A Laboratory Investigation of Quick Coupling Valves, Minor Head Loss in Solid Set Sprinkler Irrigation Systems

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ABSTRACT

One of the main reasons for sprinklers, low pressure in sprinkler irrigation systems is related to incorrect estimate of quick coupling valves, minor (local) head losses. In order to measure the quick coupling valves, minor head losses, a laboratory study was conducted in accordance with ISO 9644 and ISO 4059 international standards during year 2014. Seventy-five quick coupling valve samples were selected from fifteen manufacturers, and made of three materials of cast iron, aluminum and polymer within three sizes comprised of 1, 1.5 and 2 inch. They were tested in terms of head loss. For each sample, the minor head losses were assessed using five flow rates including the maximum, minimum as well as three intermediate flow tests. Results indicated that, there are significant differences in the minor head loss values of similar quick coupling valves due mostly to manufacturing quality. Based upon the obtained results, the average minor head losses of 1 inch quick coupling valves obtained within the maximum vs. minimum flow rates were 0.46 and 10.23 m, respectively. As for 1.5 inch they were recorded 0.60 and 4.31 m, respectively, whereas for 2 inch, the figures were 0.21 and 1.76 m. Head loss values for low level flows were close to those given in their catalogues. But as for high flows, the head loss was recorded higher than those in the catalogue values. The head loss coefficients (K) of seventy-three quick coupling valve samples were recorded in the range of 7.26 to 9.79. However, based on the standards and criteria of pressurized irrigation systems, the minor head loss coefficients of quick valves should stand in the range of 2 to 2.2. The results finally indicated that the head loss related to quick coupling valves is high and that can be an important cause of low pressure in sprinkler irrigation systems.

Keywords: Minor Head Loss, Minor Head Loss Coefficient, Sprinkler Irrigation

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Determining Economic Depth of Agricultural Well in Sprinkler Irrigated Farms in Qazvin Plain

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ABSTRACT

Decline of groundwater level in many plains of Iran has been accompanied by increase in energy consumption for pumping out water for irrigation. Long this line, a determination of the economic depth of wells, as related to pumping costs, crop value and other costs of agricultural expenditure is indispensable. This study was aimed at determining the economic depth of wells as applied in sprinkler irrigation considering two subsidized vs. non-subsidized energy costs, drilling costs, total cost of agricultural practices and benefit-cost ratio for one as a farmer. In this regard, detailed information, comprised of data from irrigation systems as well as crop yields from Qazvin Plain in year 2011 was used. Under the non-subsidized case, cost of electricity used as energy was much higher than that of diesel fuel. The average income-cost ratio obtained by farmers with electricity used as energy was more than those with diesel fuel under subsidized case, while the reverse was obtained under non-subsidized case. Increasing the depth of the well led to some partial reduction in benefit-cost ratio. The results finally revealed that due to the unusually low cost of energy, there seems to be no limit for drilling to increasing the depth of wells.

Keywords: sprinkler irrigation, groundwater, energy cost, well excavation.

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Effect of Soil Salinity and Aeration Stresses on the Root and Yield Components in Wheat and Bean

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ABSTRACT

The effects of soil matric suction and salinity were investigated on the yield components and root development of the corps, wheat and bean within greenhouse conditions. The results showed that yield components and root dry weights of wheat and bean increased with increase in matric suction (from 2kPa) and reached their maximum values at suctions of 6-10 kPa. At suctions higher than 10kPa and under $EC \leq 8 dSm^{-1}$ for wheat vs. $EC \leq 4 dSm^{-1}$ for bean, all the yield components of wheat and bean (except for 1000-kernel weight) decreased, while under higher salinities, their values remained nearly the same. At suctions higher than 10kPa and under all salinity levels, 1000-kernel weights of wheat and bean remained nearly constant. The salinities of low to medium levels did not clearly affect yield and root development of either plant. Minimum root densities of wheat and bean occurred at suction 6kPa while at other points of suction (2, 10 and 33kPa), their values almost corresponded with each other. Salinity did not clearly affect wheat and bean root densities. Wheat shoot-root ratio decreased with matric suction (up to 10kPa) under $EC \leq 8 dSm^{-1}$, while under higher salinities, this ratio increased with suctions. At 10kPa suction, weight ratio values approached each other, then remained nearly constant at higher suctions. The results finally revealed that plant response to salinity stress depends on aeration conditions in the root zone and the deficit in soil aeration can amplify the salinity stress.

