Proceedings of the Virtual Forum on Water and Environment and Water, Power and Informatics 2024

Mrinmoy Majumder
Editor

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Preface

I. Definition of virtual forums

Virtual forums are online platforms where individuals can engage in discussions, share information, and collaborate with others in a virtual setting. These forums provide a space for users to connect with like-minded individuals, seek advice, and exchange ideas on various topics of interest.

- Importance of discussing water and environment issues

Discussions on water and environment issues in virtual forums are crucial for raising awareness, sharing knowledge, and fostering collaboration towards sustainable solutions. By engaging in these conversations, individuals can contribute to positive change and collectively work towards addressing pressing environmental challenges.

- Overview of the 2024 Virtual Forum on Water and Environment

The 2024 Virtual Forum on Water and Environment aims to bring together experts, stakeholders, and enthusiasts to discuss innovative solutions, share best practices, and inspire action towards conservation and sustainability. Participants can expect engaging sessions, networking opportunities, and access to valuable resources to further their understanding and involvement in these critical issues.

II. Key Topics of Discussion

Water Scarcity and Pollution

- Circular Economy in Water
- Water Productivity
- Water Reuse and Recycling
- Virtual, Blue and Green Water Management
- Grey Water Reutilization
- Minimization of Water Footprint
- Digital Water
- Water Augmentation
- Extreme Events
- Climate Change Adaptation,
- Sustainable Agriculture,
- Biodiversity Conservation
- Circular Economy

Regenerative farming techniques and food security.

- Flood and Drought and its Impact
- Groundwater Contaminants
- Water Food Energy Nexus
- Water Management in Power Plants
- Power Management in Water Based Industries
- Water and Power Management in Agriculture

Pisicculture, and Sericulture

- Data Science in Water
- IoT Applications in Water Sector
- AI Applications in Water
- MCDM Application in Water
- Role of informatics in managing water systems
- Wetland management
- Waste water management

Role of technology in sustainable water management

- Impact of climate change on water resources
- Sustainable development practices in the water sector

III. Benefits of Attending the Virtual Forum

By attending the virtual forum, participants will gain insights from experts in the field, learn about innovative approaches to water conservation, and have the opportunity to collaborate with like-minded individuals. Additionally, attendees will leave with actionable steps to implement in their own communities or organizations to contribute to a more sustainable future for water resources.

- Access to expert speakers and panel discussions that will provide valuable knowledge and perspectives on addressing the challenges of climate change on water resources. This forum will also offer networking opportunities with professionals and stakeholders who are actively working towards sustainable water management practices.

- Networking opportunities with professionals in the field of water resources management will allow attendees to build connections and collaborate on innovative solutions. This event is a unique opportunity to gain insights, share best practices, and be inspired to make a positive impact on water sustainability efforts.

- Interactive sessions and workshops will provide a platform for participants to engage in discussions, exchange ideas, and learn from each other's experiences. By participating in this forum, attendees can contribute to the collective effort to address the pressing issue of water resource management in the face of climate change.

IV. Call to Action

- Encouraging participants to take action in their communities and implement the knowledge gained from the event to drive real change. By working together and taking concrete steps, we can make a meaningful difference in protecting our water resources for future generations.

- Promoting continued education and awareness on water and environment issues to ensure that individuals stay informed and engaged in sustainable practices. By staying educated and spreading awareness, we can empower more people to make a positive impact on water conservation efforts globally.

- Providing resources for further involvement such as volunteer opportunities with local organizations or information on how to advocate for water conservation policies, can help individuals continue their efforts beyond the initial event. By offering support and guidance, we can inspire more people to actively participate in protecting our water resources and environment.

- Recap of the importance of discussing water and environment issues, and the potential for individuals to make a difference through education and action. Encouraging ongoing engagement in water conservation efforts is crucial for ensuring a sustainable future for our planet.

- Encouragement to stay informed and engaged in the topic of water conservation, and to continue taking action in their daily lives to protect our environment. Together, we can make a positive impact on the health of our planet for future generations.

