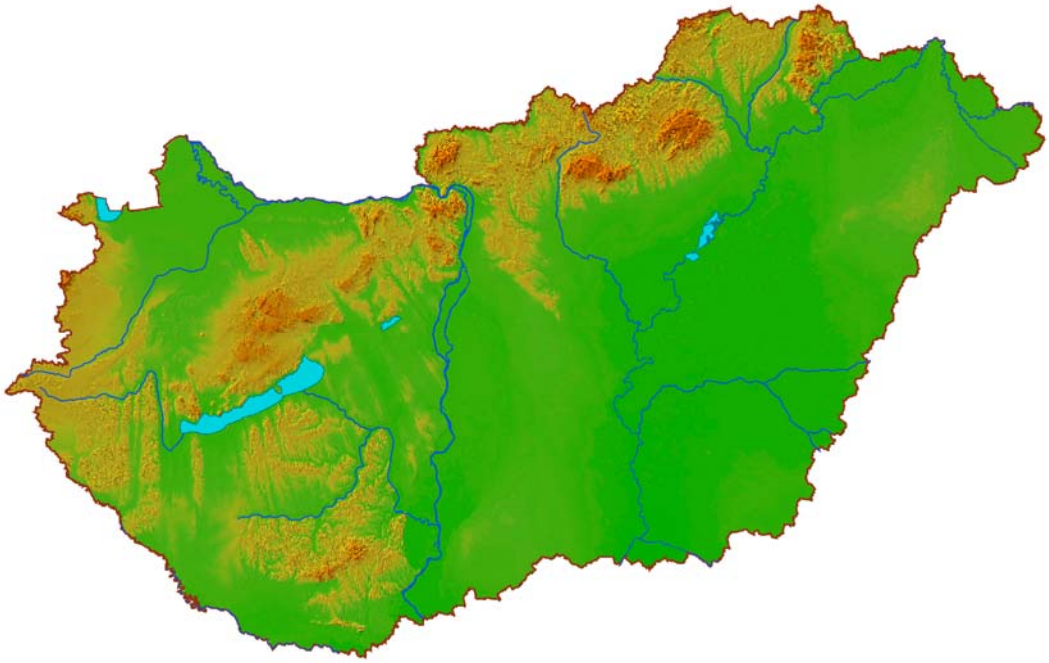
CARTOGRAPHY IN HUNGARY 2003-2007



Prepared by the

Hungarian National Committee (HNC) of ICA,

edited by

Béla Pokoly, secretary

for the

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Cover:

The figure on the front page is based on a shaded and colour coded Digital Elevation Model. The DEM was established using digital vector data (contour lines, spot heights) of the 1:100 000 scale EOTR topographic maps. Main lakes and watercourses were selected from the CORINE Land Cover database and the 1:100 000 scale digital topographic map. The source of digital boundary data is the MKH database.

CONTENTS

1. Cartographic Activities of the Hungarian National Mapping Agency

In Hungary, two ministries are responsible for national mapping.

Geodetic control networks, production and actualisation of large scale state base maps including cadastral maps and topographic mapping at scale 1:10 00 — often referred to as civil mapping tasks — fall under the responsibility of the Ministry of Agriculture and Rural Development (MoARD). The Department of Land Administration and Geoinformation (DLAG) at this Ministry is the supervisory body for the civil national mapping.

State 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 — often referred to as military tasks — are controlled by the Ministry of Defence (MoD). Its supervisory body is the Geoinformation Service of the Hungarian Defence Forces (GS 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).

1.1. Act LXXVI of 1996 on Surveying and Mapping Activities

In the Act LXXVI of 1996 on Surveying and Mapping Activities, the Hungarian Government defines the tasks and projects related to land surveying and mapping activities as well as provides the conditions to meet the national demands for map supply in a cost-effective way and in accordance with uniform professional standards.

The primary aim of the Act is to regulate

- The basic tasks of the government in respect of land surveying and mapping;
- Mapping of the country's territory based on surveys of uniform principles;
- Establishing and maintaining horizontal and vertical control networks serving as a basis for all land surveying and mapping activities;
- Establishing the map bases for linking land registers and geoinformation systems;
- The system of management, utilisation and supply of the basic state geodata;
- The conditions of performing the land surveying and mapping activities;
- The land surveying and mapping administration;
- The resources of the expenses of basic state land surveying and mapping duties.

According to this Act on Surveying and Mapping, the basic state duties are the following:

- supplying the country with state maps;
- supplying the defence forces with maps;
- handling, storing, maintaining and providing basic state geodata for the basic state land surveying and mapping activities;
- fulfilling the tasks arising from international obligations;
- determining, filing and supplying the geographical names;
- performing the related technical R+D activities.

For proper map supply, the Hungarian State arranges for the basic state surveying and mapping duties as follows:

- creating and continuous updating of state surveying base maps and their index maps;
- creating and continuous updating of state topographic maps;
- creating and maintaining of control point networks;
- surveying of state border;
- determining and filing the geographical names according to special laws and in co-operation with the Hungarian Committee on Geographical Names.

According to *Joint decree No. 21/1997 (12 March) of the ministers of MoARD and MoD* on implementation of the Act on Surveying and Mapping, the task of supplying the country with state maps, including defence, map supply has been allocated to the Land Offices, the Institute of Geodesy, Cartography and Remote Sensing (hereinafter referred to as FÖMI) as central organisation, the Geoinformation Service of the Hungarian Defence Forces (hereinafter referred to as GS HDF) and the Ministry of Defence Mapping Company.

The way and scheduling of producing state topographic maps, the establishment of the geodetic frameworks of the country, as well as the standardisation and regulation – taking into account the recommendations of the Co-ordination Committee on Map Supply – are specified in a joint directive of the two responsible ministers.

1.2. Organisation of civilian mapping

The civil 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.

The civil lands and mapping organisation is supervised by the Department of Land Administration and Geoinformation at the Ministry of Agriculture and Rural Development (DLAG/MoARD). The tasks of the civil organisation are carried out by the following institutional network (Fig. 1.):

- Institute of Geodesy, Cartography and Remote Sensing (FÖMI) as governmental organisation with nation-wide competence,
- 19 County Land Offices (CLO) and the Budapest Land Office as governmental organisations with territorial competence,
- 119 District Land Offices (DLO) and 2 Capital Districts Land Offices as governmental organisations with territorial competence,
- Office for National Cadastral Programme as a non-profit organisation.

1.2.1. Department of Land Administration and Geoinformation

The Department of Land Administration and Geoinformation (DLAG) is responsible for the general and specific supervision, regulation, monitoring and completing of governmental duties concerning land registration, land surveying, mapping, remote sensing, land tenure policy (land use, land consolidation) and supervising of the implementation. DLAG is divided into three divisions with the following main responsibilities:

- *Division of Surveying, Mapping and Geoinformation*: tasks relating to control point networks, national cadastral and topographic maps as well as regulations and rules on national mapping, surveying and geoinformation. Technical upgrade of the land offices IT development, control of Land Parcel Identification System for IACS, support of the planning and implementation of various international co-operations, remote sensing applications and developments on spatial data infrastructure (SDI) through nationwide networking.
- *Division of Land Registration*: land and property registration, land area data supply, legal measures pertaining to DLAG that revises the appeals against land office decisions.
- *Division of Land Protection and Land Use*: tasks relating to licensing of non-agricultural use of croplands, supervision of land use registration, control of utilisation obligation of croplands, support of land restoration and land use as well as judgement of applications on subsidized land consolidation.

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

DEPARTMENT OF LAND ADMINISTRATION AND GEOINFORMATION (DLAG)

Division of Surveying, Mapping and Geoinformation

- Control point networks
- National cadastral and topographic maps
- Regulations and rules on national mapping, surveying and geoinformation
- Technical upgrade of the land offices IT development
- Developments of NSDI

Division of Land Registration

- Land and property registration
- Legal measures pertaining the dept
- Land area data supply
- Revises the appeals against land office decisions

Division of Land Protection and Land Use

- Licensing of non-agricultural use of croplands
- Control of utilisation obligation of croplands
- Support of land restoration and land use
- Land consolidation

Ministry Departments

(others)

Institute of Geodesy, Cartography and Remote Sensing (FÖMI)

- Development and Maintenance of Control Point Networks
- Coordination and Managing of National Mapping
- Archiving and Supply of Land and Mapping Data
- Quality Management of Lands and Mapping Section
- Digital Map, GIS and LIS Developments
- Land Offices System Support
- Training Management and Documentation for Lands and Mapping Section
- National Boundary Survey
- Remote Sensing for Agriculture and Environment
- Distribution and Archiving of Remote Sensing Data
- Recording and Supply of Geographical Names

County Land Offices and the Budapest Land Office (20)

- Managing and Supervision of District Land Offices
- Acceptance and Quality Check of Cadastral Data
- Cadastral, Land and Survey Data Supply
- Value Added Data Supply

District Land Offices (118)

- Land and Real Property Registration Activity
- Public Data Supply

Office for National Cadastre Programme

Non-Profit Company

Fig. 1.
Structure of the Hungarian Lands and Mapping Organisation

1.2.2. Institute of Geodesy, Cartography and Remote Sensing (FÖMI)

Main activities of FÖMI are as follows:

- Development and maintenance of control point networks,
- Co-ordination, managing and budgeting of national mapping,
- Quality control and acceptance,
- Archiving and supply of lands and mapping data and aerial photographs,
- Quality management of lands and mapping section,
- Supporting the system of Land offices,
- Training management and documentation for lands and mapping,
- R+D for geodesy, mapping, land registry, GIS and LIS as well as for remote sensing,
- National boundary survey,
- Remote sensing for agriculture and environment,
- Distribution and archiving of remote sensing data including aerial photographs,
- Recording and supply of geographical names,
- Deriving and supplying value added data,
- Representing Hungary and taking part in common activities of the surveying and mapping agencies and bodies of all over the world.

Fig. 2.
The building of the Institute of Geodesy, Cartography and Remote Sensing (FÖMI)

1.2.3. County Land Offices and Budapest Land Office

The 19 County Land Offices and the Budapest Land Office are responsible for the budgeting, administration, quality control, and the hearing of appeals against District Land Office decisions. Their main tasks are as follows:

- Managing and supervising of District Land Offices,
- Acceptance and quality check of cadastral data,
- Cadastral, land and survey data supply,
- Value added data supply.

1.2.4. District Land Offices

Main tasks of the 119 District Land Offices and the 2 Capital Districts Land Offices are as follows:

- Land and real property registration activity,
- Surveying and mapping maintenance,
- Tasks concerning land classification and protection,
- Public data supply.

Fig. 3.
The building of a District Land Office in the County of Szabolcs-Szatmár-Bereg

Fig. 4.
Supplying of data in a District Land Office

1.2.5. The National Cadastral Programme Non-profit Company

In 1997 production of cadastral maps in digital form started under the National Cadastre Programme. The National Cadastral Programme Non-profit Company (NCP Non-profit Co.) is separately funding this Programme through credits guaranteed by the Hungarian Government.

1.3. Organisation of military mapping

The independent Hungarian military mapping dates back to 4 February 1919. Since January 2001, the military mapping tasks have been implemented by two organisations.

The basic mission of the Geoinformation Service of the Hungarian Defence Forces (GS HDF) is to plan and have implemented state base mapping tasks and work in the responsibility of the Minister of Defence (MoD) as well as doing state jobs in its sphere of authority. The Geoinformation Service of the Hungarian Defence Forces provides for the execution of the tasks necessary for defence map supply and professionally co-ordinates other sectors' defence related surveying and mapping activities including standardisation and regulation issues.

In connection with the above listed ones, GS HDF:

- plans and organises mapping and military geographic provision of the armed forces;
- elaborates professional standards and regulations;
- on special rule, provides for the authorisation and professional supervision of survey camera aerial photography;
- operates military geographic and digital topographic databases, provides for the continuity of map update and the filing of the changes on the maps;
- represents defence interests in determination of medium and long term mapping tasks of the country's map supply within the Co-ordination Committee on Map Supply established for scheduling and co-ordinating the tasks;
- fulfils the tasks arising from international obligations;
- directs and supervises the professional activities of MoD Mapping Company.

The basic mission of Minister of Defence Mapping Company is to implement and have implemented basic governmental duties and works in the responsibility of the minister of defence as well as custody, handling and providing governmental geodata and maps at scales from 1:25 000 to 1:250 000.

The tasks of MoD Mapping Company are as follows:

- doing and having done surveying and mapping works in the scope of state surveying and mapping tasks – first of all in order to the map supply of the defence forces – with national competency;
- custody and handling basic governmental geodata, base maps and state topographic maps arising from the activities prescribed in the previous paragraph;
- map supply of the Border Guards, the Civil Protection and the defence administrative and law enforcement bodies against payment;
- producing military thematic maps (among other things, with conversion of state topographic maps according to NATO prescriptions), military control point

catalogues and other special mapping products in compliance with the demands of GS HDF in analogue and digital form;

- storing and providing state topographic maps, mapping products and state base data for utilisation of national economy in analogue and digital form;
- implementing and having implemented aerial photography and other remote sensing tasks;
- implementing tasks in connection with geodetic provision of military engineering and other weapon systems;
- field examining and maintaining state control points for areas in MoD administration, preserving control points in control point catalogue as well as replacing destroyed control points;
- operating an aerial film archive and providing remote sensing materials;
- activities in connection with the technical servicing the 'Open Skies Programme'.

1.4. Status of the Geodetic Control Network

1.4.1. Reference System

A reference system called Hungarian Datum 1972 (HD-72) was introduced in 1972 based on independent adjustment of Hungary's astrogeodetic network. 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).

1.4.2. Projection System

A projection system for civil 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.

Recently, projection systems of earlier times are in use, too:

- three oblique-axis cylindrical projection systems: North, Median and South,
- stereographic projection for cadastral maps at scale 1:2880, 1:1440 and 1:720.

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.

1.4.3. Hungarian Geodetic Control Networks

1.4.3.1. Uniform National Horizontal Network (EOVA)

The EOVA is based on the Hungarian Datum 1972, the network orientation is provided by 40 Laplace-points and the scale is maintained by 23 EDM lines.

Parameters connecting the Hungarian control network to the EUREF-89 and ED-87 systems have already been measured, computed and finalised.

For high order scaling, a 864-m long Standard Baseline at Gödöllő town (about 30 km from Budapest) has been measured with Väisälä interferometric method and Kern Mekometer in co-operation with the Finnish Geodetic Institute in 1987 and re-measured in 1999. This very stable baseline with 5 pillars is accredited for EDM calibrations for national and international use.

The network (Fig. 5.) 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 exist in EOVA.
- The 1st, 3rd and principal 4th order sites have 10306 orientation sites. 6080 orientation sites have co-ordinates.

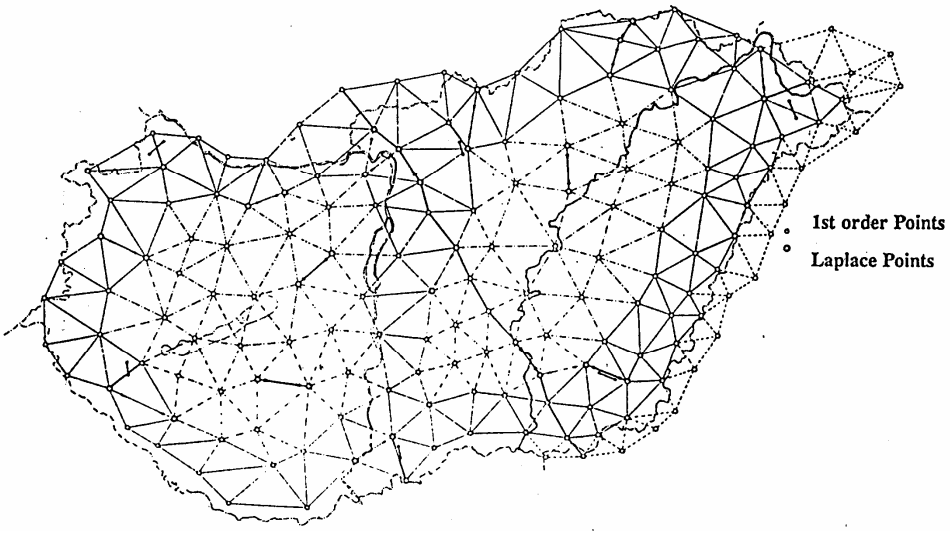


Fig. 5.
Sites of the 1st order Uniform National Horizontal Network

An EOVA Database was created and is operated by FÖMI, containing the positional and descriptive data of horizontal control sites (1st, 3rd and 4th order) as well as their sketching. It contains: the number of the sites, the vertical and horizontal co-ordinates of the sites in the EOV and old projection systems, the location of the sites (county,

settlement, sheet number), the date of determination and checking actions and the sketch of approach (Fig. 6.).

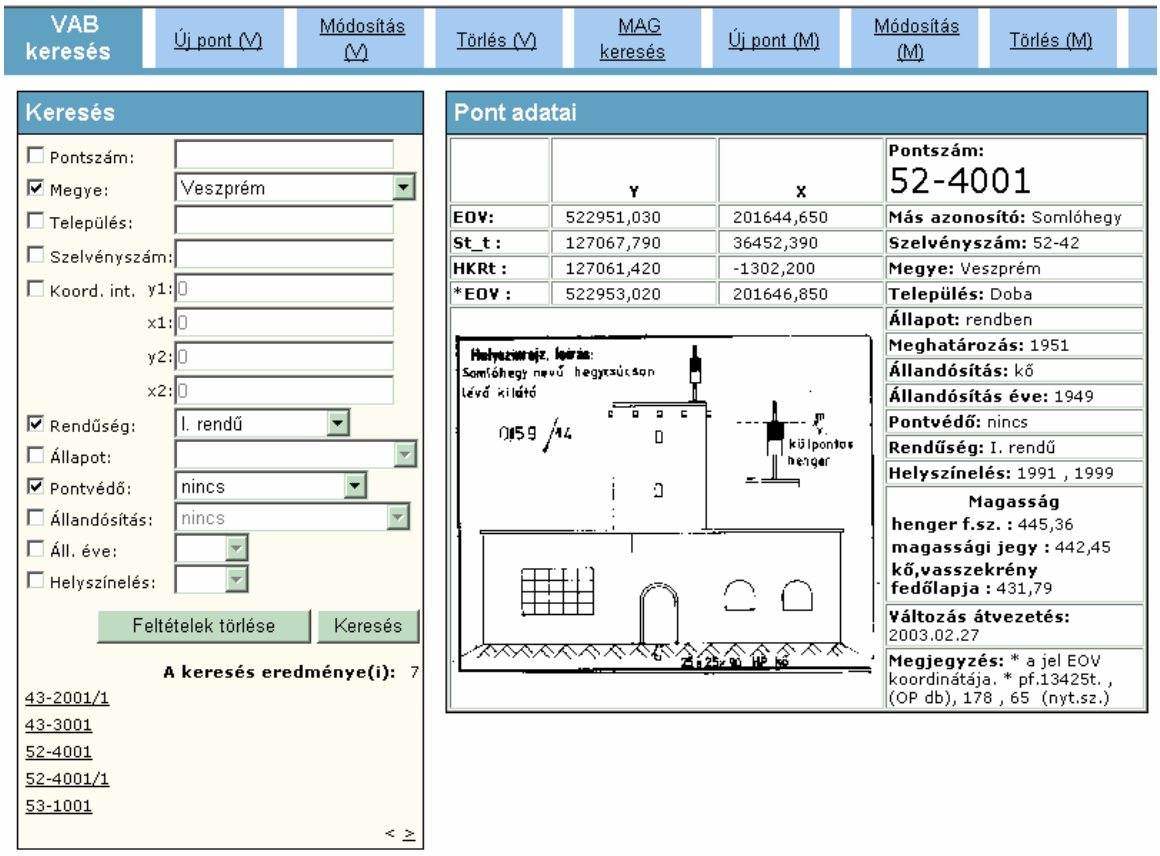


Fig. 6.
Sample printout from EOVA Database

In matters concerning EOVA, military mapping is responsible for 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.

1.4.3.2. Uniform National Height System (EOMA)

The EOMA has normal heights with Baltic Sea level. The reference 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. 7.).

EOMA consists of:

- 41 principal fundamental benchmarks (16 established on rock, others are well-based benchmarks situated in sedimentary area),
- 800 of 1st order special benchmarks based in 3-5.5 m deep,
- 5981 sites of 1st order,
- 5096 sites of 2nd order,
- 13 417 sites of 3rd order (GPS technique for the replacement of the classical 3rd order levelling is introduced in 2000),

- Hungary has a kinematical network containing about 1100 points along the 1st order levelling lines to study the recent crustal movements,
- 23 connecting levelling lines to the neighbouring countries.

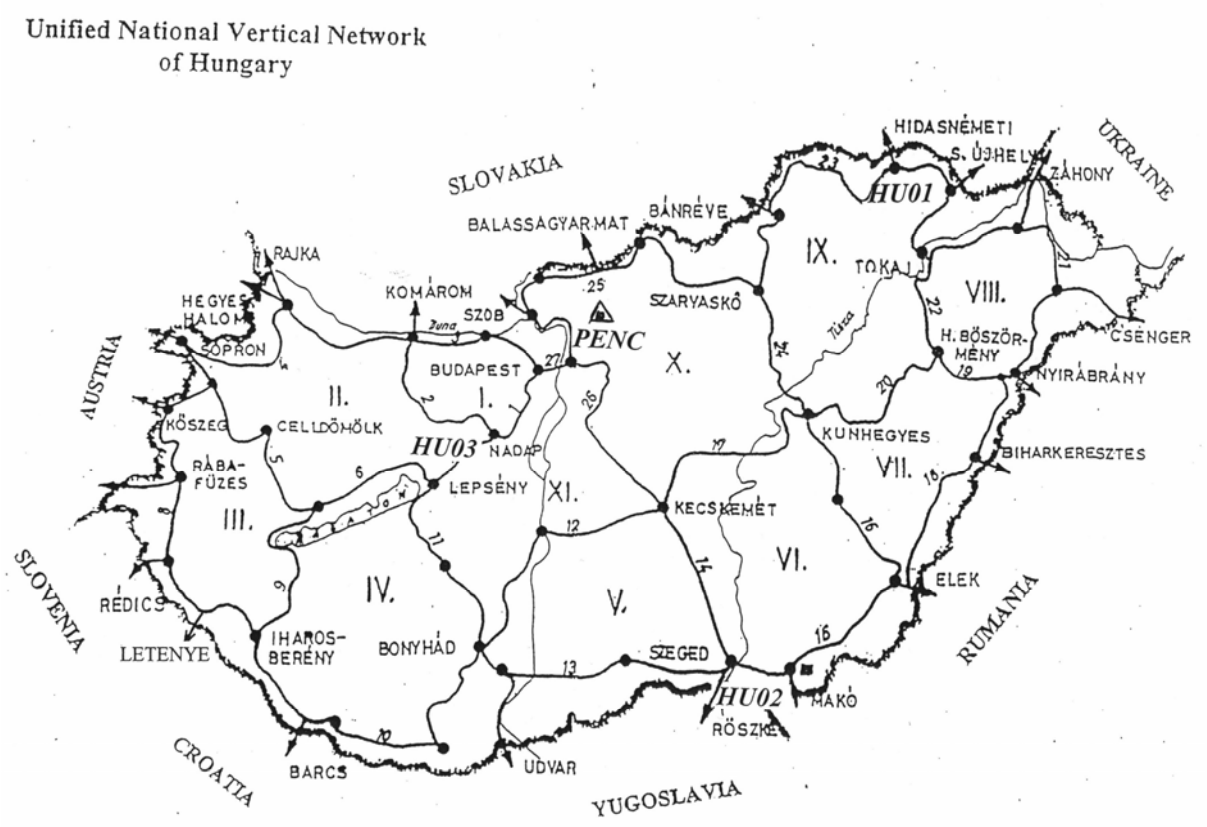


Fig. 7.
Sites of the 1st order Uniform National Vertical Network

Upon the 1994 call of IAG/EUREF sub-commission, Hungary has prepared data expressed in geopotential index numbers for the purpose of connecting the Hungarian vertical network to the UELN frame. Hungary participated at the EUVN 97 campaign with successful GPS observations as well as levelling and gravity measurements of 4 special benchmarks.