Keywords: Aeration stress, Soil matric suction, Salinity stress, Yield.

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Numerical Modeling of Dewatering System to Construct Pump Basins in Open Sea Water intake System through MODFLOW

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ABSTRACT

Pump basins are important structures in open sea water intakes. Dewatering construction site of these structures with no leakage inside the site is an essential issue. Throughout this paper, two common aspects of dewatering systems, namely big wells and well points are evaluated to make the construction site of the pump basin ready at the intake system of Bushehr desalination installations. To achieve this, MODFLOW software was employed to model the dewatering systems with results demonstrating the performance of the considered dewatering methods. According to the observed results, to have an efficient dewatering system, a number of about 26 wells as high capacity ones (well discharges ranging from 0.5 to 5.5 lit/s)are needed vs. 119 well points (well discharges ranging from 0.1 to 1.1 lit/s). In addition, sensitivity analysis of the system, as regards the variation of soil conductivity (in both space and time) proves that the well point system is more efficient than the high capacity well system, for dewatering an uncertain site.

Keywords: Dewatering, high capacity well, well point, Bushehr seashore

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Synthesis of Nano and Micro-Organobentonite Using Hexadecyltrimethylammonium Bromide; Evaluation of Their Absorption Efficiency and Release of Nitrate in Aqueous Solutions

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ABSTRACT

Organoclays are natural clay minerals modified through polymer compounds and applied for especial purposes. By being done so, the clay layers are permanently propped with high surface areas in the interlayers. The objective followed in this study was to find out the absorption efficiency and release of nitrate in aqueous solutions through modified Iranian bentonite (Arak). Micro and nano-bentonites were first modified by hexadecyltrimethylammonium bromide, a cationic surfactant. The adsorption efficiencies within 0, 3, 6, 9, 14, 20, 30 and 40 mM nitrate (by modified micro and nano-organobentonite particles) in surfactant loadings of 100 and 200% CEC were investigated in a completely randomized factorial design. Furthermore, to identity the stability of adsorbed nitrate by modified bentonite, the nitrate desorption process was performed at nitrate concentrations of 6 and 20 mM within 15, 30, 45 minutes and in 1, 2, 8 and 16 hours in a completely randomized factorial design. The results indicated that absorption efficiency of nitrate by nano-organobentonite with surfactant loading of 200% CEC in 3, 6, 9, 14, 20, 30 and 40 mM nitrate were 96, 94, 91, 90, 84, 76 and 68%, whereas in micro-organobentonite were 87, 92, 89, 86, 74, 80 and 68% respectively. The results finally revealed that concentration of surfactant was significant on adsorption and release of nitrate ($p \leq 0.01$), but the size particles was not significant ($p \leq 0.01$). Nano-bentonite in 200% CEC of HDTMA and low concentration of nitrate benefits from a highest adsorption efficiency (96%) with minimum release of 3.7%.

Keywords: Modified bentonite, Cationic surfactant, Organoclay, CEC

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Optimization of Removal Process of Petroleum Hydrocarbons from Soil Using Microwave Radiation; Its Effects on Some Soil Biological Characteristics

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ABSTRACT

Such thermal methods as MicroWave (MW) radiations are considered as fast and efficient approaches in removal of organic pollutants from aquatic and terrestrial environments. This study was carried out to find the optimum conditions for oil removal from contaminated soils treated by MW irradiation. Following soil sampling from Tehran Refinery surroundings, the samples were treated under various conditions for including MW power intensity (770, 1100 and 1250 w) and frequency of 2.45 GHz, time of irradiation (5, 10 and 15 min), soil moisture (1, 10 and 15 % w/w) and added activated carbon (0, 2.5 and 5 % w/w). The optimum conditions of oil removal were obtained from results of Taguchi L_9 orthogonal array. Besides, the effect of MW irradiation on some chemical and biological properties of soil was also investigated. Results indicated that the optimum conditions of the investigated parameter ranges were as follows: MW power (1100 w), irradiation time (15 min), soil moisture (1 % w/w) and added activated carbon (5 % w/w). About 70 % of petroleum hydrocarbons were dissipated within optimum conditions. Although the method exhibited some negative effects on respiration and population and respiration of soil microorganisms, still it can be used as an effective and fast approach for remediation of highly polluted soils considering the economic feasibility.

