Introducing a new method to aquifer vulnerability assessment of Moghan plain based on combination of DRASTIC, SINTACS and SI methods

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Abstract

Increasing growth of population leads to increase in human activities such as agriculture and industry, which these activities increasing and irregular usage of fertilizers, pesticides and insecticides result in soil and groundwater pollution. Meanwhile, vulnerability assessment can play important role in the management of polluting activities. In this research a new method has been proposed for the vulnerability assessment of Moghan plain as one of the most important provider of agricultural products and animal husbandry in the Ardebil province. This method incorporates the weighted combination of three common vulnerability assessment methods DRASTIC, SINTACS and SI which. Comparison of obtained results from the proposal method with field nitrate concentration data of this area which sampled from 21 tube wells in the study area in the autumn 1394 indicates that the proposed method has a higher correlation index than other methods. According to the result of proposed method, 41%, 46% and 13% of the study area have been located in areas with low, medium and high vulnerability respectively. The proposed methodology in this study could be used for vulnerability assessment of other aquifers.

Keywords: field capacity, rainfall simulator, rainfed land, sediment, soil loss.

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Assessment spatial variability and Mapping of drinking and agricultural water quality using geostatistics and GIS techniques

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Abstract

Quality properties of groundwater are one of the major components which can use for water resources management. In this study, spatial variability of groundwater quality for drinking uses (Schoeller standards) and agricultural uses (Wilcox standards) was investigated during 1387-1392.In this research, we use information of 24 observation wells in Fasa plain, to investigate the spatial variability of water quality parameters for different category by using geostatistics technique in GIS software and associated areas of different class of water quality were also determined. Afterwards, the change in the area by using parametric (linear regression) and non-parametric (Spearman) statistical tests for determined period was evaluated. The results showed that the areas with suitable class for drinking and agricultural uses based on the both statistical methods were decreased, while the areas with unsuitable class were increased. The categories of drinking water quality evaluated by spatial variability of the study area fall under unsuitable class, Bad class and temporarily acceptable class which these areas have been increased and are not significant at 95% level. The categories of agricultural water quality evaluated by spatial variability of the study area fall under good class, average class and bad class which the areas with average quality class have been decreased and the areas with bad quality class have been increased, these variables are significant at 95% level based on the both statistical methods.

Keywords: geostatistics, groundwater quality, schoeller, parametric and non-parametric tests, Wilcox.

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Evaluation of nitrate concentration and vulnerability of the groundwater by GODS and AVI methods (Case study: Kordkandi-Duzduzan plain, East Azarbaijan province)

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Abstract

The aim of this study is to assess the concentration of nitrate in groundwater resources of the Kordkandi-Duzduzan plain and to evaluate the vulnerability of the groundwater using AVI and GODS methods. Kordkandi-Duzduzan plain is located in East Azarbaijan Province in the northwest of Iran, which groundwater is important for drinking and agriculture in the region due to scarcity of suitable surface waters. As well as, intensive agricultural activities and excessive use of agricultural fertilizers have caused groundwater nitrate contamination. Therefore, it is required to assess the quality of the groundwater regarding nitrate and to determine the vulnerability of the aquifer. For this purpose, 22 water samples were collected from shallow and deep water wells in July 2015 and analyzed. The lowest concentration of nitrate with 3.31 mg/L was from the north of the plain and adjacent of the central ranges which was due to high depth of groundwater level and fine grain of the sediments. The highest nitrate concentration with 37.23 mg/L was from the southeast of the area which can be attributed to the course sediments of this area. The results showed that anthropogenic activities are the main reason for the presence of nitrate in the groundwater. These activities can be caused by overuse of fertilizers by farmers or leakage from domestic sewage systems in the area. The moderate correlation (r= 0.497) between nitrate concentration of bicarbonate also support the use of nitrogen fertilizers in agricultural lands. In order to initial estimation of the vulnerability, simple AVI and GODS methods were used. According to the AVI method, northwest and east of the plain and based on GODS method, northwest and southeast of the plain were determined as the highest contamination potential in comparison with other parts of the plain.

