

Determining the Effect of Intensity and Duration of Drought on the Lag Time Between Meteorological and Hydrological Drought and Examining Uncertainties (Case Study: Anzali Basin)

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Abstract

There is a deficiency in the number and depth of researches regarding the significant association between meteorological and hydrological droughts, and investigating the effects of uncertainties in the lag time between the two phases of the droughts. In this study, the lag time between the two phases of meteorological and hydrological droughts was investigated based on the available observations, using frequency-counting methods for the Anzali wetland basin with 9 meteorological and 20 hydrometric stations having recorded data from 1985 to 2015. Due to the fact that in the 30-year observation period, the possibility of severe droughts is low, to generate unobserved meteorological drought conditions of varying magnitude, continuity, and intensity, using the Monte Carlo method artificial rainfall was simulated. The SWAT water balance model was employed to generate the hydrological drought situations for different meteorological drought scenarios. The effect of the persistence and severity of meteorological drought on the lag time was investigated using the statistical technique of cross-correlation matrices. The results showed that an increase in meteorological drought duration increases the hydrological drought duration while an increase in the drought intensity reduces the lag time between the two phases of the droughts. The confidence interval of the lag time between meteorological and hydrological droughts showed that there is a chance of 70% to have a lag time of one month or less between the two phases of the droughts.

Keywords: Meteorological Drought, Hydrological Drought, Drought severity, Drought duration, Uncertainty, Lag time.

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Virtual Water Footprint at Industry (Case Study: Detergent Industry)

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Abstract

Due to its location in arid and semi-arid climates and also with the increasing growth of water consumption, Iran is facing a serious risk of water crisis in agriculture, drinking and industry. To deal with it, we must be more sensitive to the types of water consumption. The industrial sector is one of the major consumers of water resources in the country and water consumption management in this sector should be considered, in addition to saving water consumption, to meet the water needs of industries in the future. The present study was conducted on one of the large detergent factories in Qazvin province. A system boundary analysis is provided for a detergent and the range of water consumption factors is determined. Using the information received from the factory and related calculations, the total water footprint of the factory in 2019 is 26.64 cubic meters per ton of product. The amount of direct and indirect water footprints is estimated to be 0.658 and 25.9 cubic meters per ton of product, respectively, which indicates the high share of detergent production in water consumption. In this study, the gray water footprint in this industry is calculated to be 14.5 cubic meters per ton and the amount of footprint is very effective on the overall water footprint of the factory.

Keywords: virtual water footprint, detergent, reduce water consumption, energy consumption, gray water footprint.

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Flood Susceptibility Zoning in the Sanghar Basin, Kermanshah Province

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Abstract

Floods are the most common natural hazard in the world, destroying human lives and property. The impact of floods is a function of several criteria: flood strength and magnitude, repetition and duration of flood and geometry of river crossings. Evaluation of flood-prone areas on a regional scale to manage the catchment area and reduce potential casualties is of great importance. The aim of this study is to prepare a flood susceptibility map using a combined analysis of hydro geomorphic criteria and a hierarchical analysis process (AHP) to achieve this goal 12 criteria such as: elevation factor, slope, Distance from river, Geomorphology, Drainage density, Flow accumulation, precipitation, land use, geology, SPI, TWI, curvature. SPI, TWI, curvature layers in SAGA GIS environment have been prepared and the other layers have been prepared in GIS environment. After preparing the criteria, the pairwise comparison matrix is prepared and then the value of the final coefficient of the layers is prepared with the help of Expert Choice software. Then all the factors are classified and fuzzy normalization is applied to them using fuzzy functions. Finally, all layers are merged using the WLC method and the final map is prepared. To determine the degree of correlation of layers using random points, the correlation coefficient of factors has been calculated. The results of this study show that in the Sanghar catchment area, about 26% of the area is exposed to high and very high flood sensitivity and 59% have low and very low flood sensitivity. Among the geomorphic factors affecting the flood, three factors: elevation, slope, and drainage network density have a major impact on the flood sensitivity of the Sanghar catchment; In contrast, the four factors of Distance from river, SPI, Flow accumulation and curvature played a smaller role in the flood susceptibility map of the Sanghar catchment.

Keywords: Flood susceptibility, Sanghar catchment, AHP, GIS.