Keywords: Microwave, Petroleum Pollutants, Soil Pollution, Remediation

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Assessment of potassium releasing ability of some bacterial isolates in in-vitro condition and identification of efficient isolates

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ABSTRACT

Potassium (K) is an essential macronutrient that plays an important role in the growth and development of plants. Throughout the present study the possibility of K-release from mica minerals was evaluated through the action of several bacteria isolated from rhizosphere samples of grasses. The experiment was conducted as a factorial one, based upon a completely randomized design of three replicates comprised of two factors including 8 isolates of bacteria and two sources of potassium mineral. Following isolation of bacteria from the plant roots through NFB medium, eight selected isolates were ultimately used for the final experiment. Potassium release capability of these isolates was assessed using liquid Aleksandrov culture medium. Acid washed pretreated minerals, as a source of potassium, were added to 30 ml of Aleksandrov medium. Following incubation for one week at 26 °C and shaking at 120 rpm, released K in supernatant was assessed through flame photometer. The highest K release on the average was obtained by the isolate Az-8 (11.16 mg/l) and it was revealed that this bacterium was more efficient in releasing K from biotite than from muscovite, and the lowest rate of K release was obtained by Az-15 (2.8 mg/l). The results also revealed that K released from biotite exceed muscovite when the two types of mica compared. Among the bacterial isolates Az-8, Az-12 and Az-19 showed great potential for K release and their molecular (16S rDNA) and biochemical identification revealed that Az-8, Az-12 and Az-19 belonged to Pseudomonas genus. According to the promising results of in-vitro assays, inoculation and application of these efficient isolates will be recommended in greenhouse and field tests with different crops.

Keywords: Potassium releasing bacteria, Aleksandrov, Pseudomonas, Biotite, Muscovite.

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Effect of Biochar and Biological Treatments on Nutrient Elements Content (P, K, Ca, Mg, Fe and Mn) of Amaranthus in Oil Polluted Soil

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ABSTRACT

The presence of petroleum compounds in the soil causes environmental problems. Therefore, attempting to remediate contaminated soils is important. The present study was aimed at studying the effects of (1) different levels of biochar obtained from urban wastes and (2) the bacterium that degrades petroleum hydrocarbons on levels of nutrients in amaranth. The treatments were raw oil (0 (P0), 2.5(P1), and 5% (P2); weight-based), biochar obtained from urban waste compost (Bcm) and fresh urban (BM) wastes (0, 1, and 2 %, weight-based), and bacterium (with (Ba0) and without *Pseudomonas florescence* (Ba1)). The results showed that with increasing the biochar level, the plant growth was promoted, with the highest values for growth parameters in plants treated with highest level of biochar. The dry and fresh weights of shoots in treatments with *Pseudomonas florescence* had statistically considerable differences compared to those in the other treatments. Overall, with the application of biochar and *Pseudomonas florescence*, the levels of nutrients studied increased, and the maximum nutrient level was observed in the plants treated with the highest level of biochar. The highest P level (0.37%) was detected in plants treated with P1B0Ba1, and the lowest (0.23%) in plants treated with P2BM2Ba1. Moreover, the highest K level (5.16%) was recorded in plants treated with P2BM2Ba1, while the lowest (2.15%) was measured in plants treated with P0BM1Ba0 (no biological factor). The highest levels of Ca and Mg were found in treatments with biochar. The highest levels of Fe (1200.33 mg/kg) and Mn (441.5 mg/kg) were found in plants treated with P0B0Ba1, which had the biological factor, while the lowest was recorded in treatments where *Pseudomonas florescence* was absent. Accordingly, in order to increase the efficiency of soil remediation, it is recommended that organic matters, especially biochar, and bacterial treatments be exploited so that favorable conditions could be provided for plant growth and development.

