Comparison of Performance of Two Simulation and Regression Models for an Estimation of Soil Temperature under Grass Cover in Karaj Climatic Conditions

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ABSTRACT

Because of the scarcity of *in situ* measurements, estimation of soil temperature by other means is very indispensable, as for Irrigation management and scheduling when in different field conditions. So far, many regression models have been developed for an estimation of soil temperature, using meteorological data under bare soil. Throughout this study, the performance of COUP simulation model and multiple regression approach for an estimation of soil temperature within an experimental plot, and under grass (Lolium p*erenne*) canopy (in Karaj climatic conditions has been evaluated. Soil physical parameters, estimated as based on soil analysis (soil texture, bulk density), and daily meteorological data (including maximum and minimum temperature, wind speed, pan evaporation, sunshine hours and rainfall) as well as vegetation data (crop height, root depth and Leaf Area Index (LAI) were made use of to run the model over the growing period. Soil temperature was measured using standard soil thermometers at depths of 10, 30, 50 and 70 centimeters. Stepwise approach was employed to develop suitable regression models. Following a running of both simulation and statistical models, the observed and simulated data values were compared, making use of statistical indices. The results revealed that, by inclusion of variables affecting incoming radiation i.e. crop height, and leaf area index, the accuracy in the prediction of soil moisture increases.

Keyword: COUP Model, Multiple Regression, Soil temperature, Vegetation cover

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Transport and Degradation of Herbicides in Soil under Different Herbigation Systems

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ABSTRACT

The objective followed in this study was to investigate the transport and degradation of herbicides under different herbigation vs. conventional spraying systems in soil. Metribuzin and Potassium Bromide (KBr) were applied in soil plots by four application methods, including conventional spraying without delay in initial irrigation (CS1), conventional spraying with an initial 24-h delay in irrigation (CS2), herbigation via the first irrigation (HRB1) vs. herbigation via the second irrigation (HRB2). The results indicated that the highest leaching of herbicide and KBr along with the lowest degradation of herbicide was obtained for the treatment of herbigation via first irrigation. In HRB1 treatment, herbigation, when in dry soil, caused rapid movement of KBr and herbicide within the open pores preserving the herbicide from photochemical and microbial degradation which mostly occurs at the surface soil layer. Among conventional spraying methods, the first irrigation delay after chemical application, in CS2 treatment, led to herbicide diffusion to inter aggregate macrospores and as well adsorption on the organic and inorganic particles. Thus, the applied herbicide did not leach out and remained at the soil surface for a longer time. Remaining of a large portion of herbicide at the soil surface has led to an increase in herbicide degradation, due to the availability of a greater organic matter content, microbial population, sunlight radiation as well as moisture content.

Keywords: Conventional spraying; Herbigation; Herbicide transport and degradation

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Modeling and Simulation of Long-term Effects of Irrigation with Tehran Treated Wastewater on Water and Soil Resources using Dynamic Systems Modeling

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ABSTRACT

Many factors affect wastewater management and utilization plans' success with any change occurring in any of these factors leading to various feedbacks on other elements of wastewater use system. Hence, development of a model with the capability of simulation of all factors, aspects and interactions that affect wastewater utilization indispensable. The objective followed in this study was to model and make simulation of long-term effects of irrigation with Tehran treated wastewater on the water and soil resources' System Dynamics (SD) modeling method. The developed SD model validation process revealed that the model benefits from the needed acceptable efficiency. Nine possible scenarios in wastewater allocation, crop pattern as well as deficit irrigation were studied. Model results warned that the current condition if continued would lead to complete degradation of groundwater resources by 2042. Also, the results indicated that wastewater allocation can postpone the degradation of ground water resource (up to 2067). Wastewater allocation together with 11 % decrease in agricultural demand (through either deficit irrigation or modern irrigation systems' development) can result in a sustainable use of water resources as in Varamin Area, Iran.

Keywords: Feedback, Wastewater, Groundwater

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Calibration and Sensitivity Analysis of Hydraulic Behavior in Qazvin Plain Aquifer

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ABSTRACT

In a national plan of salt marsh lands' drainage in Qazvin, in order to have the water table lowered, and to prevent the progress of saltmarsh, an interceptor drain equipped with hydraulic structures was constructed. A number of 99 observation wells, in the direction perpendicular to the drain were constructed in 9 directional sections. The hydraulic behavior of the aquifer and the effect of the interceptor drain, while using PMWIN Model , (in transient flow and monthly time steps), hydrodynamic coefficients were calibrated through PEST code plus trial and error method. In sensitivity analysis, the model was run in a three step increase and three steps decrease without any changes in the other hydrodynamic coefficients. The results indicate that error variance of before and of after model calibration were respectively 0.336 and 0.127 meter. Furthermore results of sensitivity index revealed that the highest sensitivities were respectively recorded for, hydraulic conductivity coefficient, recharge and specific yield, while the effect of hydraulic conductivity coefficient being observed more around observation wells adjacent to the channel within the radius of influence drain, with little effect on the other parts of the aquifer.

