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Effect of a Combination of Wrapping Cable and Collar on Depth of Scour around Cylindrical Bridge Pier Groups in Meander Rivers

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ABSTRACT

Many authors have tried to find out how to control scouring around a pier standing in the way of the straight path flow in a direct stream. The objective followed in the present research is thus to study a scour pattern around such a pier, but installed in a curved rivers, due to the fact that there probably are differences between a flow pattern on a direct path vs. on a meander. Throughout the present study, it is tried to check whether the use of either cable or collar alone or in a combination would affect scouring around a bridge's pier group constructed in the path of a river's meander. Two thicknesses of cable 0.2D and 0.4D and three steps of 0.2D, 0.5D and D were employed. The results revealed that scouring decreases with increase in cable diameter and a decrease in the pitch of the helix. As regards the pier groups that stand in the direction of water flow, scour depth for the first pier is more than that for a standing single pier. This represents the increase in the reinforcing phenomenon. Also scouring depth for the middle and back piers is less than that for a single pier, due to the sheltering phenomenon. As regards piers perpendicular to the flow direction, the maximum scour depth is observed in the middle pier. Also, in this case the scour depth is reduced by an increase in the distance between piers. Use of collar is more effective than cable for small distances between piers. Also it has been found that use of a combination of cable and collar results in the most reduction in scouring depth.

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A Study of the Effects of Infiltrating of Activated Carbon on Hydrodynamic Properties of a Sandy Porous Medium

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ABSTRACT

Application of outflow water from treatment plants for irrigation purposes (as a non-usual water resource) is being developed due to a serious shortage of common water resources in Iran. Activated carbon as a conditioner in water treatment procedures causes undesired changes in hydraulic properties of such a porous media like soil, bringing about somehow its degradation. The effects of activated carbon concentration on hydrodynamic properties of a sandy soil were studied through a physical modeling. Variations of saturated hydraulic conductivity, bulk density and porosity of the sandy soil were assessed for two categorical tests. First, flow of fresh water through a soil-carbon mixture of 1 to 7 percent (on a mass basis) and the other for a mixture of water-carbon of 0.5 to 2 percent (mass basis) through the sand. The results revealed that the saturated hydraulic conductivity of sand decreased by 80 percent due to a mixing of 7 percent sand-carbon, reducing it 0.06 cm/s to 0.014 cm/s. Porosity was reduced from 0.44 to 0.426 and while bulk density being increased from 1.5 to 1.507 g/cm^3. Also, a reduction of 91.5% and 6% in saturated hydraulic conductivity and porosity, respectively, and an increase of 0.71% in bulk density were observed, due to flowing of water-carbon (concentration of 2%) through the sand column.

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Water Table Prediction by Use of Time Series Models and Adaptive Neural Fuzzy Inference System

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ABSTRACT

Modeling in arid regions to better manage water resources is a subject of paramount importance. Groundwater is a precious water resource especially in arid regions. The purpose followed in the present study was to assess the performance of Adaptive Neuro Fuzzy Inference System (ANFIS) and time series models in predicting the level of a water table. Throughout the study, groundwater levels in Shiraz plain were forecasted for one month beforehand by use of time series, and as well by ANFIS models. In the ANFIS model, Gamma and M-test were used to determine the optimal input combination and training as well as testing data length. Performance of different models was compared with reference to the parameters of error and Taylor diagrams. ANFIS model results indicated that this model with a Π shaped membership function benefits from a more acceptable performance than the rest of the membership functions. A performance comparison of the models indicated a very suitable performance of the ARIMA (2, 1, 2) model in comparison with ANFIS different membership functions.

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Slope Impact in High Order 1D Equations: Experimental Investigation and Application in Stage Discharge Curve Production

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ABSTRACT

The assumptions considered in developing the Saint-Venant equations limit their application in a many practical situations. The modified Boussinesq equation was presented to overcome the limitation imposed by Saint-Venant equation due to the presence of non-hydrostatic pressure distribution and steep slope. In the present paper a computational model was developed to solve the modified and the traditional Boussinesq equations for unsteady flow conditions. Verification of the numerical results was accomplished through compiled discharge experimental data within the range of 7 to 30 l/s. The relative errors associated with the results of both equations were evaluated. The average relative errors amounted to 4 and 18 percent respectively for the modified Boussineq vs. the traditional one in predicting discharge. This highlighted the importance of the slope impact on the accuracy of the results. Also, through the modified equation, it is possible to produce the stage-dischrge relationship for trapezoidal weir with a high degree of accuracy.