Keywords: Biochar, Bioremediation, Nutrient element availability, Oil components, *Pseudomonas fluorescence*

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Effects of Salinity and Soil Contaminated with Sewage on Cadmium Uptake by Corn

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ABSTRACT

Environmental pollution by cadmium is one of the most hazardous challenges occurring in ecosystem. This research work was conducted to study the effect of sewage sludge and water salinity on remediation of cadmium in soil through corn (*Zea mays* L.). The study was carried out employing corn as crop in a factorial experiment based on a completely randomized design, of 3 replications at 3 soil pollution levels of control, 20 $mg.kg^{-1}$ cadmium, soil treated with sewage sludge of 20 $mg.kg^{-1}$) and saline water in 2 levels (control, 3 $dS.m^{-1}$). The results indicated that treated soil with cadmium and sewage sludge, decreased dry and fresh wet weight of the plant. With increase in salinity of water, dry and fresh wet weight of plant decreased. With increase in salinity, cadmium concentration present in crop shoots and roots increased by 52% as compared with control. But it could not increase cadmium uptake because of decreasing shoot and root dry matter. Sewage sludge increased the level of cadmium concentration in shoot and root by almost 12% and 15% as against treated soil with cadmium, but it could not increase cadmium uptake because of decrease in shoot and root dry matter.

Keywords: Soil pollution, Heavy metals, Availability, Accumulation, Phytoremediation

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Cadmium Adsorption on TiO_2 Nanoparticles in Soil Suspensions

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ABSTRACT

In this study, some factors affect cadmium adsorption onTiO_2 nanoparticles in soil and stability of nanoparticles in soil suspensions have been investigated. The results of this study showed that in soil contaminated with cadmium in suspension conditions the amount of cadmium stabilized by nanoparticles, which is attributed to adsorption of cadmium on surface of the nanoparticles, will depend on soil to water ratio (1:20, 1:10 and 1: 5), amount of soil pollution cadmium (5 and 10 mg of cadmium per kg of soil) and the use of nanoparticles (zero, 5.0, 1, 5%). So that the least amount of Cd-DTPA was found in soil to water ratio of 1: 5 and 5% of nanoparticles and in the soil contamination level of 10 milligrams per kilogram of cadmium. Also the results of stability tests indicated that the stability of titanium dioxide nanoparticles in soil suspensions over the ten days of release was comparable with that at the beginning of addition of nanoparticles, is good. In total, considering the fact that immobilization of cadmium in soils is a technique to improve the quality of soil and titanium dioxide nanoparticles showed proper stability in soil suspensions, it becomes evident that the use of nanoparticles in the decontamination of calcareous soils is appropriate.

Keywords: soil contamination**,** Cd-DTPA, TiO_2 nanoparticles, coating, stabilization

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Management of Operation of Amirkabir Dam Water using System Dynamics and Nonlinear Planning Method

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ABSTRACT

Water resource management is nowadays considered as one of the most prominent challenges facing mankind in the current century it could become the origin of many either positive or negative changes throughout the world. The challenge of water resources in the Middle-East countries is of a more serious concern. The limitations of available water resources and the recent droughts in countries like Iran indicate that Iran is facing a serious and protracted water crisis. Here a key decisive requirement would be a suitable water resource management strategy. In this research, an integrated method of system dynamic approach, classical nonlinear optimization, as well as Box–Jenkins Linear prediction model is proposed for the proper management of dam operations. First, the monthly operation of the reservoir was simulated based upon their storage and outflow characteristics through VENSIM software. Then, the volume of inflow and also evaporation losses from the reservoir were predicted from 2014 to 2018 by use of Box and Jenkins method. Finally the reservoir operations were optimized through LINGO software and classical nonlinear method. The results indicated that in optimization conditions, scarcity and overflow values are adjusted by their division into different months. Hence, probable damages can most probably be prevented.

