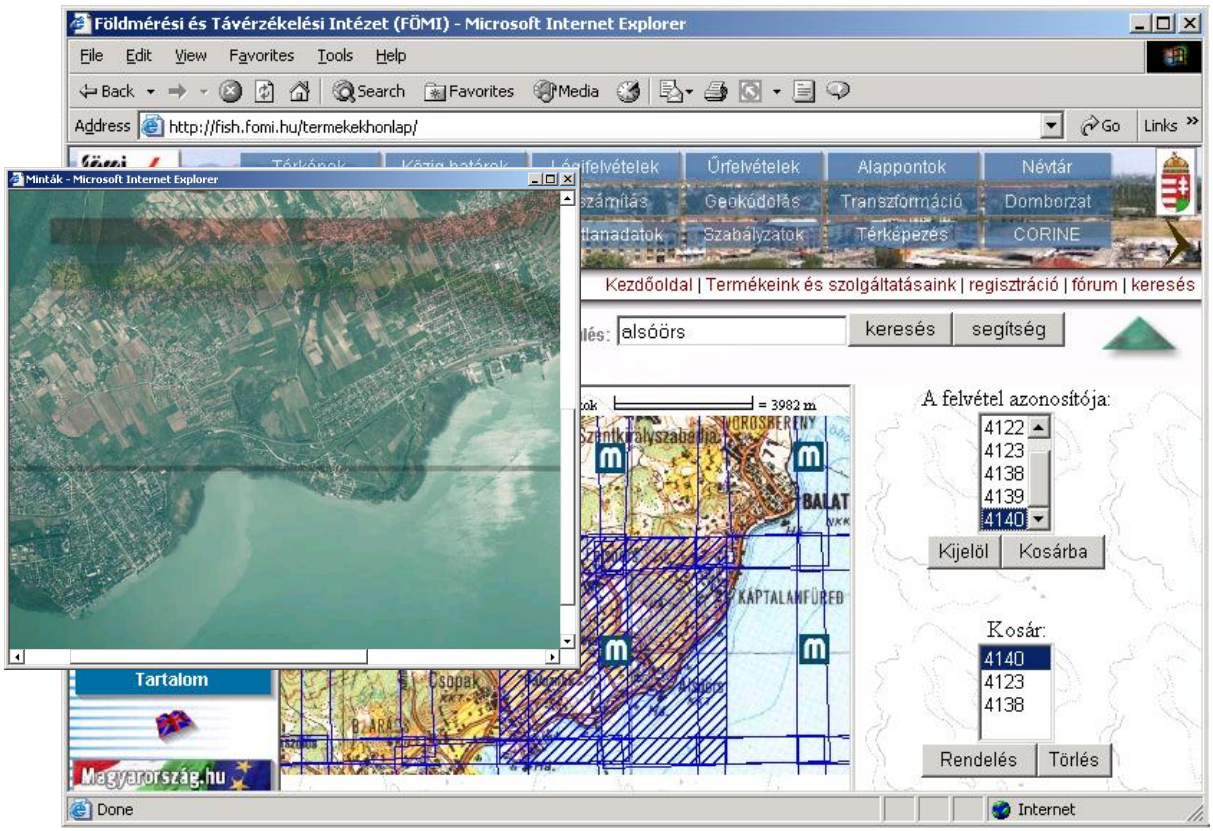

Fig. 50. Fragment from the Web site: Ordering of aerial images

The site promotes the principle of "one stop shop" (Fig. 50.). The site gives easy access to geodetic control points, central land-ownership data, analogue and digital maps, aerial photos and satellite images. It helps citizens and institutions with services, such as precise scanning and geocoding, data transformations, thematic mapping, professional plotting etc.
The website is targeting a wide range of users, among them local governments, decision-makers, banks, institutes for regional planning and development, environmental protection companies, public utility companies, scientific and others.

International Activities of FÖMI

Participation in European Land Monitoring activities

The European Topic Centre on Land Use and Spatial Information (ETC-LUSI) was one of the five Topic Centres designated by the European Environment Agency (EEA) for the period 2007-2010 to assist in its work of collecting, analyzing, evaluating and summarizing information relevant to national and international policies for environment and sustainable development.
ETC-LUSI concentrated on providing relevant information on past trends, current status and prospective developments relating to land and soils in Europe, in order to support legislative frameworks on sustainable land use, soil protection and integrated coastal zone management.
The ETC-LUSI was an international consortium composed of twelve partners from ten countries of Europe (http://terrestrial.eionet.eu.int). The consortium was led by the Universitat Autonoma de Barcelona. FÖMI was member of the consortium.
The main contribution of FÖMI experts to the activities of ETC-LUSI were:

- Writing the CLC2006 Technical Guidelines.
- A FÖMI expert coordinated the technical implementation of CLC2006 project in Europe (part of the GMES Fast Track Service Land Monitoring) in 39 European countries. The international Technical Team (with 2 FÖMI experts) organized training courses (if requested by the country) and two verification missions in each country, and provided support to national teams in the course of implementation.
- Statistical validation of the European CLC-Changes2000-2006 database.

As a combined ETC-LUSI – geoland2 activity FÖMNI experts participated in European high-resolution Land Monitoring activities:

- A statistics-based methodology has been developed to support quantitative assessment (validation) of the high-resolution soil sealing layer produced under the GMES Fast Track Service Land Monitoring. It is going to be used subsequently to validate other high-resolution layers produced under the geoland2 (FP7) project, such as forests, grassland, wetland and water layers.
- Several high-resolution land monitoring products produced by European Service Providers were validated, such as GSE Land Products (supported by the European Space Agency (ESA)), Urban Atlas (supported by DG Regional Policy).

Participation in Working Groups

GMES Land Monitoring Core Service Implementation Group

This group, including seven permanent experts (EEA, DGs and the member states), has the main task of supervising and validating the implementation of the GMES Fast Track Service on Land Monitoring between 2007 and 2010. The group had regular meetings in Brussels. One FÖMI expert participated in the work of the group.

INSPIRE Thematic Working Group

Delegated by the EEA, one FÖMI expert is participating in the work of INSPIRE Thematic Working Group (TWG) Land Cover, starting its activity in 2010.

The aim of the TWG is to draft the INSPIRE Data Specification Land Cover and submit it for the other TWGs (e.g. Land Use) and the Joint Research Centre. The TWG organizes its meetings in various European mapping centres.

