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Extreme analysis of the detected and the expected climate of the Carpathian Basin

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Global climate change implies increasing global mean temperature, which may occur due to the increasing average and the modified frequency distribution of temperature values. The main objective of our research is to detect the possible changes of intensity and frequency of the extreme events associated with precipitation and temperature.

Several climate extreme indices are analyzed and compared for the Carpathian basin following the guidelines suggested by the joint WMO-CCl/CLIVAR Working Group on climate change detection. These climate extreme indices are determined on the basis of daily maximum, minimum and mean temperature values, and daily precipitation amounts. The statistical trend analysis includes the evaluation of 27 extreme indices, e.g., the numbers of severe cold days, winter days, frost days, cold days, warm days, summer days, hot days, extremely hot days, cold nights, warm nights, the intra-annual extreme temperature range, the heat wave duration, the growing season length, the number of wet days (using several threshold values defining extremes), the maximum number of consecutive dry days, the highest 1-day precipitation amount, the greatest 5-day rainfall total, the annual fraction due to extreme precipitation events, etc.

In order to analyze the past trends, daily meteorological observations are used to calculate the time series of extreme temperature and precipitation indices for the 31 selected stations for the 20th century. Because of the lack of century-long meteorological time series, the analysis focuses mainly on the second half of the 20th century. However, the analysis is extended for the entire century in case of some stations, where sufficient data was available.

The results suggest that similarly to the global and continental trends, regional temperature of Central/Eastern Europe got warmer during the second half of the 20th century. Furthermore, regional intensity and frequency of extreme precipitation increased, while the total precipitation decreased in the region and the mean climate became drier.

In case of the future trends (2071-2100), daily values of meteorological variables are obtained from the outputs of various regional climate model (RCM) experiments accomplished in the frame of the completed EU-project PRUDENCE (the horizontal resolution of RCMs is 50 km). Both scenarios A2 and B2 are used to compare the past and future trends of the extreme climate indices for the Carpathian basin.

Some elements of the successibility of the small villages in Hungary

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In the last decades most of the settlement-sciences (settlement geography, sociology, economics) started to concentrate on success. Before it the success had been used only for enterprises and countries and not for settlements. Because of the globalization the regional competitiveness became more important. On the other hand it is not so easy to define the success of regions, towns and villages, because it is very hard to separate them from each other. We can find widespread literature about the success of towns, regions, counties, but there are only few articles about the villages. The aspects of success can be very interesting among the smallest villages of Hungary, at the "small-villages" with the population less than 500. The small villages were among the losers during the communist regime both in political, social and economic view. We could hardly find any successful small villages in that era. After 1990 (the changing of political regime) the main factors of the development of settlements changed and the small villages (one third of all the settlements of Hungary) became more diverse. Some of them started to develop (suburban ones, touristic ones, those, which located near the Austrian border), while others legged behind (the smallest ones, the peripherical ones, villages with large marginalized groups, especially with Roma people).

In this article we would like to analyze the elements of success and failure of the small villages and we tried to classify these villages into different "success-groups" by some dimensions (demography, income, economic situation, tourism,

etc.). We used different mathematic and statistic method in our research. We had another special problem with the small villages as well. The most successful villages with increasing population became larger villages and not small ones (with the population more than 500). So the most successful small villages of the previous decades are no longer small villages. Because of it we started to deal with all the villages, which population was less than 500 any time between the years of 1990 and 2007. There are successful small villages and they can be a good example for the settlement planning of the other villages.

pH relations and clay content of salt-affected lake sediments

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Keywords: clay minerals, pH, statistical analysis, salt-affected sediments, Fehér-Lake

Our research aims at the complex geochemical study of the solid phase of salt-affected profiles, originating from natural lakes and lakes under anthropogenic use. This paper presents the results of pH and clay mineral XRD analyses performed on sediment profiles taken from four sites.

The sampling area (Fehér Lake), located north of Szeged (Hungary) proved to be an ideal site to achieve the goals determined above. The 14 km^2 lake system is located in the Kiskunság National Park and drains the water of a 200 km^2 territory. It is mostly used for intensive fish breeding, though it also incorporates some relatively untouched close to natural areas. In order to interpret correctly the results of the investigation it is important to note that the water loss of the lakes is recharged through a canal from the Tisza, located 1.5 km off the territory.

Samplings were made in the spring of 2007 at four locations with different hydrological character and type of water management. At each locations a sediment core 10 cm in diameter, 4 m in depth was taken. The 4 m cores were dissected into 5 cm units, which were dried for 3 weeks under room temperature. Subsequently, the samples were ground to a 100 µm grainsize. The pH of the samples was measured following the MSZ 21470-2:1981 Hungarian patent, from a 1:2.5 ratio soil-1N KCl suspension. The identification of clay minerals was made with the X-ray diffractional (XRD) method, the fraction below 2 µm was applied.

Although values fell to the characteristic range of saline soils, significant differences were observed in relation with landuse and depth. The average pH of profiles was 7.8, but in two sampled hatcheries, was 0.5 higher, assumably due to the great volume of recharge and the intensive summer period evaporation. Based on the XRD analysis, the amount and distribution of the clay minerals are very different in the profiles. These parameters are depend on the use and waterholding of this areas. By right of the measurements, no significant correlation was observed between clay mineral content and pH, thus the development of clay mineral composition is not largely affected by pH.

Based on our measurements, the pH of saline areas is determined by post-sedimentation processes, and primarily influenced by the water household, the salt content and the mineral composition of the sediment. The analyses of grainsize distribution and salt content are in progress, to appropriate interpretations of pH and clay content.

Review of neural network analyses performed in Croatian part of Pannonian basin (petroleum geology data)

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Keywords: neural network, prediction lithology, porosity, saturation, Drava depression, Sava depression, Pannonian basin, Croatia

Neural networks represent very strong tools for different prediction tasks in many sciences. Petroleum geology, and geology overall, is one of the fields where such networks can be very successful and relatively easy applied. Neural algorithms can be applied for prediction of different variables, like porosity, depth, lithology and saturation. The basic idea encompasses the correlation of several inputs and calculation of single output (predicted) value. Up to now, the neural prediction was applied at three Croatian oil and gas fields. The first analysis was done at the Okoli field (1) (prediction of facies). It is followed by porosity prediction performed at the Beničanci field (2) and finally lithology and saturation had been simulated at the Kloštar field (3). These three applications of neural networks have been performed in Miocene sediment..

(1) Neural analysis performed at **Okoli field** in 2006 was one of the first published analyses of such type in hydrocarbon reservoir analysis in Croatia. This study is relevant for clastic facies prediction in Lower Pontian deposits of the Sava depression. Analysis is characterised by excellent correlation between predicted and true position of sandstone lithology (reservoir). On contrary, positions of predicted and true marlstones positions (in top and bottom) mostly do not correspond. The correct facies prediction probabilities are theoretically extremely high. In B-1 well (based on 3 log curves) it is minimal 78.3%, and in B-2 well (based on 7 log curves) minimal 82.1%. The Face machine is calculated relatively in the early period of network training. In B-1 well this machine is observed in 2186th iteration and in B-2 well in 7626th iteration. Such results point out that, for similar facies analyses in the Sava depression, one does not need to use such large iteration set (about 30000). Eventually, in the following neuron analyses in clastic deposits of Pannonian and Pontian ages, input dataset would need to be extended on to other well log curves. Such curves would need to well

characterize lithology, porosity and saturation, like the curves of SP (spontaneous potential), CN (compensated neutron), DEN (density) and other. Presented neural technique could be useful in log curves analysis, if the Face machine would be configured with 90 % probability for true prediction.

