Theme 2:Development and application of new technologies in hydrological practices

A modeling blueprint for assessment of satellite-based flood forecasting in international river basins

Nitin Katiyar and Faisal Hossain

Department of Civil and Environmental Engineering Tennessee Technological University USA

E-mail:FHossain@tntech.edu

Abstract: A problem faced by many lowermost riparian nations in flood-prone International River Basins (IRB) today is the assimilation of in-situ rainfall data in real-time across geopolitical boundaries to issue flood forecasts with lead times equivalent to basin response times. Anticipated global rainfall (at resolution: 3~6 hours, 10X10 km^2) from satellites of the *Global Precipitation Measurement (GPM) Mission* now appears as a promising alternative for achieving the basin-response lead time for flood forecasting. However, proper characterization of the satellite rainfall error and its non-linear propagation in hydrologic models for forecasting are therefore necessary to gauge the true potential of GPM in bridging the flood forecasting needs of IRBs. In this work, we propose a hydrologic modeling blue-print that is simple, robust and tailored for assessment of error propagation of satellite-based flood forecasting for lowermost nations in IRBs. The blueprint is based on first principles of conservation of mass and momentum. It utilizes an open-book watershed modeling concept considered suitable for assessing the hydro-political impact of satellite rainfall data availability over upstream nations. We present this blueprint as a parsimonious way of conducting an approximate yet reasonable assessment of the numerous IRBs in the vast ungauged regions of the world (in particular Asia) and thereby identify the flood-prone nations that would benefit most from anticipated GPM rainfall data. This approach, we believe, can subsequently motivate the identified nations to initiate a range of more detailed physically-based studies to design and test an enhanced GPM-based prototype forecasting system by 2010. We present an application of our proposed blueprint on an idealized international river basin. Our findings are then used to quantitatively project the anticipated value of satellite rainfall data from GPM in extending the current capabilities of flood forecasting of Bangladesh in the Ganges Brahmaputra basin - Bangladesh

Keywords: Flood forecasting, satellite rainfall, Global Precipitation Measurement Mission, International River Basins, Error Propagation, Hydrologic Modeling.

Models for optimum distribution of water resources in three hierarchies and their applications

QITING ZUO, JUNXIA MA & ZENING WU

School of Environment & Water Conservancy, Zhengzhou University, Zhengzhou, 450002, China. Email: zuoqt@zzu.edu.cn; zuoqt@sina.com

Abstract: In this paper, the models for optimum distribution of water resources (ODWR) are divided into three hierarchies, which are that the first hierarchy is the "model for optimum distribution of water resources based on considering sustainable development (SDO)", the second one is the "model for optimum distribution of water resources based on considering the carrying capacity of water resources (CCO)", and the third one is the general optimum distribution model without considering the carrying capacity of water resources (GOD). The equations of the models at all the hierarchies are derived and compared. In the first hierarchy, the model is optimized for redistributing water resources, it is at the highest hierarchy and is developed based on considering the objective of sustainable development, and the quantitative criteria of sustainable development are materialized in the constraint conditions, in which the carrying capacity of water resources is included. In the model at second hierarchy, the carrying capacity of water resources is considered and regarded as a constraint equation to be put into the optimum model. In the model at third hierarchy, the carrying capacity of water resources is not considered in developing the optimum model, and the model only is a general optimum model. In the end of the paper, a case study is carried out in the City of Zhengzhou, and the application significance of the models at all the hierarchies is introduced. After analyzing, it is considered that these models in three hierarchies are possibly applied in the study on water resources, and the corresponding models should be developed based on the different conditions.

Key words: optimum distribution of water resources (ODWR); optimum model; carrying capacity of water resources; sustainable development; the City of Zhengzhou

Application of Ant Colony Optimization for Optimal Reservoir Operation

S.Mohammad Mortazavi.N

M.Sc. Water Resources Management, K.N. Toosi University of Tech., Tehran, Iran.

Alireza Dariane

Assistant Professor, Faculty of K.N. Toosi University of Tech., Tehran, Iran.

Abstract: In this paper a new algorithm propose to solve a reservoir operation optimization problem. Ant Colony Optimization (ACO) is one of the recent optimization methods which are inspired by the fact that ants are able to find the shortest route between their nest and a food source. This is accomplished by using pheromone trails as a form of indirect communication. Application of ACO to the “four reservoir problem” that has become something of a benchmark for water resources system optimization has demonstrated its utility. In this paper results of ACO and GA are compared

Towards a new blueprint for catchment response modeling: development and application of the Representative and Elementary Watershed approach

G.P. Zhang* and H.H.G. Savenije

Section of Water Resources, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Stevinweg 1, 2628CN Delft, The Netherlands
* Correspondence to g.zhang@citg.tudelft.nl

Abstract:A novel approach for modeling watershed hydro-environmental responses, called Representative Elementary Watershed (REW) approach, has been pioneered. In this approach, watershed-scale equations governing flows in surface and subsurface domains are derived using physical principles (mass conservation, momentum and energy balance, and entropy inequality). In this approach, a given catchment is discretized into a finite number of hydrological units, i.e. representative elementary watersheds (REWs), in accordance with Strahler order system. In this manner, the basic functional components (hillslopes and river channels) within each REW are preserved and catchment responses to atmospheric forcing can be captured in a (semi)distributed way. Based on the REW approach, a parsimonious modeling tool, REWASH, has been developed and applied to meso-scale humid temperate catchment. Dominant flow processes that are commonly observed and perceived, e.g. the unsaturated flow, macropore flow, saturated flow and overland surface flow, are described in the model based on flux parameterization. Modeling results show that REWASH is an appropriate tool to simulate hydrological behavior at the catchment scale, providing not only the total response at the outlet, but the hydrological variations at the interior sties as well. Thus, one can find it as an assist for a better understanding to watershed hydrology. REWASH can be used in a distributed way or in a lumped fashion for a given application interest. It combines the strength of both lumped conceptual models and physically-based fully distributed models, showing its potential in predictions in ungauged basins (PUB). With future development, REWASH can incorporate modules dealing with sediment and solute transport, and predictive uncertainties etc., leading to an integrated water resources management tool.

Degeneration and Countermeasures of Water Resources System of the Changjiang River Delta*

DONG WANG[1], YUNLIANG SHI[2], JICHUN WU[1], SHAOMING PAN[2]
[1] Department of Earth Sciences, Nanjing University, Nanjing, 210093, China;
[2] the Key Lab of Ministry of Education of Coast & Island Development, Nanjing University, Nanjing, 210093, China
E-mail:wangdong@nju.edu.cn

Abstract: Water resources system is formed with natural water subsystem and social water subsystem. And it is a complicated large system, which contains certain regional background, as well as specific framework, function and dynamic balance. The evaluation of the water resources system needs the viewpoint of sustainable development and the measurement according to water resources system carrying capacity, which holds the meaning of both water resources carrying capacity and water environment carrying capacity. The Changjiang River Delta is a very important area in China. As the local water resources are concerned, the Delta is an area lack of water as a matter of fact. The water resources system of the Delta experiences a long, intricate and degenerate period. The lacking of water due to resources shortage in 1950s changes into that due to water quality from 1980s. Furthermore the status of water shortage sharpens gradually. The representations are summarized as follows: firstly, the discharge amount of wastewater and polluted water is large all along. Secondly, the pollution status of rivers, which involve the Changjiang River, the Grand Canal, the rivers in city and the rivers in small towns and villages, is noticeable. Thirdly, water quality of Taihu Lake is worth of more attention. Therefore, the countermeasures on the reconditioning and regulating of water resources system in the Delta demands the following new strategies, such as to treat the rivers, the lakes and the seas as an overall system, to improve, harmonize and counterpoise water resources system carrying capacity, to implement the integrated management of water resources, which means the integrated management of drainage area along with the regional area, especially the integrated management of city water, and to carry on water saving and scientific using to increase the efficiency of water use, and so on. Consequently, human can coexist with water harmoniously in the Delta. And the objective to ensure the sustainable social and economic development with the sustainable usage of water resources can be implemented.

Key words: degeneration, water resources system carrying capacity, countermeasure, the Changjiang River Delta

---

This project was supported by the Major State Basic Research Development Program of China (973 Program), No.2002CB412401, Encouragement Project of Teaching and Researching for the Outstanding Young Teacher from Ministry of Education of China and Nanjing University Talent Development Foundation.