Keywords: groundwater, contamination potential, Kordkandi-Duzduzan plain, nitrate source.

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Evaluation of IHACRES hydrological model for simulation of daily flow (Case study: Polrood and Shalmanrood rivers)

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Abstract

Due to the lack of information on most stations and economic constraints for collecting observed data. Identification of a suitable hydrological model can help in the management of water resources. The IHACRES model doesn't require complex data for input, so this model is superior to other models. In this research the efficiency of IHACRES model for simulation of daily flow for Polrood and Shalmanrood rivers which is located in a humid area are (Guilan Province) evaluated. According to results, R^2 (Coefficient of Determination) are between 0.60 and 0.70 and also low APRE (Average Parameter Relative Error) results for both rivers that for Polrood is (APRE= 0.367) and for Shalmanrood is (APRE= 0.058). The results of the evaluation showed that the IHACRES model has low deflection for simulation of daily flow amounts and has good ability for simulation of flow in humid area that has high flow. The efficiency of IHACRES model in predicting daily flow was found to be fairly good.

Keyword: daily flow, hydrology, IHACRES, model.

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Investigation of effect of basin's physiographic and climatic parameters in seasonal river flow simulation

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Abstract

Physiographic characteristics and climatic conditions are factors which contributing to river flow regime and understanding of relations between these factors and river flow in a basin result in its application for the ungauged sub-basins river flow prediction. In this research the relation between physiographic and climatic parameters of Golestan province and rivers flow were examined by application of M5 regression tree model, k-nearest neighbors (KNN) model and multiple linear model (MLR). Daily recorded data for 28 years (1984-2011) including rainfall, temperature and river flow, belonging to hydrometry and meteorological stations of 39 sub-basins were used to extract seasonal series. The average of R and RMSE criteria in different seasons were 0.768 and 0.800 for M5 model, 0.885 and 0.501 for KNN model and 0.693 and 1.205 for MLR model which revealed better results for KNN model. In addition, according to R and RMSE, the accuracy of modeling results in different seasons were respectively as winter, autumn, spring and summer. In other words, the results of predicted river flows in the wet seasons were more accurate than dry seasons. Moreover, the MBE criterion indicated that the KNN model led to underestimation for spring and winter and overestimation for summer and autumn, M5 model led to underestimation in spring and overestimation in other seasons and MLR model had underestimation in winter and overestimation in other seasons.

Keywords: KNN Model, M5 decision tree model, MLR model, river flow, ungauged basins.

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Trend analysis, modeling and uncertainty estimation of stream flow recession (Case study: Bashar River of Kohgiloyeh and Boyer Ahmad Province)

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Abstract

Streamflow recession indicates the river network balance between revenue and losses of river. Recession curve expresses the storage- output relationship for the catchment. The aim of this study was trend analysis, modeling of Streamflow recession and uncertainty estimation in Shahmokhtar station on the Bashar River in Kohgiluyeh and Boyer Ahmad province. Based on the results of the Mann-Kendall, discharge trend at studied station was very little increasing, but there was no significant trend. After determination of parts, the Maillet, Baronz, Boussinesq, Horton, Drouge and exponential reservoir models were fitted. In this regard, initially the different parts of the recession lamb (in multireservoir models) were determined and the parameters of Maillet, Barnes, Boussinesq, Horton, Coutagne, Drogue and exponential reservoir models were estimated. To calibrate the coefficients of models, in addition to overlaying the estimated and observed hydrographs, the sum of square error criteria was used. Comparing the results also showed that models of Drouge, Barnes, Horton, Boussinesq exponential reservoir and Maillet could be fitted well, respectively.

Keywords: Bashar River, hydrograph, Kohgiluyeh and Boyer Ahmad, streamflow recession, trend.

