

ENVIRONMENT CLIMATE & EARTH SCIENCES

Climate Science

Environment & Climate

Natural Hazards

Numerical Modelling &
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ABSTRACT BOOK

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Book of Abstracts



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Table of Content

Oral presentations

No.	Title	Author	Page
01	Climate Monitoring Facility For Europe: ECA&D And E-OBS	Else Van Den Besselaar, Gerard Van Der Schrier, Jouke De Baar, Tim Vlemmix	9
02	A Comparative Study Of Arcgis Classification Algorithms	Mirvjen Ulqinaku, Ana Ktona	10
03	Trend And Cycle Of Fluctuations And Statistical Distribution Of Temperature Of Berlin, Germany, In The Period 1990-2022	Saeed Rasekhi, Isidro A. Pérez, M ^a . Ángeles García1, Fatemeh Pazoki	11
04	Thermal Thresholds That Human Body Can Withstand At Different Humidity Levels	Tanja Porja, Margarita Ifti	12
05	Assessing Climate Changes In Greece And Albania By Temperature And Rainfall Spatiotemporal Patterns And Trends	Michalis Sioutas, Tanja Porja	13
06	Circulation Weather Types: Understanding Their Influence On Weather Patterns And Pollutant Concentrations In Mediterranean Areas	Fernández-Duque, B; Porja, T	15
07	Implementation Of Electrostatic Separation And Differential Scanning Calorimetry For Robust And Fast Microplastics Analysis In Sediments	Xhoen Gjashta, Elsa Tanushi, Sven Schirrmeister, Kathrin Harre, Maurice Hauffe, Lucas Kurzweg	16
08	The Transformation Of The Natural Landscape In Transition: Forest Degradation, Deforestation, And Reforestation In Post-Socialist Albania	Dritan Rustja	17
09	Heavy Metal Pollution In The Drenica River Caused By Feronikeli	Shpresa Thaqi-Ndrecaj, Agron Thaqi, Fatjonë Krasniqi, Shkumbin Shala, Mentor Shala	18
10	From Wet To Extreme Wet Spells – Case Study Of Shkodra	Tanja Porja, Dodë Prenga	19
11	For “Derechos” To “Medicanes”: Climate Change And Severe Convective Events In The Mediterranean	Mario Marcello Miglietta	21
12	Calibration Of Moment Magnitude-Local Magnitude Relation Using Albanian Seismic Networkdata: Enhancing Seismic Catalogs Through Back-Processed Event Data	Edmond Dushi, Besian Rama, Klajdi Qoshi	22
13	Natural Risk Assessment In Shkodra Lowland	Ervis Krymbi	23
14	Lamb Weather Types Influence On Urban Heat Island In Southern Europe	Fernández-Duque, B	24
15	Normalization Of Local Magnitude Scale For Routine Earthquake Processing: Insights From Albanian National Earthquake Monitoring Centre	Klajdi Qoshi, Damiano Koxhaj, Irena Dushi	25

16	Comprehensive Analysis of Aftershock Focal Mechanisms Following the 2019 Durres Earthquake: Integrating Mobile Seismic Network and National Seismic Data Using the HASH Method	Damiano Koxhaj, Edmond Dushi, Anila Xhahysa, Klajdi Qoshi, Besian Rama, Irena Dushi	26
17	South American Activities And New Developments Of The Regional Earth System Modeling Platform Of IPSL (Regipsl)	Lluis Fita Borell	28
18	Metgis, A World-Wide Comprehensive High-Resolution Meteorological Downscaling And Visulaizaton Approach	Gerald Spreitzhofer, Stefan Sperka	29
19	Multiple Delays In Light Curves Of Lensed Quasars	Lindita Hamolli1, Esmeralda Guliqani2, Mimoza Hafizi	30
20	Low-Dimensional Models As Feasible Tools To Probe The Internal Functioning Of The Geodynamo	Klaudio Peqini	31
21	Pilot Test: Site Response Evaluation Using Different Non-Invasive Methods	Migena Ceyhan	32
22	Public Communication For Global Warming And Climate Extremes	Nedim Sladić, Tanja Porja	34
23	The Competence-Based Learning Assessment For Climate And Weather In Pre-University System A Study In Physical Geography Educatin	Dr. Jostina Dhimitri, Klementina Ngjeci	35
24	Assessment Of The Annual Effective Dose From Some Cereal Crops Commonly Used In Local Markets Of Tirana City	Manjola Shyti, Erjon Spahiu, Eranda Gjeçi, Siltana Zeneli	36

Poster presentations

No.	Title	Author	Page
01	The Complementarity Of Wind And Solar Power In Vlorë, Albania	Valbona Lame, Miranda Halili, Driada Mitrushu	38
02	Problematics Of Solar Pv Implementation In High Altitude Areas Of Vlora	Valbona Lame, Fjorela Verore, Driada Mitrushu	39
03	Air Pollution Analysis And Continuous Monitoring Of Particulate Matter (Pm2.5) In An Urban Aria In Tirana	Megi Caushaj, Dhurata Premti, Fatos Ylli, Luljeta Pinguli, Hasime Manaj, Terkida Prifti, Ilirjan Malollari	40
04	Assessment Of The Climate Knowledge And General Information On High School Students	Astrit Denaj, Sonila Boçi, Daniela Neli, Dode Prenga	41
05	Remarks On Linear Modeling For Assessment Of Electricity Consumption-A Case Study For Albania	Elmira Kushta, Ervis Gega Daniela Cejku, Dode Prenga	42
06	A Nonlinear Time Series Approach For Studying Inflows On The Lakes Of Drin Cascade.	Dode Prenga, Silvana Miço, Tanja Porja, Ervis Gega	43
07	Microplastics Pollution In Some Imported Table Salts In Albania	Olta Çakaj, Semiramida Plaku	44
08	Soil Radioactivity And Its Role In Ecosystems: A Literature Review	Eranda Gjeçi	45



09	Activity Of The Photosynthetic Apparatus In Plants Under The Influence Of Direct Solar Radiation	Matilda Mema, Emil Xhuvani , Kejda Kristo, Fatbardha Babani	46
10	Standardization Of The Radiochemical Procedure Of Polonium -210 Determination In Water Samples.	Brunilda Daci, Kozeta Tushe, Elida Bylyku	47
11	Climate Change Education At School	Edlira Habilaj, Rudina Osmanaj	48
12	Determination Of Optimal Irrigation Water Requirement Of Salvia Officinalis Through Cropwat V8.0	Eljo Daci, Ilirjan Malollari, Dhurata Premti, Shamaila Zia- Khan, Klaus Spohrer	49
13	Hydrosphere And Atmosphere	Arlina Davidhi	50
14	Using DI & RI Thermal Indices Estimations: Summer 2023 Case Study	Anesti Prifti, Eni Ajdini, Greta Lugja, Kristina Jaku, Laura Hamzallari	51
15	Integrating Meteorological Parameters For Enhanced Temperature Humidity Index Formulations	Gjergji Ogreni, Mihal Proko, Adriana Memoçela, Emiljana Mhilli, Lidona Ndoj	52
16	An Algorithm For The Calculation Of Lyapunov's Exponent For Time Series Of Rainfalls And Radon Concentration	Klaudio Peqini, Tanja Porja	53
17	A Mobile Application For Collecting Earthquake Data: Citizen Seismology	Edmond Dushi, Margarita Ifti, Gentian Ruci	54
18	Data Analysis And Evaluation Of The Impact Of Meteorological Parameters On The Values Of Evapotranspiration (Eto) Calculated By Fao Penman - Monteith Equation	Glejdis Hajdini, Dhurata Premti, Ilirjan Malollari, Shamaila Zia-Khan, Klaus Spohrer	55



ECES24 – ABSTRACTS



Session 1

Climate Science

01. Climate Monitoring Facility For Europe: ECA&D And E-OBS

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Abstract

The circum-Mediterranean is a hot-spot for climate change and is therefore vulnerable for extreme events such as heat waves, droughts and floods – with potential impact on health, agriculture and infrastructure. A dataset providing the historical perspective for the region as a whole is needed to study these events. The European Climate Assessment & Dataset (ECA&D) aims to do this by collecting data from National Meteorological Services to provide a dataset that contains daily, quality-controlled time series of 13 meteorological parameters from ground stations throughout Europe and the Mediterranean area. From these station observations, the in-situ daily gridded dataset E-OBS is derived which contains 8 Essential Climate Variables on $0.1^\circ \times 0.1^\circ$ and $0.25^\circ \times 0.25^\circ$ resolutions. Apart from these meteorological values, a large number of derived indices of extremes are available. As E-OBS extends back to 1950 and many station records go back even further, while both datasets are updated monthly, these datasets are very suitable for use in climate change and climate impact studies.