- Invitation to attend the 2024 Virtual Forum on Water and Environment, where experts and activists will share valuable insights and strategies for addressing these critical issues. Join us in the conversation and be a part of the solution for a more sustainable world.

V Board of Editors

The Board of Editors of the Virtual Forum on Water and Environment 2024 and Water, Power and Informatics 2024 is as given below.

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Malluraj C. Hitni and Ganesh D. Kale

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Abstract

In the present study, trend analysis (TA) of maximum temperature (Tmax) and minimum temperature (Tmin) data is performed for various temporal scales viz., monthly, seasonal and annual for the period of 1970-2022 over the Cauvery River Basin (CRB). TA is performed for assessing four aspects of the trend viz., magnitude, statistical significance (STS), nature, commencement and end of the trend by using Sen's slope (SS) test, Mann-Kendall (MK) test or MK test with Block Boot Strapping, innovative trend analysis (ITA) plot and Sequential MK (SQMK) test, respectively along with assessment of regional significance of trends by using FDR test which is not performed by any reviewed study. The results showed increasing trends in both Tmax and Tmin data for all temporal scales with positive SS values. At greater number of grids significant increasing trends are observed in Tmax as compared to Tmin. It is observed that, at most of the grids, trends are started in 1970s. Regionally significant trends are detected in Tmax during monsoon and post-monsoon seasons and in Tmin during pre-monsoon and monsoon seasons.

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Chapter 2: Application of Two Innovative Approaches for Implementation of Groundwater Management Strategies: A Case study of Kota and Bikaner Divisions

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Abstract

As per the Central Ground Water Board Report, water levels of less than 20 m below ground level are mostly found in Rajasthan's southern and northern regions in which Kota and Bikaner Divisions are situated. Therefore, the implementation of groundwater management strategies is very essential for these subdivisions which need information about where and why these strategies are necessary. To know where and why groundwater management strategies are necessary, first and second innovative approaches are employed which prioritized groundwater blocks and identified factors affecting groundwater at the groundwater blocks, respectively in the aforesaid subdivisions. First and second innovative approaches are applied through analysing trends in groundwater levels and analysing trends in rainfall and mean temperature of groundwater blocks in aforesaid two subdivisions corresponding to four seasons and the period 1994 to 2018. Corresponding to four seasons, at some of the blocks in the Kota Division, declination in groundwater is observed because of increasing mean temperature and decreasing rainfall. At very few blocks in the Bikaner Division corresponding to four seasons, declination in groundwater is observed because of increasing mean temperature and decreasing rainfall.

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Chapter 3: Location selection for the installation of Pressure Retarded Osmosis (PRO) based Salinity Gradient Power plants with the help of MCDM-GMDH Techniques

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Abstract

MCDMs is a decision-finding process that helps you to determine which is better option from the group of alternatives. There is a method to train PNNs called GMDH. These two technologies can be used to isolate sites where the feasibility is higher than others among the selected sites for installing Saline Water based power plants. First the parameters which finds the feasible locations can be identified and then using a function the most feasible locations can be selected. It is a weighted function of the parameters we have chosen to study and its importance in identifying ideal sites. The importance of features will also vary, as different features will be selected for different type saline water-based power generation units such as Pressure Retarded Osmosis (PRO)/Reverse Electrodialysis (RED)/Hydrocratic Ocean Energy. MCDM methods will be employed to calculate the significance, and functional prediction will be performed through GMDH based PNNs.

