EUGLOHRIA
The European University Alliance for Global Health – Transformation through Joint Research and Innovation Action

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March 23-24. 2023

Natural Hazards and Climate Change

conference and workshop
for identifying and tackling challenges

Book of Abstracts

University of Szeged
Department of Geoinformatics, Physical and Environmental Geography

Natural Hazards and Climate Change

conference and workshop for identifying and tackling challenges together

Book of Abstracts

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Department of Geoinformatics, Physical and Environmental Geography
University of Szeged, Hungary

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23-24 March 2023

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DETAILED PROGRAM

Wednesday 22th March	
18:00-20:00	**Registration and Ice Breaking**

Thursday, 23rd March			
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10:20-11:20	Plenary Session 1		
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11:50-12:10	Gully erosion susceptibility mapping using machine learning algorithm	Fatemeh Nooshin Nokhandan, Erzsébet Horváth	Eötvös Loránd University, Hungary
12:10-12:30	ArcGIS Based Multi – DEM Urban Flood Resilience Assessment: A Case Study of Gyor City	Ibrar Ullah, Gábor Kovács, Tibor Lenner	Eötvös Loránd University, Hungary
12:30-12:50	Advances in satellite based inland excess water monitoring	Boudewijn van Leeuwen, Balázs Kajári, Zalán Tobak	University of Szeged, Hungary
12:50-13:10	Ground-based and Remote sensing monitoring of water resources and infrastructures	Sagynbek Zh. Orunbaev Baktyiar D. Asanov	American University of Central Asia, Kyrgyzstan

11:30-13:10	**Vegetation and Landscape Change (Chair: Péter Szilassi)**		
11:30-11:50	Wildfire Occurrence and Risk Factors in Hungary: A Spatial Analysis of Fire Records from 2011 to 2022	Péter Debreceni[1], Balázs Duray[2]	[1]National Food Chain Safety Office, Hungary [2]University of Szeged
11:50-12:10	Pine plantation verges are important for small and poor disperser Orthotptera species in a fragmented landscape	Botond Magyar[1], Róbert Gallé[2], Attila Torma[1,2]	[1]University of Szeged [2]Centre for Ecological Research, Hungary
12:10-12:30	Stand scale palynology helps to reveal the role of forest exploitation and climate change in the current distribution of Fagus sylvatica in the NE Pannonian Basin (Hungary)	Abigail A. Ofosu-Brakoh[1], Réka Csorba[1], Ákos Bede-Fazekas[1,2], Tibor Standovár[3], Zsuzsanna Pató[3],Enikő K. Magyari[1,2]	[1]Eötvös Loránd University, Hungary [2]Centre for Ecological Research, Hungary

12:30-12:50	Potential future microrefugia in changing landscapes	Zoltán Bátori, Kata Frei, Gábor Li, Csaba Tölgyesi	University of Szeged, Hungary
12:50-13:10	Investigating the usability of databases with different spatial characteristics for the occurrence of invasive plant species: a Hungarian scale analysis	Georgina V. Visztra[1], Kata Frei[1], Alida A. Hábenczyus[1], Anna Soóky[1], Zoltán Bátori[1], Annamária Laborczi[2], Nándor Csikós[2], Gábor Szatmári[2], Péter Szilassi[1]	[1]University of Szeged, Hungary [2]Centre for Agricultural Research, Hungary

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15:20-15:40	Satellite radar observations in monitoring hazards and for sustainable development	Gyula Grenercy, Péter Farkas, Sándor Frey	Geo-Sentinel Ltd. , Hungary
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15:00-15:20	Analysis of Building Damage Caused by the Effects of Natural Hazards	László Teknős, Gergő Érces	University of Public Service, Hungary

15:20-15:40	Ensuring science is useful, usable and used in disaster risk reduction – recommended actions for natural hazard scientists	Solmaz Mohadjer[1], Joel C. Gill[2]	[1]Max Planck Institute for Intelligent Systems, Germany [2]Cardiff University, UK
15:40-16:00	Assessment of climate-related impacts and risks on the tourism sector	Attila Kovács	University of Szeged, Hungary

16:00-17:20	**Poster session + Coffee Break**
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18:00-18:20	Heat Health Nexus: A U.S. perspective	Michael Allen	Towson University, USA
18:20-18:40	Human comfort research in the service of climate adaptation	Ágnes Gulyás, Márton Kiss	University of Szeged, Hungary
18:40-19:00	Foucauldian perspecitives on covid and their geographical relevance	Lajos Boros, Tamás Kovalcsik	University of Szeged, Hungary

17:40-19:00	**Environmental Hazards (Chair: Alexandru Onaca)**		
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18:00-18:20	Spatio-temporal variability of the connection between spatial characteristics of the transportation networks and PM10 air pollution: a European scale analysis	Seyedehmehrmanzar Sohrab[1], Nándor Csikos[2], Péter Szilassi[1],	[1]University of Szeged, Hungary [2]Centre for Agricultural Research, Hungary
18:20-18:40	It is not only about the climate - Landslide at Stari Slankamen (Serbia) loess palaeosol sequence	Tin Lukić[1], Milica Radaković[1], Milivoj Gavrilov[1], Rastko Marković[2], Petar Krsmanović[1], Jelena Kolundžija[1], Milan Josić[1], Qingzhen Hao[3], Velibor Spalević[4], Slobodan B. Marković[1]	[1]University of Novi Sad, Serbia, [2]University of Niš, Serbia, [3]Chinese Academy of Sciences, China, [4]University of Montenegro, [5]Serbian Academy of Sciences and Arts, Serbia
18:40-19:00	Energy production and meteorological extremes	Zsolt Hetesi	University of Public Service, Hungary

20:00-	**Conference Dinner**

Friday, 24rd March			
8:30-09:00	**Registration**		
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9:30-10:00	Socioeconomic factors behind the inequalities of morbidity and mortality during the COVID-19 pandemic	Beatrix Oroszi	Semmelweis University Epidemiology and Surveillance Center, Hungary

10:00-11:40	**Hydrological Hazards 2. (Chair: Ralf Ludwig)**		
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10:20-10:40	Dynamic geomorphometric study of the erosion of the Zagyvarona spoil tip using digital photogrammetry	Máté Dániel Petróczy, Boudewijn van Leeuwen, Zalán Tobak, Dávid Molnár, József Szatmári	University of Szeged, Hungary
10:40-11:00	Digital Twin Application for Monitoring the Impact of Climate Change on the Eutrophication and Biofiltration of the Danube River Waters in the St. George Branch	Eden Mamut, Maria Paraschiv, Manuela Sidoroff, Andreea Presura	Black Sea Universities Network, Romania
11:00-11:20	River management induced increased flood hazard on the Lower Tisza, Hungary	Tímea Kiss[1], István Fehérvári[2]	[1]University of Szeged, Hungary, [2]Lower Tisza District Water Directorate, Hungary
11:20-11:40	Are extreme floods on Danube getting more frequent? Case study Bratislava station	Igor Leščešen[1], Biljana Basarin[1], Dragoslav Pavić[1], Minučer Mesaroš[1], Manfred Mudelsee[2], Pavla Pekarova[3]	[1]University of Novi Sad, Serbia, [2]Climate Risk Analysis, Germany [3]Slovak Academy of Sciences, Slovakia

10:00-11:40	**Climate Change and Meteorological Hazards (Chair: Michael Allen)**		
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10:40-11:00	Comparison of drought damage risk/intensity and the use of damage prevention tools in the Lower Tisza catchments	Péter Kozák, Balázs Benyhe, István Fehérváry, Károly Fiala, Attila Nagy	Lower Tisza District Water Directorate, Hungary

11:00-11:20	Comparison of the Standardized Precipitation-Evapotranspiration Index values calculated using various evapotranspiration models	Jovana Bezdan[1], Atila Bezdan[1], Boško Blagojević[1], Monika Marković[2], Öner Çetin[3], Andrea Salvai[1]	[1]University of Novi Sad, Serbia [2]Josip Juraj Strossmayer University of Osijek, Croatia [3]Dicle University, Turkey
11:20-11:40	Using remote sensing tools to assess the impact of climate change on freshwater scarcity in North Africa.	Moemen Gaigi	Eötvös Loránd University, Hungary

11:40-12:00	**Coffee Break**	
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Analysis of the spatio-temporal occurrence of five common Eurasian invasive species in different land cover (habitat) types	Márton Bence Balogh, Kata Frei, Alida Anna Hábenczyus, Anna Sóóky, Zoltán Bátori, Péter Szilassi	University of Szeged, Hungary
Climate change - a palaeontologist's perspective	László Bujtor	Eszterházy Károly Catholic University, Hungary
A multi-scenario comparison of climate change in European regions based on the IPCC Interactive Atlas	Divinszki Ferenc Tamás, Rita Pongrácz, Anna Kis	Eötvös Loránd University, Hungary
Assessment of ecosystem service in floodplain areas	Johanna Ficsor, György Varga, Gábor Keve	University of Public Service, Hungary
Monitoring the Impacts of Urbanization on Land use Land cover in Ethiopia Using Remote Sensing and GIS Technique	Yohannes Gebregziabhir[1], Florent Demelezi[1], Zoltán Vekerdy[1,2]	Hungarian University of Agriculture and Life Sciences, Hungary University of Twente, Netherlands
Flash floods and stormwater management on the example of Kecskemét	Edit Hoyk[1,2], Krisztián Szórát[3]	[1]John von Neumann University, Hungary [2]Centre for Economic and Regional Studies, Hungary [3]Bács-Kiskun County Government Office, Hungary
The Influence of the Drava River on the Danube River's Discharge at Bogojevo Gauging Station Based on Extreme Discharge Values from 1931 to 2012	Milan Josić , Natalija Nikolić	University of Novi Sad Faculty of Sciences, Serbia