Although the station density over the southeastern Mediterranean and North African areas is low, the datasets can still be used over large areas of the Mediterranean. Institutes that operate meteorological stations can participate in ECA&D and E-OBS, and increasing the number of stations will immediately improve the quality of the gridded E-OBS dataset as well.

We present the embedding of ECA&D and E-OBS in the WMO Regional Climate Center (RCC) for Europe and the use of E-OBS in the European State of the Climate report as compiled by Copernicus.

Key words: *climate, observations, drought, heat, Europe*



02. A Comparative Study Of Arcgis Classification Algorithms

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Abstract

Classification of ortho-imagery is a fundamental task in remote sensing applications, aiding in land cover analysis, urban planning, and environmental monitoring. In this article, we evaluate the performance of various classification algorithms in ArcGIS for five distinct land cover classes, using both Visible and InfraRed bands. The evaluated algorithms include Maximum Likelihood, K-Nearest Neighbors, Random Trees, and Support Vector Machine. In addition, this article will further focus on the performance of the Random Trees algorithm, particularly examining its utilization of entropy.

Ortho-imagery datasets were acquired and preprocessed to ensure consistency and accuracy across all tests. Each classification algorithm was trained and tested using the same dataset and performance metrics such as overall accuracy, kappa coefficient, precision, recall and F1 score.

Results reveal notable variations in classification accuracy among the algorithms tested, on both bands. For the visible band, Random Trees algorithm emerged with the best performance, followed by the Support Vector Machine algorithm. In contrast, for the InfraRed band, the Support Vector Machine algorithm exhibited the highest accuracy among the classifiers studied, closely followed by Maximum Likelihood algorithm.

These findings provide valuable insights in remote sensing applications, aiding in the selection of appropriate classification algorithms for ortho-imagery analysis across multiple spectral bands within ArcGIS.

Key words: *Raster classification, Maximum Likelihood, K-Nearest Neighbors, Random Trees, Support Vector Machine.*

03. Trend And Cycle Of Fluctuations And Statistical Distribution Of Temperature Of Berlin, Germany, In The Period 1990-2022

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Abstract

Temperature is a crucial parameter in meteorological data analysis, exhibiting significant variability across different periods. Tracking temperature trends over time is essential for understanding climate change dynamics. This study utilizes data from the European Meteorological Observations (EMO) Project, offering meteorological gridded data with a resolution of 1 arcmin and daily temporal granularity. Focusing on Berlin, we selected maximum and minimum temperature parameters and calculated the average temperature for the urban area. Employing linear regression, Fourier transforms, and the least squared error fitting method, we examined temperature fluctuations to identify dominant sinusoidal periods. Through statistical analysis, we classified months from April to September as the hot months based on maximum temperature. Notably, the median temperature difference between hot and cold months was 10.3°C for minimum temperature and 14.2°C for maximum temperature. The temperature probability distributions were further investigated for each group, finding that beta and normal functions exhibited the highest resemblance to the observed distributions. Comparing our findings with a previous analysis using the TRY project dataset for Berlin (1995-2012), this study results in an increase in temperature trends of 0.55°C per decade for maximum temperature and 0.3°C for minimum temperature.

Keywords: *Temperature Trend, Harmonic Analysis, Statistics, Distribution Functions*



04. Thermal Thresholds That Human Body Can Withstand At Different Humidity Levels

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Abstract

High temperatures associated to the phenomenon of the heat waves are a signal for health risk around the world raising the alarm to the public health authorities. As the climate changes, heat waves are changing in the direction of a higher frequency, a longer duration and a hotter period. The concern stands on the question: “When a day is too hot for daily activities without risking the human health?” The human body doesn’t have to increase its metabolic rate by exerting more energy to maintain its ideal temperature of 37 degrees Celsius in the comfort zone of thermoneutral conditions. The human body loses the ability to rid of excessive heat and

stop functioning optimally when outside temperatures reach beyond 40 degrees Celsius and the relative humidity reaches more than 25%. In the current study, we investigated whether there are ambient temperatures lower than 40 degrees Celsius but at higher levels of relative humidity, the human body start to lose the optimal functioning by demonstrating difficulties of sweat rate, body movement, respiratory problems and other health related difficulties. This study is focused on the analyses of the heat wave events registered in Tirana city during the summer months of the period 1950 – 2023. The very high air temperatures recorded due to the summer heat waves were coupled to different air humidity percentages in order to estimate the added heat into the daily maximum temperatures. The new values are considered as heat daily indices related to humidity (HDI_h) and were used to analyze the humid-heat-waves (HW_h) for Tirana city during the summers of 1950 – 2023.

Key words: *heat index, maximum temperature, humidity, heat wave, human body temperature*

05. Assessing Climate Changes In Greece And Albania By Temperature And Rainfall Spatiotemporal Patterns And Trends

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Abstract

Anthropogenic climate change is a complex phenomenon influenced by factors including greenhouse gas emissions by human activities, change land use, urbanization, deforestation, intensive agriculture, transportations, and many other human activities. Strong signals of climate change are the rising of global temperatures and shifts in precipitation patterns as they can lead to more frequent extreme weather events. Global temperatures have been consistently rising, with the past decade and especially the year 2023 being the warmest on record. This warming contributes to more frequent heatwaves, extending of summertime duration and shortening of winter and alterations in precipitation patterns. Rainfall trends show an increase in heavy precipitation events in some regions, while others face prolonged droughts. These changes in temperature and rainfall can have severe consequences on earth ecosystems, agriculture, water resources, and overall human well-being. In this study an assessment of the two primary climate change indicators namely temperature and precipitation is undertaken, by examining a long-term temperature and rainfall time series of the European Center for Medium Weather Forecast Reanalysis v. 5 (ERA5) data set for the 45-year period 1979-2023. Yearly and monthly distributions and trends are examined in prefecture and regional scales to obtain geographically and climatically representative images for Greece and Albania. Spatiotemporal temperature patterns indicated a consistent increasing trend more pronounced in the continental interior areas of both countries. Rainfall distributions indicated increasing trends mainly attributed to increasing rainfall intensity but also with periods with less rainfalls or dry periods. Comparing the resulted trends with local norms, some useful results are extracted about the observed changes and their consistency with climate change projections. Further analyses included thunderstorm frequency patterns based on various sources included lightning data and weather station records. Monitoring these indicators helps us better understand and address the challenges posed by climate change. However, additional databases should be involving in further studies from various sources, such as satellite and weather radar measurements, lightning sensors, weather stations, and climate models. Therefore, to better comprehend the factors contributing to climate change, its effects on ecosystems and human societies, and to develop strategies for mitigation and adaptation.

Key words: climate change, temperature, rainfall, Greece, Albania.



Session 2

Environment & Climate

06. Circulation Weather Types: Understanding Their Influence On Weather Patterns And Pollutant Concentrations In Mediterranean Areas

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Abstract

Understanding air quality and quantifying pollutant concentrations is of paramount importance, particularly in Mediterranean countries where urbanization, industrial activities, and traffic emissions contribute significantly to air pollution levels. Assessing air quality from different perspectives is crucial, incorporating not only meteorological parameters such as temperature and precipitation, the two major weather factors with substantial influence on pollutant concentrations, but also synoptic situations. Synoptic analysis provides insight into larger-scale weather patterns and atmospheric circulations, giving a better knowledge of pollutant dispersion mechanisms and temporal patterns over time. By integrating meteorological and synoptic approaches, we gain a comprehensive understanding of the complex interactions between atmospheric conditions and pollutant concentrations, essential for developing effective air quality management strategies and mitigating environmental and public health impacts. This study focused on Mediterranean areas (i.e., the Iberian Peninsula and Albania). The Iberian Peninsula has been affected by several pollution episodes, exceeding PM10, O3 and NO2 legal threshold repeatedly over the last recent years. The presence of these episodes is frequently linked to either local and regional-scale events. We have calculated the circulation weather types by using an objective methodology based on the calculation of the Lamb Weather Types (LWT). This methodology consists on the calculation of a set of indices associated with the direction and vorticity of the geostrophic flow in the lower atmosphere. The synoptic characteristics and the frequency of the LWT have been analyzed allowing the identification of the main characteristics associated to the occurrence of pollution episodes shedding light on weather anomalies and pollution occurrences across the study area. The relationship between LWT and the spatial variability of (i) temperature, (ii) precipitation amount, and (iii) pollutant concentrations across Mediterranean areas has been discussed by employing a high-quality database based on reanalysis. The relationship between LWTs and poor air quality allowed distinguishing between which types are most frequently associated to pollution episodes, thereby aiding in issuing early population alerts.