Directorate of Services (DS)

Launching the Geoportal

In 2009 FÖMI won the tender "IT developments for environmental protection in the public administration. From this resource the institute was able to complete the "Launching of Geoportal with spatial data infrastructure development" project. At the end of 2010 geoshop.hu (Fig. 51.) started to be available online. Since then its users can buy several types of GIS data (such as orthophoto, topographical maps, elevation data, control points, administrative boundaries, etc.) from the area of the capital and Pest County. Users can pay with credit card and the orders will be accomplished automatically. The site is bilingual (Hungarian and English) and provides access for the visually impaired users as well. INSPIRE compatible metadata is available. To develop the service's spatial coverage and to increase the provided data types are planned in the near future.

Fig. 51.: Geoshop.hu - The FÖMI map database

GIS4EU project 2007-2010 (http://www.gis4eu.eu)

GIS4EU project – Provision of interoperable datasets to open GI to EU communities – aim is to provide base cartography datasets (administration units, hydrography, transportation networks and elevation themes) for Europe and to ensure its cross scale, cross language and cross border interoperability and accessibility according to standards and to requirements of INSPIRE Directive (2007/2/EC).
The approach consists in the development of a common data model as well as of harmonization, aggregation and data exposition rules and guidelines in order to enable the access to the consistent and homogenous reference data provided by cartographic authorities from different countries and levels (national, regional and local) without building one central database and service.
After GIS4EU full implementation, there will be a significant progress noticed of accessibility, usability and exploitation of reference data through Europe.
Founded the eContentplus 2006 program, under the coordination of CORILA (Consortium for Coordination of Research Activities concerning the Venice Lagoon System) there are 21 partners from 9 countries.

The partners are classified into the following categories:

- Data providers
- Research partners
- Technological partners
- Users

FÖMI's tasks were the data model of Administrative Unit (INSPIRE Annex I.) and the leadership of the thematic Working Group of the Elevation (INSPIRE Annex II.). There were five FÖMI experts in the project.

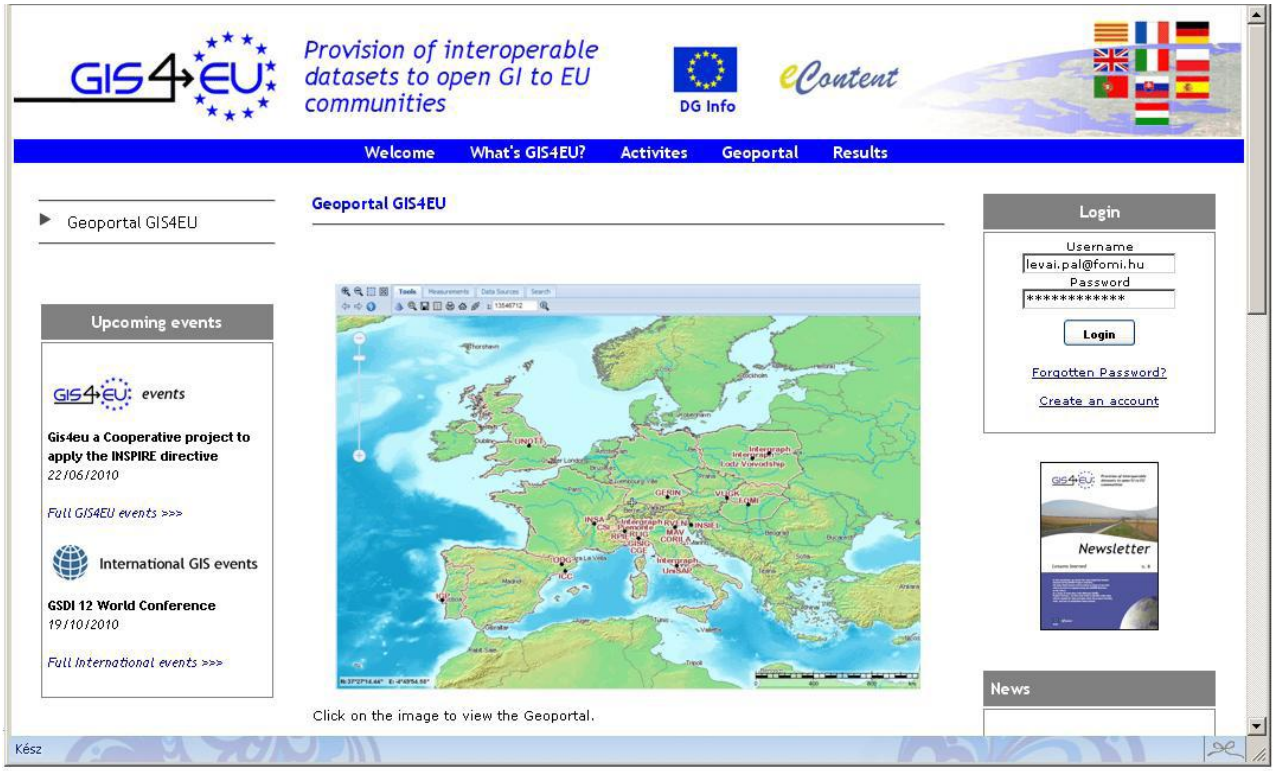

Fig.52.: The result: GIS4EU thematic geoportal

The GIS4EU project conducted successfully on 30 April 2010.

2. Activities of the Hungarian Society of Surveying, Mapping and Remote Sensing

International mapping activities

The Hungarian surveying and mapping community keeps rich international contacts, takes actively part in the work of international associations, unions and organisations at governmental, scientific and technology development levels.

Membership in the International Cartographic Association
Hungary has been a member of the International Cartographic Association since 1964. Its activity has been marked by several events such as organizing the 14th International Cartographic Conference in 1989 in Budapest, three joint commission meetings in Hungary (1983, 1993 and 2003) and a Cartography and Children commission meeting in 2000, by three honorary memberships (Radó 1974, Papp-Váry 1995, Klinghammer 2003), and – recently – by chairing and vice-chairing the commissions of Education and Training (L. Zentai) and of Cartography and Children (J. Reyes). Mr. Zentai and Mr. Reyes also organized a joint commission symposium in Madrid in 2005, and they organize a similar event in Orléans in 2011 in conjunction with ICC 2011.