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Economic Evaluation of Saline Water Desalination System in Qeshm Island Using Flat Plate Solar Collectors and Phase Change Material

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Abstract

Types of research in recent years have turned their attention to improving the efficiency of thermal and heat recovery systems. Regarding the water and energy crisis, improving the efficiency of thermal systems and heat recovery, along with the use of the desalination process, has attracted many researchers in recent years. The simultaneous design of units and the integration of processes reduce the amount of required equipment and energy consumption. The main purpose of this article is to supply fresh water to Qeshm Island with renewable energy. An integrated structure for cogeneration of freshwater and power has been developed using a multi-stage thermal water desalination system and Kalina cycle. To supply the input heat, an integrated structure of solar flat plate collectors and phase change material have been used. This integrated structure produced 227.8 kgmole/h freshwater and 1107 kW power. In this integrated structure, the efficiency of the Kalina cycle power plant and gain output ratio of the multi-effect desalination system are 6.751% and 2.874, respectively. Exergy analysis of the integrated structure shows that the highest exergy destruction occurs in solar collectors of 81.68% and heat exchangers of 14.34%, respectively. The economic analysis of the integrated structure shows that the period of return and the prime cost of the freshwater are 3.883 years and 2.131 US\$/m³, respectively.

Keywords: Water footprint and concern, Multi-effect desalination, Power cycle, PCM, Flat plate solar collectors.

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Simulation of Saline and Fresh Water Interference in Saturated and Unsaturated Zones Using Physical and Hydrus-2D Model

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Abstract

One of the threatening factors to fresh water resources is the advancement of saline water and intrusion into the groundwater aquifer. This problem occurs in coastal zones and desert margins which causes reduction in the quality of fresh water. Evaporation from the soil surface and the water table depth are factors affecting the salinity and salt distribution in the saturated and unsaturated zones. In this study, by constructing a physical model with dimensions of 4×1×1 m, the proposed situation of saline and fresh aquifer levels was studied in four different hydraulic gradients. During the experiment, moisture and salinity data were collected from the physical model and then the salinity distribution in the physical model was numerically simulated using Hydrus-2D software. The results showed that Hydrus-2D model simulates moisture and salinity distribution well. The Maximum Normalized Root Mean Square Error (NRMSE) for simulation of moisture and salinity were 9.28 and 21.69 percent. The results showed that the pattern of salinity progression and regression were different. In conditions where the fresh water level is higher, it prevents the advance of saline water in saturated zone, and in unsaturated zone it does not have a significant effect on controlling salinity due to evaporation from the soil surface. In the saturated zone, when the saline and fresh water levels were equal, three units' salinity increase in saline zone and when the saline water level was higher, 6.5 units salinity increase was observed in the middle of the two saline and fresh water reservoirs.

Keyword: Groundwater, Salinity Front, Hydraulic gradient.

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The Effect of Macroeconomic Variables on the Financial and Casualties of Natural Disasters in Iran

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Abstract

Natural disasters are one of the most important causes of human death. Meanwhile, floods and earthquakes have the highest number of casualties and financial losses. Therefore, given that Iran is one of the top ten countries in the world, Hence, the present study evaluates the effects of macroeconomic variables on casualties and financial losses caused by floods and earthquakes by the WLS method in the period 1339-1398 in Iran. The results of this study showed that one percent increase in the variables of GDP per capita, life expectancy and literacy rate caused a decrease of 1.52, 5.26 and 10.55 percent in flood and earthquake casualties, respectively. Also, a one percent increase in the variables of population density, unemployment rate, government spending on infrastructure and openness of the economy increases by 20.64, 7.47, 4.22 and 4.86 percent, respectively, of the casualties caused by floods and earthquakes. On the other hand, a one percent increase in GDP per capita, population density, government spending on infrastructure and literacy rate caused an increase of 1.86, 13.01, 12.81 and 24.52 percent in financial losses due to floods and earthquakes, respectively. A one percent increase in the variables of life expectancy and investment in physical capital also caused a decrease of 33.22 and 9.9 percent in the financial losses caused by floods and earthquakes, respectively. Therefore, considering the results of the role of economic variables in the amount of financial and casualties caused by floods and earthquakes in Iran is significant, so economic policy to reduce the negative effects of these events is considered necessary.