An efficient technique has been elaborated at FÖMI for the replacement of the 3rd order levelling with GPS and geoid. This technique is successfully applied in the practice for the completion of the EOMA 3rd order network in the Transdanubian region, operating recently.

A Database of Vertical Network containing the data of height control sites (1st, 2nd and 3rd order) was created and is operated by FÖMI. These data are (Fig. 8.): number of the sites, vertical co-ordinates, location of the sites (county, settlement, sheet number), date of determination, measurement and control of the sites, textual and scanned description of the surroundings.

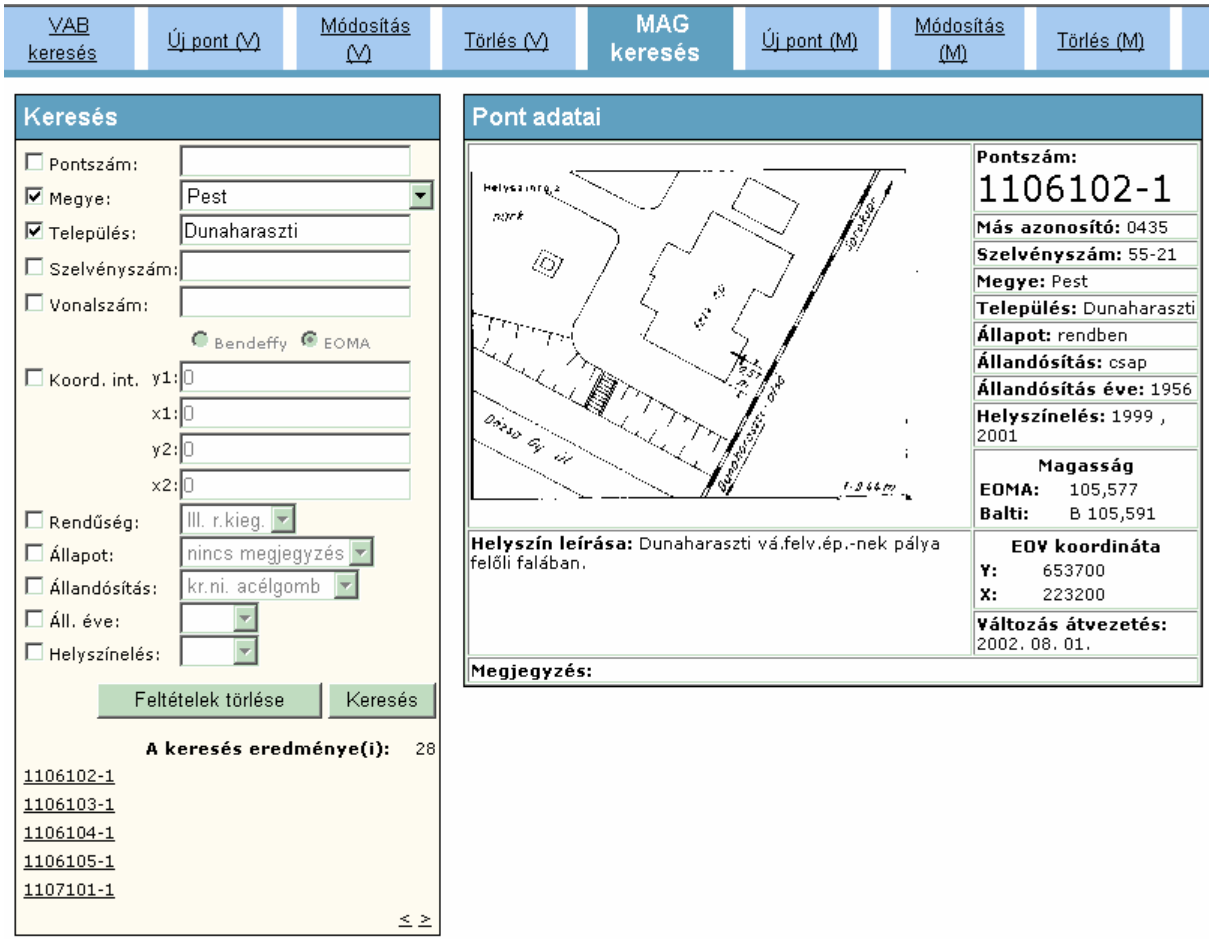


Fig. 8.
Sample printout from EOMA Database

1.4.3.3. National GPS Network (OGPSH)

The Satellite Geodetic Observatory of FÖMI, at Penc is the centre for the Hungarian GPS Network activities given below:

- 9 sites of Hungarian part determined in EUREF Network (1991 and 2002),
- 24 sites of the OGPSH frame network,
- 1153 sites of the OGPSH measured all over the country (Fig. 9.).

The coordinates of the OGPSH sites are available in the 3D spatial ETRS89 (epoch 2002) reference system, as well as determined in the EOV projection system for mapping purposes.

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), textual description and scanned site sketch (Fig. 11.).

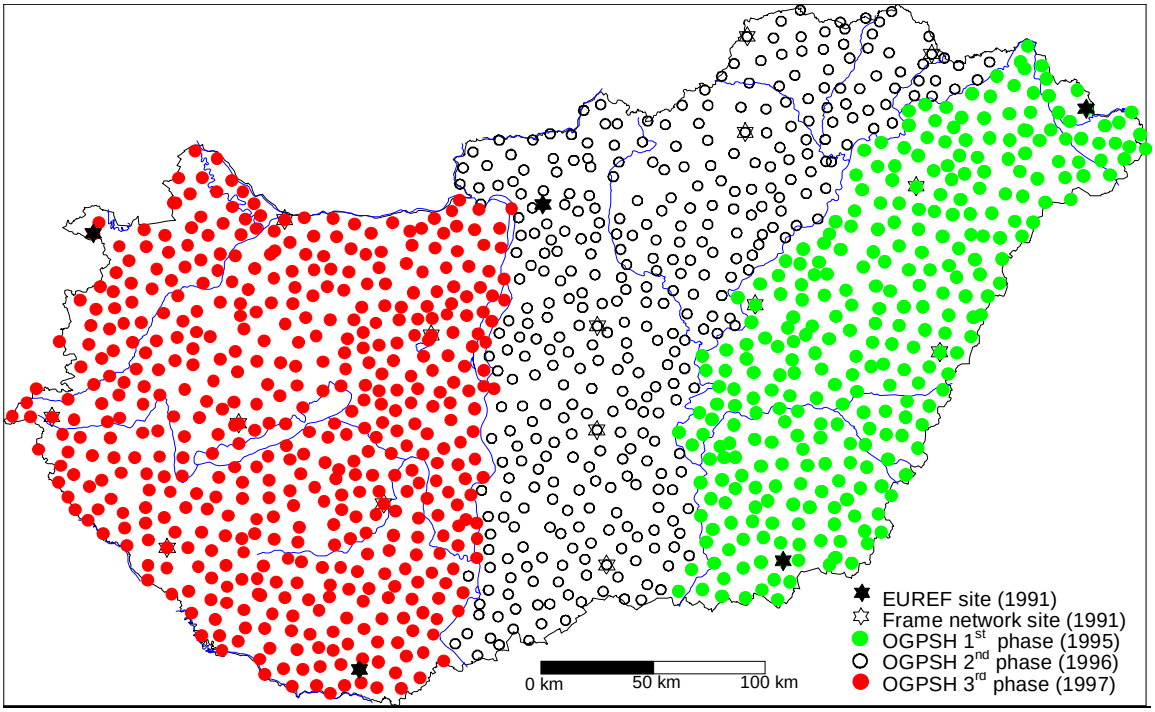


Fig. 9.
Sites of the National GPS Network (OGPSH), Hungary

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. 10. The maximal residuals are about 0.5 meters at the edge of the network.

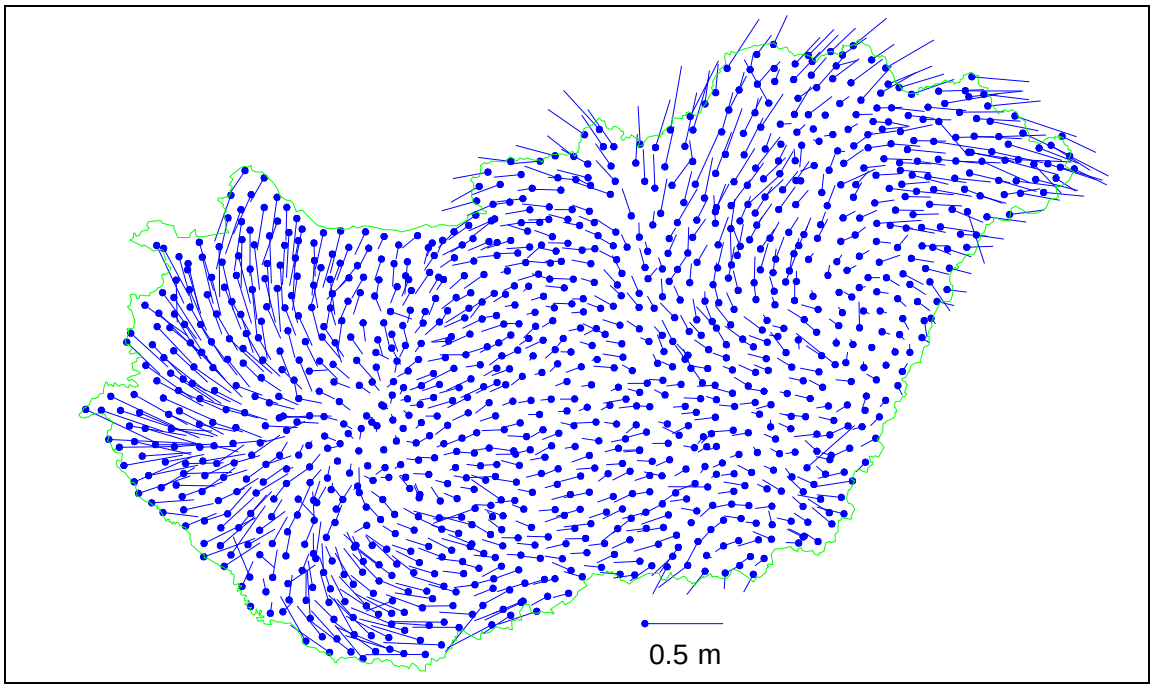


Fig. 10.
Horizontal residuals of the OGPSH

Horizontal residuals of the OGPSH and EOV networks

GPS ALAPPONT PONTLEÍRÁSA

GPS SITE DESCRIPTION

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:	Spec. info.:

EUREF89	X= 42300079,348	Y= 2381675,808	Z= 4556995,666
EUREF89 WGS-84	φ= 46-53-28.4097	λ= 10-6-2.3502	h= 215,953
EOV	y= 555501,39	x= 22270,24	H_{GPS}= 141,24

Megközelítési leírás (Description of approach)

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.

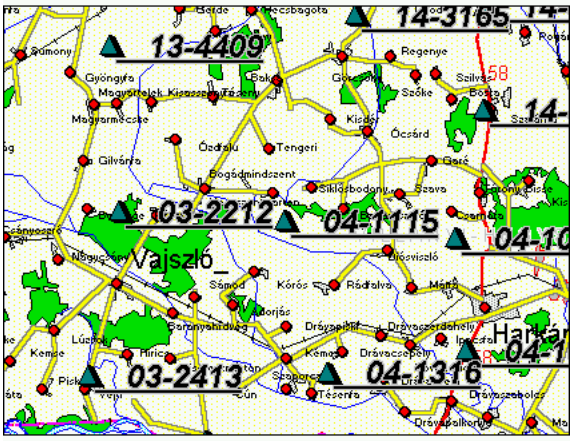
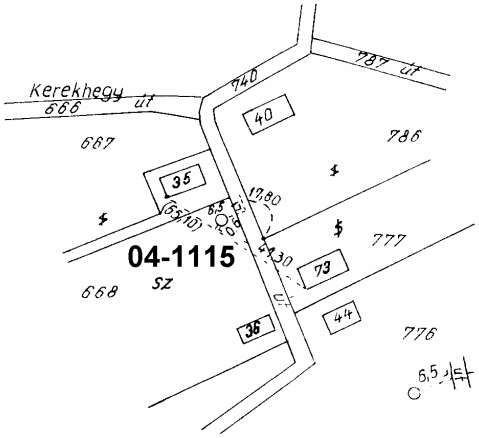
Megközelítési térkép 1 : 200 000 **1 : 200 000 scale map for approach**	**Helyszínrajz** **Site sketch**
	

Fig. 11.
Description of the OGPSH network sites
(Masked with English translation)

1.4.4. Hungarian Active GNSS Network

In 2007 a major step has been taken to complete the Hungarian permanent GNSS network development. In February fifteen state-of-the-art GPS/GLONASS reference station receivers have been purchased in order to replace obsolete equipment and build new stations. By the end of the year the GPSnet.hu network will consist of 31 Hungarian (Fig. 12.) and several external reference stations.

Four stations (PENC, OROS, BUTE and SPRN) are contributing to EPN (EUREF Permanent Network) submitting hourly and daily RINEX data. The non-EPN stations are operated along the same strict standards as the EPN ones, but their data is available only on a commercial basis.

As a result of a successful software tender in 2006 September FÖMI purchased a GNSMART network RTK software package licence from Geo++. Today all post-processing and real-time services are based on GNSMART modules.
RINEX and virtual RINEX files with flexible period and interval selection are available for our clients from all reference stations for a moderate price. The data can be accessed for registered users through the www.gpsnet.hu website of FÖMI's Hungarian National GNSS Service Centre.

Network development is focusing now on the complete coverage of the country with real-time services. Based on the existing 24 stations (status June 2007) the full coverage of Hungary with a sub-metre accurate DGPS service is provided. Single-station RTK corrections enable cm accurate real-time positioning over 2/3 of the country's area. Homogeneous cm accuracy is provided by FÖMI's most advanced network RTK service, which currently covers 3/4 of Hungary. The coverage area will be gradually extended to the borders by the end of the year. Real-time corrections and observation data in various formats are disseminated via the Internet using Ntrip technology. All real-time services are available currently free of charge. A charging system will be introduced after the new GPS/GLONASS receivers have been deployed.

The total number of our registered users is steadily rising since 2004, in June 2007 it was above 200.

Further densification of the Hungarian GNSS network is anticipated, 6 additional station locations have been already selected, these points will be equipped in the year 2008.

Data exchange testing between Hungary and the neighbouring countries started in 2006. Currently Slovakian reference stations' data are processed in Hungary and we provide data to Slovakia and Austria. By the end of the year external reference stations from Austria and Romania will also be included in the Hungarian data processing.

Hungary is participating in the EUPOS initiative, which intends to establish a multipurpose GNSS reference station network to support high-accuracy real-time and post-processing applications in Central and Eastern Europe. The developments of the GPSnet.hu network are carried out in accordance with the EUPOS standards and recommendations. All Hungarian reference stations have their coordinates fixed in the ETRS89 reference system.

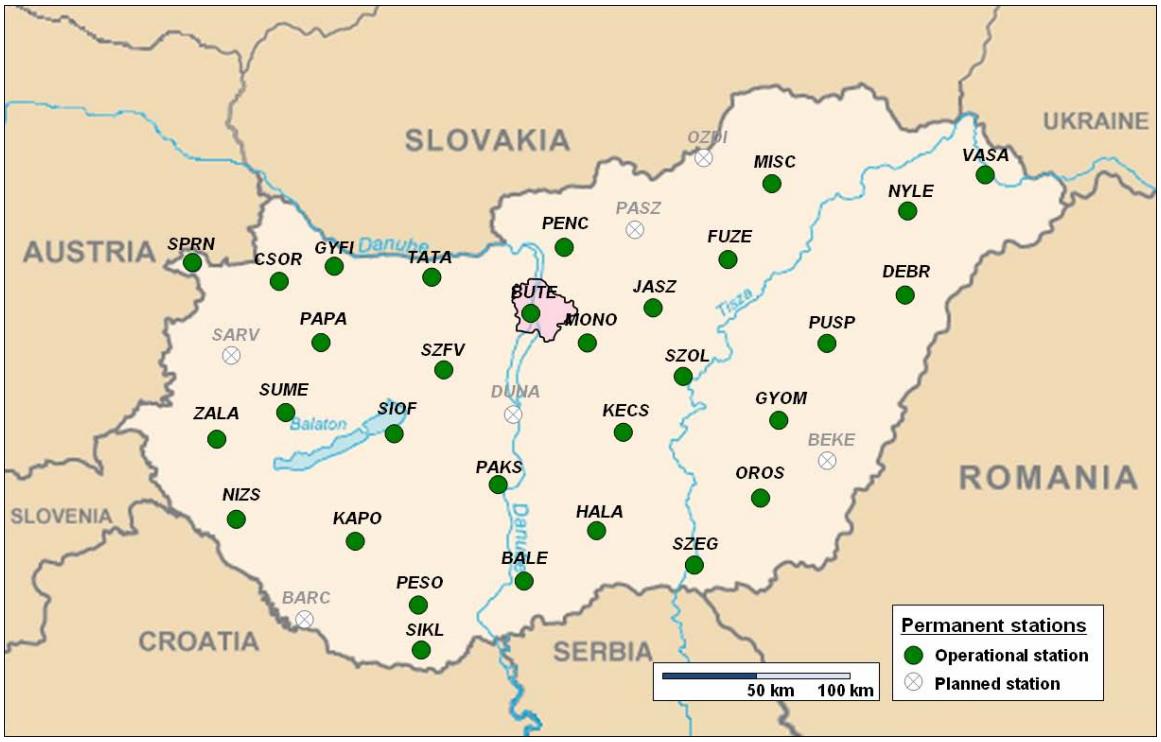


Fig. 12.
The Hungarian Active GNSS Network – GPSnet.hu
by the end of 2007

1.5. Topographic and Thematic Mapping

The Act on Surveying and Mapping and the respective Decree to it, which stepped into force on 1st March 1997, distinguishes the topographical maps produced before 1997 in EOTR and the state topographic maps. Consequently, the responsibility for topographic maps is divided between the DLAG/MoARD and GS HDF as follows:

- Topographic maps produced till 1996 in EOTR – DLAG/ MoARD,
- State topographic maps of large scales (equal to or larger than 1:10 000) – DLAG/MoARD,
- State topographic maps of medium and small scales (smaller than 1:10 000 and up to 1:250 000) – Geoinformation Service of HDF.

Before this Act, the topographic maps were produced for civil and military use. Both the civil Lands and Mapping Administration and the Defence Force have their analogue and digital maps at several scales.

1.5.1. 1:10 000 to 1:200 000 scale civilian topographic maps

1.5.1.1. Analogue Topographic Map Products of the Civil Lands and Mapping Administration

The EOTR system of topographic map (projection EOV) has been introduced in the early 1970's by the civil Lands and Mapping Administration to meet the demands, which could not be satisfied earlier by military classified maps.

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

- at scale 1:200 000 23 EOTR sheets (100%);
- at scale 1:100 000 84 EOTR sheets (100%);
- at scale 1: 25 000 267 EOTR sheets (25%) (Terminated production) ;
- at scale 1: 10 000 4098 EOTR sheets (100%).

The production of EOTR topographic maps at scale 1:25 000 was earlier terminated. 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.

1.5.1.2. Digital Topographic Map Products of the Civil Lands and Mapping Administration

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

1.5.1.2.1. Digital Topographic Map series of EOTR in scale 1:10 000

DRTA-10

- raster data of contour lines 4098 sheets (100%);
  planimetry 4098 sheets (100%);
  hydrography 4098 sheets (100%);
  colour prints 4098 sheets (100%).

DVTA-10

- vectorised data of contour lines 4098 sheets (100%)

DEM-10

- preliminary high-resolution digital elevation model, based on vectorized contour lines for the whole country (DEM with 5m grid interval) 4098 sheets 100%

DITAB-10v.0

At the end of 2006 we finished the vectorization of planimetric- and hydrographic layers of map sheets at scale 1:10 000, constructing a vectorized data base for the whole country

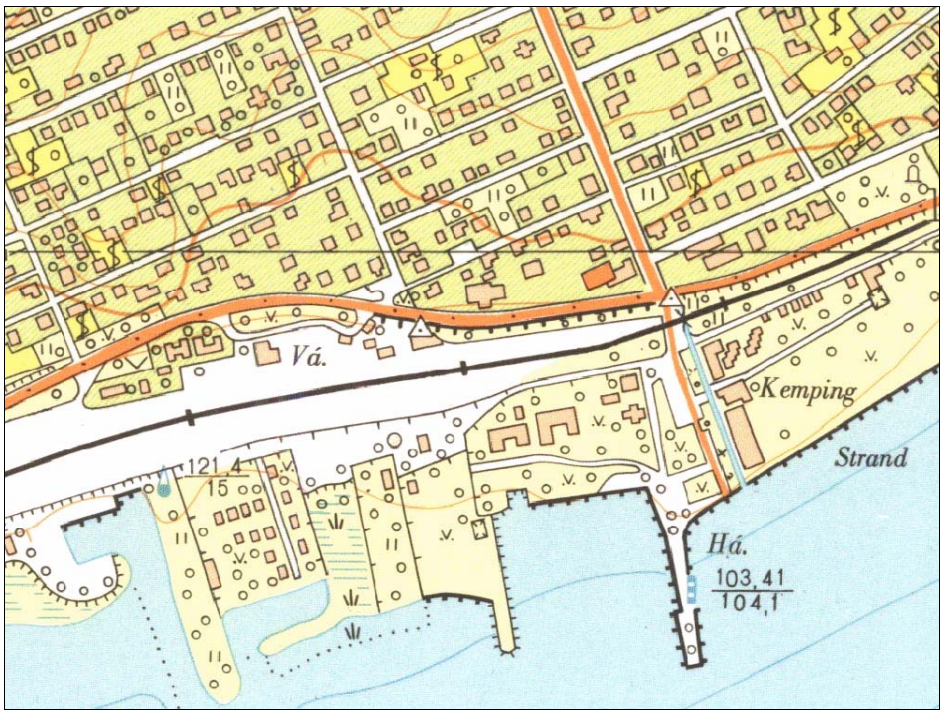


Fig. 13.
Fragment of the 1:10 000 Digital Topographic Map (© FÖMI)

1.5.1.2.2. Digital Topographic Map series of EOTR in scale 1:100 000

DRTA-100

- raster data of contour lines 84 sheets (100%);
  planimetry 84 sheets (100%);
  hydrography 84 sheets (100%);
  colour prints 84 sheets (100%).

