

ROMANIAN ASSOCIATION OF GEOMORPHOLOGISTS

REVISTA DE GEOMORFOLOGIE

24

SPECIAL ISSUE 1

PROCEEDINGS OF THE 37TH ROMANIAN NATIONAL SYMPOSIUM
ON GEOMORPHOLOGY

**GEOMORPHOLOGY UNDER MODERN CHALLENGES:
UNCERTAINTIES AND PERSPECTIVES**

Sinaia, 15-19 June, 2022



editura universității din bucurești®

2022

Revista de Geomorfologie 24(1)/2022

Editor-in-Chief:

Maria Rădoane, University of Suceava, Romania

Editorial Board:

Achim Beylich, Geological Survey of Norway
Armelle Decaulne, Université de Nantes, France
Aurel Perşoiu, Institute of Speology Emil Racovita, Romania
Ciprian Mărgărint, Al I Cuza University of Iaşi, Romania
Dan Dumitriu, Al I Cuza University of Iaşi, Romania
Daniel Germain, Université du Québec à Montréal, Canada
Dănuţ Petrea, Babeş Bolyai University of Cluj-Napoca, Romania
Floare Grecu, University of Bucharest, Romania
Florin Pendea, Lakehead University, Orillia, Canada
Florin Tătui, University of Bucharest, Romania
Hans-Balder Havenith, Université de Liège, Belgium
Ian Evans, Durham University, United Kingdom
Jean-Philippe Malet, Université de Strasbourg, France
Laura Comănescu, University of Bucharest, Romania
Lucian Drăguţ, West University of Timisoara, Romania
Marta Jurchescu, Institute of Geography, Romania
Mauro Soldati, Università degli Studi di Modena e Reggio Emilia, Italy
Mihai Micu, Institute of Geography, Romania
Mihai Niculiţă, Al I Cuza University of Iaşi, Romania
Mircea Voiculescu, West University of Timisoara, Romania
Nicolae Cruceru, Institute of Speleology Emil Racovita, Romania
Olimpiu Pop, Babeş Bolyai University of Cluj-Napoca, Romania
Paola Reichenbach, Istituto di Ricerca per la Protezione Idrogeologica, Consiglio Nazionale delle Ricerche, Italia
Petru Urdea, West University of Timisoara, Romania
Piotr Gebica, University of Rzeszów, Poland
Philip Deline, Université de Savoie, France
Sandu Boengiu, University of Craiova, Romania
Sipos Gyuri, University of Szeged, Hungary
Sunil Kumar De: North Eastern Hill University, India
Zofia Raczkowska, Institute of Geography and Spatial Organization, Poland

Cover Photo: Florin Tătui, Florin Zăinescu, Mirela Vasile

DTP: Meri Pogonariu

Address: Şos. Panduri, 90-92, Bucureşti – 050663, România,
Phone/Fax: (0040) 021.410.23.84, E-mail: editura.unibuc@gmail.com,
Online bookshop: <http://librarie-unibuc.ro>,
Sale point: Bd. Regina Elisabeta, nr. 4-12, Bucuresti,
Tel. (0040) 021.314.35.08/2125,
Web: www.edit.unibuc.ro
ISSN 1453-5068
ISSN online 2285-6773
©2022 Revista de geomorfologie. All rights reserved.

CONTENTS

ABSTRACTS

Permafrost and large slope instabilities – observations, models and implications

Bernd ETZELMÜLLER..... 6

The geomorphological sensitivity of mountain systems

Jasper KNIGHT 7

Rock slope failures in Rodna Mountains, Northern Romanian Carpathians

Anişoara FILIP, David JARMAN, Marcel MÎNDRESCU 8

Using the morphometric parameters to study the influence of the drainage on the micro depressions in the Sălcuța Plain

George TĂNASE, Sandu BOENGIU, Cristiana VÎLCEA 9

A review on earthquake-induced landslide hazard in Vrancea seismic region: necessity, uncertainties and perspectives

Mihai MICU, Hans-Balder HAVENITH, Dana MICU 10

Drilling and coring in Detunata low altitude talus slope, Apuseni Mountains

Răzvan POPESCU, Alfred VESPREMEANU-STROE, Mirela VASILE, Sabina CALISEVICI, Ilie ANDRIAN 11

The distinctive behavior of rock glaciers in marginal periglacial environment of Southern Carpathians

Alexandru ONACA, Flavius ȘÎRBU, Christin HILBICH, Valentin PONCOS, Răzvan POPESCU, Tazio STROZZI, Petru URDEA, Bernd ETZELMÜLLER, Alfred VESPREMEANU-STROE, Adrian-Cristian ARDELEAN, Oana BERZESCU, Mirela VASILE, Delia TELEAGĂ, Dan BIRTAȘ, Iosif-Otniel LOPĂȚIȚĂ..... 12

Using tree-rings to detect recent landslide reactivations. Case study: Balta Landslide, Buzău Mountains

Patrick CHIROIU, Alexandru ONACA, Denisa MUSZKOPF, Oana BERZESCU 13

Control factors of accidents/incidents and associated natural hazards along tourist trails in the Bucegi Mountains, Southern Carpathians

Mihai JULA, Mircea VOICULESCU 14

Permafrost mapping using spring water temperature in the Retezat Mountains

Oana BERZESCU, Alexandru ONACA, Petru URDEA..... 15

Dendrogeomorphic reconstruction of debris-flow activity in Călimani Mountains (Eastern Carpathians, Romania)

Andrei RUSU, Olimpiu POP..... 16

Quantification of the grain-size of debris deposits as a key factor in the distribution of alpine permafrost in marginal periglacial environments

Ilie ANDRIAN, Răzvan POPESCU, Flavius ȘÎRBU, Alfred VESPREMEANU-STROE 17

Rock glaciers formation chronology derived from relative and absolute dating in the Southern Carpathians

Mirela VASILE, Alfred VESPREMEANU-STROE, Răzvan POPESCU, Daniela PASCAL, Ilie ANDRIAN 18

Geospatial analysis and mapping of snow avalanche susceptibility in Piatra Craiului Massif, Romania

Mara ȘERBĂNUCĂ 19

InSAR based inventory of landslides and salt movements in the diapiric area between Prahova and Varbilau (valleys)

José Jorge CARACHEO-GONZÁLEZ, Mihaela Violeta GHEORGHE, Iuliana ARMAŞ	20
Multirisk assessment in protected natural areas in Romania	
Sanda ROŞCA, Ştefan BILAŞCO, Carmen GHEORGHE, Ana Maria CORPADE, Sorin AVRAM.....	21
Erosion patterns over the Holocene in the central and southeastern Romanian lowlands. First results from the HoLFloods project	
Gabriela FLORESCU, Marcel MÎNDRESCU, Gheorghe BĂDĂLUŢĂ, Simon M. HUTCHINSON, Angelica FEURDEAN.....	22
Current riverbed dynamics and implications for imminent risk management	
Florina GRECU, Benabbas CHAOUKI, Robert DOBRE, Adriana ILIE, Yakhlefoune MANEL.....	24
¹⁰Be surface exposure dating: a technique used in reconstruction of glacial chronology. Results from Făgăraş Massif, Southern Carpathians.	
Daniela Pascal, Alfred Vespremeanu-Stroe, Mihaela Enăchescu, Régis Braucher, Răzvan Popescu, Alexandru Petre, ASTER Team	25
Late Quaternary fluvial history in the Someş drainage basin	
Ioana PERŞOIU	26
Warming climate conditions during the last ~33 ka recorded in sacking deposits of the Făgăraş Mountains	
Maria-Laura TÎRLĂ, Virgil DRĂGUŞIN, Ionuţ-Cornel MIREA, Laurenţiu ȚUȚUIANU, Tiberiu Bogdan SAVA, Alexandru Gabriel CĂLIN	27
Holocene sea-level oscillations and the lower Danube floodplain response (the sector between Brăila and Tulcea)	
Laurenţiu Țuţuianu, Alfred VESPREMEANU, Diana HANGANU, Mihaela DOBRE, Tiberiu SAVA, Sabin ROTARU, Luminița PREOTEASA, Cristian PANAIOTU	28
Detection and delineation of karst sinkholes and aeolian closed depressions from Romania	
Mihai NICULIȚĂ.....	30
Geomorphometric delineation of the channels and floodplains from the Moldavian Plateau	
Nicușor NECULA, Mihai NICULIȚĂ	31
Flood event efficiency index Dan DUMITRIU.....	
32	
Hydro-geomorphological implications of hydrographic basins morphometric parameters characteristics. Application to Suceava River hydrographic basi	
Vasilică-Dănuț HORODNIC, Petruț-Ionel BISTRICEAN, Francisca CHIRILOAEI.....	33
The genesis and evolution patterns of the large fluvial deltas. Examples from Danube Delta and connections with other deltaic systems	
Alexandru BERBECARIU, Alfred VESPREMEANU-STROE.....	34
Radiometric method for assessing the erosion-accretion status of the sedimentary coasts	
Dragoș MARIN, Alexandru BĂLĂCEANU, Radu MANU, Elena VLĂSCEANU, Dragoș NICULESCU, Răzvan MATEESCU ..	35
Rip currents dynamics on the Romanian Black Sea coast revealed by field experiments and numerical modelling	
Florin TĂTUI, Florin ZĂINESCU, Florin MIRON, Alfred VESPREMEANU-STROE, Răzvan MATEESCU	36
Geoelectrical Resistivity Variations of Sedimentary Ground Induced by Geomorphological and Meteorological Conditions (Romania)	
Andreea ANDRA-TOPARCEANU, Mihaela VERGA, Mihai MAFTEIU	37

Permafrost and large slope instabilities – observations, models and implications

Bernd ETZELMÜLLER

Department of Geosciences, University of Oslo, Norway

*Correspondence to: Bernd ETZELMÜLLER; e-mail: bernd.etzelmuller@geo.uio.no

Large unstable rock slopes (LURS) are common in formerly and present glaciated mountain environments. Many of these instabilities started moving or failed shortly after deglaciation due to debutressing. However, many LURS failed long after deglaciation or showed varying creep velocities during Holocene. This has been partly attributed to warming and thawing of permafrost, which might influence rock slope stability. This presentation reviews recent studies on the relation of permafrost distribution and rock slope stability in Norwegian mountains, summarizing new observations, models and interpretations, in cooperation with the Norwegian Geological Survey (NGU), The Norwegian Water and Energy Directorate (NVE), University College of Western Norway, Technical University in Munich (Germany), University of Tromsø and EDTYM (France).