Application of Sentinel-1 SAR imagery for near real-time flood mapping	Ghahraman Kaveh	Eötvös Loránd University, Hungary
Rainfall Erosivity in the Western Balkans – Towards a Sustainable Soil Erosion Evaluation and Control	Tin Lukić[1,2], Tanja Micić Ponjiger[1] , Robert L.Wilby[3] , Slobodan B. Marković[1], Milivoj B.Gavrilov[1], Biljana Basarin[1], Velibor Spalević[4], Cezar Morar[5]	[1]University of Novi Sad, Serbia [2]University of Belgrade, Serbia [3]Loughborough University, UK [4]University of Montenegro, Montenegro [5]University of Oradea, Romania
Adapting to Changing Hydro-Climatic Patterns: Evaluating Future Climate Scenarios for the Problem of Waterlogging in the Pannonian Basin	Minucsér Mészáros	University of Novi Sad Faculty of Sciences, Serbia
The impact of land use and climate change on Syria	Nour Naaouf, Csaba Zsolt Torma, István Elek, Balázs Székely	Eötvös Loránd University, Hungary
Evaluation and prediction of climate change conditions using the Mann-Kendall test and LarsWG model in Gorganrood Basin, Iran	Arman Niknam, Mehrnoosh Tahrizadeh, Gábor Mezősi	University of Szeged, Hungary
On the way to create an age-depth model for the penultimate and ultimate glacial cycles preserved in the Süttő loess-paleosol sequence	Ágnes Novothny[1], György Sipos[2], Gábor Újvári[3], Dávid Filyó[2], Gergely Surányi[4], Tamás Végh[1], Diána Csonka[1], Tamás Bartyik[2], Gergő Magyar [2], Erzsébet Horváth[1]	[1]Eötvös Loránd University, HU [2]University of Szeged, HU [3]Institute for Geological and Geochemical Research, HU [4]Wigner Research Centre for Physics, Hungary
Anthropocene rivers - case study in NW Romania	Ioana Persoiu, Aurel Persoiu	"Ștefan cel Mare" University, Romania "Emil Racoviță" Institute of Speleology, Romania
Comparative evaluation of the material of the artificial levees: a case study along the Tisza and Maros Rivers, Hungary	Diaa Sheishah[1,2], György Sipos[1], Károly Barta[1], Enas Abdelsamei[1,2] Alexandru Hegyi[3], Alexandru Onaca[3], Abbas M. Abbas[2]	[1]University of Szeged, HU [2]National Research Institute of Astronomy and Geophysics, Egypt [3]West University of Timisoara, Romania
Investigation of the spatial changes in overbank floodplains on the pilot reach of the Middle-Tisza	Péter Tóth	Middle Tisza District Water Directorate; University of Public Service, Hungary
Suburbanization within City Limits - Hidden land use changes	Gábor Vasárus József Lennert	Centre for Economic and Regional Studies, Hungary
The effects of an extreme water scarcity period on the water supply of the Middle Tisza region	Dávid Béla Vizi	Middle Tisza District Water Directorate; University of Public Service, Hungary
Nature-based solutions for improving drainage systems in Vojvodina, Serbia	Milica Vranešević, Atila Bezdan	University of Novi Sad Faculty of Agriculture, Serbia

ABSTRACTS OF PRESENTATIONS

HYDROLOGICAL HAZARDS 1.

Flood Exposure - Towards Flood Risk Assessment and Management Plans (Case Study Serbia)

Jelena Kovačević-Majkić[1], Ana M. Petrović[1]
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It is known that the exposure component in the Disaster Risk Management (DRM) cycle has a key role in distinguishing natural hazards and disasters. In this paper we presented the flood exposure distribution in Serbia based on selected indicators (total population, built-up areas, protected areas and mineral resources) and developed methodology. For exposure assessment we have used data of flood-prone areas with an occurrence probability of 1%. The obtained results show that exposure mostly depends on the demographic and economic segment. Also there is unequal spatial exposure distribution, with the highest values in settlements affected by the process of urbanization. Except the scientific results, the contribution of this research is reflected in its social importance. That is the reason why we have used following administrative spatial units and defined flooded parts of them: (1) Water Management units (WMU), which basically follow five large river basins, (2) territory units of Serbia managed by the three Public Water Authorities (PWA), and (3) Municipalities of the Republic of Serbia. Thanks to the assessed exposure, given on the mentioned levels, management authorities are able to focus their activities to flood risk reduction activities, meaning to implement them in flood risk management plans. Having in mind that capacities of some management authorities are limited, these results also indicate the need for revising the management capabilities and undertaking purposeful measures (for example redistribution of duties).

Gully erosion susceptibility mapping using machine learning algorithm

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Erosion is a serious hazard to agricultural lands and infrastructure, especially in arid and semi-arid regions. We investigated gully erosion susceptibility in a semi-arid region northeast Iran. The study area (Kalat-e-Naderi Basin) is partly covered by loess in the central areas of the basin as well as erosion-resistant rocks/formations mainly in the southern parts. Due to the fertility of loess, agricultural lands (mostly rainfed) are distributed in the loess-covered areas. On the other hand, erodibility of loess has resulted in gully development in the study area. The aim of this study is to map the gully erosion susceptibility and to assess the impact of geoenvironmental factors on gully erosion in the study area. To reach our goal, we utilized the Random Forest (RF) model. A total of 326 gullies were identified in the studied region using Google earth satellite imagery. 70 percent of the samples were randomly selected to train the model. 30 percent of the samples were used for the purpose of validation. 11 influencing factors on gully erosion were chosen according to data availability, as well as reviewing similar studies applied in arid and semi-arid regions. Influencing factors include slope, aspect, elevation, lithology, Normalized Difference Vegetation Index (NDVI), Topographic Wetness Index (TWI), Stream Power Index (SPI), plan curvature, profile curvature, distance of road, and distance of stream. Eventually, the gully erosion susceptibility map was obtained by the Random Forest model. We validated the map by using 30 percent of the samples and analyzing the area under curve (AUC). The findings of this study can be beneficial to decision-makers in terms of soil planning and sustainable development in the study area.

ArcGIS Based Multi – DEM Urban Flood Resilience Assessment: A Case Study of Gyor City

Ibrar Ullah[1], Gábor Kovács[1]*, Tibor Lenner[1]
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Urban flooding has gained great attention in recent years since population in urban areas have become more vulnerable to climatic extremes. To cope with an increasing flooding issue, there has been an increased effort to manage flood management in urban areas. Similarly, in this study, an attempt was made to develop a two Digital Elevation Model (DEM) GIS based thematic map to assess flood resilience for the Gyor city, Hungary, which had a history of been impacted by of flood. Three elements i.e., hazard, exposure, and coping capacity with each having pre-determined parameters were selected and processed through Analytic Hierarchy Process (AHP) approach. The product value map was then analyzed in ArcGIS using Modified version of Specialized Flood Resilience Model (S-FRESI). Two resultant resilience maps were obtained i.e., SRTM based DEM resilience map and manually digitized contours based DEM resilience map. The resultant SRTM based resilience map was then subtracted from contours based resilience map in ArcGIS software. The final resilience map shows that there were 14.3% differences observed between the two maps which is comparatively low, but still significant. Therefore, it is preferable to utilize the contours based map for more reliable results. The technique shows that contours based DEM maps are more suitable in obtaining flood related hazard maps.

Advances in satellite based inland excess water monitoring

Boudewijn van Leeuwen[1], Balázs Kajári[1], Zalán Tobak[1]
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Due to climate change, we can expect that extreme weather patterns will occur more often in the Carpathian Basin. Intense rainfall, especially at the end of the winter can cause inland excess water to develop on the flat regions of the Great Hungarian Plain. To mitigate problems caused by the phenomenon, it is important to monitor the inundations. Since several years, for this purpose, we develop monitoring workflows based on freely available, active and passive medium resolution satellite data. State-of-the-art machine learning algorithms allow to monitor the floods over a large area, with high spatial and temporal resolution without the need for continuous supervision by humans. Our latest adaptation of the algorithm utilizes deep learning methods for automatic segmentation of the inland excess water patches giving superior results compared to earlier algorithms.

Ground-based and Remote sensing monitoring of water resources and infrastructures

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Starting from the 50s of the Soviet era, in connection with the construction of large reservoirs in the lower reaches of the Syr Darya and Amu Darya, reservoirs began to form one after another, and this preceded the development of cotton growing in the Central Asian republics and served irrigation. Currently, more than 120 large dams have been built and are operating in the Aral Sea basin, as determined by the International Commission on Large Dams (ICOLD) with reservoirs with sufficient useful water volume and an area of more than 1 km^2. The total volume of these reservoirs, according to unspecified data, is 250 km3. Only the volume of water in the Sarykamysh lake reached 100 km3 (for comparison, the volume of the Toktogul (Kyrgyzstan) reservoir is 19.5 km3), with a water surface area of 3670 km2, it exceeds the Small Aral, and it floods part of the territory of Uzbekistan. Our research touched upon issues ranging from the assessment of the volume of glaciers in the upper reaches and ending with natural disasters such as floods associated with the rise of groundwater. Each study was carried out by ground-based instrumental measurements and correlated with the results of processing satellite imagery data. Summing up the conducted studies, we recommend further research using ground-based measurement methods and remote sensing.

VEGETATION AND LANDSCAPE CHANGE

Wildfire Occurrence and Risk Factors in Hungary: A Spatial Analysis of Fire Records from 2011 to 2022

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Over the past decade, more than 70,000 wildfires have occurred in Hungary. Statistics indicate that 99% of these fires are caused by human negligence or intention. Most fires occur during periods of high fire risk due to meteorological conditions. The occurrence of fires is linked to land use patterns, population density, and a lack of fire safety knowledge. Wildfire statistics demonstrate that the effects of climate change are also evident in the spatial and temporal distribution of fires. Increasing the effectiveness of wildfire prevention is a challenge for authorities. We need to understand the components of the factors that determine fire risk (fire hazard, exposure, and vulnerability), as well as the effects of geographical, land use, infrastructure, and climatic factors. Wildfire risk studies have not been conducted in Hungary in the past. Our research aims to identify the probability of wildfires by analyzing fire records from 2011 to 2022 and assessing fire risk factors. The assessment was conducted using the Conversion of Land Use and its Effects (CLUEMondo) model. Several biophysical and socio-economic factors related to the spatial pattern of wildfires were used in the study. The initial results of our study confirm our hypothesis that wildfires are more frequent near residential areas and roads. Fire occurrence is mainly determined by temperature and precipitation conditions. Our results show that spring fires are associated with precipitation, while summer fires are more likely to be influenced by temperature. The probability maps generated by the model will be used in a subsequent phase of the research. Our model will be used to monitor wildfires as a function of spatial and temporal land use changes. As part of integrated fire management, land-based wildfire prevention can help create fire-resilient landscapes. Our results can also be used to develop forest fire prevention plans.

Pine plantation verges are important for small and poor disperser Orthotptera species in a fragmented landscape

Botond Magyar[1], Róbert Gallé[2], Attila Torma[1,2]
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Landscape modification caused by the increasing human activities lead to biodiversity degradation because of landscape homogenization and habitat fragmentation. Linear landscape elements (LLEs) are artificial landscape structures established for a special function such as transportation by roads and drainage by ditches, but they have a part covered by strip-like vegetation, which is not directly used for original function. LLEs could serve as potential microhabitats where a significant portion of the original flora and fauna can survive. Furthermore, these types of secondary habitats have a potential to serve as a corridor, thereby increase connectivity amongst the habitat fragments in a highly modified landscape.

In the Kiskunság region in Hungary, one of the main cause of landscape homogenization and habitat fragmentation is the intensive tree plantations. In addition to native deciduous forest plantations, exotic species like black locust (Robinia pseudoacacia) and scots pine (Pinus sylvestris) were also introduced. However, original open vegetation could remain at the edges of plantations that may provide various sources and/or function as corridors for arthropods.

