University of Zagreb
FACULTY OF GEOTECHNICAL ENGINEERING
Postgraduate doctoral study programme
Environmental Engineering

GWYN
Groundwater Youth Network

PROCEEDINGS OF ABSTRACTS

3RD INTERNATIONAL SCIENTIFIC DOCTORAL CONFERENCE ORGANIZED BY THE FACULTY OF GEOTECHNICAL ENGINEERING,

supported by

UNESCO Groundwater Youth Network

„RESEARCH IN ENVIRONMENTAL ENGINEERING“

~ hybrid conference~

Varaždin, 29. September 2023.

ENVIRONMENTAL
ENGINEERING
STUDY PROGRAME

University of Zagreb
FACULTY OF GEOTECHNICAL ENGINEERING
Postgraduate doctoral study programme
Environmental Engineering

GWYN
Groundwater Youth Network

Publisher

Faculty of Geotechnical Engineering, University of Zagreb

Hallerova aleja 7, 42000 Varaždin

Editors

Assis. Prof. Jelena Loborec, PhD

Lucija Plantak, mag. ing. amb.

ISBN (online)

978-953-8066-13-9

ENVIRONMENTAL
ENGINEERING
STUDY PROGRAME

University of Zagreb
FACULTY OF GEOTECHNICAL ENGINEERING
Postgraduate doctoral study programme
Environmental Engineering

GWYN
Groundwater Youth Network

ORGANIZER

Faculty of Geotechnical Engineering, University of Zagreb

SUPPORTER

UNESCO Groundwater Youth Network

SCIENTIFIC COMMITTEE

Prof. Ranko Biondić PhD

Prof. Miroslav Golub PhD

Prof. Aleksandra Anić Vučinić PhD

Assosiate Prof. Boris Kavur PhD

Assosiate Prof. Ivan Kovač PhD

Associate Prof. Ivana Grčić PhD

ORGANIZATIONAL COMMITTEE

Assistant Prof. Jelena Loborec PhD

Lucija Plantak mag. ing. amb.

Amin Shakya (GWYN Scientific Committee)

Gabriela Calderon (GWYN Scientific Committee)

Iva Majer univ.bacc.oec

ENVIRONMENTAL
ENGINEERING
STUDY PROGRAME

CONFERENCE PROGRAM

10:00 – 10:20 Start of the conference and Introductory Remarks doc. Jelena Loborec (GFV) & Gabriela Calderon (GWYN)

Session 1: Invited Lecture

10:20 – 10:40 Paolo Colombo (GWYN Scientific Committee member): "Groundwater's key role in climate change: from endangered resource to ally in adaptation."
10:40 – 11:00 doc. dr. sc. Robert Pašičko (GFV): "Innovations in Environmental engineering"

Session 2: Energy, Climate & Waste

11:05 – 11:20 Fran Jazbec, Faculty of chemical engineering and technology University of Zagreb
11:20 – 11:35 Renata Rožek, Faculty of Architecture, University of Zagreb
11:35 – 11:50 Ana Jelčić, Faculty of Geotechnical Engineering, University of Zagreb
11:50 – 12:05 Ivana Piljek Miletić, Faculty of Geotechnical Engineering, University of Zagreb

Session 3: Water – part 1

12:25 – 12:40 Chandan Roy, Mizoram University
12:40 – 13:55 Arsene Damiba, Pan African University–Institute for Basic Sciences Technology and Innovation (PAUSTI)
13:55 – 13:10 Bhaskar Dahal, TU Dresden
13:10 – 13:25 Dunja Turk, Faculty of Geotechnical Engineering, University of Zagreb

Session 4: Water – part 2

13:30 – 13:45 Sagar Shahi, Asia Institute of Technology
13:45 – 14:00 Isabelle Schmidt, FU Berlin
14:00 – 14:15 Igor Tošić, Croatian Waters
14:15 – 14:30 Annie Jose, Manonmaniam Sundaranar University, Tirunelveli
14:30 – 14:45 Ana Čulić, University of Split, FSB
14:45 – 15:00 Daniele Marra, Frederico II University of Naples, Italy

Closing remarks

CONTENT

INTRODUCTION

The Faculty of Geotechnical, University of Zagreb organized the third doctoral conference entitled "Research in Environmental Engineering" of an international character under the auspices of the UNESCO Ground water Youth Network, inviting all doctoral students in the technical field, as well as interdisciplinary ones, their mentors and all interested parties to prepare and present his works related to the topic of environmental engineering.

