

HUNGARIAN NATIONAL REPORT ON IAHS 2003–2006

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Selected international and national research and development activities in Hungary

Hydrological research in Hungary is carried out mainly by the recently renamed Environmental Protection and Water Resources Research Institute (in Hungarian by the old acronym of VITUKI) and several other organizations, such as the Budapest University of Technology and Economics (BUTE), the Hungarian Academy of Sciences (HAS), the National Meteorological Service (NMS), the Pannon University (PU), the University of Miskolc (UM), and the University of Western Hungary (UWH), among others.

This report aims to list (without striving to be exhaustive) major hydrology-related research and development that took place in the 2003–2006 reporting period in Hungary by the above listed institutions, putting an emphasis on the leading institution, VITUKI.

In 2003 VITUKI started to build a new program, called MAHAB (Hungarian Hydrological Database), designed to facilitate data handling, storage and share of hydrology-related information.

The National Hydrological Forecasting Service (NHFS within VITUKI) opened a new web-page (www.hydroinfo.hu) where historical and daily actual stage measurements are available to the public for selected gauging stations along the Danube (Nagymaros, Budapest, Mohács) and Tisza (Vásárosnamény, Szeged) as well as on Lake Balaton (Siófok) going back to 1901. Also, NHFS has performed a complete recalibration of its Operational Hydrological Forecasting Model for the entire

Carpathian Basin to make way for extended forecasts of up to 6 days of lead-time on the Danube.

Operation of the Central Hydrological Data Bank, the Subsurface Water Quality Monitoring System (FAVH), and the National Inventory of Wells was continued by VITUKI. The latter in 2003 alone was expanded by 975 new wells, while FAVH in 2005 contained 26,079 locations having 290,387 samples.

New volumes of the Hydrological Year Book and the Cadastre of Deep Wells of Hungary were also published by VITUKI.

The hydrological co-operation of the countries sharing the Danube Catchment, whose number at the beginning was eight and now is 13, resulted in 1986 in issuing the Danube Monograph, in three volumes. Since then, the compilation of thematic follow-up volumes of that Monograph has been under way, under the auspices of the International Hydrological Programme (IHP) of UNESCO, from which 11 volumes have been issued until September 2005. The co-ordination of this co-operation was the task of the Hungarian IHP National Committee during the period 2003–2005. From among these 11 volumes, four have been issued during the last three years, co-ordinated from Hungary. The topics of these four volumes are the following: estimation of the critical annual flood discharges of un-gauged small watercourses (volume No. VII), inventory of the hydro-technical facilities of the Danube Catchment (volume No. VIII/1), discharge-statistical and physio-geographical characterization of the runoff regime of watercourses (volume No. VIII/2) and the multi-annual hydrological balance of the Danube Catchment (volume No. VIII/3). Note that the last three volumes, as provided by the Working Plan of the co-operation, are the updated versions of the Chapters I/5, II and III of the Danube Monograph of 1986, compiled by using the hydro-meteorological data collected during the last two-and-a-half decades and (partly) by more advanced methodologies.

Each month the Bulletin of Integrated Water Budget and Its Forecast is published by VITUKI containing relevant hydro-meteorological, water logging, and groundwater information for the whole country including forecasts of drought, areas of water logging and watershed-specific water budgets.

Regularly performed activities of VITUKI involves: a) introducing new developments in data processing and technical regulations for hydrologic observations and measurements; b) review and optimization of the hydrologic monitoring network in order to comply with EU directives; (c) implementation and optimization of an up-to-date groundwater monitoring network.

Within the EU's Water Framework Directives VITUKI took part in the PHARE TWINNING project. A national survey has been conducted to assess nitrate concentrations of the groundwater of urban areas.

Research into the hydrology, channel-morphology and sediment conditions of the Upper Hungarian Danube was continued by VITUKI in the reporting period. Similar survey was performed on the sediment regime of River Drava, the summary of which was included in the Hydrographical Atlas of the Drava River.

Previously started work at VITUKI continued in the Danube-Tisza interfluvial region to characterize its groundwater resources.

A digital 1:200,000 map of the karstic water table in the Transdanubian Moun-

tains was completed in VITUKI with a comprehensive evaluation of its quantitative and qualitative characteristics. Similar evaluation took place in the thermal karst region of the Danube Bend portion of the Transdanubain Mountains.

VITUKI conducted a survey of detecting channel morphology changes in the Paks section of the Danube to ensure continuous water supply, even during extended drought periods, to the Paks nuclear station. Similar channel-bed morphology study was conducted over the Százhombatta section of the Danube to assess the effects of removing a decommissioned underwater oil pipeline section from the Danube channel.

Flood risk studies were performed at VITUKI for Budapest to detect any increased flood potential due to flood-plain encroachment.

VITUKI performed hydro-geological evaluations for Hungary's famous thermal spas, drawing tens of thousands of visitors each year from abroad, such as Gellért, Rácz, and Rudas. Its expertise was requested in future planning and exploitation of existing and new thermal water sources for municipal heating in Budapest as well as for providing water for newly planned resorts south-west (around Etyek) of the capital.