(2) At **the Beničanci field** (2007) the neural network was selected for handling uncertainties of porosity distribution in breccia-conglomerate carbonate reservoir of the Badenian age. The best porosity training results are obtained when all three seismic attributes (amplitude, frequency, phase) were used. The reached correlation is R^2=0.987 and convergence criteria $\Sigma\varepsilon^2$=0.329. These values can slightly (a few percent) differ in every new training, what is the consequence of the random sampling process in the network fitting process. The result indicates that neural network very favour the numerous inputs and it is why the meaningful variables need to be carefully selected as neural input.

(3) At **the Kloštar field** (2007) several artificial neural networks were trained with the task of predicting lithology of Upper Pannonian deposits ("2nd sandstone series") and Lower Pontian deposits ("1st sandstone series") as well as hydrocarbon saturation within these beds. Sandstone facies represent very adequate media for statistical and neural network analysis. In the case of lithological prediction on well Klo-A and Klo-B with RBF and MLP neural networks, excellent correspondence of the true and predicted values was achieved. Prediction of hydrocarbon saturation on well Klo-B with a neural network trained on well Klo-A gave excellent corresponding between real and predicted values.

Acquired results show large potential of neural networks application in petroleum geology research where they could be used as a method for acquiring quick and meaningful results from well logs or seismic data.

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Stochastic simulation of statigraphical position of Szőreg-I reservoir

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Keywords: normal score transformation, variogram surface, variogram modeling, stochastic simulation, sequential Gaussian simulation, kriging

Szőreg-I is an element of Pannonian delta sequences building up the largest Hungarian hydrocarbon accumulation (Algyo Field) consisting of several oil and gas bearing reservoirs. It has considerable inner heterogeneity.

Using the statigraphical data available, sequential Gaussian simulation of the top and the bottom of this delta sequence have been carried out. The first step was the examination of the correlation between the top and the bottom and a very strong correlation have been found. The second step was a normal distribution check, because the sequential Gaussian simulation requires normal distribution of the data. The distribution was not normal, therefore a normal score transformation has been carried out. The spatial continuity has been analysed with variogram surfaces. Based on this analysis the experimental variograms have been modeled to 125° and 165° continuity directions. The same models have been used for the top and the bottom, because they have a strong correlation. Exponential and Gaussian models have been used as theoretical models.

The simulation have resulted 100 realizations for the top and 100 for the bottom. The comparison of the kriged and the simulated maps (E-type estimation on the basis of one-hundred realizations) have been made. The simulated surfaces have more details, then the kriged ones. Finally the models have been made more precise with the probability limits.

Uncertainty of estimation and its background

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Keywords: kriging, estimation variance, uncertainty

In the theory of geostatistics, the well-known kriging method is esed for the estimaton of parameter values in discrete poins. There is a formula too, in the geostatistical special literature for calculation of kriging variance. However it is also well-known that the real variance may be much bigger than the result of calculation. In geostatistical text books there is not explanation for this deviation. The study deals with this problem and in detail demonstrate causes of this deviation.

Statistical estimation for the urban heat island using simple surface data

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The overall purpose of this study is the presentation the statistical modelling procedures what we have used in urban climate research. Firstly we would like to present an easy to use method for the estimation the maximum urban heat island intensity (UHI). Secondly we would like to demonstrate the utilization of the well-know cokriging method for UHI estimation using temperature measurement transects and surface parameters.

Our assumption is that the mean daily maximum heat island of towns situated on plain can be assessed by their surface features. Based on temperature and surface cover data from Szeged and Debrecen, the aim of our research is to construct a multiple variable model for the spatial distribution of the mean heat island, and then to extend our results to other towns situated in similar environmental situation, which have no temperature measurements.

The investigation of the development and the night time fluctuation of the UHI have got primary importance. Therefore special measurements had taken in our study area. As a result temperature transects are available with 1 hour frequencies at 12 investigated nights. With the cokriging method we have the opportunity to extend the UHI values of these temperature transects to the whole study area. With these estimated UHI fields we can investigate the night time fluctuation of the structure and the intensity of the heat island.

GEOMATHEMATICAL EVALUATION OF A CONCEPTUAL HYDROGEOLOGICAL MODEL IN CASE OF BÁTAAPÁTI

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Within the research and repository implementation projects targeting the geological displacement of LLW/ILW radioactive waste at Bátaapáti site one of the most complex sides is the hidrogeology. During the site characterization works a quite special hidrogeological conceptual model has been formed. In this model 15 blocks were defined according to the hidrological heterogeneity. It is though, that the blocks are separated from each other by special baffle zones with extremely low hydraulic conductivity. Beside of this very limited lateral connection, the main hydraulic processes within the blocks are controlled by some larger and more or less continuous fracture zones. The smaller fracture systems give rooms for the main transport processes. This model has been proved quite unique without any know analogy. Therefore the acceptability of this conceptual model is very problematic. This situation has aroused the need for applying geomathematics to validate the hydrogeological conceptual model.

The main purpose of this mathematical modeling activity was

- mathematical characterization of the rock body using the measured properties;
- stochastic evaluation of the conceptual model;
- building up an stochastic analogy of the conceptual model, if it is possible.

The data set consists of data about the fracture frequencies, interpreted set of static heads, transmissivity and hydraulic conductivity measurements and tomograph velocities. The information have been measured by the different companies and institutes taking place in the Bátaapáti project. All these data have been up scaled for 10 m of thick intervals in each wells.

The geomathematical analysis started with some descriptive statistics with special emphasize on the extreme values and outliers. In this stage the key question was to reveal the geographical and stratigraphical positions of these extremities. This overview was followed by a principal component analysis by which a general genetical charactization have been able to carry out. For the analysis of homogeneity among the blocks the Fisher's LSD method have been used in a property-by-property manner. In this step the main goal was to identify the block forming and continuous properties. Finally a discriminant analysis has been used for the analysis of stochastic recognition of the blocks. The stepwise ranking of the parameters were implemented using the Mehalanobis distance. The classification functions computed by blocks served the stochastic model for the numerical recognition. Finally the model validation were performed on the basis of cross validation.

The main results can be outlined as follows:

- The interpretation of the principal component analysis **has showed parameter-groups with high inter-correlation.** These may be regarded as key-factors in the hydrogeological evaluation of the rock body. Their spatial-temporal identification is an on-going research.

- According to the factor loadings, **the geological properties analyzed do not express the hydrological blocks**. That is **their importance** in the model are quite **low**.

- **The importance of the properties** in the mathematical recognition in relative decreasing order: (1) Static head (definete factor) (2) Tomograph velocity (3) Seepage coefficient (4) Number of open fractures (5) Frequency of open fractures

- **The stochastic model recognized** the original block definitions with **86.5% of success**.

3D RESERVOIR MODELLING OF AN UNDERGROUND GAS STORAGE

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Keywords: 3D modeling, underground gas storage, uncertainty, Sequential Gaussian Simulation, delta sedimentation

In January of 2006 serious havaria situation emerged in the gastransmission of Central Europe because of the dispute between Ukraine and Russia leading to a shutdown of gas supplies. Therefore the Hungarian Parliament passed a bill on strategic gas storage, after which the Hungarian government called for a tender in the implementation of strategic underground gas storage. The tender winner MOL Plc. has planned and developed a 1.2 Bn m^3 working gas capacity underground gas storage (UGS) which has 20 Mm^3 daily peak capacity even for as long as 45 days. The planned UGS is situated in the SE part of Hungary, in the Algyő field, which is the largest hydrocarbon accumulation in the Pannonian Basin.

On the bases of the 3D integrated study of core descriptions, core analysis, well logs and sand body geometry, the depositional history of Szőreg-1 rock body can be outlined as an initially interdistributary bay which was filled by several smaller distributary mouth bars originating from crevassing processes. During the depositional history these bars were merged several times. In this way sheet sandstones were formed.

Because of the above mentioned ring-like transporting processes the reservoir characterization started with the localization of the distributaries within the gas cap. It was solved by the restriction of the reservoir-scaled 3D sand-content model to the target gas cap.