Keywords: Boussinesq, Rating curve, Saint-Venant, Slope, Trapezoidal weir

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A Laboratory Study of the Hydraulic Traits as Related to Low-Pressure Drip Irrigation System

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ABSTRACT

Hydraulic properties of low pressure drip irrigation systems were studied under laboratory conditions, with the use of pipes prevalent in Iran. The effects of various heads ranging from 0.45 to 1.8m were evaluated on lateral pipe of an outside diameter of 32mm and lengths of 16, 30, 60 m, and as well on a lateral pipe of a length of 16 m, and outside diameters of 16, 20, 25 and 32mm, on the hydraulic characteristics consisting of: average emitter discharge, variation coefficient, uniformity and loss. Emitters employed in the study were micro-tubes of lengths of 0.7m and outside diameter of 3mm inserted into the lateral at 1m intervals. Results revealed that the low pressure trickle irrigation system supplied the necessary discharge along all the lateral lengths and diameters up to the end of the line. Moreover, a test of the effect of lateral length and diameter on emitter coefficient of uniformity indicated that a desirable uniformity is obtained in the lateral of the length of 89m, and 16 mm outside diameter accompanied by the least head.

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Simulation of Dry Drainage to Determine the Ratio of the Width of Non-Cropped to Cropped Strips

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ABSTRACT

Dry drainage is considered as a natural system in which water is made to evaporate from the neighboring fallow areas to control water table depth and soil salinity in the adjacent cropped areas. The technique demands for the retirement of part of the irrigated land. One of the most notable design criteria for this system is to estimate the ratio of cropped to fallow strip widths. A Plexiglas physical model with the dimensions of 60 cm length, 20 cm width and 50 cm height was designed and built. The model was divided into two equal parts where the first half was regularly irrigated while the other left as fallow during the test period. A précised scale was employed to record the evaporation rate. The minimum daily evaporation rate amounted to 2.7 mm when the soil was mainly covered with salt crusts. As this measured value is close to the common drainage coefficient in most parts, hence with a low risk, the ratio of 50% fallow area to 50% cropping was recommended. It seems however, that with a proper management together with salt scraping, one can expect a higher ratio of cropped to non-cropped ratio.

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A Comparison of Soft Computing vs. Regression Techniques to Calibrate Electromagnetic Induction (Ardakan Region)

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ABSTRACT

various methods have so far been applied to calibrate electromagnetic induction data. Throughout the present research, Multi-Linear Regression (MLR) as well as artificial intelligence techniques (i.e. ANFIS, GA, ANNs) were applied to calibrate the apparent Electrical Conductivity (ECa)- measured using an electromagnetic induction instrument and Electrical Conductivity (ECe)- as measured in saturation paste. A number of 600 soil samples were collected from Ardakan (Central Iran), divided into two subsets for calibration (80%) and testing (20%) of the models. To evaluate models, some such evaluation parameters as root mean square, average error, and coefficient of determination were applied. Results indicated that ANFIS model yields a more accurate estimate than the other techniques where this model increased accuracy of predictions for about 9, 9, 5 and 2% for EC15, EC30, EC60, and EC100, respectively. Higher performance of ANFIS to predict soil salinity might be because of somehow compensation for the uncertainties. Following ANFIS model, GA and ANN resulted in better accuracies in comparison with multivariate regression. As a whole, results indicated that artificial intelligence methods were of a higher performance than the regression techniques in calibrating electromagnetic induction data.

Keywords: Apparent electrical conductivity; Modeling; Soil salinity

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An Estimation of the Soil Electrical Conductivity by Use of EO-1 Hyperion Satellite Images: A case Study in the North of the Uremia plain

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ABSTRACT

Salinization and alkalization are two of the most problematic features of the arid and semi-arid regions, where precipitation is lower than evapotranspiration rate. Under such climatic conditions, soluble salts are accumulated in the soil, bringing about the lessening of the soil productivity and fertility. So, an accurate identification of the salt affected areas is essential to sustainable soil management. The specific objective of this research is the mapping of saline soils through Hyperion EO-1 satellite images, in the Uremia Plain. Throughout the study, spectral responses of 40 saline soil samples were recorded by the Spectroradiometer Fieldspace 3 and Hyperion image to map the soil salinity. These references were obtained from the United State Geological Survey (USGS) archives. Results indicated a significant correlation (R^2= 0.89) between Soil salinity Content (SSC) and the percent of reflection at the 42 and 219 bands. A Soil Salinity Spectral index (SSI) was constructed from Continuum Removed Reflectance (CR-Reflectance) at 0.762 and 2.345 micrometers. Subsiquently, a model for estimation of SSC through SSI was constructed using univariate regression. Model validation yielded a Root Mean Square Error (RMSE) of 1.23 ms/cm and an R^2= 0.8. The model was calibrated through a Hyperion reflectance image, on a pixel-by-pixel basis, and reasonable agreements with an overall accuracy of 75% and Kappa Coefficient of 0.65. The findings of this project suggest that the satellite hyperspectral data bear the potential of predicting SSC in the study area.

