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CONTENTS

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目　　次

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EDITORIAL BOARD

The spatiotemporal rates of heavy precipitation occurrence at difference scales in China

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Abstract: The spatiotemporal rates of heavy precipitation occurrence were analyzed comprehensively based on Peak-over-Threshold (POT) resampling under different thresholds by kernel estimating method, Poisson regression model and GAMLSS according to daily precipitation data of 728 stations during 1951-2014 over China. The results indicate that: (1) the time of heavy precipitation occurrence has the most un-uniform in inter-annual on northwest arid areas. In addition, the degree and scope of uneven is increasing and expanding with bigger threshold. The rate of heavy precipitation occurrence is significantly increasing in inter-annual in northwestern and southeastern China, which may cause more severe flooding; central and northeastern China are on the contrary, which may have a higher drought risk. (2) The rate of heavy precipitation occurrence of different areas in inner-year are influenced by different climate indices based on Cox regression model, which indicates that the occurrence of heavy precipitation events are not independent but dependent on the changes of the climate indices. (3) Almost all areas didn't exhibit over-dispersed in annual heavy precipitation occurrence times except northwest areas. However, annual heavy precipitation occurrence time trends to temporal over-dispersed with threshold increasing. The occurrence times of heavy occurrence are increasing with Southern oscillation index (SOI) and Pacific Decadal Oscillation (PDO) increasing in most areas except northeast areas.

Keywords: POT resampling; regression models; rates of heavy precipitation occurrence; climate indices; non-stationary

Research on the prediction parameter and evaluation method of displacement coupled with water dynamics of the reservoir landslides

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Abstract: On the basis of systematic analysis of the change rule of displacement and reservoir water level and the relation of their interaction, this paper proposes to take the reservoir water level variation as the loading dynamic parameter of landslides and to take its displacement as the response parameter, so as to determine the displacement response ratio parameter of dynamics increment and establish its prediction model by means of elastic-plastic theory and damage mechanics. Finally, taking the typical reservoir landslide of the Three Gorges Reservoir region—Huangtupo landslide as the example, this paper completes the calculation of displacement response ratio of dynamics increment of G02 and G07 monitoring points of Huangtupo landslide by using the displacement response ratio of dynamics increment prediction model. Meanwhile, the stability of the landslide is simulated and analyzed by using the Geostudio software. The characteristics of the displacement response and the evolution law of the slope stability show that the curves of displacement response ratio of dynamics increment of monitoring points basically agree with the dynamic evolution law of the slope stability. The research results above indicate that the displacement response ratio of dynamics increment is an effective dynamics displacement appraisal parameter of reservoir landslides, so it can be effectively used in the prediction of the reservoir landslides.

Keywords: reservoir landslides; displacement response ratio of dynamics increment; reservoir water level; evaluation parameters; Huangtupo landslide

Improvement of underground drainage computation method for urban flood simulation model

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Abstract: In order to strengthen the simulation capacity of urban underground drainage, acquiring more detailed results and improving analysis level on urban flooding, this paper describes an improved method for underground drainage computation based on the Urban Flood Simulation Model. A sub module combining both simplified and detailed pipe network compute is proposed, which adopts equivalent volume approach and 1D hydrodynamic equation of actual pipe network respectively for computing underground drainage, and the flow exchange position of overland and underground is set at special road passages and grids. For rainfall-runoff, surface water permeability of each land use type is considered in hydrologic module. Through coupling these sub compute modules, the improved model is capable to simulate the whole process of urban flooding, including rainfall-runoff, flowing concentration and drainage, which is more suitable to simulate urban flooding caused by local storms. Yunnan control region in Shanghai Municipality is taken as an example to carry out demonstration research, which shows that a satisfactory simulation effect and more abundant results can be achieved.

Keywords: urban flood; flood model; pipe network; drainage system; flood and waterlogging simulation

Morphological evolution of spur dike local scour hole and the scour balance critical condition

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Abstract: Roughly several parameters controlled the 3-D characteristics of the scour hole geometry. which were the scour hole depth and width geometry and the side slope of upstream and downstream. The inclinations of the upstream and downstream side-slope kept relatively stable in the stage of scour equilibrium, while the relationship between the wet angle of repose of the sediment particle and the critical condition of scour equilibrium is not clear. A series of clear-water experiments showed that the variation of the scour depth and length possessed asymmetrical characteristic in different flow condition and the angel of inclinations of the upstream and downstream side-slope oscillated damply with time until stability. The scour hole side slope is steeper at upstream than that at downstream, which has a approximate constant of inclination ratio, namely about 0.5. The angel of inclination of side-slope is close to that of repose of the sediment particle, and its lower limit angle ratio approximated to 0.7.