Study on the variation characteristics of water and sediment fluxes into the estuary of the Yellow River based on the dispatch of water and sediment*

Dong Wang[1], Shaoming Pan[2], Jichun Wu[1], Qingping Zhu[3]

[1] Department of Earth Sciences, Nanjing University, Nanjing, 210093, China;
[2] the Key Lab of Ministry of Education of Coast & Island Development, Nanjing University, Nanjing, 210093, China;
[3] the Yellow River Conservancy Committee of Ministry of Water Resources, Zhengzhou, 450001, China
E-mail:wangdong@nju.edu.cn

Abstract: Water is closely related with the existence and development of human. In history, the Yellow River nurtures the glorious Chinese civilization. It is respected as the "ancestor of the four large rivers in ancient China" and praised as "the mother river of Chinese". At the same time, the Yellow River is famous for the lack of water and much of the sediment, and the riverway is easy to silting, breaking and diverting. Flood and drought of the Yellow River is very serious. It is regarded as "the misery of the China" and considered as the most difficult and complex river to regulate in the world. Today the Yellow River is also a large river greatly influenced by the human activities. First regulate rivers before governing the country. Thus the safety of the Yellow River is always the greatest thing for the governing and developing of the country. The great achievement has been seen by all after many years' regulating of the Yellow River. However, since 1990s, some new problems, such as flow-breaking, eco-environment worsening and channel shrinking rapidly, etc., are found on the Yellow River. The new concepts and new practices are urgently needed to control the Yellow River. The Yellow River Conservancy Committee has continuously carried out the dispatch of water and sediment each year from 2002. This is a kind of new and more direct and stronger human activities which can cause the great change of the water and sediment fluxes into the estuary in short time. On the basis of the introduction of the Yellow River's water and sediment characteristics and the dispatch of water and sediment from 2002 to 2004, the variation characteristics and rule of the water and sediment in estuary are emphasized to analyze and discuss in order to research in time the new situation and problems produced by the dispatch of water and sediment. It will be helpful to deepen the understanding of the rule of the Yellow River's water and sediment and to provide reference and experience to the water and sediment fluxes research for the estuaries of other large rivers.

Key words: dispatch of water and sediment; the Yellow River; water and sediment fluxes

---

This project was supported by the Major State Basic Research Development Program of China (973 Program), No.2002CB412401, Encouragement Project of Teaching and Researching for the Outstanding Young Teacher from Ministry of Education of China and Nanjing University Talent Development Foundation.

Downscaling the future climatic change scenarios for the North China Plain from GCMs

Guobin Fu

Department of Biological Systems Engineering Washington State University Pullman, WA 99164-6120 USA.
E-mail: guobin_fu@wsu.edu fugb0129@yahoo.com

Abstract: The water shortage issue and related eco-environmental problems in North China is one of the major emerging problems in China, not only because the average amounts of water resources in this region per capita and per hectare are one-fourth and one-fifth of the country's averages respectively and it has less than half the water per person than the absolutely water-scarce Egypt, but also the region, consisting of Beijing and Tianjin, is a densely populated area acting as the centre of politics, economy, culture and transportation in China. The future climatic change would make the situation worsen as it has a major impact on the hydrological cycle and consequently on available water resources, and the potential for flood and drought. This paper will downscale the future climate scenarios for the North China Plains from different GCMs results. The uncertainties due to model inconsistent and downscaling techniques are also discussed. The results could help the government and decision-makers to make better water resources management and economic development planning.

Impact of Groundwater Irrigation on Streamflow in Nebraska

Xun-Hong Chen and Fujiang Wen

School of Natural Resources 102 Nebraska Hall University of Nebraska-Lincoln Lincoln, NE 68588-0517, USA
Phone: (402) 472-0772
fax: (402) 472-4608
Email xchen2@unl.edu

Abstract: The High Plains aquifer, underlying parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming, is the largest aquifer system in the United States. It supplies fresh water for agricultural products that are exported around the world, as well as providing water for communities throughout the region. Annual groundwater pumpage from this aquifer for irrigation was around 23.4×10^9 m^3 (19 million acre-feet) from 1974-1995 (McGuire et al. 2003). Long-term groundwater use has depleted a significant portion of the aquifer, which subsequently affects streamflow, lakes, and wetlands that are hydraulically connected to the High Plains aquifer.

About one-third of the High Plains aquifer occurs in Nebraska. According to Hutson et al. (2000), Nebraska, after California and Texas, is the third largest state for groundwater irrigation in the United States. Since the mid-1930s, especially after the mid-1950s, the use of groundwater has increased rapidly in Nebraska. The number of registered wells has grown from 1,200 in 1936 to about 100,000 serving about 85 percent of the state's irrigation land (Flowerday *et al.*, 1998; Hovey, 2005). Intensive groundwater development for irrigation or other land use typically causes the depletion of nearby streamflow. As a result, conflicts occurred between states, as well as between surface water and groundwater use groups.

This study is to analyze the streamflow trend in Nebraska and to determine the impact of groundwater irrigation on streamflows in its eight watersheds. Nonparametric techniques were applied to the analysis of streamflow depletion and trends in precipitation and temperature in Nebraska and northwestern Kansas. Fifty years of streamflow data from 110 gauging stations in eight major river basins were examined. Temporal trends of streamflow in Nebraska showed a spatial tendency of decreasing streamflow mostly in the west but insignificance in the east. This spatial pattern in streamflow depletion is unlikely to be due to a long-term change in precipitation over the entire state because precipitation, based on the records of 28 weather stations from 1948 to 2003, did not indicate a spatial trend. For the Republican River basin, 20 of the 28 gauging stations showed decreasing streamflow. To evaluate the trend of baseflow, the Local Weighted Regression method was used to generate precipitation-adjusted stream discharge. Additional analyses suggested that the local precipitation-adjusted discharge from 17 of the 22 stations decreased since the 1950s in the Republican River basin. This decrease plausibly matches a pattern of an increasing number of irrigation wells and the declines of the groundwater level. Because there was no decreasing trend in precipitation, it is most likely that groundwater withdrawal in this basin was a primary factor in streamflow depletion. Besides Nebraska, where a

significant amount of groundwater was withdrawn from the High Plains regional aquifer, irrigators in Kansas and Colorado were the other likely contributors to streamflow depletion in the Republican River.

Mean scale avalanche hazard mapping

E. Semakova

Hydrometeorological Research Institute (NIGMI),
72, K.Makhsumov str. 700052, Tashkent, Uzbekistan,
Tel. No. (Office): (998-71) 133-11-50
Fax: (998-71) 133-11-50
E-mail: sanigmi@albatros.uz , ella_sem@mailgate.ru

Abstract: Snow avalanches are serious natural hazards because of frequent appearance, wide spreading over the mountain terrain and highly destructive action. Snow avalanches cause considerable damage to economy of the state. Avalanche hazard is the result of avalanche interaction with natural and artificial objects. This result depends on the avalanche formation activity and it intensity and territory extent developing as well.

Investigation region for technique elaboration with the usage of new means of processing and information analysis is the mountain territory of Tashkent district of Uzbekistan Republic. The aerovisual and expeditionary carried out works analysis has allowed to define the avalanche activity parameters complex and to choose 4 degrees of avalanche hazard (strong, moderate, weak, potential).

It was necessary to use GIS- technologies application to coprocess heterogeneous initial materials in merge. Besides, the received map should serve a basis for the further work, particularly, for monitoring snow cover and avalanche activity. The change of snow cover and avalanche parameters in time is caused by climate change and anthropogenous influence. Therefore the constructed map is the base for long-term planning of state economic activities.
The separation method of territories with different degree of avalanche hazard consists in imposition of thematic layers composing avalanche danger. It was accepted to use all existing information available on today about seasonal snow-covered territories, snow cover depth and parameters of avalanche activity.

Input data were 1:200.000 scale topographical maps; digital space data in snow-covered territories on Tashkent district and adjacent areas; aerovisual and land route snow avalanche data for all observations period; snow cover depth on meteorological stations; “Uzbekistan Avalanches” database and expeditionary observations.

Input of the base cartographical information was carried out by means of paper maps scanning with the subsequent vectoring and modeling. The digitized information included the relief data (isolines, tops and passes marks), hydrography data (rivers with classification on large, permanent and temporary channels; lakes and water basins, glaciers), automobile and railways with classification on categories, cities (large, small cities and villages, single structures), bridges, and electric mines. It is necessary to note, that without such kind of information it is impossible to create the valuable and informative avalanche danger maps.

Hydrology exact digital elevation model with 200 m resolution was created for relief morphological and morphometric characteristics calculations to find sites with avalanche danger.

There were offered new methods of relief ruggedness and detail steepness calculation. The relation of avalanche release ways network density with river network density was received. The distribution of avalanche hazard sites, namely avalanche formation and debris cone zones by relief characteristics was calculated.

Seasonal snow-covered territories in various years were determined by digital remote sensing data for revealing of avalanche danger bottom border. The long-term change of these territories was founded.

The whole snow cover database was created. It allows realize the statistical processing, searching of relations with relief characteristics and an estimation of seasonal and year-on-year dynamics of snow cover parameters. The snow cover depth maps on maximal snow accumulation dates were constructed. On the basis of the received results about snow cover depth and seasonal snow-covered territories the avalanche danger various degree sites were allocated.

The regions of avalanche formation with different parameters of avalanche activity and avalanche mode were received with use “Uzbekistan Avalanches” database and helicopter observations of insufficiently know basins, both on selected avalanches, and wide-spread avalanching.

The resultant map of avalanche danger various degrees was compiled by means combination of avalanche hazard sites maps received separately on relief, snow cover and avalanche activity.

Further, it is supposed to continue the monitoring of snow cover and avalanches with updating of the corresponding databases connected to the specified map and, probably, creation of the additional layers containing the information on climatic characteristics and connected with them distribution of a snow cover and avalanches.