Hungary has nominated three commission chairs for the next conference period (2011-2015)

Fig. 53. The nominated commission chairs in ICC2009 (Santiago de Chile) and the secretary of the Hungarian ICA commission: Jesús Reyes, Béla Pokoly (Secretary), László Zentai and Henrik Hargitai

Membership in the International Federation of Surveyors
Hungary is represented by three member institutes in **FIG** (International Federation of Surveyors): Hungarian Society of Surveying, Mapping and Remote Sensing as member association, Institute of Geodesy, Cartography and Remote Sensing as affiliate member, and academic member, the University of West Hungary Faculty of Geoinformatics. From ten commissions of FIG two commissions have chairs from Hungary: prof. Béla Márkus, chair of Commission 2 (Education) and András Osskó, chair of Commission 7. (Cadastre and land management) Hungarian participants gave several lectures in the Conference at Sydney (Australia) in 2010.
Commission 7 organised Annual meeting in Kuala Lumpur, Malaysia in 12-16 October 2009 and in Karlovy Vary, Czech Republic in 6-11 September 2010.

Fig. 54. Hungarian participants in Sydney
(from left: Eva Harbula, András Osskó, Piroska Zalaba, Gyula Iván, dr. Szabolcs Mihály)

Fig. 55. Zsuzsanna Ferencz's lecture in Sydney

Membership in the International Society for Photogrammetry and Remote Sensing

Hungary has been a member of the International Society for Photogrammetry and Remote Sensing (**ISPRS**) for more than 70 years. Members of the Hungarian National Committee of ISPRS are working in all of the seven Commissions.

In the period 2004-2008, Peter Winkler of FÖMI serves as Secretary in the Commission VIII WG 1 devoted to Human Settlements and Impact Analysis, while Gábor Remetey-Fülöpp of DLAG MoARD was elected Co-Chair in the WG IV/1 devoted to Spatial Data Infrastructure. Instead of himself Mr. Gábor Remetey-Fülöpp nominated Dr. Árpád Barsi, Head of the Chair of Photogrammetry and Geoinformatics at the Budapest University of Technology and Economics as a new Co-chair of the ISPRS WG IV/1 Spatial Data Infrastructure who was approved by ISPRS President Prof. Dr. Ian Downman in 2006.

United Nations Group of Experts on Standardisation of Geographical Names

Hungary has taken part in **UN standardisation of geographical names** from its outset, with Ervin Földi participating in the formative meetings of the Group of Experts (UNGEGN) and on the first Conferences (Geneva, 1967, London, 1972, Athens 1977), and from 1991 onwards –at Conferences (New York 1992, New York 1998, Berlin 2002, New York 2007) and various plenary, division and other expert meetings – by Mr. Béla Pokoly.

A highly inspiring meeting organized by UNGEGN Convenor on Exonyms and ICA Commission Chair Peter Jordanon National and Regional Atlases was held in Tainach, Austria on 28-30 April, 2010. Various aspects of exonyms, like criteria for their possible use (P. Jordan) have again been highlighted.

Fig. 56. A group of participants at the Tainach (Austria) exonyms meeting, April 2010

Croatia has taken over Division chairmanship and held two remarkable meetings in Zagreb on 18-21 November 2008 and 9-11 February 2011. Four experts from Hungary took part in the meeting: Dr. András Dutkó (President of the Hungarian Committee on Geographical names), Mr. Martin Išpanović (Prime Ministers' Office), Mr. Gábor Mikesy (FÖMI Institute) and Béla Pokoly (Ministry of Rural Development).

Fig. 57. Participants at the February 2011 Divisional meeting in Zagreb

Hungary has also participated in the European geographical names infrastructure and services project called EuroGeoNames (Mr. Gábor Mikesy and Mr. Béla Pokoly).

The Hungarian Society of Map Friends

Chairperson: Annamária Jankó
Secretary: Tamás Szádeczky-Kardoss
Address: Lövőház u. 24., HU-1024 Budapest, Hungary

The scientific-artistic mystery and the love to present the surrounding world on paper, i.e. in two dimensions draw members of the Society for a meeting each month. Individual presentations are always illustrated by maps, which is the essence of the club's activity. The presentations are followed by friendly conversations and comments of the experts, which can often be evaluated as references from historic or other aspects.

Maps contain such a large amount of information that it would be a sin to leave them unexploited. Members and presenters of the Society are specialised in a wide scale of professions: cartographers, historians, linguists, archaeologists. What is common with them is that they all love maps. Though elderly people, pensioners dominate the membership, there are also university students among them. The Society has about a hundred members – many of them living outside Budapest – and 30-40 of them always attend the events.

After several years' lengthy preparations and attempts, the Society was founded in 1981 under the name, „Circle of Map Friends". The text of the first invitation is valid even today:

"The old handwritten maps or the printed rarities excite the greatest interest. But members of ever-growing number are collecting contemporary tourist maps. The aim of the circle of map friends is to assist collectors and users of maps in extending their knowledge and absorbing the possible best methods of map use. In the framework of our club activity, we would like to put on show the forgotten treasures of the Hungarian cartography, the eminent cartographic works".

The number of presentations in the last four years:

2007	2008	2009	2010	2011
6	5	7	8	4

A selection of the presentations of this period:

- Ábel Hegedüs: History of Hungarian tourist maps
- Tamás Tóth: Navigational database of TeleAtlas
- László Gyalog: Geological atlas of Hungary for tourists
- Mátyás Márton: Virtual Globes Museum

3. Other Map Publishers

Mapping activities in the Geological Institute of Hungary (MÁFI)