Keywords: Groundwater, Qazvin Saltmarsh, Radius of influence drain , Hydrodynamic Coefficients, Inverse calibration, PMWIN Model

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A Determination of the Optimum Remaining Time on Water Table Management to Decrease Nitrogen Loss in Drained Agricultural Lands

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ABSTRACT

The management of water table is introduced as one of the major parts of the solutions in water resources management. This method could play a significant role in protecting water resources, increasing irrigation efficiency, preserving nutrients in soil, and protecting the quality of surface downstream, and as well, of groundwater. Towards this end, a laboratory study has been done on the effects of water table management on control of leaching and discharging of nitrogen in sandy loam soils. Water table was controlled at a depth of 30 *cm* from soil surface through three drainpipes installed at 80 *cm* depth and while the volume and quality of effluent drained water (in terms of different nitrogen compounds, namely: nitrite, nitrate, ammonium, and ammoniac were evaluated at retention times of 2, 4 and 5 days within the framework of a physical model. Results show 29.4 percent decrease in drainage discharge at a retention time of 5 days and while 27.7 percent decrease in effluent nitrate density at 4 days past, as compared with the free drainage water. Through a statistical comparison of the results, the most appropriate time to control water table was attained after 4 days past. Given the present findings, duration of retention time in modern drainage systems is one of the management variables, and while a provision of correct and opportune usage of this management method, (Through an increase in consumption efficiency of water and fertilizer) would be hopeful in developing stable agriculture and as well improving the quality of water resources and consequently the protection of the environment.

Keywords: Controlled drainage, Drainage water, Nitrogen cycle, Physical model

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A Laboratory Study of the Effect of the Function of Hydraulic Conductance on Modeling of Seepage from Earth Dams

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ABSTRACT

Seepage analysis through earth dams is employed to determine the water loss. Moreover, as the magnitude of pore pressure in dam body is calculated using seepage analysis, this analysis plays an important role on the stability analysis in these types of structures. As the hydraulic conductivity of the earth dam materials, is considered as one of the effective parameters on the magnitude of seepage, an experimental model of an earth dam was constructed, and by the accurate measurement of saturated vs. unsaturated hydraulic parameters of materials (and by use of Disk Infiltrometer), the flow through the experimental model was simulated, employing by Seep/W as a finite element based model. The results of the study revealed that application of unsaturated hydraulic conductivity function, rather than constant saturated permeability, presents more accurate results. A comparison of the model results with the obtained data confirmed that the differences between model results and the real data diminishes, as by approaching the Phreatic Line limits. Furthermore, a comparison of results revealed that, in the transient state of seepage under drawdown conditions, the model predicted the draining of the body occurring more slowly than when the function of hydraulic conductivity being employed rather than constant saturate hydraulic conductivity.

Keywords: Hydraulic conductivity, Earth dam, Seepage, Pore pressure, Disc infiltrometer

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Swell- Shrink Behavior of Expansive Soils under Different Surcharge and Water Qualities

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ABSTRACT

Expansive soils are of the kind the volume of which will be changed to extremes by being exposed to varying conditions of moisture. This volume change is a serious menace to structures built on these types of soils. Throughout the present research the potential of volume change in these soils was investigated when exposed to the phenomenon of wetting and drying. For the purpose, samples of a statically compacted soil were positioned in a consolidation test set, and tests conducted under two surcharges of 10 and 20 KPa and along with two kinds of water quality (pure and acid). Results showed equal swell and shrinkage occurring, following a repetition of about five test cycles. Furthermore, changing water quality (to acid) was found as an effective element in decreasing of the swelling potential.

Keywords: modified consolidation, wetting and drying cycles, swelling soils, swell-shrinkage paths.

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A Study of the Volume Change Behavior of Expansive Soils Stabilized With Tape Fibers

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ABSTRACT

Expansive soils undergo volumetric changes in response to changes in their moisture content that this characteristic causes irreparable problems particularly in civil projects. Investigators have proposed chemical methods as well as mechanical treatments to stabilize the expansive soils. In this study, stabilization of expansive soil with randomly distributed fiber was investigated by reinforcing the soil with two types of synthetic fibers of the widths 3 and 5 mm. Experimental samples were prepared from static compaction with three stabilizer dosage levels of 0.5, 1 and 1.5% by weight of dry soil and lengths 10, 20 and 30 mm. The tests were conducted in a consolidation apparatus. The results of the study revealed that reinforcement reduces swelling characteristic of expansive soils and this reduction depending upon the percentage and the length of either types of fiber. A comparison the effects of the two types of fibers indicated that for the same content and fiber lengths, an increase in the fiber width causes more reduction in swell potential and consequently swelling pressure.