Keywords: Flood, natural disasters, Life expectancy index, Literacy rate, Trade freedom.

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Estimation of Drag Coefficient in Open Channel Flows with Submerged Vegetation Using Pareto Analysis and Multi-gene Genetic Expression Programming

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Abstract

The vegetation resistance, drag force and drag coefficient are among the most properties in hydraulic and Eco hydrological studies in rivers. The drag coefficient depends on flow properties, condition of density and distribution of vegetation, and is often estimated by non-accurate empirical equations. In the present study with the aim of improving the accuracy and derivation of optimum equations for drag coefficient in open channel flow with submerged vegetation, the optimal Pareto and multi gene genetic expression programming in combination with maximum dissimilarity classification algorithm is used. By using the dimensional analysis, the effective parameters derived in non-dimensional form and using 910 data points of drag coefficient and flow with vegetation conditions explicit equations for drag coefficient are developed. Investigating the results of proposed model shows that model with $R^2=0.9$, $RMSE=0.41$, $MPE=10\%$ is more accurate than the empirical equations and its errors are 20% smaller than previous equations, declare the appropriate performance of developed model. Furthermore, the physical meaning of the developed models shows that beyond its simplified form, it has the ability in inferring of physical meaning of drag phenomenon. Therefore, the superiority of proposed model versus previous studies is confirmed. The results of the current model can be used in studies and hydraulic/eco-hydrologic models in rivers and channels having vegetation.

Keywords: Pareto optimality, vegetation, drag coefficient, flow resistance, multi-gene expression model.

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Sensitivity Analysis of Parameters Affecting the Design Flood Using HEC -HMS Mathematical Model (Case Study: Sardasht Dam)

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Abstract

Several factors are affecting the flood routing process, each of which has a particular weight of attenuation of flood peaks through the spillway. This paper identifies these factors and analyzes the factors affecting the sensitivity of peak discharge estimation of Sardasht dam and the effects of these factors and their sensitivity were determined through hydrograph routing from the basin and the reservoir. At the first stage, after the construction of the basin model with full elements in Hec-Hms, one available storm event with corresponding run-off, is simulated then affecting parameters in the different sub basins were calibrated. In the second stage, the probable maximum precipitation (PMP) hyetograph converted to probable maximum flood (PMF) and routed in the reservoir. At the last stage, the sensitivity of CN, amount of rainfall design, lag time of channel and lag time of basin and also flood routing of the reservoir were investigated. The results show that the design flood is most sensitive to the amount of precipitation as with 30% change in precipitation, CN and channel lag time the flooding amount changed linearly about 40%, 25%, and 8%, respectively, but with changing $\pm 30\%$ of basin lag time the flood peak changed non-linearly by 5 in over estimating and 16% in the underestimating.

Keywords: Rainfall-runoff model, Reservoir routing, Sardasht Dam, Spillway, Hydrograph.

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Investigation Optimal Input using Gamma Test in Rainfall-Runoff Modeling of Northern Karun Watershed

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Abstract

Rainfall-Runoff (R-R) is one of the most complicated processes in hydrology. The aim of this study was to select the effective parameter and optimum combination for R-R modeling using Gamma test in the WinGamma software for Northern Karun watershed. For this purpose, daily precipitation and discharge data in 1997-2017 was used. Lake data was removed and homogeneity of data done using Run-Test. Statistical corrections were corrected by correlation method and data homogeneity test was performed by Run-Test method. The coefficients of auto-correlation, partial auto-correlation and cross-correlation in the R Studio software environment were used to determine rainfall and discharge delays. Optimum inputs and combinations were also obtained using the Gamma test in WinGamma software environment. The results showed that 9 optimum input parameters include precipitation today (P_t), precipitation with a delay of one day (P_{t-1}), two days (P_{t-2}), three days (P_{t-3}) and four days (P_{t-4}), As well as discharge the day before (Q_{t-1}), discharge with a delay of two days (Q_{t-2}), three days (Q_{t-3}) and four days (Q_{t-4}) had a significant level of confidence at the level of 5%, which for the creation of 130 suitable combinations was identified and based on the lowest Gamma (Γ) statistics, a suitable composition was determined for each sub-watershed. Finally, for the whole basin, the optimum inputs include the parameters P_t , P_{t-1} , Q_{t-1} , Q_{t-2} and Q_{t-4} , and the best combinations are P_t , P_{t-1} , Q_{t-1} , Q_{t-2} , Q_{t-3} . In general, in all sub-watersheds and the whole watershed precipitation of the current day, the precipitation of one or two days ago as well as the discharge of the previous day and two days ago have a significant effect on the run-off entering the in river basin.