Our study focused on Orthoptera assemblages of pine plantation verges as LLEs, and forest steppe patches and pastures as habitat remnants embedded into forest plantation matrix. There were 30 sampling sites in total, 10 sites for every habitat type. Our analyses showed no significant differences in the species richness and abundance of orthopterans amongst the three habitat types; only the species composition of plantation verges differed from the other two habitat types. The community structure shifted toward the smaller and less mobile species in the remnant vegetation of plantation verges. Based on our results, we can highlight the importance of plantation verges for orthopterans, particularly for small and poor dispereser species. Presumably, more agile species do not stand in need of plantation verges to disperse or survive.

Stand scale palynology helps to reveal the role of forest exploitation and climate change in the current distribution of Fagus sylvatica in the NE Pannonian Basin (Hungary)

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Black Lake (Mátra Mts.,) and Lake Egerbakta (Bükk Mts.,) were used to study the former distribution of beech at different altitudes. We used sites qualifying for stand-scale studies for pollen and plant macrofossil analyses to detect the local presence of beech. Lake Egerbakta is in an oak-dominated (Quercus cerris – Q. petrea) forest today. We expected that before the medieval forest management, beech was likely more widespread at lower altitudes and might have lived in the surrounding forest. At the Black Lake, we focused on whether beech has been cleared earlier in this region and particularly, when it first appeared >700m a.s.l. during the Holocene. High-resolution pollen and plant macrofossil analyses were combined with 210Pb, 137Cs, AMS 14C dating, LOI, and chemical element analyses (MP-AES). We found high amounts of Quercus (40–75%) and very low Fagus (1–6%) count in the pollen record spanning the last ~2000 years. We detected forest clearances at AD 1525, 1660 and 1750, and concluded that the Migration Age and Medieval land use did not decrease beech representation at this altitude since it was a turkey oak – pedunculated oak forest zone. Hemp-retting was also detected from ~AD 900. At the Black Lake, beech expanded and dominated rapidly at ~4500 cal BP and was already substantially cleared around ~2850 cal BP, likely for charcoal-burning and iron-smelting in the region. After its selective removal, our data shows beech being the dominant canopy component around the lake even during medieval times without any considerable clear-cut. Overall, we can conclude that beech forests of the eastern-slopes were not heavily exploited during the medieval forest management period; their old-growthness can be confirmed. Also, the elevation zone where beech forests were replaced by oak due to preference by medieval forest management can be located >300m a.s.l. in the Bükk Mts.

Potential future microrefugia in changing landscapes

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Microrefugia are small areas that enable the long-term persistence of species outside of their main distributions. An increasing body of evidence suggests that these areas have played an important role in mitigating regional environmental changes over time throughout the globe. Karst landscapes are the foremost examples of ground-water erosion on the Earth that provide topographically complex environments. As such landscapes cover about 15–20% of the Earth's dry land surface, they play a crucial role in ecological speciation and maintaining global biodiversity. For instance, enclosed depressions (cenotes, dolines, sinkholes or tiankengs) of these landscapes may act as important safe havens or microrefugia for many endangered species (both plants and animals); thus, they are particularly important from a conservation point of view. Our aim is to provide an overview about the ecological factors, biodiversity and threatening factors of karst depressions and to highlight knowledge gaps that will advance our understanding regarding the function of these areas. We present case studies from Central Europe to show the effects of human activities on the vegetation patterns of dolines. Finally, we point out the necessity of greater research efforts aiming to improve our knowledge of the effects of human-mediated landscape changes (e.g., agriculture and forestry management) and climate change (e.g., temperature increase and drought) on the refugial capacity of these types of topographic depressions.

Investigating the usability of databases with different spatial characteristics for the occurrence of invasive plant species: a Hungarian scale analysis

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Nowadays, biological invasions have increasingly serious environmental consequences. The increasing spread of invasive plant species is the most serious environmental risk in protected areas. The removal of established populations requires a significant financial investment. To avoid conservation and economic damage, the spread of invasive species must be prevented in the first place. To identify potentially threatened habitats, databases are needed that reliably indicate the presence of invasive species. There are several free Citizen science-type databases available, however these data are sporadic and only provide information on the presence of plants, nevertheless, they may be useful in mapping invasive species.

In this study, we investigated the usability of three databases in relation to the occurrence of two invasive plant species (Ailanthus altissima and Asclepias syriaca). One of the three databases (EUROSTAT Land Use and Coverage Area Frame Survey (LUCAS)) is non-sporadic, it covers all areas of Hungary, and the data were collected by specialists. We examined two databases (Data Source Hungarian Ministry of Agriculture and gbif.org) of sporadic data nature against this database to determine the extent to which the sporadic distribution of the data affects the reliability of the results. The analysis was carried out according to the correlation between the distribution of the invasive species considered and the characteristics of the topsoil and certain hydrological and climatic parameters. For statistical analysis, we used the one-way ANOVA model with the function aov. The pairwise comparison of the values of the environmental parameters associated with the three different databases was performed with a Tukey post-hoc test with the function TukeyHSD.

The results showed that in many cases there are significant differences between the results from different databases. In most cases, a significant difference was found between the results of the non-sporadic database and results from one of the two sporadic databases.

GEOPHYSICAL AND GEOMORPHOLOGICAL HAZARDS

EGMS full resolution processing for slow moving landslides monitoring

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EGMS (European Ground Motion Service) data provide millimeter-scale deformation information for relatively stable points (generally built surfaces that retain their radio wave reflectance properties – most often buildings) for the period February 2015 to December 2020. The technique used is MT-InSAR, a mature methodology that uses Sentinel-1A and B RADAR data to determine the displacement of the terrain relative to the satellite, from one pass of the satellite to the next (maximum 6 days between passes, considering both the descending orbit – 195° N→S, as well as the ascending one – 349° S→N). The calibrated product 2B is represented by the PS points for the ascending and descending orbits, a product that can be used to calculate deformations in the E-W (horizontal) and up-down (vertical) directions.

In the present approach, we propose to present a methodology that uses the EGMS 2B data and the EEA-10 numerical model to obtain the E-W and up-down deformation values. After calculating this deformation, based on the altitudinal data, the displacement hot-spots are evaluated geomorphometrically to reveal the existence of landslides.

Even in the case of the presence of a deformation that corresponds to the horizontal direction (along the slope direction) and the vertical (subsidence or slight uplift depending on the type of sliding mechanism), the presence of a slide must be validated on the basis of in- situ, of geomorphological evidence, possibly of displacement effects (Notti et al., 2012).

The proposed method allows a rapid assessment of the presence of deformations associated with slow moving landslides and can represent the basis of an early warning system for such landslides.

Analysis of Tsunami Wave Potential from Gela Nappe Fault Displacement in Southern Sicily, Italy based on Earthquake Focal Mechanism Since 1970

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The Gela basin, located in the subduction-collision zone between the African and European plates, has high seismicity. It represents the Pliocene-Quaternary foredeep of the Maghrebian fold and thrust belt. From 1970 to 2022, dozens of earthquakes occurred with epicenter depths between 5-50 km. Researchers have conducted studies on the possibility of tsunami generation, however, they only focused on the submarine landslide in the Gela Basin Eastern Slope (GEBS) by overlooking the potential of Gela Nappe fault (GNF) displacement. In fact, the GNF is an active fault part of the Maghrebian thrust belt which has been known as a source of earthquakes in southern Sicily. Therefore, this study will reveal the possible run-up height and propagation of tsunami waves along the southern coast of Sicily based on the GNF movement scenario. The methods involved include the simulation of tsunami wave generation and propagation onshore based on the shallow linear water equation and the application of the non-linear shallow water equation to predict tsunami inundation propagation onshore. The input parameters for tsunami formation by GNF displacement are derived from the focal mechanism of earthquakes between 1970 and 2022. The results of this assessment indicate that the movement of the GNF is expected to induce an Mw 7.58 earthquake that generates a tsunami with a maximum run-up height of up to 2.4 m and a wave arrival time of about 20 minutes from the generation of the first wave offshore. The maximum inundation distance of seawater from the southern Sicilian coastline is 163.25 m at Scoglitti. We infer that earthquakes generated by GNF displacement, ignoring the occurrence of submarine landslides after the earthquake, still have the possibility of triggering tsunamis even with insignificant run-up heights and inundation distances.

Seismotectonic hazard map of Hungary - the result of collaboration between geomorphologists, geophisicists and arcitects

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Seismotectonic hazard map of Hungary is a recent result of 4 years long collaboration between industrial and academic researchers. Seismology, geodynamics, 3D model of the lithosphere and other maps led to the final synthesis of our final result. This map includes the representation of the young deformations based on the detailed interpretation along tens of kilometers of industrial seismic surveys as well as relocation of earthquakes of the last 25 years. Catalogue of historical earthquakes has been created and represented on the map. Based on our widespread geophysical-geological knowledge, root zones of active faults have been identified. More than 100 measurements of the shear wave velocity of the uppermost 30 m rock have been derived and collected. These results were compared with geomorphologic parameters of the measurement sites. Based on these initial data set, correspondence of topographic gradient between Vs30 have been established. High risk features (alluvial and lacustrine lowlands; foothills) have been identified based on our borehole database.

Satellite radar observations in monitoring hazards and for sustainable development

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Anthropogenic and natural hazards are increasingly interconnected. Human activities significantly affect many natural hazards as well as creating new ones. Frequency and or severity may, vulnerability most probably increase in several cases. Observation and revelation of these connections are important but beyond finding them, understanding the sometimes highly indirect, complex mechanisms are crucial to prepare for such events, to prevent losses or to mitigate the repercussions. These changing hazards may also urge mankind to turn to more sustainable development. Satellite observations looking back to decades of observation, uniform, quantitative data on local as well as on large, regional scale can play a significant role not only in understanding natural hazards but also pointing out implicit relations to anthropogenic activities. It is also true the other way around, satellite monitoring of human activities and its effects on nature may provide guides for sustainable approaches, operations and levels. Our presentation aims to provide examples through space-based detection of precise and high spatial and temporal resolution surface changes over decades regarding flood hazard, landslide or unstable soil, general water management as well as exploitation of geothermal resources.