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Chapter 4: Application of Innovative Approaches for Sustainable Groundwater Management: A Case Study of Jodhpur Division

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Abstract

As mentioned in the Central Ground Water Board Report, stage of groundwater development in all districts of the Jodhpur Division has exceeded 100% due to indiscriminate use. Thus, for implementation of proper management strategies for groundwater resources, two innovative approaches are applied. The first innovative approach is applied for prioritization of all groundwater blocks in the Jodhpur Division of the Rajasthan state to identify where the management of groundwater resources are necessary andit is applied through analyzing trends in groundwater levels of groundwater blocks in the study area. The second innovative approach is applied at the study area to know why management strategies of groundwater resources are necessary and it is applied through analyzing trends in rainfall and mean temperature of groundwater blocks in the study area. These two innovative approaches are applied for four seasons for the period of 1994 to 2018 at each groundwater block of the Jodhpur Division.At some of the blocks in the Jodhpur Division corresponding to four seasons, declination (significant and non-significant) in groundwater is observed because of increasing mean temperature (significant and non-significant) and decreasing rainfall (significant and non-significant).

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Chapter 5: Flood modelling under changing climate: A comprehensive review

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Abstract

This paper outlines a methodology for conducting systematic literature reviews (SLRs) and meta-analysis studies in geospatial study of flood modelling. This paper offers an advanced and comprehensive appraisal of flood modeling, challenges, and advancements in flood-related studies. The research produced an up-to-date overview of current trends, new advances, and research gaps within the realm of flood and hydrological simulation studies. Subsequent investigation revealed due to the advent of computer applications and advancements in Remote Sensing (RS) data provides an ideal platform for integrating data and technologies for flood prediction. Further, this state-of-the-art review unveils that heuristic and metaheuristic techniques like data-driven tools are widely used in flood prediction with good efficacy. A framework is outlined on how to choose the most appropriate technique or model to address real-world flood-related issues, taking into account by considering the specific model objective, the data available, and computing requirements. However, an additional study has to be done in the flood-prone regions where less research is conducted, which have the potential to forecast floods and mitigate the associated hazards.

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Chapter 6: Application of MCDM in selection of Influential Water Quality Parameter

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Abstract

Supervising water quality is essential to prevent ecological degradation or implement necessary improvements in any watershed. However, studying the determination of water quality is both laborious and expensive. So, to reduce the time and cost of such endeavours the present investigation tried to identify the most significant parameter concerning the use of the sample water. Two MCDM methods AHP and ANP have been applied to achieve the present objective. Nine parameters such as Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Phosphate (PO), Total Dissolved Solids (TDS), Chloride, Nitrate Nitrogen(NO 3 -N), Ammonia Nitrogen (NH 4 -N), Potential of Hydrogen (pH) and temperature (T) have been chosen among the various parameters based on literature review and expert opinion to determine which one will carry the most weights as per the MCDM methods. The findings imply that, among the parameters chosen, the DO has the greatest impact.

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Chapter 7: Impact of Climate Change on Ground Water Table

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Abstract

Groundwater is also being affected by climate change. That regularity of climate also means that the short-term change to this climate may lead to a catastrophic change somewhere. The result floods, droughts, peak rainfall etc. extreme events will be near maximum in their intensity and magnitude most time and over most part of the World. Consequently, it is more prudent to read more on this subject. Groundwater is not exempt from climate change impacts. The water level may change, the water table of fresh water may get receded or sometimes increases. Anyway, this type of impact can be quantified with a prediction model that can be developed with the help of MCDM such that we can predict the outcome. MCDM can also be used to select better models. GIS can be utilized to draw a map representing the climatic impacts and their severity with time and space.

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Chapter 8: Determination of Water Quality Index of Surface Water Bodies around Rubber Industries

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Abstract

Water is one of the most natural resource you can't live without besides air. The Earths surface is composed largely of water, but much of that water is not readily usable therefore making this resource severely limited. So this priceless and scarce resources must be used wisely. Since the water is used for various purposes, it has to be tested before utilizing it. In addition, local water sources should be regularly checked whether they are still healthy or otherwise. Bad health of water bodies is not only an indicator of poor environmental health it is a threat to an entire ecosystem. Poor quality water may also lead to crisis and huge economic loss in industries. Hence water availability is significant from environmental and economic perspective. Therefore, to use it for any purpose, water quality analysis is necessary. Water quality analysis is count day some customary standards but do not part to lead generally of the nutrients into solvent of water. There are standard sampling, sample preservation and analysis procedures. The current research aimed at assessing the Water Quality Index of the surface Water Bodies in the vicinity of the rubber industries to ascertain the effect of such Industries on the Water Bodies.