Keywords: Time series, System dynamics, Dam operations, VENSIM, LINGO

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A Comparison of Hedging Policy using MetaHeuristic Algorithm and Standard Operation Policy in Conditions Optimal Operation of Voshmgir Reservoir Dam in Drought

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ABSTRACT

Surface water resources constitute a main part of water resources on earth, specifically surfaces of water at dam reservoirs. One of the methods to improve utilization of such rich storage reservoirs is the policy of Hedging. The objective function followed in this study is to minimize the rate of this scarcity through implementing the policy of water rationing for agricultural purposes in conjuction with Voshmgir Dam in Golestan province. Hence, a three-year consecutive period of drought (1380- 1382) was selected for the study. The Hedging policy was performed using Annealing, Genetic and Imperialist competition algorithms. Then, the results were compared with the Standard Optimization Policy (SOP). The results showed that the Annealing Algorithm with the Hedging policy of 99.94% reliability, 50% Resilience, 49.39 Sustainability, 6% Vulnerability and 99 percent supply presented a high performance. Also the Standard operation policy with 99.25% reliability, 11 Resilience, 9.22 Sustainability, 15.5 Vulnerability along with 80 percent supply renders a low performance in Voshmgir reservoir operation during drought periods.

Keyword: Drought, Hedging Policy, Standard Operation Policy, Voshmgir Dam, Meta-Heuristic Algorithm

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Long-lead Streamflow Forecasting using Singular Spectrum Analysis in the Karkheh Basin

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ABSTRACT

In basin areas, river discharge is one of the important items of input data for use in hydrological models. In the past decade, different methods have been utilized to analyze and predict the physical variables, one of which is Singular Spectrum Analysis (SSA) statistical method. SSA is one of the methods, employed in modeling various statistical processes in more recent times, its use in various engineering disciplines, including water resources, to eliminate random components (in time series) has been expanded. The main objective followed in this study was to forecast streamflow in Karkheh basin utilizing Singular Spectrum Analysis. The gage stations in Karkheh basin (five stations) were selected for the study. The peak flow periods for these gage stations were determined. The Caterpillar SSA and R statistical software were employed to model Singular Spectrum Analysis methods which 70% and 30% of data being respectively used for calibration and validation. Singular Spectrum Analysis method was used for pre-processing of data and as well in the elimination of noise in the time series of streamflow. Within the next step, the recursive algorithm of the Singular Spectrum Analysis model was used to develop forecast models of streamflow within the Karkheh basin gage stations. To evaluate the performance of the model, Normalized Root Mean Square Error, Mean Absolute Error and correlation coefficient were made use of. Accordingly, in the calibration the highest and lowest value of the NRMSE statistic were 0.43 and 0.30 respectively (as well the MARE statistic were 0.36 and 0.27 respectively) for Pol Chehr and Cham Anjir stations. In the validation the highest and lowest value of the NRMSE and MARE statistics were 0.47 and 0.50 for Pol Chehr station. The lowest value of the NRMSE statistic for Pol Dokhtar and Cham Anjir stations was 0.3 and 0.31 respectively and close to each other and the lowest value of the MARE statistic for Cham Anjir and Pol Dokhtar stations was 0.29 and 0.30 respectively and close to each other. Finally, the best and the weakest results in two stages of calibration and validation were for Cham Anjir and Pol Chehr Stations respectively. The results finally indicated that Singular Spectrum Analysis could be employed to forecast streamflow with a reasonable accuracy.

Keywords: Long lead forecasting, discharge, streamflow, Singular Spectrum Analysis, Karkheh basin.

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Temporal Changes of Runoff Generation and Soil Loss during the Growth Season of Rainfed Chickpea (A Case Study: in Tikmeh-dash Research Station, East Azerbaijan)