In the last four years the publishing of maps in earth sciences has continued to fall back in Hungary and the Geological Institute of Hungary remained the only institution making and publishing maps in this subject. Reduced budget sources allowed to publish only the most relevant issues, although the institute tries to make remarkable efforts to follow its traditions in map publishing.
Digital cartography generally became the outstanding method and our publishing concept must be realised in line with constant technological changes. Nevertheless, our concept is to preserve the traditional appearance of printed maps and atlases, concerning especially systematic survey maps of different scales.
Behind the traditional look there are very deep and radical changes: the process of map making is based on large databases. It starts with the query of the existing databases followed by visualisation, both processes using the capabilities of the ArcGIS system.
The building of databases is an important and persistent program of the Institute, because spatial data has been widely used during the last 140 years in accomplishing the Institute's programs.
Compilation of the geological map of Hungary in 1:100 000 scale opened the possibilities to make new versions of geological maps in smaller scales, wall maps and to deliver applied geological maps.
Topographic bases of the middle and small scale maps derive of the digital state topographic maps of Hungary compiled by MoD Mapping Company.
Collections of old geological and chorographical maps allowed making an exhibition in 2009 and a CD on the Institute's geological maps of the last 140 years. Last year we took part in the common and successful work of the Visegrad Group: Geological Mapping in Central Europe of the 18th and Early 19th centuries.
During the last period two publications of great significance occurred. The first one was a new bilingual book of popular science, "Magyarország földtani atlasza országjáróknak/Geological Atlas of Hungary for Tourists" and "Magyarország földtani atlasza országjáróknak/Geologischer Atlas von Ungarn für Touristen". The atlases contain a brief summary of the geological build-up of Hungary and a 200k geological map, descriptions and photos of some outstanding geological values of Hungary, caves, geological nature trails, medicinal baths, geological collections and mining memorials.
The other valuable publication was a half million scale map "Magyarország pre-kainozoos földtani térképe/Pre-Cenozoic geological map of Hungary". For the better visualization of the basement relief a plastic 3D version of the map was also completed in co-operation with the MoD Mapping Company.
Published maps of the Institute won several first prizes in the annual competitions of the Fine Hungarian Map meetings.
Beside published maps several hundred other map figures, report appendices and sections complete the cartographic activity of the Institute.
Using the possibilities of the web facilities we launched publishing our main maps of general interest directly in our webpage.
In contrast to former classical cartographic compilation this radically new approach lets the costumer define the requested map content. It can be performed by the free selection of the graphical layers and by well-defined queries. According to our intent, these possibilities will get priority in our future cartographic activities.
Finally, our institute also takes part in the EU's INSPIRE project as an LMO (Legally Mandated Organisation). We are responsible in Hungary for the Directive Annex II. point 4. Geology and also for providing several datasets for Directive Annex III.

Private map publishers

Cartographia (*1590 Budapest Pf. 80 E-mail: mail@cartographia.hu*)

Cartographia Ltd. has been the leading map-making company in Hungary for more than 50 years. It's still one of the big private publishers in Hungary.
The main product lines for a worldwide export activity are European Road Map, International City Map and World Travel Map series. Each map contains lot's of information, precise quality mapping, index and legend in at least English, German and French.
Cartographia maps are available in most countries of Europe and also in other continents like America, Asia, Australia and Africa.

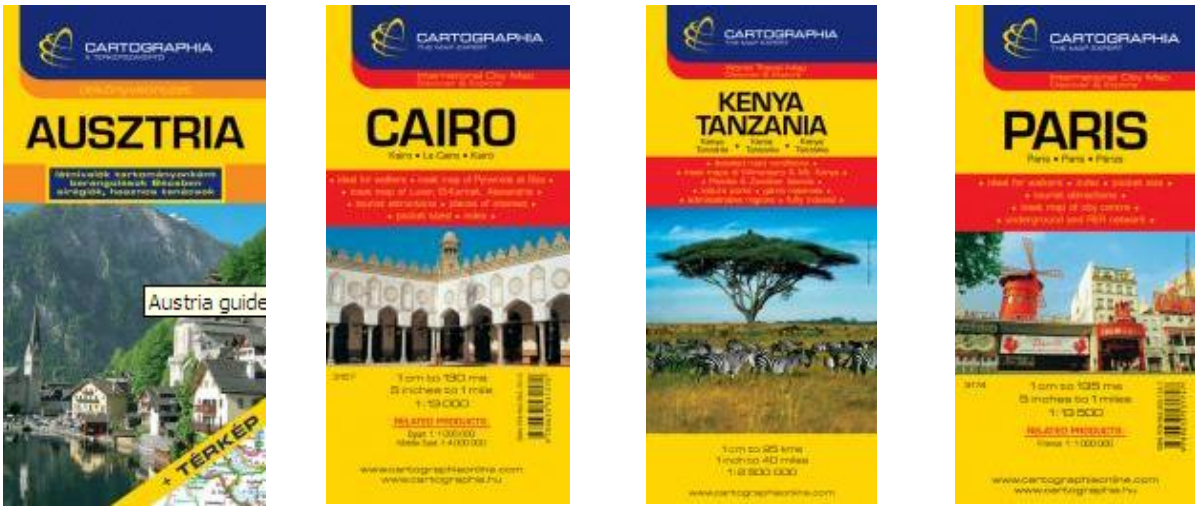

Fig. 58. Collection of Cartographia maps

Beside the export of its own publications Cartographia is ready to make digital maps according to specifications.
Cartographia Ltd. produces a big variety of maps and guides for the domestic market as well: maps and atlases of Budapest and Hungary, a wide range of tourist maps and atlases, maps of Hungarian cities and also a wide range of travel guides.
Beside the own products of the company, Cartographia Ltd. distributes also several products from well known publishers from all over the world, containing products of Mairdumont, Michelin, Hallwag Kümmerly+Frey, Lonely Planet, Dajama,etc.