Interactions between seawater, groundwater, and river water in the Yellow River Delta

Makoto Taniguchi, Jianyao Chen, Yoshihiro Fukushima, and Guanqun Liu

Research Institute for Humanity and Nature (RIHN) 335 Takashima-cho, Kamigyo-ku, Kyoto 602-0878, Japan.
E-mail:makoto@chikyu.ac.jp

Abstract: Measurements and analyses on interactions between seawater, groundwater and river water in the Yellow River Delta and Bohai Sea, have been made to evaluate (1) groundwater and river water discharges and their dissolved material transports into the Bohai Sea, (2) the effects of recent Yellow River cut-off due to changes in land utilization and water management, and (3) the impact zone of the Yellow River in the lower reach of the basin.

Measurements of submarine groundwater discharge (SGD) have been done at seven locations of 500 to 2000m from the coast in September, 2004 and May, 2005. Automated seepage meters and CT sensors were used to measure SGD rates, temperature and electric conductivity of SGD. As a result, SGD rates were evaluated to be from 3 to 173 × 10^{-7} m/s. The separation of SGD into the fresh terrestrial groundwater discharge and recirculated seawater discharge were also done by using the electric conductivities of the SGD water and two end members, groundwater in the coast and seawater. As a result, ratios of the fresh terrestrial groundwater of SGD were from several percent to several ten percent in most locations. However, the phosphate and silica transports by groundwater into the Bohai sea have much higher (groundwater/river water) ratios than that of water itself.

The Yellow River water is connected with groundwater hydraulically in whole delta, therefore the impact zone of the river may be whole delta of the Yellow River. The impact zone includes not only natural water transfer but also human induced water movement such as irrigation in the lower reach of Yellow River. The water diversion from the river is a major reason of the recent water shortage in the lower reach of the Yellow river. The “impact zone” should be used for water resources issues in particular at the lower reach of the basin.

Temperature Resulted from a Weather Generator for Climate Impact Studies in the Headwater of Yellow River Basin

Xu Z. X., Zhao F. F.

Key Laboratory of Water and Sediment Sciences, Ministry of Education
College of Water Sciences, Beijing Normal University, Beijing 100875, China

Abstract:Impacts of climate change on hydrological circulation are frequently assessed by a hydrological model with climatic scenarios from the Global Circulation Model (GCM). Most of hydrological models require a smaller spatial resolution such as 1km×1km while observed climatology and GCM output is generally available on a large resolution such as 200km×200km. A temperature disaggregation model currently used to convert temperature at large resolution down to the temperature at smaller resolution is investigated in this study. The performance of the model is evaluated using daily data from a network of seven raingauges covering headwater of the Yellow River basin. The daily maximum and minimum temperature were downscaled from GCM grid to local area using the Statistical DownScaling Model (SDSM) in this paper. A grid with resolution of 2.5° in latitude and 3.75° in longitude in headwater of the Yellow River basin was selected and daily temperature series of 30 years in 7 stations were used. Firstly, a statistical transfer function between the large scale predictors and the local temperature was constructed using the SDSM. Then, the transfer function was validated by using observed data. Finally, the temperature scenarios for future periods (2020s, 2050s and 2080s) were generated using the validated transfer function from output of the HadCM3 SERS B2 in 7 stations. On the basis of above analysis, the temperature scenario for headwater of the Yellow River basin was developed by kriging interpolation integrated in Arc/GIS. The results show that the downscaled maximum temperature increase quickly, and the scenarios for future periods are +1.34℃, +2.60℃ and +3.90℃, respectively. However, the change of daily minimum temperature is relatively unobvious, and the scenarios for future period are +0.87℃, +1.49℃ and +2.27℃, respectively. The change for twelve months and four seasons are different. The tendency of maximum temperature is remarkable in spring and autumn, and the tendency of minimum temperature is significant in summer and autumn.

Key words: General Circulation Model; headwater; Yellow River; maximum (minimum) temperature; scenario; downscaling

Genetic Algorithm Used for Optimization in Decision Makingin the Operation of A Multi-Objective Water Resources System

Fang Hong-yuan

Yangzhou University, Yangzhou, Jiansu Province, 225009, China

Song-kai Yan

Shaw Environmental & Infrastructure, Inc., Baton Rouge, Louisiana, 70810, USA

Wang Hao

China Institute of Water Resources and hydropower Research ,Beijing, 100044, China
E-mail:hyfang4936@yahoo.com.cn

Abstract: The optimization in decision making for the operation of a multi-objective water resources system applying genetic algorithm (MODGA) is presented. Based on the principle of genetic algorithm the solution structure is expressed in floating point vector, and following the coordination principle of multi-objective decision making, the goodness-of –fit is defined as the standardized distance between real objective point and ideal target point. The convergence process by applying this methodology proves to be effective for the model constructed and the reasonableness of the computational results is demonstrated by an example.

Key Words: multi-objective decision; water resources system; genetic algorithm

Experimental study on beneficial reclamation of oilfield produced water

Wang Beifu[1], Yu Shuili[1], Dong Xigui[2], Ban Hui[2], Miao Baolin[2]

1.School of municipal & environmental engineering, Harbin institute of technology, Harbin, China, 150090;

2.The No. 2 oil production factory of Daqing oilfield limited company, Daqing, China, 163414

Tel：13845190557

E-mail: wangbeifu@sohu.com

Abstract: Oilfield produced water is one that is extracted from stratums along with crude oil, which not only contains certain amount of crude oil, suspended solids and bacteria, but also possesses high demineralization degree with plenty of anions and cations. In the past, oilfield produced water was usually treated with removal of oil and suspended solids to achieve injection water standard and then reinjected into stratums. It not only savedfresh water but also disposed oilfield produced water to avoid discharged oily water polluting environments. However, with Daqing oilfield entering later phase of highly containing water, the exploitation theory of less water injection and steady oil production was put forward in terms of geology, which resulted in reducing injection water quantity for reservoirs. It is, therefore, emergent to solve the disposal of a mass of oilfield produced water.

In this paper, ultrafiltration(UF) and electrodialysis(ED) were combined to treat oilfield produced water. UF could get rid of 99% of crude oil and suspended solids, and almost 100% of bacteria; ED could remove 95% of total dissolved solids(TDS) and make this sewage attain farmland irrigation water quality. Consequently oilfield produced water was reclaimed to be irrigation water and beneficial disposal of this wastewater was accomplished.

Key words: ultrafiltration(UF); electrodialysis(ED); oilfield produced water; irrigation water

Uranium ISL Mining and Leach-field Groundwater Administration

Zhang Xiaowen, Li Qin, Zhou Yaohui, Lei Zeyong

Nanhua University, Hengyang 421001, Hunan, China
mail:shawn_zhang@sina.com

Abstract: Key elements for integrating sustainable development goals are water safety and energy efficiency. At present, two main directions are guiding uranium exploration and mining throughout the world. One is looking for unconformity type U deposits. The other is ISL(In Situ Leach) sandstone U deposits. ISL mining has shown economic efficiency and has limited adverse influence on the environment. In recent years, in accordance with the geological setting and practical conditions in china, the main prospecting project has targeted on ISL sandstone U deposits and significant success has been achieved. ISL uranium mining may result in a serious ecological problem. These characters are as follows: long-term, invisible and difficult to restore. The main environmental impact of ISL mining is ground water contamination. So, it is necessary to assess the environment impact and offer Countermeasures and Groundwater Administration regulation for ISL deposits to reduce impact and protect environment.

Taking the No.512 uranium deposit as an example, there are many methods to prevent or reduce environment impacts. Such as, laying down radiation protection and environmental legislation; keeping the solution volume from recovery well more than that of the injection wells; building strict computer analytic model and mathematic model of ISL blocks and ground water polluted blocks; pumping ISL residual liquid in the first mining block to second and third blocks; pumping ISL residual liquid from mined blocks by pumps or compressed air continually to replace it by inpouring fresh water from the outside of the mining block; injecting remediation reagent; boring protection wells to form water screen; building a grouting screen; using microorganism method etc..

