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EDITORIAL BOARD

Progresses on statistical modeling of non-stationary extreme sequences and its application in climate and hydrological change

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Abstract: In the context of global warming and average rise in sea level, obvious changes are witnessed with regard to the frequency and intensity of major extreme weather and climate events. Climate change has become an important cause of non-stationarity in hydrology. Several approaches have been proposed to tackle non-stationarity of hydro-meteorological extremes in the literatures. The structures and extreme inference methods of non-stationary sequences model applied usually in climate and hydrology change are summarized in this paper. Some typical examples in statistical modeling of extremes of non-stationary hydrologic sequences are analyzed. The applications demonstrate that changes of hydrology variables according to time or covariates can be reflected by statistical modeling of extremes of non-stationary sequences, and the return period and risk assessment for non-stationary situations can be quite different from those corresponding to stationary conditions. Finally, perspectives on statistical modeling of extremes of non-stationary sequences are proposed.

Keywords: non-stationary; statistical modeling of extreme values; climate change; hydrological sequences; covariate

A review on the development of geotechnical centrifuge modeling technique on frozen ground engineering

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Abstract: The development of frozen ground engineering practice put forward some new problems to frozen ground engineering. Frozen ground geotechnical centrifuge modeling technique is an exclusive physical simulation technology for frozen ground engineering, which can realize the coupling of temperature and in-situ stress field, basing on a geotechnical centrifuge. This technique can be used to simulate prototypes in a short time according to the scale factors. In the last thirty years, frozen ground geotechnical centrifuge modeling technique has made rapid development around the world with innovation of heat exchange devices, the consummation of scaling laws and the improvement of testing methods. This technique can provides a new way for the research of frozen ground engineering. The development process of the test devices are reviewed, and the main research and achievements of the research are summarized in this paper. and then, the development trend for frozen ground geotechnical centrifuge modeling technique is predicted.

Keywords: cold regions engineering; geotechnical centrifuge; test device; centrifugal model test; research progress

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Study on the bayesian model averaging coupling with the *k*-nearest neighbor selection

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Abstract: The BMA (Bayesian model averaging) is a multi-model ensemble forecasting algorithm based on the Bayesian formula to estimate the posterior probability distribution of forecasting variables. The performance of BMA depends largely on the quality of its training datasets. However, there are a lot of redundant samples, which are inconsistent with the current flow state and affect the accuracy and the reliability of BMA forecasts. In this study, the *k*-nearest neighbor (KNN) method is applied to address the similarities between the historical samples and the most recent flood process to reduce the influence of redundant samples on the parameter estimation of BMA. Two cases of BMA, i.e. with the use of KNN sample selection (namely KBMA) and the original one, are investigated and compared at the Wangjiaba catchment located in the upper region of the Huai River basin. The ensemble means of these two cases were examined against the observations and the forecasts from their ensemble members to test the efficiency of their deterministic forecasts. Additionally, the probabilistic forecasts from these two cases were intercompared on the basis of two assessment criteria including Coverage Rate and Ranked Probability Score. The results indicate that the KBMA can produce improved deterministic and probabilistic forecasts as compared to the original BMA. By employing the KNN sample selection method, the KBMA is able to adjust its parameters according to the real time state of the flood processes and ensemble members, rather than adjusting them through the use of all samples. Our analysis demonstrates that the KNN sample selection method has the potential to substantially improve BMA ensemble forecasts.

Keywords: ensemble forecast; sample selection method; *k*-nearest neighbor; Bayesian Model Averaging; Gaussian mixture model

Research on the mechanism of water and salt transport in root soil and the advantage of intercropping system in Hetao irrigation district