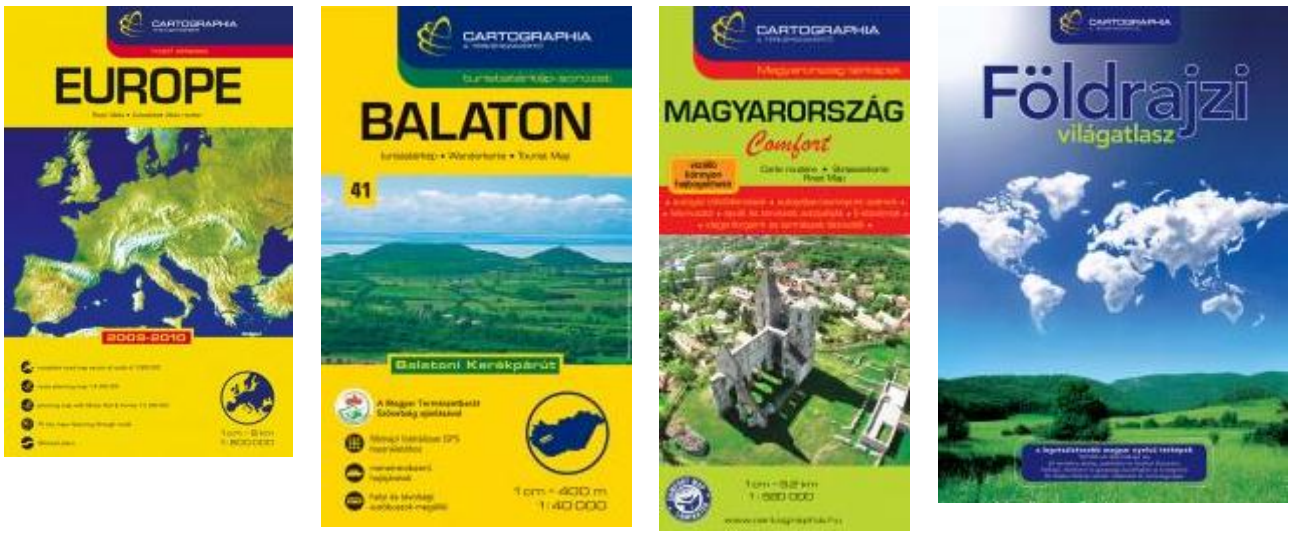

Fig. 59. Collection of Cartographia atlases

Cartographia Schoolbook Publishing Ltd.

H-1119 Budapest, Fehérvári út 89-95. E-mail: info@cartographia.org
Contact: Mónika Varjú (+36/20 6611-727, ci@cartographia.org)

Cartographia Schoolbook Publishing Ltd. (Cartographia Tankönyvkiadó Kft.) considers itself the legal successor of the one-time company founded in 1954.

Its product family, with harmonized international symbols, covers both classical and modern deductive tools in geography, history and literature for all levels from the first classes up to the maturity.

- Printed atlases made in soft- and hard cover.
- Printed wall maps made by "in-house" plotter printing either on two-sided foiled strong paper or textile with massive wooden rods.
- Exercise books in printed- and digital form.
- Digital wall maps burned on CD.
- Interactive digital software license program packages burned on CD.
- Special atlases and tools for partially sighted and other groups with limited learning talents.

Fig. 60. Atlas of world history

GiziMap

Gizi Map is a Hungarian map publishing company situated in Budapest. The cartographer Gizella Bassa has founded the company in 1993. GiziMap has specialised on maps of the Baltic States, Central Asia, the Balkans and some countries of Eastern Europe as well as countries of conflict, such as Irak and Afghanistan. It took only a short time for GiziMap to get a good reputation in the international map branch.

Gizella Bassa established her publishing firm in 1993. She continues producing maps of the Baltic States, Central Asia, the Far East, the Balkans and countries of political unrest or touristic interest, like Afghanistan, China, Kosovo, Irak or the Caribbean Islands.

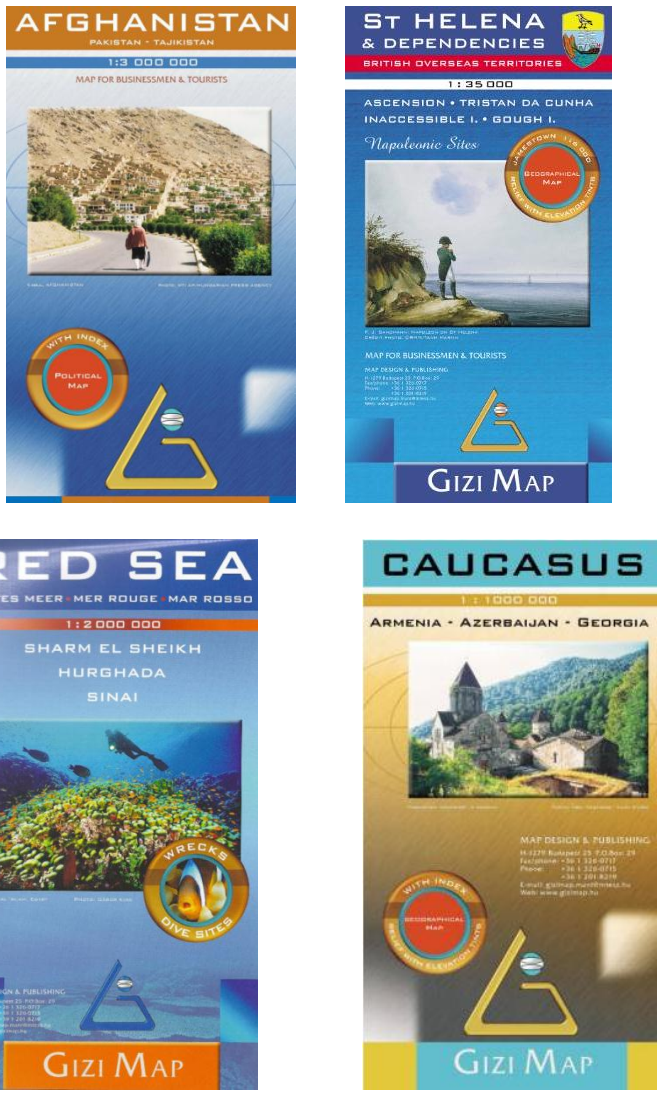

Fig. 61. Collection of GiziMap maps

Contact address:
Ms. Gizella BASSA
GiziMap H-1279 Budapest 25, P.O. Box 29.
Hungary
E-mail: gizimap.mant@mtesz.hu

Szarvas András Cartographic Agency

member of the International Map Trade Organisation

SZARVAS András

TÉRKÉPÉSZETI ÜGYNÖKSÉG / CARTOGRAPHIC AGENCY

Mr. András Szarvas continues to publish a wide range of maps and cartographic services from country through tourist (hiking) to city maps. With decades of map producing experience he sometimes undertakes to publish jointly with small private firms (Dimap, Kárpátia, Térkép-Faragó, Espolarte and others).

Fig. 62. Collection of Szarvas András Cartographic Agency maps

Contact address:
András Szarvas
engineer cartographer
H-1149 Budapest, Répásy u. 2.
Phone./fax:(+36 1) 221 6830, (+36 1) 363 0672
E-mail: szarvas.andras@map.hu

Or you may try his long-standing website: http://www.map.hu

TOPOGRÁF Cartographic Ltd.

TOPOGRÁF Cartographic Ltd, established in 1992, is still one of the major players in the Hungarian map publishing field. Its recent publications include a wide type of maps for the general public.