Since the production intensification in this reservoir was implemented by the water injection on the initial GOC, there are several possibilities for water coning processes. That is the actual stratigraphical position and the uncertainty of the actual Gas-Fluid Contanc (GFC) is a key question in characterizing the UGS volume. For this problem a Sequential Gaussian Simulation of the GFC identified in the well were used. In this way there was a possibility for not only producing a map showing small scale heterogeneity of the surface, but the characterizing the uncertainty of each individuals wells, too.

One of the most important results coming from the 3D porosity model of the gas cap is the series of porosity maps which show the lateral porosity distributions on cutting surfaces 0.5 meters below each other. These maps can be used for planning perforation intervals within the producers and injectors.

Using the 3D model of effective pore volumes the best parts of the UGS can be outlined in 3D. This is the way, by which the injection pressure can be controlled for reaching the best results. Moreover these models can be used for evaluating the well-network plan, as well.

Biometric research and Multivariate Statistic Treatment of *Viviparus* species in Lake Pannon with a Genetic Approach

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Keywords:

The species of the snail family Viviparidae can be regarded cosmopolitan; their wide distribution reflects excellent adaptation abilities. The energy of the ambient water is an important external factor that influences these animals, thus the Viviparus species can be characterized by a wide variety of morphologies and adaptations to the environmental changes.

The point of the research is the analysis of shell diversity by the use of biometric methods and its treatment by multivariate statistic methods.

The factor analysis highlights the most important biometric features at each locality. The hierarchic cluster analysis shows the relation between the localities.

The morphological classes have been separated with the help of discriminant analysis. The functions shown by the discriminant analysis provide possibility to assign new specimens into the morphological groups.

These morphological groups created by statistics correspond to the groups separated by the internal structure of the shells.

As a result, one species with four morphological groups has been determined. These groups cannot be considered subspecies or geographic races, because they do not display individual geographic distribution. Intermediate forms occur between localities as well as between the parameters of the four groups.

By taking into consideration the stratigraphic order of the localities and displaying the results on a map, it becomes clear that sediment influx from westerly directions into Lake Pannon was more significant than thought before.

The cause behind the different morphologies – if these are not genetically determined – may be the individual answer to environmental effects (ecophenotypes). One such environmental factor can be the streaming of the water. The conical, elongate form might have facilitated life in unidirectionally streaming water, whereas the squat, shouldered morphology may reflect perennial lacustrine environment.

QUARTERMALACOLOGICAL ANALYSES ON PROFILE OF BRICKYARD AT KATYMÁR, SOUTHERN HUNGARY

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Keywords:,

The brickyard of Katymár village is situated in the southern part of the Danube – Tisza Interfluve, on te Bácska Loess Area. The smaller part of this loess region is shared by Hungary, the greater part by Yugoslavia. The Hungarian part of the Bácska loess area lies close to the Hungarian – Yugoslavian border, thus its detailed geological investigation was delayed until 1966. In 1966 a geological mapping procedure started in the analysed region and many of well-exposed geological sections were observed in the Bácska Loess Area. Of these the exposures of Madaras and Katymár proved to be the best. The Mollusc-rich loess covering the surface is exposed, together with the wind-blown sand underneath, at both localities. In 1979 the southern 11 m high loess section of brickyard at Katymár was selected for geological elaboration and samples were taken at every 25 cm and at any change in lithology. These 50 samples were then subjected to detailed sedimentological and quartermalacological analyses. According to this geological, paleontological work the sandy, loess and sandy loess layers accumulated during the Upper Weichselian Age and some quartermalacological paleoecological zones were detected based. Then, in 2003 a new fine-stratigraphical study started on the western loess-wall in the brickyard at Katymár. The samples of 2 dm^3 were taken every 4 cm regular intervals throughout the analysed loess profile in accordance with the requirements postulated by Sümegi (2005) for quartermalacological and Szanyi-Braun (1995) for statistical studies. From the 258 sediment samples more than 25.000 specimens of 23 species were screen washed using 0,5 mm sieves. Chronology was obtained from 10 radiocarbon age determinations. Using these radiocarbon-dated new palaeoecological records, we reconstructed palaeoclimatological, palaeoecological and palaeobiogeographical changes during the Upper Weichselian. The rhythmic dominance changes of the different ecological tolerant Mollusc species and the different palaeoecological groups indicated some short-term climatic and palaeoecological changes with intervals of 3.000 years and 600 years. On the basis of malacological data the presence of a major palaeclimatic trend could be assumed for both the short-periods of warming ad cooling in the Carpathian Basin between 30.000 and 13.000 BP years.

Characterization of a paleosoil profile with a modified deconvolution of RE pyrograms

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Keywords: soil organic matter, paleosoil, pyrogram deconvolution

Humification of biopolymers is determined by those environmental parameters (relief, climatic conditions), which define soil types too. The aim of our work was (i) to apply Rock-Eval (RE) pyrolysis for characterization of organic matter dynamics in a Quarter paleosoil profile and (ii) reconstruction of the formation of the paleosoil by statistical evaluation of classical (sedimentological, pedological, micromorphological) parameters and RE data. Previous studies used Gaussian curves for deconvolution of RE pyrograms. In this work we try to develop the method and to apply Lorentz curves for evolution of the major classes of soil organic matter with different thermal stability. We analyzed buried paleosoil samples from an archeological site from NE Hungary, where we the development of the soil was finished in the Neolitic Age. According to the pedological details we determinded the original soil type as a transitional form of Fluvisol and Luvisol.
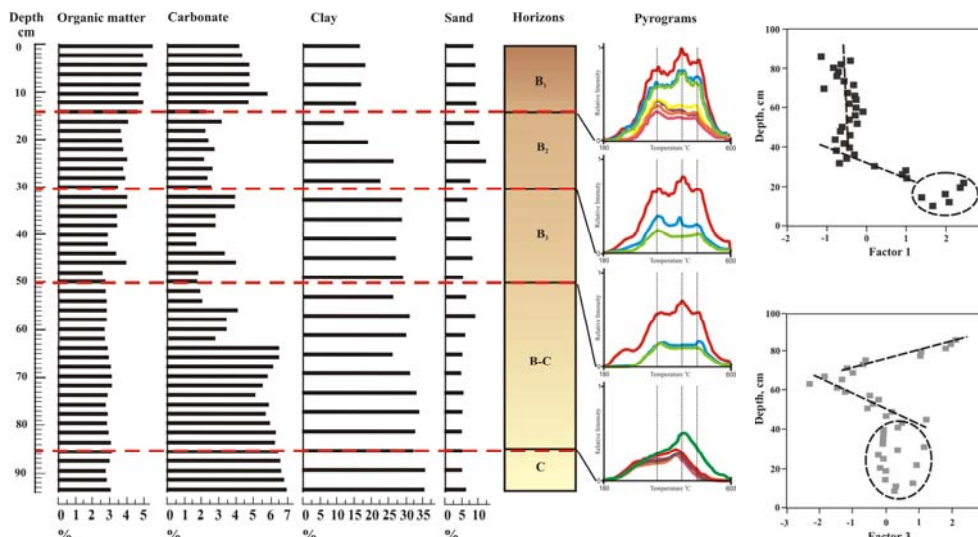
Rock-Eval pyrolysis gave us new data to determination paleosoil type, what we identified Luvisol. We found, that the Rock-Eval pyrolysis is usable new method for determination paleosoil type and supplements the routinish classical measurement methods. Pyrolysis of the known paleosoil type provided new data in accordance with the classical data. Rock-Eval pyrolysis is capable for determination parameters, which help to define of unknown paleosoil type and allow to identify minor occurrences within genetical horizons.