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Chapter 9: Finding Coastal Vulnerability Maximization Sites using MCDM-Guided NIPT (Nature Inspired Predictive Technique)

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Abstract

The coastal regions of many oceans on many continents are becoming more vulnerable due to the effects of climate change and extensive urbanization. A coastal zone can become vulnerable due to a number of issues, such as encroachment, uncontrolled tourism, coastal erosion, deforestation of mangroves, etc. But not every spot along a coast is at risk in the same way. Certain people are more susceptible than others. In order to create an indication that reflects a location's vulnerability, each input parameter's function in the vulnerability calculation must be clearly stated. The goal of the current study is to identify the factor that most significantly contributes to vulnerability. However, as of right now, there is no method for identifying the primary factor that caused coastal vulnerability. The current goal was to carry out a strategy to determine which metric is most important. It will be challenging to year mark the site as a result, necessitating quick mitigating actions. This work employs a two-phase methodology to address this problem. First, using the MAUT, it will assess the likely causes of the coastal damage parameters. Then, depending on the results of these comparisons, it will compare many sites. Second, it will use GMDH and MAUT to create a decision-making application for identifying coastal vulnerability areas. This will allow for the implementation of mitigating measures where necessary, assuring the best use of money allotted for the adoption of compensatory measures.

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Chapter 10: Evaluation and Projection of Precipitation, Maximum and Minimum Temperature Changes Using Multi-Model Ensemble: A Case Study of Radhanagari Dam, India

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Abstract

This study evaluates the performance of 27 NASA-NEX-GDDP CMIP6 general circulation models (GCMs) in replicating precipitation (Pr), maximum temperature (Tmax), and minimum temperature (Tmin) over the catchment of Radhanagari Dam, India. The compromise programming (CP) and technique for order of preference by similarity to ideal solution (TOPSIS) are employed to identify the best-performing GCMs. The MIROC6, ACCESS-ESM1-5, CanESM5 are the top-performing models for Pr, Tmax, and Tmin based on TOPSIS and CP techniques. The top 5 performing GCMs for each of these aforesaid climatic variables are then used to develop multi-model ensembles (MMEs) by employing reliability ensemble averaging technique to project Pr, Tmax, and Tmin under two shared socio-economic pathways (SSP245 and SSP585) for three future periods.The results show that the developed MME have shown superior performance as compared to individual GCMs. Projections indicate an increase in annual Pr and Tmin for all three future periods under SSP245 and SP585 scenarios. Tmax is projected to decrease in the near future period, but increase in the mid and far future periods under SSP245 and SSP585 scenarios. The projected climatic variables under SSP245 and SSP585 can be utilized in hydrological models to project the future streamflow in the basin.

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Chapter 11: Spatio-Temporal Analysis of Suspended Particulate Matter in a River Using Landsat 8 - Implications for Water Quality Management

Bhagavat Punde and Namrata Jariwala

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Abstract

Suspended particulate matter (SPM) in the water body leads to various problems, such as light penetration into the water body, affecting the entire aquatic ecosystem. This research article investigates the spatio-temporal dynamics of SPM concentration in a river from 2018 to 2022. Acolite software, utilizing the default settings of the Dark Spectrum Fitting (DSF) algorithm for atmospheric correction, was employed to process Landsat 8 satellite images to estimate SPM concentration in Tapi river. The research employs point estimation techniques at strategic locations, including Kamrej, Sarthana, Katargam, Rander, and the Causeway, to capture the complexity of spatio-temporal patterns. The findings reveal that the Causeway consistently exhibits higher SPM concentrations, potentially due to water stagnation. Additionally, analysis of the summer and winter seasons demonstrates lower mean SPM concentrations in 2020 and 2021, attributed to the COVID-19 lockdown measures reducing anthropogenic activities and industrial discharge. These results emphasize the need to consider additional factors such as rainfall patterns, sediment dynamics, and point source pollution in understanding SPM dynamics. The research findings contribute to a comprehensive understanding of SPM dynamics and provide insights for effective mitigation strategies to sustain water quality in the studied river system.

