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NEWSLETTER

NATIONAL ADAPTATION GEO-INFORMATION SYSTEM

CONTENT

NAGiS - a reasonable response to the challenges of climate change

The climate change of our age, which is also proven by measurements, continues to pose serious challenges for societies. The average surface temperature has been showing a continuously increasing tendency since the industrial revolution, therefore, based on appropriate modelling, by 2081–2100, it is forecast to be even 1.5–2 °C higher than the corresponding value before the advent of the Industrial Revolution. The consequences of this can be felt over the entire Earth, but with different symptoms at different places. As a result of the climate change, the ice sheet of our planet is receding, sea levels are rising, the habitats of certain species are changing and agricultural production zones are shifting. In Hungary, heat waves are expected to become more frequent with less cold days, and the distribution of precipitation and water movement will be more uneven, to name but a few of the most important effects. The Intergovernmental Panel on Climate Change (IPCC), relying on the research results of reputed scientists' research of this area, today states with 95% certainty that the present climate change is of an anthropogenic origin. The main driving force for climate change is the emission of greenhouse

gases, which is mostly related to the consumption of fossil fuels.

It is not possible to avoid climate change and its consequences, but they can be mitigated by reducing the emission of greenhouse gases. A reasonable objective of the decarbonisation methods (i.e. procedures aimed at the reduction of the emission of greenhouse gases) is to keep the average temperature change below +2 °C in comparison with the pre-industrial era.

Besides reducing the volume of greenhouse gases emitted, the preparation of the Hungarian society and economy

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to adapt to the expected unfavourable local spillover effects of climate change is likewise important. The integration of the aspects of climate, water and energy security into territorial and sectoral strategies at national, regional and local levels plays a key role in finding the solution to this problem. The strategic integration of adaptation requires comprehensive information on the societal, economic and environmental vulnerability of being exposed to these changes. The National Adaptation Geo-information System (NAGiS) will play a key role in collecting and processing information and in supporting decisions regarding climate policies.

Professional and statutory background

The statutory background for the establishment of NAGiS is provided by *Act LX of 2007 on the implementation framework of the UN Framework Convention on Climate Change and the Kyoto Protocol thereof.* In accordance with Article 3 of the Act, the National Adaptation Strategic Framework System, which is part of the National Climate Change Strategy, is supported by the National Adaptation Geo-information System and the results of the related territorial and sectoral climatic vulnerability investigations.

Based on statutory authorization, *Government Decree No. 94 of 2014 (III. 21.) laying down detailed rules of operation of the National Adaptation Geoinformatic System,* was issued in March 2014 and the General Rules of Operation of NAGiS were approved in May 2014. Based on the Decree, NAGiS will be run by the Geological and Geophysical Institute of Hungary.

Using the data available and the derived indicators, analyses and impact studies, NAGiS will provide information on the country's climatic status within the limits laid down in the Decree. It will help gaining information by exploring the impacts of climate change and other strategic risks related to long-term management of natural resources and the possibilities of adaptation to these. It will help the work of the central, territorial and local governments and state administrative bodies by its research, analysis and decision supporting functions. It will be useful for the sectoral and territorial planning activities concerning the transport, forestry, agriculture, rural development, health protection, living standards, tourism and disaster management sectors.

EEA subsidy to develop the system

Framework of the project

The Geological and Geophysical Institute of Hungary received subsidy in 2013 from the European Economic Area (EEA) Grants to establish the system. In the current period, which will last until 2016, this support scheme covers 15 EU Member States, including Hungary. In the period 2009–2014, the combined budget of the EEA Grants and the Norway Grants is EUR 1.79 million, of which about 97% is provided by Norway. Based on the Memorandum of Understanding signed in October 2011, a budget of EUR 153 million is available for Hungary, helping the implementation of 12 programmes. The largest amounts are allocated for environment protection, research and development and the capacity development of NGOs. The NAGiS Project is a key element of the "Adaptation to Climate Change in Hungary" programme, financed from the EEA Grants. The fund manager for this programme is the Regional Environmental Center for Central and Eastern Europe (REC). The National Adaptation Center (NAC) of the Geological and Geophysical Institute of Hungary is responsible for the implementation of the NAGiS Project.

Objectives and target groups

The specific objectives of the NAGiS Project are the following:

– **Establishment of a geographic information system and metadata database.** The primary objective is to support decisions related to climate change adaptation through the establishment and operation of a multi-purpose geographic information system. This system is based on results derived from various thematic knowledge bases. The related metadata database serves orientation in the various data systems, documentation of the system and the reconstructability of the processes of data processing.

– **Methodological development.** A second main objective of the project is to analyse the territorial impacts of climate change and to further develop the methodology of data collection and processing, climate modelling and analysis and vulnerability tests serving the related adaptation methods, as part of the National Spatial Data Infrastructure.