Key words: Lamb Weather Types, temperature regime, precipitation patterns, pollutant concentration, Mediterranean areas



07. Implementation Of Electrostatic Separation And Differential Scanning Calorimetry For Robust And Fast Microplastics Analysis In Sediments

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Abstract

By 2050, projections indicate that approximately 13% of the global carbon budget will be attributable to the escalating production of plastic derived from fossil fuels. Due to unsuccessful management, plastic waste is entering ecosystems, presenting a serious threat due to its persistent nature in the environment. Subjected to weathering, mechanical stress and interaction with biota, plastic waste undergoes fragmentation into microplastics (particles smaller than 5 mm). Standardized methods for analyzing microplastics in real-world environmental samples are lacking. Monitoring the origin and fate of MPs is critical for risk assessment and regulatory action, but current methods are often impractical due to their time-consuming nature, high cost, and inability to handle large sample volumes. In response, this study advocates for an operational approach combining electrostatic separation (ES) and differential scanning calorimetry (DSC) for the enrichment, identification, and quantification of microplastics in sediments, while addressing obstacles for future research. ES effectively enriches sediment samples with particles larger than 200 μm , although the separation can be hindered by factors such as total organic carbon (TOC) and sediment particle size distribution. Adjusting parameters in the separation chamber holds promise for improving the efficiency of ES. Using the thermodynamic fingerprint of polymers, DSC allows parallel identification of MPs based on phase transition temperatures. Quantification of the mass of MPs in the sample is possible by determining changes in enthalpies or heat capacities for semi-crystalline and amorphous polymers, respectively. We present experimental data sets to determine limits of quantification (LOQ), with semi-crystalline polymers showing LOQs below 0.5 mg. The LOQs are not only polymer specific, but they depend on the sample enrichment factor, therefore investigating density separation and oil separation as complementary methods to the ES to increase the enrichment factor are in focus of future work. Our combined ES-DSC approach provides a robust and fast means of monitoring microplastics in sediment samples, as we demonstrated in the Elbe River 2021 and Saxony studies, which included samples from the entire river course in Germany as well as first- and second-order waterways in Saxony.

Key words: *microplastics, microplastics analysis, DSC, electrostatic separation, density*

08. The Transformation Of The Natural Landscape In Transition: Forest Degradation, Deforestation, And Reforestation In Post-Socialist Albania

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Abstract

This paper analyzes a major transformation of the natural landscape in post-socialist Albania: forest degradation, deforestation, and subsequent reforestation efforts. These processes are consequences of the dramatic environmental and socio-economic changes that occurred in the country after 1990, following the introduction of a new political and economic system. Utilizing existing scientific literature, official data, statistical sources, and field observations, this paper aims to rationally evaluate the processes of forest degradation, deforestation, and reforestation during the transition period. In addition to analyzing the situation at the national level, a local case study—the municipality of Shkodër—is also considered. The analysis of available data reveals that Albania has significant potential to leverage forests for economic development, as approximately 30% of its territory is forested. However, these resources have largely been exploited in an unsustainable manner. The forests have faced numerous threats during the transition period, including the delineation of new forest usage rights that have yet to be implemented; reliance on forest resources by many households for livelihood; uncontrolled woodcutting and illegal activities; and mismanagement by both central and local authorities, including local communities. Recently, important efforts to protect the remaining forests and invest in reforestation have been initiated at both national and local levels. In 2016, a moratorium was approved, the impact of which will be observed over time. This paper also attempts to evaluate this impact and to offer recommendations for measures that should be adopted to address forest degradation in Albania, with a focus on transitioning toward sustainable use.

Key words: *Natural landscape, transformation, forest degradation, deforestation, post-socialist Albania*



09. Heavy Metal Pollution In The Drenica River Caused By Feronikeli

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Abstract

Environmental issues have consistently received significant attention and continue to be a major concern for scientists. Among these, water pollution remains a critical global challenge, exacerbated by various factors. Heavy metal pollution, in particular, poses a severe threat to the environment, triggering a chain of contamination that affects soil, water, and air, and ultimately impacts human lifestyles. Due to their toxicity, persistence in the environment, and propensity for accumulation in the human body through bioaccumulation, heavy metals can become extremely hazardous when combined with various environmental elements, such as water. Consequently, humans and other living organisms can be exposed directly or indirectly through the food chain.

In this review, we focus on research concerning water pollution in the Drenica River with heavy metals from the Feronikeli enterprise, known for extracting metals like nickel (Ni), iron (Fe), zinc (Zn), lead (Pb), and others. The Drenica River, a crucial water source, faces significant challenges due to contamination with heavy metals. This issue has raised concerns within the community and has a direct impact on public health and well-being. Our findings are alarming, showing an increasing concentration of metals in the river over the years. This is contrary to expectations that advancements in technology and environmental regulations would lead to improvements in water treatment before its discharge into the river.

Key words: pollution, heavy metals, water, Drenica River

10. From Wet To Extreme Wet Spells – Case Study Of Shkodra

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Abstract

One of the most important climate's elements is the precipitation and changes in their long-time regime is crucial to the changes of the climate itself. Periods of heavy precipitation play an important role in the total precipitation monthly amounts and consequently in the seasonal and annual totals effecting in this way the water resources of a certain area. More often the period of heavy precipitation in one area more fragile the water balance of that area, more difficult the management of water reserves. In this study, we analyze the maximal Consecutive Wet Days (CWDmax) in monthly and annual bases in order to define a certain month or season as a wet or very wet period for a corresponding year or decade. In the wet months or seasons resulting from the CWDmax analyses, we searched for very wet or extremely wet period by estimating the monthly maximum consecutive 5 up 10-days precipitation (respectively the RX5day and RX10day indices). In a last step we estimate the weight of the RX5day and RX10day indices to the monthly, seasonal and annual total precipitation. All the above indices were estimated based on the daily precipitation data series of Shkodra city for the long period of 1950 – 2022 in order to have signals of the climate change impact to the local changes of precipitation.

Keywords: *wet spells, wet period, rainfall tendency, water resources, climate change*



Session 3

Natural Hazards

11. For “Derechos” To “Medicanes”: Climate Change And Severe Convective Events In The Mediterranean

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Abstract

Climate change is increasingly affecting the intensity of severe weather events in the Mediterranean. A "derecho", an extremely anomalous and vigorous linear convective windstorm, occurred in August 2022 over the Mediterranean Sea, moving from the Balearic Islands to Slovakia, producing severe wind and intensive damage. Numerical simulations have revealed that a record-breaking marine heatwave and anthropogenic climate change have substantially contributed to the development of this event. The pseudo-global warming simulations show that the windstorm would have not formed in pre-industrial conditions. The role of sea surface temperature anomaly was identified as fundamental for the occurrence of the event. Other storms that are affected by climate change are the so called "Medicanes". Different studies agree that the intensity of these events is expected to increase in the future climate, while the frequency will remain around the same. This is mainly a consequence of the increased sea surface temperature that affect the air-sea interaction mechanism responsible for their intensification. Conversely, the average warming will affect more the upper than the lower troposphere, thus inducing more stable conditions detrimental for their development.

Recent studies have shown that within the category of “medicanes”, cyclones with different characteristics may occur, showing larger similarities to tropical cyclones or to warm seclusions, depending on the case study. Therefore, future studies should disentangle better the impact of climate change on these two separate categories.