DVTA-100

- vectorised data of contour lines 84 sheets (100%);
  planimetry 84 sheets (100%);
  hydrography 84 sheets (100%).

DEM-100

- digital elevation model of Hungary
  (DEM with 100m x 100m regular grid interval) 84 sheets 100%

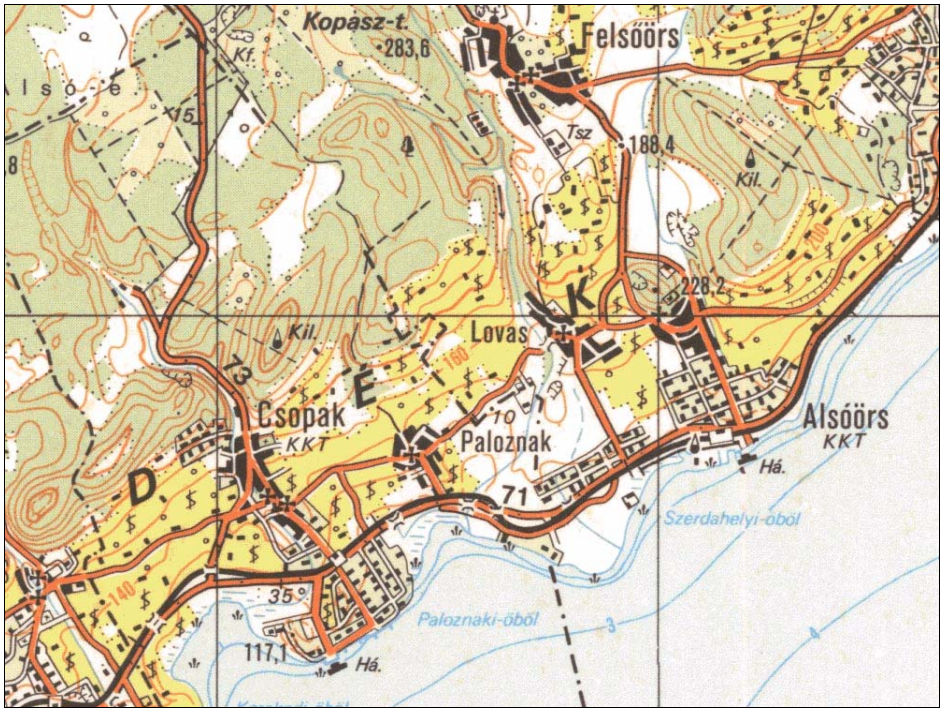


Fig. 14.
Fragment from the 1:100 000 Digital Topographic Map (© FÖMI)

1.5.1.2.3. Digital Topographic Map series of EOTR in scale 1:200 000

DRTA-200

- raster data of colour prints 23 sheets (100%)

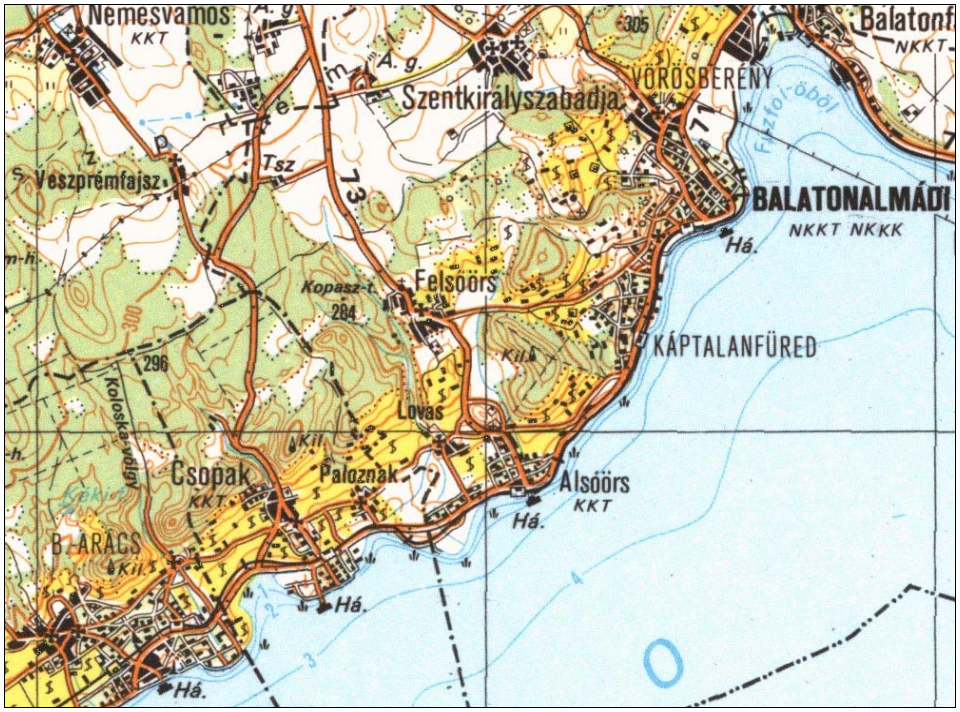


Fig. 15.
Fragment from the 1:200 000 Digital Topographic Map (© FÖMI)

1.5.2. Topographic and Thematic Mapping Activities at the Defence Mapping Organisations

1.5.2.1. Analogue Topographic Maps

With Hungary's NATO membership a new project was launched at the Hungarian Defence Forces to replace its old WP type maps with a new series of military topographic maps to be produced according to NATO standards in 2000. The new map series, among others, were to be produced in UTM projection, on WGS-84 datum and with a Hungarian-English bilingual marginalia. The base of the new 1:50,000 scale military topographic map series was the updated DTA^{TM}-50 v. 2.0 Digital Mapping Database, and the full country coverage was achieved in July 2004. (Fig. 16./a).

Fig. 16./a

Extract from the 1:50,000 scale military topographic map in UTM projection

Fig. 16./b

Extract from the 1:50,000 scale state topographic map in UTM projection, enhanced with EOV grid

The production of the civilian version ('state version') of the above product, supplemented with EOV gridlines, started in 2004 and was completed in 2005. (Fig. 16./b).

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

1.5.2.2. Digital Databases

Defence mapping organisations started establishing digital databases in the early 1980's. As a result of these activities, a number of databases and elevation models have been made available for the users in various sectors, e.g. governmental, defence and public, by now.

1.5.2.2.1. DTATM-200 - Digital Mapping Database

The creation of the DTA^{TM}-200 database commenced in 1988. Since that time DTA^{TM}-200 has been used by several institutions as grounds for their individual thematic databases.

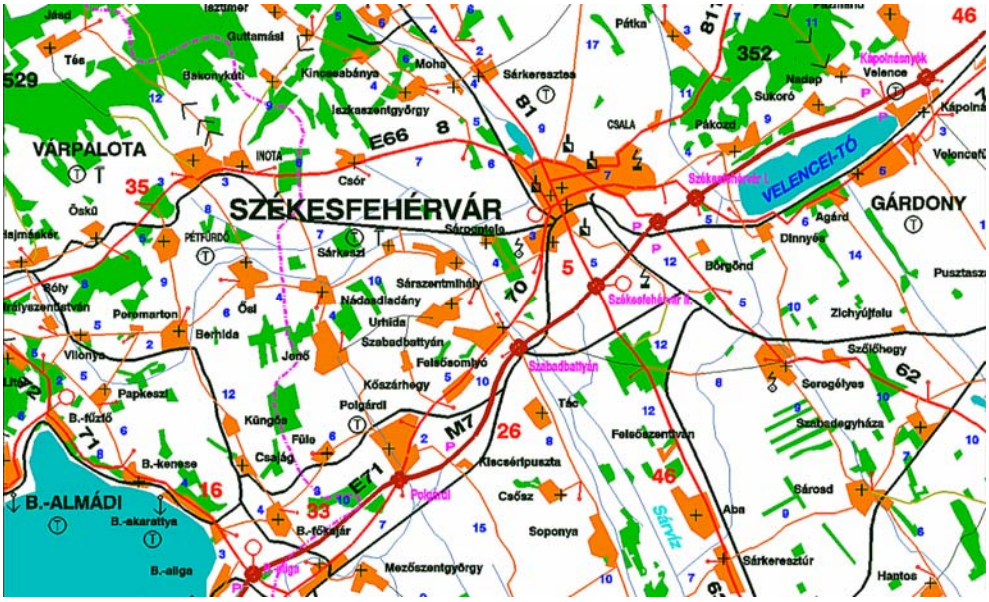


Fig. 17.
Extract from DTATM-200 database, new version

1.5.2.2.2. DDM-10 and DDM-50 - Digital Elevation Models

DDM-10 and DDM-50 Digital Elevation Models hold elevation data for the whole 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.

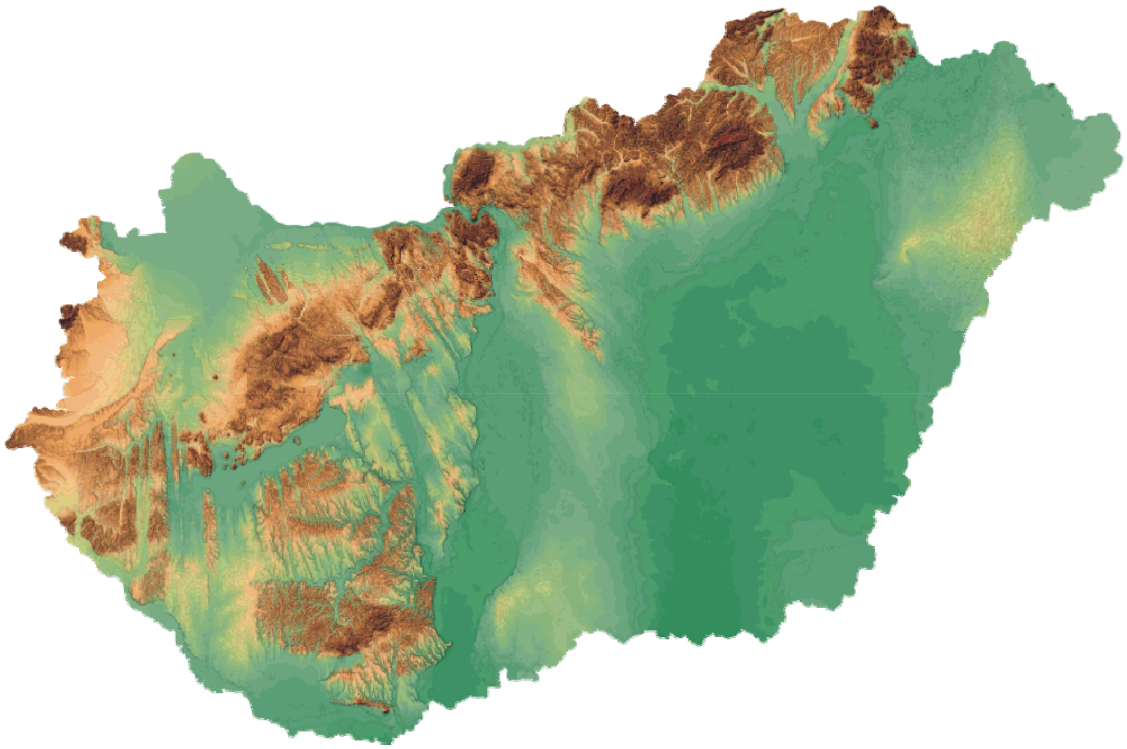


Fig. 18.
Representation of the Digital Elevation Model

1.5.2.2.3. DTATM-50 - Digital Mapping Database

DTA^{TM}-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 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.

DTA^{TM}-50 contains some 900 features in ten categories:

- marginalia;
- control points;
- settlements;
- facilities (industrial, mining, telecommunication, etc.);
- bridges and crossings;
- hydrography;
- hydrographic and shipping facilities;
- relief;
- vegetation and soils;
- boundaries.

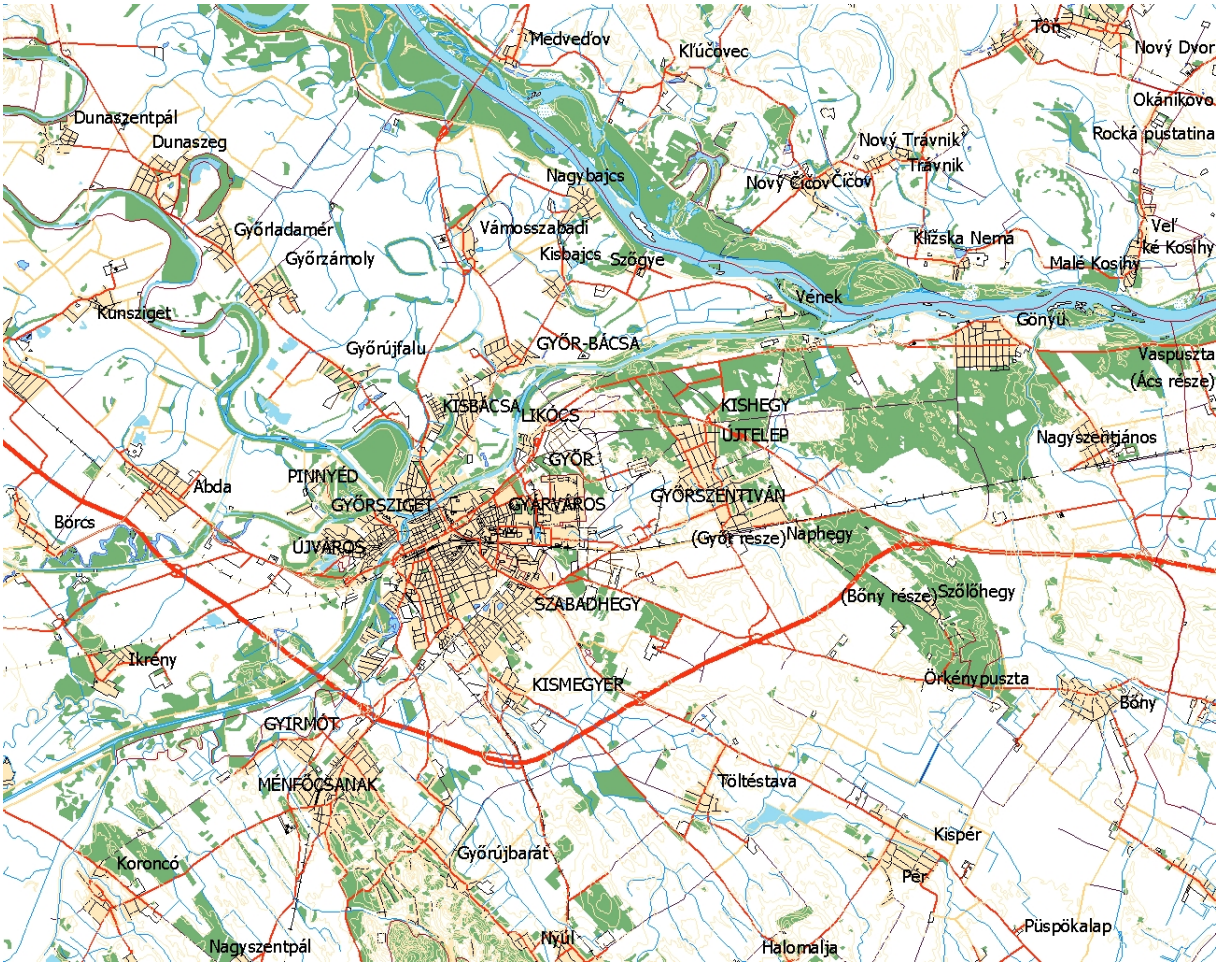


Fig. 19.
Extract from DTATM-50 v. 2.0, Digital Mapping Database

The updated and enhanced version (V2.0) of DTA^{TM}-50 database was completed in 2005 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 could have been reached. As another benefit of the DTA^{TM}-50 (V2-0) database the completion of a new product, the 1:50 000 scale TopoExplorer digital raster database assigned for a wide range of use can be mentioned.

Fig. 20.
Extract from TopoExplorer

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 civilian users, it is the 'state' version of the 1:50,000 scale topographic maps that can be obtained in raster format as well. Pre-NATO topographic maps at scales 1:25,000; 1:100,000 and 1:200,000 can also be accessed by civilian users, however, in raster format only. The format of the raster files is GeoTiff.

Raster format databases serve as basis for a number of products made for civilian purposes. (Fig. 21..)

Another venture is the newly started VTopo-25 digital topographic project. Its aim is to provide up-to-date analogue topographic maps at scale 1:25,000 based on a digital vector database especially created for this purpose for the territory of Hungary. A pilot project was completed in 2006 and a database for 36 map sheets is planned to be accomplished in 2007.

Fig. 21.
New TopoExplorer products

1.5.2.2.4. Other Digital Mapping Databases

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.

Compilation of the EuroRegionalMap (ERM) is carried out by the Geoinformation Service of the Hungarian Defence Forces (GEOS HDF). In October 2004, the ERM Specification issued by EuroGeographics was adopted and a Hungarian ERM Technical Specification was prepared. In harmony with the Technical Specification, the following layers are compiled:

- administrative boundaries;
- hydrography;
- transportation network;
- miscellaneous objects;
- settlements;
- soil and vegetation;
- locations with names.

The production of the ERM database for the territory of Hungary started in February 2005 and the first database was handed over to the regional lead nation in June 2006. The necessary edge matching procedure and the required corrections were carried out in 2006.

Hungary joined the Multinational Geospatial Co-production Programme, a common mapping project of 27 nations called into existence to create a consistent GIS database at scale 1:50,000 for key strategic areas of the Earth in 2006. Upon successful accomplishment of the pilot task in 2006 processing an area of 45,000 sq. kilometres is planned for 2007.

1.5.2.3. Thematic Maps

In addition to topographic maps various thematic maps and charts are produced. Over the past years Low Flying Charts (LFC) and Tactical Flying Charts (TFC) over Hungary have been updated and published every year. Joint Operation Graphics (JOGs), both air and ground versions, are also maintained permanently. The newest, however, not NATO designated 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, created by the Ministry of Defence Mapping Company (MoD Mapping Co.), can be mentioned.

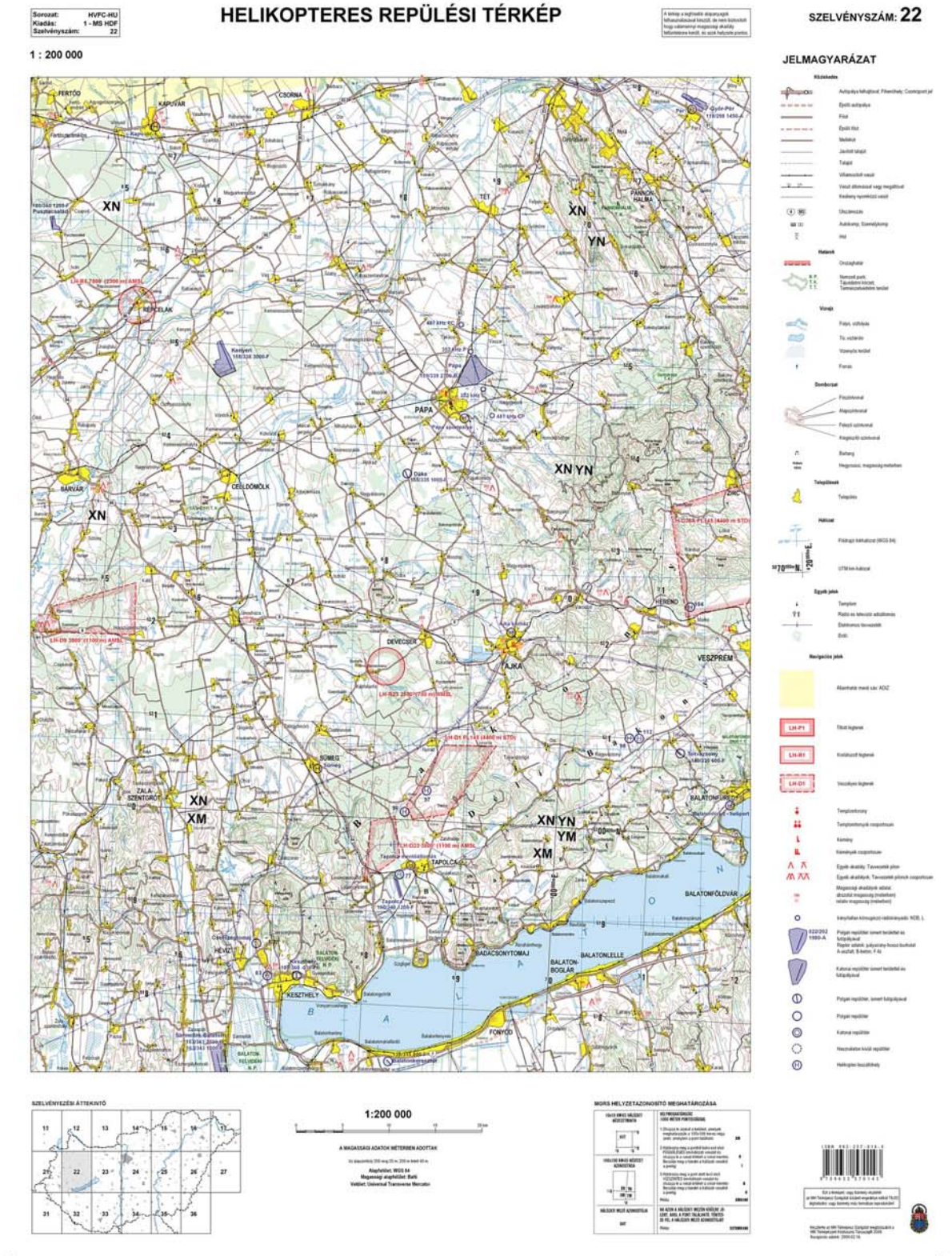


Fig. 22.
1:200 000 scale helicopter navigational map

The MoD Mapping Co. has updated and published a Tourist Map of Budapest and a Road Map of Hungary.

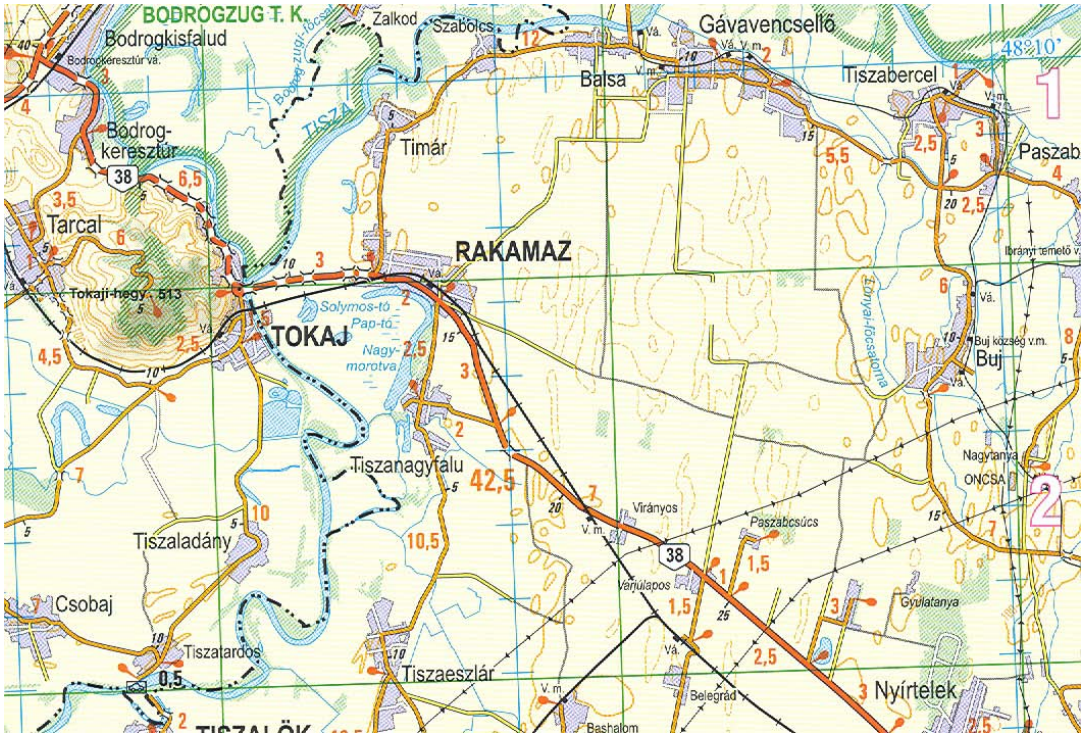


Fig. 23.
Extract from the 1:200,000 scale road map

It has published a new series of road atlases for both military civilian users, too.