Keywords: Auto-correlation Coefficient, Gamma Statistic, North Karun Watershed, Rainfall-Runoff Process, WinGamma.

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Forecasting of Precipitation in Karkheh Catchment Area through LARS-WG Model

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Abstract

Forecasting of precipitation changes in the next periods is one of the most important issues in water resources management and planning. The present paper aims to investigate the trend of precipitation changes of Karkheh Catchment Area in 19 following years through 6 synoptic stations (Eslam Abad Gharb, Bostan, Khorram Abad, Ravansar, Kangavar, and Malayer). Firstly, climate data of the basic period was provided daily from 1998 to 2016. Then, output data of IPCM4 Atmospheric General Circulation Model became microscale through A1B, A2, and B1 scenarios of climate change through LARS-WG Model in Karkheh Catchment Area. Results obtained from precipitation changes were evaluated and analyzed in 6 synoptic stations of Karkheh Catchment Area in the basic period (1998-2016) and the next period (2017-2035). Results of investigating precipitation average represent that the precipitation during the next 19 years will increase compared to 19 previous years based on all A1B, A2 and B1 scenarios in stations of Eslam Abad Gharb, Bostan, Ravansar, and Malayer, and A2 Scenario shows more increase rather than the others. Moreover, according to all three scenarios, precipitation during the next period will decrease compared to the previous period in Kangavar Station. According to A2 Scenario, there will be more precipitation in the next period compared to the previous period in Khorram Abad Station and the precipitation during the next period will decrease according to A1B and B1 Scenarios.

Keywords: Climate Change; IPCM4 Model; Scenario; Greenhouse Gases.

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Assessing the Impacts of Climate Change and Human Activity on Water Resources, Case Study: Karun River

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Abstract

Climate change and human activities, including dams, are keywords in water resources management that directly affect water exchanges between surface and groundwater resources. The purpose of this study is to determine the contribution of human activities (dam construction) and climate change (hydrological drought) on the water resources of the Karun River. For this purpose, the study area of Gotvand-Aghili was selected. By analyzing the Iranian matrix, the effects of dam construction on water resources were determined. The results showed that there are 6 and 4 negative effects in the column and row respectively. However, the matrix shows that the consequence and impact of tourism development and recreational activity and surface water quality are less than -3.1. Continuously, to determine the contribution of climate change in water resources, hydrological and hydrogeological drought indices were calculated over an 11-year statistical period. The results of comparing the electrical conductivity in the sampled points show a significant increase that was consistent with the results of the Iranian matrix. Comparison of SDI and GRI indices shows that from 2012 to 2015, there was no hydrological and hydrogeological drought in the region, and based on this, part of the aquifer decline can be considered as a result of the construction of the Gotvand Olya Dam.

Keywords: Environmental Impact Assessment, Climate Change, Sustainable Development, Dam, Groundwater Resources.

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Water Footprint in Electricity Generation with an Emphasis on Renewable Energies

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Abstract

With the increase in population, the use of natural resources increased and despite the limitations of these resources, environmental problems were created. Climate change, on the other hand, doubles concerns about water and energy supply. There are only two solutions to the water crisis: creating and discovering new resources, keeping existing resources available, and using them in a planned way. The aim of this study is the investigation of the water footprint of the electricity industry. At first, a number of power plants in the country were studied as samples. Then, the amount of virtual water consumption per kilowatt hour of electricity generated from thermal power plants and renewable energy was investigated and calculated. The results showed that the amount of virtual water used in different power plants depends on the type of power plant and the type of cooling system. Water consumption in all types of power plants is as follows: heat >combined cycle >gas >photovoltaic> wind. The average water consumption in the stem power plant with wet tower cooling system is 2.2 L/kWh, in the steam and CCGT power plant with once-through cooling system is 1.5 L/kWh, in the steam and CCGT with dry cooling system is 0.2 L/kWh, in the gas turbine is 0.025 L/kWh and in the PV is 0.07 L/kWh. The price of water is different for drinking water, irrigation and industry. So the price of water consumption of electricity is low in wind turbine, gas turbine and photovoltaic, respectively. Therefore, in order to develop and grow the country's power industry, choosing the type of power plant and especially the type of cooling system plays an important role in saving water consumption.