Thermal comfort investigations in the centre of Szeged

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Keywords: thermal comfort, urban square, Szeged

Due to the increasing urbanization people spend less and less time in the open air and therefore the city parks and squares of appropriate qualities and quantities could play an important role in the recreation and outdoor activities of city-dwellers. But what makes a given (urban) public space appropriate? To answer this question thorough human biometeorological examination of the factors behind the outdoor thermal sensation (or rather thermal comfort) is necessary. Up to now several comfort indices were created which describe the thermal conditions in the terms of human biometeorology. These indices include many meteorological and personal parameters, but up to this day none of them were absolutely adequate for the estimation of outdoor thermal comfort. No wonder, since people's thermal sensations depend on countless variables e.g. expectations, thermal history, environmental stimulation, culture etc. To assess these factors' influence on thermal comfort one needs to apply subjective approach too.

We evaluated the human biometeorological aspects of the Aradi square in the centre of Szeged (Hungary) with objective and subjective methods using a dataset from 17th, 22nd August and 12th September of 2006. We measured the meteorological factors influencing people's thermal comfort level with the help of a meteorological station in order to calculate a thermal comfort index (called *Predicted Mean Vote*) with the RayMan model (objective approach). At the same time a social survey was carried out with structured interviews to determine which factors influence people's thermal comfort sensation the most. Then we compared the answers reflecting the subjective opinion of the people staying in the area with the objective results (*PMV*) derived from the model. In order to find out whether there are significant differences between the thermal sensations of groups of people defined on the basis of individual characteristics (e.g. age, gender, momentary mood, urban vs. open air attitude etc.) we applied analysis of variance and Mann-Whitney U-test. Since human biometeorology is almost an unknown discipline in Hungary, this is a pioneer work in our country.

Oaks and climate. Case study about Málvád-Bányarét ancient oak forest in Southeastern-Hungary

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Keywords: oaks, dendrochronology, climate factors

The Bányarét ancient oak forest can be found in the Málvád forest, in one of the largest forest in Southeastern-Hungary, on the left side of Körös River. The territory of the ancient oak area is only 1,8 hectare. The indigenous class of plant community is Fraxino pannonicae-Ulmetum oak-ash-elm gallery forest. There are 26 pieces of about 200-250 years old, 4-6 m perimeter Pedunculate Oak trees (*Quercus robur*), some Wild Pear-Trees (*Pyrus pyraster*) and some Hungarian Ash trees (*Fraxinus angustifolia ssp. Pannonica*). These typical and valuable stands can be found only separately and in small fragments in Hungary so the forest was decelerated nature conservation area in 1989.
Our goals were to

- start to build an oak chronology for this area,
- compare tree ring widths, precipitation and water level data
- find out if oaks can be used for climate reconstruction in Southeastern-Hungary.

We have cored and analyzed 18 trees so far and took 2 cores per trees from the north and south side of the trees. To evaluate the data we used geostatistics methods.
We analyse the effect of climatic factors on the 150 years long oak chronology we got, since it has not been studied yet.

CT investigation of loose soils during geotechnical tests

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Keywords: geotechnical testing, CT, loose agricultural soils,

The understanding of soft soil behavior is a critical issue of many practical applications. There are number of constitutive laws in the scientific literature but their validity on loose, soft, agricultural soils has not been tested in all of the details. At the University of Miskolc, Faculty of Earth Science & Engineering a new soil mechanical laboratory unit was established for testing the behavior of different kind of soft soils. The testing equipments are fully computer controlled and prepared for investigation of any kind of triaxial or uniaxial stress paths.

The goal of the investigations was to prove the validity of the Critical State Soil Mechanics (CSSM) Theory on soft soils and to determine the most characteristic material parameters using hydrostatic and deviatory triaxial tests. The measured parameters were controlled by oedometric tests of the same type of soils at given moisture content; meanwhile all types of the tests were simulated by FEM calculations as well. The comparison of the laboratory test results and the numerical simulations can show the weakness and the strength of the applied soil model.

The calculated compaction field represented by the void ratio distribution was controlled by using a new tool, namely a computer tomography procedure. The CT technology was also used to determine the processes and their evolution in the investigated samples. The soil columns to be tested were investigated by CT in initial state and after the tests, and due to the CT pictures taken and their evaluation several critical points of the measurements were highlighted and solved to increase the signal/noise ratio during the tests and to get more realistic soil parameters as before.

The presentation deals with the determination of the coherent experimental soil parameters supported by CT picture evaluation and some results at the field of determination of application range and limits of the CAM-CLAY constitutive law, achieved using the CT supported geotechnical test system.

Modeling the effects of water level fluctuation on fish habitats in the littoral zone of Lake Balaton

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Keywords:. Balaton, hydrological modifications, water level fluctuation, fish reproduction

According to the typology specified by the Water Framework Directive, Lake Balaton represents a unique freshwater body in Europe. It can be considered as a heavily modified shallow lake from hydrological point of view. Its water level was lowered in the 18th century and since than it has been controlled artificially. Besides, shoreline structure has also been significantly altered, both factors resulting in the reduced availability of appropriate habitat for certain fish species for reproduction. Negative tendencies, in addition, may be enhanced by global climate change. In 2004, the types of shoreline were estimated on Lake Balaton, such as rip-rap, reedy, concrete or grit. Taking into account the reproduction characteristics of the studied fish species (Cyprinidae) the potential substrates for spawning are dominantly the shallow zones (littoral) near the shoreline. The dominant type of shoreline is rip-rap covering app. 42% of total length. These sections are used for reproduction by species of bream. Almost all grit area has been lost in recent decades though it is the typical reproduction area of carp. When surveying fish community composition we found that the dominant species were the bream, bleak and roach. GIS-based models were run to estimate the availability of different shoreline types at different water levels, predicting a critical level when spawning habitats would disappear. The wet rocky substrate disappears almost everywhere around the lake when the water level decreases to and below -30 cm. The lake becomes substrate deficient when the water level decreases to -50 cm. This may cause problems in the reproduction of species of bream, a possible solution can be to provide access to River Zala and to the Kis-Balaton reconstructed wetland for spawning.

Investigation of Importance of Sampling Rate in Connection with a Case Study

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Keywords: geological model, sampling strategy, data density, scale, resolution

The data acquisition and the proper sampling strategy are in the most important questions of successful creating the geological model. The sampling rate has to consider the dimensions of the object to be detected and the scale of the model to be created. Though the global aim of the exploration is the deteminative factor creating the model, the scale of alteration to be considered is not always known in advance. All these facts demand the joint usage of more investigation methods, i.e. geology, surface- and borehole geophysics and engineer-geophysical sounding. The applied sampling rate is limited by resolution of the data acquisition methods and so the final conclusion is often determined even at the level of planning and at the selection of technique. The group of models is determined by the measurements and the collected geological information but the different data and the consistency of information is not always suitable to resolve the contradictions between the results of the individual measurements. . Increase of sampling rate may cause a sudden change among suitable models.

Some problems of hidrogeology and of stratigraphy will be introduced in the presentation in connection with exploration of a near-surface sedimental formation which seemed to be simple at first sight. Actually the usage of another exploration method and so the increase of sampling rate changed the conception of the hidrogeology and so the environmental sensitivity model was reshaped too.

Review of geostatistical analyses performed In Croatian part of Pannonian basin (porosity data)

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Abstract

Geostatistical methods of interpolation are the most appropriate for almost all porosity interpolations in all lithostratigraphic units in Croatian part of Pannonian basin. Of course, the number of inputs need to be enough large for application of mathematical method of interpolation, what means approximately 10 or more values. The first extensive variogram analyses are calculated in the Bjelovar subdepression, but only for core porosity values in vertical direction. The maps are not interpolated, just variogram parameters (range, sill, nugget) had been calculated for Pepelana and Poljana sandstones (Pontian age), Mosti member (Badenian age) and carbonate basement (Mesozoic age).

In the western part of the Drava depression (Stari Gradac, Kalinovac, Molve fields) porosity was interpolated in reservoirs of very heterogeneous lithology. In the eastern part of Drava depression (Beničanci field) porosity was estimated using also seismic attribute as the secondary variable in the breccia reservoir of Badenian age.