Problems from the domain of environmental engineering require an interdisciplinary scientific-research approach that seeks to offer specific solutions. A wide range of topics focuses on the needs of society directed towards circular economy, sustainable waste management, management of natural resources and their protection, environmental monitoring, introduction of renewable energy sources and climate change research.

The conference was held on Friday, September 29, 2023 in a hybrid environment due to its international character. Fourteen doctoral students from different studies presented their works, which certainly testifies to the interdisciplinary nature of the field, but also to the topicality of the topic in different fields of science. Plenary lectures at the beginning of the conference were held by Assis. Prof. Robert Pašičko and Paolo Colombo, member of the Scientific committee of GWYN, both emphasizing the importance of certain professions in the formation of interdisciplinary teams when solving environmental problems.

We sincerely thank the members of the UNESCO Groundwater Youth Network, and especially the members of the Scientific committee of GWYN Amin Shakya and Gabriela Calderon, who actively participated in the organization and promotion of our first international doctoral conference. Also, we would like to thank everyone who responded to our call and helped us start a new chapter in promoting our postgraduate doctoral study program Environmental engineering beyond the borders of the Republic of Croatia.

Organisers

KNOWLEDGE IN THE SERVICE OF THE ENVIRONMENT PROTECTION

IMPROVING DWC CONTROLLABILITY TROUGH STEADY-STATE DESIGN

Fran Jazbec[1], Goran Lukač, Igor Dejanović[2]

[1]PhD student, Faculty of chemical engineering and technology, University of Zagreb, Marulićev trg 19, Zagreb, Croatia, fran.jazbec@gmail.com
[2]Supervisor, Faculty of chemical engineering and technology, University of Zagreb, Marulićev trg 19, Zagreb, Croatia, ideja@fkit.hr

ABSTRACT:

Distillation is the process of separating liquid mixtures into pure components, or mixtures of certain compositions based on differences in volatilities. In the continuous separation of a multicomponent mixture into more than two high-purity products, a sequence of distillation columns is required to achieve the goal, creating a significant expenditure of energy and capital. One of the approaches to the intensification of the distillation process is the application of the so-called dividing wall columns (DWC) – fully thermally coupled distillation sequence realized within a single shell, capable of performing separation of liquid mixtures into three or more products. Compared to the sequences of conventional, two-product columns, DWCs require less capital, energy and space to perform the same separation task. Since the energy required to perform a separation sequence in a DWC is equal to that of the most difficult binary split between components, the energy required for four-product separation can, in theory, be reduced by up to two thirds. Despite the potential savings, there is only one known real-life application of the four product DWC, albeit in its simpler, but less energy effective variant known as the Kaibel column. The main reason for this is their complex structure, which makes the process design and their operation significantly more complicated. A common approach is to use a steady-state model for optimization and hydraulic design, and then to synthesize and evaluate different control system designs using a dynamic column model for various disturbance scenarios. This paper proposes a simultaneous steady state design and control system synthesis, taking into consideration possible disturbances during design phase, with the aim of achieving better controllability.