A GIS-based distributed non-point source pollution modeling approach applied to the Poyang Lake Watershed

Baojun ZHANG[1], Xiaoling CHEN[1], Peng GUO[1], Shaogang ZOU[1], Zhirui HU[2], Haichong YU[2]

[1]State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, Wuhan, China, 430079, baojunz@126.com,
Fax: 86-27-68778229, Telephone: 13517210308
[2]School of Resource and Environmental Science,
Wuhan University, Wuhan, China, 430079, ruirui8096@163.com

Abstract:Poyang Lake watershed mainly consists of Poyang Lake and its five sub-watersheds. Poyang Lake lies in the northern part of Jiangxi Province, at the southern bank of the middle and lower reaches of Yangtze River, it hold water from its five rivers -- Gan River, Fu River, Xing River, Rao River and Xiu River, and emptied into Yangtse River at Hukou after storing up. Its wetlands, the largest bird habitat in Asia, play an important role in biodiversity and ecologic protection. But, with the rapid economic growth and urbanization, the wetlands in Poyang Lake area have been keeping shrinking and face many environmental challenges. Because of lack of data and/or difference of data criterion, it's more difficult to apply foreign models to national study areas. Therefore, to better understand the environmental and ecologic change of Poyang Lake watersheds, this paper proposes a GIS-based non-point pollution modeling approach for the determination of rainfall runoff response and flood routing and especially non-point source pollution through a watershed. In order to meet the goals of this study, all the data are organized by establish a personal geodatabase of Poyang lake watershed, and computational input data are all ESRI GRID format, and also a useful flood and non-point source simulating tool is developed based on ESRI ArcObjects technology and Microsoft Visual Basic programming language. Runoff simulation and prediction is an important and essential project in flood prediction, water management studies and so on, especially non-point source pollution simulation in this study. Firstly, Digital Elevation Model (DEM) data is used to extract topographic structure for GIS analysis, precipitation grid dada generated from rain gauge data based on Kriging interpolation method. In respect that there are not enough data and SCS model can be used to modeling areas without data, so it is chose to generate runoff coefficient of different land use/cover. The watershed channels are delineated based on the upstream area above each cell and channel flow depth for each cell is calculated using linear interpolation method based on in situ observation data, overland flow velocity is estimated using a kinematic wave approximation, and channel flow velocity is calculated in each cell by the Manning equation based on the local slope, roughness coefficient, wetted perimeter and channel cross-sectional area. Then, travel time of runoff for each cell is calculated and a GIS method is used to sum the travel time to outlet trough each cell in the optimal path. Therefore, a spatial distributed unit hydrograph (SDUH) model is developed to directly

reflect spatial variation in the watershed in generating runoff hydrographs. Based on the hydrologic modeling method having talked above and pollution Event Mean Concentration (EMC) gird data, a cell by cell method is used to predict pollution load for each cell in a rainstorm event, and also simulated pollution concentration for watershed outlet variable can be visualization in time.
Keywords: non-point source pollution, distributed hydrologic model, spatial distributed unit hydrograph, GIS, Poyang watershed.

Country drinking water security GIS in the mountainous and hills region of western most edge of Sichun natural basin of China

Fuquan Ni，Rongchao Ma & Lihua Zhang

College of Information and Engineering, Sichuan Agricultural University,
Yaan City, Sichuan Province , 625014, China
E-mail:nfq1965@sina.com

Abstract: Based on the investigation of the problem of country drinking water security in the mountainous and hills of western most edge of Sichun natural basin of China, the authors analyzed and assessed the problem. Country drinking water security GIS(CDWSGIS) of the Yaan city was established in order to sustain development the mountainous of western most edge of Sichun natural basin of China. CDWSGIS are composed of six inquiry subsystems and four user tool subsystems. In many ways, the powerful function is provided in CDWSGIS for the treatment of the spatial datum, the graph images and the text information. The function includes information collection, storage, management, analysis, assessment, change, inquiry, exportation and renewal.

Grey correlation analysis between incidence of liver cancer and drinking water quality in eastern-south coastal areas of china

Fuquan Ni，Rongchao Ma & Lihua Zhang

College of Information and Engineering, Sichuan Agricultural University,
Yaan City, Sichuan Province , 625014, China
E-mail:nfq1965@sina.com

Abstract: Based on the grey correlation between incidence of liver cancer in high occurred district and drinking water quality in fujian, jiangsu, guangxi, considering the basic features of the original environment and the secondary environment in study area, the author drew conclusions as follows:

Many factors are related with liver cancer, the drinking water isn't only one of the important factors; the contents of human body necessity components in drinking water in liver cancer high occurred district in eastern-south coastal areas of China, such as ,Ca2+, Mg2+, Mo, Zn, etc. are lower : Ca2+ of magnanimous components ,as well as Cu of the trace components , NO-2 , of the pollution index etc. factors are higher related with the incidence of liver cancer .

DRINKING GROUNDWATER QUALITY PROBLEM AND CONTROL OF KASCHIN-BECK DISEASE IN THE CHANGBAI MOUNTAINOUS REGION OF CHINA

Fuquan Ni，Rongchao Ma & Lihua Zhang

College of Information and Engineering, Sichuan Agricultural University,
Yaan City, Sichuan Province , 625014, China
E-mail:nfq1965@sina.com

Abstract: According to the ecological-environmental factors, such as climate, vegetation, geomorphology, the degree of the Kaschin-Beck disease and geology, hydrogeology, soil, the degree of original environmental transform as well as the difference of the disease, etc., the author divided the east of Jilin province into three ecological environmental zones, compares the situation among three zones, then drew conclusions as follows:

Kaschin-Beck disease of Changbai mountainous region grows in the ecological environment of magnanimous elements, trace elements deficiency obviously: Na, S are the most deficient magnanimous elements, Sr, V, Co, Zn, Se are the most deficient trace elements.

Considering the drinking groundwater quality problem, the authors gives good suggestions as follows.

1. In the basins among the mountains, should exert utmost effort to drill deep well for getting fissure water from bedrock as drinking water sources;
2. In the region of mountains, higher mountains and hills should exert utmost to recover spring which are deep-cycling or deep pressure water through faulted zones;
3. Na, S, Zn, Sr, V, Co and Se bearing wasted water in the mining of Na, S, Zn, Sr, V, Co, Se deposits are directly discharge into the environment.
4. Directly apply the Na, S, Zn, Sr, V, Co and Se to the environment.

Estimation of hydraulic characteristics of the shallow aquifer system, Qingtongxia Irrigation District Ningxia, China P.R.

Fei liangjun, Fang shuxing, Zhao xinyu

Xi'an University of Technology, Xi'an 710048, China
Email:fangshux@email.nx.cninfo.net

Abstract: One of the most effective ways of determining an aquifer's hydraulic characteristics is to conduct and analyze aquifer test .In this paper we will focus on the analysis of aquifer tests which were conducted with more observation wells at 24 sites in the study area ,particularly ,separate estimates of the hydraulic characteristic has been made for each well ,the various values being compared .and we have made yet another estimate of the hydraulic characteristics by using not the time-drawdown relationship ,but also the distance-drawdown relationship . The results from the aquifer tests were used to derive spatial distribution of the aquifer properties，with the result that a hydraulic characteristics map will be produced . Combining the results with the data available from the existing observaton-well network, a set of maps, including depth-to-watertable maps, watertable contour maps and electrical conductivity maps, may be produced showing locations and information of the aquifer system in the district

Key words: Hydraulic characteristics; Shallow aquifer; Aquifer test; distance-drawdown relationship

Extract average hillslope length and the application to SWAT Model

Jiang Hai, Huang Jie-sheng, Wan Xi-chun ,Zhao Wei

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, Hubei, China
E-mail:fox031@sina.com

Abstract: Average hillslope length is an important characteristic parameter of the watershed and is widely used in the distributed hydrologic model and water erosion prediction model. The process of manually identifying hillslopes length is very time consuming and can be subject to large variation between users. Furthermore, the representation of hillslope profiles is subjective and can differ between different modelers. Two methods about how to extract this parameter from digital elevation model were discussed in this paper. The results were applied to SWAT hydrologic model and the sensitivity to the model was analyzed.

Effect of DEM Data resolution on extracted landscape parameters and runoff simulation in SWAT Model

Jiang Hai, Huang Jie-sheng, Wan Xi-chun, Zhao Wei

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, Hubei, China
E-mail:fox031@sina.com

Abstract: SWAT model is a highly physically based distributed hydrological model which can use GIS and RS data to simulate different hydrological and physical process of complex watershed. DEM data is fundamentally spatial data of the SWAT model, whose resolution will affect the delineation of the watershed and extraction of landscape parameters. Further more DEM data resolution will affect the prediction of stream flow and sand transportation. This paper describes the effect of DEM data resolution on predictions from SWAT model using six scenarios at increasing DEM grid sizes(75m×75m，100m×100m，200m×200m，300m×300m，500m×500m，1000m×1000m) based on the data of Huangbehe watershed. Results show the DEM data resolution affects the watershed delineation, shape of stream and sub-basin classification in the SWAT model. A decrease in DEM resolution resulted in decreased average slope and a increased average slope length. When the DEM data resolution range around the watershed average slope length, the daily stream flow simulation gets better results.

Artificial Neural Network Model for Groundwater Level Forecasting of the Minqin Region in Northwest China

Zai-lin Huo, Shao-yuan Feng, Wang-cheng Li, Shao-jun Cheng，Wei-Wang

Center for agriculture water research in china, China Agriculture University.
Beijing 100083, China. huozl@163.com

Abstract: The minqin is a typical interior region that faces water shortage and ground water is a main water resource in the northwest china. As human activity's effect, with its arid climate, this region's ground water level has a greatly dropped. Based on analyzing changes of several main human activities and climate indexes including population, irrigation field area, inflow into Hongyashan reservoir, precipitation and water surface vapor, this study have established a ANN model which input factors are the above six indexes and output factor is minaqin's year average groundwater level. The testing result with 6 years data shows that the model has highly precision. A sensitivity analysis was conducted with the established ANN model that quantified the importance of the various input predictor variables on final water level elevations. The study result showed that the most important factor affecting minqin year period groundwater level is the initial groundwater level and irrigation field area, the others order is the run-off of hongyasha reservoir, precipitation, water evaporate and population. The sensitivity analysis's result is consistency with the local actuality that human activity has strongly affected the groundwater changes and the ANN model can effectively predict the groundwater changes under the condition of simultaneity of arid climate and human activities. Unlike traditional physical-based models, ANN predictions was made on the basis of more easily quantifiable, measured variables, rather than physical model input parameters and condition. This study demonstrates that ANN can provide both excellent prediction capability and valuable sensitivity analyses, which can result in more appropriate ground water management strategies.