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Abstract: In order to study the issues on the mutual water use efficiency, the mechanism of soil salt transport, the contribution rate of underground part to intercropping advantage and the relative competitiveness of intercropping in spring wheat-spring maize intercropping system in Hetao irrigation area, a field experiment has been conducted on the base of root partition method. The results show that the intercropping wheat utilized 214.0~224.5m^3/hm^2 of water by the side of maize. Meanwhile, the intercropping maize utilized 108.1~125.2m^3/hm^2 of water by the side of wheat. The mean value of root soil *EC* in wheat and maize belts could reduce 0.2% ~ 1.5% and 2.7% ~ 3.1%, respectively, by the superposition utilization effect of soil internal space under the intercropping mode. The water circulation is another factor that could reduce the mean value of root soil *EC*, with a decrease of 4.4% ~ 4.5% and 3.4% ~ 5.2% in the intercropping wheat and maize belts, respectively. The yield advantage of wheat-maize intercropping system in Hetao irrigation district is 27.7% ~ 33.1%, with 20.4% ~ 26.6% attributed to the compensation effect of underground part, and 6.5% ~ 7.2% is attributed to the effect of aboveground part. The 10.0% ~ 15.8% of intercropping yield advantage results from superposition utilization of soil internal space by intercropping root, and the compensation effect of water and nutrient between the wheat and maize belts is 10.4%~10.8%.

Keywords: root separation; wheat-maize intercropping; soil salt; intercropping advantages

The analysis and accounting on the damages induced by water hazards and the effects arising from water affairs

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Abstract: Reducing the damages induced by the water hazards is recognized as the development goal in water sector under the new period. Therefore, the systematic and correct accounting on the losses induced by water hazards is vital for the target achieved. This paper conducts a series of analyses: defining the damages induced by water hazards from the perspective of resources and environment economics; explaining the phenomenon that total losses of water induced disasters are unequal to the sum of individual disaster insettheory; furthermore namingit after the effect on the difference in aggregation and sum set, which helps us to well understand the interactive relationship between the individual loss and the total. The process of disaster loss in an S-shaped curve is explored based on the interactive process of energy accumulation and resisting effect. A unique function is derived as well. However, it is subject to the nature of disaster. A complete S-shaped curve is widely observed in the original disaster from natural phenomenon; whereas, the loss from artificial disturbance only appears the bottom part of an S-shaped curve. A calculating framework consists of the method on individual loss and value shifting in the relief and offset of losses during the alternation of these natural hazards. Finally, an example on Yangtze Delta is described in detail.

Keywords: damage induced by water; the effect arising from water affair; the difference in aggregation and sum set; S-shaped curve; Yangtze Delta

Research on the colluvial landslide stability during reservoir water level fluctuation

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Abstract: Colluvial landslide is a very common geological disaster in the Three Gorges Reservoir Area. Changes of water level in different rate significantly influence on landslide stability. Taking the Liangshuijing landslide as an example, the stability of the colluvial landslide were analyzed with ten rates between 0.2 to 2.0 m/day and four different saturated permeability coefficients of colluvial landslide in the process of water rise and drawdown in the reservoir. Based on which, the risk grading scheme of the water level regulation was put forward for the colluvial landslide in the Three Gorges reservoir area, taking $v < 0.6$ m/day as a lower risk, and 0.6 m/day $< v <$ 0.8 m/day as a medium risks, and $v > 0.8$ m/day as a high risk. Using the safety coefficient curve calculated under the real fluctuation of water level in the reservoir and the method combined with the geological disaster hierarchies, the long-term risk of landslide process curve was shown intuitively. The results have certain application values for landslide monitoring and warning and reservoir scheduling in Three Gorges Reservoir Area.

Keywords: the TGR area; colluvial landslide; water level fluctuation; permeability coefficients; stability analysis; hazard risk

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Mesoscopic analysis of reinforced sand triaxial test using PFC3D

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Abstract: On the basis of the results of single reinforced triaxial test in the laboratory, the discrete element PFC3D triaxial test numerical model is established, and the results are compared with the laboratory triaxial test results. The influence of reinforced layers changes on shear strength parameters and the microscopic parameters is analyzed, and soil particles contact force variation and macroscopic-mesoscopic mechanisms of geosynthetics reinforcement effect are discussed. The results show that reinforcement triaxial specimen peak strength, cohesion and internal friction angle increase with the increase of reinforcement layers, but the increase will gradually weakened, and the reinforcement effect of the triaxial specimen under low confining pressure is higher than that of the high confining pressure. The sliding fraction value of the triaxial specimen has a significant fluctuation with the increase of axial strain, which reflects the obvious contact slip and rotation in triaxial test. Due to the friction restrain effect of geosynthetics, the fluctuations of porosity and sliding fraction of reinforced specimen in the central region are relatively small, and the contact force corresponding to the middle part of the outer periphery is obviously less than that of sand triaxial test. The reinforcement materials play a role in diffusing stress and enhancing reinforcement of sandy soil.