Keywords: the local scour of spur dike; depth and broadening of scour hole; scour hole shape; critical condition of scour balance; the angle of repose for sediment particles

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Simulated impacts of climate change on evapotranspiration and vegetation in Horqin Sandy Land

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Abstract: Vegetation degraded significantly in Horqin Sandy Land over the past three decades. Identifying the variability of the key ecohydrological processes (such as evapotranspiration and vegetation growth) that are closely related to desertification is prerequisite for a better control of desertification processes in the future. Based on an ecohydrological cellular automata model, the Water and Vegetation Interactions-based Eco-hydrological Model (WaVEM) was developed and employed to evaluate the effects of the precipitation and potential evapotranspiration changes on the actual evapotranspiration (E_t) and leaf area index, and to analyze the responses of vegetation to the multi-year precipitation reduction. During 1964—2013, E_t and annual maximum *LAI* (LAI_{max}) had insignificant trends while precipitation changed insignificantly and potential evapotranspiration increased significantly. The precipitation change was the major factor causing the decreases of both E_t and LAI_{max}, while the effect of potential evapotranspiration was the second. Multi-year precipitation reduction during 1999—2011 caused significant vegetation degradation in Horqin sandy land. A short-term drought could lead to a sudden decline in vegetation, however, vegetation recovered quickly after the drought.

Keywords: evapotranspiration; vegetation change; ecohydrological model; Horqin Sandy Land; climate change

A new version of system response method for error correction based on total least squares

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Abstract: To improve the accuracy of real-time flood forecasting, a new version of system response method which is based on total least squares is proposed. Original system response method involves a least squares problem suited for problems in which the observed value is known approximately but fails to determine the error in system response matrix. We analyze the system response method and apply total least squares to consider the perturbation in both system response matrix and the observation. It is necessary to use ridge estimation to stabilize the solution for ill-posed system response matrix. The improved correction method has been adopted in Qilijie basin to update the estimates of soil moisture content and the improved method is compared with the original method. Both of the methods can lead to better accuracy. The new version of system response method leads to better and more stable performance than the original method.

Keywords: flood forecasting; error correction; system response method; total least squares; Xinanjiang (XAJ) model

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Numerical analysis of temperature field and thermal stress of the crack control structure with induced joint of RCC gravity dam

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Abstract: RCC dams have similar troubles with temperature stress as CVC dams. Stress caused by high temperature will lead to uncontrollable cracks. Induced joints can guide the crack growth to the dam zones with protective measures, and reduce the damage of temperature cracks. Aiming at the problem of temperature cracks in RCC dams, a valid solution has been put forward, considering cracks control structure with induced joints and the prepared High-fluidity Impermeable and Anti-cracking Concrete (HIAC). The FEM model of the studied RCC dam was built with the designed HIAC layer and induced joint, and the numerical simulations of the temperature field and thermal stress were carried through during the construction process. According to the time-space evaluations of the thermal stress near the upstream part of the dam, the initial scheme was optimized with the effective positions and lengths of the induced joints. It could ensure the better effects of stress releasing, reasonable induced joints and convenient construction procedures, and would bring in a better solution to the problem of temperature cracks in RCC dams.

Keywords: RCC gravity dam; high-fluidity impermeable and anti-cracking concrete; induced joint; crack control structure; thermal stress; numerical simulation

Effect of channel networks cutoff on extraction of distributed erosion slope length

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Abstract: Topographic is one of the important factors affecting soil erosion. Distributed soil erosion slope length is an important parameter to evaluate terrain. Associated with erosion process, accumulation of distributed soil erosion slope length should be stopped once cut off by channel. Channel head position is difficult to define, so threshold is always used to estimate channel networks. It is necessary to study the impacts of channel networks and different thresholds on slope length, and find the way to set a reasonable threshold in the case that the actual channel head cannot be determined. In this paper, the DEM data of Xiannangou and Jiuyuangou catchments in the Loess Plateau are used to extract slope length under different thresholds. The results show that the impact of channel cutoff on the maximum slope length is greater than that on the averages of the extracted slope length, and the impact of the different thresholds on the slope length is greater than that of the different areas. The threshold of channel cutoff in Loess Plateau area can be set as 4% of the average value of the slope length.