Key words: *cyclones, derechos, medicanes, climate change, convection*



12. Calibration Of Moment Magnitude-Local Magnitude Relation Using Albanian Seismic Networkdata: Enhancing Seismic Catalogs Through Back-Processed Event Data

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Abstract

This study focuses on calibrating the moment magnitude-local magnitude (M_w - M_L) relation using seismic data from the Albanian Seismic Network, spanning the last three years. Our approach includes back-processing specific events to expand the dataset, aiming for a comprehensive analysis. Utilizing GISOLA real-time moment tensor inversion software within the Seiscomp (v.4) seismic monitoring system, we compute M_w values. Concurrently, M_L values are derived using SEISAN (v.12), following the methodology of Hutton and Boore (1987), with manual amplitude checks for validation. The findings reveal a strong correlation between M_w values computed through GISOLA, utilizing full waveform data for moment tensor inversion, and M_L values obtained through routine location in SEISAN. Notably, exceptional efforts in back-processing specific events contribute to enriching the dataset, enhancing the reliability of the calibration. The best correlation scores are observed for moment tensor solutions of quality A and B, corresponding to the highest variance reduction. These results are represented by high correlation coefficients and low correlation standard deviations, indicating the robustness of the calibrated M_w - M_L relation. Our study contributes to the development of comprehensive earthquake catalogues for Albania, crucial for seismic hazard assessment and risk mitigation. By refining the M_w - M_L relation, we enhance the accuracy of magnitude estimation, facilitating more informed assessments of seismic hazard.

Key words: *moment magnitude, calibration, earthquake catalogues, seismic hazard assessment, moment tensor inversion*

13. Natural Risk Assessment In Shkodra Lowland

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Abstract

In recent years, Albania underwent a rapid socio-economic transformation, accompanied by uncontrolled construction and degradation of the territory in certain areas. For these reasons, an increasingly large part of the Albanian population is exposed to natural hazards, where the main threat is represented by floods. The lowland of Shkodra is formed in the meeting zone of four tectonic zones (Alpes, Mirdita, Krasta-Cukalit and Krujës), that is, with a diverse and extremely complicated lithological and structural construction. The origin of this Lowland is mainly accumulative. The main types of its relief are fluvial, structural-erosive and erosional-denuding, opening widely from the west to the southwest. The hydrographic network of lowland is one of the richest in the country, as the Drini and Buna rivers pass through here. One of the main goals of this paper is to analyze basic information about flooding (egg, where the most vulnerable areas are) and how measures can be taken using relatively simple and low-cost technologies and methods, which give effective opportunities to state institutions and the local community to cope with a natural hazard such as flooding. Albania is classified in the red zone for its vulnerability to natural disasters according to the World Bank index, and especially Shkodra is one of the regions most exposed to them. Taking concrete measures, against any kind of natural risk, should be part of national/local studies and strategies and especially periodic control over the territory.

Keywords: *natural hazards, flood, Buna River, Shkoder Lowland*



14. Lamb Weather Types Influence On Urban Heat Island In Southern Europe

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Abstract

The Urban Heat Island (UHI) effect describes elevated temperatures in urban areas relative to their rural counterparts. This disparity stems mainly from human-induced alterations to the environment and microclimate, including urbanization, changes in land surfaces, and heat emissions from buildings, vehicles, and industries among others. The UHI effect intensifies heat-related hazards, affects energy usage, alters atmospheric circulation, and holds substantial implications for public health and urban sustainability. Thus, it is crucial to evaluate the spatio-temporal influence of the Urban Heat Island (UHI) in metropolitan regions to gather essential environmental information and foster sustainable urban development. Utilizing meteorological reanalysis data across various regions in southern Europe, the Lamb-Jenkinson weather types (LWTs) were employed to assess their impact on the urban heat island phenomenon during both daytime and nighttime over recent decades. We used temperature and mean pressure level data from CAMS global reanalysis (EAC4). This dataset is based on global gridded data with a spatial resolution of 0.75° x 0.75° and a temporal resolution of 3 hours. Furthermore, the vertical resolution is also very high since it is based on 60 model levels, with pressure levels from 1 hPa to 1000 hPa. UHI was determined by analyzing the maximum and minimum temperatures within specific regions. Frequency analysis was conducted for annual and seasonal LWT types. We observed a higher frequency for the anticyclonic (A), cyclonic (C), southwestern (SW) and Western (W) types (together accounting for nearly 50% of occurrences). However, these LWT were not always associated with higher UHI values. Overall, a greater UHI contrast was observed during the night in the studied cities. Additionally, the highest UHI values were found in the summer for most of the studied areas.

Key words: *Lamb Weather Types, urban heat island, seasonal analysis, spatial coverage, reanalysis*

15. Normalization Of Local Magnitude Scale For Routine Earthquake Processing: Insights From Albanian National Earthquake Monitoring Centre

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Abstract

This study investigates the normalization of the local magnitude (ML) scale utilized in routine local and regional earthquake processing by the Albanian National Earthquake Monitoring Centre. A dataset comprising 406 events from the national database of earthquakes in the Institute of Geosciences (IGEO) spanning 2 years (2021-2022) is analyzed. Events with magnitudes in the range $2.0 \leq ML \leq 4.3$ are considered, primarily focusing on moderate earthquakes prevalent in the region. Event depths range from 0.5 km to 64.3 km, reflecting the shallow activity associated with the seismically active crust and continental subduction. Regression analysis is conducted to compare ML values reported by TIR with those from the Euro-Mediterranean Seismological Centre (EMSC) and the National Observatory of Athens (NOA), representative seismological agencies for the region. This analysis builds upon previous work covering events from 2021 to 2022, yielding parametric relations. The study utilizes the local model implemented in SEISAN for ML computation, based on Hutton & Boore (1987), corrected by a factor of 0.4. The analysis extends over a longer period, focusing specifically on moderate earthquakes and incorporating a more concentrated spatial extension. Orthogonal regression methodology is employed, accounting for variations in the analyzed variables. The findings contribute to the normalization of the ML scale for local and regional earthquake processing, enhancing the accuracy of seismic magnitude determination and reporting. This work provides valuable insights for seismic monitoring and hazard assessment efforts, particularly related with a representative and homogenize regional earthquake catalogue.

Key words: local magnitude scale, earthquake processing, seismic monitoring, regression analysis



16. Comprehensive Analysis Of Aftershock Focal Mechanisms Following The 2019 Durres Earthquake: Integrating Mobile Seismic Network And National Seismic Data Using The HASH Method

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Abstract

This study investigates the focal mechanisms of aftershocks following the November 26, 2019, Durres earthquake (Mw6.4) using a combination of data from a mobile seismic network and the permanent national seismic network, recorded and processed at the Albanian National Earthquake Monitoring Center in the Institute of Geosciences (IGEO). The HASH method by Hardebeck and Shearer (2002) is employed, a widely used approach based on first motion polarities, effective for seismic events down to $M \sim 2.5$. However, for shallow events (<5km depth) and offshore locations with limited station coverage, the method's reliability diminishes due to inadequate velocity models and network coverage. Approximately 100 earthquakes were analyzed, focusing on events within the seismic network centered around Durres and those offshore in the Adriatic Sea.

While the first motion method yields robust results for events within the network's coverage area, it proves less reliable for offshore events due to station limitations. The HASH method addresses uncertainties by generating a set of acceptable mechanisms for each event, considering factors such as polarity errors, event location uncertainty, and takeoff angle variability. This approach provides stable, high-quality focal mechanisms, enabling a comprehensive analysis of aftershock focal mechanisms in the study area. By considering the uncertainty inherent in seismic data, including polarity measurements, event location, and velocity model variations, the HASH method provides valuable insights into the focal mechanisms of aftershocks, contributing to a better understanding of seismic activity in the Durres region.