In the Sava depression all geostatistical analyses had been done in sandstones of Pontian and Pannonian ages. The first experimental work is done at the Voloder field, but very applicable and extensive analyses are performed at the Kloštar and especially Ivanić fields. The kriging is definitely confirmed as the best interpolation approach for sandstone reservoirs in the Sava (and the Drava) depression.

The applicability of experimental variogram calculations for analysis of porosity data measured in cores was tested at values from Miocene and Mesozoic rocks from the Bjelovar subdepression. It is accepted as valuable tool for determination of spatial dependence in vertical direction, especially of Miocene strata.

The primary goal was the modelling of porosity, as one of the most important and descriptive variable for reservoir description. But, many of achieved results had been easily transformed for other geological variable like thickness, depth and permeability. Especially this is valid for sandstone lithology, where the most appropriate geostatistical methods for describing of this lithology can be used for interpolation of other mentioned geological variables.

Keywords: *geostatistics, porosity, Croatia, Sava depression, Drava depression, Pannonian basin*

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Exponential function in economic evaluation of potential hydrocarbon discovery (theoretical approach)

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Abstract

Every potential hydrocarbon discovery could be described by geological and economical risks. The calculation of geological risks is the most often part of estimation of geological categories, and multiplication of each of them.

But, economic risk depends on economic factors like company budget, exploration costs, expected value and expected profit. Exploration and drilling feasibility studies are based on net present value (NPV) and expected value (EV) for potential discovery. Utility function is well-known tool for describing *utility* of potential hydrocarbon discovery, regarding invested money and risk (geological and economical). Application of utility function leads to numerical a result that describes possible profit that could be reached regarding company's financial strength and obligations. Different types of utility function, especially exponential, has been using through decades in different petroleum companies and expert teams. Here is presented theoretical background how to apply and calculate final result of risk-adjusted value using exponential function for any hypothetical case characterised by the geological risk, estimated hydrocarbons volume and consequently expected value of new reservoir.

Keywords: *exponential function, utilities, certain equivalents, discoveries*

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Review of neural network analyses performed in Croatian part of Pannonian basin (petroleum geology data)

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Abstract

Neural networks represent very strong tools for different prediction tasks in many sciences. Petroleum geology, and geology overall, is one of the fields where such networks can be very successful and relatively easy applied. Neural algorithms can be applied for prediction of different variables, like porosity, depth, lithology and saturation. The basic idea encompasses the correlation of several inputs and calculation of single output (predicted) value. Up to now, the neural prediction was applied at three Croatian oil and gas fields. The first analysis was done at the Okoli field (1) (prediction of facies). It is followed by porosity prediction performed at the Beničanci field (2) and finally lithology and saturation had been simulated at the Kloštar field (3). These three applications of neural networks have been performed in Miocene sediment.

(1) Neural analysis performed at **Okoli field** in 2006 was one of the first published analyses of such type in hydrocarbon reservoir analysis in Croatia. This study is relevant for clastic facies prediction in Lower Pontian deposits of the Sava depression. Analysis is characterised by excellent correlation between predicted and true position of sandstone lithology (reservoir). On contrary, positions of predicted and true marlstones positions (in top and bottom) mostly do not correspond. The correct facies prediction probabilities are theoretically extremely high. In B-1 well (based on 3 log curves) it is minimal 78.3%, and in B-2 well (based on 7 log curves) minimal 82.1%. The Face machine is calculated relatively in the early period of network training. In B-1 well this machine is observed in 2186th iteration and in B-2 well in 7626th iteration. Such results point out that, for similar facies analyses in the Sava depression, one does not need to use such large iteration set (about 30000). Eventually, in the following neuron analyses in clastic deposits of Pannonian and Pontian ages, input dataset would need to be extended on to other well log curves. Such curves would need to well characterize lithology, porosity and saturation, like the curves of SP (spontaneous potential), CN (compensated neutron), DEN (density) and other. Presented neural technique could be useful in log curves analysis, if the Face machine would be configured with 90 % probability for true prediction.

(2) At **the Beničanci field** (2007) the neural network was selected for handling uncertainties of porosity distribution in breccia-conglomerate carbonate reservoir of the Badenian age. The best porosity training results are obtained when all three seismic attributes (amplitude, frequency, phase) were used. The reached correlation is $R^2=0.987$ and convergence criteria $\Sigma\varepsilon^2=0.329$. These values can slightly (a few percent) differ in every new training, what is the consequence of the random sampling process in the network fitting process. The result indicates that neural network very favour the numerous inputs and it is why the meaningful variables need to be carefully selected as neural input.

(3) At **the Kloštar field** (2007) several artificial neural networks were trained with the task of predicting lithology of Upper Pannonian deposits ("2nd sandstone series") and Lower Pontian deposits ("1st sandstone series") as well as hydrocarbon saturation within these beds. Sandstone facies represent very adequate media for statistical and neural network analysis. In the case of lithological prediction on well Klo-A and Klo-B with RBF and MLP neural networks, excellent correspondence of the true and predicted values was achieved. Prediction of hydrocarbon saturation on well Klo-B with a neural network trained on well Klo-A gave excellent corresponding between real and predicted values.

Acquired results show large potential of neural networks application in petroleum geology research where they could be used as a method for acquiring quick and meaningful results from well logs or seismic data.

Keywords: *neural network, prediction lithology, porosity, saturation, Drava depression, Sava depression, Pannonian basin, Croatia*

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Complex hidrogeologycal research of Dunaharaszti and its surroundings

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Keywords: hydrogeology, water-flow, water-chemistry,

The subject area of our research can be found near Budapest where, besides traditional and large-scale open-pit gravel mining, industrial plants carrying out significant water production have been established. These plants have radically changed the natural water budget of the area. Several individual hydrogeological researches have been done by others and us as well in this region. Still, it is more and more urgent to provide a complex and comprehensive series of surveys that would be based on the collective and concurrent examination of single activities.

Our aim was to both reconstruct the transformed environment through hydrodinamical simulations and, with full knowledge of hydrogeochemical, isotope geochemical and the specified geological build-up, to understand the movement of ground water systems in the Southern region of Plain Pest.

Although only few geological profile were available, we have managed to purchase the hydrogeological documentation of some average depth well drilled in the area. On the basis of the above mentioned documentation we have been able to draw uniform geological profile. To carry it out, we have used up the data of more than a hundred wells. We have to mention that our investigation has only covered the upper layers (100-300 m depth) due to the lack of deep-drilled wells and the good water supplying capacity (from both quantitative and qualitative point of view) of newly formed upper layers.

Almost 670 wells' data and chemical composites have been studied. As were provided with continuous data almost 30 years retroactively, the large number of wells made extensive comparison possible. Not only the effect of newly established high yield wells on flow systems can be observed – which can be traced in transformation of chemical composition of waters as well - , but also the recharge and discharge areas can be profoundly determined. By examining isotope geochemical data of the area we have managed to specify further the results of chemical composition studies. In addition, the supposed age of waters found in certain depths can also be given.

In the course of this comprehensive study, we have prepared the regional flow model of the area with the help of Processing Modflow program. During the operation, we applied the more specific picture of geological build-up that we had formerly obtained. Results of the simulation have been calibrated with the help of hydrogeological and isotope geochemical analysis.

As a result, recharge and discharge area borders can be given, and how well-pumping affects changes in chemical composition of water can also be provided.

Phytolith analysis: environmental reconstruction derived from a Sarmatian kiln used for firing pottery

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Keywords: phytoliths, kiln material, fuel, provenience, environmental conditions

Kilns are relatively composite objects of archeological sites. The purpose of our work is to give an environmental historical analysis of the kilns. Namely, we are seeking an answer to the question whether or not we can extract information about the former vegetation or fuel (wood, straw) via the analysis of samples deriving from kilns. We focused on phytolith assemblages, because biogenic opal is very resistant and it can survive among conditions where pollen assemblages are destroyed. We have analyzed 10 samples from a Sarmatian kiln used for firing pottery. The phytolith, organic matter and carbonate content of every sample was recorded. This presentation gives an overview of the results and the interrelations.