KEYWORDS rock slope stability, permafrost, Norway

The geomorphological sensitivity of mountain systems

Jasper KNIGHT

School of Geography, Archaeology & Environmental Studies, University of the Witwatersrand,
Johannesburg 2050, South Africa

*Correspondence to: jasper.knight@wits.ac.za

The responses of mountain geomorphic and sediment systems to climate change are highly variable over time and space, and depend on a range of climatic, geologic and geomorphic factors. There are also significant differences between the workings of mountain systems that are not glaciated and those that are. The concept of geomorphological sensitivity can help explain the nature and dynamics of mountain system responses to climate change, and this concept includes consideration of key systems' properties such as response time, relaxation time, and feedback. In detail, this study explores the causes and nature of geomorphological sensitivity in mountains, and then provides specific examples of geomorphic and sediment system changes within mountains caused by mountain deglaciation and the onset of paraglacial process regimes. Implications for the generation (and then the preservation) of relict geomorphological features and for the dynamics of mountain sediment systems are then highlighted. Key ideas of geomorphological sensitivity and tipping points can be used to predict trajectories of geomorphic change in mountains in the Anthropocene, and this shows both the importance and the application of these concepts in understanding climate change impacts in mountains.

KEYWORDS climate change, deglaciation, mountain geomorphology, paraglacial, sediment systems

Rock slope failures in Rodna Mountains, Northern Romanian Carpathians

Anișoara FILIP^{1*}, David JARMAN², Marcel MÎNDRESCU¹

¹Geography Department, Ștefan cel Mare University, Suceava, Romania

²Mountain Landform Research, Ross-shire, Scotland

*Correspondence to: Anișoara FILIP; e-mail: anisoarafilip990@gmail.com

Rock slope failures (RSFs), including rock slope deformations (RSDs), are commonly found throughout the high belt of mountain ranges, especially the formerly glaciated ones. The present contribution presents the results of a systematic inventory of RSFs and RSDs in the Rodna Mountains (Northern Romanian Carpathians) which totals over 150 significant affected areas. The inventory was conducted using present and historical satellite imagery available in Google Earth Pro as a detection tool and ground-truth checks. GIS-based geomorphological mapping reveals multiple types of RSFs (rockslides, rock avalanches, failed plateaus and saddles, and RSDs, with frequent splitting ridges, antiscarps, and other indicators) and evaluates the spatial incidence of all modes of RSF, with consideration for influential factors, such as geological aspects and paleoenvironmental evolution of the region. While larger RSFs are complex, difficult to delineate and categorize, conditions in Rodna Mountains favoured the formation of RSF sites up to 1.5 km², with some of the RSD features exceeding 1 km in length. The RSF density patterns helped to define a series of hotspots with multiple RSF modes which occur at sites close to areas where Pleistocene cirque and trough glaciers were active on both sides of ridges, at high altitude. RSF occurs predominantly in micaschists and paragneisses. Moreover, the RSF incidence resembles the north-south asymmetry noted for glacial landforms and activity, with a high number of RSFs on the northern slopes. The majority of RSFs are deduced to be the result of postglacial/paraglacial topographical adjustment of the terrain, as scenarios of landscape evolution could be inferred from observed patterns and previous dating results. Indirect evidence suggests that RSDs were more prevalent in the early Holocene, given the impact of the thermal contrast and erosional activity, while other forms of RSF were more active later on, with the vegetation gaining altitude. The lakes formed in some of the RSF trenches are important for their potential as paleoenvironmental archives.

KEYWORDS: rock slope failure, rock slope deformation, paraglacial geomorphology, Northern Romanian Carpathians

Using the morphometric parameters to study the influence of the drainage on the micro depressions in the Sălcuța Plain

George TĂNASE^{1*}, Sandu BOENGIU¹, Cristiana VÎLCEA¹

¹Geography Department, Faculty of Sciences, University of Craiova, Romania

*Correspondence to: George TĂNASE; e-mail: georgetanase18@yahoo.com

The main objective of this study is to establish the drainage pattern and what is the impact of this drainage regime on the micro depressions formed in the loessoid deposits located in Sălcuța Plain. The drainage regime was established using the morphometric parameters like plan curvature, profile curvature, tangential curvature and convergence/ divergence index. The morphometric parameters were generated using SAGA GIS 7.8.0 using a digital elevation model with a 5 meters spatial resolution. After generating the parameters, the resulted grids had been exported in GeoTiff and projected in Pulkovo 1942(58) / Stereo70 - EPSG 3844. QGIS 3.22 was used to make the final maps representing the above-mentioned parameters. Google Earth Pro and images from 2019 were used to identify and digitize the micro-depressions. The resulted polygons were reprojected in Pulkovo 1942(58) / Stereo70 - EPSG 3844 using QGIS 3.12. The same software was used to calculate the main morphometric parameters of the micro-depressions using the previously obtained polygons. 143 micro-depressions had been identified in the studied area with a average area of 0.04 km², an average perimeter of 0.74 km, a minimum average extension of 0.15 km and a maximum average extension of 0,28 km. The average values of circularity of 0.08, 0,80 and 0,53 corresponding to the circularity ratio, elongation ratio and of the shape factor indicate the fact that the micro-depressions have a less circular shape and elongated on the west-east direction. In the eastern and western area corresponding to the valleys that section perpendicularly the slopes of the Jiu and Desnățui rivers, there is an accelerated drainage regime, their shape being convex, the values of the curvature in profile being close to -1 radian. At the level of micro depressions and in their vicinity, the values of the indicators, curvature in plan, curvature in profile, tangential curvature and convergence / divergence index have an average value close to 0, hence it follows that water from precipitation tends to accumulate.

KEYWORDS: micro depression, loess, curvature in plan and in profile

A review on earthquake-induced landslide hazard in Vrancea seismic region: necessity, uncertainties and perspectives

Mihai MICU^{1*}, Hans-Balder HAVENITH², Dana MICU³

¹Institute of Geography, Romanian Academy, Bucharest, Romania

²Department of Geology, Liege University, Liege, Belgium

³National Meteorological Administration, Bucharest, Romania

*Correspondence to: Mihai MICU; mikkutu@yahoo.com

In seismically-active regions, earthquakes may trigger landslides enhancing the short-to-long term slope denudation and sediment delivery and conditioning the general landscape evolution. Co-seismic slope failures present in general a low frequency - high magnitude pattern which should be addressed accordingly by landslide hazard assessment, with respect to the generally more frequent precipitation-triggered landslides. The Vrancea seismic region, corresponding to the curvature sector of the Eastern Romanian Carpathians, represents the most active intermediate-depth (focal depth > 70 km) earthquake province of Europe. It represents the main seismic energy source throughout Romania with significant transboundary effects recorded as far as Ukraine and Bulgaria. During the last 300 years, the region featured 13 earthquakes with $M > 7$, among which seven events with magnitude above 7.5 and three between 7.7 and 7.9. Apart from the direct damages, the Vrancea earthquakes are also responsible for causing numerous other geohazards, such as ground fracturing, groundwater level disturbances and possible deep-seated landslide occurrences (rock slumps, rock-block slides, rock falls, rock avalanches). The older deep-seated landslides (assumed to have been) triggered by earthquakes usually affect the entire slope profile. They often formed landslide dams strongly influencing the river morphology and representing potential threats (through flash-floods) in case of lake outburst. Despite the large potential of this research issue, the correlation between the region's seismotectonic context and landslide predisposing factors has not yet been entirely understood. Presently, there is a lack of information provided by the geohazards databases of Vrancea that does not allow us to outline in details the seismic influence on the triggering of slope failures in this region. We only know that the morphology of numerous large, deep-seated and dormant landslides (which can possibly be reactivated in future) with head scarps near mountain tops and close to faults is similar to the one of large mass movements for which a seismic origin is proved (such as in the Tien Shan, Pamir, Longmenshan, etc.). Thus, correlations between landslide occurrence and combined seismotectonic and climatic factors are needed to support a regional multi-hazard risk assessment. The purpose of this paper is to outline the current knowledge level and to draw the attention towards the need to open new and consistent perspectives to the research needs in the field of multi-hazard risk, as acknowledged by the *Sendai Framework for Disaster Risk Reduction* (SFDRR): the construction of quantitative evaluations for a more accurate assessment of multi-hazard exposure/vulnerability/risk as needed for the development of knowledge and innovation to build a risk resilient culture.