Keywords: Water footprint, Electricity Generation, Virtual Water.

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Water Quality Assessment of the Choghakhor Wetland for Heavy Metals Using MI, HPI, HEI, Cd and IRWQI_{ST} Indices

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Abstract

In order to maintain the ecological and biological sustainability of wetlands, it is necessary to have a proper understanding of their physical, biological and chemical environment and to investigate the status of heavy metals in them. The purpose of this study was to investigate the contamination of Choghakhor wetland with arsenic, copper, chromium, lead, zinc and cadmium using MI, HPI, HEI, Cd and IRWQI_{ST} indices during autumn 2018. Surface water sampling was performed in 10 stations and the concentration of metals was measured by ICP-MASS. The results of calculation of water pollution indices also showed that the wetland water was within the danger threshold class in terms of drinking according to MI index in all of the stations with a value of 1.04 and within the low pollution class according to HEI index with a value of 0.46. Cd index showed low pollution with a value of -4.96 and HPI showed that wetland water was not polluted with heavy metals with a value of 34.73. Also, according to the results of IRWQI_{ST} index, water quality was within the good condition of this index in all studied stations in terms of toxic pollutants with the lowest value of 76.4 in station 1 and the highest value of 80.4 in station 10. Therefore, the water quality of Choghakhor wetland was within the low pollution condition in terms of heavy metals in the water, which requires special attention to the water quality of this wetland in order to prevent further pollution.

Keywords: Choghakhor wetland, Water pollution indices, Heavy metals, Water quality.

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Investigation of the Efficiency of Dilution Flow, Detention Time and Discharge of Contaminated Water on Quality Management of Water Distribution Network After Pollution Incidence (Case Study: Drinking Water Network of Zahedan)

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Abstract

Urban water distribution systems constitute a large part of urban infrastructure. Awareness and understanding of pollutant sources and transport of contamination process in the water network cause suitable modeling of this phenomenon in the water network as well as perform a proper crisis management when the contaminants enter the network. In order to simulate the movement of nitrate in the soil, the nitrate advection-dispersion equation was programmed in MATLAB in this research. The second water distribution network of Zahedan has been considered as the study area and potential points with high concentration of pollutants in the network have been identified. Network simulation, after two hours of contamination, was tested for water contamination by linking EPANET and MATLAB software. To manage the network pollution crisis, two tools were proposed including detention time and dilution flow and were used along with polluted water discharging. The results of discharging of the polluted water showed that by closing pipes from 1.25 to 2.4 of the pollution injection time and also discharging water at a rate of 5% of the base pipe flow can prevent the entering of the pollution to other parts of the network. To calculate detention time, the network was divided into four parts including: near, middle, far and very far. The results of the qualitative analysis of the network indicated that required detention time to treat the quality of water in the nodes of the middle, far and very far decreased 25 to 30, 50 and 67 to 75 percent compared to the near nodes, respectively. Moreover, efficiency and positive performance of dilution flow as a tool for quality management and control of water distribution network, was proved. Required dilution flow to treat the quality of water was determined to be nearly 20% of the base pipe flow.

Keywords: Water Quality Management Tools, Water Network Pollution, Suction Phenomenon, Discharge of polluted water, Dilution Flow, Detention Time.