Keywords: soil erosion; USLE; topographic factors; distributed erosion slope length; channel cutoff

Research on the relationship between cement take and transmissivity of fractured rocks under dam foundation based on fractal theory

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Abstract: Due to the imperceptibility and uncertainty of the fractures and cracks under the dam foundation, it is difficult to accurately evaluate the permeability and groutability of the fractured rocks. As a useful tool to describe the natural fracture networks, discrete fracture network can represent the statistical properties of the natural fracture networks, but it cannot reveal the microscopic characteristics and internal relations of the fractures in the fractured rocks. The fractal geometry, proposed by Mandelbrot, is an important tool to describe the characteristics of the fractal objects. The fractures distributed in fracture networks have been found to exhibit fractal characteristics, many researchers have studied the permeability of fracture networks by using this theory. However, the groutability and grout take of the fractured rocks have been rarely researched. In this paper, firstly, the fractal model of permeability and groutability for the fractured rocks are established, the equation of relationship between transmissivity and fractal dimension is derived. By comparing with the existing research results, the equation is proved to be reliable. Secondly, the fractal model of cement take for the fractured rocks grouting is analyzed, based on which the equation of relationship between cement take and transmissivity is derived. According to the delimitation by the curve of cement take vs transmissivity, the graph is divided into three grouting zones, which are defined as normal zone, tiny fracture zone and dilation zone, respectively. Finally, for verification purposes, the measured data from a cement grouting project in China are compared with the calculation values, the results show that the relationship between cement take and transmissivity derived in the paper is reliable, and defined grouting zones is reasonable and important. Therefore, the relationship and the grouting zones can used to predict and evaluate the reasonability and groutability of grouting.

Keywords: dam foundation; fractured rocks; fractal theory; cement grouting; transmissivity; cement take

Impacts of bridge pier on ice jam initiation and ice thickness in a curved channel—an experimental study

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Abstract: The presence of bridge piers in natural rivers would change the local flow field characteristics, and influence initiation and evolution of ice jam. Through model experiment study in which the location of bridge pier constantly changes, the ice jam evolution process under different position of bridge pipers were studied. The experiment results show that the presence of bridge piers changes the local flow field characteristics, relatively enhancing the ability of ice conveyance around and reducing the ice thickness; the ice conveyance efficiency intends to increase if bridge pier is placed at the apex of a bend, compared to be placed at the midway between two consecutive bends. If bridge piers are synchronously placed at midway between two consecutive bends and the apex of a bend, the balance of ice jam is not smaller than the single bridge pier placed at two different location of pipers, but between them.

Keywords: bridge pier; ice jam; thickness; ice conveyance; experimental study

Research on optimization method of pump sump parameters based on response surface model

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Abstract: The parameters of pump sump, especially the parameters of bell-mouth are significantly important for the flow pattern of pumping station. Thus, the floor clearance, back wall clearance and submergence of bell-mouth are taken as the design variables, and the weighting function composed of evaluation indexes for pressure, velocity and vortex is taken as objective function. Therefore, optimization design and analyses of two and three factors have been done on the basis of response surface model and CFD simulation. The results show that the interactions between variables and the flow pattern are significant, and the impact of submerged depth on floor clearance and back wall clearance cannot be ignored. Furthermore, the interaction (P=0.0019) between submergence and floor clearance is more significant than that (P=0.0696) of submergence and back wall clearance. The optimized pretreatment parameters are as follows: the floor clearance is 0.77D, and D indicates the bell-mouth diameter; the back wall clearance is 0.37D, and the submergence is 2.19D. Under the optimized parameters, the error between the actual value and the predict value of objective function is less than 4.82%. Comparing with the recommended parameters of Design code for pumping station, the hydraulic efficiency of computational domain and the uniformity of axial velocity distribution are 0.98% lower and 5.92% higher, respectively; and the vortex distribution value of pump sump profile is reduced by about three times, which greatly improved the flow pattern of the pumping station. So it can be concluded that the relationship between the design variables and the objective functions can be accurately presented by the two order polynomial response surface model, and the optimization method based on response surface model can be effectively used for the optimization of flow in pumping station.