Using ASTER Remote Sensing Data for Catchment Rainfall Runoff Modeling

LING Feng，WANG Cheng，ZHANG Qiu-wen

Institute of Remote Sensing and Spatial Information Science,
HuaZhong University of Science and Technology, Wuhan 430074,
CHINA
Tel: (86)-27-87544644
E-mail: lllingfeng@yahoo.com.cn

Abstract: Regional spatial hydrological relative information is becoming more and more important for catchment rainfall runoff modeling, especially for distributed hydrological models. However, the maintenance of these GIS information for hydrological models is insufficient in many areas and makes water management and flood disaster prevention is difficulty. To reduce these problems, the use of remote sensing data to obtain the information stable accuracy, short a time and low cost is the most effective. Recently, ASTER remote sensing data provides a means of observing hydrologic state variables over large areas. Both the Digital Elevation Models (DEMs) and land cover products, which are primary inputs for hydrologic models of surface runoff that affects infiltration, erosion, and evapotranspiration, could be derived with ASTER data. The object of this paper is to evaluate the quality of ASTER remote sensing to derive these hydrological relative parameters for rainfall runoff simulation in regional area.

The Qingjiang catchment located in HuBei province is chosen in this research. Relative DEM is firstly extracted from ASTER stereo imagery (3N and 3B images) based on the principle of automatic stereo correlation. Some important hydrological parameters such as drainage basins, catchments and sub-catchments are derived from this DEM dataset with GIS software. Then ASTER VNIR and SWIR imagery was used for a hydrologic land cover classification and mapping, which must include information not only on vegetation species, but also on land surface and what classes are important hydrologically. This kind of classification in this study incorporates information on elevation, slope, aspect, surface roughness, and vegetation species derived from satellite added-value products.

To access the ability of derived hydrological parameters from ASTER remote sensing data for rainfall–runoff modeling in regional scale, two widely used hydrological models were used for validation in this research. The first one is TOPMODEL and the second one is HEC-HMS package with SCS-CN based methods. The result shows that both hydrological models used in this research should simulate the hydrograph efficiently and ASTER remote sensing data should be a promising new means to obtain important hydrological relevant parameters for hydrological researches.

Applications of the hybrid accelerating generic algorithm in parameter optimization of hydrology model based on the niche technique

LI Na MEI Ya-Dong WANG Xiang-San ZHAO Wei

State Key Laboratory of Water Resources and Hydropower Engineering Science,
Wuhan University, Wuhan 430072, China
E-mail: lina_whu@163.com

Abstract: In order to improve the capability of the traditional algorithm of parameter optimization in hydrology model, a hybrid accelerating genetic algorithm (HAGA) based on niche technique is suggested, adding locally searching operator and accelerated searching operator in real coding genetic algorithm. This method could avoid the results of GA excessively depended on the initialization and convergence at a much earlier stage, The HAGA is successfully applied to the parameter optimization of the Hepu basin model, Guangxi Zhuang Autonomous Region of China. The results show that this method has not only better optimization capability, but also better accuracy. It is a superior non-linear optimal method which could locally search the global solution for greater probability.

Keywords: parameter optimization; hydrology model; hybrid accelerating genetic algorithm; Niche techniques

A Simple Method for Simulation of Flood Submerging Range based on GIS

Wei Bai[1], Xiaohui Lei[2]

[1] College of Water Conservancy and Civil Engineering, China Agricultural University, Beijing 100083, China

[2]Doctor' Program in Life and Environmental Science, University of Tsukuba, 31-503 Ichinoya, 2-1 Tennodai, Tsukuba, Ibaraki, 3050006, Japan

E-mail:microwhite@126.com

Abstract: The fundamental work in the Flood Risk Analysis is to simulate the flood submerging range that is included in the computation of flood process. The essential of the flood submerging simulation is to simulate the flood spreading process on the geographic space, the flood submerging range, submerging depth and the extent of disaster that was caused by the flood under various designed levels.

In this paper, **Volume method** was put forward to simulate the flood submerging range, which is based on Geographic Information Systems (GIS). The essential of the Volume method is that according to gravity characteristics that flood flows from high position to low and variation of terrain, the principle is used to simulate the flood submerging range, which could be expressed as that the flood volume bursting from the river equals the flood volume in the submerging range. Following this principle, the theoretical formula of the Volume method to compute the flood submerging range was put forwarded firstly; and then the discrete method was used to solve the numerical solution of this formula; finally, the model based on **Volume method** was built. And the computer program was developed to achieve the whole computing processes.

Data needed for Volume method are: (1) the flood volume bursting from river; (2) discrete elevation data in the submerging range. The formula of the broad-crested weir without bank was used to calculate the dike burst. And the whole process was realized with the computer programs written in FORTRAN. In addition, grid format of GIS was used to establish the discrete elevation data of the flood submerging range.

Finally, **Volume method** was used in analyzing Mudanjiang urban flood submerging simulation and the flood submerging simulation under the condition of the dam burst caused by one percent frequency flood was given.

Keywords: Volume method, flood risk analysis, flood submerging simulation, flood submerging range

Fuzzy pattern recognition coupled with Nerve Network based on the BP and the Genetic algorithm making for hydrology forecast: model and application

Ranhang Zhao* and Shouyu Chen

Water Resources Research Group School of Civil & Hydraulic Engineering
Dalian University of Technology Dalian 116024 P.R.China
mail:ranhang-z@sdu.edu.cn

Abstract: Hydrology forecast is generally complex in nature as it is often associated with a large quantity of uncertain factors in combination of non-commensurable criteria. It has been found that the use of Artificial Neural Network methods is very promising. (ANN) has self-organization, self- adaptability and self-study function. Pro. Chen established the network topological configuration (i.e. the layer node number imported and implied) by combining the fuzzy pattern recognition model with the artificial neural network theories and put forward the neural network forecasting model with the fuzzy pattern recognition. In the model, he brought forward a BP model adjusting the weights of the forecasting system by using BP arithmetic.

Although BP arithmetic has an ability to accurately optimize, there often are two problems resulting from the randomicity of initial weights in the network model: first, the training times of every time and the final weights are different, respectively, so the optimal value may have not only one, and appear local minima. Then, the randomicity of given initial weights can result in more training times and slow rate of convergence. The two problems restrain its further application in the real-time forecasting for hydrology.

Considering that genetic algorithm (GA) is a kind of global search arithmetic concurrently, based on natural selection and genetic rule, and possesses the stronger macroscopical search ability (i.e. using the arithmetic, global optimum can be obtained), which can overcome the problem of getting local minima in BP arithmetic. In this paper, combining BP with GA, a fuzzy pattern recognition model coupled with nerve network for hydrology forecast is established. First, network training is carried out by using GA; then, the weights are accurately computed, and a range of values for weights can be obtained; finally, global optimum can be obtained with network training in the range avoiding the appearance of local minima. One operation case (forecast the annual runoff of Yamadu station by using the measured data of runoff and four antecedent forecasters) is provided to illustrate the application of the proposed model. The results show that the proposed model is flexible in medium-long-term hydrology forecasts and can reach more practical hydrology forecasts in lacking data or ungauged basins, and that the method has global and accurate optimum, as well as a quick rate of convergence.

EVALUATION OF GENETIC ALGORITHM IN SCS-CN METHOD

S.Mohammed Mortazavi.N, Graduate Student

Smohammad.mortazavi@gmail.com

Department of Civil Engineering, KH.N.Toosi University of Technology, Tehran, Iran

P. Suresh Babu, PhD Candidate

CSIR-SRF, Institute of Remote Sensing, Anna University, Chennai, India

Abstract: Calibrating the most appropriate parameter is one of the crucial stages in dependable rainfall-runoff modeling. This paper evaluates the computational performance of Genetic Algorithms used for calibration of CN and λ parameters of the Soil Conservation Service Curve Number (SCS-CN) model in optimization. Various methods of GA are proposed. Employing standard error of estimate (S_e) and standard error ratio (SER), the performance of various methods of the algorithms was tested on a large set of US data.

Key Words: GA, Calibration, Hydrology models, SCS-CN

Analysis for Annual Maximum Precipitation Series for State of Selangor Using Probability Weighted Moments

Masimin* and Sobri Harun**

* Masimin, Graduate Student Fakulti Kejuruteraan Awam, Universiti Teknologi Malaysia Skudai, Johor Bahru, Malaysia. E-mail:masimin@plasa.com

** Sobri Harun, Associate Professor, Fakulti Kejuruteraan Awam, Universiti Teknologi Malaysia Skudai, Johor Bahru, Malaysia.