Keywords: Hyperion image, Soil Salinity Index, Spectral response, Spectroradiometr

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Effects of Soil Moisture, Phosphorus and Zinc Levels on the Growth Attributes of Potato, Greenhouse Conditions

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ABSTRACT

The present study was conducted to evaluate the combined effects of soil moisture as well as phosphorus (P) and zinc (Zn) levels on the growth attributes of potato (*Solanum tuberosum* L. cv. Agria). The investigation was arranged as a factorial one based upon randomized complete blocks design with Zn at three levels (0, 10 and 20mg Zn per kg of dry soil (as zinc sulfate)), P at three levels (0, 30 and 60mg per kg dry soil (as monocalcium phosphate)) and soil moisture at three levels (50-60% FC, 70-80% FC and 90-100% of FC), the experiments being replicated thrice. Such growth attributes of the potato crop as stem, leaf number and lengths, chlorophyll index, stomatal conductivity, Relative Water Content (RWC) as well as dry weight were assessed. The results revealed that the drought stress resulted in a significant decrease in stem and leaf length, stomatal conductivity, stem dry weight and RWC. Application of P significantly increased the leaf number, stem and leaf length, stomatal conductivity and stem dry weights. Application of Zn also, significantly affected the stem and leaf length, chlorophyll index, stomatal conductivity and stem dry weights. The P×soil moisture and Zn×soil moisture interaction effects were significant for the traits of stomatal conductivity and stem growth rate. The P×Zn×soil moisture interaction effect was significant for chlorophyll index, stomatal conductivity and stem dry weight. The results showed that the two way interactions of Zn, P and soil moisture were mainly synergistic on the above mentioned attributes. In total, to achieve the optimum growth of potato in similar soils, application of 20 mg Zn and 30 mg P per kg of dry soil would be recommended under normal irrigation conditions while at water deficit conditions application of 20 mg Zn and 60 mg P per kg of dry soil would be recommended.

Keywords: Growth attributes, Phosphorus, Potato, Soil moisture content, Zinc

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A Study of Rainfall Processes in Calcareous Soil Aggregates, under Laboratory Conditions, NW Zanjan, Iran

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ABSTRACT

The processes of rain erosion, together with the rain peculiarities, are affected by the particle resistance of the soils (to erosion) too. The present study was conducted to investigate the susceptibility of the aggregates, within different soil textures, to the rainfall erosion processes. The experiments were done on thirty soil samples recognized within the scope of four different soil textures (of different replications) as based upon a completely randomized design. Ninety boxes were filled with aggregates (6-8 mm) and exposed to simulated rainfalls for 30 minutes. Results indicated significant differences among different soil textures as regarded aggregate breakdown ($P< 0.001$), soil compaction ($P< 0.001$), and splash of soil particles ($P< 0.01$). The highest aggregate breakdown was observed in sandy loam textured soils, whereas the highest soil compaction and splash of soil particles occurred in clay loam soils. The aggregate breakdown was significantly affected by silt (r= -0.63, $P<0.01$), and clay particles (r= -0.70, $P<0.01$). Nevertheless, the soil compaction and its splash of particles were significantly increased by silt and clay contents. Sand, contrary to other soil particles (silt and clay), had different effects on the rainfall erosion processes.

Keywords: Aggregate breakdown, Rainfall erosion, Soil compaction, Splash of soil particles

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An Investigation of Kaolinite Charging Behavior in NaCl Electrolyte Solution

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ABSTRACT

Colloidal particles prevalent in a soil influence its chemical and physical properties as by the particles' surface electrical charges. With respect to the importance of the issue, from both agriculture and environmental points of view, charging behavior of a kaolinite soil sample was studied in the pH range of 4 to 10 and at three background electrolyte concentrations of: 0.005, 0.05, 0.5 M NaCl, by potentiometric titration. Using a combination of mass and electrolyte titrations, kaolinite point of zero charge (PZC) was determined to occur at pH=7.6. Increase in pH from the initial value of 4 caused at first a gradual decrease in positive surface charge and then a gradual increase in the negative surface charge, indicating a net positive surface charge at pH<PZC and a net negative surface charge at pH>PZC. Increase in ionic strength reduced positive surface charge at pH<PZC while enhancing the negative surface charge at pH>PZC. The adverse effect of ionic strength on the surface charge at pH<PZC was ascribed to the competition between proton and sodium ions for adsorption on the kaolinite planer surfaces, where some permanent negative charges exist.

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An Assessment of the Interactions between Natural Climatic Variability Human Activities as regards Runoff

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ABSTRACT

Long-term trends, and the abrupt changes of hydro-climatic variables were investigated (in the observation period of 1971-2000) for Aidoghmoush basin, employing Mann-Kendall nonparametric test, and cumulative curve of climatic variables-runoff, respectively. Results indicate a decrease in trends for rainfall and for runoff versus an increase in the trend for temperature as by the Mann-Kendall test (with a confidence level of 99%). Change of cumulative curve gradient of climatic variability-runoff indicates that the relationship among the parameters of climatic variables-runoff could be affected by human activities. With an identification of curve gradient change point, the observed period was divided into two sub-periods, namely: base line period and period associated with human activities. To determine the effects of human activities on runoff, hydrological model was calibrated and verified (within the baseline period), and by an introduction of hydro-climatic parameters (within the period associated with human activities) to the model, the produced runoff was estimated. The results reveal that contributions of climatic variability and human activities to the decrease in runoff amount to 79 vs. 21%, respectively.

Keywords: Basin; Change point of curve gradient; Natural climatic variability

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