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Chapter 12: A Novel Approach to Multi-Criteria Decision Making for Choosing Coastal Vulnerability Index Parameters

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Abstract

Given that more than half of the world's population lives within some distance of the coast, it's hardly surprising that that's where most of the problems tend to occur, due to the untrammelled development and irresponsible exploitation of coastal zone resources. Vulnerability assessment studies encourage sustainable use of coastal resources by addressing coastal values and hazards and by identifying vulnerability along the coast. In these types of investigations, multi-parameter indices are the most common, like the Coastal Vulnerability Index (CVI). Vulnerabilities are classified according to the relative impact and interaction of risk variables The importance of these characteristics and how logically they appear in the index govern the method's accuracy and dependability. However, existing methods in the same direction are oblivious to the appropriateness of dependence and evaluate the significance of dependent elements based on the decision-making behavior of the decider and apply it to Coastal Vulnerability Index (CVI). Thus, the present-day coastal risk index is often misestimate and evolves as quickly as decision makers do. Although MCDM has been used by a few research to eliminate bias on the system through this alternatively and overlapping as well as uneven comparison technique, it presented the wrong decision. To classify the parameters and ultimately suggest a new coastal vulnerability index, the present study endeavours to identify the key parameters of coastal vulnerability. It does this by creating a new multi-criteria decision-making approach. One new method of the decision-making process is through

considering the (pairwise comparison) through its inverse probability purpose notion while given the attribution dimension of sustainability criteria. Coefficients and estimate the cumulative relevance of the elements pass the sustainability criteria.

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Chapter 13: Assessment and prediction of monthly Indian summer monsoon rainfall by using nineteen large-scale circulation indices with four lags

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Abstract

Indian summer monsoon rainfall (ISMR) provides 80% of total annual precipitation and thus has a tremendous impact on water resource management, agricultural yield and, consequently, on India's gross domestic product. In this study, assessment of hydro-climatic teleconnection between monthly ISMR and large-scale atmospheric/oceanic circulation indices is performed by using monthly composite index (MCI) and machine-learning technique named support vector regression (SVR) with linear kernel. The MCIs between monthly ISMR and final selected significant indices (FSSIs) are formed by using multivariate linear regression (MLR) for development phase periods 1951-1985, and 1951-1988 and these are tested during testing phase periods 1986-2014, and 1989-2014, respectively. Similarly, SVR model also has the same training and testing periods as of MLR model. The correlation coefficient is evaluated between observed and simulated monthly ISMR corresponding to both MLR and SVR models corresponding to development/training and testing phases. The study revealed that, correlation coefficients obtained by SVR model are better than that of MLR model for testing phases.

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Chapter 14: Assessment of Urban Stormwater Drainage Network of the Southwest Zone in the Surat City

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Abstract

Urban floods have been exacerbated by hydro-climatological changes linked with climate change and climatic variability, as well as impermeable covering over the soil in cities. Vulnerabilities such as flooding arise in typical urban storm water systems as the capacity of components within the system is overburdened and runoff accumulates at the surface. Owing to the construction of buildings and roads, urban growth continues to create an impervious ground surface, which raises the risk of flooding in urban areas. Thus, Storm Water Management Model (SWMM) is used in the present study to assess the adequacy of the storm water drainage network of the Southwest zone of the Surat city. The storm drainage network was assessed for 2-year, 5-year, 10-year, 20-year and 50-year return period storms. The result showed that, existing storm water drainage network have 17 hotspots corresponding to 2 year return period rainfall and these are increasing corresponding to 5, 10, 20 and 50 years return periods.