Snow avalanche synchronicity detected by a multi-path tree-ring based approach in the Făgăraș Mountains, Southern Carpathians

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Snow avalanches are natural hazards prepared and triggered by a combination of climatic and topographic features. Efficient management of snow avalanche related hazards and risks requires knowledge on past occurrences. Unfortunately, in many mountain regions of the world, archival records on past snow avalanches are scarce, generally focusing on events which caused victims or extensive damage. This is also the case of the Southern Carpathians, a region with continuously growing winter tourism. To overcome this lack of information, natural archives such as tree-rings are very useful in providing proxy data on the past occurrences of snow avalanches and other geomorphic processes.
The present study is a tree-ring based approach which aims at reconstructing the snow avalanche regime in the Făgăraș Mountains, Southern Carpathians. The study uses information extracted from a total number of 933 Picea abies trees growing on 17 snow avalanche paths located in the central-northern part of the Făgăraș Mountains. The multi-path approach, with a high number of different individual sites, is quantitatively unique in the dendrogeomorphic literature, and provides a high-resolution century-long avalanche reconstruction at local scale. The results reveal a mean return period of 4,5 years for major avalanche events in the region. Several years show high inter-path synchronicity. In 1988, 1997 and 2005, 80% of the analyzed paths experience major events, and more than 50% in 1967, 1992 and 2002. Reviewing the dendrogeomorphic literature this situation is rather unusual. However, the similar topographic and climatic settings of the analyzed paths advocate for a synchronous behavior of avalanches. In addition, the results of several other studies undertaken in various mountain ranges of the Southern Carpathians (Parâng, Bucegi, Şureanu, etc.) show that major event years identified in Făgăraș are present in other regions of the Southern Carpathians as well. This suggests a common climatic trigger or specific synoptic conditions favoring major snow avalanche events in a larger region. The identification of such conditions would be of utmost importance to update the risk management in areas with intense winter tourism activities, hiking or off-piste skiing.

THE SOCIAL PERSPECTIVES

Green transition and climate change in the EU - aspects for a more sustainable and healthy future

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Socio-spatial inequalities caused by environmental changes related to climate change have increasingly come to the forefront of Hungarian social geography researches. In recent decades, the increasingly frequent extreme events of the effects of climate change (heat waves, floods, forest fires, etc.) are causing an increasing number of environmental disasters and the resulting environmental damage has enormous social costs. All this also has an impact on people's daily life, quality of life, health. In December 2019, the European Commission launched its proposal for a European Green Deal (EGD), a wide-ranging package of legislation and financial instruments to address climate change and ensure a "just, fair and inclusive" transition in the European Union. The presentation showcases the most important aspects of the EGD and its potential effects on different European countries by reviewing the most important factors, which might influence the green transition process. Three major aspects were identified, namely, socio-cultural and economic; political and administrative; environmental out of which a transition framework was set. Considering the framework three potential transition pathway were identified for the European countries, the progressive, the parallel and the pragmatic.

Formal Education on Natural Disasters

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Education on natural disasters is a dynamic process which creates knowledge, attitudes and skills leading to prevention or mitigation of consequences caused by natural disasters impact on people and their environment. In Serbia, knowledge related to natural disasters has traditionally been transferred through informal and non-formal education. Due to the fact that these forms of education are not officially standardized by laws and regulations, their effects are unsatisfactory. Additional problem is that informal education is not subject to any expert verification. Through the electronic and printed media, under the pressure of the market, great deal of information related to natural disasters is presented in a sensational or even fatalistic context. The effects of such reporting lead to panic reactions and the feeling of weakness. On the contrary, the non-formal education is objective, carried out through the activities of scientific and expert institutions (e.g. Seismological Survey), societies, international organizations, such as UNICEF, etc. The drawback of this type of education is that it reaches relatively small number of people and, additionally, it mostly considers reactive protection measures, instead of proactive. Finally, in order to increase the resilience of the society, Serbia established the formal education on natural disasters in 2017/2018. The Ministry of Education enacted the Programs of Teaching and Learning which explicitly defined the outcomes related to this thematic field. The Programs encourage the learning in all three domains: cognitive, affective and psycho-motoric. Cognitive domain is traditionally the dominant one, explaining the notion, process and dynamics of natural disasters. Affective domain is related to readiness for integration of the received information to personal assurances and attitudes, which reduces the panic reactions. The third domain are psychomotor skills which contribute to the development of the appropriate physical reactions in cases of potential natural disasters.

Analysis of Building Damage Caused by the Effects of Natural Hazards

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The aim of this presentation is to identify and typify natural hazards and to describe their negative impacts. The authors will analyse the effects of natural hazards on buildings, with particular emphasis on meteorological events, and will look for solutions to increase the resilience to these effects.
Analysing the topicality with the help of index databases, primarily using data from ScienceDirect and Google Scholar. The identification of natural hazards is based on annual reports of relevant bodies and organisations, international discourse, and the main findings of conferences. Trend analysis is used to assess changes in the number of natural hazards that have occurred.
Safety is a growing societal need, with increasing trends in natural hazards posing significant potential risks in terms of time spent in the built environment and exposure to lifestyle factors. In terms of damage to buildings, it is essential to increase the resilience to specific impacts. The engineering, technical, economic, political and social elements of this need to be continuously analysed and assessed.
This presentation complements meteorological research by providing practical answers to the question of what we are up against, in the knowledge that it is necessary to prepare not only man but also his material assets (buildings) against the increasing impact of natural hazards. In this presentation, the authors will show how.

Ensuring science is useful, usable and used in disaster risk reduction – recommended actions for natural hazard scientists

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Natural hazard scientists can contribute to the planning and development of sustainable and resilient communities through improved engagement in disaster risk reduction (DRR). In this presentation, we set out seven recommendations for how this can be done: (i) characterize multi-hazard environments; (ii) prioritize effective, positive, long-term partnerships; (iii) understand and listen to stakeholders; (iv) embed cultural understanding into natural hazard research; (v) ensure improved and equitable access to hazard information; (vi) champion people-centered DRR (leaving no one behind); and (vii) improve links between DRR and sustainable development. Following these recommendations, we put forward key actions that natural hazard scientists and research funders should consider taking to improve education, training, and research design and to strengthen institutional, financial, and policy actions. Finally, we introduce an online, self-led training course designed to strengthen natural hazard scientists' engagement in DRR activities.

Assessment of climate-related impacts and risks on the tourism sector

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Climate constitutes a natural resource for the tourism sector, promoting tourism activities and supply. From the potential impacts of changing climate conditions, risks can arise, with adverse consequences on natural and human systems. For impact and risk assessment, climatic impact-driver (CID) framework was introduced in the recent IPCC assessment report. Main climatic impact-drivers affecting tourism include decrease in snow and ice, coastal erosion, sea level rise, or changes in hot and cold extremes. According to the recent risk framework in IPCC, the drivers of climate-related impacts and risks are the interplay between the CIDs (hazards), the exposure of the system affected and the vulnerability of the system to the adverse conditions. The most commonly used tool for objective, quantitative climate impact and vulnerability assessments on different sectors (including tourism) is the CIVAS model (Climate Impact and Vulnerability Assessment Scheme), which was based on the approach in the fourth assessment report of IPCC. The model describes the natural, economic and social vulnerability caused by climate change as a complex indicator by integrating exposure, sensitivity and adaptive capacity factors. In addition, a more recent, the so-called dynamic vulnerability assessment method provides a practical and real understanding of the dynamically changing environmental vulnerability on tourism with the toolbox of interviews, experimentation and experience by involving experts and stakeholders in tourism. In the presentation, the most important climate-related hazards, impacts and consequences affecting tourism are identified. Then major assessment methods are overviewed at conceptual and methodological level based on recent literature to study the complex climate-related vulnerability, impacts and risks on tourism.

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HUMAN HEALTH

Future prediction of heat wave periods with Markov chain analysis

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The impact of global climate change is also felt in Hungary. An undesirable effect of climate change (associated with rising temperatures) is mainly the increase in the frequency, intensity, and length of summer heat waves. In this respect, the region of the Southern Great Plain and the Danube-Tisza Region are particularly endangered, but the number of heat wave days has increased throughout the country in recent decades. This study takes the climatic data sets of Baja into account, and on this basis, it gives the probability that a particular day falls into a heat wave period. Based on this information we draw a general conclusion about the long-term change of this climatic characteristic of the Southern Great Plain. The mathematical model used in the research applies the theory of Markov chains, which is relatively new in statistical analysis.

Heat Health Nexus: A U.S. perspective

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While progress has been made at reducing adverse heat-health outcomes, a warming world poses significant public health challenge. Seasonal warming influences the distribution and timing of allergens, habitat suitability for pests, and precipitation patterns that are essential for livelihood. This presentation contextualize heat mitigation efforts in the United States while also framing the issue in the global context. Scientifically, efforts to improve forecasting and monitoring are important, but equally so, evaluating social determinants of health and working with science communicator professionals is also essential. Vulnerability remains a concern, particularly as the average age of global population continues to rise, thus interdisciplinary partnerships must be adopted, strengthened, and institutionalized across sectors and geographic regions.

Human comfort research in the service of climate adaptation

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Climate change affects all aspects of our lives, having most prominent influence on thermal comfort and thus indirectly on our health. Our research group has been conducting basic- and applied human comfort research for years, which initially focused on mapping the thermal conditions of urban public areas and the factors that directly determine them. These studies clearly proved that during summer heat waves, the most effective way to improve human comfort conditions is to reduce solar radiation, thus reducing the mean radiant temperature. Our results highlighted the prominent role of green infrastructure, especially woody vegetation in this phenomenon.

Urban green infrastructure (UGI) – in addition to its many other positive effects – is one of the most versatile tools for increasing the resilience (adaptation potential) of cities to climate change (micro and local climate regulation, urban water balance), but its role in mitigation (carbon sequestration and storage) is also not negligible. However, for Hungarian urban planning practice and decision-making, there are not enough data and a suitable evaluation methods that can adequately support this potential. Therefore, our resent research is aimed at developing the evaluation of the climate regulation ecosystem services of urban (primarily woody) vegetation. Furthermore, as a member of an international team, we are investigating the impact of green infrastructure (hospital gardens) on the condition of patients in a questionnaire survey.

Foucauldian perspecitives on Covid-19 and their geographical relevance

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The Covid-19 pandemic affected not just health, the quality of life or the health care system – it had complex effects on the wider political, economic and social processes as well. Power relations and mechanisms have outstanding significance in this regard: these are interrelated with the perception and management of the pandemic – and with the spatial differences of them. The paper aims to present a social theory framework in order to gain a better understanding of these issues. The analysis uses the Foucauldian concepts of biopolitics and governmentality as starting points to understand how various forms of power were manifested and shaped throughout the pandemic. Furthermore, through a multiscalar approach we also analyse the governmental measures and interpret them through the above mentioned concepts, presenting how power was retained and used. The reframing of responses of decision-makers to the pandemic and highlighting the spatial aspects of power and its use during Covid-19 emphasise the need for theoretical approaches that can contribute to a critical understanding of crises and their effects. In addition, the analysis also demonstrates the necessity of social theories in geographical research and that space, scale and place all have outstanding relevance in social processes.