Keywords: *Durres earthquake, aftershocks, focal mechanisms, HASH method, mobile seismic network*



Session 4

Numerical Modelling & Simulations



17. South American Activities And New Developments Of The Regional Earth System Modeling Platform Of IPSL (Regipsl)

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Abstract

RegIPSL is the regional earth system modeling platform developed by the 'Institut Pierre Simon Laplace' (IPSL, France). RegIPSL dynamically couples dedicated models for most of the components of the climate system: ORCHIDEE (land and routing), WRF (atmosphere), NEMO (ocean), OASIS (coupler) and XIOS (input/output). Aside of Europe, RegIPSL is also being used over the South American continent for different purposes and projects. In this work we will show the current different uses of the platform as well as the ongoing plans of its upgrading. We have been using the platform in continental regional resolution (20 km) experiments in which we analyzed, for example, the feedback into the atmosphere when the floodplains wetlands are simulated, and the impact of the deforestation in the local water budget and the tropical circulation patterns in the Amazonian Basin. We are starting to perform the first tests at kilometer-scale resolution over the transition between Amazon basin and the Andes mountain range in the area of the 'Altiplano' region. Current upgrading plans include the update of the WRF version from v3.7.1 to v4.3.3, ORCHIDEE from v2.2 to v4, as well as XIOS and OASIS upgrades. With current activities and planned projects, we hope that RegIPSL could provide reliable and complete information useful for climate and impact studies as well as for policy and decision making in the region.

Key words: *Numerical simulation, kilometer-scale resolution, Amazonian Basin, climate change*

18. Metgis, A World-Wide Comprehensive High-Resolution Meteorological Downscaling And Visualaizaton Approach

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Abstract

MetGIS is a powerful, interdisciplinary weather forecasting, analysis and visualization approach, developed at the Institute of Meteorology, University of Vienna (Austria), and subsequently extended by MetGIS GmbH through a number of international R&D projects. MetGIS is a specialist for ultra-high-resolution weather (both predictions and historical data), based on powerful downscaling approaches. Extra high resolution terrain data are included in the weather simulation process, substantially raising the quality of the computations. MetGIS operates a powerful, automated world-wide weather forecast system which is also in successful use over Albania. MetGIS provides APIs for point forecasts, weather maps, historical weather data, climate data, snow related topics, precipitation radar and weather warnings. These give providers of foreign information systems (websites, apps, etc.), environmental modelers and AI developers access the weather not only for individual points, but also as color map overlays, zoomable to resolutions of less than 100 m. Beside APIs, MetGIS also offers turnkey solutions for its world-wide real-time weather predictions, such as the graphical user interface MetGIS Pro+, PDF forecasts sent to email and forecasts in form of text messages sent to smartphones. Users of MetGIS technologies stem from a variety of industries such as energy production, tourism, traffic operation and agriculture, and are companies and institutions that need precise weather information in order to take better decisions and to optimize their business models, thus increasing their profit and/or reducing the risk of accidents.

This paper will give some insights in MetGIS downscaling techniques, data distribution, visualization options and use cases, also with reference to Albania.

Key words: *Downscaling, Visualization System, High-Resolution Forecast, Numerical Modelling, Graphical User Interface.*



19. Multiple Delays In Light Curves Of Lensed Quasars

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Abstract

The time delays measurement of lensed quasars depends on the quality of the light curves measured in each split image. These delays are created because the light rays of images follow different paths through the gravitational field of the galaxy when the source is time-variable. Generally, the source of variability has a finite size, and when it is widely distributed (>100 pc as a whole), variabilities between split images may not show a good correlation, even though their origin is identical. In these cases, multiple delays can be measured. We investigate this phenomenon in double lensed quasars that are expected to be observed by the Roman Space Telescope. Using Monte Carlo simulations, we generate quasar-galaxy systems based on the mass-luminosity function of galaxies and the redshift distribution of both galaxies and quasars taken from observations. Relying on the capabilities of the Roman Telescope, we define the lensed quasars, the time delays between images, and time delay differences for the variability source size in the range of 10 to 1000 pc. We find values of time delay differences exceeding 30 days, and these do not depend on the mass distribution of the lens galaxy. We conclude that in 30% of double lensed quasars, the light curves will not be correlated, and multiple time delays can be measured.

Key words: quasar, galaxy, strong lensing, time delay.

20. Low-Dimensional Models As Feasible Tools To Probe The Internal Functioning Of The Geodynamo

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Abstract

The intrinsic complexity of the Geodynamo is an extended field of study deeply reliant on the employment of advanced numerical models. The magnetohydrodynamic models devised to emulate its behavior currently work in a parameter regime far away from the estimated values. Despite the complexity of such models, they produce not necessarily Earth-like magnetic fields and consume huge amounts of computational resources. As a practical alternative, low-dimensional models are seen as a feasible alternative that emulates many features of the main dipolar field and is much more computationally efficient. In the current paper we investigate some of such models and provide the advantages and drawbacks of each. We must stress that each model is conceived in order to address certain aspects of the dipolar field and combining several of them would increase the complexity and would make the interpretation of results more challenging. Furthermore, being toy models means that they are a simplified version of the system thus losing salient mechanisms. We advise a multi-faceted analysis where the low-dimensional models can be constructed and analyzed to get some insights about the system under study. Afterwards we can employ the gained knowledge to refine the magnetohydrodynamic model.

Keywords: *Geodynamo, magnetohydrodynamic model, low-dimensional models, dipolar field reversals, dipolar moment*



21. Pilot Test: Site Response Evaluation Using Different Non-Invasive Methods

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Abstract

Evaluation of site-specific response is of crucial importance for improved urban planning, structural design and risk-management strategies. In light of the recent development of instrument capabilities, updated software packages and increased accessibility to mobile seismic sensor pools, this study aims to present the findings of a pilot test for site response characterization. Referring to the cost and time required for geophysical measurements dedicated to specific sites, this study compares the results from HVSR analysis of 30 min records from all the stations of the Albanian Seismic Network, in order to check the compatibility of the predominant period and amplification between the two methods. Different methods of combination of horizontal components have been evaluated, namely the geometric-mean, squared-average and single azimuth. A lognormal distribution for the fundamental site frequency (f_0) for each site is defined, in order to represent consistently the uncertainty in f_0 . For some cases requiring additional checks HVSR data from multiple time window are presented, not only the mean/median curve. This method has been largely validated to develop rigorous and unbiased spatial statistics. The method used in this study uses a fully-automated frequency-domain window-rejection algorithm and provides automatic checking of the SESAME (2004) peak reliability and clarity criteria. This study suggests a confidence interval for the compatibility of both methods in terms of predominant period. Moreover, we can deduce that local or regional seismic sensor mobile pools aiming to reveal tomographic features of a zone of interest, can serve as well for microzonation studies as a very efficient approach referring to time and cost.

Key words: *Seismic Network, geophysical measurements, tomographic features, microzonation studies*



Session 5

Public Communications & Interdisciplinary Studies



22. Public Communication For Global Warming And Climate Extremes

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Abstract

Broadcasting meteorology is the underestimated part of the meteorology science which deals with communicating the science information to the public. Nowadays it has gained momentum due to the rise of extreme weather conditions, providing the beneficial opportunity to inform and educate the public accordingly with a more suitable terminology using the most advanced visual aids. However, the perception regarding extreme weather is considered a double-edged sword due to the public lack of knowledge about climate and the inability to comprehend the importance of the planetary energy budget and the overall contribution of greenhouse gases to the climate system. Broad accessibility to the data source plethora and the lack of fact-checking consequently led to conspiracy theories to see the daylight. One of the most legendary challenges that follow in the daily life of a broadcaster meteorologist is that her/his words have an early expiration date; she/he may be verified in a few minutes, hours or days. In the total of 365 days of a year, it happens not rarely that a frontal system is delayed or a convective storm degrades faster or changes the trajectory and for that, the broadcaster meteorologist can be crucified by the public. Therefore, narrow space and time references are often the biggest enemy. Another very recent issue is the color bar scheme choice, the red and pink colors are considered the most fearmongering for the public, and often used to be compared with past events. In July 2022, the conspiracy theories skyrocketed when the Met Office announced its first 40°C in the UK, with the accusation of meteorologists being "harbingers of doom" another case in April 2023, due to an exceptional heatwave for the time of the year, meteorologists at AEMET faced life threats, severely raising the pressure and affecting their contribution to society. These issues remain the challenges for the foreseeable future and the concerns of a broadcast meteorologist in front of the public.