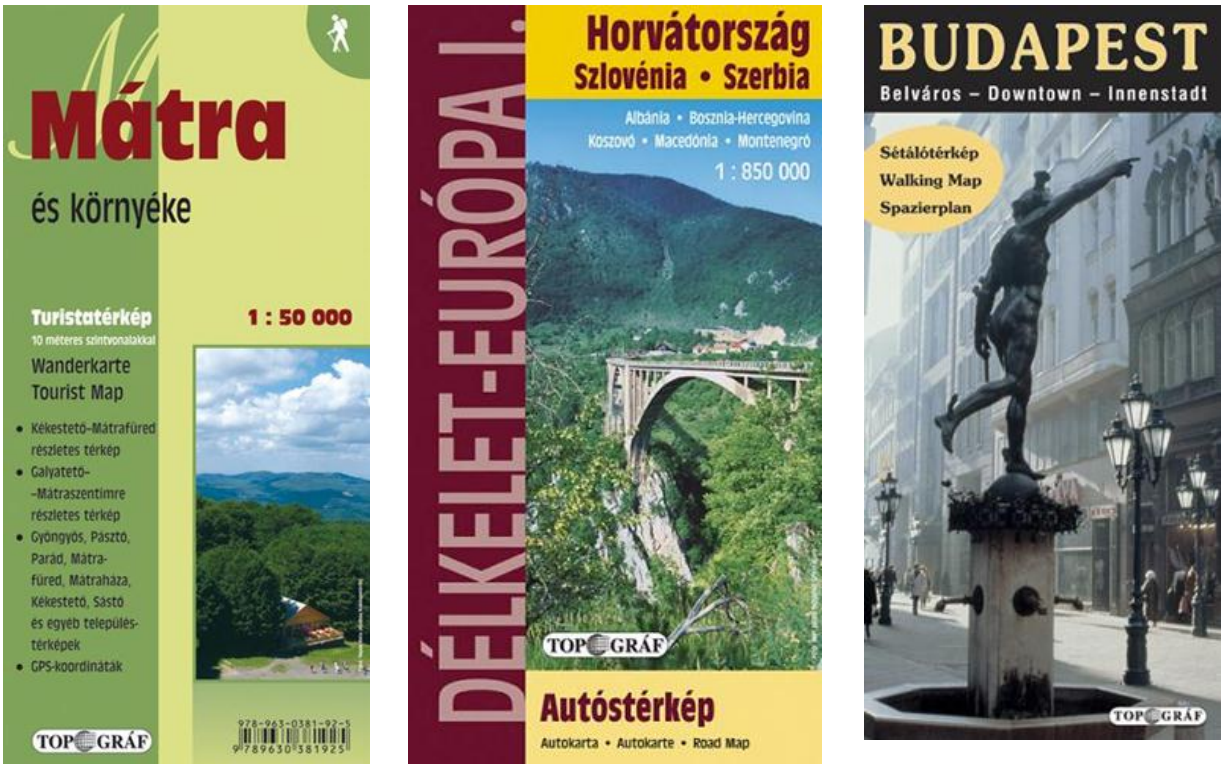

Fig. 63. Collection of TOPOGRAF maps

Contact address:
TOPOGRÁF Térképészeti Kft
H- 1141 Budapest, Komócsy utca 5.
Phone./fax:(+36 1) 478-0519, 351-2402
E-mail: mail@topograf.hu
website: http://www.topograf.hu

4. Cartographic training and research at institutions of higher education

Higher Education in Cartography 2007–2011

Report of the Activities of the Department of Cartography and Geoinformatics, Eötvös Loránd University (ELTE), Budapest

Introduction

The status of the Department was changed last time in 2003: the Department of Cartography was named Department of Cartography and Geoinformatics and moved to the newly formed Faculty of Informatics. The three basic duties of the Department are as follows:

- training of cartographers at BSc, MSc and PhD levels,
- teaching cartography to future teachers of geography and to students of environmental sciences and programmers,
- supplying of maps, digital images, webmaps and professional advice for educational and scientific activities of the university's faculties.

The staff of the Department (full time and lecturers on contract) numbers 16. Subjects of the cartography syllabus that require other professional qualification than the Department staff has are taught by noted Hungarian and foreign scholars (giving a full course, an optional course, or just a few lectures). Altogether 20 foreign experts and visitors contributed to the training of cartography undergraduates and graduates between 2007 and 2011. The training activities of the Department were expanded within the Doctoral School of Earth Sciences, Cartography Sub-programme: 17 candidates got the PhD in cartography in the last 4-years period. Within the past four years, the Department received 20 students and sent 20 student on mostly Erasmus mobility.

László Zentai, the head of the department served as a Vice-Rector of the University in 2007–2010.

The website of the department (http://lazarus.elte.hu) was opened in 1995. For long this was the starting point of the Hungarian cartography; the daily average data transfer is still about 10 GBytes.

Training

The first independent university department of cartography was established in 1953. The first training syllabus was prepared in 1955, and it formed the basis of the training of Hungarian cartography students until the early 1970s.

In 1973, cartography training was changed as part of the general reform of university training. Cartography training continued to be a 3-year programme.

The Hungarian Act on Education of 1986 made it possible that cartography training become a 5-year programme. The first 10-semester programme was launched in the 1988–1989 academic year. The Department continuously modernized its curriculum after 1990 to introduce digital cartography. A new curriculum was formed in 2001.

The multi-cycle system according to the Bologna model started in all fields of studies in Hungary as of 1 September 2006. This process was not consistently linked to the establishment of the programmes of the second cycle (master level). The specialization in cartography (starting after the second semester) is available in the Earth Sciences BSc programme; the whole BSc programme is of 6 semesters. Based on the bachelor degree, the students can apply for the MSc programme in cartography (4 semesters), which is unique in Hungary.

The teaching of the processes and methods of computer-assisted cartography (automated surveying methods, computer graphics, computer-controlled technologies) are supported by a range of technical acquisitions of the Department (GPS receivers and base station, scanners, output devices, computer software).

Sub-programme for Cartography of the Doctoral School of ELTE

Cartography is traditionally related to several disciplines. Historical events, geological formations, meteorological phenomena, and ocean currents are all chances for communication of cartographic information.

If you visit the homepage of the Department of Cartography and Geoinformatics, you can get a sample of this variety by taking a view of the degree theses and their themes chosen by the PhD students.

The Department does not plan a radical change in the practice of training doctoral students, but it is susceptible to any new tendency arising. The purpose is to go before the prevailing challenges and guide the way to those who work in practical cartography. Indeed, most of the students, including the majority of PhD students, will find employment in the field of cartography (or in fields related to it, e.g. informatics, environmental conservation, public administration); some of them had even worked in these fields prior to being a student at the Department.