ENVIRONMENTAL HAZARDS

Last glacial atmospheric environment of the Carpathian Basin

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Nowadays, atmospheric particulate matter, and in particular PM10 and PM2.5, are considered to be priority air pollutants and are associated with very significant health risks. Environmental research has focused on the main anthropogenic sources, but research on natural sources of particulate matter, which are highly differentiated in space and time, has been overshadowed in this respect. This is particularly true for dust storms in the geological past, which are completely free of anthropogenic influences.
Aeolian dust deposits with appropriate stratigraphic data, in particular chronostratigraphic data and granulometric information, provide a unique opportunity to estimate the atmospheric dust volume of the last few hundred thousand years. In the case of the Carpathian Basin loess-paleosol series, we have sufficiently accurate data for the last glacial period to contribute to a better understanding of past atmospheric conditions in relation to the atmospheric dust concentration in the late Pleistocene.

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Spatio-temporal variability of the connection between spatial characteristics of the transportation networks and PM10 air pollution: a European scale analysis

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The rapid development of urbanization has generated various air pollution problems in Europe. There is a high proportion of transportation-related emissions in total air pollution. The urbanization process is accompanied by the construction of many roads and land use changes. They are constantly changing in the process of urbanization and have an essential impact on air quality and land use structures. Among pollutants, particulate matter (PM) is the one associated most consistently with a variety of adverse health outcomes even at very low concentrations.

In this study, the spatial and temporal variability of the connection between monthly average PM10 concentration and transportation networks was analyzed across European countries. We used General Additive Model (GAM) to investigate the relationship between the density and distance to the different types of transport networks and monthly PM10 concentration in 1216 air quality (AQ) European stations (1039 urban and 177 suburban stations) and in two different buffer zones (1000m and 3000m) from AQ station points.

The results show that there is an inverse relationship between the monthly average PM10 concentration and distance to roads and in contrast, it has a positive correlation with distance to railways. In addition, the monthly average PM10 concentration is positively associated with the density of railways, primary, residential, and link roads in urban landscapes. while PM10 showed a negative significant correlation with motorways and secondary road density in these areas. Also, we found a strong additive influence of motorways and primary roads in suburban landscapes. Our GAM model estimates a dramatic increase in PM10 concentration during the heating period. The outcomes of the study may help landscape planners, environmentalists, and decision-makers in framing better policies and management.

It is not only about the climate - Landslide at Stari Slankamen (Serbia) loess palaeosol sequence

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Slope instability is regarded as one of the most widespread natural hazards. On January 5th and 27th 2022, a massive landslide occurred at the most famous loess-palaeosol sequence (LPS) in Serbia. Fortunately, Stari Slankamen LPS was already studied by multiple parameters and proxies in the past decades through numerous papers, which confirm its European importance. Thus, the palaeoenvironmental record it contained is somewhat preserved. This was a 50 m high cliff displaying the last 9 glacial cycles, but after the landslide event, the lower parts of it are covered with collapsed material. Our investigation, focused on the main causal factors, determined that occurred landslide event had rather complex components, reflected in the joint climatological characteristics, properties of the geological substrate, and human activity that further contributed to the intensive change of landscape and acceleration of cliff instability. In the last three months of the year 2021, the precipitation was higher than the 30-year average. The monthly averages for the studied area showed that the maximal precipitation should be expected in May and June, but in the year 2021, this precipitation peak was postponed for November and December. This situation is rare in the 30-year period (e.g. 1993, 2011, 2017). The Mann-Kendall (M-K) test for the precipitation data, as well for the quantified indices - The Precipitation Concentration Index (PCI), The Modified Fournier Index (MFI) and Lang Aridity Index (AILang), indicated that there is no statistically significant trend for the given significance level. Urbanization process and reduced vegetation cover intensified cliff instability. The authors implemented remote-sensing techniques in order to monitor and assess the mechanism of the given landslide event at local level. Results from this study could have implications for mitigation strategies at national, regional, and municipality levels, providing knowledge for the enhancement of geohazard prevention and appropriate response plans.

Energy production and meteorological extremes

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For weather-dependent renewables, both forecasting and managing power variations due to intermittency will in the future be the task of an electricity grid known as a smart grid. The task of electricity management will be to handle weather extremes and meet the electricity demand. The increase in the number of weather extremes and the absolute value of the phenomena on any scale has increased significantly as a result of climate change and is likely to continue in the future. This includes stormy winds and dark, wind-free (Dunkelflaute) days (from a substituting power perspective), but also heatwave days (from a summer peak load and base load plants back-loading perspective). The presentation will elaborate on these relationships.

HYDROLOGICAL HAZARDS 2.

Mapping of flood prone areas in the lower Timiș Basin

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The increase of natural hazards worldwide, particularly the occurrence of floods is more and more visible. Flooding can happen anywhere, but certain areas are especially prone to serious flooding. In this sense, a landmark is the 2005 floods, when, at the exit of the country, Timiș River reached a historical discharge of 1675 m3/s, compared to the multi-year average discharge of 46 m3/s. Urban sprawl and economic activities in river floodplains increase the potential impact of flooding. Absolute flood protection will never be possible, but damage can be reduced through flood risk management, which starts with understanding the flood hazard. It is difficult to estimate the probability of different flood events because complex data is required to create an accurate hydrological forecasting. This paper aims to identify flood prone areas based on geospatial data and a minimum amount of hydrological data using ArcGIS and HEC-RAS. A flood modeling is not only aimed at obtaining acceptable simulated results, but also at using these maps in the decision-making process. The lower Timiș Basin is a part of Timiș-Bega system with many interconnections between the two river basins. Our hydrological modeling is based on the data from Lugoj and Șag hydrological stations, with scenarios for 10, 50, 100 and 1000 years discharge recurrence using Gumbel distribution. The analysis revealed that once in 100 years scenarios (1480 m3/s) and millennial ones (2064 m3/s) for discharge occurrence will cause great damages for agricultural lands and settlements especially in the subsidence plain located next to Serbian border.

Dynamic geomorphometric study of the erosion of the Zagyvarona spoil tip using digital photogrammetry

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Large-scale mining activity took place in the Salgótarján coal basin (Nógrád county, Hungary) until the mid-1900s. The byproducts of the processing of the mined coal and iron ore, saturated in heavy metals, are still exposed to erosion in the form of alien spoil tips in the Medves plain, in the area of Zagyvaróna. Due to global warming, the precipitation distribution in Hungary might show a variable trend, so the number of precipitation events with higher intensity may increase, which could have a major impact on the landscape erosion dynamics. The aim of this study was to analyze the dynamic geomorphometric changes of the spoil tip in the area, particularly due to water/precipitation erosion, and to estimate future morphological changes.

Digital photogrammetry and geospatial techniques was used to determine the rate and dynamics of the changes in the spoil tip due to erosion over the studied period. For the time-series analysis, we used scanned, digitalized versions of archived analog aerial photographs obtained from the Lechner Knowledge Centre. The 3D digital point cloud created from the 1976 aerial photographs was compared with the 3D point cloud generated from the images taken in 1988. Subsequently, UAV surveys were carried to record the current state and to study the dynamics of the erosion of the spoil tip over a period of approximately 50 years. To estimate future changes, 10-minute precipitation data from two automatic National Meteorological Service stations (nearest to the study area) were analyzed for the period of 2002 to 2022. The analysis of the areas most exposed to future erosion was performed in ArcGIS Pro.

A comparison of the point clouds showed that the spoil tip lost almost a quarter of its volume during the study period due to erosion activities. Further volume analyses revealed that the volume loss of the slag cone resulting from erosion activities is estimated to be 600 m3 per year on average. Despite the variable trend in the climate of Hungary, due to the local topography, no significant increase in rainfall intensity is expected in the near future, but the steep morphology of the spoil tip is expected to increase the erosion rate.

Due to increased erosion, more contaminants could be transported to the surrounding soils and groundwater. Continuous monitoring of the erosion activity and the spread of contaminants will provide a more accurate conclusion on the environmental impact of the spoil tip.

Digital Twin Application for Monitoring the Impact of Climate Change on the Eutrophication and Biofiltration of the Danube River Waters in the St. George Branch

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Danube Delta is one of the most vulnerable European regions to climate changes. Risks related to the decrease of the available water on the Danube River side and the slow increase of the level of the sea is expected to change fundamentally, hydrological situation of the Delta in terms of concentrations of pollutants inflowing from the river side and the salt concentration from the sea side. The situation may possibly lead to fundamental changes of basic processes including the biofiltration.
Several communities are already suffering on fresh water sufficiency and the region has the highest vulnerability and least adaptive capacity to climate change impacts. Urgent masterplan actions need to be applied and reinforced with knowledge-based solution.
The proposed paper is presenting the results of research activities carried-out as part of the ARSINOE project aiming to contribute to improve and facilitate the nutrients removal or use of nature-based solutions such as selective symbiotic relationships of microorganisms and aquatic biomass. Thus, controlled biomass production can be obtained by using the nutrients from water and ensuring the proper condition for trophic chain equilibrium or restoring in functionally affected ecosystems.
The paper include the results of the following activities:
- Evaluation of existing datasets and data sources and digital twin approaches within the borders of Biosphere Reserve;
- Evaluation of different Multiscale and Multiphysics models for hierarchical and complex phenomena in the river-sea Deltaic Ecosystem;
- Evaluation of the climate risk analysis methods and methodologies for resilience building in river-sea Deltaic Ecosystem.

River management induced increased flood hazard on the Lower Tisza, Hungary

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In the last centuries various human impacts altered the European rivers. For example, floodplains were confined by artificial levees, channels were fixed by various built-in structures (i.e. revetment, groynes), and the land-use of the floodplains was changed providing habitats for invasive species. These human impacts resulted in such semi-anthropogenic processes, like accelerated floodplain aggradation, channel narrowing and incision, overbank flow pattern changes. Our aim was to evaluate the cross-sectional channel changes, overbank floodplain aggradation, riparian land cover and artificial levee height changes from the point of local flood hazard. The research was performed in a low-gradient river (Lower Tisza, Hungary), which was regulated in the late 19th century, thus the effects of century-long processes on flood hazard could be evaluated. To estimate the elevation changes of the floodplain and the channel, a LiDAR survey was applied; besides, to analyse channel changes the hydrological surveys (since 1890s) were studied along the 92 km long reach of the Lower Tisza.

According to our measurements the channel became narrower by 9%, its cross-sectional area decreased by 2% in average, however at some locations the narrowing was over 30%. These channel changes increased the flood level by 12.8 cm in average (max. 134 cm). The mean overbank floodplain accumulation was 1.2 m (max. 2.6 m), thus it increased flood levels by 112 cm in average. The mean vegetation roughness of the channel increased from 0.048 to 0.11, increasing flood levels by 42 to 139 cm (depending on different modelled scenarios). It must be noted, that the vegetation influences not just the overbank flow velocity and pattern, but also the in-channel flow conditions: the actual very dense vegetation further accelerates the channel narrowing and incision. On the other hand, artificial levees became lower by 23 cm in average (max. 75 cm). By overlapping these data, the actual flood hazard along the Lower Tisza increased by 175-272 cm (max: 350-443 cm) in average since the late 19th century river regulation works. As these processes are still active, further increase in flood hazard could be predicted. Based on our method the managers can identify those processes which contribute to peak flood level increase at a given location, thus they can plan flood hazard mitigation.