Key words: *Distillation, Dividing wall column, Process control, Energy saving, Process simulation.*

INTEGRATED ENERGY, CLIMATE AND SPATIAL PLANNING CRITERIA OF BUSINESS AREAS

Renata Rožek[1], Nenad Lipovac[2]

[1]PhD student, University of Zagreb, Faculty of Architecture, Fra Andrije Kačića Miošića 26, Zagreb, - Counselor for Spatial Planning and construction, Department of Spatial Planning, Construction and Environment Protection, Zagrebačka županija, Ulica Ivana Lučića 2a, Zagreb, Croatia
rrozek@arhitekt.hr
[2]Supervisor, Department of Physical and Urban Planning and Landscape Architecture, University of Zagreb, Faculty of Architecture, Fra Andrije Kačića Miošića 26, Zagreb, Croatia
nlipovac@arhitekt.hr

ABSTRACT:

In the last decades, climate change has become one of the main topics in preserving the human environment. Accelerated urbanization contributes to reducing cities' resistance to climate change. Cities are facing unstoppable growth, which leads to the loss of natural values, climate change, and increased risk of natural disasters. Cities, as drivers of economic development, face pressure to expand the build able area, especially for the needs of Industry & Business (I&B) Zones. These areas usually occupy large areas of land that lose their natural landscape very quickly. Industry, transportation, and waste production consume large amounts of water and energy and generate high emissions of greenhouse gases, which directly affect climate change. In addition, in practice, it often happens that the locations for planning new I&B Zones are determined only by the appearance of a "big" investor who, after buying cheap non-building land, gets valuable building land for industrial or business purposes through the creation of Physical Plans. Even the planning ordinances are adapted to the investors' needs without checking the project's environmental impact. This disrupts the stability of the ecosystem and leads to the loss of biological diversity. For this reason, experts from various fields (planners, urban planners, architects, sociologists, ecologists, etc.) should be included in the planning process. At the same time, an interdisciplinary approach (planning, energy, protection, etc.) plays an essential role in preventing climate change, which will determine the conditions for developing I&B Zones, conditions for enabling the sustainability of urban areas and their necessary and accompanying I&B Zones to reduce the negative impact on climate and environment.

Key words: *bussines/industrial areas; climate changes; sustainable development; energy, climate and physical planning*

BRAVE NEW WORDS IN ENVIRONMENTAL ENGINEERING

Ana Jelčić[1], Marija Omazić[2]

[1]PhD student, Faculty of Geotechnical Engineering, University of Zagreb, Hallerova aleja 7, 42 000 Varaždin, Croatia, ana.jelcic@gfv.unizg.hr
[2]Supervisor, Faculty of Humanities and Social Sciences, Josip Juraj Strossmayer University of Osijek, Lorenza Jägera 9, 31 000 Osijek, momazic@ffos.hr

ABSTRACT:

Language is not an unchangeable system of communication. On the contrary, it constantly evolves due to the fact that our lives, experiences and culture change. Language change, which includes the creation of new words as well as the change of meaning of the existing ones, enables us to express new ideas, technologies, inventions as well as different kinds of social phenomena. The growing importance of environmental issues has influenced language and has led to the creation of new words. Therefore, we wanted to analyse the word formation of twenty new words which refer to the environment. The analysed words refer to the environment in general, to waste and recycling, to food and the environment, to fashion and the environment, to people and the environment and to transport and the environment. The analysis shows that the majority of them (ten examples) are compounds, six are created by using prefixation, two by using blending, one by using conversion and one by using abbreviation. The corpus is based on lexicographic sources.

Key words: *environment, word formation, compound, prefixation, blending, conversion, abbreviation.*

ECOLOGICAL ENGINEERING IN LANDFILL REMEDIATION

Ivana Piljek Miletić[1], Zvjezdana Stančić[2], Željka Fiket[3]

[1]State inspectorate of Republic of Croatia, Šubićeva 29, Zagreb, Croatia, ivana.piljekmiletic@gmail.com
[2]PhD Student, University of Zagreb, Faculty of Geotechnical Engineering, Hallerova aleja 7, Varaždin, Croatia, zvstan@gfv.hr
[3]Supervisor, Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička cesta 54, Zagreb, Croatia, zeljka.fiket@irb.hr

ABSTRACT:

Ecological engineering is a new branch of engineering based on ecology that emerged in the 1960s from the growing need for more sustainable biological solutions to environmental problems. It is based on the design of natural ecosystems for the benefit of both nature and human society. Its techniques can be applied to a range of environmental problems, from the restoration of degraded ecosystems to the removal of pollutants. Landfills represent one of the major environmental problems worldwide, with their various negative impacts on the environment, living beings and human health. Conventional landfill closure and remediation techniques have proven to be economically and energetically challenging and are not sufficiently effective in reducing leachate formation and removing pollutants. For this reason, several ecological engineering techniques that can be used in landfill remediation will be presented. Phytocapping is an alternative to conventional cover systems that uses plants to control and limit water infiltration into waste, leachate formation, stabilize landfills, control erosion, and reduce methane emissions. Phytoremediation is an environmentally friendly technology for soil remediation through natural processes, in two forms: phytoextraction that uses plants to extract and remove pollutants from waste and soil and phytostabilization that immobilizes pollutants in the root zone. Constructed wetlands, designed and constructed according to the principles of natural wetland ecosystems, can be used to clean leachate. Natural attenuation uses natural biological processes to mitigate pollution without taking specific action. All of these techniques are based on viable natural solutions that can reduce remediation costs and further maintenance of landfills.

Key words: *ecological engineering, landfills, phytocapping, phytoremediation, constructed wetlands, natural attenuation.*

INVESTIGATION OF DRINKING WATER QUALITY IN DIFFERENT VILLAGES OF SOUTH TWENTY-FOUR PARGANAS, WEST BENGAL

Chandan Roy[1], Vishwambhar Prasad Sati[2]

[1]PhD Student, Mizoram University, Aizawl, Mizoram, PIN-796004, India, roymzu@gmail.com
[2]Supervisor, Mizoram University, Aizawl, Mizoram, PIN-796004, India, sati.vp@gmail.com

ABSTRACT:

Access to safe and clean drinking water is very limited in the World. Good health and well-being depend on the quality of drinking water. Contaminated drinking water can be affected to human health by various water-borne diseases. The study examines the quality of drinking water in the study villages with different statistical techniques. This study will be helpful for targeted public health interventions and micro-level policy implementations. The data for the present study were collected from the different sub-district water testing laboratories in South Twenty-Four Parganas, West Bengal. A linear interpolation method was applied to replace missing values and to make an equal sample size (n=777). And KMO and Bartlett's test was used to check sample adequacy. The IBM SPSS Version 26 software was used for statistical analysis. Descriptive statistics, water quality index, analysis of variance (ANOVA), component matrix, Pearson correlation, and Dendogram of different physico-chemical parameters were performed for data-driven decision-making. The three villages were rated as having poor water quality. In the ANOVA test, we found that five physico-chemical parameters were statistically significant. Besides, TDS and Chloride have a strong positive correlation (0.617) and are statistically significant ($p<0.05$). TDS and conductivity also exhibit a strong positive correlation (0.932) and are statistically significant ($p<0.05$). There is regional heterogeneity in the quality of water in selected study villages. And a number of micro-level policy measures are recommended by the author in order to address this issue. Moreover, the author recommends that villages affected by arsenic monitor shallow tube wells frequently in order to minimize the effects of water quality on human health.

Key words: *Drinking water quality, Health risks, IBM SPSS, South Twenty-Four Parganas, Statistical techniques, west Bengal.*

USE OF WATER QUALITY INDEX IN EVALUATING THE WATER QUALITY STATUS OF AN AGRICULTURAL WATERSHED

Wendyam Arsene Flavien Damiba[1], John Mwangi Gathenya[2], James Messo Raude[2], Patrick Gathogo Home[2]

[1]PhD student, Pan African University–Institute for Basic Sciences Technology and Innovation (PAUSTI); P.O. Box 62000-00200 Nairobi, Kenya; arsene.damiba@gmail.com
[2]Supervisor, Soil, Water and Environmental Engineering Department, Jomo Kenyatta University of Agriculture and Technology (JKUAT), P.O. Box 62000-00200 Nairobi, Kenya; j.m.gathenya@jkuat.ac.ke or j.m.gathenya@jkuat.ac.ke, ramesso@jkuat.ac.ke, pghome@jkuat.ac.ke