The Institute of Water Pollution Control of VITUKI continued its effort of maintaining the National Center (PIAC-05) of the Accident Emergency Warning System (AEWS) of the Danube Basin. It received and forwarded warnings of more than a dozen accidental water pollution events during the reporting period. The Institute conducted several detailed hydro-biological surveys along the Bratislava-Budapest and the Paks sections of the Danube.

Measurement and modeling of nutrient loads to lake Balaton has continued in this reporting period as well. This work is based on regular and detailed expeditionary field measurements by VITUKI, local environmental authorities (KOFEs) and relevant water directorates (VIZIGs). Load estimates were made with and without using the expeditionary data for high runoff periods. It was reconfirmed again that the brunt of the annual phosphorus load to lake Balaton originates from diffuse sources during such high runoff events. This load component is much higher than would otherwise be estimated using data only from the regular monitoring network.

During the reporting period lake Balaton suffered unusually low water levels (just to have unusually high water levels the following year). This triggered a complex study conducted by the Department of Sanitary and Environmental Engineering of BME, HAS, and VITUKI about the economical, water management, and hydro-biological aspects of any possible future water supplement scheme from outside sources. The study concluded (just in time before the unusually high water level period set in) that it was not necessary at this point because on a long-term basis lake Balaton would most probably have enough inflow to offset any possible increases in future, perhaps, climate-change induced evaporation rates and shifts in precipitation patterns.

VITUKI again compiled data necessary for a comprehensive evaluation of the natural environment including quantitative and qualitative description of surface and groundwater resources of Hungary.

VITUKI, with the help of the National Radiation Detection and Control Center (OSJER), continued its effort of monitoring the nations surface and groundwater resources for radioactive micro-pollutants. It took part also in hydro-geological evaluations (with the Geological Institute of Hungary (GIH)) of the planned, future site for low intensity radioactive waste depository near Bátaapáti-Üveghuta.

The international ecological inter-calibration network planning work within the EU's Water Framework Directives was concluded in 2005 and the final report sent to Brussels in 2006. Ecological measurements in this international inter-calibration network have been continued.

Since 1979, hydrology is an elective area of emphasis, organized by the Department of Physical Geography at the Eötvös Loránd University, Budapest (ELTE). Students who take part in this curriculum typically major in geography, meteorology, cartography or in geology. Each year about 8–12 students participate. Courses are taught by the faculty of ELTE and by researchers from VITUKI.

VITUKI involvement in international co-operation and projects

- German-Hungarian co-operation on the “Hydrography of the Danube and its Basin”
- Multilateral co-operation among Hungary, Romania, Slovakia, Serbia-Montenegro, and the Ukraine on flood forecasting which includes the development of a web-based information and alarm system
- Participation in the EU's HARMONIQUA project on harmonizing watershed and river management quality assurance issues
- Participation in the EU's European Flood Forecasting System (EFFS) project
- Taking part in a NATO-sponsored Hungarian-Romanian co-operation on flood forecasting and levee breaking emergencies on the Fekete-, Fehér-, and Kettős-Körös Rivers
- Testing the Károlyi bed-load sampling device in the Loire for the request of French colleagues within the framework of a sediment evaluation and survey project
- Hungarian-Italian (IRSA-CNR and the Agricultural Faculty of Tuscia University) co-operation on sensitivity analysis of diffuse-source contamination spreading in the saturated zone
- Completion of the EU-funded Tisza River Project in co-operation with Romania, Slovakia and the Ukraine with participation of leading research institutes and universities from Austria, Belgium, Germany and the UK. The project concentrated on conserving ecological values within the watershed with simultaneously ensuring a sustainable water management in the region. The completion report (in both Hungarian and English) can be downloaded from the following website: www.vituki.hu

- The International Postgraduate Course on Hydrology in VITUKI continued (its 34th to 37th year) in the reporting period with a typical student attendance of about 10 each year
- VITUKI maintains a long-standing good professional relationship with the following intergovernmental organizations: UNESCO, WMO, WHO, EGB, as well as with nongovernmental organizations, such as IAHR, IAHS. It has bilateral co-operation with the French International Water Bureau, the Dutch RIZA and Delft Hydraulic Institute, the German Federal Water Management Institute, the Department of Water Resources of the University of Graz, the Institute of Technology and Development in Kuwait, the British Water Resources Centre, and the HALCROW Group (the last two being co-owners of VITUKI Consult)
- VITUKI participation in the EUROPEAID/114956/D/SV/HU2002 PHARE project titled ‘Chemical assessment of groundwater’. Also VITUKI was a member of an international consortium in an EU-sponsored project called ‘LIFE-Szigetköz’ on sustainable water and land-use management in the Szigetköz area of the Danube in north-western Hungary
- In 2005 VITUKI participated in the World Bank sponsored ‘Gemenc Project’ to perform an ecological assessment of the flood-plain area of the Danube among other responsibilities. Similar ecological assessment work along the EU Water Framework Directive was accomplished by VITUKI in the Kapos watershed of western Hungary