KEYWORDS Curvature Carpathians, Vrancea, earthquakes, landslide hazard

Drilling and coring in Detunata low altitude talus slope, Apuseni Mountains

Răzvan POPESCU^{1*}, Alfred VESPREMEANU-STROE¹, Mirela VASILE², Sabina CALISEVICI¹, Ilie ANDRIAN¹

¹Faculty of Geography, University of Bucharest, Bucharest, Romania

²University of Bucharest Research Institute, University of Bucharest, Bucharest, Romania

*Correspondence to: Răzvan POPESCU; e-mail: razvan.popescu@geo.unibuc.ro

Detunata Goală is a talus slope-rock glacier landform characterized by persistent snow and ice during springtime and summer in spite of a mean annual air temperature of around +7°C. This is a porous talus made of andesitic basaltic columns affected by chimney circulation that seems to allow for an extrazonal permafrost of low altitude in a temperate climate much lower than the regional limit of alpine permafrost. In the postdoctoral project FrozenCORE electrical resistivity tomography (ERT) and seismic refraction tomography (SRT) were applied in October 2020 in order to check permafrost presence at the end of the warm season and to determine the internal structure of the deposit. The two methods indicated contradictory results, as ERT indicated a high resistive layer in the first 10-15 m while the SRT indicated a high velocity layer at depths greater than 15 m. A borehole was drilled in June 2021 in the coldest sector of the scree and the cores recovered indicated that: 1) the talus is relatively thin, less than 13 m laying on top of sedimentary deposits such as clays and marls; 2) the deposit has a low amount of ice, several lenses were found between 3 and 10 m each of at most a few centimeters thick; 3) the scree porosity is relatively low, much smaller than at the surface. A thermistor chain was installed in the borehole at depths according to the GTN-P recommendations for future monitoring of the temperatures in the underground. Ice samples were collected from the cores for isotopic analyses in order to check if the ice from the greater depths is older than the upper one assumed to be seasonal. The drilling indicated that ERT and SRT have to be used in tandem in order to detect possible permafrost occurrences in the ground and that ERT is better in investigating internal structure of porous talus slopes.

KEYWORDS: low altitude permafrost, permafrost borehole, ERT, SRT, thermal monitoring

The distinctive behavior of rock glaciers in marginal periglacial environment of Southern Carpathians

Alexandru ONACA^{1*}, Flavius SÎRBU¹, Christin HILBICH², Valentin PONCOS³, Răzvan POPESCU⁴, Tazio STROZZI⁵, Petru URDEA¹, Bernd ETZELMÜLLER⁶, Alfred VESPREMEANU-STROE⁴, Adrian-Cristian ARDELEAN¹, Oana BERZESCU⁷, Mirela VASILE⁴, Delia TELEAGĂ³, Dan BIRTAȘ³, Iosif-Otniel LOPĂȚIȚĂ¹

¹Geography Department, West University of Timișoara, Timișoara, Romania

²Department of Geosciences, University of Fribourg, Fribourg, Switzerland

³Terrasigna, Bucharest, Romania

⁴Faculty of Geography, Bucharest University, Bucharest, Romania

⁵Gamma Remote Sensing, Gümlingen, Switzerland

⁶Department of Geosciences, University of Oslo, Norway

⁷Institute for Advanced Environmental Research, West University of Timișoara, Timișoara, Romania

*Correspondence to: Alexandru ONACA; e-mail: alexandru.onaca@e-uvr.ro

In marginal periglacial mountain regions, the permafrost occurrence is patchy and limited to those sites favorable for permafrost conservation. The behavior of rock glaciers in marginal periglacial environments, such as the Southern Carpathians, is poorly understood. To develop an in-depth understanding of the slow geomorphologic evolution of rock glaciers in the Southern Carpathians, we examined the correspondence between rock glaciers dynamics and permafrost distribution and characteristics in the Southern Carpathians. The dynamics of rock glaciers were measured using Persistent Scatterer Interferometry (PSI) on Sentinel-1 images between 2015 and 2020 and validated with in-situ GPS measurements with a Topcon Hiper V Differential GPS. BTS measurements, ground surface temperature monitoring and geophysical measurements were used to map permafrost occurrence in the Southern Carpathians. The analysis of radar satellite imagery revealed low displacement rates of a few cm/year in different parts of the investigated rock glaciers. In addition, we identified moving areas within several rock glaciers characterized by different movement signals. These low displacement rates obtained from remote sensing analysis were confirmed by ground-based GPS measurements conducted in the Retezat Mountains. We interpreted the estimated displacement rates as the creeping permafrost bodies. Displacement rates recorded in the Southern Carpathians are considerably lower than rock glaciers velocities reported elsewhere due to the very thin deforming permafrost layer. Recent geophysical measurements (electrical resistivity tomography and seismic refraction) confirmed that the frozen layers reach only a few meters thick in the Galeșu (Retezat Mountains) and Pietroasa (Făgăraș Mountains) rock glaciers. The results obtained from thermal measurements are consistent with the PSI analysis since the areas experiencing relatively slow movement correspond well with areas with low BTS values during the late winter. The distribution pattern of the permafrost related moving areas was compared with an existing permafrost distribution model in the Retezat Mountains, and we found an excellent spatial agreement.

KEYWORDS: permafrost, rock glaciers, displacement, Persistent Scatterer Interferometry, geophysics

Using tree-rings to detect recent landslide reactivations. Case study: Balta Landslide, Buzău Mountains

Patrick CHIROIU¹, Alexandru ONACA¹, Denisa MUSZKOPF¹, Oana BERZESCU¹

¹Department of Geography, West University Timișoara, Timișoara, Romania

*Correspondence to: Patrick CHIROIU; e-mail: patrick.chiroiu@e-uvv.ro

Landslides are slope processes which pose important threats to infrastructure and human activities causing, in some cases, even human fatalities. Knowledge about past occurrences is important in order to identify triggering factors and to design efficient warning and risk mitigation measures. Yet, in most landslide prone regions, data about past activity is sparse or completely missing. Therefore, proxy data is needed to acquire as much as possible information on this topic. Tree-rings represent an essential proxy for reconstructing landslide reactivations, therefore dendrogeomorphic studies have been employed in several mountain regions all over the world since the early 1970s. In the last decade, studies undertaken to ameliorate key methodological issues as well as the diversification of analyzed tree species expands the possibilities of the method. The present study aims to reconstruct landslide reactivations on the Balta landslide body, located in the Buzău Mountains (Curvature Carpathians, Romania). The Curvature Carpathians are acknowledged as one of the most landslide-affected regions in the Romanian Carpathians, being closely linked to the Vrancea seismic area. In June 2021 we sampled 30 *Fagus sylvatica* trees growing on the body of the landslide, as well as another 20 trees located in an unaffected area, to build a reference chronology. Affected trees were selected regarding their position on the landslide body and the visible irregularities in stem growth. The specific growth disturbances induced by landslides in broadleaved species are eccentric growth, growth suppression and tension wood. But because tension wood is visually hard to identify, we only used the first two mentioned growth reactions. Eccentricity was accounted based on the index defined by Wistuba et al. (2013). The results of our study indicate areas where reactivations have occurred in the last 100 years and areas with no landslide activity. At the same time, along with the possibilities of the method, the present study points on some of the difficulties in analyzing broadleaved species, especially *Fagus sylvatica*.

KEYWORDS landslide, dendrogeomorphology, tree-ring eccentricity, Buzău Mountains

Control factors of accidents/incidents and associated natural hazards along tourist trails in the Bucegi Mountains, Southern Carpathians

Mihai JULA^{1*}, Mircea VOICULESCU¹

¹Department of Geography, West University Timișoara, Timișoara, Romania

*Correspondence to: Mihai JULA; e-mail: mihai.jula88@e-uvv.ro

The Bucegi Massif is one of the most important mountain tourist areas in Romania, being visited annually by hundreds of thousands of tourists, according to INS data. During the hot season between May and September, tourist traffic is abundant, disorganized and does not respect the marked trails and the indications of the lifeguards. Our study was carried out in the sector managed by the Prahova Mountain Rescuer Public Services and which includes the Prahova escarpment of the Bucegi Mountains, the Bucegi Plateau and the high, glaciated area of the mountains. We took into account the most frequented tourist trails: Jepii Mari, Jepii Mici, Babele-Vf. Omu, Valea Cerbului-Vf. Omu, Babele-Peștera, along which a number of accidents/incidents and associated natural hazards occur. The analysis period is 2011-2020, from 1 June to 31 October. Accidents/incidents are under the control of a number of factors, grouped into: environmental factors such as relief by local morphology (steepness, fall, rock-barr), crumbly rocks, slope and residual snow; meteorological conditions (heavy precipitation, wind, fog, snow); equipment, and medical conditions. We focused on accidents/incidents caused by terrain conditions, which account for about 60% of the more than 800 records of public mountain rescue services statistics in association with meteorological factors (22% of the total), followed by equipment and medical conditions. Considering the morphology of the Bucegi Mountains, a significantly higher number of accidents/incidents were recorded in the area of the Prahova escarpment of the Bucegi Mountains than in the Bucegi Plateau (80.7% vs 19.3%, $p=0.03$). 78% of tourists were rescued after slipping on steep slopes or getting stuck on the trail, followed by falls from the steep with 14.4% and getting stuck in residual snow (7.6%). A percentage of 32.8% of casualties were recorded during ascent and 67.2% during descent respectively, of which 10 fatalities, mostly by slipping on steep slopes and/or falling into steep slopes or jumps. Correlatively, we also addressed the presence of natural hazards such as heavy rainfall, storms, summer snowfalls that impact the development of tourism practices.