Key words: Public speaking, meteorology terms, climate's normal, climate changes

23. The Competence-Based Learning Assessment For Climate And Weather In Pre-University System A Study In Physical Geography Education

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Abstract

The study aims to analyze the competence-based approach in pre-university education to develop students' skills in subject knowledge related to climate and weather. The research focuses on the field of physical geography education and employs a methodology centered on assessing key and subject competencies, as well as learning situations, highlighted in climate and weather topics found in textbooks. The learner-centered approach based on competencies is considered a bridge between mastering subject knowledge and practical student proficiency. The methodology utilized relies on textual analysis of three alternative geography textbooks, selected for 7th and 10th grades, which cover fundamental knowledge of physical geography. The development of these textbooks is based on the philosophy of competence-based learning. Additionally, a qualitative criterion-referenced assessment approach from Competency Assessment Programs (CAP) is suggested. The findings of this research highlight the importance of the competence-based approach, revealing the complexity of both subject-specific and key competencies frequently used in weather and climate contexts. The study serves and helps various stakeholders operating in the field of education.

Key words: *competence-based learning, climate and weather, pre-university education, physical geography, quality criteria, Albania.*



24. Assessment Of The Annual Effective Dose From Some Cereal Crops Commonly Used In Local Markets Of Tirana City

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Abstract

About fifteen samples of cereal crops commonly used in Albania were collected from the local markets of Tirana city for this study. Radionuclides are found everywhere in the environment, therefore some radionuclides are transferred to the cereal crops and further enter our bodies by different pathways. This study aimed to assess the total annual effective dose from these cereal crops. The HPGe detector was used for the measurements and the activity concentration for radionuclides of ^{226}Ra , ^{232}Th , ^{40}K and ^{137}Cs was calculated before assessing the total annual effective dose. Radionuclide of ^{40}K has the highest value of the activity concentration for all samples and then they follow from ^{226}Ra , ^{232}Th and ^{137}Cs . The activity concentration of the artificial radionuclide of ^{137}Cs was detected only in four samples at a low level. The total annual effective dose, based on intake of ^{40}K , ^{226}Ra , ^{232}Th and ^{137}Cs in cereal crops, was found to be $350.68 \mu\text{Sv/year}$. The main contributors to the total dose come by radionuclides ^{40}K and ^{226}Ra , while two other radionuclides ^{232}Th and ^{137}Cs have a minor contribution.

The total annual effective dose in this study falls within the global range defined by UNSCEAR reports and was lower than the recommended limit value of $1 \text{ mSv} \cdot \text{y}^{-1}$ by WHO and ICRP for adults. Therefore, results indicated that consumption of cereal crops by the people of the study region is safe, with acceptable radiological risk and no harmful health effects are expected for living things.

Key words: Radionuclide, Activity Concentration, Cereal Crop, Annual Effective Dose



Poster Session



01. The Complementarity Of Wind And Solar Power In Vlorë, Albania

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Abstract

Vlora is a city located in the southern part of Albania. It is not only a historical city, but also a very attractive one. Its favorable geographical location has made it an important year-round tourist destination. The growing demand for electricity highlights the need to use renewable energy sources. The study presented is based on data of monthly average values of wind speed and solar radiation in this area. Converting these values into expected electricity for each month of the year is based on the selection of a suitable wind turbine and photovoltaic panels. We then applied the quantitative method to study the complementarity over time between two renewable energy sources, wind and solar. A dimensionless index as a product of three components was used for the outcome. The results obtained lead us to conclude that in the Vlora district we have partially good complementarity between the two chosen sources.

Key words: *complementary on time; wind energy; solar energy; index of complementarity. Average monthly energy value*

02. Problematics Of Solar PV Implementation In High Altitude Areas Of Vlora

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Abstract

Photovoltaic (PV) systems have received a lot of attention in recent years due to their ability to efficiently convert solar energy into electrical energy, which offers significant benefits for the environment. Albania has great potential for solar energy. It receives around 2100-2700 hours of sunlight, making solar energy accessible. This study provides a review of the challenges of implementing photovoltaic systems in the mountainous areas of Vlora, specifically in the Llogora National Park, which is located 910 meters above sea level. This area is highly frequented by tourists. Tourism is the most important sector in the park and has the greatest potential to be a source of sustainable income. The basic concept is the utilization of solar panels in businesses operating in this area. The energy network challenges and climatic conditions are detailed. The performance of PV system installation, energy costs, and types of panels that can be installed with one axis or two axes are evaluated. By using cost data per unit for materials and different subsystems, it is possible to identify an individual panel or panel system that minimizes the cost of produced energy. The cost per kWh for different PV system technologies in the network ranges is 0.111 EUR/kWh. However, on the other hand, compensating for network interruptions, and low voltage problems in the main network, which affect businesses in this area, is a good investment.

Key words: *Photovoltaic systems; cost of electricity production; mountainous areas; single-axis panels; dual-axis panels.*

03. Air Pollution Analysis And Continuous Monitoring Of Particulate Matter (Pm_{2.5}) In An Urban Aria In Tirana

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Abstract

Tirana is a highly populated city with a significant number of vehicles, making the control and management of air pollutants crucial. Primary pollutants originate from various sources, including industrial factories and fuel combustion. Correlation analysis, along with the determination coefficient R^2 , reveals strong relationships among certain primary pollutants, particularly organic ones. Through this analysis we investigated pollutants common sources. The analysis gave both high and low values. High values indicated a strong connection between pollutants, suggesting a shared source. We analyzed daily median concentrations for PM_{2.5} (average yearly concentration 8 $\mu\text{g}/\text{m}^3$) and PM₁₀ (18 $\mu\text{g}/\text{m}^3$) dataset for two urban sites in Tirana, available from the World Air Quality Index (WAQI). We evaluated that during years 2020 - 2024 the average daily concentration of PM_{2.5} varied each year, with higher peaks in winter due to biomass burning reaching the highest median daily value 49.08 $\mu\text{g}/\text{m}^3$ in January 2021. Concentration of PM₁₀ was every year double the concentration of PM_{2.5}. We also conducted continuous measurements in an urban area in Tirana using a low volume sampler device. To ensure accurate measurements, the equipment was placed 15 meters above the ground in an open space collecting information regarding not only PM_{2.5} but also temperature and pressure, twice weekly in Mars until 15 April. Consistently measured a flow rate of 2.3 m^3/h and an average PM_{2.5} concentration of 20 $\mu\text{g}/\text{m}^3$ across several days. While temperature max and min values were 23.9 °C and 10.8 °C. The Air Quality Index calculated for PM_{2.5} 24-hour measurements was 68 indicating moderate levels.

Key word: *Primary pollutants, Low Volume Sampler device, correlation analysis, WAQI.*

04. Assessment Of The Climate Knowledge And General Information On High School Students

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Abstract

Providing elementary and high school students with a clear understanding of climate change and other environmental changes that impact the quality of live is crucial for their general scientific formation and as future earth stewards. However, the weakening interest in Science and Mathematics education would affect crucially this knowledge's component which reveals the importance of a more professional assistance on curricula, textbooks' edition and other means of knowledge transfer. This work aims on starting with a very initial assessment of students' knowledge on climate and earth sciences mostly based on the information provided by our education system but not limited too. The assessment is based on evaluation of knowledge through multiple choice tests. Considering the relatively small number of percipients in the test and the non-randomness of the sampling, for achieving confident test's outcomes we have used the Rasch model for calibrating the testing and also, we utilized indexes to analyze the ratability and consistency of the test itself. Finally, a comparative view on the results related to physics, chemistry and geography as being introduced to the actual high school system are depicted straightforwardly for further consideration. We observed that the overall level of high school students on climate and earth sciences is at moderate level despite the fact that those matters are not introduced by a unique syllabus. The problems observed are similar with those found by employing CI models for assessment of students' knowledge. Particularly, the answers based on common sense and guessed answers are typically frequently, which limits the exploratory power of such easement categories.

Key words: *knowledge on climate, earth sciences, conceptual knowledge, high school education, Rasch model*



05. Remarks On Linear Modeling For Assessment Of Electricity Consumption-A Case Study For Albania

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Abstract

The simplification of using linear approaches for modeling real system's behavior, comes together with non-neglectable uncertainties. Here we have reconsidered the prediction of the consumption of electricity based on a standard econometrical model by proposing an improvement of the prediction for temperatures. For this purpose, we have used a seasonal based time series of temperatures, and we have qualified for prediction the series that exhibit lo un-stationarity feature of their distribution. We obtained near to stationary distribution of the average temperatures buy grouping them on three daughter series covering 4 months each. Next, by using the predicted econometric variables from official sources, we have concluded in the assessment of the predicted electricity consumption for the near future.