Abstract: The knowledge of statistical hydrology have played an important role in engineering practice for water resources design and management. Estimation of a design storm is an unrest topic in statistical hydrology that needed in a broad spectrum in civil works. Hydraulics structures for large water resources project to retain water must be designed to pass extreme flood events without significant damage. When this condition applied, it is recommended to use probable maximum precipitation (PMP) method in determining the design storm. It is designed for a probability of ever occurring that is close to zero, so the structure is safe under extreme meteorological condition. An annual maximum rainfall data for 1-day, 3-day, 5-day, and 7-day from 34 stations distributed in the State of Selangor is available to be analyzed. The length of records for each station is longer than 30 years and some of them are longer than 60 years.

There is a Hershfield approach (1961) in literature for statistically calculating PMP estimates, that is widely accepted and is used primary for making quick estimates for watershed of no more than 1000 km^2. The value of PMP is an addition of mean value and the multiplication of standard deviation with a frequency factor. The frequency factor is determined based on the maximum rainfall data and its values are in between 3.0 to 14.5. Since a direct application in determination the value of K_m based on Hershfield approach to be avoided, it proposed that a 5000-year return period will be used in calculation oh K_m. and mean value for one-tenth greater data will be used to replace the mean value. In determining the value of K_m based on recurrence interval or return period (T) and mean value for one-tenth greater data are considered to the methodology. The value of K_m is also depending on the type of distribution. Zalina (2002) found that rainfall data in Selangor region followed some type of distributions, such as the generalized extreme value (GEV), gamma (GAM), and log normal (LN) distributions. Every data set out of 134 is analyzed to fit on of these three types of distributions, before calculating its parameter and quantile estimates based on the probability weighted method (PWM).

After statistically analyzing the whole 134 data sets, it shows that about 47%, 12%, and 41% of data sets follow the GEV, GAM, and LN distributions respectively. The results of PMP calculation for methods, recurrence interval and mean of one-tenth greater data, are comparable to get its ratio. The ratios between the methods for four groups of data are 0.9292, 0.9171, 0.9403 and 0.9250 for 1-day, 3-day, 5-day, and 7-day rainfall data respectively. Since the ratios are greater than 90%, it is concluded that Hersfield method for PMP calculation can be used directly by replacing the mean value with the mean value of one-tenth greater data.

The Technique of Complex Recharge Estimation for Groundwater Flow Simulation in Tropical Floodplain with Quaternary Sediments, Thailand

Phattaporn Mekpruksawong[1)] Tsutomu Ichikawa[2)] Tadashi Yamada[3)]

[1)] Royal Irrigation Department, Thailand
[2)] Depart of Civil Engineering, School of Engineering, Kyushu Tokai University
[3)] Depart of Civil Engineering, Faculty of Science and Engineering, Chuo University
E-mail:phatta05@yahoo.com

Abstract: The modeling of the 3-D unconfined aquifer groundwater flow (GWF) in tropical floodplains with quaternary sediments is rather complex for several factors concerning the input data. The groundwater flow mechanism becomes complicated by the recharge water (i.e., penetration of flood water, river water, rainwater, water held in rice fields, agriculture ponds and commercial sandpits) and the local soil layer structure that has long been affected by the flood sediment from the river. This paper presents the technique of recharge rate estimation by the Thiessen polygon tank model with the use of field observation data and the application of the Visual MODFLOW program for the 3-D unconfined aquifer groundwater flow simulation. The simulated groundwater level appears to be in accordance with the observed values with the exception of a few certain locations. In addition, the simulation results indicate that in tropical floodplains, floodwater recharge is the main income of unconfined groundwater. The water balance shown that groundwater level can be rise up 13-124 cm if farmer use surface water instead of groundwater.

Key Words: Groundwater, Floodplain, Pumping, Recharge, MODFLOW

Water Cycle Mechanism in Semiarid Area

Ye Aizhong[1], Xia Jun[1, 2], Qiao Yunfeng[2] and Wang Gangsheng[2]

[1] State Key Lab. of Water Resources & Hydropower Engineering Sciences, Wuhan University, Wuhan 430072, China
[2] Key Lab. of Water Cycle & Related Land Surface Processes, Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China
E-mail: aizhongye@etang.com, azye@163.com

Abstract: Finding out the water cycle mechanism is an important hydrological question in semiarid area. The result of simulation and forecast is not very good, because we insufficiently knew water cycle mechanism. A Distributed Time-Variant Gain Model (DTVGM) was developed, which relied on the rain-runoff experiment of Chabagou catchment in Yellow River basin. The DTVGM is a water balance model and it bases on system theory and physical mechanism. The DTVGM have three time yardsticks: month, day and hour, corresponding three spatial yardsticks: large basin, medium and small catchment. The rain-runoff experiment was done in 1960-1969 year and 2003-2004 year in Chabagou catchment. We can get the value of the field capacity, the saturated water capacity, the covering affecting flow parameters and so on. The DTVGM can run by these parameters. The monthly model and hourly model simulation result is very good, the Nash-Sutcliffe Efficiency Criterion (NSEC) is greater than 0.80. The daily model simulation result is not very good, NSEC is about 0.8. The data of model are in 1960-1969 year and 20th 70-90s in Dali River, Xiaoli River and Chabagou catchments. Through the experiment and the model simulation, we may realize: in semiarid area, because precipitation is fewer than 600mm and not continuously, and degree of vegetation is low, the soil is thick, even if in the flood season, the soil seldom can achieve the saturated condition, these has caused runoff process was sharp. Using the model, we can quantify the runoff change by land use and cover change.

Key words: semiarid area; experiment; DTVGM; water cycle mechanism

Experimental studies on the effects of circle rate on transfer and distribution characters of soil moisture and nitrate nitrogen of intermittent infiltration under surge flow irrigation

Jia Hui[1] Fei Liangjun[2] Zhang Hongwei[1,3]

1. School of Environmental Science and Engineering, Tianjin University，Tianjin 300072, China；
2.Institute of water resources Xi'an University of Technology, Xi'an 710048, China;
3. Tianjin Polytechnic University, Tianjin 300160, China

Abstract: The optimal combination of technical elements in surge flow irrigation can make the best water saving and irrigation effect. Among those elements the circle rate *r* directly affects the development of the water sealing layer, therefore weakens the infiltration reduction and the increase of advancing velocity of furrow flow under periodic water-supply. In this experiment, a simulated indoor environment, a vertical one-dimension intermittent fertilizer infiltration, with 70cm of ground water table, was set up. In the experiment, the influences of circle rate on the infiltration reduction, the transfer and distribution character of moisture and nitrate nitrogen in the soil and the consistency distribution of nitrate nitrogen in the ground water were studied. The results indicate that with the same water supply, the smaller the circle rate is, the better the water sealing layer develops, and the stronger the infiltration reduction is. Meanwhile the moisture and nitrate nitrogen would distribute in shallower soil layer, therefore the leaching trend of nitrate nitrogen weakens. In the ground water, the nitrate nitrogen mainly distributes in the upper part and its concentration decreases evidently with the circle rate reduces.

Key words: surge flow irrigation intermittent infiltration circle rate infiltration reduction nitrate nitrogen ground water

Sensitive Analysis for the Parameters in SWAT Model Based on Monte Carlo Method

LIU Xing[1]、XIA Jun[1,2]、WANG Zhong-gen[2]、WANG Gang-sheng[2]、LIN Yao-ming[2]

1. State Key Laboratory of Water Resources and Hydropower Engineering Science
Wuhan University, Wuhan 430072
Hubei Province, P.R.China
Tel: 010-64889010 027-68773772
E-mail:lxing20001@126.com
2. Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing, China

Abstract: SWAT model is a distributed hydrological model, which is physically based and can be used on ungauged basins. It gets frequent development and application in recent years. This paper used a new multi-parameter sensitivity analysis method which based on Monte Carlo method to analyze the sensitive of parameters in SWAT Model. Firstly, a stochastic method was used to generate a random parameter series which based on the prior distribution, then inputted the parameter series to the SWAT model, and compared the result sequence with the serviceable rating data. Then, a quantifiable method was used to estimate the acceptability of every population of parameter which based on the simulation residual. Finally, the sensitivity of main parameters was achieved, and the relations among parameters CN，SOL_Z，SOL_K，SLSOIL，CANMX，ESCO，EPCO etc and rainfall-runoff were also calculated. Lastly, the SWAT model was applied to simulate the rainfall-runoff relationship in the Qianyanzhou basin. The results show that the model make a good simulate result, and can be used widely to some extent.

Key word: SWAT model; Monte Carlo method; sensitive analysis; distributed hydrological model

Weather Radar- Based the Rainfall Data Assimilation

LI Lu[1]， XIA Jun[1, 2]

1.Wuhan University, Wuhan 430072,China;
2.Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101,China

E-mail:marylilu@163.com

Abstract：Precipitation is one important key element of hydrology circulation. The amount of precipitation especially its space distribution determines directly the changing course of the flow in the basins. So the studying of the characteristic of high-accuracy precipitation space-time distribution has very important theoretic value and a good prospect of using. Because the precipitation stations distributes sparsely in basins, only utilizing rain gauge data to get precipitation space distribution has a lot of issues. In recent years, with the introduction of the remote sensing technique, lots of domestic and international hydrologists are devoted to the research of radar estimating rainfall technology. There are some algorithms of radar estimating precipitation at home and abroad now. Different algorithms have different characteristics, but some limitations and problems exist.