ABSTRACT:

Concentrations of dangerous pollutants into water resources are rising day by day and are negatively impacting ecosystems and to some extent affecting human health. Water quality control is consequently becoming crucial to address the possible associated dangers. This study objective was to evaluate the Water Quality Index (WQI) for the Kakia-Esamburmbur watershed using water samples that had undergone thorough physical, chemical, and microbiological investigation. To calculate the WQI, 12 indicators were selected: Physical indicators included water temperature (WT), pH, electrical conductivity (EC), total dissolved salts (TDS), turbidity and total suspended solids (TSS); Chemical indicators were nitrate-nitrogen (NO3-N), phosphate-phosphorus (PO4-P) and chloride (Cl-); Biological indicators included total viable bacteria (TVC), faecal coliforms (FC) and Escherichia Coli (E. Coli). Analysis showed that indicators including turbidity, TVC, FC, E. Coli (100% of samples), EC (50% of samples), WT, TDS, TSS, pH, NO3-N, PO4-P, Cl- (0% of samples) exceeded the permissible limits for domestic uses mentioned in WHO, East African and Kenyan standards. According to EAS, quality assessment revealed that 30% of water sources were of "poor" quality, 20% were of "very poor" quality, and 50% were "unfit" for domestic use. However, the overall average WQI values based on the three standards (138.20, 241.24 and 245.04) all indicated "unsuitable" quality. The statistical evaluation utilizing the correlation matrix and principal component analysis (PCA) demonstrated that geogenic and anthropogenic pressures are the major sources controlling hydrogeochemical and microbiological water processes.

Key words: *Domestic Uses, Water Quality Standards, WQI, PCA, Hydro-bio-geochemistry.*

BENCHMARKING PERFORMANCE OF NEW TOPNET HYDROLOGICAL MODEL WITH ALREADY IN USE CALIBRATED LUMPED MODELS FROM MATLAB TOOLBOX

Msc., Er. Bhaskar Dahal[1], Prof. Dr. Niels Schütze[2], PD Dr. habil. Thomas Wöhling[2]

[1] PhD Student, Hydro Science and Engineering, TU Dresden, Helmholtzstraße 10, 01069 Dresden, dahalbhaskar5624@gmail.com
[2] Supervisor, Technical University of Dresden, niels.schuetze@tu-dresden.de, thomas.woehling@tu-dresden.de

ABSTRACT:

A new concept of the TopNet model as NZWaM has been developed as a result of ongoing efforts to construct hydro-logical models that can deliver accurate and robust output while being simple at the same time for many decades in hydrological society. The goal of this research is to compare the performance of this model to two other calibrated lumped models from the MARRMoT toolbox using simulated flow comparisons and various hydrological analyses. The performance of the models after being analysed and computed for several scenarios that are of significance in hydrology, and the advantages and limitations of the models are compared. Using the same input for all of the models creates a common ground for comparison of the models. Even while the calibrated model comes out on the top with consideration of more parameters and interaction between hydrological processes, NZWaM has demonstrated some promising performance and potential while being at disadvantage mainly due to uncalibrated form. It seems to be becoming more plausible with time as a result of technological advancements, more accessibility, and improvements in the spatial representation of the real world.

Key words: *Hydraulic modelling, NZ Water Model, MATLAB, Hydrology, Water, Distributed model, lumped model.*

THE IMPACT OF AGRICULTURAL ACTIVITY ON THE NUTRIENT CONTENT OF STREAMS IN MEĐIMURJE AREA, CROATIA

Dunja Turk[1], Jelena Loborec[2]

[1]PhD student, Bioinstitut d.o.o., R. Steinera 7, 40 000 Čakovec, Croatia, dunja.turk@bioinstitut.hr
[2]Supervisor, University of Zagreb, Faculty of Geotechnical Engineering, Hallerova aleja 7, 42 000 Varaždin, Croatia, jelena.loborec@gfv.unizg.hr