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Determination of Groundwater Potential Using Artificial Neural Network, Random Forest, Support Vector Machine and Linear Regression Models (Case Study: Lake Urmia Watershed)

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Abstract

The purpose of this study is to determine the areas with groundwater potential using artificial neural network (ANN), random forest (RF), support vector machine (SVM) and linear regression (GLM) models. In the present study, 14 parameters groundwater potential including altitude, slope, slope direction, curvature, distance to stream and fault, stream and fault density, lithology, average rainfall, land use, topographic position index (TPI), relative slope position (RSP) and topographic wetness index (TWI) were used. From a total of 10,624 springs, randomly 70% as test data and 30% as validation data were classified. The RF model was also used to determine the most important parameters. Alignment test between parameters was performed using SPSS software. The Receiver operating characteristic was used to Predictive power of models and the Seed Cell Area Indexes (SCAI) was used to accurately distinguish between classes. The results showed that there is no alignment between the parameters. The results of RF model showed that the parameters of height, land use, slope, and distance from fault, TWI and lithology are the most important factors affecting groundwater potential, respectively. Also, based on the ROC curve in both training (0.915) and validation (0.909), the ANN model had the highest accuracy and the RF, SVM and GLM models were in the next categories. Also, the results of the seed cell area index showed that all four models have separated the classes with appropriate accuracy. According to the ANN model, 31.4% of the basin has high and very high groundwater potential.

Keywords: Artificial Neural Network, Groundwater Potential, Lake Urmia, Machine Learning, Random Forest.

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Efficiency of the Linear Muskingum Method in Flood Routing of Dual Rockfill Detention Dams

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Abstract

One of the most important applications of rock-fill dams is to control flood by reducing the peak discharge of inflow. It is of great importance to study how much of the inflow to the rock-fill dam reservoir is transferred to the downstream under unsteady flow conditions. In the present study, flood routing in dual detention rock-fill dams was studied using four experimental data samples, linear Muskingum method, and particle swarm optimization (PSO) algorithm and the effect of rock-fill dam length, distance between two dams, and aggregate size was studied on the K coefficient of linear Muskingum method. The results showed that the mean relative error (MRE) of the four experiments used in the present study were equal to 4.9, 3.4, 4.35 and 3.55%, respectively, and the relative error of the peak discharge (DPO) of the mentioned experiments were calculated as 1.58, 0.47, 2.86 and 1.78%, respectively, which indicates the high accuracy of the linear Muskingum method in estimating the outflow hydrograph. The results also showed that, by increasing the distance between the inflow and outflow hydrographs, the K coefficient increased and by increasing the aggregates size, the flow velocity increased and consequently, the K coefficient decreased.

Keywords: Particle Swarm Optimization (PSO) Algorithm, Flood Routing, Linear Muskingum Method, Dual Detention Rock-fill Dams.

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Identifying the Sustainable Development Strategies of Jazmorian Wetland in Iran by Meta- Swot Methodology and Provision of Appropriate Solutions

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Abstract

The present study seeks to introduce the capabilities and advantages of the strategic model of Meta- Swot in the form of relevant software in wetland planning. The resource is based on resource-based theory (RBV). This theory believes that unique resources and capabilities form the main factor of continuous and sustainable competitive advantage. Accordingly, wetlands can identify their sustainable competitive advantages by programming in principle and recognizing valuable, irreplaceable, rare, and irreplaceable (VRIO) resources and capabilities compared to competitors. At first, the Environment Protection Organization's aim was to extract in related with wetland, then each of the goals prioritized by experts. Then Wetland Strategic Indicators to succession determined and weighted by Delphi and technique like and indicators for evaluation was identified. We produced strategic-managerial map. According to assessment of resource capability, we extracted proper indicators and effective environmental factors in Jazmoorian Strategic Planning. strategic map based on resources and environmental factors. Finally judging by strategic-managerial plans for achieving strategies was done. Results show that by using native management with protection approach by co-ownership local communities in management processes can be suggested such as best management style at the time of drought and water crisis. Dam construction with bubble size: 4.4 and coordinates (1.3,6.5), population with bubble size and coordinates (0.3,8.3), drilling well with bubble size and coordinates (0.3,8.3) and most importantly, land use changing with bubble size 6.5 and coordinates (1.3,9.8), has the highest strategic fit.

Keywords: Revival wetland, Basin, Strategic – spatial model, Wetland jazmoorian.