Analysis of the urban environment using remotely sensed thermal information

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Keywords: Urban heat island effect, satellite imagery, surface temperature

Human settlements (especially, the large urban areas) significantly modify the environment. Atmospheric composition near urban agglomerations is highly affected mainly due to industrial activity and road traffic. Urban smog events are common characteristics of large, very populated cities. Furthermore, artificial covers (i.e., concrete, asphalt) considerably modify the energy budget of urban regions, and thus, local climatic conditions. One of the most often analyzed phenomena related to cities is the urban heat island (UHI) effect.

Besides several detailed studies of UHI using ground-based measurements, a more effective tool became available with the use of satellite imagery detected by different sensors on board. MODIS (Moderate Resolution Imaging Spectroradiometer) is one of the sensors on-board satellites Terra and Aqua. They were launched to polar orbit as part of the NASA's Earth Observing System in December 1999, and in May 2002, respectively. Sensor MODIS is capable of viewing the entire globe daily with 1 km spatial resolution. In this study, measurements of sensor MODIS have been used to analyze the spatial structure of daytime and nighttime surface temperature of urban areas in Central Europe (i.e., Bucharest, Warsaw, Vienna, Milan, Munich, Sofia, Belgrade, Zagreb), and especially, in Hungary (i.e., Budapest, Debrecen, Miskolc, Szeged, Pécs, Győr, Nyíregyháza, Kecskemét, Székesfehérvár, Szombathely).

The results suggest that the UHI intensity detected in the selected Central European cities exhibits high variability. Monthly average values of the temperature differences between urban and rural areas range between 1°C and 6°C, the most intense UHI occurs in daytime in the summer period (May-June-July-August). Population of the cities (which is highly correlated with the industry) is the main factor of determining UHI intensity that is modified by orography.

Well Interference Investigations, case study

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Keywords: geothermics, well interference, pumping tests

Hungary has favourable geothermal conditions both potentials and perspectives. More and more local governments want to use geothermal energy for district heating and making electricity because of rise in prices of hydrocarbon fuels. Reinjection is needed to satisfy these increasing demands.

The reinjection to upper-Pannonian sandstone has generated bitter controversy among experts. The Mineralogical Geochemical and Petrological Department of University Szeged with Geo-Hód Ltd. decided to investigate this problematical topic.

A new reinjection well was drilled to 300 m distance apart from the old reinjection well. These wells were filtered the same layers from 1450 to 1680 m below the ground surface. The three pump test phases with one month duration and the parallel geophysical investigations have been done by Geo-Log Ltd. During the first 3 steps pumping phase the pressure, temperature and gas content of the water were measured both in production and observation wells. During the second phase 6 hours of pumping and recovery cycles were perfeormed, and also the reinjection to old well in two steps. In the third phase was investigated the effect of common reinjection to both wells.

Conclusions of the well interference investigations:
- Long term pumping test (12-14 days) needed to calculate hydrogeological parameters
- Wide range geophysical investigations help to study groundwater flow and pressure spreading.
- The hydrodynamic regime seems to be asymmetrical.
- We can calculate well log with used methods, so the effect of reinjection is quantified in the surrounding of the well.
- The estimated radius of depression cone is 8000 m in case of 3000 m^3/day pumping rate

An effective and low-cost method to detect environmental contaminations: the promise of CIR small format aerial photography (SFAP)

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Keywords: SFAP, CIR, automated image processing

The acquisition of aerial photography and conversion to a digital format has traditionally been a slow and costly process. With the appearance of relatively inexpensive digital cameras and computer systems, along with GPS positional information, it becomes possible to reduce the cost and time involved in digital image acquisition.

We developed a low cost, digital aerial imaging system, and have been flying it since February 2008. The system, based on a Duncantech MS3100 CIR (Color-InfraRed) Multi-Spectral camera, can be deployed within an hour, and enhanced digital photos can be viewed in real time as they are collected or within minutes after landing. The MS3100 camera is a 3CCD system with independent gain controls for each CCD which allows the use of different gains for each of the three bands. In our situation, about six images are being captured per second, allowing for flight speeds of 140 to 170 kilometer per hour. The typical flight altitude is 1500 to 1600 meters yielding a spatial resolutions of 42 centimeter. A National Instruments IMAQ 1428 frame grabber is used to capture the images. A GPS is used to mark the approximate center point of each photo as it is taken. The flights are executed with a four seated, single engine Cessna 172 airplane.

The standard acquisition software from the camera vendor is used to control the camera. The camera operator has a real-time view of what the camera is capturing during the flight and can control the gains, integration time, and frame rate in flight. A typical flight generates about 600 images, so it is necessary to automate the processing as much as possible. That's why several custom scripts were written to be run in ArcView and ArcGIS. The first step is to combine the data from the GPS track and the image acquisition log of the camera software to create world files. The world files are used to give the images a more or less accurate position in the proper coordinate system. After this geocoding step, the images are stretched to 8 bit and converted to a usable file format. During the final step, Leica Photogrammetry Suite (LPS) is used to automatically create tie points and finally to orthorectify the images.

The system has been used for a several applications, such as inland excess water detection, environmental contamination, and monitoring of sand migration. The system has proven effective at detecting short lived events and for mapping small areas that can not be efficiently acquired by traditional air survey.

Today's state of technology allows for the development of an affordable digital image acquisition system. With relatively simple hardware and software, it is possible to generate high quality images for time critical applications. Improvements of the automation of the image

processing stream will give us the opportunity to even shorten the time between data acquisition and the availability of the images for further analysis.

THE EFFECT OF CLIMATE CHANGE ON THE SUBSURFACE WATER IN THE DANUBE–TISZA INTEFLUVE

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Keywords: climate change, subsurface water, wavelet spectral decomposition, dynamic factor analysis

The Intergovernmental Panel on Climate Change (IPCC) states in his 2007 report: it is unambiguously indicated that the content of gases inducing climate changes – called greenhouse gases -- is increasing in the atmosphere. Based on previous studies, these gases are the reason for global warming, which will be followed by numerous unfavourable effects in the nature and, as a consequence, in the society.

According to the predicted changes for Hungary, both in a shorter time period of a few decades and in a longer outlook, the increasing temperature and the altering spatial and time distribution of precipitation will influence the subsurface water supply. By the end of the first third of this century, the annual mean temperature (is expected to) will increase by 1.4 °C and the annual precipitation will decrease slightly, about 0.3 %. The annual distribution of precipitation – an increase in winter, a decrease in summer – will have a major impact on water supply. In a longer forecast, temperature will increase by 2.5 – 4.8 °C in all seasons, and the various models predict different changes in precipitation, a significantly increase (20 to 30 %) in winter, and a decrease (10 to 20 %) in summer.

Based on the of the models, revisions of the data processing procedures and methodologies of the monitoring network, as well as, of the gathered data are necessary, especially on areas, where the water withdrawal already is higher than the safe yield. For example, the Duna – Tisza Interfluve or the Maros alluvial fan are areas, where such changes will impact external, larger areas as well.

At the moment, one of the major tasks is to revaluate the hystorical data. Processing these data by the recently developed mathematical methods is essential. This study focuses on the periodical changes of the subsurface water level of the Danube – Tisza Interfluve, and it has been already found that the changes of shallow groundwater table in the last decades show extreme variations already. For example between 1971 and 1975 there were missing periodic signal in this area. The frequency of this type of missing periodical signal will increase as a consequence of climate change. The changes in periodical signal will indicate the vulnerability of a given area, which is estimated by the dynamic factor analysis.