Keywords: triaxial test; discrete element method; geosynthetics; interface interaction

Determination of liquefaction resistance of deep alluvial soils considering in-situ structure effects

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Abstract: How to accurately determine the mechanical parameters of deep alluvial soils with strong structure is a difficult issue in construction of projects with deep alluvial soils. This paper focuses on the problem by studying how to determine the dynamic strength parameters through comprehensively considering the in-situ tests and the laboratory tests, which include three aspects in: (1) determining the basic dynamic strength of deep alluvial soils with in-situ tests; (2) determining the dynamic strength parameters under different vibration magnitude and consolidation stress conditions with laboratory tests and (3) extending the basic dynamic strength parameters to different magnitude and various consolidation stress conditions based on the results of laboratory tests. Field standard penetration tests and laboratory tests were carried out toward soils of a real deep alluvial layer, then dynamic strength parameters considering in-situ structure effect were determined with method mentioned above, which were compared with those determined by laboratory tests. These research results can provide the basis for seismic safety evaluation of foundation and embankment system, and can also be used as reference for similar projects

Keywords: deep alluvial soils; in-situ structural effects; dynamic strength parameters; field tests; laboratory dynamic tests

Effect of unclosed characteristics of the basin on hydrological modeling in Karst regions

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Abstract: In karst areas, there is usually a complex subsurface water system due to the well-developed karst fractures, conduits and caves, which contributes to the special water cycle pattern. The existence of karst structure leads to the noncoincidence of the surface and underground watersheds and as a result, the basin becomes unclosed. In order to comprehend the effect of unclosed characteristics of a karst basin on hydrological modeling, the Chaotianhe River basin (an important subbasin of the Lijiang River basin) is selected as the study area. The Xinanjiang model is used as the hydrological model to simulate the rainfall-runoff process for a study period from 1996 to 2005. Through comparing calibrateion results obtained by using several different area values of the basin, the effect of watershed area selection on model simulation accuracy is analyzed. Furthermore, the water exchange pattern between the Chaotianhe River basin and the surrounding watershed was discussed. The results show that the *NSE* firstly increases and then decreases and the *RE* increases when the watershed area varies from 340 km^2 to 460 km^2. The *NSE* reaches the maximum and the *RE* closes to zero when the watershed area is near 380~390 km^2. It implies that the reasonable watershed area shrinks by 8.9 %~11.2 %, compared with the surface watershed area of the Chaotianhe River basin, owing to a proportion of water flowing into the adjacent basins through karst structures. The performance of the hydrological model for Chaotianhe River basin is improved significantly by using the calibrated watershed area, especially for dry seasons.

Keywords: karst basin; unclosed characteristic; Xinanjiang model; hydrological modeling

Sandy bed-load transport

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Abstract: Calculation of bed-load transport is the key for both the research of sandy bed deformation and the engineering application. Based on the review of representative formulae used in China, it is realized that most of the existing bed-load transport formulae are not suitable for sandy riverbed because the accuracy of the measured data cannot be guaranteed. This paper addresses the exchange mechanism of bed-load and suspended sediment at riverbed layer; then recurs to sediment concentration vertical distribution formula extended to the riverbed, considering the impact of sediment particle size, flow intensity and hydraulic friction characteristics on the sandy bed-load transport intensity. Finally, a high reliability sandy bed-load transport rate formula has been derived. It shows that the measured data of natural sandy riverbed agree well with calculation and the formula can be used in the natural engineering calculation.