Are extreme floods on Danube getting more frequent? Case study Bratislava station

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Floods occur naturally and can transform into calamities that result in extensive destruction, health concerns, and fatalities. This is especially true when rivers are obstructed from their inherent floodplains and confined by embankments, or when residential and industrial structures are erected in regions that are naturally susceptible to flooding. Despite this, recent flood records across various European regions do not indicate a distinct rise in flood frequency during the last few decades. In this paper we present longer-term records of winter and summer floods in the Danube River for the 1876-2020 period. By applying threshold level method, we analyzed two group of events, strong and extreme floods. By applying this data and approach, we can conclude the following for the Danube River: (1) downward but not significant trend in strong winter floods and upward but not statistically not significant trend of summer floods, (2) Upward and statistically significant trends of extreme events both in winter and summer season. Based on our study, several conclusions can be drawn regarding flood protection and disaster management on the Danube River. Firstly, there has been a noticeable decrease in the frequency of strong events during winter season. Secondly, it is crucial to regulate the number of assets located in flood-prone regions to minimize economic damages. Thirdly, raising awareness about the growing incidence of extreme floods during both summer and winter seasons can aid in preventing future floods. Overall, our study indicates that key to a better understanding of flood risk analysis involves (A) the application of a local to regional scale in order to take in account the considerable spatial variability and (B) the usage of advanced statistical estimation tools (e.g., Mudelsee, 2020, Statistical Analysis of Climate Extremes, Cambridge Univ. Press) in order to robustly detect climate extremes and estimate their rate of occurrence.

CLIMATE CHANGE AND METEOROLOGICAL HAZARDS

Ianos: a severe medicane in Greece

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Mediterranean Tropical-like Cyclones, or commonly named Medicanes are a special type of cyclones which develop over the Mediterranean Sea. They follow the development process of subtropical or tropical cyclones which form over the higher latitude subtropical areas of the Atlantic Ocean: they mainly originate from extratropical lows or small-scale baroclinic disturbances, which cut off from the main westerlies and gradually acquire subtropical and then tropical characteristics if they remain long enough over relatively warm waters. These types of cyclones are officially classified by the National Hurricane Center in the Atlantic region, and nowadays some meteorological services, for example the UK Met Office already admit the medicanes as subtropical or tropical cyclones, too. In September 2020 a unique and strong medicane developed over the Central Mediterranean Sea, named "Ianos" by the Greek Meteorological Service. The cyclone made landfall in the western parts of the country with winds equivalent to a category 1 to 2 hurricane, causing severe damages in the Ionian Islands. The cyclone also produced heavy rainfall across the country, leading to mudslides in higher altitudes and major floods, especially in Thessaly, destroying many roads, bridges and railway lines. This cyclone, along with many others, is an example of how destructive a medicane can be, despite its small size and limited strength. Some studies also show that the intensity of such lows is likely to increase due to the climate change, since as the sea becomes warmer, convection and precipitation may become more intense. It would therefore be useful to raise awareness about medicanes even in Hungary, even though these cyclones do not affect our county, but many people travel to the affected regions for holiday.

Potential risks related to heat load, energy demand and water balance based on EURO-CORDEX climate projections in the broader Carpathian region

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Due to the rapid change in our climate, gathering information about regional patterns of basic climatic parameters and indices is essential. This study aims to present the future trends in various temperature and precipitation related climatic indices in the broader Carpathian region throughout the 21st century. To calculate these indices, the study utilizes multi-model average temperature and precipitation data from EURO-CORDEX model simulations for future time periods (2021–2050, 2071–2100) and emission scenarios (RCP4.5, RCP8.5). These indices provide insight into the heat load, energy demand, as well as extreme precipitation and drought characteristics that can be expected in the future. The results indicate an obvious temperature increase, with the heat load and energy demand quantifying indices following the temperature trend. However, evaluating precipitation trends is more difficult. Changes in precipitation and related indices are considered small and confined to specific regions. The Carpathian Basin experiences the most significant alteration, but the following decades will bring critical changes to the entire examined region.

Comparison of drought damage risk/intensity and the use of damage prevention tools in the Lower Tisza catchments

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"One of the consequences of global changes is that the frequency and severity of droughts has increased, resulting in the higher magnitude of damages caused at the national level. The range of tools for preventing and mitigating water damage risks is extensive (especially for surplus water) in terms of flood risk management, which has been applied for decades or even centuries, however, the range of water management tools for actively managing drought damage is much more limited. One obvious reason for this is the increase in the number of water scarcity-related phenomena in the last three decades in the domestic context, which has led to an increasing focus on balancing anomalies that result from changing hydrological system dynamics. The development of existing and future technical (water management, agro-technical, nature conservation) and legal frameworks is increasingly being emphasised, leading to a rapid expansion of the set of tools, the optimal use of which can significantly help mitigation.
According to the principle of integrated water management, drought management should be effective in the whole river basin using the available tools, but at present there is no complex framework in national practice other than the retention of collected surface water in reservoirs and canal networks and the use of irrigation. One reason for this may be that a comprehensive strategy to address water scarcity has not been adopted and its development was interrupted in the early 2010s.
The presentation shows how the spatial relationship between drought and irrigation has changed in the Lower Tisza catchments over the last 10 years. The spatial specificities of the relationship are discussed and suggestions for improving the efficiency are made.

Comparison of the Standardized Precipitation-Evapotranspiration Index values calculated using various evapotranspiration models

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One of the most commonly used drought indices is the Standardized Precipitation-Evapotranspiration Index (SPEI). Initially, the Thornthwaite equation was proposed for calculating potential evapotranspiration (ETP) in SPEI. Later, the authors of SPEI suggested the FAO-56-Penman-Monteith equation for estimating evapotranspiration. Although FAO-56-Penman-Monteith is a standard equation, and many organizations and experts recommend it, the main problem is that it does not give precise and correct results in the absence of reliable data. If the data needed for the FAO-56-Penman-Monteith equation are not available, SPEI authors recommend the Hargreaves equation as the first choice or the Thornthwaite equation. Thus, different ETP methods give different values of SPEI. The aim of this study is to test whether ETP influences SPEI results in the observed area. The values of SPEI based on FAO-56-Penman-Monteith equation (SPEI-PM) were compared to the values of SPEI based on modified Hargreaves (SPEI-H), Thornthwaite (SPEI-TH), and Turc (SPEI-TU) equations. The study area was the central part of Vojvodina province of Serbia where drought often occurs and significantly affects crop yields. We analyzed the occurrence of drought for the period of 45 years. SPEI indices are calculated for one, three, and six-month timescales. Differences between the three indices were analyzed using R2 (Coefficient of determination) and MAD (Mean Absolute Difference). Results show that the R2 values are all high and very similar for all comparisons, but the highest value of R2 (0.98) is between the SPEI-PM and SPEI-H, for all three timescales. Also, the lowest value of the MAD is between SPEI-PM and SPEI-H (0.15) for all three timescales. Results indicate that all indices generally provide similar results; however, the performance of the SPEI-H is considered to be the most accurate. The study represents a result of the research activity carried out on projects: Interreg-IPA WATERatRISK(HUSRB/1602/11/0057) and COST Action (CA17109).

Using remote sensing tools to assess the impact of climate change on freshwater scarcity in North Africa.

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North Africa is considered highly vulnerable to water scarcity and other environmental problems due to global warming. If temperatures in the region continue to rise at a relatively high rate, there could be less rainfall for agriculture and a deterioration in the quality of freshwater resources due to saltwater intrusion into freshwater aquifers and increased concentrations of pollutants. The drought of rivers and lakes in Egypt, Libya, Tunisia, Algeria and Morocco, which are already suffering and will continue to suffer, will lead to conflicts between different water users, which will be intensified in the future, as well as in regional economic and political instability. Some regions of the African continent are experiencing higher and less predictable rainfall due to global warming, increasing the risk of floods and landslides, while other regions are facing hotter, drier weather and longer droughts. All of these effects were proved by statistics of the local institutes (Please place here one literature references).

To achieve food security, protect biodiversity and maintain peace and stability, the Middle East and North Africa (MENA) region must adopt a climate-smart approach to agriculture and natural resource management. Meanwhile, the development of remote sensing and satellite technology is needed to study and monitor these phenomena. Understanding the relationship between greenhouse gas (GHG) emissions and climate change is crucial. The relationship between GHGs and the rhythm of changes in climate variables has been investigated using machine learning (ML) models based on ECVs (Essential Climate Variable). Data from meteorological and oceanographic satellites are now an essential tool for numerical weather and climate prediction and are directly assimilated by numerical models. Finally, spatial patterns of freshwater stress and scarcity need to be characterised to support initiatives in North Africa.

ABSTRACTS OF POSTERS

Vegetation Cover Change in an agricultural area in Mongolia: A case study in Shaamar soum, Darkhan-Uul Province

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This paper presents a detection of vegetation change in Shaamar soum, Mongolia using Landsat-8 Operational Land Imager from 2013 and 2017. Normalized Difference Vegetation Index (NDVI) was calculated in the Landsat Imagery, additionally, the image classification techniques and change detection processes were applied. The aim of the study was therefore to assess the land degradation-based reduction in the amount of green plant material of vegetation cover. Moreover, the study is examined that is correlation between vegetation cover change with land use and pasture type. The classification based on NDVI value was divided into six classes from Highly Dense vegetation to No Vegetation. The results show that the Less Vegetation class has increased by 1.4% and less moderate increased by 14.7 respectively. Moderate and Highly Dense Vegetation decreased by 2.9% and 12.3. The settlement and wetland vegetation NDVI value changed negatively. The steppe pasture NDVI has increased by 10pixel values. Meadow area's vegetation cover changed positive, and water area decreased.

Analysis of the spatio-temporal occurrence of five common Eurasian invasive species in different land cover (habitat) types

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Biological invasion is a known harmful environmental process that threatens native species and their natural habitats. The mass spread of invasive plants can result in an increased number of allergic diseases and potential flood risk. Spatial modelling and analysis of plant invasion can help mapping and predicting the spread of invasive plants. The aim was to investigate the spatio-temporal variability of five common Eurasian invasive plant species (tree of heaven, common milkweed, Russian olive, black locust, goldenrod) in the main land cover (habitat) type of National Ecosystem Service Mapping and Assessment (NÖSZTÉP) of Hungary, and how this has changed between 2009 and 2018. We calculated the percentage of EUROSTAT LUCAS field observation points infected with the species in the given year within the NÖSZTÉP main habitat type. Using these percentages of the LUCAS survey years (2009, 2012, 2015, 2018) we calculated trends of change of the occurrences of each invasive plants for each main land cover (habitat) type using linear, logarithmic, exponential, and binomial regression (R2), and plotted the most significant changes on graphs. Graphs show considerable trends of change in the infection percentage of the main habitat types with a given species. If the R2 value of the trend line for the study years was greater than or equal to 0.7, we defined as significant change in invasion within the main land cover (habitat) type. Direction of change within the studied period (2009-2018) could be increasing or decreasing. The results show that tree of heaven is spreading rapidly near roads and railways. Common milkweed is a major threat for diverse, mosaic, so-called complex landscapes, and grassland habitats. Black locust is becoming less common in built-up areas, presumably linked to the increasingly urban heat island environment. Goldenrod species prefer increasingly wetlands, posing a growing threat to floodplain habitats.