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ABSTRACT

Proper information concerning the temporal changes of soil loss and runoff generation during growth season is not only valuable in soil conservation programing but could also be used in soil erosion and runoff estimation models. This study was conducted to investigate soil loss and runoff generation trend within in different sowing rates during growth season in erosion plots of Tikmeh- dash research station. The study was performed in a randomized complete block design of with three cultivation densities of 30, 35 and 40 kg per hectare of rain fed chickpea in three replications, and the resultant data were analyzed in a split plot of time design. The plots were plowed on April 6 2013, then, the seeds placed at a depth of approximately 5 cm of soil. During the growing season, the generated runoff and amount of sediments were recorded. Results revealed that soil loss and runoff generation were significantly ($P \leq 0.01$) affected by plant density and as well by sampling time. But their interactions did not significantly affect runoff generation. Overall, plant density was more effective in sediment control, as compared with runoff control. A minimum level of runoff and sediment formation occurred at 40 kg/ha treatment within the third sampling time (421.88 l/ha and 2.45 kg/ha respectively) while a maximum degree of runoff and soil loss occurred within first sampling time at 30 g of seed per hectare treatment (1550 l/ha and 31.54 kg/ha, respectively). Results also indicated that total runoff and soil loss in the 30 kg/ha treatment were 1.1 and 1.4 times those in 35 kg/ha treatments and 1.5 and 1.9 times those in 40 kg/ha treatments, respectively. So 40 kg/ha of sowing density (For rainfed pea) is recommended for better soil conservation practices to be observed in similar conditions in conditions this region.

Keywords: Erosion plots, Plant canopy, Soil erosion, Soil loss.

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Treatment of a Soil against Piping Phenomenon using Geogrid Sheets

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ABSTRACT

Piping is an erosive process that occurs in hydraulic structures under the influence of upward seepage. Lack of sufficient notice of this phenomenon may seriously affect the stability of hydraulic structures. In this research work the effect of reinforcement soil on the variations of critical hydraulic gradient and seepage force were investigated through experimental tests. Reinforcement of samples was performed by two geo grids with mesh diameters of 6mm (No.1) and 2mm (No.2). One dimensional piping test were carried out on non-reinforced vs. reinforced sandy soil samples, compacted and fabricated through static methods, and in a specially designed apparatus. The results indicated that the critical hydraulic gradient and resistance against seepage force increased by reinforcement of the samples and that the resistance is a function of the number of the geogrid sheets as well as their location. In addition, the results indicated that the effect of the two geo grids is nearly the same for treatment of the soil against piping.

Keywords: piping, seepage velocity, critical hydraulic gradient, soil reinforcement, geogrid

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Assessment and Uncertainty Analysis of Different "Time of Concentration Methods"

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ABSTRACT

There are many uncertainty sources initiated from dependency of time of concentration equations (Tc) upon different parameters, which generally include rainfall intensity, topographic and land use map scale, DEM resolution and streams' delineation threshold. Throughout the present research the uncertainty and the performance of twenty Tc equations were investigated in the Kasilian and Amameh catchments. Results indicate that in either of the catchments, BransbyWilliams and Morgali-Linsley equations show good agreement with the observed values, with a relative error of less than 10%. Also, the uncertainty analysis of different Tc equations by use of delta method illustrates that McCuen, ASCE, Eagleson and FAA, Johnstone-Cross equations are of the highest vs. lowest uncertainties, respectively. In the geomorphological-based equations, the uncertainty that is caused by streams delineation threshold is approximately 3-4 times that of DEM and data resolutions' uncertainties. This indicates that streams delineation threshold is the most important factor and should be more consideration, especially in ungagged catchments.

Keywords: Time of concentration, Uncertainty, Geomorphological Parameters, Relative Error, Data Resolution, DEM Resolution.

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Drought Monitoring in the Last Two Centuries in the Arid and Semi-arid Regions Using Dendrochronology, a Case Study of Karkheh Basin

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ABSTRACT

Through a measurement of the annual growth of a tree ring and finding out of its chronology, the possibility of study and reconstruction of Palmer Drought Severity Index (PDSI) in the habitat areas is provided. The aim followed in this research is to reconstruct PDSI using dendrochronology, and drought monitoring within Karkheh basin. Throughout the research the chronology index of two tree species, namely *Quercus brantii*, and *Quercus infectoria*, in the central Zagross region during the period of 1840-2010 were used to reconstruct Palmer Drought Severity Index in Karkheh Basin. Correlations between Palmer Drought Severity Index and regional chronology index were positive and significant within 1% of confidence level. With regard to this fact, the Palmer Drought Severity Indexes from year 1840 to 2010 were reconstructed. The values of observed vs. reconstructed Palmer Drought Severity Index within the common statistical period are consistent with each other. Within further steps, the hydrological conditions during chronology period were studied and accordingly, hydrological drought was analyzed within the Basin for years, 1840 to 2010. Severity and duration of the droughts as well as decades of the highest number of drought and wet events were determined. In addition, the results were compared with those obtained by other researchers as well.