Fig. 24.
New road atlases

The MoD Mapping Co. has been producing relief maps, facsimile maps and calendars for decades. (*Fig. 25.* and *26.*).

Fig. 25.
Facsimile map of Europe

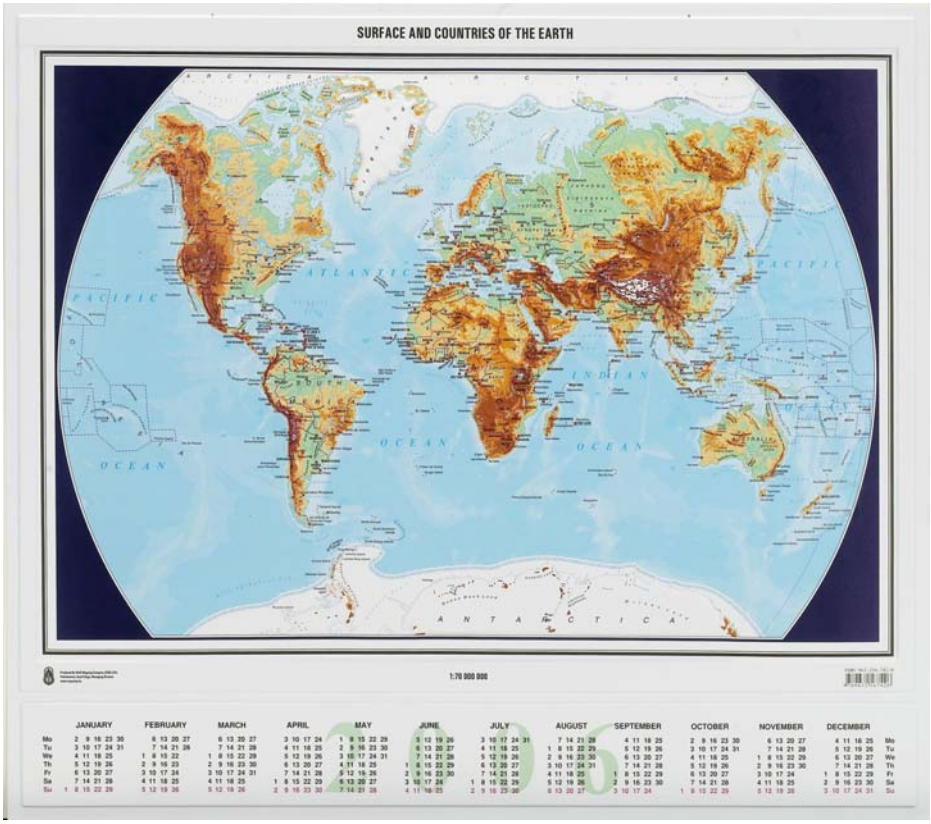


Fig. 26.
Relief Calendar

1.6. 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 urban 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 co-ordinates
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.

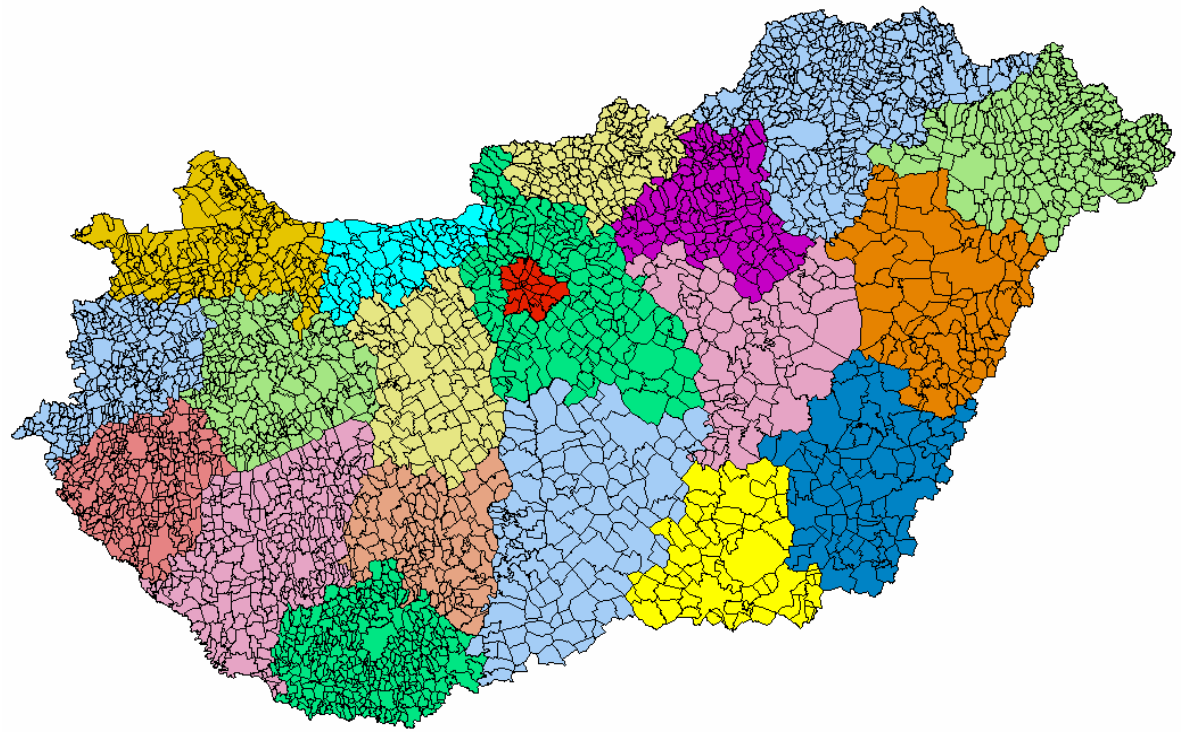


Fig. 27.
Administrative Boundary Database of Hungary

1.7. 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 conspicuous points (ruin, lookout tower etc.) as well as the names of the most important objects of traffic. It is a Database of Geographical Names (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 50%. 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. The two parts of the database comprise about 200 000 records.

1.8. Digital Orthophoto Programme of Hungary (MADOP)

In the frame of European Harmonisation Programme of the Department of Land Administration and Geoinformation at the Ministry of Agriculture and Rural Development, three nationwide 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" (Fig. 28.) was finished successfully. Now in the archives of FÖMI about 7000 aerial photos at scale 1: 30 000 are available in analogue and digital forms. As a result of almost 20 years project – ended in 1999 – Hungary is covered by ~ 4092 map sheets at the scale 1:10 000 in analogue form.

The estimated and overall quality controlled accuracy of contour lines 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 (about 4 billion points) is archived now according to map grid of 1:10 000 and is available for the user community.

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.

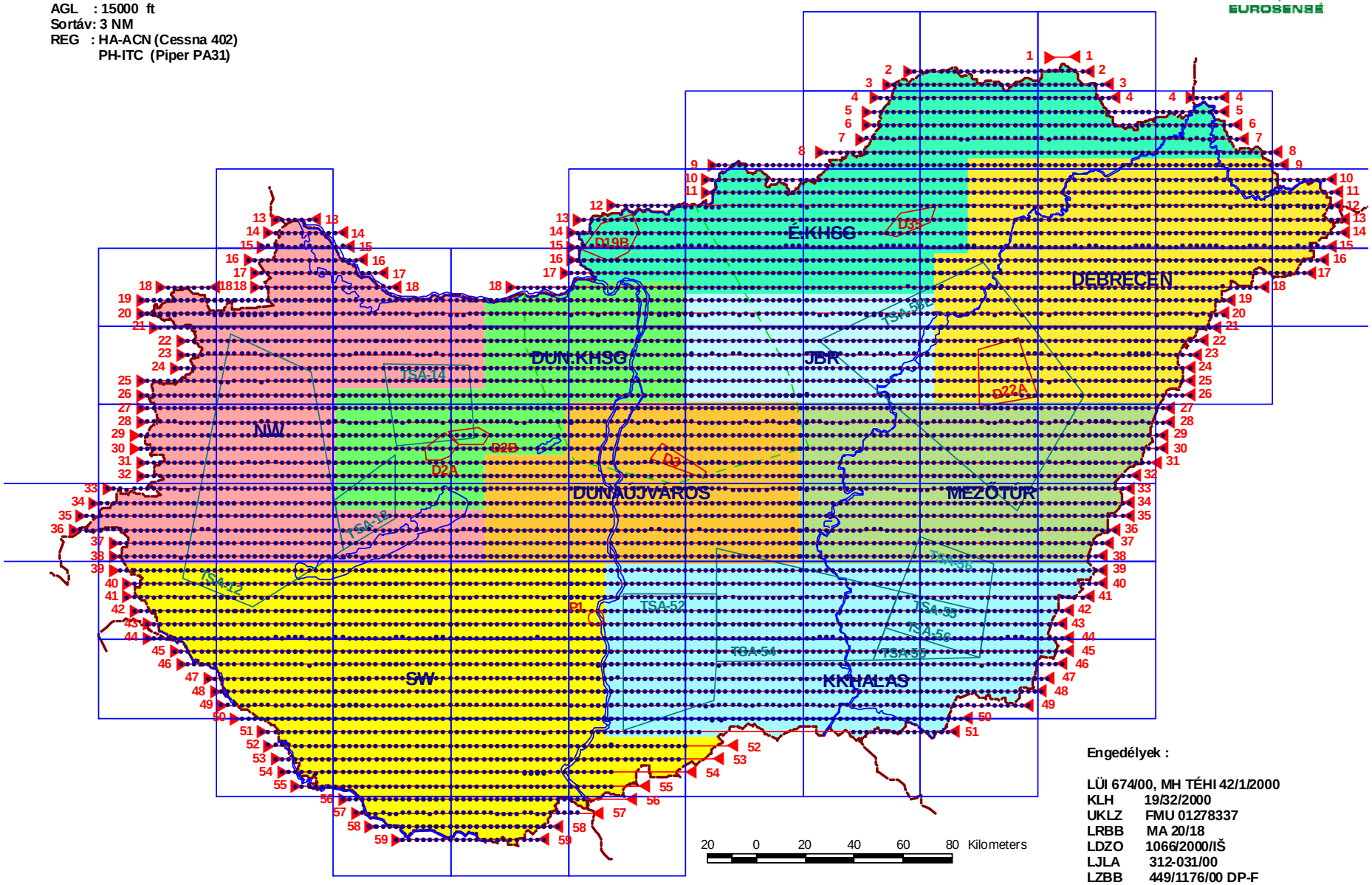
The technology takes into consideration the creation of orthophotos on the base of DEM and the orientation elements of aerial photos adjusted for the whole country.

An overall quality control was applied during the whole procedure and for every map sheets of digital orthophotos. The accuracy of aerial triangulation is characterised with ± 0.25 m in X and Y ground co-ordinates. The "MADOP" project was finished in June 2003.

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. 28.
Aerial photography of Hungary

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 we 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.

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, as

- Creation Hungarian Land Parcel Identification System (See Chapter 1.9.1.1.),
- 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,
- Forest inventory, management etc.

Fig. 29.
Digital orthophoto of Pannonhalma draped to the high resolution DEM

The “wall to wall aerial photography of Hungary 2005” was completed on 6th September 2006. 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 is 1:30000; H = 4500 m; film – color diapozitive; scanning aperture – 21 µm; ground resolution of scanned images - ~ 0.60 m. 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 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.

At the end of 2004 we launched a program – the vectorization of planimetric and hydrographic layers of topomaps at scale 1:10 000 for the whole country. The vectorization program was finished at the end of 2006.

1.9. Remote Sensing

The two main mandates of FÖMI Remote Sensing Centre (FÖMI RSC) 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 utilisation of satellite and aerial remote sensing data, and consulting for the entire Hungarian users community in their RS projects.

FÖMI RSC distributes different satellite images and has contracts with EURIMAGE, SPOTIMAGE, EUROMAP and the INTA Spaceturk. FÖMI RSC has been maintaining the national archive of satellite images too. Hungary is completely and repeatedly covered by SPOT, Landsat TM and IRS images. FÖMI RSC serves also as basic institution of the Hungarian Space Office in Earth Observation.

Under the direction of FÖMI RSC, complete aerial photography coverage of Hungary was completed in 2000 and 2005. (See Chapter 1.8.). Ortho photography of the country at scale 1:10 000 was completed on the basis of these countywide acquisitions.

1.9.1. Scientific activities, results and applications

1.9.1.1. 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. 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 (called MePAR in Hungarian) has been one of the ongoing main activities of FÖMI RSC since 2002. After RSC completed the orthophoto background and the GIS database of the LPIS-Hu, the system was included 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 several 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.

The system is based on physical blocks with natural boundaries (Fig. 30.), which was found to fit the best to the country's agricultural utilization characteristics. Approximately 300 000 physical blocks cover the entire area of Hungary. The

average size of the blocks is 32 ha, including all land cover categories. The LPIS-Hu project also includes the development of the GIS of physical blocks, integrating area-based information for managing rural development schemes, LPIS-Hu internet applications together with training for the institutional participants and the clients of the IACS. The Institute provides an internet application with geographical data searching facilities for institutional users. It also operates a telephone advice service.

Fig. 30.
Illustration of the MePAR GIS database with orthophoto background

The LPIS-Hu determines the geometrical order of the area aid applications. It plays a central role in the evaluation and control procedures of the applications through the unique physical block identifier, the block maps, and the block's eligible areas delineated on the orthophoto. MePAR ensures the well functioning system of area based aid application related tasks for the farmers. Since 2004, there are over 200 000 farmers using the LPIS-Hu system during submitting the annual area-based aid applications in every year, such as applications for the SAPS and Top-up payment, for agri-environmental schemes and for Less Favoured Area scheme. Based on the farmer-block database, individual farm-tailored block maps are distributed in every year for the farmers as part of their claim dossier. In 2006, it meant roughly 850 000 block maps in A/3 size, with colour orthophoto background (Fig. 31.). In 2006 January, FÖMI generated LPIS block maps which were the annexes of payment applications of some 24 000 ongoing agri-environmental support contracts. FÖMI handed over 117 000 individual block maps to ARDA with necessary annexes.

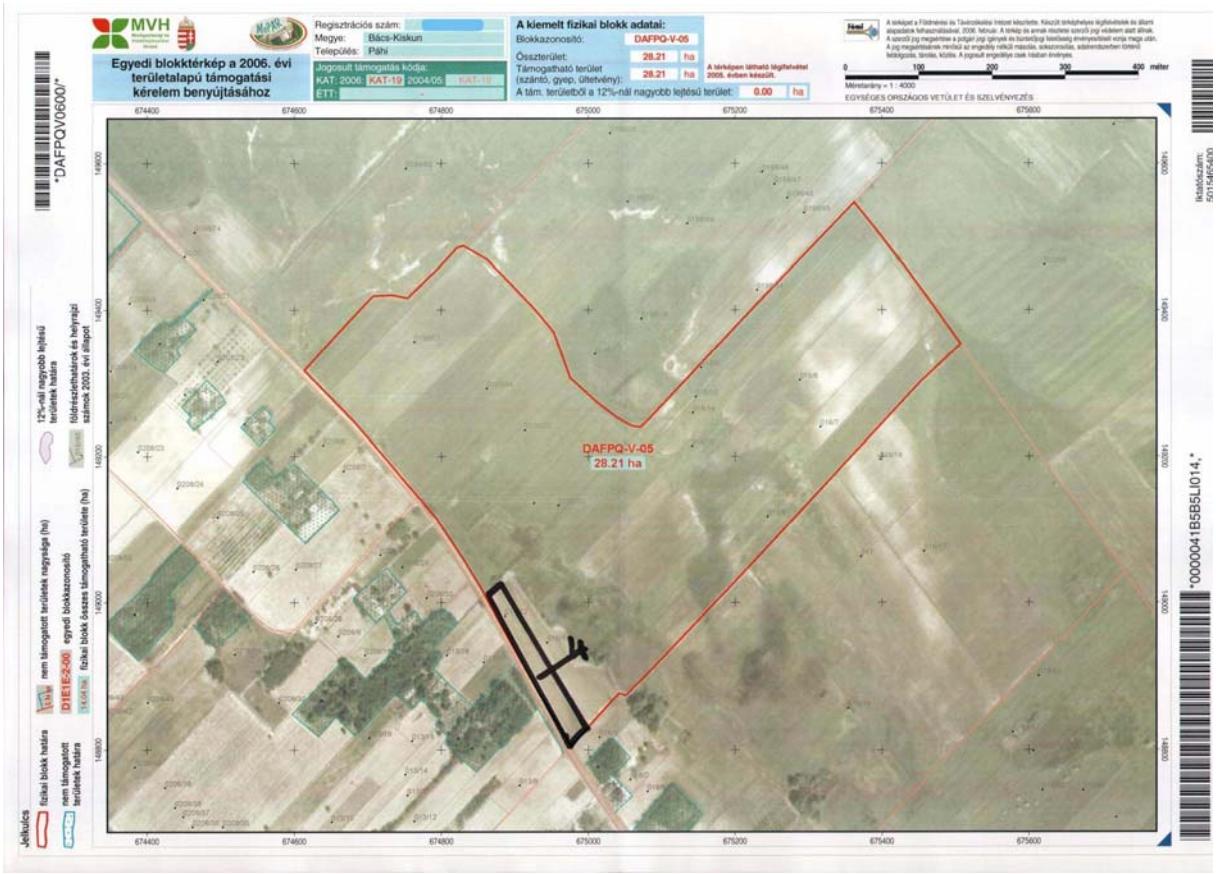


Fig. 31.
A sample of unique block maps
with the drawings of claimed parcels

The renewal and the development of the LPIS-Hu is managed in collaboration with ARDA and harmonised with the IACS activities. The LPIS-Hu is the driving force of the IACS development and it is appreciated by several EU missions and regular reviews.

After the initial building up further improvements were necessary in order to successfully proceed with the yearly updating of the LPIS database and to pursue the legal and technological issues related to the subsidy control. The image background used for updating of reference system must not be older than 5 years, moreover it is recommended to be less than 3 years old. In order to fulfil this requirement, the aerial photo flight took place in 2005. Other cases of modifying the LPIS are based on clients' applications and ex officio notified by ARDA.

In 2005/2006, the update of LPIS was completed programmatically covering Hungary. It was based on orthophotos created from aerial photographs taken in 2005, topographical maps and satellite image time series taken in the period 2000-2005. The orthorectification procedure has been carried out by FÖMI in 2005. An independent team of the institute managed to perform an internal quality control of the orthorectification. The quality of orthophotos has been controlled at scale 1:1000, and was found to be of very high level.

In 2006, the elaboration of the 5 year-long LPIS renewal plan was started. In 2006, the preparation of programmatical LPIS renewal was set up on the one third of Hungarian territory.

The thematic layers of LPIS on Less Favoured Areas (LFA) and Environmental Sensitive Areas (ESA) were set up in 2004. Afterwards, the thematic layers of nitrate sensitive areas were also integrated into LPIS in 2006. These thematic layers and reference databases of LPIS support the management and evaluation of agri-environmental payments. The integration of NATURA 2000 areas into LPIS has been under preparation since 2006. Further development of the definition with GIS tools of the LFA are also managed, based on the requirements given by the new system of European Agricultural Fund for Rural Development (EAFRD) should be implemented from 2007. In 2006, FÖMI was assigned to establish GIS database of parcel drawings created by farmers who have agri-environmental support contract. Within the framework of this project, FÖMI processed some 147 000 parcel drawings and completed their GIS data transmission and necessary analysis.

1.9.1.2. 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 the agricultural subsidy claims with the use of satellite images.

Using FÖMI RSC'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. In that 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 CwRS 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. Scanning of the claims and alphanumerical data input is carried out by ARDA. The remote sensing control of the selected claims (dossiers) is the task of FÖMI. This task is subdivided into two major parts: the digitization of parcel drawings into GIS and the actual remote sensing control using satellite images – the latter is called Computer-Aided Photo-Interpretation (CAPI). The aim of CAPI is to answer two questions for every declared parcel: whether the declared crop can be observed in the parcel, and whether the declared area is correct. High resolution (HR) image time series are used to determine crops, while exact area measurement is done using very high resolution (VHR) images. The fulfillment of Good Agricultural and

Environmental Conditions (GAEC) are also checked. Parcel digitisation and CAPI are carried out on several (25-30) graphic workstations, with a central database and automatic task distribution. The results of control are delivered to ARDA in digital and paper form, containing tabular and geographical data. ARDA carries out some 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. 32.

Since 2004, remote sensing controls have undergone some methodological improvements. Extra care have been paid to the proper handling of the so-called joint cultivation, a special Hungarian property of the 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 – the control of these two schemes has undergone a substantial methodological development in 2006. The format and structure of the (electronic and paper-based) control documents have also been improved to allow the most effective carrying out of the follow-up checks.

From 2004, the total number of submitted claims in Hungary grew to about 200 000 – 210 000. In 2004, 8 660 dossiers were controlled by remote sensing. This number grew to 11 000 in 2005, and it was 12 124 in 2006. This sample is considered a rather big sample among the EU states. The successful control of these amounts 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.