Keywords: pumping station; floor clearance; back wall clearance; submergence; response surface model

Response of runoff and sediment reductions to plants in red soil region of southern China

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Abstract: Vegetation has important influences on water erosion, thus its effects on water and sediment reduction have received great attention. The observed data for runoff and sediment yieldsfromfield runoff plots between 2011 and 2014, the impacts of vegetation types, inter-month vegetation coverage variation, inter annual vegetation growth and rainfall at different time scales (individual rainfall, monthly and yearly) on the slope runoff and sediment yield were carefully investigated. The results showed that: (1) In comparison to the plots with bare soil, the vegetation on the runoff plots can decreased sediment yield and runoff by 24.77% and 12.95%, respectively. (2) In respect of the plots with bare soils, the eucalyptus, pine trees and Melinisminutiflora can significantly reduce sediment yields when the rainfall were within the ranges of 20-30 mm, 20-40 mm and 20-50 mm. The pine trees and Melinisminutiflora showed great water conservation benefit when the individual rainfall amounts varied at 10-50 mm. However, the soil and water conservation benefit of the vegetation were insignificant when the individual rainfall was greater than 50 mm. (3) At monthly scale, the runoff and sediment yields showed no significant difference for the runoff plots. However, due to changes of vegetation coverage, their sediment control benefits varied for different months. Whereas their water conservation benefit kept the a constant rule with the highest control benefit for Melinisminutiflora tree and the lowest benefit of eucalyptus. (4) At yearly scale, the soil and water conservation benefits were 7.00 %-38.66 % and 2.98 %-8.76 %, 7.74%-37.30 % and 6.67 %-19.67 %, 8.35%-45.33% and 10.00%-23.36%, for the eucalyptus, pine trees and Melinisminutiflora, respectively. The annual yields of runoff and sediment for individual rainfall were both in a sequence of bare soil >eucalyptus> pine trees > Melinisminutiflora. The agreement between soil and water conservation benefits for different plants indicated that their sediment reduction effect was mainly achieved by reducing runoff.

Keywords: sloping water erosion; vegetation; runoff reductions; sediment reductions; precipitation

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Scale effect of spatial variability of cropland soil water content in black soil region

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Abstract: In order to reveal the scale effect of spatial variability of soil water content in black soil region, the change rules of spatial variability of soil water content with the sampling area were analyzed by the methods of traditional statistics, geostatistics and multifractality on the basis of soil water content measured with TDR in 32 m×32 m, 48 m×48 m, 64 m×64 m, 80 m×80 m and 96 m×96 m sampling areas. The results show that the mean values of soil water content from different sampling areas range in 31.13%-33.57%, existing variations caused by scales less than the sampling one and experimental errors, with spatial correlation scope between 25.80-123.60 m, and spatial correlation degrees within 16.742%-29.874% and spatial variability degrees ranged 0.0292-0.1026 in different sampling areas. With the increase of sampling areas, the mean content and spatial variation degree of soil water content decrease, and the variations and spatial correlation range decreased firstly and then increased, its spatial correlation degree increased firstly and then decreased, and local information that caused its spatial variability in different sampling areas are different.

Keywords: black soil region; soil water content; spatial variability; scale effect

Experimental investigation on tensile strength of unsaturated fine sands

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Abstract: Tensile strength of soil plays an important role in controlling the cracking and tensile failure of many earth structures, such as core wall of earth-rock dam cracking, ground fracturing and hydraulic fracture. In order to study the tensile strength of unsaturated soils, the design value is derived for determining the inclination angle of inner sidewall of the specimen molds. Then an improved direct tensile test apparatus based on constant strain rate controlling method is developed to determine the tensile strength of fine sands over a broad range of water contents and with different dry densities. The results show that the tensile strength of fine sands significantly depends on dry density and water content. The tensile strength increases with the increase of dry density, and shows an "increase-decrease-increase" pattern with the increase of water content.

Keywords: tensile strength; unsaturated soils; tensile strength test apparatus; water content; dry density