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Improving the performance of ANN model, using wavelet transform and PCA method for modeling and predict Biochemical Oxygen Demand (BOD)

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Abstract

In recent decades, the developments of artificial intelligence to predict hydrologic models have been widely used. In this study, the ability of artificial neural network (ANN) models for modeling and predict the biological oxygen demand (BOD) is located on the Karun River in West Iran were evaluated. To improve the simulation results, wavelet analysis was used as a hybrid model. BOD index monthly time series Karun River in Mollasani station for 13 years (2002-2014) and the use of auxiliary variables dissolved oxygen (DO), river flows and monthly temperature was simulated. The best of inputs of model by the Principal Component Analysis method (PCA) was selected. To evaluate and compare the performance of models, Root Mean Square Error (RMSE) criteria, Coefficient of Determination (R^2) and Akaike's Information Criterion (AIC) were used. The results showed that ANN has a margin of error of 0.0412 and the coefficient of determination 0.76 and application of wavelet transform on input data model improves the results to error of 0.0273 and the coefficient of determination 0.89.

Keywords: BOD, Karun River, PCA, wavelet transform.

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Remediation of cadmium contaminated water by *Populus nigra* Sawdust as a low-cost biosorbent: Process optimization by using response surface methodology

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Abstract

In this study, the removal of Cd(II) from aqueous solutions have been carried out using Populusnigra saw dust as low-cost, readily available biosorbent. Various physico-chemical parameters such as pH, initial metal ion concentration, and adsorbent dosage level and contact time were studied at room temperature to optimize the conditions for maximum adsorption. The central composite design was carried out with aqueous solution of cadmium with various concentrations ranging from 5-25 mgl^{-1}. The range of variation for the other variables including pH, sawdust dosage and contact time are 2-10, 5-50 gl^{-1}, and 5-105 minutes, respectively. A good agreement between predictive model for cadmium removal by sawdust and experimental results was observed (R^2= 0.9283 and RMSE=2.93%). The maximum removal of 96.25% was achieved at cadmium concentration 38.75 mgl^{-1}, pH of 6.5, saw dust dosage of 10 gl^{-1} and contact time of 80 min as the optimal conditions. The highly efficient and the rapid uptake of Cd(II) by low cost saw dust indicated that it could be an excellent alternative for the removal of cadmium by sorption process from contaminated aqueous solutions.

Keywords: bioadsorbent, heavy metals, modeling, response surface methodology, water pollution.

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Assessing the conservation impacts of climate change based on temperature projected on 21 century (Case study: Arazkoseh and Nodeh stations)

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Abstract

Assessing the potential impacts of 21st-century climate change on species distributions and ecological processes requires climate scenarios with sufficient spatial resolution. In this study we projected future changes in maximum temperature and minimum temperature under CMIP3 SRES and CMIP5 RCPs scenarios with two station-based datasets (Arazkoseh and Nodeh) of the eastern Golestan province. Change scenarios (2046-2065 and 2080-2099) are compared to the reference period (1986-2005). Therefore, 8 GCM models under 6 emission scenarios are downscaled by LARS-WG and SDSM. The results indicated that the largest increase in temperature among the old emission scenarios and new emission scenario are projected by A1B and RCP8.5, respectively. The variation between model projections is considerable. The uncertainty range is large for the change in warm seasonal period. For the two future periods, the downscaling methods produce seasonal increases in the temperature with an almost ordinal order of summer, spring, winter and autumn. Also, results show that temperature indices based on seasonal maxima are generally projected to increase more than minima. In general, uncertainty generates large spread ranges of estimated climate change impacts, therefore due to wide ranges of temperatures projection, to provide a complete picture of possible climate change impact studies that focus on a single or a few of climate models open to the charge of cherry-picking.

Keywords: emission scenario, LARS-WG, representative concentration pathways, SDSM, uncertainty.