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Chapter 15: Impact of Natural Gas Power Plant on The Water Quality of Surface and Groundwater

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Abstract

Thermal energy is the major source of power generation in India. The Power Plant is an electricity-generating facility. Water is one of the key input requirements for thermal power generation. Water quality impacts include temperature, dissolved oxygen, nutrient concentrations, and redox-sensitive metals. Seasonal variations in reservoir water quality also impact downstream conditions. The present study aims to Impact of thermal power plants on the water quality of surface and groundwater. Three MCDM methods AHP, MAUT and OPA have been applied to achieve the present objective. Ten parameters such as Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Electrical Conductivity (EC), Total Dissolve Solid (TDS), Hardness, Chloride, Turbidity, Total Suspended Solid (TSS), Potential of Hydrogen(pH) and temperature have been chosen among the various parameters based on literature review and expert opinion to determine which one will carry the most weight as per the MCDM methods. Here after doing the AHP, MAUT; OPA MCDM method BOD is the least and DO is the most significant parameter. Increasing WQI value the quality of water will decrease. According to the result minor effect has happened nearest point from the power plant surface and groundwater is more affected from the farthest point surface and groundwater.

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Chapter 16: Application of Polynomial Neural Network in Assessment of Water Vulnerability in Rubber Industries of Tripura

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Abstract

Rubber (Hevea brasiliensis), known to do best in tropical climates, grows well in this nation. Natural rubber is the most important cash crop in Tripura. It is recognised as one of the nation's key crops, supplying employment and revenue to smallholders, estate workers, and their families. Meteorological conditions are one of the factors that can affect rubber yield and productivity. In recent years, climate change has become a major threat and has been widely documented in the geographic distribution of many plant species. This paper analyses the impacts of climate change in the rubber production of Tripura based on three important factors as temperature, soil moisture and water availability. In this regard, a model has been developed using the Group Method of Data Handling (GMDH) to analyse the climate change impacts on rubber production of Tripura. The data has been collected from different sources in all over Tripura for Achievement of Rubber production w.r.t Area. In the meantime, Water availability data has also been collected from PWD (WR) Tripura and the unknown data has been predicted as well as determined by GMDH. During data collection, various knowledge has been gathered related to harvesting, watering and marketing. Our aim for this project is to predict whether current water availability can satisfy the water demand for rubber or not.

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Chapter 17: Optimal Resource Allocation within Peri-Urban Consumers with the help of Mine Burst and Glow Worm Optimization Technique

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Abstract

This study presents a framework for efficient resource distribution among key consumer groups: residents, tourists, aquaculture, livestock, wildlife, and invertebrates. The Analytic Hierarchy Process (AHP) is employed to prioritize these consumers based on their economic and environmental significance. The optimization process compares the performance of the Glowworm Optimization (GWO) and Mine Blast Algorithm (MBA) in determining the most effective resource allocation. Results show that GWO achieves a more balanced allocation compared to MBA. However, MBA excels in specific scenarios with fewer resource constraints. The project demonstrates the utility of GWO for resource management, though challenges such as limited data accuracy and real-world validation persist. Future work will involve refining the model with empirical data and addressing dynamic influences like climate change and seasonal impacts to enhance the robustness of the resource allocation strategy.

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Chapter 18: Comprehensive Approach": A Holistic Approach of Trend Analysis Derived Through Review and It's Application to Rainfall over All India and Seven Homogenous Regions of India