Most of the staff of the Department – researchers, professors, and teacher-engineers – participates actively in education, research and practical cartography. In the publication lists, beside traditional maps, you can find electronic atlases and multimedia cartographical publications financed by domestic or foreign superiors (companies, funds, offices). Their preparation includes theoretical and practical work of the staff of the Department.

Modern education, especially doctoral schools and workshops surpassing even the higher education, needs the intensive development of technical resources. This is the only way to keep pace with the development of the general level of techniques. This is why one of recent fundamental tasks of professors, PhD students and undergraduate students is to compete.

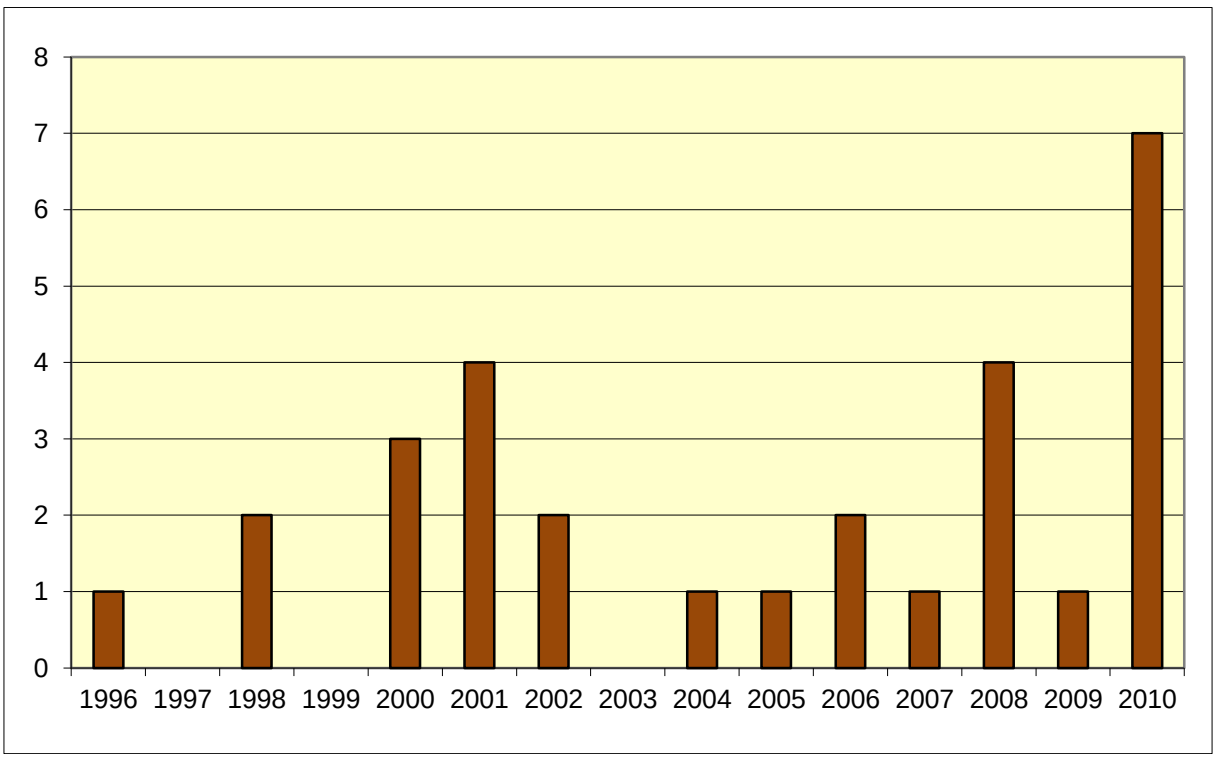

Fig. 64. The number of PhD degrees awarded in cartography since the beginning of this type of education

Research

The Department has undertaken research in the following three fields of subjects:

Aspects of representation in thematic cartography (digital maps - electronic atlases)

Major results:

- Virtual Globes Museum
- Participation in a project "Environmental monitoring system with GIS for the watershed of the Ipoly River".
- Managing a special sub-project in the National Research University Project (TÁMOP): Large cartographic databases and informatics in thematic cartography.
-

Education in Cartography

Major results:

- Establishment of an MSc in cartography (the only cartography programme in Hungary),
- Working in the European Education on Geodetic Engineering, Cartography and Surveying (EEGECS)
- Working in the ICA Commission on Education and Training.
- Publishing two books on GIS (by István Elek), 2006–2007
- Publishing the first volume of a textbook series on Cartography-Geoinformatics edited by Prof. Klinghammer

5. Map collections

Map Room of the National Széchényi Library

Events on Map History in Hungary between 2007 and 2010

The past couple of years were very rich again in conferences and exhibitions organized in Hungary in the themes relating to map history.

The National Széchényi Library organized the following exhibitions, or actively participated in organizing them:

In 2007:

- *Where can you find the treasure of the pirates?* (As part of the Museums' Night programme)
- *Tabula Hungariae 1528.* An exhibition organized on the occasion that in 2007, The Memory of the World entered Hungary's first map in the UNESCO list.

In 2008:

- *The definition of space in the Renaissance cartography* (As part of the Museums' Night programme)
- *Theatrum Terrae Sanctae* (Maps depicting the Holy Land)
- *Margaritae Cartographicae* (Reguly Antal Library, Zirc). The Map Division participated in organizing the exhibition and lent several globes and celestial globes.

In 2009:

- *The art of navigation* (As part of the Museums' Night programme)
- *„For the one who flies over by plane, the landscape is just a map"* (An exhibition of flight navigation maps of the Second World War, in cooperation with Erődítés Történeti Egyesület – a Hungarian society for war history)

In 2010:

- *Tabula Peutingeriana. The history of the itineraries of the Roman Empire* (a vitrine show)
- *The art of navigation* (As part of the Museums' Night programme)
- *Hungarian printed globes and celestial globes* – a major exhibition in the National Széchényi Library
- *Globe-rarities of the Map Room* (a vitrine show)

Publications:

- Plihál, Katalin: Tabula Hungariae. The Lazarus map and its versions. Budapest, 2007. National Széchényi Library, CD-ROM
- The finest maps of Hungary. Edited by Katalin Plihál. Budapest, 2009. Kossuth Kiadó, 239. p. + DVD
- The finest illustrated maps of Hungary, 1528-1895. Budapest, 2009. Kossuth Kiadó and National Széchényi Library, 239 p.+DVD

People living in any corner of the world can have online access to and use the digitized maps kept in the Map Room (www.topomap.hu/oszk/hun/).