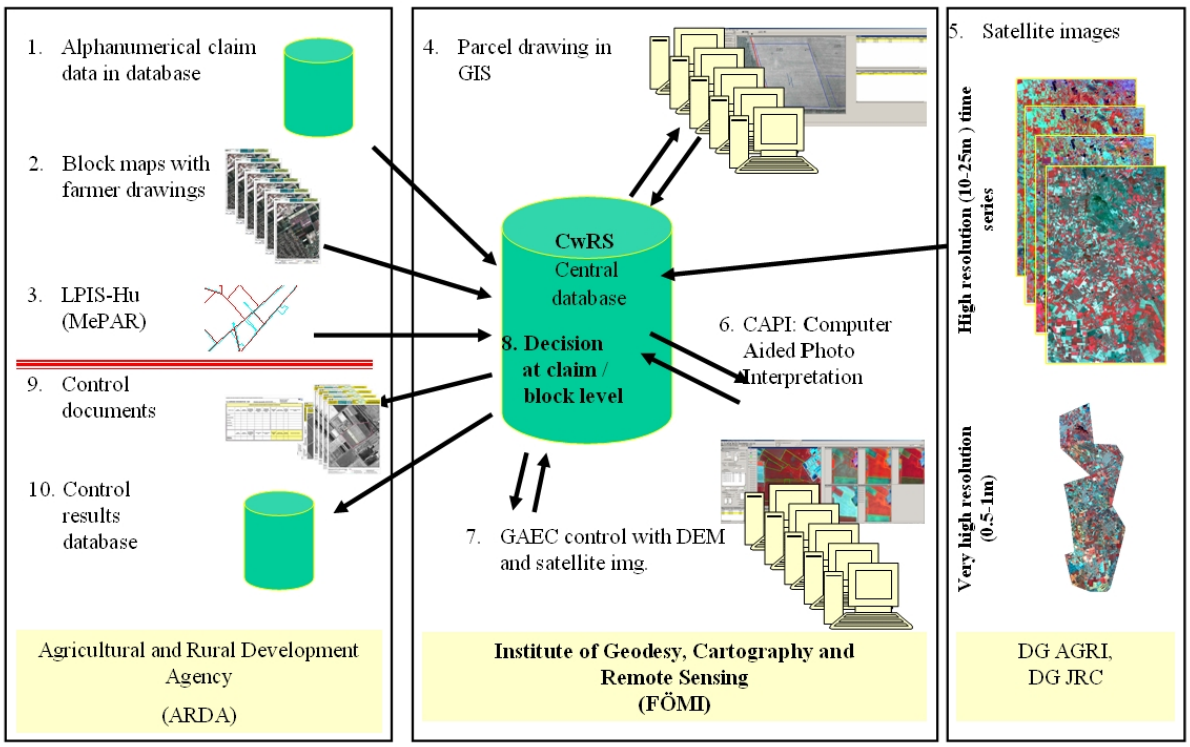


Fig. 32.
Basic Elements of Area-based Subsidy Control by Remote Sensing

1.9.1.3. Remote Sensing Applications Supporting the National Ragweed Exemption Program

FÖMI has a many year experience in the applications of remote sensing. The methodology and experience of the NCMPF provided an excellent basis for further applications development. This was one of the operationally proven program components that could support the ragweed control in Hungary.

The 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. To the efficiency of this priority program, the government amended the plant protection law in 2005. This allowed to the Plant and Soil Protection National Service to cut the infected areas almost immediately after their detection. This can be done before the pollen scattering. The authorities can retrieve this cost from the land user later. In Hungary, some 500.000 – 700.000 hectares was estimated to be strongly infected by ragweed. About 80% of this area can be pinpointed by remote sensing on the arable land.

The ragweed recognition is much more difficult than the crop identification. The temporal development assessment of ragweed has fundamental importance. FÖMI produces a countrywide ragweed risk map focusing to the most heavily infected croplands. The ground recording can be done very efficiently by the local Land Offices. Important case-categories are non-cultivated arable spots, the 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 to the spots larger than 0.8 hectares. The most significant pollen production comes from these infected spots.

In 2005, FÖMI detected about 20 000 heavily infected spots (60 000 hectare) in the country. Applying the procedure of four high tech (two space technology related) areas, the whole system is 4-12 times more efficient than the former ground based one, concerning different parameters. The pollen load decreased by some 20% in the first operational year.

In 2006 FÖMI carried out only a reduced ragweed monitoring program due to financial causes. The emphasis was put on developing of the Central Ragweed Server. The result of this reduced program was about 3 500 spots which amount to 18 601 hectares of ragweed infected areas were identified in the most infected counties (Fig. 33.). Beyond the remote sensing based maps and the Land Offices' on-the-spot checks that are supported by a dedicated integrated hand-held GIS-GPS equipment, there is a central server to synchronize the 300 people in the most critical July-Sept period. To ensure the fast data exchange among the authorities and to store information about the infected spots, FÖMI has had developed the Central Ragweed Server and Information System (Fig. 34.). The redesigned Ragweed Control Program certainly builds on the co-operation of the land users. To catalyze, ragweed infection maps are available for the people, via the web site of FÖMI and MARD. After developing the Server in 2006 and providing multiday-trainings for clients the Central Ragweed Server provides more efficient service.

The Hungarian Ragweed Control and Monitoring system can serve as an example for the essential revision and upgrade of an existing national, regional service by introducing space technology.

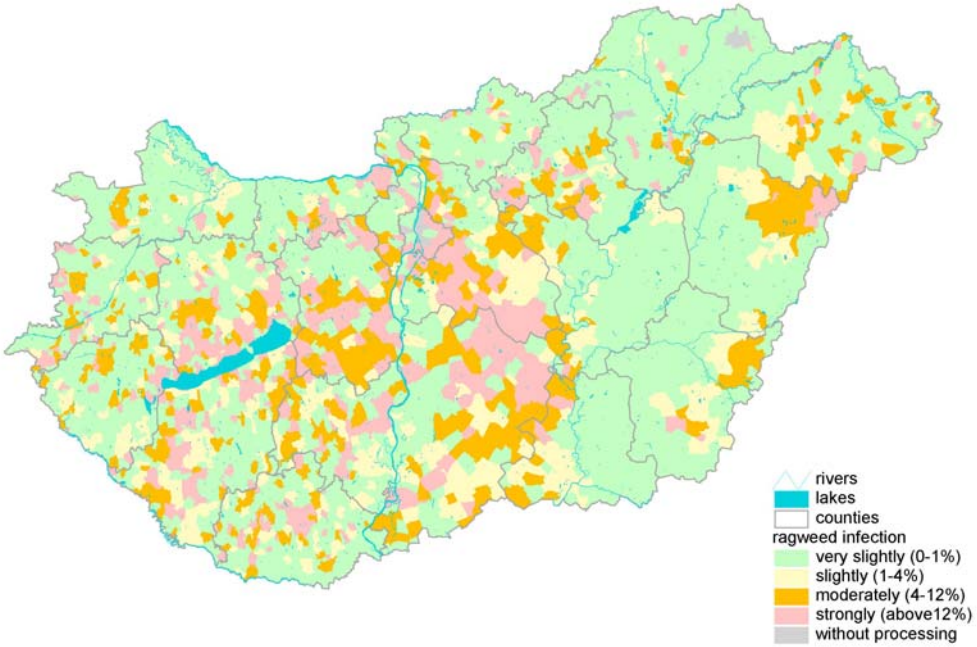


Fig. 33.
Ragweed-risk map of settlements in 2006 based on the quantitative evaluation of high-resolution satellite data

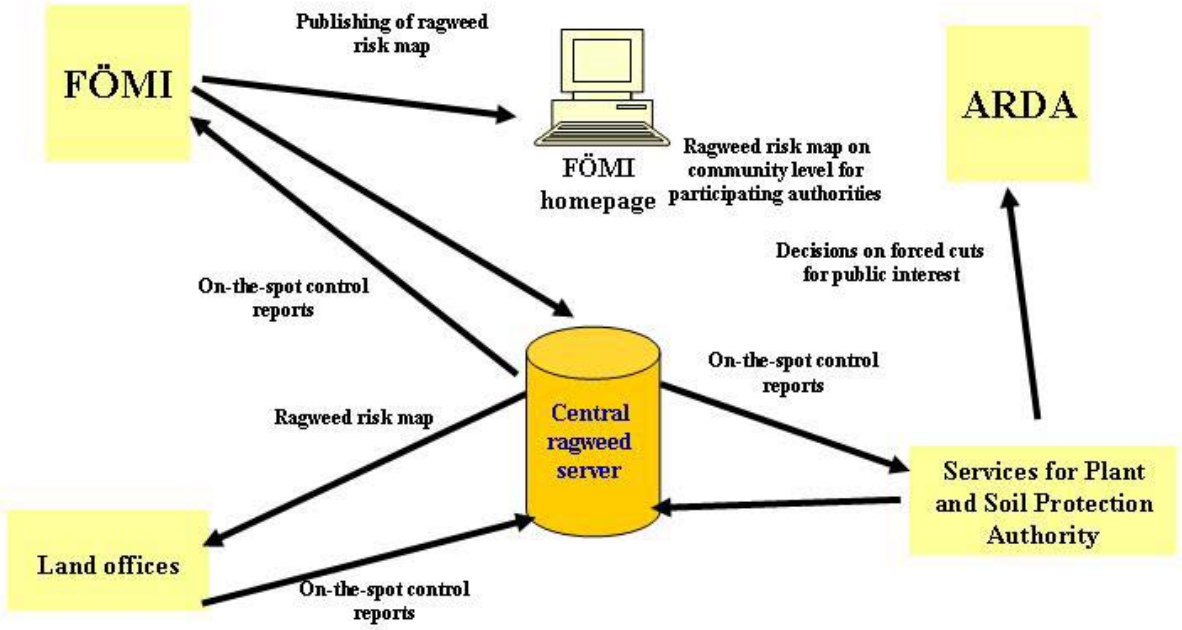


Fig. 34.
Central Ragweed server and information System

1.9.1.4. The integrated utilization of ESA ENVISAT data in regional flood/waterlog or drought monitoring and impact assessment (2004-2007)

Series of severe flood, waterlog and drought events has hit Hungary recently. Thus the provision of quick, objective, reliable and homogenous information about the development and impact of these disasters is very imperative at local and regional scale.

The recent FÖMI-ESA PECS[1] project "The integrated utilization of ESA ENVISAT data in regional flood/waterlog or drought monitoring and impact assessment (2004-2007)" aims at the further development of the previous R+D activities of FÖMI-ESA Prodex[2] program (2000-2004). It monitored all these disasters at regional level utilizing multi-source satellite data set (NOAA AVHRR, SPOT VEGETATION, IRS WiFS, Landsat TM and IRS LISS) including also ENVISAT (MERIS) data.

The tasks of PECS project are to focus on the utilization of ENVISAT sensors by assessing a longer monitoring period (2004-2007) and using larger ENVISAT data set (MERIS, ASAR). The FÖMI-ESA PECS Experiment Arrangement (No. 98016) was signed on 30 June 2004.

The PECS project is being implemented in three main phases (2004-2007).

In the first phase (2004-2005) of the project more emphasis was put on the improvement of the processing and evaluation chain of available ENVISAT MERIS data set (2003-2004) - through FÖMI's NCMPF satellite database – which were used for countrywide retrospective drought monitoring (2003-2004). Other necessary monitoring tasks such as waterlog monitoring (2004-2005) were also accomplished using ENVISAT MERIS and other available satellite (IRS WiFS, AWiFS and Landsat) data.

The main characteristic of second phase (2006) of the project were the evaluation of an extended ENVISAT (MERIS, ASAR) and other optical satellite database (IRS AWiFS and Landsat TM/IRS LISS) and the fulfilment of the requirements of retrospective and real-time disaster monitoring tasks for the period of 2004-2006. The quantitative analysis and comparison of the results – spatial extension and temporal changes of the disasters – obtained from different individual or integrated input satellite data were also carried out.

An extended ENVISAT (MERIS, ASAR) and other (IRS AWiFS, IRS LISS, Landsat TM) satellite database were utilized successfully for regional waterlog monitoring (2005, 2006) using different type of datasets and detailed category system. Further methodological development and data integration tasks were accomplished together with the comparative analysis of results using both individual images and integrated optical and radar data set of different sources (ENVISAT MERIS and ASAR, IRS AWiFS, Landsat TM). Flood and waterlog affected areas of the Körösz ug study area were mapped (April 2006) and compared using different satellite data sets complemented also with ENVISAT ASAR data (Fig. 35.). The quantitative

[1] PECS= Plan for European Co-operating States
[2] Prodex= Scientific Experiment Development Programme

assessment of the derived MERIS based waterlog maps has shown that MERIS data can be used effectively for the quick mapping of larger waterlog spots on the surface. Further methodological investigation is needed to prove the utilization of integrated ENVISAT ASAR-MERIS dataset in the improvement of waterlog monitoring techniques.

Comprehensive ENVISAT MERIS time series (2003-2006) were also utilized to assess the average crop development of these years and to develop drought and crop development maps solely on the basis of MERIS images. The newly derived maps were based exclusively on the MERIS MGVI values, appropriately reflecting the crop development.

Years 2003-2006 could be used as reference period, the positive or negative difference of current year data from data in this reference period was used to generate the maps. To assess the adequacy of the drought and crop development maps derived in the first two phases (2005-2006) of PECS project, comparative analysis has been carried out between the maps (Fig. 36.) generated in the first phase (calculated from IRS WiFS or calibrated ENVISAT MERIS images) and the ones created in the second phase, based exclusively on ENVISAT MERIS data using different methods (image type, reference period). Besides, remote sensing-based maps have been compared to statistical yield data.

The conclusion of comparisons is that the kinds of satellite images used in this project appropriately reflect the crop development and show the presence of drought in the majority of the cases. With the proper choice of satellite images used and reference period, and taking into account the limitations of the selected kind of data source, appropriate drought or crop development map can be obtained at country and regional level.

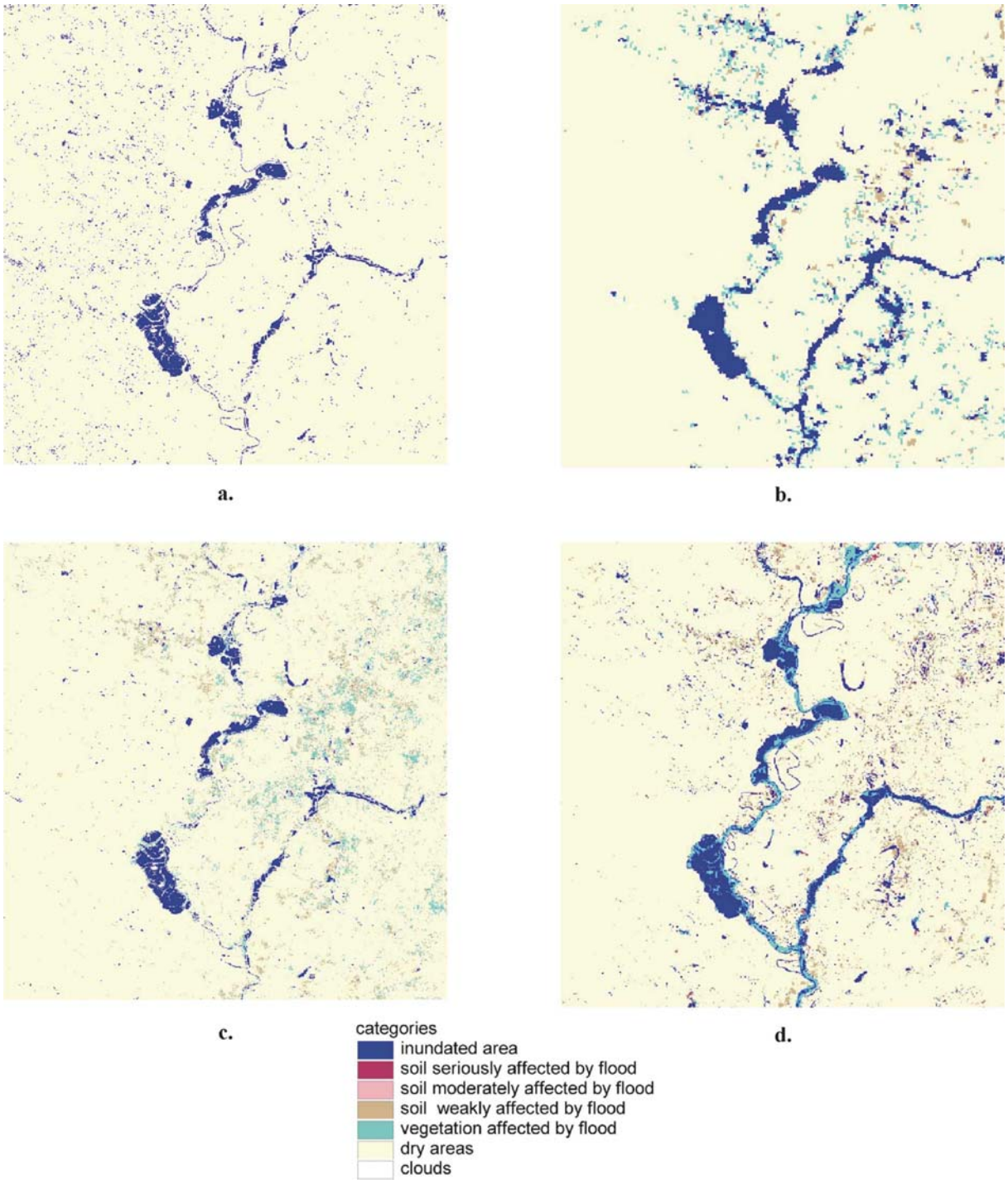


Fig. 35.
Inundation maps derived from different satellite images of the Köröszug study area
a: ASAR (24. 04. 2006), b: MERIS (26. 04. 2006),
c: the integration of them, d: Landsat TM (23. 04. 2006)

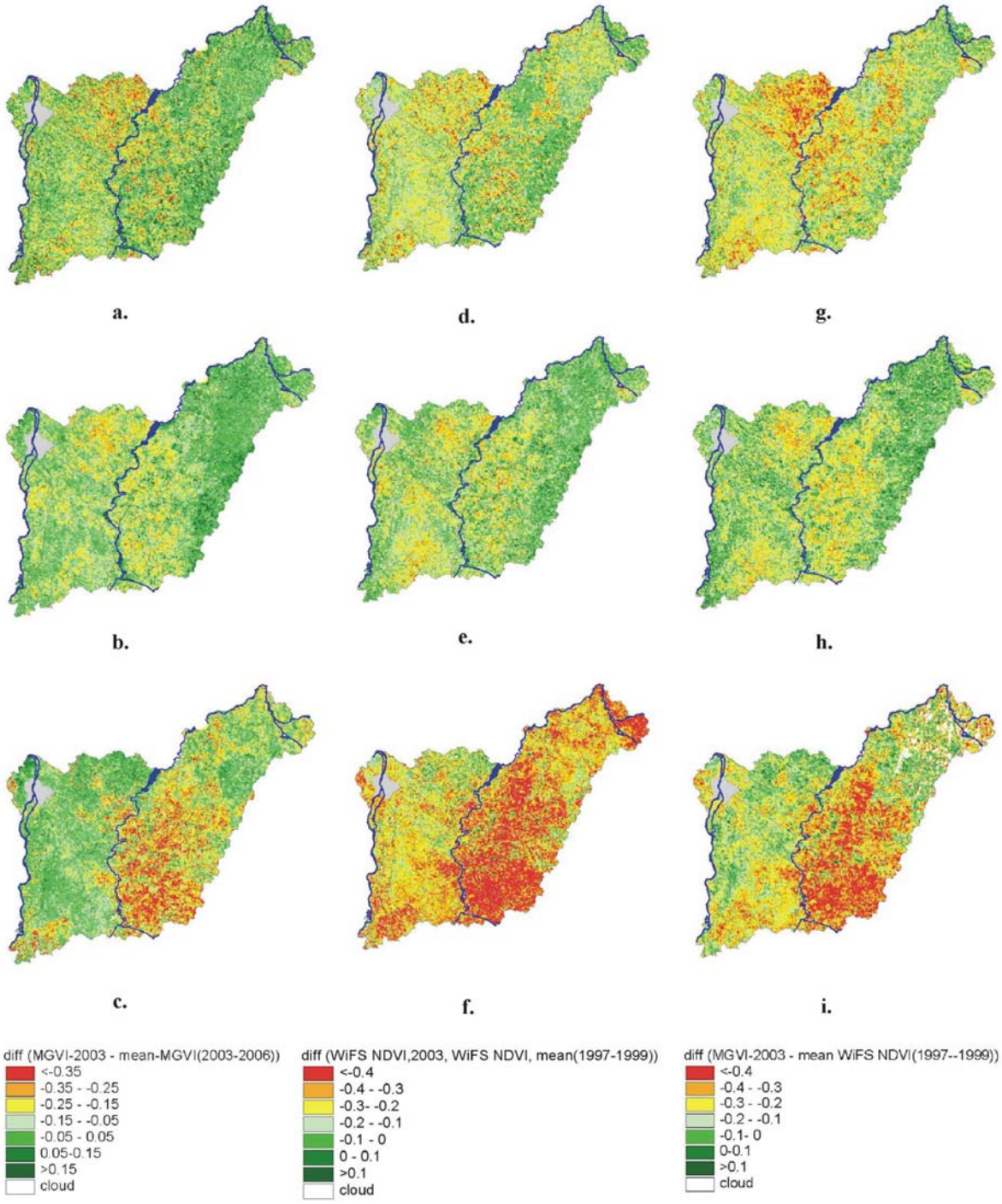


Fig. 36.
Drought monitoring for the Great Plain region of Hungary (7 counties) in 2003 using ENVISAT MERIS (a., b., c.), IRS WiFS (d., e., f.) and calibrated ENVISAT MERIS-IRS WiFS satellite data (g., h., i.);
middle of May (a., d., g.), beginning of June (b., e., h.), August (c., f., i.)

1.9.1.5. Monitoring of forest damages caused by gipsy moth (2004-2006)

As a consequence of the climatic change, the gradual deterioration of the forests can be observed world-wide. In Hungary the insect pests (mainly caterpillar of gypsy moth) contributed to this process significantly. The extent of forest damage caused by gypsy moth was about 110.000 ha in 2004, about 210 000 ha in 2005. Based on data of gypsy moth eggs spatial assessment made in Autumn, 2005 by the Research Institute of Forestry (RIF) a considerable area was threatened by gypsy moth invasion in Spring, 2006. The National Forest Service (NFS) and RIF expected some 180 000 ha forest that was threatened by gypsy moth.

FÖMI began a remote sensing based monitoring of damages caused by gypsy moth in 2004. Cooperation was built with the specialists at RIF. The FÖMI proposal was accepted and supported by the Hungarian Space Office and the Ministry for Informatics and Telecommunication “Monitoring the forest damage caused by gypsy moth in the surroundings of Lake Balaton”. The main objective of that project was to monitor the damages of forest areas caused by gypsy moth at local and regional scales. Different high and medium resolution and multitemporal satellite data sets were (years 2004 and 2005) used. Based on the results of the R&D project carried out in 2005 for mapping of the forest damage caused by gypsy moth it was established that the very high (IKONOS) and medium resolution (mainly IRS-P6 AWiFS) satellite data were suitable to identify and monitor forest damage. The special advantage of remote sensing method in contrast to other methods based on ground survey that we can get quick, objective and unified information from the entire affected area about the extension and spatial-temporal change of the forest damage both on small area and regional level.

The forest damage-monitoring project is continued in 2006 also, in the frame of a won tender launched by the Hungarian Space Office and with the support of the Ministry for Informatics and Telecommunication. This project is the further developing and spatial (Veszprém, Somogy, Nógrád, Heves and Borsod-Abaúj-Zemplén counties) and temporal (2005 and 2006) extension of the former R&D project that was carried out by FÖMI in 2005. The aim of this project was monitoring the forest damage caused by gipsy moth at regional level in 2005 and 2006 using ENVISAT MERIS data time series. This involves the reference data collection (
Fig. 37.), the quantitative evaluation of the ENVISAT MERIS data time series, the comparative analysis of the damage maps derived from medium resolution ENVISAT MERIS data and IRS-P6 AWiFS data and the quality control of the thematic results.