– **Establishment of a NAGiS portal.** The third main objective is the creation of a web-based information hub on

climate policy. With the help of the portal, any interested party may obtain reliable and objective information on adaptation to climate change and the policy areas influencing it.

The NAGiS portal will make information derived and processed from the basic data available to the general public. The target groups of NAGiS are:

– decision makers and those involved in preparing decisions;

– economic and infrastructural development, investments and land use;

– scientific research;

– public opinion and information.

Organising execution of the tasks

The corresponding elements of the project tasks are grouped into work packages (WPs) as described below:

– WP1 – Establishment of the legal and IT background required for the operation of the project;

– WP2 – Establishment and configuration of the hardware environment for NAGiS;

– WP3 – Software development and fine-tuning to NAGiS methodology;

– WP4 – Methodological developments (indicators), R+D and background studies for the establishment of national strategies;

– WP5 – Widespread dissemination of the results achieved by the NAGiS Project and of the information originating therefrom;

– WP6 – Project management.

Implementation of the project lasts from 24 September 2013 to 30 April 2016. Its results will be fully accessible after conclusion of the project.

Introduction of the project

Kick-off conference

The Kick-off Conference of the NAGiS Project was held on 14 October 2013 in the Geological and Geophysical Institute of Hungary with a total of 84 participants. The institute, as the project promoter, introduced the details of the programme and the planned system. Approximately 50 print and online media articles reported the event.

Designing the visual identity elements

The webpage of the project was launched in early 2014 (nagis.hu and nater.mfgi.hu) and the key visual identity elements have also been designed. A brochure was prepared in English and Hungarian to generally introduce the project, which has since been used to provide information to the professional as well as the general public at several events and exhibitions.

Introduction at various conferences and fora

Since the time of its launching, the project has been introduced at a total of 12 fora, conferences and work meetings, primarily in the form of presentations. The following events were the key milestones:

– A workshop held in the framework of a series of public debate fora in November 2013 in Budapest on the draft of the renewed National Climate Change Strategy;

– The 21st Conference on Subsurface Waters held in Siófok in April 2014;

– The annual assembly of the Geoscience Information Consortium in May 2014 in Slovakia;

– A study trip to Bergen, Norway, in June 2014 financed by EEA Grants, and the Climatic Adaptation Forum held in Budapest in the same month;

– The 12th HUNGEO Conference, held in August 2014;

– The 41st International Conference of the International Association of Hydrogeologists (IAH) in Morocco in September 2014;

– The ESRI Hungary User Conference in October in Budapest and

– One of the side events of the United Nations Climate Change Conference (COP20) held in Lima, Peru, in December 2014.

NAGiS workshop

In the framework of the project, a workshop was held on 2 December 2014 under the name "Soil-Climate-Adaptation". Colleagues of the Geological and Geophysical Institute of Hungary (MFGI) and of the Institute for Soil Sciences and Agricultural Chemistry (TAKI) of the Centre for Agricultural Research operating within the Hungarian Academy of Sciences participated at the event.

Dr. Tamás Fancsik, Director of the Geological and Geophysical Institute of Hungary, highlighted in his keynote speech the pioneering role of the NAGiS Project on a European as well as a global scale and the possibilities of implementing extensive exemplary scientific cooperation in connection to it. *Professor Éva Lehoczky,* Director of the Institute for Soil Sciences and Agricultural Chemistry (TAKI) agreed that cooperation implemented in the framework of the NAGiS Project may be mutually beneficial for the participating institutions. Her presentation introduced the history and the current work of the institute under her direction.

The moderator of the morning programme was *Dr. Tamás Pálvölgyi,* Deputy Director of the Geological and Geophysical Institute of Hungary, Head of the National Adaptation Center (NAC), while the afternoon session was moderated by *Dr. Gábor Turczi,* likewise the Deputy Director of the same institute. The 8 professional presentations and the roundtable discussion afterwards provided an opportunity to present and discuss the results so far achieved and the further possibilities of professional cooperation.

Three presentations were held by colleagues of the Geological and Geophysical Institute of Hungary.

Dr. Zsolt Mattányi introduced the project objectives, highlighting their importance among the long-term responsibilities of the Central Government.

Gábor Halupka and *László Orosz* presented the correction tasks performed in the Shallow Boring Database, the applied methodology and other details.

Dr. István Marsi, Dr. Ildikó Szentpétery and *Rita Szeiler* described the complex environmental assessment method applied in the course of mining concession explorations.

Dr. László Pásztor holding his presentation

From among the participants from the Institute of Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences, *Dr. László Pásztor* introduced in two presentations the fundamental principles of soil mapping and the methods of data collection, underlining that the data systems of the Geological and Geophysical Institute of Hungary may play a significant role in the mutual further clarification of mapping data.