Although it is not exactly an event of map history, in this place it is worth mentioning that for many years the National Széchényi Library and the Lazarus Cartographic Foundation have been organizing every spring an exhibition and competition for the most beautiful printed and digital maps produced in Hungary during the previous calendar year.

Katalin Plihál, Keeper of the Map Room
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War History Institute and Museum, War History Map Room

National Progress Report 2007-2011

Activities of the Maproom:

The main task of the Maproom is promoting researchers with different pieces of cartographical materials /ancient maps, series maps, aero-photographs,.../. The most studied items are the first, second and third military survey maps of Hungary. The number of researchers is about 550-600 persons per year.

Education in the Maproom:

Study visits of different groups from universities, colleges and even groups from abroad, 10-15 groups per year. The objectives of these visits are historical cartography, introduction to military surveys. Courses has been regularly held to the students of Military Academies.

Automation of map-catalogues:

The catalogue of the individual maps of the Maproom has been processed – 30.000 pieces. For the elaboration Folio Views program was used. The catalogue can only be used locally in the Maproom, internet access is under discussion.

Digitising projects:

Digitising (scanning) of cartographical materials have been continued with the next items:

Maps of military events used during the First World War (3800 sheets)
Topographic maps of Central Europe, in German edition (on scale 1:300.000) during the Second World War (600 sheets)
Topographic maps made in Hungary between the two wars (on scale 1:25.000, 1: 75.000, 1:200.000, 1:750.000) (500 sheets)
General political, administrative, physical, special thematic maps of the Habsburg Empire, the Austro-Hungarian Monarchy, Hungary from the 16th century to 1920. (7500 sheets)

Collection development:

We have an increase cca. 2000-2500 maps per year (military maps, colour copies, other maps).

Conservation, restoration:
10-20 maps per year are under professional restoration, scanning of maps for security reasons.

Exhibitions:

Chamber exhibition for the 110th anniversary of the birth of Sándor Radó, Hungarian Chartographer
(held in November of 2009)

Publications:

2007.

- Jankó, Annamária: Magyarország katonai felmérései. (Military surveys of Hungary. – Special book of history of cartography) 196 pp. + CD.
- War History Institute and Museum-Arcanum: A harmadik katonai felmérés. 1869–1887. 1:25 000. Ungarn, Siebenbürgen, Kroatien–Slawonien. Digitized Maps of the Habsburg Empire. (The third military survey. Scale 1:25.000.) Georeferenced. 1350 map-sheets and different studies. 2 double DVD-s.
- War History Institute and Museum-Arcanum: A harmadik katonai felmérés. 1869-1887. 1:75 000. Österreichisch-Ungarischen Monarchie. Digitized Maps of the Habsburg Empire. (The third military survey. Scale 1:75.000.) Georeferenced. 752 map-sheets and different studies. DVD..
- War History Institute and Museum-Arcanum: Grossfürstenthum Siebenbürgen. Erdély az első és második Habsburg katonai felmérés térképein. (Transylvania on the maps of the first and second military surveys.) Georeferenced. 580 map-sheets and different studies. DVD.

2008

- War History Institute and Museum-Arcanum: Az Osztrák-Magyar Monarchia első világháborús hadszíntéri térképei - keleti front, olasz front. (Maps of the Austro-Hungarian Monarchy on the battlefield in the period of the WWI - eastern front, Italian front.) – 800 map-sheets. Double DVD.
- War History Institute and Museum-MH-GEOSZ-Arcanum: Magyarország topográfiai térképei a II. világháború időszakából – méretarány 1:50.000. (Topographic maps of Hungary in the period of the WWII. Scale: 1:50.000) Georeferenced. 404 map-sheets and different studies. DVD.
- War History Institute and Museum-Arcanum: Az Osztrák Császárság, az Osztrák-Magyar Monarchia és Magyarország térképei a Hadtörténeti Térképtárban 1566-1918. (Maps of the Habsburg Empire, the Austro-Hungarian Monarchy, Hungary in War History Maproom from 1566 to 1918. 2 double DVD-s.

2009

- War History Institute and Museum-Arcanum: Magyarország megyetérképei a Hadtörténeti Térképtárban. (Country maps of Hungary in War History Maproom.) Double DVD.
- War History Institute and Museum and Duna Museum: Duna- Mappáció. Vízrajzi és hajózási térképek a 19. század első feléből. (Mapping of Danube. Hidrographic and navigation maps from the first part of the 19th century). DVD.

2010

- War History Institute and Museum-Arcanum: Szakmai-tudományos térképek a Hadtörténeti Térképtárban. Az Osztrák Birodalom, az Osztrák-Magyar Monarchia és Magyarország területére 1765-1920. (Special thematic maps of the Habsburg Empire, the Austro-Hungarian Monarchy and Hungary from 1765 to 1920.) Double DVD.

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Virtual Globes Museum

This virtual exhibition is intended to present the earth and celestial globes made in or related to Hungary. However, some kind of VRML player is needed to be installed on your computer in order to view the virtual globes. We recommend Flux Player. (download)

Installing Google Earth is also recommended to reach all functions of the museum.

Information

Usage:

Clicking the "Museum" menu will show you the list of the currently available globes with their primary properties. Selecting an item from the list will load the globe's 3D VRML model if the required software is already installed. (The VRML player can be downloaded by clicking the link above.)
The list can be shortened by defining searching criteria. The results will include all the records in which the specified data field contains the word fragment typed into the "Search" textbox. It is also possible to specify a date interval by typing e.g. *1526-1984*.
Clicking the "Detailed data sheet" sign will load the data and images (if there is any) of the globe into a new window. There is also a link to a Google Earth file of the globe.
The resolution of the downloadable and on-line viewable 3D models is limited to the larger (d>20 cm) globes. These globes high-resolution models of these globes can be viewed at the Department of Cartography and Geoinformatics and at the exhibitor place after pre-arrangement.
The pages are best viewed by Mozilla Firefox with a minimum screen resolution of 1024*768
http://terkeptar.elte.hu/vgm/

Fig. 65. The title page of the Virtual Globes Museum