ABSTRACT:

Almost 60 % of Međimurje territory is covered with agricultural and arable land, where mostly agricultural and vegetable crops are grown, followed by meadows, orchards and vineyards. Agricultural production has always been of great importance in that area, in terms of production quantity and product quality. One procedure that is used to ensure competitiveness, considering the market requirements and prices of agricultural products, is the application of plant nutrients through fertilization. The excess of added nutrients that plants do not consume for their growth and development, eventually reaches the environmental waters by leaching and runoff and contaminates the environment. Analytical parameters that indicate the influence of soil fertilization on surface water are ammonium, nitrate, nitrite, total nitrogen, orthophosphate and total phosphorus. Measurement results of these nutrients for the period from 2016 to 2022 in 10 streams in Međimurje were analysed (approx. 79 data by location). Sampling, sample handling and measurement were carried out using accredited analytical methods in a certified laboratory. The UV/VIS spectroscopy was used to determine all indicators. All results were analysed and compared at the level of parameters and measuring sites. The concentration trend of an individual parameter at each site was expressed and the highest measured values for each parameter were singled out. For the comparison of locations with regard to the load of a particular nutrient, the mean annual concentrations of parameters were used. Mean annual values were also used to evaluate the ecological quality of water at each location for every year, based on the basic physicochemical indicators of nutrients according to the Regulation on water quality standard (NN 96/19 and 20/23), for all parameters except nitrite, for which limit values are not prescribed. Based on the water quality assessment, shares of results that satisfy at least good water quality were expressed, considering that it is the goal for all waters in the EU according to the Water Framework Directive (2000/60/EC).

Key words: *surface water quality, nutrients, soil fertilization.*

ASSESSMENT OF ECOSYSTEM-BASED ADAPTATIONS FOR GROUNDWATER MANAGEMENT IN TRA VINH PROVINCE, VIETNAM

Sagar Shahi[1], Ho Huu Loc[2]

[1]Recent Masters' graduate, Asia Institute of Technology, Thailand, shahisagar85@gmail.com
[2]Supervisor, Assistant Professor Asia Institute of Technology, Thailand, hohuuloc@ait.asia

ABSTRACT:

In Tra Vinh Province Vietnam groundwater is one of the main sources of water resources. Agriculture, industries, and many other activities that support human life depend on water resulting in the drop in groundwater level. Therefore, it is important to conserve groundwater, and Ecosystem-based Adaptation (EbA) appears to be a promising method for doing so on a local level. This study aims to assess EbA to lessen the effect of stressors on groundwater. In this study, firstly, non-parametric statistical tests were conducted on observation well time series data and it was found that groundwater is declining in the majority of the area. Secondly, surveys were conducted in different communities were interviewed to identify potential stressors on groundwater and results from the survey show that over-extraction, decline in rainfall, and change in land use were major stressors. Lastly, GMS MODFLOW calibrated and validated using observation well time series data in the steady state was used to develop a conceptual groundwater model for the study area for analyzing the impact of stressors and assessing EbA to mitigate the stressors' impacts, and the following results were observed: i) increased pumping and decreased recharge caused by stressors decline groundwater levels by 1.2 m and 1.1 m on average, respectively as compared to the base case (2017), ii) the most effective EbA measure is to protect the Groundwater Dependent Ecosystem which increases the groundwater level by 1.5 m on average while the most preferred EbA measure, protection of critical recharge zone increases the water level by 0.9 m on average as compared to base case (2017). Hence, it is concluded that EbA can lessen the impact of stressors on groundwater and improve groundwater status.