Dr. András Makó described the Hungarian Detailed Soil Hydrophysical Database (MARTHA) created recently, and *Dr. Kálmán Rajkai* presented on the significant effect of soil parameters on the evolution of meteorological conditions.

In the afternoon session, the last of the presenters from the Institute of Soil Science and Agricultural Chemistry was *Dr. Nándor Fodor*, describing a plant cultivation simulation model, aimed at the plot-level estimation of the crop losses brought about by drought and inland water, using meteorological and agrotechnical data.

The workshop contributed to establishing the long-term cooperation of the Geological and Geophysical Institute of Hungary and the Institute of Soil Science and Agricultural Chemistry, of which even a framework agreement has been concluded since.

Mariann Sziráki

The "soul" of NAGiS: the IT background

Based on *Government Decree No. 94 of 2014 (III. 21.)* the basic IT infrastructural background for the Project must be provided within the infrastructure of the Geological and Geophysical Institute of Hungary. As one of the first significant achievements of the project, the IT System Plan of NAGiS was prepared by April 2014.

As a result of the work of the institute, the hardware environment of NAGiS has been established in the framework of this EEA Grants funded project, which included among others the procurement of the desktop computers and monitors suitable for work, servers suitable for data storage and publication on the Internet, the data transmission switches indispensable for efficient GIS (Geographic Information Science) work and a large format scanner serving the digitalisation of archive materials.

The establishment of the software environment required for the operation of the project also began. These do not only cover the GIS software used to perform the analyses of NAGiS, but also the environment allowing the operation of the hardware tools mentioned above and the systematisation and saving of data. The server environment indispensable for the storage of databases, the software managing the complete saving cycles of the project, the GIS software and the operating systems required for the servers have been procured in light of the above.

The Shallow Boring Database

The Shallow Boring Database contains the basic and sample analysis data of 12,810 boreholes bored in the period 1960–1980. The original data of the boreholes were subsequently supplemented with tens of thousands of water chemistry and sedimentological data in the course of the analyses conducted, providing highly comprehensive shallow geological information about the Great Hungarian Plain, the Little Hungarian Plain and the South Transdanubian Region.

In order to make this data volume better accessible and available for other researchers as well, the data have been compiled into a harmonised database that can be queried according to various criteria. This database is part of the boring data system of the Geological and Geophysical Institute of Hungary. Finalisation of a restructured database took place in the framework of the NAGiS Project, i.e. the elaboration of data links and correction methods to make the database searchable and queriable.

The project gave significant momentum to the restructuring of the database and the value-added, high-quality overview of these elements of the database. The resulting advanced database is used as an input in the NAGiS Project, among others, for the preparation of the dynamic hydrogeological model.

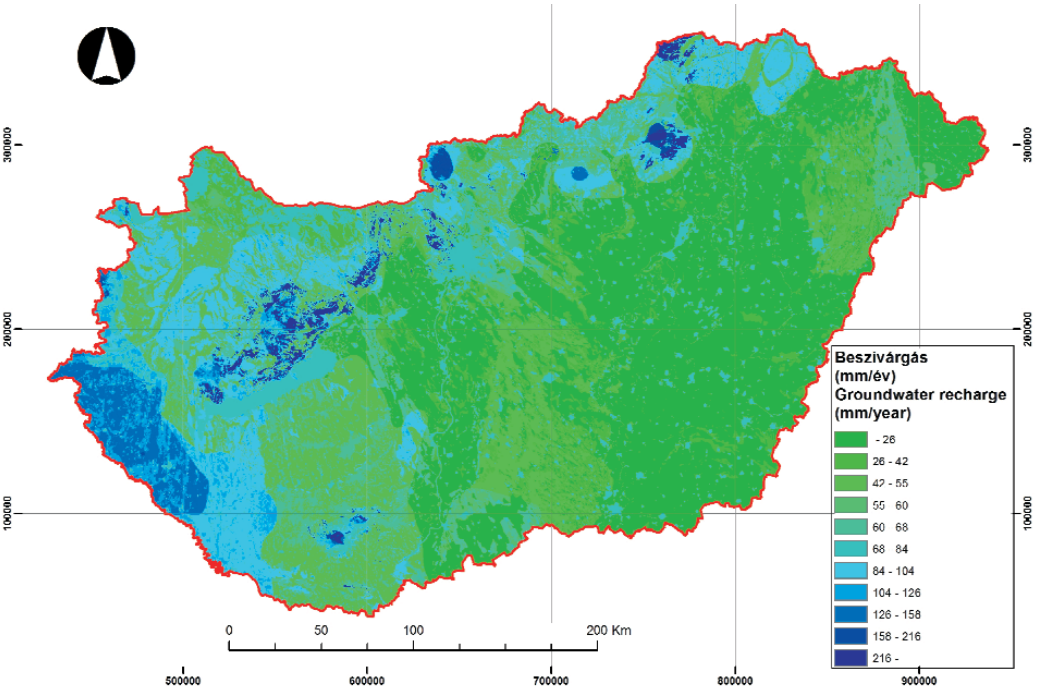
László Orosz

Renovation of the old wellhead of Zsámbék–13 (left); new, uniform wellhead (right)