KEYWORDS accident/incidents, natural hazards, relief, meteorological conditions, Bucegi Mountains, Southern Carpathians

Permafrost mapping using spring water temperature in the Retezat Mountains

Oana BERZESCU^{1*}, Alexandru ONACA², Petru URDEA²

¹Institute for Advanced Environmental Research, West University of Timișoara, Timișoara, Romania

²Geography Department, West University of Timișoara, Timișoara, Romania

*Correspondence to: Oana BERZESCU; e-mail: oana.berzescu@e-uvv.ro

Permafrost is the layer of soil or rock that remain at or below 0°C for at least two consecutive years. The measurement of spring water temperature during late summer (SWTS) is used to identify permafrost distribution in alpine regions. The water temperature was measured in the field using a digital (TFA 30.1027) thermometer. In addition, iButtons DS1922L miniature thermistors, installed in the springs were used for continuous monitoring. According to previous studies (Frauenfelder et al., 1998; Scapozza, 2009), water temperature above 2°C indicates the absence of permafrost, while a temperature between 1 and 2°C indicates the possible presence of permafrost, and a temperature below 1°C indicates that permafrost is probable. The current study displays results of measurements conducted in several valleys in the central part of the Retezat Mountains. The temperatures of springs seeping from the base of the rock glaciers front were measured over two consecutive years (2020 and 2021). Both the measurements made seasonally (summer/autumn) and the continuous monitoring of the springs recorded low temperature value (<2°C) in a few cases (e.g., Valea Rea, Judele, Pietrele). At the same time, we encountered situations in which a spring with a high flow and a temperature below the thermal limit of the permafrost springs, which was measured at the beginning of August, would be dried in September. As stated by Krainer et al. (2007), the springs of rock glaciers have four sources of water: groundwater, rain, snow and permafrost. Snow and permafrost are the primary sources that control the low spring temperatures. Due to the cooling effect of the persistent snow layer, spring water temperatures can be very low even in July in the Retezat Mountains. After snow melts, the presence of permafrost mainly controlling the low spring temperatures.

KEYWORDS: permafrost, spring water, rock glaciers, SWTS

REFERENCES

- Frauenfelder, R., Allgöwer, B., Haeberli, W. & Hoelzle, M. (1998). Permafrost investigations with GIS – a case study in the Fletschhorn area, Wallis, Swiss Alps. In *Permafrost, Proceedings of the Seventh International Conference, 23–27 June 1998, Yellowknife, Canada*, Lewkowicz AG, Allard M (eds), Collection Nordicana 57. Centre d'études Nordiques, Université Laval: Québec; 291–295.
- Krainer, K., Mostler, W. & Spötl, C. (2007). Discharge from active rock glaciers, Austrian Alps: a stable isotope approach. *Austrian Journal of Earth Sciences* 100: 102–112.
- Scapozza, C. (2009). Contributo dei metodi termici alla prospezione del permafrost montano: esempi dal massiccio della Cima di Gana Bianca (Val Blenio, Svizzera). *Bollettino della Società Ticinese di Scienze Naturali* 97: 55–66.

Dendrogeomorphic reconstruction of debris-flow activity in Călimani Mountains (Eastern Carpathians, Romania)

Andrei RUSU^{1*}, Olimpiu POP¹

¹Laboratory of Dendrochronology, Faculty of Geography, Babeş-Bolyai University, Cluj-Napoca, Romania

*Correspondence to: Andrei RUSU, andreiciprian.rusu25@gmail.com

In the last decades, an increasing of recreational activities is observed along several hiking trails in the central part of Călimani Mountains (Eastern Carpathians, Romania). Debris-flows (DFs) may repeatedly perturb the hiking trails frequented by tourists, particularly in the areas where channels intersect the hiking trails. One of the hiking trails named *Via Maria Theresia* was recently re-open for tourists on 42 km length following a segment of an historical road constructed in the 18th century during the Austro-Hungarian Empire period. In several points, DF channels intersect the hiking trail and consequently the tourist access is impeded. Because DF activity in these remote mountain areas is not monitored, records of past events is lacking. Indirect methods might provide information about the past frequency and spatial extent of such hazardous phenomena. Dendrogeomorphic approaches applied in various mountains areas worldwide have already proved to be useful to reconstruct DF history with an annual or even a seasonal resolution. In Călimani Mountains, such studies are lacking. The main objective of this study is to apply the dendrogeomorphic methods, in order to reconstruct DF activity along a debris-flow channel located in the central part of Călimani Mountains. Since 2007, a survey of changes in the channel's morphology was carried out by tacking successive cross-section measurements. Tree-ring samples were collected from trees living along the investigated channel and in the debris cone area and showing clear evidence of mechanical disturbances on stems and roots (abrasion scars, partially uprooted and tilted trees). Spatial position of each sampled tree was determined in the field using a GPS device. Several trees were sampled from an adjacent forest stand located outside the area disturbed, in order to build a local reference chronology. All samples were air-dried and then sanded using a sanding belt machine. Tree-ring widths were measured to the nearest 0.01 mm using the LINTAB 5 tree-ring measurement station (a DMS 1000 Leica microscope connected to a computer with TSAP-WinTM Scientific software). The reference chronology was used for visual cross-dating and then statistically validated with COFECHA software. Typical growth disturbances (GDs), i.e. impact scars (SC), callus tissue (CT), sequences of tangential rows or traumatic resin ducts (TRD) and compression wood (CW), as well as abrupt growth suppressions (GS) were identified within growth rings and classified based on their intensity. A tree-ring DF Index (I_t , %) was then calculated based on the cumulative number of trees showing disturbance(s) in a given year divided by the total number of trees alive in that year. The dendrogeomorphic approach allowed to reconstruct past DF events that occurred in the study area since the beginning of the 20th century. Reconstructed frequencies, magnitude and spatial extent may further be integrated within the DF hazard assessment and mitigation plans.

KEYWORDS debris-flow, growth disturbances

Quantification of the grain-size of debris deposits as a key factor in the distribution of alpine permafrost in marginal periglacial environments

Ilie ANDRIAN^{1*}, Răzvan POPESCU¹, Flavius SÎRBU², Alfred VESPREMEANU-STROE¹

¹Faculty of Geography, University of Bucharest, Bucharest, Romania

²Department of Geography, West University of Timișoara, Timișoara, Romania

*Correspondence to: Ilie ANDRIAN; e-mail: ilie.andrian@s.unibuc.ro

The grain size of the debris deposits is a key factor in the distribution of the alpine permafrost in the marginal periglacial environments. A coarse grain size contributes to the permafrost preservation in the debris deposits by: 1) ensuring a bigger stoking capacity for inflowing cold air in early winter before the installation of a continuous snow cover; 2) causing a low thermal conductivity during the warm season as a consequence of high porosity; 3) providing a more powerful shading effect. At similar altitudes, slope, aspect and land cover conditions from the alpine area of Southern Carpathians it was found that thermal conditions in debris deposits are quite different and grain size, solar radiation and snow cover persistence could be the factors responsible as they are the only ones with large variations on short distances. Taking into consideration that the solar radiation and snow cover can be assessed by GIS and satellite images, the need for quantification of the grain size is also emerging. Unfortunately, a method that would automatically measure the size of each block on the surface of the deposit was not found. However, an alternative method could be based on the values of the surface roughness which can be a proxy for grain size, on the condition of being applied on very high resolution DEMs, i.e. LiDAR like. In other words, a big grain size should correspond with high roughness values and vice versa. In this study three algorithms (vector ruggedness measure (VRM), standard deviation of residual topography (STD) and terrain ruggedness index (TRI)) were tested to obtain raster images which would precisely show the areas with different roughness values on the surfaces of debris deposits. These were applied on 2 high resolution digital elevation models (with cell size of 6 cm) of 2 rock glaciers (RG): 1) Doamnei RG stretching from 2005 to 2150 m a.s.l. in Făgăraș massif and 2) Galeșu RG which lies between 2060 and 2170 m a.s.l. in Retezat massif. Two orthophoto mosaics of these RG were used to visually check the accuracy of the roughness raster images. Both, the DEMs and the orthophoto mosaics were generated from drone derived images which were acquired during a field campaign of ClimaLAND research project team in September 2021. The best results were obtained using VRM algorithm developed by Sappington et al. (2007). This algorithm is a part of the Benthic Terrain Model plugin for ArcMap. The roughness values were correlated with bottom temperatures of snow (BTS) (measured in March 2012 and 2017 for Doamnei RG and in early April of 2019 for Galeșu RG) used in permafrost mapping, indicating a medium correlation between these two variables, with r^2 values ranging from 0,37 to 0,46. This proves the fact that the areas from debris deposits with coarser grains are generally colder and more likely to preserve permafrost than the areas with finer grains.

KEYWORDS: marginal periglacial environments, alpine permafrost, debris grain-size, BTS, vector ruggedness measure

Rock glaciers formation chronology derived from relative and absolute dating in the Southern Carpathians

Mirela VASILE^{1*}, Alfred VESPREMEANU-STROE^{1,2}, Răzvan POPESCU², Daniela PASCAL^{2,3}, Ilie ANDRIAN²

¹Research Institute of the University of Bucharest, Division of Earth, Environmental and Life Sciences, Bucharest, Romania

²Faculty of Geography, University of Bucharest, Romania

³Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering, Măgurele, Romania

* Correspondence to: Mirela VASILE; e-mail: mirela.vasile@geo.unibuc.ro

Rock strength assessment has been proved as an efficient tool in weathering studies in various climatic environments, and has been applied as well as a relative dating method where reference absolute ages were also available. In this context, Schmidt Hammer rebound values have been used in extrapolating landforms formation ages, especially in deglaciated areas, although a common sampling protocol has not yet been adopted. More recently, relative dating by rock strength measurements has successfully highlighted complex rock glaciers evolution phases. In this work we follow a similar approach and use Schmidt Hammer rebound values in order to i) distinguish between formation phases of complex rock glaciers, and ii) assess rock glacier formation chronology in correspondence to early Holocene intense rock slope failures occurrence, documented by absolute dating. For this, we focused on five rock glaciers located on the northern slope of Retezat Mountains, where we performed Schmidt Hammer measurements and sampled rock surfaces to further obtain reference absolute ages. Averaged rebound values ranged between 49 and 42, showing a good correlation with altitude, and highlighting different phases of debris accumulation within the same rock glacier. For the second purpose of this work, four surface ages from Doamnei rock glacier, in the central Făgăraș massif, determined by cosmogenic ¹⁰Be exposure dating, were used in this analysis. The absolute ages were complemented with rebound values sampled on a longitudinal profile which showed decreasing values towards the frontal sector. The results indicate multiple phases of debris accumulation, and highlight the magnitude of early-Holocene debris production, indicating the rapid accumulation of massive boulders as well as their displacement between 12.97 and 9.91 ka ago. Younger age values closer to the slope indicate rockfall favorable conditions of much lower magnitude around 3.4 ka. This hypothesis is sustained by two similar clusters of exposure ages documented in formerly glaciated valleys of Făgăraș Mountains, that we associated with Holocene rock slope failures activity.