Forest damage monitoring using ENVISAT MERIS and IRS-P6 AWiFS data was accomplished in two regional study area: Northern-Central Mountain and Veszprém, Somogy counties in Hungary. The project was accepted by ESA in 2006 (“Utilization of ESA Data under Category-1 scheme” ESA EO CAT-1 3949). It assigned a quota of 50 MERIS FR satellite image data (all archived) for the project at reproduction cost.

Based on the results in 2006 it can be stated that both new type of medium or medium-high spatial resolution satellite images are very suitable for spatial and temporal monitoring of damages caused by gypsy moth. The used methodology is adaptable for monitoring of defoliating damages caused by other reasons too.

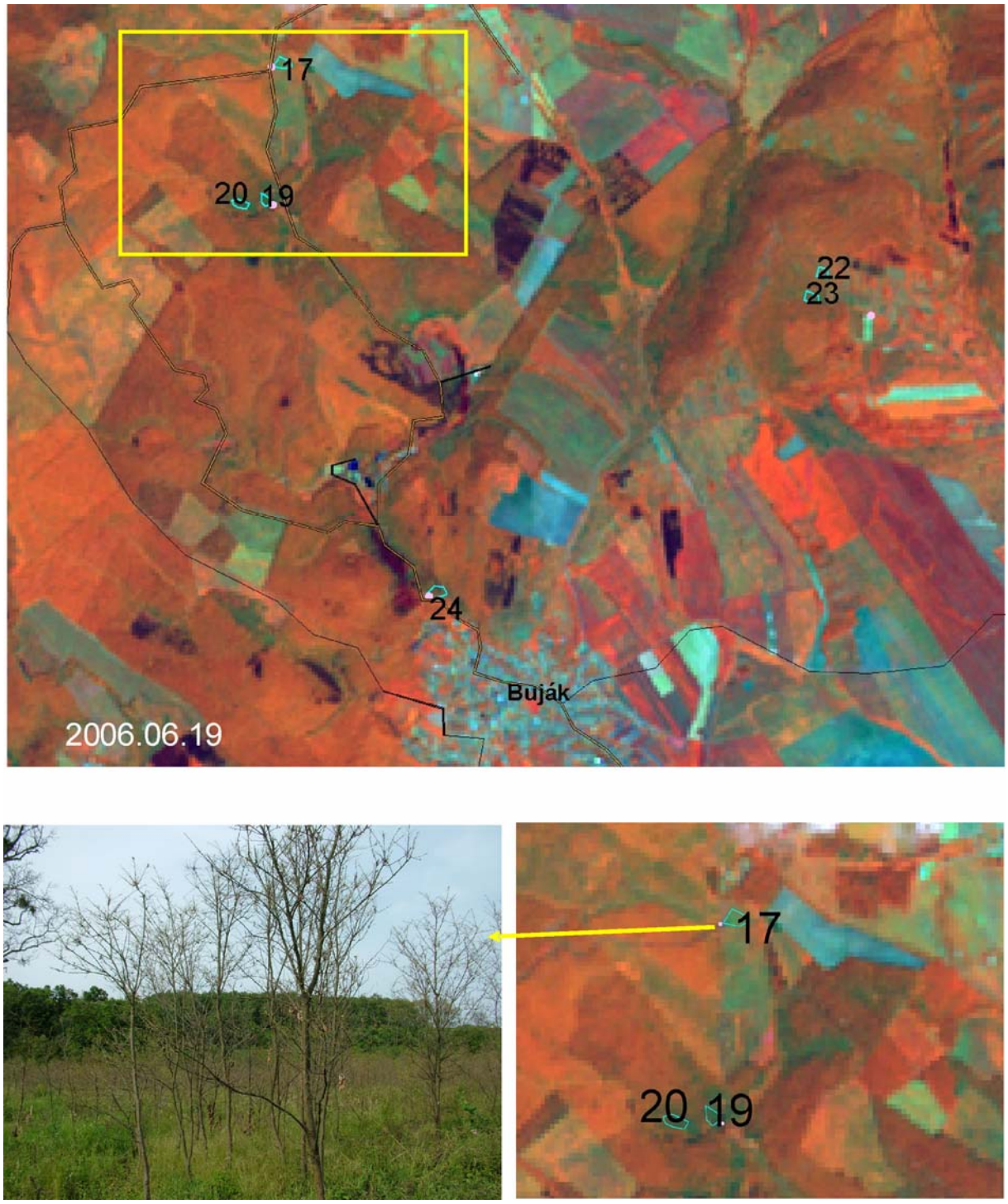


Fig. 37.
Ground reference data collection near Buják, Nógrád count, (21 June 2006) Upper: IRS-P6 LISS III. satellite image (19 June, 2006)
The parts of non damaged forest are brownish, while the parts of forest suffered by defoliation damage are greenish on the satellite image color composite. The light blue spots (with black identifiers) show the referenced damaged areas.
Below right: ground reference spot (#17) as it reveals the damage. Below left: photo made on the ground in spot 17. Young oak forest totally defoliated by caterpillar of gypsy moth.

This can be also produced for the entire country when required. Application of an operative system for monitoring forest damages by remote sensing should be used to make efficient control on different defoliation reasons. The conditions are far too good during this mild past winter 2007, for the gypsy moth outbreak.

1.9.1.6. Developing of Pollen-information system (2005-2006)

The Carpathian basin is the area of Europe, where the heaviest ragweed pollen concentration was measured at the end summer period by European pollen monitoring system (EPI). According to weed expert's opinion, 80% of the infected areas are on arable land and about 50% of that are on not-maintained stubbles of cereals (except for maize) and on sunflower fields, where the infected parcels are detectable by remote sensing.

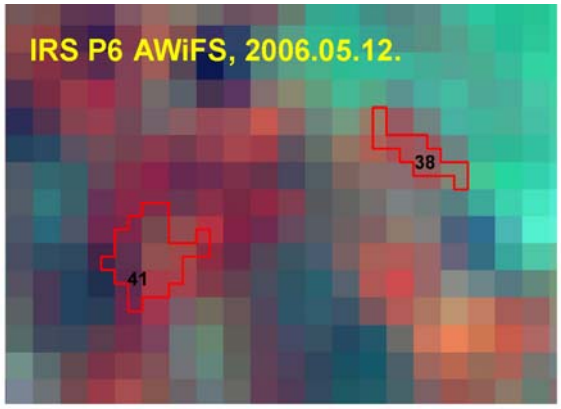
As a member of a consortium, Institute of Geodesy, Cartography and Remote Sensing (FÖMI) won an NKFP tender in the topic of researches on health of the society titled as Developing of Pollen Information System. The objective was to realise a pollen air pollution forecast by up-to-date technology in order to reduce allergic symptoms. The task of FÖMI in this project was to elaborate a remote sensing methodology for ragweed-infected parcel assessment and to test it on a pilot site at local level in 2005 and on an extended area covering 60% of the country in 2006.

The members of the consortium were as follows:

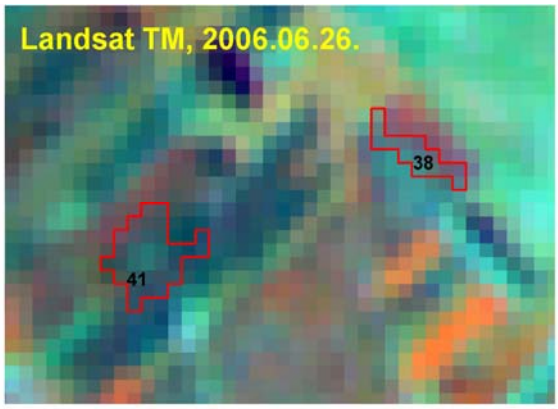
- The National Meteorological Service (leader of the consortium),
- The Environmental Health Institute of the Fodor József National Public Health Centre,
- The Institute of Geodesy, Cartography and Remote Sensing (FÖMI),
- The Glia Ltd.

The application has started on 2nd January 2005 and ended on 30th October 2006. In both years of the project, ground reference data survey was carried out by weed specialists of the West-Hungarian, the Veszprém and the Debrecen Universities of Agriculture and of the Oenological and Viticultural Institute of Kecskemét using accurate methods to collect data on ragweed-infected cereal and sunflower parcels.
GIS database was built from the reference data. Integrated satellite image and reference data analysis was carried out in order to detect ragweed-infected areas at local (in 2005) and regional level (in 2006).

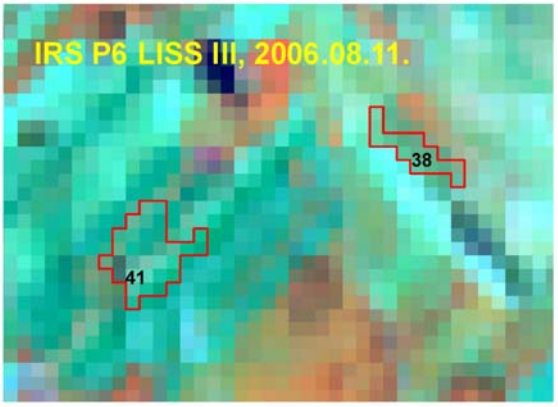
In 2006 ragweed-infection map was created to cover some 60% of Hungarian area by quantitative analysis of RS data, assessment of reference data and high resolution satellite images. Spots identified by RS were also verified by ground-based control (Fig. 38.). The results show that it is possible to create a regional ragweed-infection map accurately and quickly by quantitative evaluation of multitemporal satellite image data. This ragweed-infection map supports efficiently the planning and execution of ragweed control.



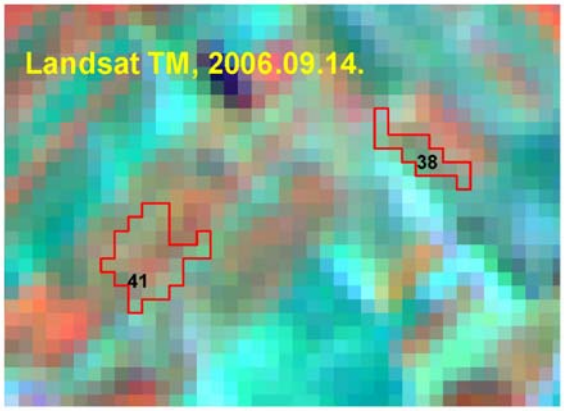
a.



b.



c.



d.

e.

f.

Spot code	rate of ragweed	land cover plant	coverage (%)	weeds	characterization
38	90%	cereal stubble	90%	ragweed: 90% (stubble of barley)	1
41	70%	meadow	100%	ragweed: 70%, grass: 25%, other: 5%	1

g.

Fig. 38.
As shown in the satellite image time series, the changes of two RS identified ragweed-infected spots (code 38 and 41) in 'Duna-Tisza köze' sample area are presented chronologically. (a-d)
In the orthophoto taken 2005, the route of ground-based control is shown. (e)
Spot code 38 is connected to the documentation of control. (f)
The features about spots code 38 and 41 registered during the ground based control (g).

Based on this R&D project an OASIS application was submitted to SPOT and it was accepted in October, 2006. The aim of this OASIS application is to test SPOT5 satellite data in two selected test areas, in 2007. The selected pilot sites can be covered by 2 adjacent SPOT5 scenes, so we receive 5 pairs of images at no cost during the vegetation period of ragweed (March-September, 2007). We expect to get a significantly better accuracy of ragweed infected parcel identification on the pilot sites and a decrease of parcel size where ragweed infection is detectable, by using SPOT5 data time series with 0.01 hectare spatial resolution rather than using Landsat TM or IRS P6 AWiFS data time series by the end of September, 2007.

1.9.1.7. The Implementation of The Hungarian GIS Register of Vineyards – VINGIS –

1.9.1.7.1. The Hungarian National Vineyard GIS

Regarding EU and professional inland requirements in 2001 the Hungarian Ministry of Agriculture and Rural Development (MARD) designed the elaboration of a Geographic Information System (GIS) supported Vineyard Register (VINGIS) to the Institute of Cartography Geodesy and Remote Sensing (FÖMI), Remote Sensing Centre.

The goals of the VINGIS system are the followings: serving the fulfilment of the CAP, utilizing the subsidies of the sector for establishing an integrated nation-wide professional register, facilitating the discernment and decision-making of agricultural governance and wine-viticulture sectorial institutions and leaders, creating possibility for the quality improvement of the obligatory statistical reports, firming the Vineyard Communities in completion of their statutory tasks. They are instrumental in improving the quality production and market competitiveness, they assure the protection of the designated origin and take action against adulteration of wine. The GIS approach allows an objective analysis of the utilization degree of the actual wine producing capacity, promotes the design to realize favourable modifications and supports also the tasks of legal regularization and control.

VINGIS is the GIS background which supports vineyard registration and serves as a basis to check and supervise subsidy allocation for vineyard uprooting, planting and restructuring, and allocating the subsidy paid on vineyard-basis.

Since 2005 for each restructuring claim and since 2006 for each grubbing up claim individual maps were printed using the VINGIS database system. These individual maps were bolstered up with ortophoto. Besides the cartographic information other technical data supporting the control were added to these documents.

The experiences of the controllers unambiguously justified that without these individual VINGIS maps the accuracy of the on spot checks, and the identification of the target area could not be satisfactory in every case.

The http://www.vingis.hu address is available since 18th May 2006.

Since 25th of May 2006 the operation of the VINGIS web server provides opportunity for the authorities – receiving, considering and controlling of subsidy claims – pre-filtering of incoming claims and checking of specific key information.

1.9.1.7.2. The Map of Potential Production Sites for Vineyards

The analogue maps of potential production sites for vineyards which were developed and maintained by the Viticultural and Enological Research Institute (SZBKI) show the production site suitability for vineyards (Fig. 39.).

The basic goal and role of the descriptive data of mapping production site suitability for vineyards is to appoint the best areas for vine production, and within those areas, to differentiate the quality to promote the marketable and competitive wine production. There is a qualification methodology in the background of this process which dates back to several decades and it was developed by SZBKI.

The descriptive data of mapping production site suitability for vineyards includes: Agrometeorology (frequency of winter, spring and fall frost damage), Soil (Soil type, Soil forming rock, pH and lime content, physical soil type, water management features, Humus level, thickness of topsoil, area homogenity concerning the soil type), Water management (watermanagement of the area based on site observation), degree of erosion, exposure of the land, (slope degree and aspect, elevation above sea level on hill and mountainside, emergence from the environment on the plain and flat areas, relief, area surface on hill and mountainside, relief, area surface on plain and flat areas, environment proximity of woods, degree of built-in areas), area utilization, road conditions.

The digitizing of these maps and integration into the VINGIS system, is very useful for the administrators of the vineyard communities, because they were using the paper versions of these maps in their daily work to draw the certificate of new plantation; moreover, it is also a requirement, because according to the law, subsidies can be only provided for vineyards that are planted on areas suitable for vine production.

On this map, the areas with the same value of production site are contoured by polygons and assigned a number. By digitizing of these polygons a map layer is created, which shows the area with optimal features for the plantation within the administrative boundaries of a settlement. These maps can be connected to the tables of the detailed features.

1.9.1.7.3. Updating The Map of Potential Production Sites for Vineyards with the help of the VINGIS

These maps were created by onsite observation but at that time the available maps and technology did not provide enough accuracy to demonstrate the research and the know-how. By now updating of these maps became easier and more efficient with the help of the GIS technology. The analysis of digital toponimic, cadastral and vineyard maps together with their data allows the follow-up of products from the vineyard to the final utilization. It is a new approach to update the production site evaluation.

Predominant elements of the potential production value, exposition and frost-sensibility may be defined more exactly by using DTM model. In a GIS system also exploitation degree and structure varieties of the first and second-class sites may be checked.

The VINGIS also serves to support the system of protection of vines with designated origin (Fig. 40.). The regulations of the MARD concerning the different vine-growing regions permits to give the label of designated origin to a vine on the base of its derivation (community, topographic name where the vineyard is) and the variety, or on the value of winegrowing potential of the production site. The VINGIS gives opportunity to analyze and study the different areas based on their features and find out the common properties that makes an area unique and eligible to be a protected origin.

Fig. 39.
An example of potential production sites map for Vineyards on Ortophoto background

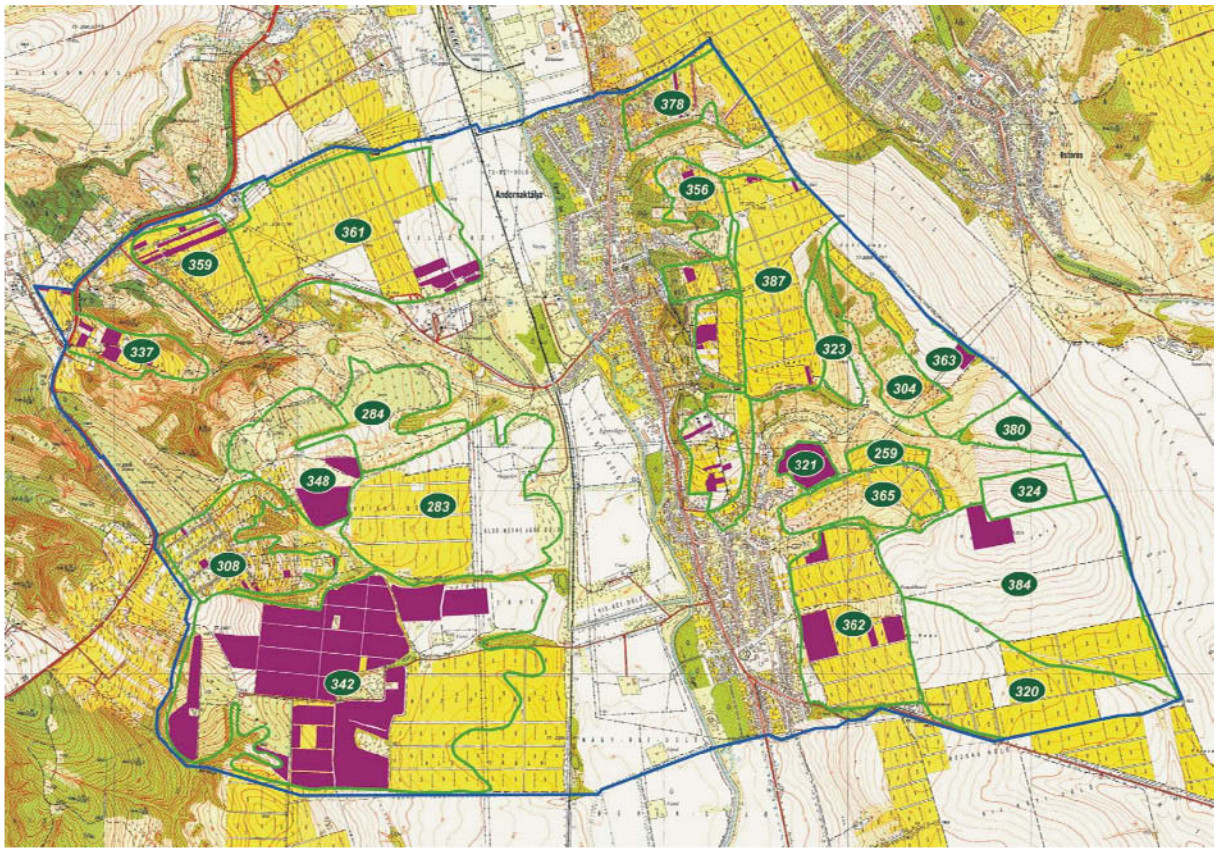


Fig. 40.
Vineyards with protected origin in Andornaktálya (Eger wine-growing region). Superior: Wine growing sites with more than 300 points; Wine: Bull's blood of Eger superior: Kékfrankos, Kadarka, Portugeiser (Kékoportó) Blauburger, Kék medoc, Zweigelt, Cabernet franc, Cabernet Sauvignon, Merlot, Pinot noir in accordance with Regulation of FVM No. 130/2003 (XII.31.)

1.9.1.8. Updating CORINE Land Cover 1:50 000

As part of fulfilment of the government resolution on the "Development of environmental information systems", the implementation of the CORINE Land Cover database at scale 1:50 000 (CLC-50) was finished using financial resources from the Ministry of Agriculture and Rural Development and the Ministry of Environment and Water in 2004. The database supports Hungary's accession to the EU in various fields, such as the planning of sustainable agriculture, rural development, agro-environmental planning and nature conservation.

International experience shows that updating is preferable in 5-year periods at this mapping scale. The CLC-50 database reflects the status of Hungary's land cover in 1998/99. During the time passed since then, significant changes in land cover occurred in several parts of the country, as confirmed by an update feasibility study carried out by FÖMI in 2004, using support from the Hungarian Space Office. This justifies the updating of CLC50 for 2003/05, which will provide us a "snapshot" of Hungary's land cover at the time of accession to the EU, an event likely to induce more profound land cover changes in the future. The updated CLC50 could serve as a basis for further land cover change analyses.

Beyond the above considerations, the importance of CLC50 updating is hardly arguable concerning EU initiative INSPIRE (Infrastructure for Spatial Information in Europe). INSPIRE – whose databases include land cover as well – will be represented on governmental level as an EU directive. In order to meet the requirements drawn up by the directive, land cover data will have to be kept timely. This will already be partly executed by recent CLC50 updating.

Phase I of CLC50 update, covering 25% of the country has been finished in 2005 using support from the Hungarian Space Office.

Due to financial difficulties progress slowed down in 2006, resulting only 32%.

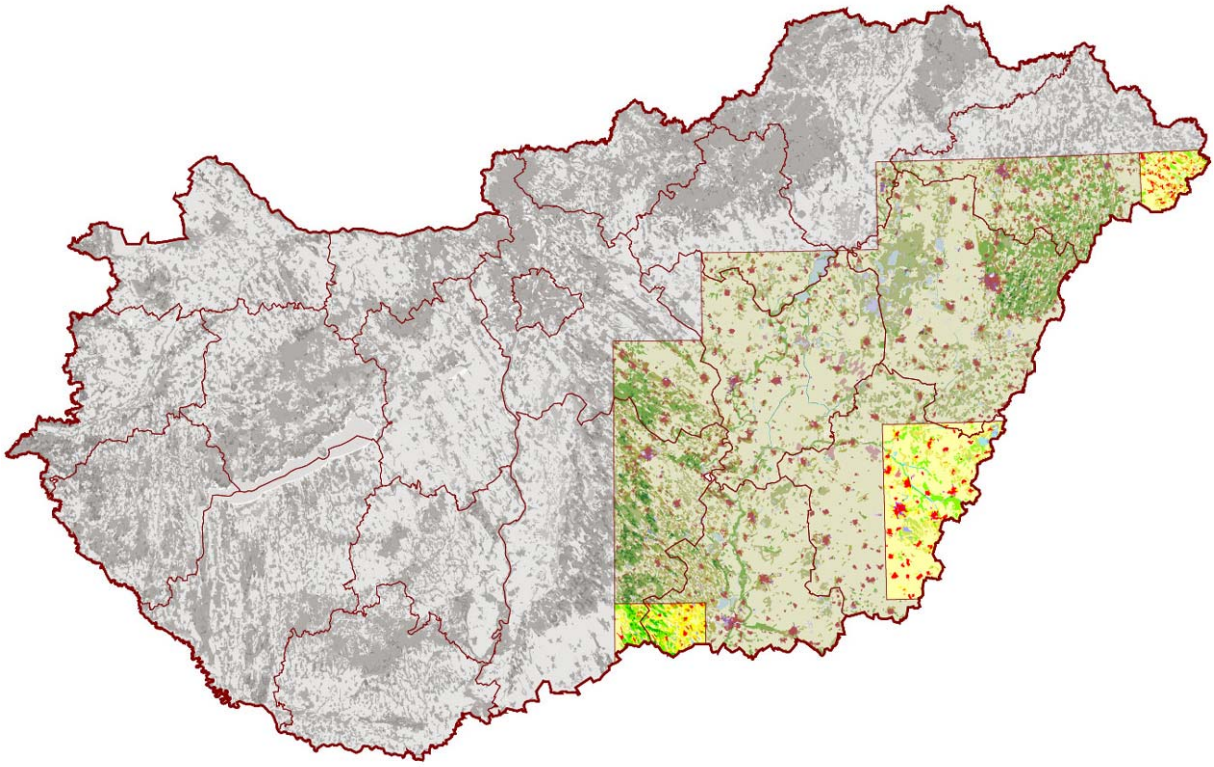


Fig. 41.
Status of updating of the CLC50 database.
Areas updated in 2006 are shown with vivid colour.