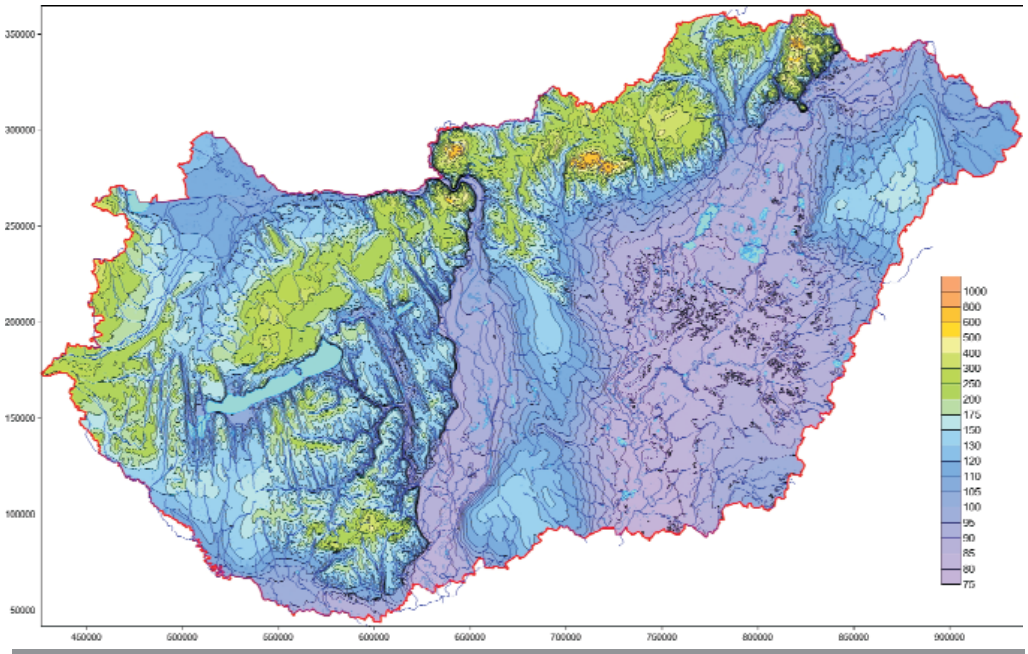
Sensitivity of Subsurface Waters
Development of the hydrogeological monitoring system

Observation of water levels supports the tracking of the possible effects of climate change on subsurface waters. The water level time series obtained as a result of the continuous monitoring measurements provide basic data for the analysis of earlier periods characterised by extreme weather conditions, for further precising models and methods prepared for forecasts, as well as to control measurements that will take place at a later date.

Changes in the water levels of all subsurface water types of the country are tracked by the Hydrogeological Monitoring Network. The observation network of the Geological and Geophysical Institute of Hungary is part of this, too, six groundwater and karst water level observation wells of which were renovated in the course of the project.



Calculated drainage-distribution map for the period 1961-65



First version of the model of Hungarian groundwater levels created using numerical modelling

Upon expansion of the network with the renovated wells, new and representative measuring points are incorporated in the monitoring network equipped with online transmitters, making the distribution of measuring points capable of real time data recording and data transmission more even.

Definition of drainage

Drainage zones are surface areas where - considering our geological, plant cover, climate and terrain conditions - homogeneous drainage can be assumed.

Drainage can be determined using the CARPATCLIM MoPlusz climate database (prepared in an earlier project led by the Hungarian Meteorological Service) with the help of analytical, one-dimensional hydrological models (HELP). Reconciliation of the data included in the Shallow Boring Database (see above) with the data on the water level changes of the aforementioned groundwater wells and the parameterisation of soil profiles play a significant role in determining drainage.

Dynamic hydrogeological model

This two-dimensional, single-layer hydrogeological model will show the spatial evolution of groundwater levels for the territory of the entire country in the light of various possible climatic or anthropogenic events. The modelling codes of the MODFLOW software (which is used for the regional modelling) are able to simulate 2D and 3D water flow and solute transport processes with high accuracy. The first runs of the groundwater and terrain simulation prepared for the entire territory of the country has been completed in the course of the modelling work carried out in the frame-work of the project.

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