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Impressionability of suspended sediment from land use changes in Dinevar watershed of Kermanshah Province

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Abstract

The devastating impact of land use change in the watershed is increasing the generation rate of sediment and entrance to rivers and sedimentation in reservoirs. According to this, studying on impact of land use change on hydrological process is necessary. Aim of this study was investigating the impact of land use change on suspended sediment during 1994 to 2010 by SWAT model in Dinevar watershed. SUFI-2 program was used for SWAT calibration and validation. The results of NS and R^2 indicators above of 50 and 60 percent for both calibration and validation steps respectively imply to the model efficiency to hydrology data simulating in Dinevar watershed. The analysis of land use over a period of 16 years showed that the greatest change was for agricultural land more than 30 percent and the minimum was occurred for residential area and roads (3.25%). The results of the suspended sediment study showed the significant effect of land use change on sediment generated in the study period. So that the maximum amount of suspended sediment in 1994, 18.1 grams per liter, but this amount in 2010 reached to 65/12 gram per liter.

Keywords: Dinevar, hydrologic models, SUFI-2 program, SWAT model.

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Microclimate changes of cushion species *Onobrychis Cornuta* affected by fire in Golestan National Park grasslands

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Abstract

Cushions as dominant species of mountainous habitats facilitate surrounding species. The aim of this study is the investigation of fire on *Onobrychis Cornuta* microhabitats in the mountainous grasslands. Fire occurred in summer 2013. Therefore, in order to study the temperature fluctuations, thermometers were established under burned and unburned patches since 15 March 2016 for 31 days (half hours intervals). Parameters related to temperature were recorded with i Button thermometers and then were compared using t-test between control and burned shrubs in two time intervals. Except for the min temperature, other parameters related to soil temperatures including max, DTF and mean temperatures significantly increased ($P \leq 0.01$). DTF in burned patches (2.5-14.5ºC) was higher than control shrubs (1.0-3.5ºC). Soil moisture was also measured by TDR instrument in the both burned and unburned shrubs during two time intervals. For determination of the most important factors affecting soil moisture including fire, time and their interactions, GLMM were applied and compare mean were tested by T-test. Considering GLMM results, time ($F= 22.4$; $P \leq 0.01$) had highest impact on soil moisture. Soil moisture in both control and burned sites declined which was only significant at the first sampling time ($P \leq 0.05$).

Keywords: facilitation, GLMM, moisture, Nurse Shrub, temperature.

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The performance of artificial neural network in prediction and analysis of hydrological processes (Case study: Water shortage in Nazloo-chai watershed, West Azerbaijan province)

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Abstract

Precipitation is one of the hydrological processes that play an important role in controlling water resources management. Shortage of rain causes some problems such as lack of drinking water. Due to the importance of the issue of water shortage, using modern methods to predict hydrological processes will play an important role in planning and management of water resources. Therefore, in this study, monthly shortage of water in Nazloo-chai watershed was predicted using Artificial Neural Network (ANN) and improved wavelet-neural network (IWNN) models, for the past 39 years (1973-2012). Performance of these two models was evaluated using statistical indicators including correlation coefficient (R), determination coefficient (R^2) and root mean square error (RMSE). According to the results of IWNN model, the obtained correlation coefficient was 0.960 and 0.945 for testing and training modes, respectively, and this model has greater ability for predicting the shortage of water in comparison with ANN. Accordingly, the amount of monthly water shortage in this watershed was predicted for 2013 to 2020. Results indicated that shortage of water still remains as in the past years. The average water shortage was estimated nearly as 2.95 million cubic meters (MCM) in the next 7 years, while, this parameter for the past 39 years was 4.04 MCM. Therefore, it is required to take necessary measures for future years, and with careful management plans for exploitation of water resources (agriculture, industry, urban, etc.), it is possible to reduce water shortage in the coming years.

Keywords: artificial intelligence, de-noising, optimized network, water shortage, wavelet algorithm.