List of selected hydrologic research not yet summarized

- Outlining and characterization of international surface and subsurface water bodies within Hungary (Department of Sanitary and Environmental Engineering of BUTE, HAS, VITUKI)
- Building of a comprehensive Hydrogeology Model of Hungary using MODFLOW (HAS, VITUKI)
- Flood Risk project for better understanding of flood occurrences on the rivers of Hungary (VITUKI as lead institution among 12 other institutions involved)
- “Investigating extreme flood events in Hungary’s small watersheds within rolling hill and mountainous regions” project that was concluded in 2004 (VITUKI)
- Feasibility investigations of reestablishing traditional floodplain management techniques (i.e., the “eco-hydrological approach”) in the Tisza valley (VITUKI)
- Complex monitoring and database creation and management for selected small water bodies (Rákos and Galga streams, Csórrét reservoir-stream system) in Hungary (RAGACS), subjected to different levels of environmental stressors (VITUKI)

- As a consortium member VITUKI took part in the GIH (Geological Institute of Hungary)-co-ordinated project titled ‘Optimal Waste Deposal Possibilities in Hungary’
- In 2004, within the METINFO project between VITUKI and the National Meteorological Service (NMS), complex meteorological fields have been started to be obtained and manipulated in the National Hydrological Forecasting Service (NHFS) of VITUKI to facilitate extended (i.e., 6-day lead time) hydrological forecasts on the Danube
- In 2003 the Department of Hydrogeology and Engineering Geology (DHEG) of UM with collaboration of the University of Liege completed a NATO-sponsored project on ‘Complex hydrogeological investigation of the alluvial fan of the Szamos River’
- Karst hydrology research in the Bükk Mountains has also continued at UM
- Further research at DHEG involves: a) Hydro-dynamical investigation of groundwater flow systems; b) Hydrological and environmental protection applications of hydro-dynamic transport models; c) Environmental risk assessment of contaminated land areas
- The Department of Sanitary and Environmental Engineering of BUTE, HAS and NMS have completed a distributed-parameter, physically-based hydrologic model for the Upper-Tisza watershed
- Hydrologic and water quality characteristics of forested small watersheds in north-western Hungary (Institute of Geomatics and Civil Engineering of UWH)
- Monitoring quality and quantity of spring waters in the Sopron Hills (Institute of Geomatics and Civil Engineering of UWH)
- Transpiration and plant surface temperature of reedbeds with different watering levels (PU)
- Microclimate and transpiration of reed beds on lakeshores with changing water levels (PU)
- Evapotranspiration characteristics of swamp vegetation (PU)
- Long-term (130 years of record) changes in annual precipitation at Keszthely (PU)
- Historical developments in evaporation studies of Lake Balaton (PU)
- Adaptive modeling of wind and wind-induced wave-current fields of shallow lakes in complex terrain (Department of Hydraulic and Water Resources Engineering of BUTE)

- Measurement and parameterization of spatial flows in surface waters (Department of Hydraulic and Water Resources Engineering of BUTE)
- Historical and climate-change-scenario modeling of evaporation from Hungary's large lakes (Department of Hydraulic and Water Resources Engineering of BUTE, as a contributor to the EU-sponsored 'Climate Change and Variability: Impact in Central and Eastern Europe (CLAVIER)' project, co-ordinated by the Max Planck Institute of Meteorology, Hamburg)

References

- Anda A, Boldizsár A 2005: Transpiration and plant surface temperatures of reedbeds with different watering levels. *Georgikon for Agriculture*, 8(1), 39–52.
- Anda A, Boldizsár A 2006: Microclimate and transpiration of reed beds on lakeshores with changing water levels. *Acta Agronomica Hung.*, 54(1), 39–47.
- Boldizsár A, Varga B, Kocsis T, Bem J 2006: Evapotranspiration characteristics of swamp vegetation (in Hungarian). Pannon University Annals of Meteorology, No. 20.
- Department of Hydraulic and Water Resources Engineering, Budapest University of Technology: Report on OTKA-sponsored projects, 2006
- Department of Hydrogeology and Engineering Geology, University of Miskolc: www.hidrotanszek.hu/indexe.htm
- Domokos M 2006: The cooperation of the hydrologists of the countries sharing the Danube Catchment, coordinated from Hungary during the period 2003–2005
- Institute of Geomatics and Civil Engineering, University of Western Hungary: Report on projects, 2007
- Kocsis T, Anda A 2005: Long-term (130 years of record) changes in annual precipitation at Keszthely (in Hungarian). *Léhkör*, 50(2), 16–21.
- National Meteorological Service: National research and development programs, 2007
- Varga B, Boldizsár A, Kocsis T, Bem J 2006: Historical developments in evaporation studies of Lake Balaton. Pannon University Annals of Meteorology, No. 20.
- VITUKI: Annual reports of the Director General for the 2003–2006 period