1.9.2. Users' Service, Consultancy

Commercial agreements have been upgraded with EURIMAGE, EUROMAP and SPOTIMAGE. The agreements provide possibility for FÖMI RSC to purchase and deliver Landsat, Quick Bird, IKONOS, ERS, SPOT etc. data for Hungarian and foreign users.

According the commercial agreements, FÖMI RSC distributes in Hungary raw or pre-processed satellite data (Landsat, Quick Bird and IKONOS (very high-resolution satellite data), SPOT, ERS-1, IRS-1C/D, IRS P6 etc.) for research centres, university departments and profit-oriented companies. Members of the RSC staff provide methodological and technical consultancy for end users of remote sensing data and take part in producing value-added products.

1.10. International activities relating to mapping activities

The Hungarian Lands and Mapping Administration keeps rich international links, takes actively part in the work of international associations, unions, organisations on governmental, scientific and technology development level. Some of them are as follows:

1.10.1. Membership in ICA

Hungary has been a member of the International Cartographic Association since 1964. Its activity has since been marked by such events – among others – as organizing the 14th International Cartographic Conference in 1989 in Budapest, and three joint commission meetings in Hungary (1983, 1993 and 2003), 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) respectively. Mr. Zentai and Mr. Reyes also participated and presented papers in the ICA workshop "Digital approaches to cartographic heritage" in Salonika, Greece, 18-19 May 2006.

Prof. Dr. Milan Konecny, President of ICA visited Dr. Szabolcs Mihály, DG of FÖMI in February 2006 and agreed on the role and importance of cartography.

Fig. 42.
Prof. dr. Milan Konecny, President of ICA and dr. Szabolcs Mihály, DG of FÖMI.
Photo: HUNAGI Visual Resources

1.10.2. Membership in UN standardisation of geographical names

Hungary has been taking part in this activity since the early sixties, particularly in the so-called East, Central and South-East Europe Division meetings and the recently established Working Group on Exonyms. The 23rd session of the United Nations Group of Experts on the standardisation of geographical names (28 March – 4 April 2006, Vienna) was attended by experts Mr. András Dutkó PhD (chairman, Hungarian Committee on Geographical Names, HCGN) and by Mr. Béla Pokoly, UN expert and Secretary to the Committee. Information about recent activities, decision-types of HCGN was given at the session.

1.10.3. Membership in EuroGeographics

The Hungarian national surveying and mapping organisation has been represented in CERCO since the 1991 Plenary Assembly held in Southampton, and also in MEGRIN since its establishment in 1991 by the Department of Land Administration and Geoinformation (CERCO) and the Institute of Geodesy, Cartography and Remote Sensing (MEGRIN), and continues to be full member of EuroGeographics. Hungary actively participates in the EU Coordination Group, the Expert Group on Legal and Commercial Issues and the Expert Group on Quality and Standard of EuroGeographics. FÖMI occasionally attends other EuroGeographics events too, e.g. in 2006: the workshop of Expert Group on Cadastre & Land Registry, the meetings on INSPIRE Advisory Group etc.

Fig. 43.
Fragment from the Hungarian part of EGM

Hungary also takes part in EuroGeoraphics' pan-European projects. The Hungarian Administrative Boundaries Database is part of EuroBoundaryMap (EBM, formerly known as SABE) project. In the EuroGlobalMap project the Hungarian data are provided by the Institute of Geodesy, Cartography and Remote Sensing. The EGM product is a digital topographic dataset that covers Europe at the scale 1:1 Million. The other topographic project of EuroGeographics is the EuroRegionalMap (ERM), at the scale 1: 250 000. The Geoinformation Service of the Hungarian Defence Force takes part in this project. Data for the EuroDEM project will be provided by the Institute of Geodesy, Cartography and Remote Sensing, too. The description directory of the Hungarian geodetic references, as well as descriptions of different databases of the Hungarian NMA have been elaborated and submitted to MEGRIN GDDD. In succession to GDDD the metadata service of EuroGeographics is the

EuroMapFinder (EMF,) project, in which also some Hungarian metadata of geographic products can be found.

Recently, Hungary takes part in the work of Eurogeographics' Expert Group on Cadastre and Land registry to assess the role of cadastral parcel in INSPIRE draft directive with impacts on Land Registry and Cadastral operations, and will contribute to the development of a new vision statement on cadastres and land registries.

Compiled by

Enikő Kovács
Head of department
Institute of Geodesy, Cartography and Remote Sensing

2. Other map publishers

2.1. Mapping activities in the Geological Institute of Hungary (MÁFI)

In the last four years the publishing of maps in earth sciences has fallen back in Hungary and the Geological Institute of Hungary remained actually the only map maker and publisher. Although sources in budget were reduced significantly, the institute continues to make remarkable efforts to follow its traditions in map publishing.

It's a very important fact, that digital cartography became the dominant method and our publishing concept must be realised in line with constant technological changes.

Our concept is to preserve the traditional appearance of printed maps, especially at the systematic survey maps of different scales. This concept was adopted in the publishing of the geological maps of Hungary in the last four years.

Behind the traditional look there are very deep and radical changes: the process of map making begins with querying of the existing databases and using the capability of the GIS systems. (INTERGRAPH, ArcGIS). The visualization also utilizes the capability of these GIS systems.

Building of databases is a very huge and persistent program of the Institute, because the use of spatial data in the last 140 years is very valuable in the accomplishment of the Institute's programs.

The most valuable result in map publishing was the compilation of the Geological Map of Hungary in 1:100 000 scale which was finished in 2005.

The 88 map sheets were prepared on Gauss-Krüger quadrangles and in local (Uniform National Map System) coordinate system. Quaternary deposits are essentially classified on genetic basis (beside the age divided upon lithology), while pre-Quaternary assemblages were determined on litho-stratigraphic basis, divided mainly on formations (or on members and beds in more detailed version). There are 651 different units in the harmonized legend.

Because of limited requests plotting of sheets takes place in 600 dpi printer upon commission with issuing additional non-printable CD and explanatory booklet.

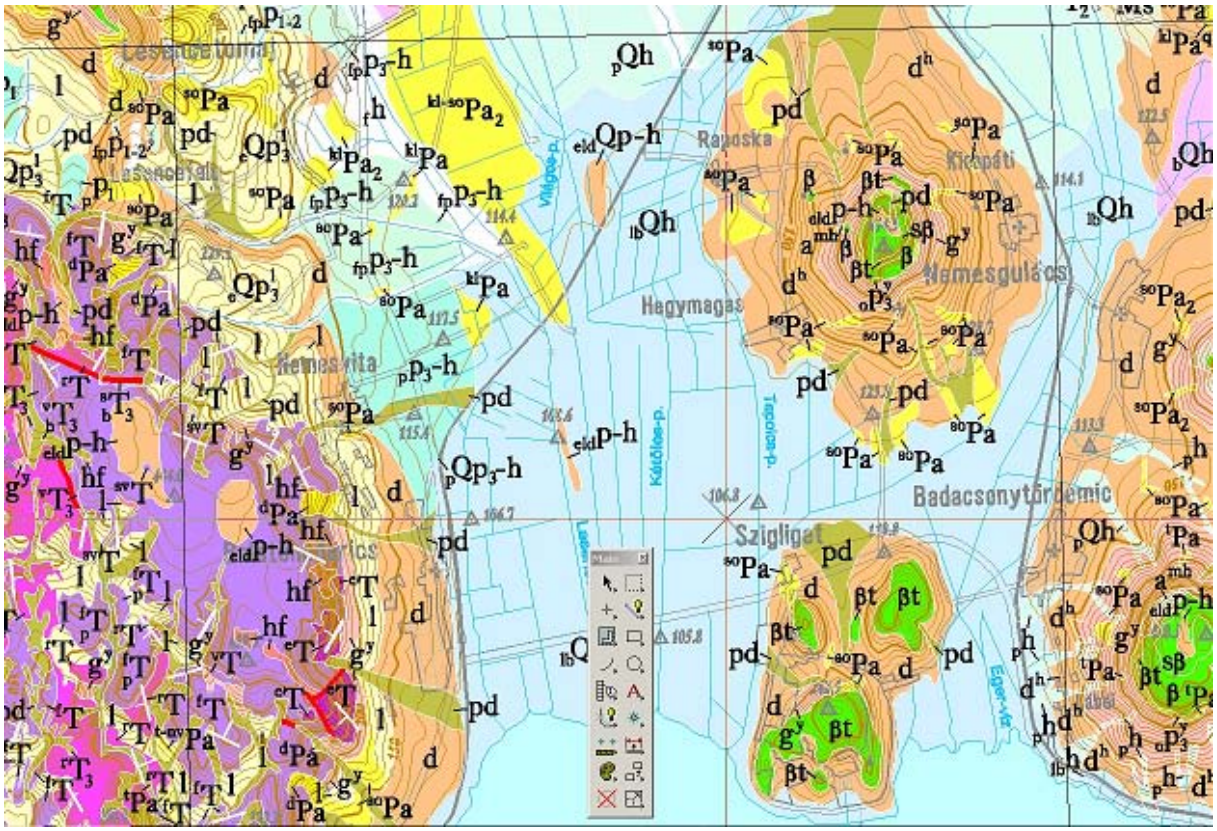


Fig. 44.

Also a new map and a booklet of the Bükk hills together with the adjacent Slovakian karst area were published in 1:50 000 and 1:100 000 scales. The map with its geological accuracy, appearance and colours is a masterpiece of Hungarian thematic mapping.

Topographic bases of the middle and small scale maps derive of the digital state topographic maps of Hungary compiled by MoD Mapping Company.

Experts of the Institute took part in the geological survey of Libyan People's Republic. They compiled two sheets of 1:250 000 scale in the south part of the country. The work included preliminary remote sensing survey, field work, analysis, database building and printing of the final maps and booklets.

Published maps of the Institute won several first prizes in the annual competitions of the Fine Hungarian Map meetings.
Collections of old geological and chorographical maps allow publishing articles and short publications on the history of maps and for dissemination to the public. Beside published maps several hundred map figures, report appendixes and sections complete the cartographic activity of the Institute.

Using the possibilities of the web facilities we edited our main maps of general interest (i.e. Geological Map of Hungary of 1:100 000 scale), directly in our webpage (http://www.mafi.hu/mafi/en/node/510).

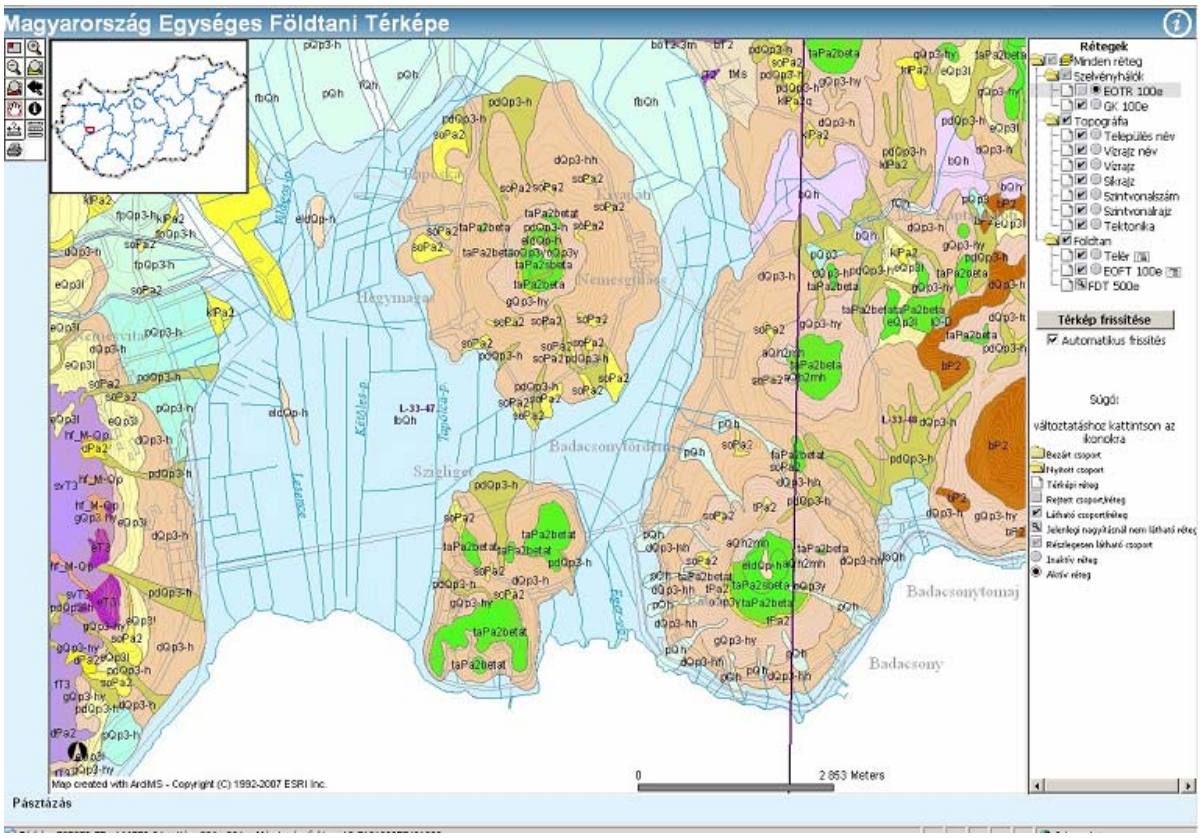


Fig. 45.

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.

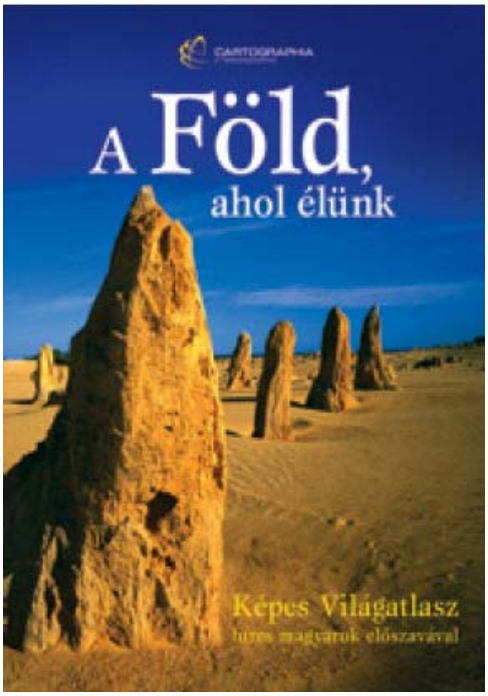
László Kordos director
Ferenc Síkhegyi scientific advisor

2.2. Private map publishers

2.2.1. Cartographia

Besides national mapping several private publishers emerged on the Hungarian cartographic market following the change to market economy in 1990. Among them Cartographia, that has been the leading map-making company in Hungary for 50 years, was fully privatized in 2004, and continues to be the largest publisher. The school map section was detached from the main body in 2005.

Cartographia Ltd., the legal successor of Kartográfiai Vállalat (1954) was established in 1993. The firm has more than 50 years' presence on the map-market. Its name and proficiency is well-known in Hungary as well as all over the world. The enterprise disposes almost the whole vertical process of map-making: from brain-storming to compilation, from publishing to distribution.



Cartographía Ltd. is the publisher of more than 250 different products: road- and city maps, atlases, tourist guides, guidebooks. Between 2003-2007 most of the new publications were prepared targeting the domestic market. **Illustrated World Atlas** has special importance among them and **Geographical World Atlas** has been signíficantly reworked, updated, completed.

As the leader in the domestic map market,the firm takes part in reforming cultural environment, education and tourism in the past few decades. There were 16 items, brand-new or signtficantly reworked tourist maps and tourist guides, launched in the past three years:

Börzsöny guide + map,
Pilis- Visegrádi-hegység guide+map,
Zemplén guide +maps,
Gőmőr- Tornai-karszt guide + map,
Tisza-tó gulde+map,
Budai-hegység guide+map,
Kőszegi-hegység, Vértes, Gerecse maps.

For the 50 years Anniversary of the company, its devoted service was appreciated and rewarded it with a medallion by the revered Hungarían Ramblers Association.

The ***guidebook series*** of popular destinations are written by Hungarian authors after Hungarian specifications, it contains 20 titles. For visitors taking low-cost flights, for short visits, a new practical ***quick-guide series*** were published with 6 titles, 48 pages each.

The ***Atlas of Hungary + Guide*** was qualified for the final at the TourMap International Competitive Exhibition of Maps and Guides in Prague, 2007. The ***Pocket Atlas of Budapest*** is a great success to be followed by the ***Pocket Atlas of Hungary*** in 2007.

New items of intemational interest:

Map of Iran,
Map of Libya,
Atlas of Bucharest,
Map of Bucharest (total city),
Map of Beijing (olympic thematics).

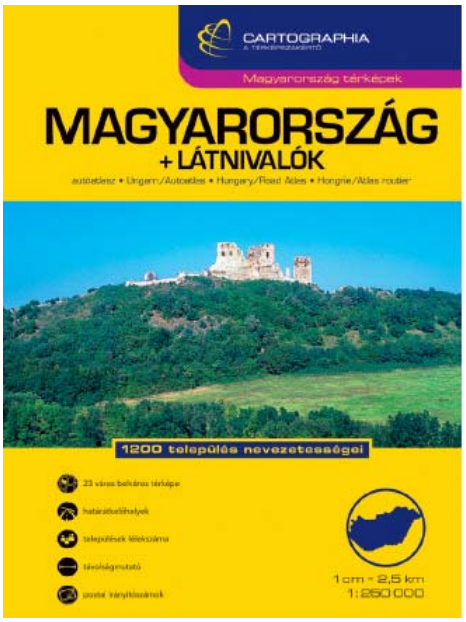
Beside the publishing activity there is an increasing tendency in preparing maps on special demand, ***customized mapping***.
Professional experts, unique map database ensure sources for technical background, guarantee permanently high quality for customers' satisfaction.

The firm undertakes ambitious mission: as a mature participant in cartography, it wants to keep its dominance in map publishing in Central and Eastern Europe.

Its ***export activity*** is traditionally based on correct partnership and confidence. The company established a prospering map distribution company in Romania.

Through the well-organized wholesale distribution system the wide range of product lines are well known all over Europe and also worldwide.

E-mail: **exp_imp@cartographia.hu**

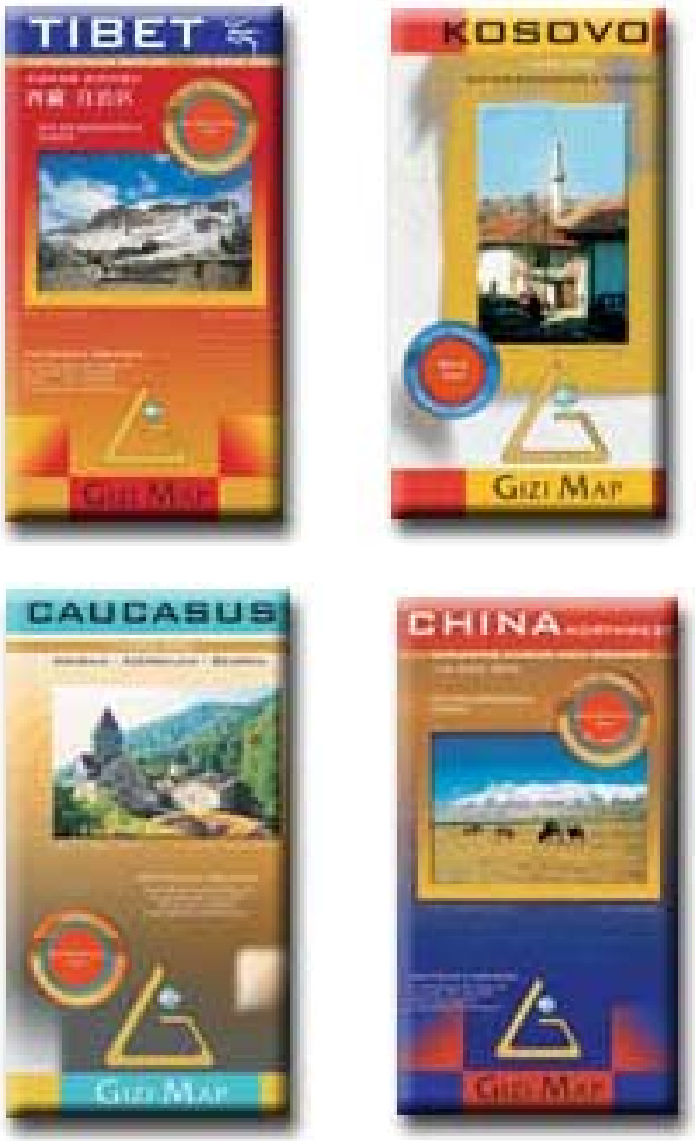


In order to hit the target, the firm orientates dynamically by constant market demands. Its strategy and philosophy is to apply modern technologies and to establish long-term customer contacts with prospering professional business alliances. There were incentive workstations and offices created for the employees to help effectiveness in operation, development of skills and personal responsibility in customer-oriented communication.

http:// **www.cartographiaonline.com**

2.2.2. GiziMap

Gizella Bassa continues to head her small cartographic publishing enterprise GiziMap. She concentrates on areas of great political and touristic interest (Tibet, Kosovo, China etc.).



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

2.2.3. Szarvas András Cartographic Agency

member of the International Map Trade Organisation

SZARVAS András

TÉRKÉPÉSZETI ÜGYNÖKSÉG / CARTOGRAPHIC AGENCY

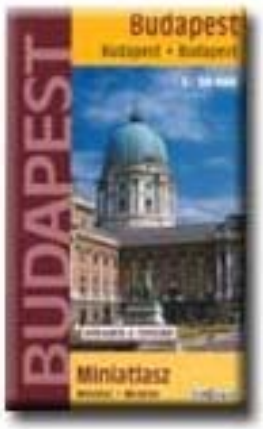
Mr. András Szarvas joined Cartographia-Budapest after leaving the Moscow Institute of Engineers for Surveying, Aerial photography and Cartography. He held various positions from 1972-77 as he learned to translate theory (which he was equipped with during his studies at the Institute) into a sound cartographical and commercial practice. As the dispatcher at the printing house, Mr. Szarvas had the opportunity to become familiar with all the equipment, including the printing and copying machines, the largest photo apparatus in Central Europe, and typesetting devices. Skills gained at the beginning of his professional life helped him become one of the most knowledgeable specialists in the company.