Climate change - a palaeontologist's perspective

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Climate changes (either rapid or slow) could be best understood from geological perspective. Not only because of the consequences but more importantly to monitor the ways, time scales and recovery processes. In this review the rapid climate changes sensu Wallace Broecker, The Younger Dryas event, PETM, TOAE, GOBE, and the Snowball Earth events are introduced and compared looking for the similarities on a highly different time scaled events from a 1,000 year-scale to a 100 million-year-scale. The main focus of the presentation is on the consequences of the climate changes and their impacts on the biosphere (marine and terrestrial, too). In the past 500 million years of the Earth history the presence of polar ice caps – as it is today, is characterized by less than 30% of time passed. This means that, generally speaking, we are living in an unusual period. The track in front of us is obvious: temperature will go up definitely on long run being inevitable. The very interesting and controversial connection between the rapid and long-term climate change processes is also discussed. A conclusion is drawn: we cannot avoid, alter or slow the long-term climate change processes; however, we have an outstanding responsibility to tackle the short-term changes in order to save the planet. This will be highlighted by the survival rates, generation rates and extinctions of fossil taxa involved in the discussed climate change processes taken from the past half billion years of Earth history.

A multi-scenario comparison of climate change in European regions based on the IPCC Interactive Atlas

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In 2021-22, the Intergovernmental Panel on Climate Change (IPCC) published its Sixth Assessment Report on the matter of climate change, providing new data and results to researchers and decision makers. Moreover, as a brand-new element to climate research, an Interactive Atlas has been provided that not only makes the understanding of climate impacts easier with its eye-catching maps and graphs, but also assembles data collected by the climate research community over the last decades. For this reason, the Interactive Atlas is a useful tool to create interregional climate analysis using the built-in options of datasets, scenarios, and variables available. In this study, we compared the potential climate change of the three European climate regions (defined as IPCC WGI reference regions) on the basis of the maps, diagrams, and charts of the Atlas. Our goal was to analyse the frequency and the magnitude of the potential climate extremes that European citizens will have to face towards the second half of the 21st century. For this purpose, we chose the TX35 and CDD indices, defined as the number of days with maximum temperature above 35 °C and the maximum number of consecutive dry days (precipitation < 1 mm), respectively. From the available datasets, the EURO-CORDEX dataset was selected as it provides the highest resolution for the target domain, hence the best punctuality out of the possible options. Our results show that throughout the next decades, both the frequency and the magnitude of the climate extremes are likely to increase in the whole European continent. However, huge spatial differences and a high influence of climate policies and mitigation can be seen on the speed and magnitude of this increase, implying that the positive response of society is essential to reduce the impacts of climate change.

Assessment of ecosystem service in floodplain areas

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NKE VTK participates in 5 subprojects of the National Laboratory program, one of which is the definition of ecosystem services in the Floodplain areas. In this project, the method of assessment and analysis should be developed and carried out in selected areas within the framework of a pilot project. This extensive survey, data collection and analysis makes it possible, in addition to defining and assessing Floodplain ecosystem services, to lay the foundations for estimating the changes expected under the influence of climate change and for preparing for protection against harmful processes. During the project, the domestic adaptation of the German methodology will take place, of course, taking into account the domestic specifics. In the project, which is carried out in cooperation with different specialties, our task is to carry out the geospatial and water management tasks of the research. At the conference, we would like to present the details of this valuable research.

Monitoring the Impacts of Urbanization on Land use Land cover in Ethiopia Using Remote Sensing and GIS Technique

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With the economic growth of developing countries, the rapid urbanization of rural land and its conversion to urban land directly lead to an increase in the area of impervious surfaces. It is important to build accurate and fast methods to extract impervious surface distribution which is helpful for detecting regional environmental changes in urban areas and achieving sustainable urban development. Bahir Dar city in Ethiopia is not an exception to this, as rapid growth of urbanization and high population growth causes land use and land cover change. Therefore, monitoring LULC change is important for sustainable future urban development. The objective of this study is to define how the land cover and land use changes through time and how much intrusion of urban area to the LULC by using remote sensing and GIS techniques. To achieve this Landsat 4-5 TM and Landsat 8 OLI images were used from 1987 to 2020. TM 1987, TM 1999 TM 2010 and OLI 2020 images were analyzed by using Quantum GIS. Results shows that urban area is expanded rapidly since 1987. In 1987 most of Bahir Dar city area was covered by open spaces (crop lands) while the urban and industrial areas were concentrated in the center of the city. Wetland vegetations cover the area along the river. In 1999 the built-up areas increased horizontally with a coverage of 788.58 ha. In this year the three classes were increased except open field. In the year 2010 the built-up area shows a dynamic increase from 788.58 ha to 1938.24 ha area coverage. In the same year water bodies and open fields decreased while forests become higher. In 2020 the built-up areas and the forests become higher in area coverage compared to 2010.

Flash floods and stormwater management on the example of Kecskemét

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Nowadays, flash floods caused by heavy rainfall not only threaten mountainous and hilly areas, but also lowland settlements. Intense rainfall of 50-60 mm in 12-24 hours is unmanageable for urban sewerage systems. However, the large amounts of precipitation falling at once – and drained from the area – will be absent from the system in the coming weeks and months. This is why it is a priority to develop and operate an urban stormwater management system that focuses not on runoff, but on retention and treatment of precipitation. Water retention systems are now an essential part of adapting to the negative impacts of climate change.

In our research, we use the example of Kecskemét, a city in the Hungarian lowlands, to illustrate the problems caused by the increasing frequency of heavy rainfall and one possible way of managing flash floods. Rain gardens are artificially created and planted areas of deeper ground to capture, temporarily store and filter rainwater. These surfaces are an effective method of stormwater management.

Kecskemét currently has three rain gardens, which could be complemented by additional rain gardens, mainly in areas most affected by flash floods. In our work, we analyse one of the city's most prominent location and demonstrate the potential of rain gardens.

The Influence of the Drava River on the Danube River's Discharge at Bogojevo Gauging Station Based on Extreme Discharge Values from 1931 to 2012

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It is known that the confluences of rivers have an impact on the main river's characteristics. This study is focused on the statistical analysis of the Danube River's discharge at Bogojevo gauging station, located about 15 km from the Drava River's mouth. Daily data for discharge were obtained at Bogojevo gauging station from 1931 to 2012. The data was analyzed in Caliza – software for analysis and risk estimation of extreme events. After the analysis, the extreme discharge values were compared to the time of floods of the Drava River and to the discharge data from two other upstream gauging stations. This comparison shows that extreme discharge values at Bogojevo gauging station occur at the same time as the floods of the Drava River. On the other hand, extreme discharge values of the two upstream gauging stations are very similar to each other, but differ from the ones at Bogojevo. Therefore, it can be concluded that the mouth of the Drava River influences the discharge of the Danube River.

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Application of Sentinel-1 SAR imagery for near real-time flood mapping

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Flood monitoring plays a crucial role in hazard management and loss reduction. During the last decade, remotely sensed data have been used widely for flood monitoring as well as flood mapping. We utilized Sentinel-1 synthetic Aperture Radar (SAR) imagery to identify flooded/inundated areas along the Kashkan river in the Zagros Mountain range, Iran. The average annual discharge of the Kashkan river is measured at 33.2 cubic meters at the Kashkan bridge station. The length of the Kashkan river in the study area is about 100 km. In March and April 2019, three flooding events occurred in the study area. To extract flooded/inundated extend from SAR imagery, we used the OTSU threshold segmentation method. OTSU thresholding is an algorithm to determine the threshold of binary classification. For pre-processing and processing steps, we used SNAP and MATLAB software. Flood map of the March 25th showed that with a daily average precipitation of 47.46 mm, 6.51 percent of the study area was flooded/inundated. on March 31st the daily average precipitation was 31.64 mm. flood maps showed that 3.96 percent of the study area was flooded on March 31st. Results also showed that meanders are the most flood-prone sections of the study area. Results revealed that Sentinel-1 SAR imagery are useful tools for near real time flood mapping.

Rainfall Erosivity in the Western Balkans – Towards a Sustainable Soil Erosion Evaluation and Control

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Estimation of rainfall erosivity (R-factor) is essential for understanding the complex relationships between hydrological and soil erosion processes. Therefore, the two main objectives of this research were to estimate the spatial-temporal rainfall erosivity across the Western Balkans (WB) region by applying the RUSLE and RUSLE2 methodology with data for the period 1991–2020 and to apply cluster analysis to identify the places of greatest erosion risk. To achieve these goals, the ERA5 reanalysis with hourly precipitation data resolution was used. The research showed that: 1) hourly precipitation intensity and monthly precipitation totals exhibit pronounced variability over the study area, with highest values observed in the SW (>0.3 mm h^{-1} average), while the least precipitation was seen in the Pannonian Basin and on the far south (0.1 mm h^{-1} average); 2) R-factor variability was very high for both the RUSLE and RUSLE2 methods. The mean R-factor calculated by RUSLE2 was 790 MJ mm ha^{-1} h^{-1} yr^{-1}, a 58% higher than the mean R-factor obtained from RUSLE (330 MJ mm ha^{-1} h^{-1} yr^{-1}). The analysis of the R-factor at decadal timescales suggested a rise of 14% in the 2010s; 3) the k-means algorithm generated maps of homogeneous areas for the R-factor values. This study also provided useful information for more detailed and dynamic soil erosion assessments, as well as for the analysis of extreme erosive events on a regional scale. The rainfall erosivity maps presented in this research can be seen as useful tools for the assessment of soil erosion intensity and erosion control works, especially for agriculture and land use planning. As the RUSLE-type models have been extensively used as the most employed erosion-by-water modeling tool during the past decades, parameters as the R-factor are key features for the estimation of soil-erosion rates in the WB region.