Modeling of Small Scale Fluid Flows by Core Samples Measured by Computer Tomography

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Keywords: CT , sedimentary structure, fluid flow,

The use of computer tomography in geological tests become more common. In examination of sedimentary rocks CT is not suitable for identify discrete mineral grains in sedimentary rocks, defining the size of pore space or pore throats, but is able to identify the change of macroscale texture, the nature of sedimentation and of the bulk density. So thus the examination without any destruction is capable to the two and three dimensional plotting of spatial heterogeneity of sedimentary rocks.

The purposes of research are to:
-    find connection between sedimentary structures and the pathways of flowing fluid in sedimentary rocks
-    trace the ways of fluid flow by core samples which were measured by CT under pressure
-    detach the streamlines and -areas from collector regions
-    explore the possibility of spatial extension of the examined features

The data of examinations were analized by geostatistical methods as well.

THE EFFECT OF OPEN PIT GRAVEL QAURRIES ON THE ROUNDWATER REGIME

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Keywords: hydrogeology, open pit gravel, groundwater-model

Gravel mining activities are rapidly growing nearby the large cities of Hungary due to the expanding needs of building industry. There are several abandoned, but also currently operating and planned pits in regions with favorable geological conditions. One of the most significant gravel occurrence located cca. 20 km SE from the center of Budapest on the left bank of the Danube river between Inárcs, Dunaharaszti, Áporka and Kiskunlachaza villages where not only valuable gravel deposits but also sites of natural interests are known. Most of the protected biotopes are evolved on wetlands where the water table frequently located nearby the surface.

The general problem of gravel mining is the groundwater table sinkage caused by the dramatic increase of evaporation of lakes in pits compared to the natural situation. Some previous investigations showed that in this region the loss due to evaporation lies between 140-670 mm/yr depending on the annual precipitation, temperature and air humidity, generally said on the climatic conditions.

To evaluate the effect of gravel mining and of the evaporation losses in water balance of the region a GW flow model was built using the Processing MODFLOW for Windows environment. The model simulated the processes in the shallow aquifer and its overburden.

Using the GW flow model the changes of hydraulic heads and drawdown were determined at different climatic conditions. All the calculations were performed considering the recently existing lakes but also the estimated situation in year 2015 based on the database of the officially licensed gravel pit claims. Upon the calculations the perceptibly affected area - where the GW level sinkage due to the pit lakes is bigger then 10 cm - was determined. It is proven that the size of perceptibly affected area growing following an ln function versus the evaporation losses independently from the amount of the lakes. The cause of this phenomena is the superposition of the effect of each lake and therefore the discharge of the pits can be considered as one "big well". The hydraulic parameters of the "big well" are hardly affected by some new lakes and their discharge effect.

The areas with perceptible (>10 cm) and serious (>50 cm) GW level sinkages were also calculated and it was foreseen that the perceptibly affected area will linearly, the seriously affected area will exponentially grow in the near future. Since both gravel mining and the protection of nature are of high priority there is a great need to evaluate the effect of past, present and future mining activities on the protected, wetland related biotopes.

Hydrological database management system in a thermal water project

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Keywords: database, geoinformatical system, thermal water

Nowadays geoinformatical systems with relational databases are used more often.

In this project, data are hydrological data from a company, which use thermal water heating system in many field.

Further on, by the help of this geoinformatical system they can increase economically the system of thermal water wells.

It become important to acquaint that the renewable source of energies are need to use. With a hydrological database management system it will be easier, because the project site join the components with the user interface.

The centre of the geoinformatic system is the relational database. Data of the relational database are results of measurements and metadata.

The user manage the input data, the riports from query interfaces and save the selected data in browser platform.

Analyses of the urban environment using hyperspectral remote sensing methods

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Keywords: hyperspectral remote sensing, urban ecology

A relatively small part of the world is occupied by built-up area, but the spatial pattern and growth of these areas have a large impact on environmental, economical and social processes. Until the last decade remote sensing methods were mainly used to map and characterize other land use and land cover categories. With the appearance of very high spatial and spectral resolution acquisition systems, and new processing methods, remote sensing analyses of urban changes have moved into a new direction. These new systems and methods were used to analyse the spatial and functional changes in Szeged, Hungary in the last tree decades.

The urban land cover change was investigated by satellite and aerial remote sensing methods. Our earlier results (Mucsi, 2007) were extended with hyperspectral analyses. Hyperpectral sensors measure reflectance in more than 100 narrow bands. With this data, it is possible to derive almost continuous and more accurate reflectance curves compared to those that can be acquired with multispectral scanners. Using hyperspectral data, it is possible to map the physical and chemical characteristics of the surface in a more detailed way. The high spatial resolution is also a great advantage when mapping of complex urban surfaces. Hyperspectral methods were primarily used for mineralogical mapping in the early 80s. Later, precision agriculture became an other important application. In Hungary, the first hyperspectral survey was organized in 2002.

The hyperspectral flight campaign (8 June, 2007) in Szeged was executed by the University of Debrecen using their Finnish AISA Dual instrument. It was one of the first applications of this new sensor, which combines an AISA EAGLE instrument for VNIR imaging and an AISA HAWK instrument for SWIR imaging in one device covering the full spectral range of 400 to 2450 nm. During the preprocessing of the data, problems that occurred due to the immature workflow (e.g. time-synchronization) had to be solved. After corrections of system errors, geometric and radiometric corrections, several land cover classifications were generated and different indices were calculated to evaluate the usability of the dataset in the urban environment. Satellite imagery and field survey data was used as reference data to evaluations the classifications.

The more and more, mainly North American publications on use of hyperspectral remote sensing in urban environment are occurring (Herold, 2004). Accurate and detailed land cover maps, generated by adapting hyperspectral processing and analysis methods, can be useful not only in urban ecology research but also in urban management and decision support systems.

The structural importance of the morphological footprints in Sibiu/Hermanstadt/Nagyszeben town region

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The present article shows a possible interpretation of the Shuttle Radar Topography Mission (SRTM; Werner 2001; Timár et. al 2003[4].) data on the region of Sibiu town (Romania). Based on morphologic elements (valleys and crests/highs) and with the use of digital filtering we compiled the limeament map of the perimeter. We concluded a scenario about a possible latest tectonic evolution of the region. Finally we compared these footprints with some available tectonic maps, evaluating the coincidences and contradictory deductions.

As a result we sketch a lineament/tectonic map in which image the salt diaper and the mud volcanoes has a well defined position.

This way we made a step further in the tectonic evolution investigation of a region, starting from a macro scale to a micro scale, using the possibilities of the remote sensing, image processing and the GIS tools.

The next step should continue in field, when the lineaments status will be clarified, whither they get a well defined, identified fault status or not.

Fig.1: The analised SRTM image of Sibiu Region.

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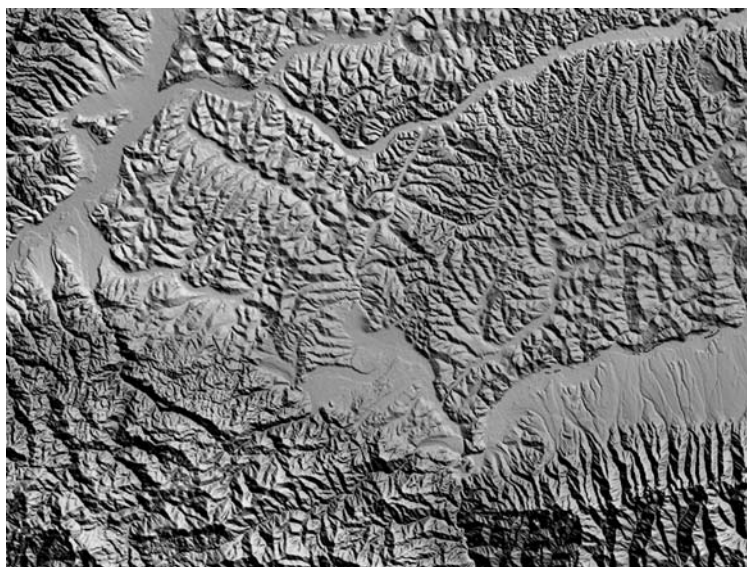
[4] TIMÁR Gábor, TELBISZ Tamás, SZÉKELY Balázs (2003): Űrtechnológia a digitális domborzati modellezésben: az SRTM adatbázis. Geodézia és Kartográfia 55(12): 11-15.