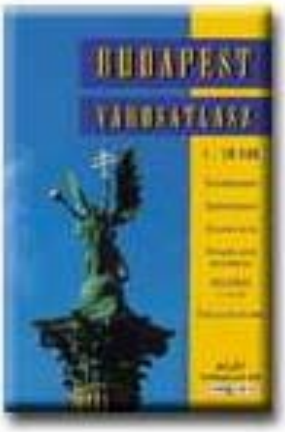
His agency specializes in the sale of the widest range of maps and cartographic services. Customized map products are generally derived from the original products of the publisher. Very often, only the cover is different. Such specialized products are essential tools of oil companies, auto clubs, car rental firms, real estate boards, distributing or logistic companies.

Contact address:
András Szarvas
engineer cartographe
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

2.2.4. TOPOGRÁF Cartographic Ltd.

TOPOGRÁF Cartographic Ltd was established in 1992. Until the year 2001 it was identified under the name AGÁT Kft. It has a significant share in the Hungarian market from various atlases and regional tourist and road maps for the general public.





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

3. Map collections, events on map history

3.1. Map history and map rooms

3.1.1. The Map Room of the National Széchényi Library

3.1.1.1. Events of Map History organized in Hungary between 2004 and 2006

In Hungary, the recent couple of years were rich both in conferences and exhibitions dealing with map history.

The National Széchényi Library organized the following exhibitions:

In 2004:

Európa térképei 1520-2004 (*Maps of Europe*)
Ungarn auf Karten – *exhibition in Berlin (Hungary on Maps)*
Magyarország 1000 éve a térképeken – *in Ipolyság/Šahy, Slovakia (Thousand Years of Hungary on Maps)*

In 2005:

Margaritae cartographicae – Treasures of the National Széchényi Library
Maps of Hungary – *in London, in cooperation with the London Hungarian Institute*
Térkép a történelem szemüvege – *Nagytárkány/Vel'ké Trakany, Slovakia (Map as the Spectacles of History)*

In 2006:

Thematische Karten über Ungarn. 1556-1946. Budapest, ELTE (*Thematic Maps of Hungary)*
A térképész humora – humoros térképek (*Cartographer's Humour – Funny Maps)*
Ungarn auf Landkarten – *in Vienna, Collegium Hungaricum (Hungary on Maps)*
Ungarn auf Landkarten – *in Tübingen, University Library (Hungary on Maps)*
Hely, ahol élünk (Válogatás Zemplén megye úrbéri térképeiből) – *in Nagytárkány/Vel'ké Trakany Slovakia (The Place We Live In, a Selection of the Old Maps Showing Socage Lands in Zemplén County)*

3.1.1.2. Publications in Map History:

PLIHÁL, Katalin – HAPÁK, József: Európa térképei 1520-2001. Budapest, 2003. (*Maps of Europe, 1520-2001*)
PLIHÁL, Katalin – HAPÁK, József: Maps of Europe 1520-2001. Budapest, 2003.
PLIHÁL, Katalin – HAPÁK, József: Karten Europas 1520-2001. Budapest, 2003.

3.1.1.3. Materials published on DVD-ROM:

1. Vas megye az első kataszteri felmérés térképein, 1856-1860. ARCANUM - Vas megyei levéltár, Szombathely-Budapest, 2006. (*Vas County on the Maps of the First Cadastral Survey, 1856-1860)*
2. Lipszky János a Magyar Királyság és társországai térképe és névtára (1804-1810) ARCANUM – Cartofil, 2005. (*János LIPSZKY: Map and Gazetteer of the Kingdom of Hungary and its Associated Countries, 1804-1810*)
3. Az első katonai felmérés. A Magyar Királyság teljes területe 965 nagyfelbontású színes térképszelvényen, 1782-1785. ARCANUM – HM Hadtörténeti Intézet és Múzeum Térképtára, 2004. (*The First Military Survey. The Whole Territory of the Kingdom of Hungary on 965 Colour Mapsheets of High Resolution, 1782-1785*)
4. Az első katonai felmérés. Erdély és a Temesi Bánság. ARCANUM – HM Hadtörténeti Intézet és Múzeum Térképtára, 2004. (*The First Military Survey. Transylvania and the Temes Governor's Dominion)*
5. A második katonai felmérés. A Magyar Királyság teljes területe 965 nagyfelbontású színes térképszelvényeken. 1819-1869. ARCANUM – HM Hadtörténeti Intézet és Múzeum Térképtára, 2005. (*The Second Military Survey. The Whole Territory of the Kingdom of Hungary on 965 Colour Mapsheets of High Resolution, 1819-1869)*
6. Budapest térképei 1-4. DVD. Budapest, 2005-2006. (*Maps of Budapest, 1-4*)
7. Az első katonai felmérés. A Magyar Királyság teljes területe 965 nagyfelbontású színes térképszelvényeken. 1782-1785. Georeferált. ARCANUM – HM Hadtörténeti Intézet és Múzeum Térképtára, 2006. (*The First Military Survey. The Whole Territory of the Kingdom of Hungary on 965 Colour Mapsheets of High Resolution, 1782-1785, Georeferenced version.*)
8. A második katonai felmérés. A Magyar Királyság teljes területe 965 nagyfelbontású színes térképszelvényeken. 1819-1869. Georeferált. ARCANUM – HM Hadtörténeti Intézet és Múzeum Térképtára, 2006. (*The Second Military Survey. The Whole Territory of the Kingdom of Hungary 965 Colour Mapsheets of High Resolution, 1819-1869, Georeferenced version)*

So far as we know, nobody has produced georeferenced topographic maps from historical old maps up-to-now. For technological purposes, this solution allows a simple access to the contents of old maps.

The digitized maps of the Map Room of Széchényi Library are available and accessible for use on the following website: www.topomap.hu/oszk/hun

3.1.1.4. The Spring Exhibitions

Finally, about a not expressly map-historical event:

National Széchényi Library and „Lázár deák" Foundation have yearly been organizing spring exhibitions from the most beautiful printed and digital map productions of the previous year.

Katalin Plihál
kplihal@OSZK.Hu

3.1.2. The Cartographic Collection of the Maproom of the Hungarian Institute and Museum of War History

In its present form the Maproom of War History was founded in 1954. The backbone of its total collection was made up of two sets of earlier materials:

- - a collection of fifty thousand items rightfully belonging to Hungary was transferred from the War Archives /Kriegsarchiv/ of Vienna to the Royal Hungarian Archives of War History /later: War Archives/ after the First World War;
- - a set of sixty thousand objects of the Royal Hungarian Cartographic Institute /later: Defence Mapping Institute/ was founded following the First World War.

The collection of the Maproom grew steadily partly by old maps /heritages, materials of other discontinued collections/, partly by new acquisitions /military map series, aerial photographs, other civil maps/. The total collection now numbers nearly 500.000. items /maps, atlases, globes, relief maps, professional journals, books, aerial photographs/, and by sheer size it constitutes the largest cartographic collection in Hungary.

Those military maps, which were forbidden to give to the researchers, because they had "secret" qualifications, are free for research from 1992. Nowadays we have no classified maps in our Maproom.

3.1.2.1. Subdivision of the Cartographic Collection

The majority of maps are grouped according to the following geographical-regional divisions:

- maps of the heavens, of the world - historical, geographical atlases;
- maps of the continents
- maps of cities and their vicinities, travel guide books
- maps of war history - maps showing battles, campaigns, military events - are further groupped according to chronological order, following the classification of major historical epochs.

Within the territorial divisions there are the following *thematic classes:*

- general political, administrative maps
- physical maps
- special thematic maps

One of the most important parts of the collection of the Maproom is made up of the military series based on detailed field surveys, showing both Hungarian and foreign territories. In Hungary only the Maproom possesses complete series of the so-called first /1772-1784/, the second /1806-1869/ and the third military surveys /1869-1884/.

The original coloured manuscript sheets of the first and second military surveys are kept in the Kriegsarchiv in Vienna. Our Maproom has the colour copies of the originals in the same size. Usefulness, aesthetic value of these copied maps are all but identifical with those of the original ones.

The collection consisting of the military series published by the Royal Hungarian Cartographic Institute, established after the First World War, can also be considered as complete, both for basic survey and derived scales.

The Maproom's collecting interests also cover military series of different scales and publishing years published after the Second World War in a different mapping and projection /Gauss- Krüger/ system.

In our collection as new items we have the Nato compatible UTM coordinate system 1:50.000 and 1:250.000 scale military maps.

The 120.000-piece collection of aerial photographs also has considerable value. A smaller part of them was made before the Second World War, while most of them are copies of air photos made for mapping purposes during the 1950s, '60s, ‘70s. and ‘80s.

3.1.2.2. Automation of map-catalogues:

The catalogue of the individual maps of the Maproom has been processed – 30.000 pieces. For the elaboration the Folio Views program was used. From January 2008 the catalogue can be browsed on the Internet on the website of the War History Institute and Museum.

3.1.2.3. Digitising projects:

The next frequently used serial maps have been digitalised – altogether 7.000 maps:

- maps of first, second and third military surveying (on scale 1:28.800, 1:25.000, 1:144.000, 1:75.000, 1:200.000)
- maps of Hungary on scale 1:50.000 between 1940-1944 (stereographic projection)
- maps of Hungary on scale 1:25.000 between 1950-1953 (Gauss-Krüger projection)

The collection grows by some 4-5 thousands new items yearly, a smaller part of them being old maps, new books and other publications, while most of them are deposit copies of military series.

The Maproom, as a public collection, is open to the public from 9 a.m. to 4 p.m. from Tuesday to Thursday. The number of researchers is about 1000-1100 in a year. Black-and-white and colour photo and paper copies of maps are available on order request.

The Maproom took part in the organization of different exhibitions of the War History Museum, by lending maps.

3.1.2.4. Publications:

In 2004.:

War History Institute and Museum, Maproom:

- Az első katonai felmérés. A Magyar Királyság teljes területe. (The first military survrey of Hungarian Kingdom). 965 map-sheets and different studies. DVD.

In 2005.

War History Institute and Museum, Maproom:

- A második katonai felmérés. A Magyar Királyság és a Temesi Bánság nagyfelbontású, színes térképei. (The second military survey, colour map sections of Kingdom of Hungary and Temes.) 1112 map-sheets and different studies. DVD.
- Az első katonai felmérés. Erdély és a Temesi Bánság. (The first military survey of Transylvania and Temes). 488 map-sheets and different studies. DVD.

In 2007.

War History Institute and Museum, Maproom:

- Königreich Ungarn. The first military survey. 1763-1785. 2. edition.
- Königreich Ungarn. The second military survey. 1806-1869. 2., georeferenced edition.
- Ungarn, Siebenbürgen, Kroatien-Slawonien. The third military survey. 1869-1887. (1:25.000). Georeferenced edition.

- Österreichisch.-Ungarischen Monarchie. The third military survey. 1869-1887. (1:75.000). Georeferenced edition.
- Jankó, Annamária: Bemutatkozik a térképtár. Magyarország katonai felmérései. (The presentation of the Maproom. The military surveys of Hungary). 150 maps and studies. CD. 2005. Arcanum.
- Magyarország katonai felmérései. (The military surveys of Hungary.) 1763-1950. Budapest, 2007. Argumentum (the book) –Arcanum (CD).

3.1.2.5. Exhibitions:

- A magyarországi hadi térképek kiállítása a XVI. századtól a II. világháborúig. (Hungarian military maps from the 16th century to the Second World War.) War Institute and Museum, organized by War History Maproom, and held from July 2005 to April 2006.

Annamária Jankó Ph. D.
Director of the Maproom
Hungarian Institute and Museum of War History
H-1014 Budapest, Kapisztrán tér 2/4. Tel: +36 1 325-16-68., Fax: +36 1 325-16-74.
E-mail: janko.annamaria@hm-him.hu

3.2. The Hungarian Society of Mapfriends

Scientific-artistic mystery and 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 always illustrated by maps – this is the essence of the club's activity, followed by friendly conversations, comments of the experts, which can often be evaluated as references either from historic or other points of view.

Maps contain such an amount of information, which would be a sin to leave unexploited. Members and presenters of the Society are specialised in a wide scale of professions: cartographers, historians, linguists, archaeologists – what is common with them: they all love maps. Though elderly people, pensioners dominate, 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 lectures.

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".

A selection of the presentations of the past two years:

- László Bassa: Literature in the mirror of maps (February 2007)
- Péter Schmidt: The Caucasus Region today (January 2007)
- Ábel Hegedüs: Hungarian maps from the River Don Bend (November 2006)
- György Kisari Balla: Maps by General Marsigli (May 2006)

Gyula Szabó
Chairman

Szádeczky-Kardoss Tamás
Secretary

Address: HU-1024 Budapest, Lövőház u. 24. Hungary

4. Higher Education in Cartography

Report of the Activities of the Department of Cartography and Geoinformatics, Eötvös Loránd University (ELTE), Budapest, between 2003–2007

4.1. Introduction

The status of the Department was changed in 2003. The name Department of Cartography was changed to Department of Cartography and Geoinformatics and we 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 other students of environmental sciences,
- 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, part-time and lecturers on contract) numbers 15. Subjects of the cartography syllabus that require other professional qualification than the Department staff has are taught by noted Hungarian and foreign scholars (giving either a full course, an optional course or just a few lectures). Altogether 16 Hungarian and 4 foreign experts have contributed to the training of cartography undergraduates between 2003 and 2007. The training activities of the Department were expanded since the 1994–1995 academic year within the Postgraduate Degree School of Earth Sciences, Cartography Sub-programme. In this period, 5 candidates got the PhD in cartography (17 in the whole period). Within the past four years, 10 students and 3 staff members took part in foreign training projects at German, Portuguese, Spanish, French and Norwegian universities in the frame of ERASMUS co-operation. We had 3 foreign staff members and 3 foreign ERASMUS students from Spain and Portugal.

István Klinghammer, former head of the department was elected Rector of the University in 2000. He was re-elected in 2003 for another 3-years period. He finished this position in 2006. László Zentai was elected the new head of department in 2005. He is also the vice-dean of the Faculty of Informatics (2003–2007).

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 8.5 GBytes (May 2007).

4.2. 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 course.

The Hungarian Act on Education of 1986 made it possible that cartography training become a 5-year course. The first 10-semester course was launched in the 1988–1989 academic year. The Department modernized its curriculum continuously since 1990 to fit digital cartography. A new curriculum was established in 2001. The Bologna Process was implemented in the Hungarian higher education in 2006. Since then, Hungary has about 100 BSc courses. The development of MSc courses is in preparation now. These courses will start in 2009.

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

4.3. 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 cartographical information.

If you visit the homepage of the ELTE 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 our PhD students.

We do not plan a radical change in the practice of training doctoral students, but we are susceptible to any new tendency arising. Our purpose is to go before the prevailing challenges and guide the way to those who work in practical cartography. Indeed, most of our 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, teacher-engineers – participate 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 include theoretical and practical work of the staff of our department.

Modern education, especially doctoral schools and workshops surpassing even the higher education, needs the strong development of our 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, compete and compete.

4.4. Research

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

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

Major results:

- Amiről a térképek mesélnek (Cartography for everyone), CD-ROM (2003)
- Magyar Nagylexikon (Great Hungarian Encyclopaedia), all volumes, 1999–2005
- Atlas of the 1956 revolution, 2006

4.4.2. Education in Cartography

Major results:

- Working in the European Education on Geodetic Engineering, Cartography and Surveying (EEGECS)
- Publishing a book on GIS (István Elek), 2006–2007
- Publishing of a CD-ROM containing a selection on conference papers between 1995 and 2005 (ICA Commission on Cartography and Children: The first ten years), 2006.

4.4.3. Theoretical Cartography

Major results:

- In Hungary, research supported by the Commission on Marine Cartography of the International Cartographic Association started in 1989. As result of this, research on two topics was completed during the period. The two topics are:
- Multilingual gazetteer of geographical names of marine areas and ocean floor (CD-ROM)
- IHO/IOC “Standardization of Undersea Feature Names” English/Hungarian version; Bathymetric Publication No. 6. Published by the IHB, Monaco
- Dr. Zsolt Török got the David Woodward Memorial Fellowship (2006–2007), he visited the Institute for Research in the Humanities, University of Wisconsin, Madison, USA in 2007.

4.5. The Department's other activities in ICA

4.5.1. Commission members

- János Györffy: Commission on Map Projections
- Mátyás Márton: Commission on Marine Cartography
- Jesús Reyes: Commission on Cartography and Children (vice-chairman)
- Zsolt Török: Commission on Theoretical Cartography
- László Zentai: Commission on Education and Training (chairman), Commission on Maps and Internet

4.5.2. Conferences, meetings

- "Expanding Horizons in a Shrinking World" joint symposium (IGU Commission on Geographical Education) (2004)
- Joint Commission meeting of 5 ICA Commissions in Madrid, Spain, before the ICC 2005. The proceeding was edited and published by the Department (2005)
- 21st International Conference on the History of Cartography (2005)
- The conference was organized by Eötvös Loránd University, Budapest, with the support of the Hungarian Society for Geodesy, Cartography and Remote Sensing and in cooperation with Imago Mundi Ltd., London. ICHC 2005 took place in Budapest, Hungary, and ran from July 17 to July 22, 2005.
- ICHC 2005 co-ordinator was Dr. Zsolt Török.
- Participation in the Location based Services Conference in Vienna, Austria (2004, 2005)
- Participation in Cartography and GIS Conference in Borovets, Bulgaria (2006)
- FIG eGovernance, Knowledge Management and eLearning workshop, Budapest, Hungary (2006)
- Digital approaches to cartographic heritage workshop, Thessaloniki, Greece (2006)
- Leopoldina Meeting – Thematic Mapping in Geosciences – Applications using New Technologies and Media, Budapest, Hungary (2006). Publication of Studia Cartologica Volume 13 for the 65th birthday of Prof. Klinghammer.
- GICON, Vienna, Austria (2006)
- InterCarto-GIS, Berlin, Germany (2006)
- The President (2004, 2005, 2006) and the Secretary General (2006) of the ICA visited the Department during the period.
- Participation in the 13th International Seminar on the Naming of Seas and East Sea in Vienna, Austria (2007)

László Zentai
Professor, Head of Department

5. Major Cartographic Events and News of the Hungarian National Committee (HNC) of ICA and the Hungarian Society of Surveying, Mapping and Remote Sensing 2003-2007

5.1. Cartographic Events and HNC ICA News

Hungary was represented by six persons on the 21st Conference and 12th General Assembly of ICA, Durban 10-16 August, 2003. (dr. Árpád Papp-Váry, dr. László Zentai, Béla Pokoly, dr. Ferenc Sárközy, Henrik Hargitai, and András Dutkó. 3 papers have also been read by Hungarians (Zentai: Experiences of Compiling CET Modules, CD ROM Maps, Multimedial History of Hungary and Finland, Hargitai: Multilingual Planetary Maps)

Hungarians were delighted to see Mr. István Klinghammer being elected honorary fellow of ICA and Mr. László Zentai chosen as Chairman of Commission Education and Training.

The 36 items of maps and atlases, as well as the national report „Cartography in Hungary" well illustrated the standard of Hungarian map-making.

On 22 January 2004 HNC, chaired by President Papp-Váry, nominated a total of 25 regular and corresponding members to ICA's 17 Commissions and working groups.

In late January 2004. László Zentai was taking part in a very snowy meeting of the ICA Executive Committee in Prague.

On 3 May 2004 István Klinghammer became a member of the Hungarian Academy of Sciences.

On August 13-15 of the same year Jesús Reyes took part in the "Expanding Horizons in a Shrinking World" joint symposium (IGU commission on Geographical Education - ICA Commission on Cartography and Children) in the University of Strathclyde, Faculty of Education, Glasgow. The title of his presentation: "How do Hungarian pupils read thematic maps?" Later that year he also visited Buenos Aires (Argentina) in the frame of the bilateral scientific and technological research (Map reading and map use in secondary school: teaching cartography in Hungary and Argentina).

HNC was active in the double ICA event in Spain: it took part in the preparation and execution of the Madrid Joint Workshop on 6-8 July of the Commissions on Education and Training , Cartography and Children, National and Regional Atlases, Maps and the Internet and Visualization and Virtual Environments. The Proceedings of the meeting was edited by *László Zentai, Jesús Reyes Nuñez* and *David Fraser.* It was followed by the 22nd Conference in A Coruna, where 9 persons took part from Hungary: *dr. Árpád Papp-Váry*, *dr. László Zentai, Béla Pokoly*, *dr. István Elek*, *dr. Jesús Reyes Nuñez*, *Gizella Bassa*, *András Dutkó*, *Balázs Mihályi*, *Bálint Németh*.

4 oral presentations were given, they were: *Fraser-Zentai*: Development of the ICA-sponsored Internet cartography teaching programme, *Márton–Dutkó*: Multilingual Lexicon of Undersea Features, *Reyes Nuñez - Gallé:* Survey about experiences using thematic maps in Hungarian Elementary Schools", *Zentai* Mapping standards for sprint orienteering maps. Several more poster presentations were held by our representatives (*Reyes Nuñez – Gallé* on experiences of use of thematic maps in primary schools*, Németh* on mistakes of meteorological maps. Hungary has sent a total of 61 maps and atlases for the cartographic exhibition and the ortophoto map of the wine region of Tokay (produced by *FÖMI/Budapest*), and the album of historical maps of Europe 1520 – 2001 (*Plihál-Hapák*) won second prize in their category.

Following the cartographic events of Spain the 21st International Conference on the History of Cartography (ICHC) was held in Budapest on 17-22 July, held jointly with the Commission on the History of Cartography.

On 28 April of 2006 Zentai László actively took part, as member of the local organizing committee, in the Agile international GIS conference in Visegrád. He discussed with President Konecny issues before the Executive Committee, and held a presentation on the ICA-supported Internet-based map training programme.

5.2. Memorial Book on the 50th Anniversary of the Foundation of the Hungarian Society of Surveying, Mapping and Remote Sensing

In 2006 the Hungarian Society of Surveying, Mapping and Remote Sensing celebrated the 50th anniversary of its foundation. A memorial session was held on the Hungarian Academy of Sciences on 12 December. Hundreds of members of the Society listened to the speech of Professor István Klinghammer, who gave a historical review of Hungarian surveying and mapping.

A well-illustrated 272-page volume was also issued for this noted occasion. Chapters of the book are dealing with the historical perspective, major events of the past 50 years, professional and territorial divisions of the society, international contacts, the journal „Geodézia és Kartográfia", as well as other publications of the society. A full list of members of the society concludes the volume. An excellent review of the Hungarian National Committee of ICA is included in the book, with the first participation of Hungarians (Edinburgh 1964), through the successful Budapest Conference of 1989, to the prospects of future co-operation. The chapter, written by Árpád Papp-Váry, also includes a detailed literature.

On 30 May 2007 the Hungarian Society of Surveying, Mapping and Remote Sensing elected Dr. László Zentai as President of HNC ICA. It also thanked Dr. Papp-Váry for chairing the Committee for more than 25 years, and awarded him honorary fellowship of the Society.

Béla Pokoly
secretary HNC ICA