Adapting to Changing Hydro-Climatic Patterns: Evaluating Future Climate Scenarios for the Problem of Waterlogging in the Pannonian Basin

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Despite the trend of decreasing precipitation amount and receding groundwater levels in the Pannonian basin in the last three decades, the problem of waterlogging still represents a significant challenge, mainly due to the changes in seasonal distribution of rainfall and increase in rainfall intensity.
This study evaluates the potential impact of future climate scenarios on the problem of waterlogging in the region. The study analyses multiple climate models and future scenarios based on the IPCC's Representative Concentration Pathways (RCPs) to understand potential changes in precipitation patterns and temperature, which are the two main climatic factors affecting waterlogging.
The results indicate that the Pannonian Basin is likely to experience an increase in precipitation intensity in the winter-spring season, creating conditions for waterlogging. The findings confirm that adaptation measures are relevant and necessary and improvements in soil drainage, water retention for dry periods and sustainable land use practices will remain important in the future.

Keywords: waterlogging, precipitation, climate change, Pannonian-basin

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The impact of land use and climate change on Syria

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Natural hazards are one of the major challenges for sustainable development in any country, but the consequences will be severe in a country like Syria, which is already suffering from an ongoing armed conflict.
Using remote sensing (Sentinel-2 and Landsat satellite imagery), this study examines changes in land use/land cover changes before and during the Syrian conflict in two different parts of the country (the Euphrates River Basin and the Salamiyeh district). It also assesses the expected changes in temperature, precipitation, solar radiation and cloud cover characteristics over Syria under a moderate emissions scenario (RCP4. 5) and a high emissions scenario (RCP8.5) for the near future (2031-2050) and for the distant future (2080-2099) based on four regional climate model simulations obtained from the CORDEX initiative.
The results within the Euphrates River Basin showed that the area was affected by an overall decrease in water bodies and green cover, and that the rate of change was higher during the period of the Syrian conflict (periods of (2003 - 2011) and (2011 - 2019)). These findings were also reflected in the results for the actual cultivated area within the Salamiyeh district over almost the same period.
On the other hand, the regional climate model simulations show a pronounced warming over Syria, which is expected to reach 6°C by the end of the 21st century under the high emissions scenario (RCP8.5), while the results for solar radiation vary between seasons and locations across the country under both scenarios. Furthermore, the simulations analysed also show a decreasing trend in cloud cover (up to 10%) and precipitation (up to 9%) by mid to late century, regardless of the forcing scenarios.
Such an increase in these variables, combined with a decrease in precipitation, will shift Syria's climate towards a more arid one.

Evaluation and prediction of climate change conditions using the Mann-Kendall test and LarsWG model in Gorganrood Basin, Iran

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For studies on the impacts of climate change, it is crucial to understand how well stochastic weather generators can simulate daily climate scenarios. In order to achieve the goals of this research, one of the outputs of the Atmosphere-Ocean General Circulation Models (AOGCM) has been used. The LARS-WG software is one of the most famous models for stochastic weather generator data. In this study, first, the trend of precipitation, maximum & minimum temperature, and runoff for the base period was investigated using the non-parametric Mann-Kendall test. Then, the Lars WG and HadCM3 models under the SRA1B scenarios related to IPCC were used for simulating the study area. Ten stations in the Iranian Gorgranrood basin were part of the experiment, which used the years 2007–2011 as the baseline climate period and the years 2011–2044 as the changing climate period. The most significant temperature increase changes are in June, August, and February, which shows that it will be hotter in the coming periods. Still, April and May will have a decrease in temperature. In all the stations except Minodasht, Aliabad, and Bandargaz, we will witness an increase in the monthly temperature during the study period. At the same time, the rainfall changes in Inchebroon and Marave Tapeh stations will decrease, and in other stations, we will see an increase in rainfall compared to the base period. The highest increase in monthly rainfall simulated by the HadCM3 model is 100 mm for the SRA1B scenario in November, which is more than three times the base rainfall in the study area. The percentage of monthly changes in runoff under RCP4.5, RCP2.6, and RCP8.5 scenarios show the runoff increase in half of the months of the year for the future. Most are related to March, with an increase of 54%.

Anthropocene rivers - case study in NW Romania

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Climate models suggest that the NW region of Romania will become wetter over the years and warmer in winter, both likely leading to an increase in flood frequency. This could lead to increased risks to human settlements and activities, most of which are located in large floodplains that cross the region. To prevent them, flood risk management strategies extensive flood protection structures for the near future. Additionally, hydropower is listed as an environmentally friendly alternative to fossil energy, while aggregate channel and floodplain mining is expected to grow to support large-scale construction projects in Romania and the surrounding region. All these projections and scenarios suggest the imminence of a new wave of intensive pressure on the rivers in this area.
To better understand appropriate management measures, we argue for the need to place the current state of rivers and their possible future trajectories in a broader historical context. We exemplify this idea by discussing the current morphodynamics of the rivers in the Someș hydrographic basin in the context of the Holocene fluvial dynamics. In a first attempt to define the characteristics of the Anthropocene rivers in this region, the key aspects addressed here are the definition of the natural reference dynamics and the relationship of the present-day fluvial trends to them.

Comparative evaluation of the material of the artificial levees: a case study along the Tisza and Maros Rivers, Hungary

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Artificial levees are important in protecting human lives and infrastructure as they are essential to flood protection measures. Nevertheless, lacking information about their structure and internal composition might cause high risks. To monitor their stability, integrated surveys are needed, including geophysical and geotechnical methods. Levees along the rivers in Hungary were constructed more than 150 years ago and were heightened several times; therefore, investigations are required to assure their performance in flood risk mitigation. Our investigation aimed to utilise non-invasive geophysical techniques, primarily electrical resistivity imaging, and Ground Penetrating Radar with the validation of a geotechnical method to map and compare the compositional and structural variations of two very different levee sections and check the levee health along River Tisza and River Maros. Integrating the analysed drilling data with ERT and GPR profiles enabled to provide of information about the structure of the levees and the interfaces between different layers and also showed that the main composition of the investigated Tisza levee section is fine and medium silt with an average resistivity 30 Ωm; however, the investigated section of Maros levee was built of not only of fine and medium silt but also of medium and coarse sand exhibiting higher resistivity values reaching up to 2200 Ωm. Several physical parameters were measured to study the nature of constituting levee materials, like moisture content, grain size, porosity, bulk density, saturated hydraulic conductivity, and resistivity. It was found that most of them show a connection with resistivity, but the hydraulic conductivity did not show a direct connection; however, the latter could exhibit the aquitard nature of Tisza levee materials and the non-aquitard nature of Maros levee materials.

Investigation of the spatial changes in overbank floodplains on the pilot reach of the Middle-Tisza

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The major regulatory works of the Tisza River began more than 150 years ago. Since then a 1.5 m rise in flood levels was experienced until the end of the 20th century. Based on the surveys between 1929-31 and 2019, it can be concluded that, overall, the river regulation works achieved their goal, the river is almost in a state of equilibrium, although the sections with free development continue to show morphological changes.
The main result of the study is a numerical estimate of siltation in the (active) floodplain in the period since the turn of the millennium. The accumulation can be estimated well based on the DTM available on the examined pilot reach. Two digital terrain models served as the basis of the investigation. After analyzing the recordings, it can be concluded that the degree of accumulation is the most intense near the main riverbed, which can reach 1.0-2.5 m in some places. The negative effect of summer dams can also be clearly demonstrated. Based on the two DTMs, these can be characterized by an increase rate of 1.9 cm/year in the left overbank and 1.6 cm/year in the right overbank areas.
Based on the above, if this rate continues, an increase in the occurrence of natural hazards from the increase in flood levels can be expected. In order to ensure satisfactory flood safety and to keep flood risks at a tolerable level, comprehensive, complex flood protection strategies are necessary. In addition, it is clear that the measurement of the suspended and bedload of the river needs to be intensified in space and time, using up to date, state of the art equipment and methodology.

Suburbanization within City Limits - Hidden land use changes

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Suburbanization is one of the most prominent processes of post-socialist urban development. This phenomenon has a significant impact on the traditional rural landscape and leads to environmental and social sustainability challenges. Outmigration from the city center to the rural municipalities of the agglomeration ring is already a thoroughly studied topic. However, less attention is given to migration processes not crossing municipal borders.

Because of the general lack of data, this phenomenon is seldom researched. However, this study attempts to address this gap. The prevalence of this process in Hungary is explored by analyzing national statistical data sources. Four case studies are selected for detailed examination — Győr, Zalaegerszeg, Kecskemét, and Szeged. GIS methods, field examinations, surveys, and expert interviews are used to get a detailed picture of the demographic and land cover change processes, as well as the distinctions between the destination areas of the case studies.

A comparison of the results drawn from the different methods reveals that land use change in the study area is more widespread than what the land cover datasets indicate. The findings indicate that the Corine Land Cover categories describing mixed land use — especially complex cultivation patterns — are not able to capture the drastic function shift caused by intense suburbanization.

The effects of an extreme water scarcity period on the water supply of the Middle Tisza region

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Climate change takes more and more challenges to the water management. The prevalence of the droughts has increased over the past decades, and especially the rolling drought phenomena have become critical when consecutive years of drought multiply the adverse effects of previous years. These new extreme hydrological situations need to be properly handled and an additional task of the water management can be the fulfilment of the increasing water demands.
The water scarcity period of 2022 highlighted that we need to adapt to these new conditions. The incoming water supply from the upper part of the river basin was not sufficient to meet the needs, which also resulted in a unique hydrological situation. The availability of an adequate amount of water is also critical because of the drinking water supply of Szolnok. The poster presents the reasons for the development of this special hydrological event.
Kisköre barrage plays an important role in the water supply of lowland areas in Hungary. During the period of water shortage, a special operating schedule was necessary, in addition to ensuring the ecological water yield, they could also meet the emerging water demands. The poster shows these special measures that were important during the drought period.

Nature-based solutions for improving drainage systems in Vojvodina, Serbia

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Presence of the drainage system in Vojvodina creates part of the conditions required for stable plant production. Occurrences of extreme amounts of excess water in the last decades, as consequence of climate change, are an increasingly common occurrence, creating the need to increase the efficiency of the drainage system. In the whole process, nature-based solutions for improving drainage systems can get a significant and multi-useful place. The biggest problem in their introduction is overcoming the correction of the existing technical approach in land reclamation, but also in agriculture. The basic idea of reducing the inflow of excess water into the canal network is the application of nature-based solutions and riparian buffers as supplementary melioration measures on certain areas. The factors on the basis of which a decision would be made on the areas on which nature-based solutions for improving drainage systems will be implemented primarily depend on the threats to the soil by water. By identifying the key factors and their adequate evaluation, the classification and mapping of the most suitable areas for the application of nature-based solutions for improving drainage systems can be carried out. In this paper the area suitable for the establishment of nature-based solutions (along the watercourse) will be obtained by applying GIS methodology, by overlapping different layers. The layers used are pedological map, digital model of the relief – land slope, land use and drainage classes. The drainage system "Plavna" was chosen as an example of one of the larger watershed areas in Vojvodina, where it would be shown how, nature-based solutions can use for improving drainage systems with the application of GIS. It would be possible to reach areas that could be used not only for increasing the efficiency of that system, but also for optimal afforestation of the area and increase in biodiversity.

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