GIS Solutions for Belvíz Monitoring: A case study in Csongrad county, Hungary

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Keywords: Font, pt, paragraph (they must be typewritten with italic Arial 12 pt font).

Inland excess water is an annually returning problem on the Great Hungarian plain. At the end of the winter, large parts of the plain are covered with water, causing huge economic losses and environmental problems. The floodings are not caused by rivers flooding beyond their banks, but are due to an excess of water outside of the river banks. There are three main reasons for inland excess water; (1) high precipitation levels; (2) cold winters causing the top soil layer to be frozen; and (3) high water levels in channels, rivers and lakes.

Three approaches to study belvíz will be discussed. The first is a near real time monitoring system using video and thermal recordings combined with aerial photographs. The second is a long term approach to study the occurrences of inundations using high resolution digital elevation models and long term survey data. The final approach is in-situ ground measurements to map inland excess water.

To monitor and analyse inland excess water in near real time, an application has been developed to simultaneously visualise video images and thermal recordings (Mucsi L., 2004). These recordings are synchronised based on an aerial photograph showing the flight path of a monitoring flight. With this application, it is not only possible to evaluate the inland excess water areas within hours after the flight, but it can also be used for other time critical observations.

To study the variations of occurrences of inundations, a long term dataset was collected and processed. From 40 years of data, a map showing the local temporal variations of inundations was compiled. This map clearly identifies the areas that have the largest risk of inland excess water. To determine the relationship between local depressions and the identified risk areas, digital elevation models at various resolutions were calculated. From the elevation models, local depressions were derived and these were compared with the high risk areas.

Belvíz occurrences were also analysed based on in-situ observations. Every year, the inland excess water is mapped during an extensive fieldwork carried out by the regional water board (Kozák P., 2006). The results of the 2006 survey were compared with our own fieldwork results. Although both fieldworks were executed just one week apart, the results show large differences in mapped inundation areas. Reasons for this might be the very dynamic nature of the inland excess water, difference mapping techniques and

different mapping scales. A detailed survey will be carried out to analyse the inconsistencies, and to determine how to improve the monitoring process.

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Hydrodynamic Modelling of Fractured Reservoirs

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Keywords: Fracture network, REV, porosity

The investigation of fluid flow characteristics in the fractured crystalline basement of the Pannonian Basin is very important in the view of geothermal energy, fluid mining and hazardous waste disposal. To perform numerical simulation of the geological-hydrogeological problem in which hydraulic interaction between porous and fractured rock bodies are investigated, we combined different finite difference modelling systems. A fractal geometry based DFN (discrete fracture network) modelling system (RepSim) was used to simulate the fracture network. The program uses input parameters such as fractal dimension of the fracture midpoints (D), length distribution (E) as well as dip and strike (α, β) data. Then fractured porosity, REV and the horizontal and vertical coefficients of the permeability tensor was calculated, so the fracture network properties of the two characteristic rock type of the basement – amphibolite and gneiss – could be built in a standard porous hydrodynamic (MODFLOW) model.

It has long been known that because of regional geological reasons, water regime is highly overpressured in the deepest sedimentary sub-basins. Our model suggests that even if the permeability of the metamorphic rocks is low, such a geological situation makes possible that fluids can penetrate the fractured basement and migrate upwards through the metamorphic domain. Behavior of the flow system above the top of the highs depends essentially on the character of the gravity driven system of the upper part of the basin.

Results of modelling suggest that because of their rather special stratigraphic and structural position, the uplifted basement highs govern heat transfer and fluid flow like a chimney and so such formations are found very prospective for further geothermal investigations.

Hydrodynamic Modelling of the Transboundary Hungarian-Serbian Aquifer

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This project is one of the cross-border cooperation programs fully funded by the European Agency for Reconstruction aiming at improving the management of common groundwater resources. These resources are vital for the economy and the society, as well as for the development of large flat parts between the Danube and Tisa rivers in both Hungary and Serbia. The transboundary aquifer system of Hungary – Serbia was separated into the unconfined, and further five confined aquifer layers, two in the Pleistocene and three in the Upper Pannonian. The total area is assumed to cover around 27000 km^2 and the region is completely satisfying its demands for drinking and thermal water from the ground. There are more than 1000 operational wells, most of them for water supply are drilled to a depth of 50-150m, but some reach 250m or even more for example in the Szeged area. Thermal water wells are filtered from the depth of 500m down to 2400m. In Serbia it is assumed that current exploitation of the transboundary aquifer is reaching around 3 m^3/s – half of that for centralized waterworks and half for industrial purposes –, while water catchments are less in Hungary because of higher water price.

A Processing MODFLOW model was built to simulate and analyze the groundwater flow properties of the transboundary region. The bottom boundary of the model is the lower surface of the Upper Pannonian down to 2500m deep in the east and nipping out near the Danube in the west. In this range of depth in the Pannonian basin the groundwater flow is gravitational and controlled by the elevation of the topographic relief. The driving force is orientated downwards beneath the highlands and upwards beneath the lowlands, so there is a significant hydraulic interaction between the Pleistocene and Upper Pannonian layers. The model provides a prediction of groundwater level changes as the effect of increasing or decreasing well production, furthermore it tries to predict the effect of climate change resulted in less precipitation rates.

As a final result of the project, the common conceptual hydrogeologic and hydrodynamic model has been created and tested. It is intended to be an important tool for transboundary water management and future sustainable water use and monitoring.

Geophysical Information on the Web

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Keywords: electronic content, geophysical data, metadata, parameter maps

A free available new data source has been opened as a result of KINGA project. The name of the portal is: www. kinga.elgi.hu, a free access geophysical data service.

The portal is a result of a two years project, which was sponsored by the National Development Plan (NFT) Economic Competitiveness Operative Programme (GVOP)
The main idea was to open to the public the result of geophysical studies, the data of explorations, the library of the Eötvös Loránd Geophysical Institute. You can get information on the available geophysical data measured in Hungary. The parameter maps of most common interests (like gravity, mag and resistivity) are also available. The figure 1 shows the opening page of the portal, with the three main function.

Fig.1: The opening page of the portal.

Research of tropospherical ozone time-series with geomathematical tools

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Keywords: tropospherical ozone, variogram, wavelet spectral decomposition.

We analyzed the time-series of the EMEP tropospherical ozone measurement network. The available dataset contains data for almost 160 stations in Europe. The length of the time-series was varied by stations. We used for geostatistical analysis the measurements from the year 2003, for the wavelet analysis the measurements from the three-years-long periods from 1995-1997 and 2001-2003. The time-resolution of the data was hourly.

In the geostatistical analysis we investigated how large the spatial range of tropospherical ozone measurements is. Due to the simpler approach we supposed izotropic spatial distribution. We used in the analysis the variogram function, the base-function of the geostatistics. We calculated the variograms for three dates on the mid-day of every season's mid-month in 2003.
The results were spherical variograms in July and nugget-effect in the other months. This latter case means that the available station density is not enough to determine the spatial range of tropospherical ozone. The approximated spatial ranges for the dates in July are 200 and 650 km.

In the second part of the research we analysed the periodical behaviour of the ozone time-series. To explore the frequencies appeared in the time-series we used wavelet spectral decomposition. This method, in opposition of traditional Fourier-method, allow to observe the process of changing of the frequencies.
After the decomposition the diurnal period with various intensity was observable in every time-series. The intensity of this period is also changing during one year.