Key words: *Distillation, Dividing wall column, Process control, Energy saving, Process simulation groundwater level decline, GMS MODFLOW, EbA.*

CALCULATING WATER LEVEL IN SMALL SURFACE WATER RESERVOIRS FROM HIGH-RESOLUTION SATELLITE IMAGES

Isabelle Schmidt[1], Michael Schneider[2]

[1]PhD Student, Isabelle Schmidt, FU Berlin, Malteserstr. 74-100, 12249 Berlin,
Isabelle.Schmidt@fu-berlin.de
[2]Supervisor, Prof. Michael Schneider, FU Berlin, Malteserstr. 74-100, 12249 Berlin,
m.schneider@fu-berlin.de

ABSTRACT:

In India, small surface water reservoirs (known as irrigation tanks) store runoff from the monsoon season to provide water for irrigation during dry periods. Studies investigating their impact on groundwater recharge usually focus on groundwater level fluctuation. Only considering groundwater level changes might lead to an overestimation of the actual infiltration through the tank floor, since groundwater level rise can be caused by reduced groundwater withdrawal due to use of tank water for irrigation. To better estimate the recharge rates, this study focusses on infiltration processes through the soil and the tank floor. For this purpose, a combined approach of numerical modelling using HYDRUS and travel time estimation using stable water isotopes is employed. As frequent water level measurements of water in the tanks are missing, high resolution satellite images are used to fill the data gap. Images from planet superdove are processed to determine the water surface area and further calculate the water level in the tanks while using differential GPS measurement from the tank floor. The water area is determined through 3 different approaches: 1. determination of a threshold of near infrared band, 2. using a support vector machine in python, 3. applying a classification in google earth engine. The 2nd approach provided the highest match with the mapped area. The water level was then calculated with a power function representing the relation of water area and water level in small wetlands (Hayashi & Van Der Kamp, 2000).

Key words: *groundwater recharge, satellite images, Hydrus.*

INTEGRATED CROSS-BORDER APPROACH TO THE MANAGEMENT OF ALLUVIAL RIVER RESTORATION PROJECTS

Igor Tošić[1]

[1]PhD student, Hrvatske vode, igor.tosic@voda.hr

ABSTRACT:

The river Drava begins at a source in the Toblach Field in South Tyrol (Italy) and flows through five countries, with a total length of 749 km and a catchment area covering 41,238 km2. To address current issues related to the river's ecosystem, various European Union legislations, such as the Framework Water Directive, Flood Directive, and Habitats and Birds Directives, need to be integrated. This integration aims to achieve, among other objectives, the restoration and improvement of the river's ecological state. A cross-border, synergistic approach between water management, environmental protection and nature conservation authorities is essential for achieving this goal. Two EU projects that I lead, co-financed under the LIFE Programme, serve as examples of how concrete restoration practices along the Croatian stretch of the Drava River (from the Slovenian border to its mouth at the Danube) can promote unconventional, innovative, contemporary, and sustainable methods of managing alluvial rivers in Croatia and the region. These projects have a general objective to enhance the ecological and hydromorphological conditions of the river Drava at seven locations in five counties through international and national cooperation among all stakeholders in the river basin. During the duration of these projects, over 60 specific multidisciplinary project activities are planned for implementation. Through sustainable management of river resources, these concrete in situ actions include the restoration and expansion of the riverbed, preservation, and encouragement of valuable habitats along steep riverbanks and in floodplain forests and influencing a positive balance of groundwater in river inundation. Moreover, the projects aim to raise awareness and involve stakeholders from the river area in the decision-making process.

Key words: *Drava River, integrated river management, EU co-financed projects.*

OPTIMIZED ANN - MC METHODOLOGY FOR GROUNDWATER QUALITY PREDICTION OF KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

Annie Jose[1], Dr. Y. Srinivas[2]

[1]PhD student, Manonmaniam Sundaranar University, Tirunelveli, anniejoseee@gmail.com
[2]Supervisor, Manonmaniam Sundaranar University, Tirunelveli, drysv@yahoo.co.in

ABSTRACT:

Groundwater is one of the most valuable sources of fresh water on our planet, Earth. It is crucial to monitor groundwater quality in order to ensure its safety and suitability for various uses, including drinking water. Contaminant-free drinking water is essential for minimizing health risks. Historically, groundwater quality assessment relied on traditional methods. However, dealing with extensive datasets became challenging. To improve accuracy and efficiency, modern machine learning techniques are now employed to manage and analyze the large groundwater quality datasets. The study area Kanyakumari is a district is the southernmost part of India which is covered by Arabian sea in the west, Bay of Bengal in the East and Indian Ocean in the South and experiences a mild climate throughout the year. The prediction model in this study combines Artificial Neural Networks (ANN) for detecting intricate data relationships and Markov Chain (MC) for probabilistic modeling of groundwater quality transitions. It accommodates regime changes and transitions while ensuring precision through rigorous training and validation. The dataset is split into training and testing sets, and various metrics like accuracy, precision, and F1 score are used to assess the model. Remarkably, the model achieves nearly 90% accuracy, demonstrating its reliability in capturing dynamic groundwater quality behavior. Insights into regime changes and state transitions are valuable for water resource management and decision-making. This study showcases the ability of machine learning to handle complex datasets effectively, providing a precise method for assessing groundwater quality and aiding decision-makers in understanding and managing groundwater conditions.

Key words: *Artificial Neural Network (ANN), Markov Chain (MC), Drinking Groundwater quality, Kanyakumari District, Machine learning.*

PERSONAL THERMAL COMFORT FOR OFFICE BUILDINGS

Ana Čulić[1], Sandro Nižetić[1]

[1]PhD student, University of Split, FESB, Croatia, Adress, aculic00@fesb.hr
[2]Supervisor, University of Split, FESB, Croatia, snizetic@fesb.hr

ABSTRACT:

Balancing thermal comfort and energy efficiency in the built environment is a crucial challenge. This study explores the connection between thermal comfort and building energy performance, emphasizing the potential of smart technologies in assessing personalized thermal comfort. Leveraging IoT and wearable sensor devices, researchers gain insights into individual thermal preferences as valuable input for optimization of building energy systems. Recognizing the impact of thermal comfort on energy consumption, particularly in space heating and air-cooling systems, this research highlights the importance of occupant satisfaction in high-performance buildings. Smart building paradigms enable user-centric thermal comfort modeling, enhancing occupant experiences and energy savings. Through a review of relevant literature, this study investigates experimental practices in monitoring technologies for personal thermal comfort. Real-world measurements were conducted in a commercial and university buildings. Wearable sensors (i.e. smart bracelet) monitored heart rate and skin temperature during daily activities. Ambient sensors measured air temperature, humidity, CO2 levels. Users provided subjective thermal comfort assessments through questionnaires, facilitating data-driven models for efficient building energy systems. In conclusion, embracing smart technologies could allow personalized thermal comfort modeling while optimizing energy performance in high-performance buildings. This research opens new avenues for greener and more comfortable living spaces.

Key words: *Thermal comfort, smart buildings, IoT.*

MAGNETIC-BASED BIOSENSORS FOR POLLUTANTS AND FOOD SAFETY

Daniele Marra[1], Nikola Sakač[2]

[1]PhD student, University of Naples, Federico II, Italy, misjurce@fesb.hr
[1]Supervisor, University of Zagreb, Faculty of Geotechnical Engineering, Hallerova aleja 7, Varaždin, Croatia, nikola.sakac@gfv.unizg.hr

ABSTRACT:

This research focuses on the utilization of various types of gold-coated magnetic nanoparticles to enhance their biocompatibility for the development of biosensors for food safety and environmental monitoring. Initially, we employed these nanoparticles to create a biosensor for gluten detection in food products, capitalizing on their optical properties. These nanoparticles interact with gluten, leading to an increase in the solution's extinction, proportional to the gluten concentration. Subsequently, different types of gold-coated magnetic nanoparticles were employed to detect glyphosate by harnessing microstirring effects in the solution, significantly enhancing sensor performance. Currently, our research is directed towards the detection of deoxynivalenol (DON) using these nanoparticles in magneto-phoretic measurements. This research paves the way for the development of advanced biosensors for crucial applications in food safety and environmental monitoring.

Key words: *Biosensors, magnetic-nanoparticles, pollutants, food-safety, environmental monitoring.*