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The application of RUSLE model in spatial distribution determination of soil loss hazard

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Abstract

The modeling can provide a quantitative approach and consistency in the estimation soil erosion and sediment yield by a wide range of conditions. In this study, the integration method of revised universal soil loss equation model, geographic information system and remote sensing techniques were used in order to identify the spatial distribution of soil erosion and sediment yield in the Talar watershed. Parameters of rainfall erosivity, soil erodibility, slope length and slope gradient and vegetation cover were calculated in order to provision RUSLE map. The amount of soil loss was calculated from 0 to 9201 tons per hectare per year for the total basin and classification of erosion areas showed that erosion class of low, medium, high and very high with value of 33.12, 27.62, 21.13 and 18.13 percent respectively covered the total watershed. The linear regression analysis showed that in the between parameters of RUSLE model, the slope length and slope gradient parameter with value of 0.93 have the most correlation with the soil loss map. Also sw3 sub-watershed with value of 5580.33 tons per hectare per year and the sw4 sub-watershed with value of 19.59 percent have the highest and lowest Erosion hazard and Sediment yield respectively in the between sub-watersheds. The results showed that conservation and management measures can be useful to control and also reduce soil erosion and sediment yield in the Talar watershed.

Keywords: experimental model, geographic information system, remote sensing, Talar watershed.

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Compare learning function in neural networks for river runoff modeling

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Abstract

Accurate prediction of river flow is one of the most important factors in surface water recourses management especially during floods and drought periods. In fact deriving a proper method for flow forecasting is an important challenge in water resources management and engineering. Although, during recent decades, some black box models based on artificial neural networks (ANN), have been developed to overcome this problem and the accuracy privilege to common statistical methods (such as auto regression and moving average time series method) have been shown. In these researches only attended change number of hidden layer and number of neurons for to approach to the best structure in neural network, and complex in proper network design and can't be simply used by other investigators. In this study examined 15 the neural network learning function and the results indicated in the structure of the network with one hidden layer (ANN1),learnlv1, learnh and learnis by MSE=0.000158, 0.000185 and 0.000188, have been better performance than the other learning functions. And in the structure of the network with two hidden layer (ANN2), learnh, learnsomb and learncon learning function by MSE=0.000154, 0.000173 and 0.000176 have been better performance than the other learning functions. But on the other hand by ten times run this two models, learnsom and learngdm learning functions in ANN1 model and learnh and learnos in ANN2 model had most frequency among the best learning functions and thus it is better that the number of hidden layer not more than one, when we use back propagation network (that its learning function is learngdm). Because in this way we have more chance to achieve ideal response. But if we are going to increase network performance by increasing the number of hidden layer, it is better that use the default of network and learngdm carefully.

Keywords: artificial neural networks, learning function, performance criteria, prediction.

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Comparison between estimated annual soil loss using RUSLE model with data from the erosion pins and plots in Khamsan representative watershed

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Abstract

The present study aimed to compare the annual soil loss prediction of RUSLE model with the soil erosion measurements using erosion pins and plots in Khamesan representative watershed, Kurdistan Province. For this purpose, the distributed annual soil loss was estimated by RUSLE model. The suspended sediment samples were then collected daily for one year (2015/7 to 2016/6) in hydrometry station at the watershed outlet. Soil erosion was also measured in pins and plot located in North, West and East aspects of control subwatershed at the same period. The sediment delivery ratio (SDR) was then calculated through dividing total sediment load and erosion of the watershed resulted from three methods of RUSLE, erosion pins and plots. Results indicated that in plot method, the erosion generalized to the whole watershed (0.06 t ha-1 y-1) was much lower than reality and therefore, SDR was overestimated (655%). In erosion pin method, the erosion generalized to the whole watershed (76.79 t ha-1 y-1) was much more than reality and therefore, SDR was underestimated (0.51%). Whereas in RUSLE method, SDR was estimated more acceptably (2.21%) and estimated soil erosion by model (18.53 t ha-1 y-1) was clearly closer to reality. Therefore, generalizing the results of erosion pins and plots considering only the area ratio, cannot be a suitable estimate of erosion to the whole watershed. Investigating watershed topography showed that low-slope area in the middle and downstream probably is the main factor of sediment trapping and decreasing sediment transport ratio to the watershed outlet.

Keywords: sediment delivery, sediment transport, sediment trapping, soil loss.

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