This paper introduces the R-G Method that estimates the rainfall spatial distribution based on radar rainfall data. The precision of rain gauge data is high and the spatial distribution of radar rainfall data is applicable. In this paper, the idea of the R-G Method is that radar rainfall data are used in conjunction with rain gauge data that is capable of adequately capturing the spatial detail of the precipitation that is more precise. This method doesn't have high expectations for the density of the rainfall station distribution. And it isn't restricted by the objective data conditions. And there is also no restriction that chooses parameters. The more important thing is that it is simple and convenient to operate and the result of the rainfall distribution is corresponds to reality. The R-G Method is superior to the other methods in many aspects both at home and abroad, which utilize rain gauge data to correct radar rainfall data to estimate the rainfall spatial distribution.

The research firstly introduces four kinds of the precipitation data assimilation approaches and the weakness of these methods. Secondly, the research introduces the basic steps of the method that is using radar rainfall data and rain gauge data to estimate the rainfall spatial distribution, especially proposes that utilizing the rain gauge data to regulate radar rainfall data to estimate the precipitation with the R-G Method. In the case study of an east area in Hubei province that is more ideal in rainfall station's density, various traditional data assimilation methods and the R-G Method are applied to calculate the spatial distribution of the rainfall in this research. The cross-validation method is used to examine the precision and applicability of all the approaches, and to compare and to analyze the characteristics of each method, such as the pluses and minuses, space distribution and so on. In the end, the instance shows that the R-G Method that this paper puts forward can truly reflect the characteristics of rainfall space distribution, and have improved the precision of the precipitation data.

Key words: data assimilation； radar rainfall； spatial distribution； rainfall

WATER BALANCE EVALUATION AND REGIONALIZATION OF ALBANIA RIVERS BASIN

NIKO PANO, BARDHYL AVDYLI

E-mail:bavdyli@icc-al.org

Abstract: In this paper, it is attempted to present a general evaluation of the water balance in the Albanian rivers system including regionalization of the catchment area of this system, according to the correspondent types of the water balance. Albanian territory is one of the most complicated natural area in the Europe because of its physiographical specific conditions: mountainous region with an average altitude of 785m above the sea level, particulary littological structure with an important calcare formation, lake system present, typical Mediterranean climate, specific geographical position near the Adriatic and Jonian seas etc. Water balance evaluation was carried out based on the many years archived data of the Albanian hydrometeorological Institute. The monitoring network consists of more than 175 hydrometric stations with observed periods of 20-50 years, 125 pluviometric and 35 pluviographic stations with 15-45 years observed period and 9 experimental stations typ GGI for the evaporation evaluation of water surface with 10-15 years observed period. this stations are located all over albanian territory. All the maps of the water balance components and their principal parameters are compiled to the national topographical maps of 1:750000 scale.Values of these elements were computed based on their vertical gradients of the territory. The annual precipitation in the Albanian hydrographic network ranges from 750 mm in the coast area to 4444 mm in the mountain with a average of X_0=1540 mm. The water potential of Albanian river system is W_0=41,249.$10^9 m^3$ that corresponds to a discharge of Q_0=1304m^3/s and a module of q_0=30.1 I/s.km2. Estimation of run off discharge (Qi) are carried out in two categories of river basins with different hydrographical and hydraulically Condition: 1) Drini, Mati, Semani and Vjosa rivers systems , etc, where run- off discharge Qi is computed as a function Qi=f(Hi),where Hi- is altitude of water level of the river section i. 2) Sentary lake ,Drini river system,etc where where run-off discharge of the Buna river Q2 that flows away from the Sentary lake-Q2, depends upon the lake water level (H2) and the Drini river discharge into the Buna river Q4. Buna discharge was calculated by the following equation (Pano,1973,1984,1994,2003)

$$Q_2=\{ 0.025.[H_2 - Q_2^2/ (0,0073.H_2^{1.6143})^2]^{1.85} – Q_4\} \quad (1)$$

So Albania is one of the countries of a high specific water potential in Europe. The annual run-off level in the Albanian hydrographic network ranges from 250 to 2800 mm with a average all over catchment area y_0=957 mm .The surface water flow represent 69% of the global water potential (y_0=656 mm) and underground flow 31%(Y^N_0=295 mm).The real evapotranpiration in the Albanian hydrographical network ranges from 300 to 800 mm. Map of the regionalization of the catchment area of the Albanian river system according to the correspondent types of the water balance is also presented.

Keywords: water balance components,regionalisation, global territory humidity, water potential, Catchment, water potential.

Risk management for the improved operation of the Three Gorges Dam using seasonal streamflow prediction

Kaiqin Xu[1,2*], Casey Brown[3], Hyun-Han Kwon[2], Abedalrazq Khalil[2] ,Upmanu Lall[2,3] and Masataka Watanabe[4]

1) Watershed Management Research Team, National Institute for Environmental Studies, Tsukuba 305-8506, Japan
2) Department of Earth Environmental Engineering, Columbia University, NY 10027, USA
3) International Research Institute for Climate Prediction, Columbia University, NY 10964, USA
4) Faculty of Environmental Information, Keio University, Kanagawa 252-8520, Japan

*Corresponding author: joexu@nies.go.jp or xk2103@columbia.edu

Abstract: The Three Gorges Dam on the Yangtze (Changjiang) River is one of the world's largest reservoirs with a critical role in energy provision, flood control, irrigation, navigation and water quality management in China. The proposed South-North Water Transfer Systems further enhance the national role played by this dam and by other upper Yangtze dams in China's economy. Given the dramatic inter-annual variability in the monsoonal climate of the region, a multi-scale strategy for the reliable multi-objective operation of the system is needed. Current operating rules for the system are based on a traditional seasonal storage allocation strategy with monthly, seasonal and end of year storage targets, i.e., rule curve operation. Given the complexity of the system and the need to manage and respond to flood events as well as schedule storage for droughts, this is a reasonable and practical strategy.

As data collection and modeling efforts have enabled real time flood forecasts and seasonal inflow forecasts, a natural question that arises is whether a more proactive reservoir management strategy is feasible. The key issues involved with this transition, including potential physical and social/policy constraints, objectives and opportunities and the adequacy of available tools is first reviewed. Based on this review, we explore whether reliable seasonal inflow forecasts can be developed and used for the Three Gorges system.

First we demonstrate that climate informed, probabilistic streamflow forecasts, at the Yichang hydrological station are feasible for the summer monsoon through modeling and analysis of the historical record. Cross-validated statistical forecast models using a suite of Sea Surface Temperature and Atmospheric data demonstrate significant forecast skill (forecast to observed correlation >0.7) at 3 month lead times. Prospects for extending and improving this method to year round forecasts of inflow disaggregated to monthly time steps and including time series information from the streamflow series are discussed. The resulting forecasts could be presented as either conditional probability distributions or as ensembles over a one year time span.

Next, we use reservoir systems simulation to develop a sensitivity analysis of how the multiple objectives of reservoir operation respond to incremental changes in the storage allocation rules, over average, dry and wet years, and with respect to the storage in the reservoir at the beginning of the period. This sensitivity analysis is then used together with the forecast skill information to assess the periods /conditions during which it is most desirable to modify reservoir operating rules given a probabilistic forecast of the remaining period. Simulations that implement the new/proposed operating rules using the forecasts we developed are then implemented and the potential gains for different aspects of reservoir use are demonstrated. The potential for a formal optimization strategy is also discussed.

Keywords: Climate indices, streamflow prediction, risk management, Three Gorges Dam, Yangtze (Changjiang) River

Monthly streamflow simulation for Upper Changjiang basin above the Three Gorges, China

Tian-yu Long[1], Ming-ko Woo[2] and Robin Thorne[2]

[1]School of Urban Construction and Environmental Engineering, Chongqing University, Chongqing, China, 400045
email: Longty128@yahoo.com.cn
[2]School of Geography and Earth Sciences, McMaster University, Hamilton, Ontario L8S4K1, Canada

Abstract: Upper Changjiang (or Yangzi River) rises from the Tibetan Plateau and flows along deeply incised valleys in southwestern China before passing through the Sichuan Basin to exit the Three Gorges. Ability to simulate the flow input to the Gorges permits reconstruction of past hydrological events and prediction of flow changes under climatic change scenarios. Using the SLURP (Semi-distributed Land Use based Runoff Processes) macro-scale hydrological model, and temperature and precipitation from the ERA40 (European Re-analysis of Global Atmospheric) data, monthly flows of the main trunk river and its major tributaries are simulated successfully. Simulated monthly discharge at Cuntan in Chongqing compares well with 16 years of flow record, as do the simulated and observed monthly flows of two test sub-basins (Jinsha and Jialing rivers). Forty-five years (September 1957 to August 2002) of simulation (total length of available data from ERA40) indicates high discharges in the 1960s, followed by a decline in the 1970s and a subsequent gradual increase towards the end of the 20th Century. These annual flow tendencies closely follow the variation in precipitation, notably with large flows during periods of high rainfall. Winter is a low flow season. Much of the basin runoff in the spring and early summer (April to June) comes from the eastern areas, but the western sector is responsible for over half of the flow between August and November. An examination of flow contribution from the main tributaries indicates that the headwater Jinsha basin provides about one-third of the annual flow, while Jialing River produces about one quarter of the total flow at Cuntan. A comparison of monthly discharge with precipitation suggests that the flow of Changjiang at Cuntan lags basin rainfall by one month but the correlation is highly significant. A runoff ratio of about 30-40 percent indicates that much of the basin precipitation is lost to evaporation.