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Abstract

One of the most severe problems present day worlds facing is climate change. Thus, proper assessment of impacts of climate change on hydro-climatic variables and consequently on the society are essential. Kundzewicz and Robson (2004) have given method for statistical analysis of change and it is modified in the present work to derive a robust method called as Comprehensive Approach (CA) that further addresses research gaps identified through reviewed literature. The CA is employed for the trend analyses in rainfall of seven homogeneous regions and all India corresponding to temporal scales viz. annual, monthly and seasonal for the three-time intervals 1901 to 2003, 1948 to 2003 and 1970 to 2003. Trend analyses results shown presence of statistically significant trends in: 1) Peninsular India region's winter rainfall TS (1901-2003) having negative trend, 2) North West India and Central North East India regions pre-monsoon rainfall TS (1948-2003) having positive trends, 3) West Central India region's monsoon rainfall TS (1948-2003) having negative trend, 4) North East India (NEIND) region's August month rainfall TS (1901-2003) and June month rainfall TS (1948-2003) having negative trends. Also, in pre-monsoon rainfall TS (1948-2003) of five homogeneous regions, regionally significant trend is detected.

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Chapter 19: Assessment of Stormwater Drainage System for the Southwest Zone of the Surat City in the Context of Climate Change using Machine Learning Techniques

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Abstract

The World Meteorological Organization described the year 2020 as one of the most extensively flooded years in its State of the Global Climate 2020 Report. Due to its impacts on hydrologic components, climate change is a crucial concern that influences the effectiveness of drainage networks in urban areas. Urbanization, unlawful settlement along the riverbanks, bank erosion, dense population, heavy rainfall, industry, and high tide all contribute to flooding in shoreline urban floodplains such as Surat City. Increases in precipitation inside the city, its surrounding areas, and in the Tapi basin are predicted to be caused by climate change, which will likely worsen the risk of flooding. The population of the Southwest Zone of Surat City according to Census 2001 was 242466 and according to Census 2011, it was 348423. This indicates rapid urbanization of the Southwest Zone of Surat City. As a result, the current study is being carried out to assess the suitability of the storm drainage system in the Southwest Zone of the city of Surat in the context of urbanization that occurred in the past few decades and climate change. In the current investigation, an effort has been made to analyze the performance of several multi-model ensembles corresponding to CMIP6 and generated by using four distinct machine learning regression techniques namely Support Vector Machine (SVM), Random Forest (RF), K-Nearest Neighbour Algorithm (KNN) and Artificial neural network-multilayer perceptron neural network (ANN-MLP). The study also tried to identify the optimum number of GCMs to be included in the multi-model ensemble. The storm drainage network of the Southwest Zone of Surat City was evaluated for the observed rainfall and rainfall generated by using a multi-model ensemble of 18 top-

ranked CMIP6 GCMs corresponding to SSPs namely ssp585 and ssp245 for different return periods viz. 2, 5, 10, and 20 years. The investigation revealed that the existing storm drainage network contains 5 hotspots and 14 hotspots for rainfall events corresponding to two-year return periods for observed and SSP585 (ANN-MLP) CMIP6 datasets, respectively, and these hotspots are increasing for the rainfall events corresponding to five-, ten- and twenty-year return periods.

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Chapter 20: Using Multi Criteria Assessment for Coastal Vulnerability Analysis: A Guided Bacteria Foraging Method

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Abstract

The various subcomponents of the coastal management systems make up their main structure. The effectiveness of these subcomponents determines the effectiveness of the coastal encircling system. But according to relevant prior research, no attempt was made to determine the ideal subcomponent contribution ratio to guarantee the least amount of susceptibility. Once more, there aren't enough scientific studies to determine which components of the coastal management system's representation of vulnerability are prioritized. The goal of the current study is to determine the ideal contribution ratio and priority that each component of the coastal vulnerability of the coastal surrounding system must provide. The benefits of multicriteria decision making and nature-based algorithms were applied in this context, and the results were verified by a physical model. A coastal management system is very important, based on the findings of Potential Hydraulic Energy from Wave (PE) and Distance of Sea from the Coast. Adopting this process has the advantage of approximating the solution while taking the economic and technical aspects into account. After the results were verified in a physical model, it was determined that the approach could enhance performance while minimizing cost requirements. The findings of the study can be used to inform priority-based mitigation actions for coastal conservation, ensuring the sustainability of the coast.