Keywords: Palmer Drought Severity Index, Dendroclimatology, Tree ring, Drought monitoring, Karkheh Basin

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Performance Assessment of LARS-WG and SDSM Downscaling Models in Simulation of Precipitation and Temperature

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ABSTRACT

Throughout the present study, the results of two downscaling models (SDSM vs. LARS-WG) are compared, considering the error criteria in terms of daily rainfall, daily minimum and maximum temperatures within two research stations of Ravansar and Kermanshah. In either of the models, 1988-1961 and 1989-2001 periods were respectively considered for calibration and validation. The results indicated that in either of the calibration and validation periods, SDSM model benefits from a more appropriate performance than LARS-WG in the simulation of daily minimum vs. maximum temperatures at the two stations, whereas LARS-WG model presents a more acceptable performance than that in the simulation of daily rainfall. The results of downscaling indicate that Kermanshah and Ravansar stations will be faced with less precipitation under A2 scenario and HadCM3 model in 2020s and 2050s. Also, it is concluded that in both models, minimum and maximum temperatures increase in the next two decades under the A2 scenario in either one of the stations.

Keywords: Climate change, Rainfall, Minimum temperature, Maximum temperature.

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An Assessment of Reference Evapotranspiration Changes during the 21st Century in Some Semi-arid Regions of Iran

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ABSTRACT

Changes of ET_0 and its atmospheric control were investigated in six stations located in West Iran during the period of 1966-2100. The outputs related to HadCM3 under B2 emission scenario were downscaled through SDSM. The results revealed that ET_0, as averaged across all stations, would increase by 5.12, 7.33 and 11.01% respectively over the early, middle and late 21st century relative to the baseline period (1966-2010). The results obtained through Mann-Kendall test revealed that there was an insignificant positive trend in ET_0 at the level of 95% over 1966-2010 in most of the surveyed sites. This increasing trend could be explained by an upward trend in temperature and solar radiation vs. a negative trend of relative humidity within the study area. The increasing trend in ET_0 will likely be significant during 2011-2040 and 2071-2100 while insignificant during 2041-2070. The occurrence of ET_0 upward trend in the future is most likely due to temperature rise.

Keywords: climate change; evapotranspiration; SDSM; statistical downscaling

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Evaluation of Different Missing Data Reconstruction Methods for Daily Minimum Temperature in Elevated Stations of Iran: Comparison with New Proposed Approach

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ABSTRACT

Daily minimum air temperature data are greatly needed in climatic studies of first-fall and last-spring frosts, frost periods, evaluation and improvement of crop production potentials, and eventually their effects upon food security. Despite the fact that climate stations, set up at high elevations play important roles in accurate estimate of temperature parameter gradients, and on their mappings, the number of such established stations in Iran is limited, causing many gaps to be served in their data time series. Hence, reconstruction of temperature data for elevated stations is considered to be essential, especially for studies requiring long-term homogeneous data items. This study was aimed at making a comparison of the different methods of readjustment of the daily minimum temperature data (obtained from highly elevated stations) and to determine the most suitable method for readjusting and lengthening of their record periods. To follow the purpose, a number of 12 stations at elevations exceeding 1900 m were selected. A number of 500 randomly sampled (minimum daily temperature) data were taken and reconstructed through 31 classic methods, and as well, through a new proposed approach, based on Cumulative Distribution Function (CDF) of minimum temperature data. Accuracies of these methods were tested using RMSE within 90 and 95 % of confidence interval of errors. Results revealed that Principle Component Analysis, proposed method based on CDF, and Artificial Neural Network stood in priority for reconstruction of daily minimum temperature data, with 95% of confidence intervals, reconstructed error of ±2.0, ±2.2 and ± 3.1 °c, respectively. This study led to completion of daily minimum temperature data series of highly elevated stations for the period of 1965-2010. This can be employed in climate change studies and as well in first-fall vs. last-spring frost risks, and reform of farming calendar depending upon climate change.

Keywords: Reconstruction of Daily Temperature, Elevated Meteorological Stations, Estimation Error, Iran.

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