KEYWORDS rock glaciers, relative dating, Schmidt Hammer, ¹⁰Be dating

Geospatial analysis and mapping of snow avalanche susceptibility in Piatra Craiului Massif, Romania

Mara ȘERBĂNUCĂ^{1,2*}

¹Geodesic Engineering, Faculty of Silviculture and Forest Engineering, Transilvania University of Brasov, Brasov, Romania

²Cartography, Faculty of Geography, University of Bucharest, Bucharest, Romania

*Correspondence to: Mara ȘERBĂNUCĂ; e-mail: maraserbanuca@yahoo.ro

Snow avalanches are among the most common geomorphological processes in Romanian Carpathians. The nivology service of the National Meteorological Administration deals with the estimation of the snow condition and the risk of avalanches production by elaborating the daily bulletins. But these bulletins are issued at the level of the entire massif, on a small / medium scale, requiring spatialized detailed information. The aim of this paper is to identify the land susceptibility to snow avalanche processes and the vulnerability degree of the tourist routes in the Piatra Craiului Massif. In this respect, a set of geomorphological, climatic and land cover factors controlling snow avalanches were mapped based on geographical information systems (GIS) and remote sensing techniques and then reclassified with values ranging from 1 to 100, according to their potential to snow avalanche processes formation/occurrence. A multicriteria analysis approach helped the integration of all variable datasets in order to obtain the land susceptibility to snow avalanches processes at a high/medium spatial resolution of 5 m. The resulted map with five classes of susceptibility (from very low to very high susceptibility) was validated with field observation on the avalanche corridors in the Piatra Craiului Massif. Following the validation of the results, it was found that the analysis methodology is good and provides results close to reality, even if no snow data were taken into account. Our results show that 7% of the territory has a high and very high susceptibility to avalanches during the winter and also 7% during the spring. Moreover, the vulnerability of the tourist routes was achieved and mapped by overlapping the data regarding the marked tourist routes over the susceptibility data. This highlights that about 10 km of the route overlaps with areas with high and very high susceptibility to avalanches in the winter season, compared to about 4 km of route that overlap with areas of high and very high susceptibility during the spring. The study is useful for those who travel the routes during the winter, despite the recommendations of the specialized authorities not to approach such routes during this period. It is also important because by using it you can accurately determine the areas prone to avalanche processes in all massifs in our country, regardless of whether there are measurements of snow cover or not.

KEYWORDS: avalanches, susceptibility, multicriteria analysis

InSAR based inventory of landslides and salt movements in the diapiric area between Prahova and Varbilau (valleys)

José Jorge CARACHEO-GONZÁLEZ^{1*}, Mihaela Violeta GHEORGHE², Iuliana ARMAŞ²

¹Faculty of Engineering, UNAM, Mexico City, Mexico

²Faculty of geography, University of Bucharest, Bucharest, Romania

*Correspondence to: José Jorge CARACHEO-GONZÁLEZ; e-mail: jjcaracheo@gmail.com

Salt diapirs in the Subcarpathians are known to be one of the main sources of oil in the country. The rising of salt structures it's done over millions of years due to a process known as diapirism. As salt diapirs rise they imprint stress on the overburden and surrounding strata leading to faults and deformation and causing landslides as the most common geomorphological hazards. Because of the economic importance of such structures in Romania, human settlements are located over them. This is the reason why it is very important to know their evolution and how diapirism affects the inhabited area around salt diapirs. The aim of this article is to capture salt movements and identify landslides caused by diapirism in the area between Prahova and Teleajen rivers by using satellite radar techniques and InSAR technology. InSAR can capture terrain changes with millimetric precision. In this purpose, two stacks of 65 Synthetic Aperture Radar (SAR) images acquired between January 2017 and December 2021 by the Sentinel-1 A satellite on ascending and descending orbits have been processed using the Small Baseline Subset Interferometry algorithm (SBAS). The SBAS approach relies on small baseline interferograms that maximize the spatial and temporal coherence. The deformation maps obtained are compared from a quantitative and qualitative point of view, taking into account also the type of movements that are expected and what the technique can derive. Due to technical limitations of the method, the majority of points were obtained for the inhabited area, which displays a better return of the radar signal. However, the initial deformation maps obtained show areas of interest that display movement patterns consistent with translational moves associated to landslides.

KEYWORDS Diapirism, Prahova, InSAR, landslides, SBAS

Multirisk assessment in protected natural areas in Romania

Sanda ROȘCA^{1*}, Ștefan BILAȘCO^{1,2}, Carmen GHEORGHE³, Ana Maria CORPADE¹, Sorin AVRAM^{3,4}

¹Department of Physical and Technical Geography, Faculty of Geography, Babeș Bolyai University, Cluj-Napoca, Romania

²Romanian Academy, Cluj-Napoca Subsidiary, Geography Section, Cluj-Napoca, Romania

³National Institute for Economic Research "Costin C. Kirițescu" (INCE), Romanian Academy, Bucharest, Romania

⁴Department of Geography, University of Craiova, Craiova, Romania

* Correspondence to: Sanda ROȘCA; e-mail: rosca_sanda@yahoo.com

Protected natural areas occupy 23.42% of the land area and 28.81% of the marine surface of Romania, being the most useful types of maintaining the biodiversity of species and habitats. They are under the direct influence of natural and anthropogenic hazards that influence their state of conservation, spatial and temporal dynamics. It is therefore extremely important to know the effects of hazards on protected areas so that structural and structural measures can be taken to reduce the negative effects. For the analysis of natural hazards, the risk of landslides and soil erosion inside naturally protected areas was identified, flooding was analyzed, but also aridity and wildfire probability. From the category of anthropic hazards, land-use, the influence of the density of localities and roads were analyzed. For both categories of chance the analytical hierarchy process was used where decision was made using weights through pair wise relative comparison. The proposed method is to construct a Delphi algorithm approach for expert's opinion upon each indicator's impact weight on final multi hazard risk map. The integration of the various individual risk classes in a single multirisk map will be made using weighted overlay techniques. Following the analysis, 34% of the territory identified a classification in the medium multi-risk class, 33% a low multi-risk, but for 23% and 5%, respectively, 5% of the naturally protected areas, a high and very high multi-risk was found. Hotspots were highlighted such as: ROSPA0081 Munții Apuseni -Vlădeasa, ROSCI0058, RONPA0621 Pădurea Borovăț, RONPA0625 Dealul Vărănic etc. The aim of this study was to apply an innovative method capable of capturing individual characteristics of geomorphological, climatic, man-made risk, but also the interconnections between them in order to achieve future impact scenarios at the level of protected natural areas in Romania.

KEYWORDS multirisk, protected areas, vulnerability, AHP

Erosion patterns over the Holocene in the central and southeastern Romanian lowlands. First results from the HoLFloods project

Gabriela FLORESCU^{1*}, Marcel MÎNDRESCU¹, Gheorghe BĂDĂLUȚĂ¹, Simon M. HUTCHINSON², Angelica FEURDEAN³

¹Department of Geography, Ștefan cel Mare University of Suceava, Universității 13, 720229 Suceava, Romania

²School of Science, Engineering and Environment, University of Salford, Salford, M5 4WT, United Kingdom

³Department of Physical Geography, Goethe University, Altenhöferallee 1, 60438 Frankfurt am Main, Germany

*Correspondence to: Gabriela FLORESCU; e-mail: gabriela.florescu@usm.ro

The Romanian lowland areas are predicted to face accelerated drying and warming over the next decades which, coupled with an intensification of precipitation extremes, will likely accelerate erosion processes, river channel changes and land degradation. Such developments will have severe impacts on soils, vegetation and agriculture, and human usage of natural resources in these populated and important agricultural regions. Erosion dynamics at the catchment level reflects changes in both climate and land-use, which influence the catchment's sensitivity to erosion processes. To address the threats posed by the intensification of erosion processes in a future world with a higher frequency of extreme hydrological events and increasing anthropogenic pressure on natural resources, it is essential to understand the dynamics and present state of these lowland landscapes. Such an attempt is impossible without a long-term (centennial to millennial) framework of environmental data to properly assess the extent of past anthropogenic influences.

Lakes form ideal sediment traps in the landscape, by continuously recording land surface processes in the catchment. Deposited on a lakebed from suspended sediment transported from its catchment, the properties of the layers of accumulated sediment can provide a proxy record of sediment sources, erosion and deposition energy levels and therefore environmental conditions. Here we compare the erosion history in two lowland sites in southeastern and central Romania, Lake Oltina and Lake Țaga Mare respectively, and explore possible drivers of erosion over the last 6000 years. We use sediment geochemistry, mineral magnetic properties and particle size to derive sediment influxes at the catchment scale and changes in the characteristics of the depositional environment. Published palaeoecological and palaeoclimate reconstructions, together with the resources of the National Archaeological Database are used to provide the context of the palaeoenvironmental changes developed at both the local and extra-local scale and to account for local erosion patterns. Results show differences in the timing and extent of erosional episodes between the two lowland areas. Specifically, the Lake Țaga proxy record indicates a change in sediment sources around 1800 years ago, from eroded topsoil, which predominated between 3200-1800 cal yr BP, to the erosion of deeper soil layers, dominant over the last 1800 years. These patterns were associated with tree cover clearance, extension of pastures and arable land, and direct anthropogenic intervention on the water body. Contrastingly, at Lake Oltina, similar erosional developments were observed in the proxy record ca. 1000 years earlier. Prior to 1800 cal yr BP in the Lake Țaga catchment, and prior to 2500 cal yr BP in the Oltina Lake catchment, erosion patterns appeared more regulated by climatic factors.