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Study of Sustainable Water in Agriculture Sector and Its Relationship with Economics and Management to Use Sustainable Water in Iran

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Abstract

Limited water resources and population growth have made the agricultural sector more in demand than other water-consuming sectors, so today the challenge for the agricultural sector is related to food production using less water. This case study was conducted in the plains of Tehran province in 1397-98 and it is based on the information available in agricultural management of Tehran province. Therefore, the purpose of this survey is to investigate the challenges and factors affecting the sustainability of water resources management. First, we did random sampling from agricultural producers and 110 producers determined based on Cochran's formula as the sample size. The reliability of questionnaire determined between 75%-93% by Cronbach's alpha index with SPSS. Then the appropriate production function called Cobb–Douglas production function is given and using the shepherd theorem, the production cost function and then Demand function for agricultural water has been calculated. The added value of the agricultural sector was considered as a dependent variable and independent variables including economic, social and technical variables. According to the results of the correlation test, there is a significant relationship between sustainable management of water resources and the variables of economic factors and then the views of experts is at the level of 99%. There is no significant relationship between age and background of experts and water sustainability. In other words, these factors are independent of sustainable water management.

Keywords: Water sustainability, agriculture, economic management, economic factors, water resources, sustainable management.

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Estimating the Suspended Sediment Load and Evaluating the Homogeneity and Heterogeneity of Water and Sediment (Case Study: Kasilian watershed, Mazandaran)

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Abstract

There is a significant difference between the observed and simulated suspended sediment yield with respect to many watersheds in Iran as this country does not have sediment stations. Due to station limitation, it is necessary to evaluate the experimental models and statistical methods for estimating the transfer rivers suspended sediment. The aim of this study is to evaluate homogeneity and heterogeneity, the trend of changes in discharge and sediment value and assesses a suitable comparison of suspended sediment load estimation methods efficiency using rating curves. The present study, the ProUCL software was used through the Kendall and Pitt test to evaluate trend changes and homogeneity and heterogeneity of time series relating to water and sediment discharge, respectively. To estimate suspended sediment a one-line, two-line, and mean-load rating curves were used. The performance of the methods was evaluated based on R^2 , NSE, RMSE and SD and the best method was selected. The finding of this study suggested that the mean-load method was selected as an appropriate method with the highest efficiency in the study area. Further, the trend changes of water and sediment discharges using the Kendall test showed that the trend is declining with a significance level of 5% and indicated that there are adaptations between water and sediment discharge changes. Pittet test revealed that the discrete time series in related to water and sediment discharges are homogeneous and heterogeneous, respectively. Therefore, having knowledge about the homogeneity and heterogeneity of water and sediment discharge can be effective in protection measures and environmental effects moderation.

Keywords: Pittet test, Man Kendall test, Suspended sedimentation, Sediment rating curve, and Sediment heterogeneity.

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Monitoring and Evaluation of Spatial Variations in Soil Electrical Conductivity Using Remote Sensing

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Abstract

Soil salinity is an important environmental issue that reduces soil productivity. For optimal management of soil resources, quantitative monitoring of soil salinity, temporal changes and spatial analysis of the factors affecting it are necessary. The purpose of this study is to extract the soil salinity distribution map and its spatial analysis after more than normal rainfall in the rainy year of 1997-98 in western Iran. Using Landsat satellite imagery and GDVI index and algorithm written in Google Engine system, soil electrical conductivity map was extracted and classified into five salinity classes. The results showed that in general, soil salinity has decreased in the study area. Areas with high salinity that are in the low altitude class have not changed. If the precipitation factor in this study period is the most important factor in changes in salinity distribution, this factor could not have a great effect on the salinity class, but the medium salinity class had the most changes. Move the soil surface of this class down. For the ellipse, three times the standard spatial deviation of the northwest to the southeast was obtained, which shows that more than 99% of the salinity dispersion follows the spatial arrangement of altitudes, precipitation and dispersion of soil categories in this direction. Statistics of 0.4566 of Moran index and P_Value showed 0.00 spatial salinity of soil salinity in the west of the country. The hot-spot map also showed that the surface salinity of the soil is clustered in the northwest and southeast directions at altitudes of less than 1200 meters. Hot-spot analysis also showed that soil salinity to the east and inland has found more clustering pattern. The results and methods of this research can easily and quickly identify areas that are exposed to soil salinity and could be used in environmental planning to implement preventive measures. The results of this research are also used and its outputs are also utilized to identify soil salinity centers in agricultural planning and allocation of facilities.

Keywords: Soil salinity, Landsat images, GDVI index, G-Star statistics.

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