Keywords: sandy bed-load; suspended sediment; bed layer; transport rate

Study on the formation and characteristics of height of debris flow head

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Abstracts: The height of debris flow head is a major parameter for prevention and treatment engineering reflecting the scale of debris flow. Steep terrain, massive loose material and rich water source are three major elements for debris flow initiation, and meanwhile, they are key factors for height of debris flow head. The relationship between height of debris flow head and graduation of bed sediment, flow or gradient is explored with homogeneous sand and wide grading of sand in test flume. The results show that the height of debris flow head rises at first and goes down with the increasing of flow, gradient, the mean grain size and the content of fine sand. Finally, the calculation model of debris flow head is established based on the concept of flow power and regression analysis method, and validated by other scientist's experimental data. The results above are significant for predicting scales for debris flow.

Keywords: debris flow; homogeneous sand; wide grading of sand; the height of debris flow head; stream power

Study on early warning index of concrete dam's deformation based on the risk management

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Abstract: This paper aims to establish a method for determining early warning index of concrete dam deformation on the basis of risk management, based on the prepared deformation index of concrete dam by risk theory and the structure calculation method, which satisfies the requirement of engineering safety management and shows dam risk measurement. According to the requirement of the concrete dam engineering safety operation and the downstream economic and social development, the risk grade standard of the dam is established at first. Then, the failure path and model of concrete dam are analyzed and studied under the condition of the corresponding risk grade standard. By expert experience, with concrete dam failure mode and dam structure characteristics abnormality as a link, the load conditions and the constraint criterion of structure calculation are set. Finally, the corresponding deformation early warning index value is obtained by finite element calculation. Thus, the early warning index determining method of concrete dam deformation based on the risk management is put forward. Taking a hydropower station as an example, the early warning index value of the low risk operation is proposed, which proves that the method is feasible and effective.

Keywords: concrete dam; risk management; dam failure; deformation characteristic; early warning index; intersection

Combination of high content limestone powder and fly ash used in RCC

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Abstract: Combined with limestone powder and fly ash which is taking 60% of the total replacement of cement, compressive strength, freeze-thaw resistance and impermeability performance of roller compacted concrete(RCC) with different proportion of limestone powder content to replace fly ash were investigated, With help of micro calorimeter, scanning electron microscope and mercury intrusion, the hydration process as well as microstructure of pastes was also analyzed. The results indicate that, when the replacing ratio of limestone powder was 50% in composite paste, the mechanical property and durability of RCC were satisfactory. The coupling effect of limestone powder and fly ash led to hydration promotion and formation of denser microstructure, which resulted in great improvement in RCC performance.

Keywords: limestone powder; fly ash; roller compacted concrete(RCC); coupling

Optimal model for selecting evacuation routes in flood-prone areas based on 2D hydrodynamic processes and its application

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Abstract: The evacuation distance and water depth are regarded as the key factors in flood events, and the flooding process and the temporal-spatial distributions of victims would influence greatly on the choice of opportunity and route of evacuation. The model for selecting optimal escape route in flood-prone areas is proposed based on the two-dimensional hydrodynamic model. It would direct the flood victims away from danger, but also provide a rational basis for construction of road networks. The Dijkstra algorithm is adopted to derive the shortest routes, the effect of the flood conditions on the escape speed is considered, and the optimal refuge and escape route is selected based on the stability of the human body and the final escape moment. Finally, the optimal escape routes were selected for two overbank flood events in July 1958 and August 1982 in the Lankao-Dongming floodplain area in the Lower Yellow River. The variations of risks for people in floodwaters were analyzed, and the locations and corresponding final escape moments of optimal escape routes were determined for three disaster locations in these two flood events. The results indicate that there would be 3-6 hours more for evacuees if they escape on the optimal routes. The locations of optimal escape routes for these two flood events were the same, but the final escape moments would be earlier in the 1958 flood event because of the larger amount of water volume and higher peak discharge.

Keywords: hydrodynamic model; flood-prone areas; human stability; escape speed; escape route optimization