Key words: modeling, electricity consumption, temperature, time series

06. A Nonlinear Time Series Approach For Studying Inflows On The Lakes Of Drin Cascade.

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Abstract

The study of Drin lakes inflows remains always interesting and attractive for researchers, engineers and managers because of the strategic status of Drin HPPs, and complexity of the system itself. Bounded by the limited data set that we had in disposal at the time of this work, we have elaborated herein a prognostic view on the analysis of time data series of side inflows on Drin's lakes. Those series are typically nonlinear, nonstationary and heterogenous, and can be analyzed by using nonlinear and complexity approach. By using q-functions as an instrument for measuring the level of the non-stationarity, we have recognized several daily data series based on month reference as of manageable un-stationarity in the sense of reliable usage of standard modeling and forecasting tools based on them. Next, we employed cluster diagnostic tools to evidence dissimilarities between individual data series. Next, multifractal features are considered for measuring the heterogeneity level. Smoothness of multifractal spectrum and moderate non-stationarity are considered to indorse the use of autoregressive or neural network model for prediction purposes. Finally, to deal with insufficient measurement for an evolving environment due to climate changes, we suggested employing sequential measurement idea based on yearly records. In this work we have used some data records gathered for 1998-2013, which were appreciable regarding to qualitative and scholar analysis but not sufficient for accurate prediction and engineering purposes. Consequently, the findings elaborated in this work consist of methodological outcomes and a basic proposal for achieving good results on the improvement of prediction and administration of water resource of the basin.

Key words: lakes' side in flows, simulation, stationarity distribution, q- functions, multifractal, clustering and dynamic time warping



07. Microplastics Pollution In Some Imported Table Salts In Albania

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Abstract

The substitution of metals and ceramics with polymers has grown rapidly since the 1950s, due to their low production cost, few manufacturing processes, low density, good mechanical stability. Unfortunately, the growing usage of plastic materials has also increased their wastes. According to simulation results, plastic wastes will triple to 270 million tons from 2015 to 2060 around the globe. After production, during their usage stages and until their deposit in disposal sites, plastic materials will degrade and break into small fragments and particles. Microplastics (MPs) have sizes less than 5mm while nano plastics (NPs) less than 1µm. Their environmental pollution has been detected in aquatic sites (seas, rivers, lakes), on land and in living organisms, only after 2004. Since then, more than 690 marine species have been reported to be contaminated by micro- and nano plastics, which according to several studies have toxic effects such as growth inhibition, oxidative damage and immune stress. Microplastics can find their way into humans through marine edible organisms and table salt. The most common detected types of MPs are PA (polyamide), PE (polyethylene), PES (polyether sulfone), PET (polyethylene terephthalate) and PS (polystyrene). In this study table salt samples from Greece, Italy, Germany and Bosnia & Herzegovina have been analyzed with optical microscopy and image analysis. The purpose is to categorize MPs according to their sizes and to evaluate which of the imported table salts contain the least amount.

Key words: *Microplastics, Table salt, Optical microscopy, Image analysis, Albania.*

08. Soil Radioactivity And Its Role In Ecosystems: A Literature Review

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Abstract

This article presents an effort to perform a literature review related to ecosystem interrelations of soil radioactivity and some of its other parameters, with regard to disrupting the normal functions within an ecosystem. Soil radioactivity can have various impacts on ecosystems, depending on the levels of radiation and the types of radioactive materials present. Natural soil radioactivity is a natural component of ecosystems and is typically at levels that do not cause significant harm to organisms. On the other hand, the ecological role of soils upon radioactive contamination is clearly manifested in soil ecosystems services, mainly in the role of a buffer and protective shield from ionizing radiation. Excessive soil radioactivity can harm organisms living in the soil, including microorganisms, plants, and small animals. It can disrupt nutrient cycles, inhibit plant growth, and alter the composition of microbial communities essential for soil health, affecting decomposition and mineralization processes. Soil animals are the most suitable biological indicators of radioactive pollution because they are parts of nutritional chains. Furthermore, radioactivity can accumulate in plants and animals, potentially entering the food chain and posing risks to higher trophic levels, including humans, who play a crucial role in ecosystems as both consumers and stewards. They contribute to the balance of ecosystems through activities.

Though the complete understanding of the role of soil radioactivity in ecosystems is difficult, needs further exploration and studies, the conclusion is that radioactive contamination of soils is considered as a separate type of degradation decreasing their fertility. Soil radioactivity can be hypothesized as an important parameter and it is essential to monitor and understand the effects of natural radioactivity on ecosystems, especially in regions with elevated levels or in areas where human activities may exacerbate natural radioactivity levels.

Key words: *Soil radioactivity, soil parameters, radioactivity monitoring*



09. Activity Of The Photosynthetic Apparatus In Plants Under The Influence Of Direct Solar Radiation

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Abstract

Transmission and reflection spectroscopy are used for the non-destructive assessment of chlorophyll in leaves. Reflectance in the spectral region around 700nm is the best indicator of chlorophyll and for this the ratios R_{750}/R_{700} are used. Reflection spectra demonstrating the optical properties of leaves provide information on reflectance of some specific wavelength. The measurements were carried out with three types of leaves (sun, partial shade and shade) for Abbas pear variety in an area under water. The spectra allow determination of leaf color with x and y coordinates, brightness, luminance as well as "dominant" wavelength. In the narrow band of wavelengths 531 nm and 570 nm, the diffuse reflectance values allow the calculation of the photochemical diffuse reflectance index (PRI).

Key words: *Reflection spectra, Chl a, Chl b, $a+b/x+c$, R_{550} , R_{750}/R_{550} , PRI.*

10. Standardization Of The Radiochemical Procedure Of Polonium -210 Determination In Water Samples.

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Abstract

Naturally occurring radionuclides of terrestrial origin called primordial radionuclides are present in various quantities in the environment, including the human body. Polonium- 210 is one of the most toxic naturally occurring radionuclides and one of the most important environmental radionuclides due to its wide distribution and potential for human radiation exposure through ingestion and inhalation. It is a naturally occurring alpha emitter and exists in the environment, mostly found in water, soil and food because of the Lead-210 decay within the Uranium-238 decay chain. There are limited number of methods available for its determination in water samples, the most used being alpha-particle spectrometry. In this study are performed two procedures for chemical separation of polonium, solvent extraction and Sr-resin extraction chromatography to determine the activity concentration of 210-Po by alpha-particle spectrometry. The other steps of the procedure including sample preparation, co-precipitation to concentrate the Po from the bulk sample, chemical separation and purification of the polonium in order to avoid interference from natural or artificial alpha emitters and stable elements in the test sample, source preparation by auto-deposition of Po onto a silver disk, measurement in an alpha spectrometer, calculation of the analytical result was the same.

Keywords: Polonium, radiochemical procedure, alfa-spectrometry, decay chain.



11. Climate Change Education At School

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Abstract

One of the key competencies that in pre-university education students acquire is competence for life, business and the environment. At school, students are introduced to the general problems of human impact on climate change. Nowadays, ecological problems are increasing and are getting complicated. The purpose of this study is to understand from the teachers' point of view if there are difficulties carrying out discussions/projects at school about human influence on climate changes. Do teachers face difficulties in educating students about human impact on climate change? Should we add topics to the program on human impact on climate change? Are the teachers prepared to answer all the students' questions? Do they have all the tools to explain/develop projects on ecological changes? The study was carried out from the answers to the questionnaire completed by Albanian teachers who teach different subjects such as physics, mathematics, biology, chemistry, history, geography, information and communication technology etc. Teachers need to be trained for specific topics which may include subjects outside their profile. Topics dedicated to climate change are missing, although teachers can discuss how the concepts taught affect climate change. There is a lack of suitable teaching materials for carrying out the experiments.