These are the first results obtained within the project HolFloods (Mid-late Holocene flood events in south-eastern and central Romanian lowlands), which aims to reconstruct past flood activity and drivers in the Romanian lowlands based on lacustrine sedimentary archives. The results also allow us to better define challenges associated with palaeoflood regime reconstruction more widely across the Central-Eastern European lowlands.

KEYWORDS: erosion, land-use, lake sediments, floods, lowlands, Romania, Holocene

Current riverbed dynamics and implications for imminent risk management

Florina GRECU^{1*}, Benabbas CHAOUKI^{2,3}, Robert DOBRE¹, Adriana ILIE¹, Yakhlefoune MANEL²

¹Faculty of Geography, University of Bucharest

²Department of urban techniques and environment, University of Constantine 3 Salah Boubnider, Constantine, Algeria

³Centre National de Recherche en Aménagement du Territoire CRAT, Constantine, Algeria

*Correspondence to: Florina GRECU; e-mail: greco@geo.unibuc.ro

Rivers are considered that have, partially or totally, courses in particular areas as tectonics: Carpathian Curvature, north-eastern region of the Atlas Mountains, local subsidence on rivers in the Transylvanian Depression.

The changes are detected using the diachronic method for the years 1980 and 2018 or 2019,2020. The interpretations are based on observations, research and field mapping, on corroboration with data from geomorphological, geological and geophysical literature.

Oued Rhumel which is part of the largest watercourses of North East Algeria presenting sinuosities from one bank to the other especially in its downstream part, which is characterized by the development of large meanders widening the valley. The interpretation of the mapping of the dynamics of the Oued Rhumel shows that it is very unstable and unpredictable. The irregularity of rainfall affects its flow regime. This makes the spreading of the flood in the alluvial plain more spectacular.

The results highlight the tendency of the rivers either towards a pronounced dynamic or towards a return to previous stages. They are useful in riverbed management, in the management of imminent risks.

KEYWORDS: riverbed dynamic, tectonics, Carpathian curvature, risks management

¹⁰Be surface exposure dating: a technique used in reconstruction of glacial chronology. Results from Făgăraș Massif, Southern Carpathians.

Daniela Pascal^{1,2*}, Alfred Vespremeanu-Stroe², Mihaela Enăchescu¹, Régis Braucher³, Răzvan Popescu², Alexandru Petre¹, ASTER Team^{3*}

¹Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), Măgurele, Romania.

²University of Bucharest, Faculty of Geography, Bucharest, Romania.

³Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement, Aix en provence , France.

^{3*}Georges Aumaître, Didier Bourlès, Karim Keddadouche.

*Correspondence to: Daniela Pascal; e-mail: daniela.pascal@nipne.ro

Surface exposure dating (SED) is a technique that utilises the concentration of cosmogenic nuclides produced in minerals (especially quartz) at the surface of the Earth to date landforms. The annual rate of production per gram mineral, concentration per gram and rate of decay of cosmogenic nuclides (i.e. ¹⁰Be, ²⁶Al, ³⁶Cl) are used to determine exposure ages, burial ages, or erosion rates of rocks and sediment for a variety of landforms and geomorphological processes such as deglaciation, landslides, sediment transport and deposition rates, formation of fluvial terraces, volcanic eruptions, uplift and incision rates.

Methods of extracting Be and Al from a rock sample have been described in Merchel and Herpers (1999), Ivy-Ochs (1996), Kohl and Nishiizumi (1992) and Nishiizumi et al. (1989). The processing of the raw samples follows the order: quartz purification, spike addition, HF digest, Be and Al separation by cation and anion exchange and precipitation methods, oxidation and AMS measurements.

Samples were chemically processed in two laboratories, RoAMS from Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), Măgurele – Romania (Applied Nuclear Physics Department), measured at AMS setup with 1 MV Cockcroft-Walton Tandetron Accelerator and LN2C Laboratory from Centre de Recherche et d'Enseignement de Géosciences de l'Environnement – CEREGE, Aix en Provence, France), measured at ASTER HVE 5 MV accelerator.

The obtained exposure ages were compared to the measurements performed at the CEREGE laboratory (France) and the differences were negligible in terms of isotopic ratio(¹⁰Be/⁹Be). Based on the measurements carried out on samples taken at different altitudes, using erratic boulders and large boulders of moraines, absolute ages indicate similarities in the manifestation of cold phases of glacier advancement, as well as some differences dictated by inherited morphological features of the respective valleys.

KEYWORDS cosmic ray exposure dating, cosmogenic ¹⁰Be, glacier chronology, AMS measurements, Făgăraș Massif

Late Quaternary fluvial history in the Someș drainage basin

Ioana PERȘOIU^{1*}

¹Department of Geography, Ștefan cel Mare University, Suceava, Romania

*Correspondence to: Ioana PERȘOIU; e-mail: ioanapersoiu@gmail.com

In this paper we present the fluvial history of Someș drainage basin in relation with climatic changes during the second half of the last glacial cycle. Our work is based on study sites located along the floodplains and lower terraces of Someșul Mic and Someșul Mare Rivers, and along the lower reach of Someș River and the associated fluvial fan. A series of morphological, sedimentological and chronological (OSL, 14C) investigations in these areas lead to reconstructed local fluvial histories. The emerging overall picture emphasizes the complex fluvial response to the climate changes of the last ca. 50.000 yrs, with distinct channel patterns active at different moments, differences in timing of vertical and/or spatial fluvial response to climatic changes, and the role of other local controls (e.g., local/regional tectonics, general slope of the valleys, distance from the catchment areas), in amplifying/delaying or inhibiting fluvial reactions to these disturbances. Significant differences in fluvial responses to the main regional scale climate changes occur along the longitudinal profile of the river. These findings suggest a much more complex picture on Late Quaternary palaeofluvial behavior, when compared with the Central European general model, i.e. braided channel pattern during glacial and stadials, followed generally by large scale meandering channels, possible returning to braided pattern during Younger Dryas, and a final small scale meandering channel pattern as the climate transitioned to the last interglacial (Holocene). Our data highlights that before the Holocene, Someșul Mic and Someșul Mare Rivers were braided, only partly abandoning this pattern after 14.700 yrs, while the large-scale meandering pattern was the dominant one along the rivers draining the Someș fluvial fan, in a similar manner as the channel patterns reported along the middle and lower Tisa. Following the onset of the Holocene and associated warming, the river's morphology responded with a millennial scale lag to these changes, with an apparent final adjustment ca. 5000 yrs ago.

KEYWORDS Late Quaternary, Someș drainage basin, fluvial history, climate, tectonics

Warming climate conditions during the last ~33 ka recorded in sackung deposits of the Făgăraș Mountains

Maria-Laura TÎRLĂ^{1,2,3*}, Virgil DRĂGUȘIN^{2,3}, Ionuț-Cornel MIREA², Laurențiu ȚUȚUIANU^{1,2}, Tiberiu Bogdan SAVA⁴, Alexandru Gabriel CĂLIN⁵

¹Faculty of Geography, University of Bucharest, Bucharest, Romania

²Emil Racoviță Institute of Speleology, Romanian Academy, Bucharest, Romania

³Earth, Environmental and Life Sciences Division, Research Institute of the University of Bucharest, Bucharest, Romania

⁴Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering, IFIN-HH, Măgurele, Romania

⁵Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania

*Correspondence to: Maria-Laura TÎRLĂ; e-mail: tirla@geo.unibuc.ro

Sackung are geomorphic features triggered by deep-seated gravitational slope deformations with high potential of preserving sequences of deglaciation history in high mountains. Their sedimentary record may successfully complement geochronological information from moraine deposits or other proxies. We here investigate for the first time in the Romanian Carpathians the morphology and sedimentary content of a sackung trench and report novel data for the last 33 ka. The sackung developed perpendicularly to the Mușeteica glacial cirque, at ~2260 m a.s.l. in the Făgăraș Mountains. A 1.8-m deep sedimentary profile was opened in the center of the sackung, at its maximum width and depth. Another 0.5-m deep trench was transversally cut at the southern end of the sackung, down to the fault breccia. The sediment was sampled at 10-cm interval for grainsize, organic matter content, and magnetic susceptibility. The profile stratigraphy exposed poorly sorted material, dominated by thinly layered fine to very fine sands with isolated rock fragments. A disconformity probably representing a depositional hiatus underlined by black to brown-red clayey laminae separates the upper 70-80 cm of the profile from its lower part. A buried talus scree with decimetric subangular dolomite blocks underlies the profile base. This distinction is also marked by a sudden increase of inorganic carbon content and coarser sands, joined by a decrease of organic matter content, magnetic susceptibility, and sorting. Three sediment samples taken from the central profile and the lateral trench were analyzed for radiocarbon dating. The 2 σ calibrated ages, reported at 95.4% probability level, are as it follows: between 33.040 and 31.914 ka at a depth of 80 cm; between 10.153 and 9.704 ka at a depth of 10 cm (below the organic soil horizon A); between 8.287 and 8.021 ka at a depth of 50 cm. Preliminary data indicate that sediment deposition occurred mostly during the warm periods, with interruptions caused by glacial activity during the Last Glacial Maximum. The sackung functioned as a sediment trap during the warming periods of the Last Glacial Period and Early Holocene, in close connection with the surrounding karst landforms. Its high-resolution stratigraphic heterogeneity recorded new paleoclimatic data for this interval at the highest altitudes in the Southern Carpathians.