Keywords: Expansive soil, Synthetic fibers, Swell potential, Swelling pressure, Soil improvement.

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A Determination of the most Suitable Cell Size of the Digital Elevation Model to compute the Topographic Factor in RUSLE

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ABSTRACT

Preparation of the topographic factor (LS) map in RUSLE model is a very tedious step because of the complicated effects of topography on soil loss. The objective of this study was to determine the suitable cell size of Digital Elevation Model (DEM) for computing LS factor by the method of Moore and Wilson (1992) in a 5326 ha area, northwest of Tehran Province. Towards this end, cell sizes of 30, 50, 100, 200 and 400 m were derived from the 10 m cell size in ArcGIS 9.3. The appropriate cell size was selected making use of the criteria of spatial dependence and the coefficient of determination (R^2). Results revealed that in the preparation of flow accumulation map, the sinks created in digital elevation models must be resolved. Also, analysis of variograms showed that the calculated LS factor obtained from DEM of 50 m cell size is of the most spatial dependence (0.613) with the highest coefficient of determination (R^2=0.983). As a result, a DEM of 50 m cell size was found out to lead to the production of a more accurate LS factor map.

Keywords: DEM, Soil erosion, LS factor, Geostatistics

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An Assessment of the Dynamics of Physical Fractions of Organic Carbon in Water-Stable Aggregates within Different types of Land Uses

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ABSTRACT

Throughout the present study, similar horizons (A, AB and B1) from deciduous forest, coniferous forest and rangeland types of land uses were selected, and the percentage of water stable aggregates in them measured. In each class of stable aggregate at the horizon A, free light fraction, free-particulate organic matter, intra-aggregate of particle organic mather (POM), and clay + silt complexes were separated through density and size method. Carbon and nitrogen percentages were measured by use of CHN elemental analyzer. Results of the study indicate that along with decrease in aggregate size, stable aggregate as well as organic carbon percentages were increased. It was also found that large macro aggregates (>2 mm) were more susceptible to the change to deciduous forest-land than the other aggregates. Based on organic matter fractionation techniques, free particulate organic matter and intra-aggregate particulate organic matter among other fractions, and even total organic carbon are critical and sensitive indicators of change into other types of land uses. The levels of nitrogen and C: N of organic matter fractionation were determined within the degradation order of F-LF> F-POM> IA-POM> IA-S+C, which revealed the main role of aggregates in conservation of organic matter.

Keywords: Stable Aggregates, Physical Fractionation, Particulate Organic Matter (POM), Intra-Aggregate Fraction, Land Use.

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Isotherms of Adsorption on and Desorption from Calcite of Boron: pH and Salt Dependency

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ABSTRACT

The role of calcite as related to the chemical behavior of boron (B) in calcareous soils was investigated through an assessment of B adsorption and desorption reactions on and from calcite in four ratios of solid to solution rate, three levels of ionic strength, and within a pH range of 7.5 to 11.5. Experimental data indicated that B adsorption is increased by an increase in the solid to solution ratio and by increase in its equilibrium concentration. Further, an increase in ionic strength strongly stimulated B adsorption, which is likely due to the formation of boron inner-sphere surface complexes and as well shrinkage in the electrical double layer thicknesses. Boron adsorption increased by increase in pH getting maximized at about 9.2. Any further increase in pH reduced B adsorption. After four successive desorption stages with calcium nitrate as background solution, approximately 20-40% of the initially adsorbed B was released. In general, it could be concluded that even though calcite is the major mineral in calcareous soils, however, boron-calcite adsorption interactions influence B concentration in the soil solution as by weakly.

Keywords: Calcareous soil, Double layer, Soil solution, Chemical behavior

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Effects of Combined Application of As and P on the Growth Characteristics and Uptake of As and P by Two Wheat and Marigold Plants

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ABSTRACT

Concern about arsenic pollution to soils and plants has been on an increase, throughout the world and an interaction of As with P due to the similarity in chemical characteristics has been also reported. In the present research, a factorial experiment was conducted as based upon a randomized complete block design of three replications including three levels of arsenic (0, 50 and 100 mg kg^{-1}) from a sodium arsenate source, and phosphorus (0, 20 and 40 mg kg^{-1}) taken from a source of mono calcium phosphate .After 90 days past, the dry weight of shoot and root, chlorophyll index, concentrations and total contents of As and P were determined. The results showed that by increase in As level, shoot and root weight, chlorophyll index and water use efficiency in the two plants decreased. By an increase in As level, the concentration and uptake of As within shoots and roots of the plants wheat and marigold increased, while the concentration and uptake of P being decreased. With increase in As level, the translocation factor of As in wheat decreased while it increased in marigold. The P translocation factor was fount to decreased by an increase in As level, for both plants.

Keywords: Arsenic, Calcareous soil, Marigold, Phosphorus, Wheat

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