Key words: Education, Climate Change, Albania, Pre-University Education

12. Determination Of Optimal Irrigation Water Requirement Of *Salvia Officinalis* Through Cropwat V8.0

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Abstract

*Abiotic factors such as water, air, climatic changes and microelements derived from chemical fertilizers are decisive in the growth and quality of the *Salvia Officinalis* plant. The presence of nutrient microelements and salts in water has a positive effect on the growth of plant height, the wet and dry weight of the plant, as well as the tendency of the plant to increase the production of essential oils during the extraction process. In determining the amount of water for irrigation, the climatic conditions in which *Salvia officinalis* grows must also be considered. The conditions for which the growth of *Salvia Officinalis* will be studied are intermediate conditions where the maximum ambient temperature reaches 35°C and the height above sea level is 950 m in Prrenjas, Albania. This paper shows the possibility of healthy growth of *Salvia Officinalis* for the climatic conditions offered in the cultivation area and with the water used for irrigation. The implementation of the amount of the main abiotic factor, water, is applied through the model created with the Cropwat V8.0 and the complementary climatic database from Climwat V2.0, where the irrigation regime of *Salvia Officinalis* is determined throughout its growth and cultivation period.*

Key words: irrigation water, abiotic factors, Cropwat V8.0



13. Hydrosphere And Atmosphere

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Abstract

The hydrosphere is the sum of all water on Earth and the water cycle that distributes it around the planet. The hydrosphere comprises the combined mass of water that occurs on or near Earth's surface. It includes oceans, lakes, rivers, and streams. The hydrosphere holds a major role on Earth and is vital to sustain all life present. Because it covers about 71 percent of Earth's surface area, the hydrosphere plays a vital role in sustaining communities of water-inhabiting plants and animals. The hydrosphere holds a major role on Earth and is vital to sustain all life present. Climate change has had a large influence on the hydrosphere, resulting in countless negative outcomes. The burning of fossil fuels has significantly changed the entire world including the hydrosphere by causing atmospheric CO₂ levels to rise. Skyrocketing CO₂ levels have also led to a warming ocean, the bleaching of the coral reefs and also an increase in the pH level of the ocean. These trends predict a dire future for the health of the hydrosphere and the vitality of the Earth as a whole.

The atmosphere, which is primarily composed of nitrogen and oxygen, is one of the most influential climate systems on Earth. As the concentration of certain key gases in the atmosphere has shifted over time, the importance of the atmosphere has become more apparent. These small shifts in gases like CO₂ and methane have significantly worsened the greenhouse effect and have led to some major changes in Earth's climate. Many researchers stated that the human contributions to greenhouse gases in the atmosphere are warming the earth's surface a process that is projected to increase the evaporation of surface water and accelerate the hydrologic cycle. In turn, a warmer atmosphere can hold more water vapor. Some major consequences of this shift have been the increased melting of sea ice, increased ocean acidity, worsening of natural disasters like hurricanes and wildfires, and the reduction of air quality in heavily populated areas.

Key words: *hydrosphere, atmosphere, warming, climate change, greenhouse gases*

14. Using DI & RI Thermal Indices Estimations: Summer 2023 Case Study

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Abstract

Extremely high temperatures especially during the summer period are common in the Mediterranean area, (with extremely high temperatures we mean temperatures that are higher than the average for the region) and when those temperatures are combined with high levels of humidity and other conditions can affect the life of people. In recent studies there is a hypothesis that the temperature felt from an ordinary person can be higher or lower than the value a thermometer shows. That makes them feel uncomfortable and unable to deal with such conditions. For example, there could be a case that the thermometer can show a value around 33°C and it can be felt like it is 41°C, that can happen as a result of high level of humidity or the lack of wind. But it could also happen the opposite, the thermometer may show high values but low levels of humidity or a windy day can make it feel like an ordinary day. The indices of discomfort and Robaa are a tool that can help as calculate the temperature felt from an ordinary person.

Key words: *Robaa index, discomfort index, temperature, relative humidity, wind speed*



15. Integrating Meteorological Parameters For Enhanced Temperature Humidity Index Formulations

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Abstract

Temperature Humidity Index (THI) serves as a vital tool in quantifying thermal discomfort and heat stress, particularly in agricultural, occupational, and environmental health contexts. This study proposes an advanced framework for THI formulation, emphasizing the integration of meteorological parameters including ambient temperature and relative humidity. By incorporating wet adiabatic temperature and dew point alongside standard variables, the proposed THI formulas aim to provide a more comprehensive characterization of thermal environments. The inclusion of wet adiabatic temperature accounts for the cooling effect of evaporative processes, offering insights into the thermoregulatory mechanisms of living organisms. Furthermore, the consideration of dew point enables a direct assessment of air moisture content and its influence on perceived thermal discomfort. Through mathematical modelling and statistical analysis, this study explores the synergistic relationships among various meteorological parameters and their collective impact on THI values. The findings highlight the significance of a multidimensional approach to THI formulation, offering researchers and practitioners a refined tool for assessing heat stress and optimizing thermal comfort strategies in diverse settings. This abstract contributes to the advancement of THI methodologies, fostering interdisciplinary collaboration and promoting evidence-based decision-making in environmental and occupational health sciences.

Key words: maximum temperature, thermal index, relative humidity, adiabatic temperature

16. An Algorithm For The Calculation Of Lyapunov's Exponent For Time Series Of Rainfalls And Radon Concentration

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Abstract

The Lyapunov's exponent (LE) is a signature of chaotic behavior of a system described by a set of Ordinary Differential Equations (ODEs) and provides important insights regarding the extent of possibility to predict the outcome of said system. The calculation of LEs (depending on the dimensionality of the system) is complex but can be performed either analytically or numerically. It is possible to calculate a LE for a time series as well but the lack of an ODE that generates it forces the employment of numerical methods only. In the current paper we propose a new algorithm which enables the calculation of the LE for a one-dimensional time series. We analyze two time series: the series of daily rainfalls for the city of Shkodra, and the series of hourly measurements of the concentration of Radon inside a dwelling. The aim is to uncover features of chaotic behavior and the analysis is completed with multifractal analysis whenever it is possible.

Key words: *Lyapunov exponent, chaotic behavior, rainfall time series, radon concentration, predictability of a time series*



17. A Mobile Application For Collecting Earthquake Data: Citizen Seismology

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Abstract

Citizen science is a collaborative research approach involving researchers and citizens in scientific projects, encompassing various activities from data collection to analysis and interpretation of results. Citizen seismology, a branch of citizen science in seismology, engages citizens in scientific projects alongside seismologists.

During earthquakes, affected individuals serve as the primary source of information regarding the felt shaking and observed damages. The data provided by citizens holds dual significance: it aids in sociological and risk management analyses, elucidating "how the population reacted to the event", and contributes to seismological analyses by documenting visible earthquake effects. Thus, citizen seismology fosters collaboration between seismologists and non-scientists, facilitated by advancements in connection technologies such as the internet, social media, and mobile applications.

Here, we introduce a mobile application developed in collaboration with ARK IT for collecting earthquake data, focusing on citizens' perceptions of seismic events. We also discuss potential avenues for future research and development in this field.

Key words: *Citizen seismology, earthquake data collection, mobile application, sociological analysis, risk management.*

18. Data Analysis And Evaluation Of The Impact Of Meteorological Parameters On The Values Of Evapotranspiration (Eto) Calculated By Fao Penman - Monteith Equation

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Abstract

This study focuses on data analysis and assessment of the impact of meteorological parameters on Evapotranspiration (ET_o) values calculated by the FAO Penman-Monteith Equation in daily time step. The data analysis gives an accurate and clear overview of the negative and positive correlations between the parameters. The FAO Penman-Monteith equation is widely recognized as a reliable method for estimating ET_o due to the comprehensive consideration of various meteorological parameters such as temperature, humidity, wind speed, solar radiation, sun hours, and daylight hours. Data analysis has been carried out for all the terms that affect the final ET_o equation from FAO. Meteorological data has been collected by weather station installed at the experiment station in Prrenjas, Albania. Through the analysis and evaluation of data, this study highlights that a strong positive correlation exists between ET_o and wind speed, sun hours, radiation, solar declination, and sunset hour angle. A slightly positive correlation between ET_o and temperature, solar radiation. A slightly negative correlation was observed with humidity and daylight hours. The conclusions of this study serve to make it clearer which are the factors that directly influence and have the greatest impact, we should have in monitoring the irrigation system of plants in the study area.

Key words: *ET_o calculation, data analysis, FAO*

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