KEYWORDS sackung, deglaciation, MIS 3, radiocarbon dating, Carpathians

Holocene sea-level oscillations and the lower Danube floodplain response (the sector between Brăila and Tulcea)

Laurențiu Țuțuianu^{1,2*}, Alfred VESPREMEANU^{2,3}, Diana HANGANU^{1,4}, Mihaela DOBRE², Tiberiu SAVA⁵, Sabin ROTARU⁶, Luminița PREOTEASA^{2,3}, Cristian PANAIOTU⁷

¹GEODAR Research Center for Geomorphology, Geoarchaeology and Paleo-Environments, Bucharest University, 1 N. Bălcescu, 01004, Bucharest, Romania

²Emil Racoviță Institute of Speleology, Romanian Academy, Bucharest, Romania

³Sf. Gheorghe Marine and Fluvial Research Station, University of Bucharest Faculty of Geography, Romania

⁴ArchaeoSciences Division, ICUB Research Institute of the University of Bucharest, Panduri 90-92, Bucharest, Romania

⁵Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering, IFIN-HH, Măgurele, Romania

⁶GeoEcoMar National Institute for Marine Geology and Geo-ecology, Bucharest, Romania

⁷Faculty of Physics, Bucharest University, 405 Atomistilor, 077125, Măgurele, Romania

*Correspondence to: Laurențiu ȚUȚUIANU: e-mail: tzuk_laur@yahoo.com

Sea-level oscillations represent the main controlling factor of floodplains evolution, forcing the response of the tributary rivers. After their post-glacial reconnection 9400 years ago, the Black and the Mediterranean seas experienced synchronous sea-level oscillations. After this date, the sea level experienced three main stages of evolution: i. before ~7,500 y BP, a rapid increase (~ 12 mm/year); ii. between 7,500 and 5,000 y BP, a decelerated increase (~3 mm/year), and iii. the last 5000 years, when it became relatively stable (with a slight increase of <0.5 mm/year).

Danube's lower floodplain landscape transformations during the last 8000 yrs have been investigated on ten cores (between 6.5 and 18 m long). 50 radiocarbon ages, and over 1000 samples were analyzed for grain-size, organic matter content, magnetic susceptibility and paleofauna.

Our results suggest that:

i) before 7,500 y, the sediments deposited in this area were mainly coarse silt with sand (30%), with less than 5% of organic matter content. Species of brackish ostracodes and foraminiferas have been identified within these layers, indicating the existence of a marine gulf or ria system. This gulf was filled with danubian sediments until ~7,500 years ago when the Danube Delta began to form.

ii) Between 7,500 and 5,500 years ago in the Danube floodplain evolved through alternating periods of rapid and slow sedimentation, with average accretion rates of ~2.5 mm/year (compared with one of 5.9 mm/year of the above unit). The stratigraphy of this unit consists of several silty and sandy layers with a directly proportional magnetic susceptibility and an inversely proportional organic matter content. Our chrono-stratigraphic and palaeoecological data indicate that the Danube floodplain keeps pace with the decelerated sea-level rise: it starts with an elevation increase of the riverbed, followed by an increase of the fluvial levees. This will lead to a disequilibrium occurs between levees and the distal area of the floodplain, thanks to it, a series of avulsions will be formed that will reduce the lateral elevation difference within the floodplain. As the sea-level continues to rise, such fluvial sides elevation offsets will lead to a cyclical evolution of the floodplain

iii) After 5,500 y BP a relatively uniform sedimentary unit consisting of medium silt (or peat) with an organic matter content of more than 10% and a magnetic susceptibility less than 2×10^{-4} SI will accumulate in the Danube floodplain. This unit is representative of a stable floodplain marked by the development of large lakes and swamp areas. This large lakes/ swamps will be split into smaller ones by channels detached from the main course of the Danube. This type of floodplain was maintained until the anthropogenic transformation in the middle of the XXth century.

KEYWORDS sea-level, sedimentation rate, Holocene, ¹⁴C ages, lower Danube floodplain

Detection and delineation of karst sinkholes and aeolian closed depressions from Romania

Mihai NICULIȚĂ^{1*}

¹Department of Geography, Faculty of Geography and Geology, Alexandru Ioan Cuza University of Iași, Romania

*Correspondence to: Mihai NICULIȚĂ; e-mail: mihai.niculita@uaic.ro

Concave and convex features are characterizing many landforms and can be relatively easy identified by means of geomorphometric approaches. Despite this, the particularities of the landform development process and the evolution after the process cessation introduce slight changes of shape from the pure concave or convex shape. Very often this includes the apparition of compound shapes, so beside the concave or convex shape a planar or a mixture of concave and convex shape appear at the border of the landform. I present the case of sinkholes and of aeolian closed depressions as example of concave features. So, despite the morphological convergence, the shape particularities are influenced by the erosional process and by the later evolution of the landform. These particularities will influence mainly the precision of the concave part delineation, which is better for pure concave form and worse for deformed concavity. In the same, the particularities will allow the usage of a machine learning algorithm to learn these patterns and to be used to predict the presence of such features from the candidates in a certain area. Sinkholes have symmetric or asymmetric concavity but often appear with multiple minimums of curvature along drainage features. Aeolian closed depressions have a flat bottom, so there is not a pronounced minimum curvature, have steep sides and a gentle slide in the direction where the wind was blowing the sand. While the sinkholes can be defined morphometrically as single shape features the aeolian closed depression are actually compound shapes that requires an additional step in the process of classification (identification) and delineation. For the sinkholes local concavity was segmented using watersheds and a multilayer perceptron (MLP) was trained to identify the sinkhole segments. For the aeolian closed depressions a watershed segmentation of slope was used to delineate the flat bottom and the steep sides. An MLP was trained to detect both classes of shapes. The results accuracy of over 0.95 show that the presented approach is a powerful one in the delineation and delimitation of these features.

KEYWORDS concave features, geomorphometry, watershed segmentation, artificial intelligence, sinkholes, closed depressions

Geomorphometric delineation of the channels and floodplains from the Moldavian Plateau

Nicușor NECULA^{2*}, Mihai NICULIȚĂ¹

¹Tulnici Research Station, Alexandru Ioan Cuza University of Iași, Romania

²Department of Geography, Faculty of Geography and Geology, Alexandru Ioan Cuza University of Iași, Romania

*Correspondence to: Nicușor NECULA; e-mail: nicusor.necula@uaic.ro

Floodplains and channels are important fluvial landforms that have practical implications from many perspectives: quaternary geology/geomorphological mapping, flood risks and planning. The availability of a medium resolution Digital Elevation Model (DEM) like Copernicus DEM opens-up the possibility to perform delineation of channels and floodplains with a better accuracy than with SRTM or other similar DEMs. Since the elevation data comes from radar measurements, the landform shape in non-vegetated areas is very well constrained and the Copernicus DEM is characterized by a low noise in flat areas. At the 20 m spatial resolution channel and floodplain of rivers up to third Strahler order are recognizable. The channel network was delineated using the D8 algorithm and a breaching algorithm for depressions. The floodplains were delineated by training a neural network for the geomorphometric variables of watershed segments of slope. Because there is no source of ground truth data the evaluation of the results was performed mainly qualitatively by comparison with LiDAR data. The obtained results show the feasibility of geomorphometry and of the Copernicus DEM for channel and floodplain delineation.

KEYWORDS Copernicus DEM, channels, floodplains, geomorphometry, flow direction, watershed segmentation

Flood event efficiency index

Dan DUMITRIU^{1*}

¹Faculty of Geography and Geology, Alexandru Ioan Cuza University of Iași, Romania

*Correspondence to: Dan DUMITRIU; e-mail: dndumitriu@yahoo.com

The study focused on improving the degree of understanding of the role of in-channel factors in the sediment flux during flood events in terms of their geomorphic effectiveness. Changes in the channel morphology were reported after each flood event. The intensity of these changes varied depending on the magnitude and duration of flood events. The most evident adjustments included channel widening, degradation and aggradation. The morphologic response of stream channels to large floods involve larger-than-average volumes of sediment transport. To this end, 84 flood events were investigated. The relationships between the sediment load and the flow discharge analysed based on the event efficiency index (EEI) revealed that subsequent to major flood events, changes occur in the sediment flux, which indicate certain shifts in the transport capacity of the river. The event efficiency index was determined based on data recorded between 2000 and 2020 at four gauging stations along Trotuș River. The changes documented in terms of the sediment transport rates after the flood events of 2005 show that major events mark important thresholds in the hydrogeomorphic evolution of river channels. The size of previous flood events appeared to influence the degree of exhaustion of the sediment sources after the flood peaks. This behaviour is probably because during the large previous events sediments may have been eroded from more distant hillslopes and "charge-up" channel sediment storages. The temporarily stored sediment is then remobilized and transported downstream in the next small event, but, due to its lower flow, the remobilized sediment in this event mostly reaches the catchment outlet after the flood peak. Thus, the main cause of the changes occurring in the sediment regime likely lies in the channel adjustments subsequent to flood events, considering that during the analysed timeframe, no significant disturbances of the other controls were documented. The results of this study are in the range of investigations focusing on the role of major events in the global sediment cascade.

KEYWORDS flood event, suspended sediment load, event efficiency index, sediment availability, Trotuș River

Hydro-geomorphological implications of hydrographic basins morphometric parameters characteristics. Application to Suceava River hydrographic basin

Vasilică-Dănuț HORODNIC¹, Petruț-Ionel BISTRICEAN¹, Francisca CHIRILOAEI¹

¹Faculty of History and Geography, Department of Geography, „Ștefan cel Mare” University, Suceava, Romania

*Correspondence to: Vasilică-Dănuț HORODNIC; e-mail: vasilica.horodnic@usm.ro

Topographic maps at different scales, together with remote sensing images and GIS analysis techniques have proved to be the most at hand instrument for studying hydrographic networks, surface fluvial morphology characteristics and their correlation with the changes recorded at hydrographic basin level. In hydrology and geomorphology studies and research, the morphometric parameters, once identified and measured can give clear, quantitative evidence on the evolution of hydrographic basins, including the denudation potential, flow regime and ground infiltration, as well as on the general impact of lithological formations and geological structures over the basin dynamics.

In this study, we present a quantitative analysis of the morphometric parameters (linear, textural, geometric and relief parameters) for the hydrographic basin of Suceava River, using manual, automatic and semi-automatic methods in ArcGIS10.4 platform. Morphometric parameters such as size order, length of the hydrographic network, bifurcation ratio, drainage network density, frequency and texture, shape coefficient, circularity ratio and elongation ratio have been calculated for Suceava River hydrographic basin and the hydro-geomorphological implications have been discussed. Also, the computed variables give the possibility to create databases that can be used to improve the activities of sustainable management of the fluvial corridor, especially with regard to floods attenuation, water use as resource in different purposes and so on. The present study proposes the use of GIS techniques for the evaluation of hydrographic network characteristics for Suceava River hydrographic basin and for establishing a study protocol for this issue at hydrographic basin level. According to the hierarchization proposed by Strahler, all the range of river order can be found, in different proportions, within Suceava River hydrographic basin, from order I rivers (tributary rivers, sometimes with temporary flow) (over 76% from the total), to order VI rivers (Suceava River). We can identify a dendritic-type network, where the sum of the river lengths from the basin is close to 4000 km. Concerning the bifurcation ratio, our observations show that it reaches values lower than 5 in most cases (except for the order IV rivers, where it is possible that the geological structure might have controlled the formation, dynamics and evolution of the small rivers), but not very small values, which means that the probability of floods occurrence on the rivers from the basin is relatively small, because water tends to split and spread fast in this type of dendritic network with high values of the bifurcation ratio.

KEYWORDS morphometric parameters, hydrographic basin, bifurcation ratio, dendritic network

The genesis and evolution patterns of the large fluvial deltas. Examples from Danube Delta and connections with other deltaic systems

Alexandru BERBECARIU^{1,2}, Alfred VESPREMEANU-STROE^{1,2,3}

¹Faculty of Geography, University of Bucharest, Romania

²GEODAR – Research Centre in Geomorphology, Geoarchaeology and Paleoenvironments, University of Bucharest, Romania

³“Sfântu Gheorghe” Marine and Fluvial Research Station, Sfântu Gheorghe, Tulcea, Romania

*Correspondence to: Alexandru BERBECARIU; e-mail: alexberbecariu@yahoo.com

Large river deltas are among the most dynamic and complicated natural systems, with a complex evolution which explain the relatively small number of deltas which formation has been fully understood and reconstructed. However, deltas evolution is governed by a series of laws and patterns starting from their formation to the present. The aim of this study is to define the specific growth models of the Danube Delta and to discuss them in association with the other deltas of the world which share similar patterns of evolution. Thus, 7 evolutionary patterns have been identified in the Danube Delta as follows: (i) starting the deltaic units formation (as a bayhead delta around 7500 BP) before the sea-level stabilization, (ii) the preference of delta development into the deeper sectors of the Danube bay, (iii) the river mouths of the open-coast lobes get a polycyclic evolution, (iv) open-coast lobes are asymmetric and share the same evolution, (v) deltaic lobes have large (multi-secular) periods of decay despite the short-time triggering events (i.e. avulsions, sediment reduction), (vi) neotectonic subsidence reshaped the southern delta, (vii) the land-use controls the sediments discharge and impose the rhythms of delta development. Although each delta has its own particularities, certain patterns that are found in the evolution of the Danube Delta have also been found in other deltas, apparently different from the morphological point of view. The specific cases of the large Asian deltas (e.g.: Changjiang, Mekong, Godavari, Krishna, Huang He, Song Hong) and many other from around the world (Mississippi, Rhone, Po, Kuban, Rioni) are discussed in relation with different evolutionary patterns identified for Danube. A special attention is paid to the role of human influence (via deforestation, agricultural practices, river damming and channeling) on delta formation and evolution during different historical periods, from Neolithic to modern times.

KEYWORDS deltaic systems, growth models, sea-level, human influence, Danube Delta

Radiometric method for assessing the erosion-accretion status of the sedimentary coasts

Dragoş MARIN^{1*}, Alexandru BĂLĂCEANU², Radu MANU¹, Elena VLĂSCÉANU¹, Dragoş NICULESCU¹, Răzvan MATEESCU¹

¹National Institute for Marine Research and Development "Grigore Antipa", Constanta, Romania

²Horia Hulubei National Institute for Research and Development in Physics and Nuclear Engineering, Bucharest, Romania

*Correspondence to: Dragoş MARIN; e-mail: dmarin@alpha.rmri.ro

Studies on sediment transport are vital for many civil engineering projects. Typical problems related with the sediment movement is that littorals in many countries are subjected to erosion. The aim of this study is to present a method of identification of the erosion and accretion processes of beaches by using natural radionuclides (K⁴⁰, U²³⁸ and Th²³²) as tracers. This method was tested in Greece, on 2 beaches: Limani Passa and Legrena. The TCR data showed changes in trends along the beaches that could be related with local and seasonal erosion and accretion processes. The initial hypothesis is supported by the analysis of the natural radionuclide concentration versus sediment granulometries.

KEYWORDS Gamma spectrometry, coastal beaches, erosion, accretion, sandy coasts

Rip currents dynamics on the Romanian Black Sea coast revealed by field experiments and numerical modelling

Florin TĂTUI^{1,2,3*}, Florin ZĂINESCU^{2,3,4}, Florin MIRON¹, Alfred VESPREMEANU-STROE^{1,2,3}, Răzvan MATEESCU⁵

¹Faculty of Geography, University of Bucharest, Romania

²Research Institute of the University of Bucharest (ICUB), Romania

³Sfântu Gheorghe Marine and Fluvial Research Station, University of Bucharest, Romania

⁴Institut Terre Environnement Strasbourg (ITES), UMR 7063, CNRS, Strasbourg, France

⁵National Institute for Marine Research and Development "Grigore Antipa", Constanta, Romania

*Correspondence to: Florin TĂTUI; e-mail: florin.tatui@geo.unibuc.ro

Rip currents represent strong offshore flows of the surf-zone, with high temporal and spatial variability due to changing forcing conditions (incident waves) and controlling factors (nearshore morphology). Even though is an unaware issue in the public space, rip currents pose a great danger on beach safety of the Southern Romanian Black Sea coast, as 24 out of 32 analyzed touristic beach sectors (27 km in length out of 36 km) are affected by various types of rip currents. Two field experiments aiming at measuring rip currents dynamics and behavior were carried out in October 2021 and May 2022 on Eforie Nord beach, the most hazardous coastal area, with 10 individual rip currents developing along a 1-km stretch and with hundreds of drowning rescues during the summer season each year. Rip currents monitoring was done using a complex methodology: video techniques (video camera and UAV), topographic and bathymetric surveys, sediment sampling, drifters and ecological dye deployments, offshore wind and waves (Spotter buoy) and nearshore hydrodynamic measurements (3D current profilers and pressure sensors). Both 'circulatory flow' and 'exit flow' circulation regimes were registered within the measured channel rip currents during the two field experiments, with the development of deflection rip currents near perpendicular dikes during the 2nd experiment. Repeated drifter deployments in different hydrodynamic conditions revealed average lagrangian surface velocities between 0.2 and 0.4 m/s, with maximum instantaneous values exceeding 1.6 m/s. They reached cross-shore distances up to 150 m from the shoreline, showing the high potential of these currents to generate strong offshore flows even during low-energy wave conditions. Numerical modelling (Delft3D) reproduced with high fidelity the circulation patterns and surface flows during the 1st field experiment, giving us confidence in using it for future scenario creation of different combinations of underwater morphology and hydrodynamic conditions.

KEYWORDS coastal hazards, nearshore circulation, underwater sandbars, hydrodynamics, beach safety

Goelectrical Resistivity Variations of Sedimentary Ground Induced by Geomorphological and Meteorological Conditions (Romania)

Andreea ANDRA-TOPARCEANU^{1*}, Mihaela VERGA¹ Mihai MAFTEIU²

¹Department of Geomorphology, Pedology, Geomatics, University of Bucharest, Faculty of Geography, Bucharest, ROMANIA

²MM Georesearch, Bucharest, ROMANIA

*Correspondence to: Andreea ANDRA-TOPARCEANU; e-mail: andreea.andra@geo.unibuc.ro

A variation of the resistivity values measured repetitively in identical geological, geomorphological and biogeographical conditions, but in different meteorological ones was observed. This fact allowed us to advance the hypothesis of the existence of relations between the meteorological parameters and the geophysical response of the ground at shallow depths. Many studies emphasize the connection between the variations of geotechnical parameters of the ground, the geomorphological processes (landslides, suffusions) and the meteorological changes. Several Vertical Electrical Soundings (VES) were conducted repetitively in five different locations in sedimentary shallow ground. After a careful analysis of the collected data, we came to the conclusion that even in the absence of rainfalls the resistivity values at shallow depths varies along with the other meteorological parameters: air humidity, temperature, air pressure and evaporation. The variation curves obtained by subtracting the resistivity values for each repeated sounding revealed three inflexion points at relative similar depths, regardless of the geotechnical features of the ground. These inflexion points are related with the depths at which several phenomena or processes occur: freezing, influence of both the atmospheric pressure and humidity, capillarity and soil compaction by evaporation. Below these threshold depths the variation curves tend to flatten emphasizing the diminution of the meteorological factors influence, while the geomorphological processes tend to extend the impact of the meteorological parameters to depths higher, the shape of the variation curves being preserved. The aim of this paper is to emphasize the variation of the resistivity values at shallow depths in correlation with the variation of the meteorological parameters in order to reduce as much as possible the interpretation errors and increase the geomorphological interpretation accuracy of the geophysical data.

KEYWORDS geomorphic processes, geomorphological interpretation accuracy, goelectrical resistivity variations, meteorological parameters