Study on Multi-objective Scenario Analysis Method for Assessment of Water Resources Carrying Capacity

CHEN Shao-jun , FENG Shao-yuan , LI Wang-cheng , HUO Zai-lin , Wang Wei

Center for Agricultural water Research in China , China Agricultural University, Beijing 100083,China
E-mail:chensj@cau.edu.cn

Abstract: Many evaluation methods were presented on water resources carrying capacity(WRCC), but lack of large-scale system and multi-objective comprehensive model which can describe complexity and dynamic of WRCC. In this paper, the multi-objective scenario analysis method of WRCC is improved based on some former achievements. With sustainable development theory, complex system theory of water- social economy-ecology environment, water cycle process and mechanism under nature-manual work dual mode, ecological water demand theory and systems analysis theory for theoretical foundations, this method regards population predictive model, macro-economic predictive model, water resources development and utilization management model, eco-environmental and ecological water demand model as auxiliary models, regards multi-objective scenario analysis model and comprehensive evaluation model as core models. The main process of this method is, firstly, predicting the planned years' main scenarios(for example: population, economy, the level of society development, water supply, water environmental capacity, water utilization quota, eco-environmental and ecological water demand) of integrated ecological economic system through four auxiliary models; secondly, combining the main scenarios to construct several scene schemes; thirdly, working out the optimization value of evaluation indexes which describe WRCC under different scene schemes; fourthly, evaluating every scene scheme by comprehensive index of WRCC conceived by comprehensive evaluation model; finally, choosing a scene scheme with the greatest comprehensive index as WRCC of evaluated region. Some new ideas are proposed during the construction of models including the selection of objective function, constriction condition and parameters, and the solution of models, a simulated system reflecting the essence of WRCC is built up to evaluate WRCC and to predict the dynamic transformation process of WRCC.

Key words: water resources carrying capacity ; evaluation methods ; multi-objective scenario analysis method

Study on the Relationship between Groundwater and the Teganuma Lake, Chiba, Japan

Changyuan Tang[1,4], Yasuo Sakura[2], Takuro Yamaguchi[1], Masami Kawamori[1] and Yintao Lu[3]

1. Faculty of Horticulture, Chiba Univ., 648 Matsudo, Chiba County 271-8510, Japan
2. Faculty of Sciences, Chiba Univ., 1-33 Yayoi, Inage, Chiba 263-8522, Japan
3. Graduate School of Science and Technology, Chiba Univ., 1-33 Yayoi, Inage, Chiba 263-8522, Japan
4. Institute of Geographical Sciences and Natural Resources, CAS, Beijing 100101, China
Tel: +81 47 308 8911 Fax: +81 47 308 8911 Email: cytang@faculty.chiba-u.jp

Abstract: Water quality in the Teganuma Lake, Chiba, Japan was once the worst one in Japan for more than twenty years. In order to make clear the effects of urban development of on regional water quality and quantity of the Teganuma Lake in past 30 years, authors focused their attentions on the following aspects in this paper based on the field works in the basin including the Teganuma Lake. To study the history of urbanization and water resources development; To study the changes of water quantity and quality of groundwater and lake water in past 20 years; and To understand comprehensively relation between groundwater and lake water.Field surveys were conducted in two periods from 1983 to 1984, and from 2004 to 2005. The hydraulic potentials were measured at piezometers. Water samples were taken from piezometers, spring and the lake. During field surveying, pH, electrical conductivity, temperature, DOES and redox potential of water were measured *in situ*. Water samples were analyzed in the laboratory at Chiba University. The major ions such as NO_3^-, Cl^-, SO_4^{2-} Na^+, K^+, Ca^{2+} and Mg^{2+} were measured by ion chromatography (LC-10A, Shimadzu). The concentration of HCO_3^- was measured by titration.

At first, urbanization has been studied based on the historical records, maps, and landsat image data. It was found that area for residents and industry expanded rapidly in the study area since 1970s. Water quality in the Teganuma Lake deteriorated rapidly from 1975, and recorded the highest COD value of 27 mg/L in 1979. Although it gradually began to improve after that, annual average COD rose to 24 in 1995 before dropping back to 14 in 2000.

Groundwater in the study area flows toward the lake year around, which means that the lake is not only recharged by rivers that run into, but also by groundwater surrounding of the lake. Because of much better quality than the rivers, groundwater has very high potential to improve the lake environment. However, it was found that many spring disappeared and less groundwater flowed into the lake in past 30 years, because of the decrease of infiltration area by urbanization on one hand and the increase of pumping on the other hand. Finally, the reasons of the effect of urbanization on the structure of regional hydrological cycle were discussed by considering relationships among groundwater, river and lake. It

was concluded that integrated groundwater recover and water development management are urgent tasks in the study area.

Key Words: Relation between groundwater and lake, hydrological cycle, nitrate, urbanization

Impact of urbanization on local groundwater quality and water supply in the Pearl River Delta

Lu Yintao[1], Tang Changyuan[2], Chen Jianyao[3], Sakura Yasuo[4]

1. Graduate School of Science and Technology, Chiba University, Chiba, 263-8522 Japan (Email: Yintaolu@graduate.chiba-u.jp)
2. Faculty of Horticulture, Chiba University, Chiba, 271-8510 Japan
3. Zhongshan University, Guangzhou, 510275 China
4. Faculty of science, Chiba University, Chiba, 263-8522 Japan
Tel: +81 47 308 8911 Fax: +81 47 308 8911 Email: cytang@faculty.chiba-u.jp

Abstract: Located at south part of China, the Pearl River Delta (PRD) is facing serious water problems in both quantity and quality with its rapid urbanization in last decade. It is the most remarkable that the local groundwater, the source of drinking before the urbanization, was polluted due to using plenty of the septic tanks without proper management.

In order to know how the septic tank affects the local water environment, Fencun, Guangzhou has been chosen. It was the village with a drinking well for each family twenty years ago and become the residential area with more than 500 residents now. One third of them have their own septic tanks in the house. Under the septic tank, they use calcareousness to prevent infiltration of wastewater that is finally drained into pond through ditch.

To measure major ions and stable isotopes (^{18}O, D and ^{15}N) in the groundwater, water samples were taken from the wells in Fencun twice in March and July, 2005. It was found that the $\delta^{18}O$ values of groundwater ranged from -3.3 ‰ to-5.6‰, which were heavier than the $\delta^{18}O$ value in precipitation. The average electrical conductivity (EC) of the groundwater fluctuated between 560 and 1188 us/cm. Nitrate concentration of groundwater in the study area were higher than 10 mg/l, with the highest around 51 mg/l. The poor management of the septic tanks can be considered as the main reason for local groundwater pollution. Shallow water table and high permeable soils also increased the vulnerability of the study area to nitrate contamination by septic systems.

Because the groundwater of wells has been polluted, the residents have to use taps water which is transferred by pipe line from the reservoir far away. In the same way, population increase will further accelerate the pollution of groundwater and reduce the supply of potable water, which makes more pressures on the water supply in the Pearl River Delta.

Finally, some scenarios are discussed to consider the effects of septic tank system on the local and regional water problem in the Pearl River Delta near future.

Key Words: Groundwater, septic tank, nitrate, urbanization

Urbanization and green-planting impacts on regional summer precipitation in megacity--Beijing

Chaolin ZHANG[1] Shiguang MIAO[1] Fei CHEN[2] Qingchun LI[1] Chongping JI[1]

[1] Institute of Urban Meteorology, China Meteorological Administration, Beijing 10089
[2] RAP Division, NCAR, P.O. Box 3000, Boulder, CO, 80307-3000, U.S.A.
E-mail:clzhang@ium.cn

Abstract: According to the fact that summer serious rainfall event is the most predominant factor to the annual rainfall amount and its distribution in Beijing, and serious rainfall near Miyun water reservoir has important contributions to the total water resources budget of Beijing and its climatic variation, We summarize the above relationship as: Water resources -> atmospheric water resources -> rainfall -> serious rainfall weather events -> summer serious rainfall. And then investigate the statistical relationship between regional precipitation and rapid urbanization of Beijing. Thirdly, under different urbanization and green planning schemes that are designed based on the 1980-2000s' underlying surface data with 500'm resolution in Beijing, and two green planning schemes(annular and cuneiform) for 2010 years, 24hrs numerical simulation of Aug. 18-19 2002 with typical precipitation pattern similar to summer precipitation climatically, utilizing the 10/3.3km two-domain two-way nested MM5V3.6 coupled with Noah LSM, are conducted to indicate the influence of landuse change of megacity--Beijing on regional summer precipitation, respectively. Results show that, due to the important interaction and mass and energy exchange between land surface physical process and synoptic system, the underlying surface change and future green planning all play distinct impact on the intensity and center position of rainfall. The maximum relative difference of precipitation reaches up to 30-40%, and distribution difference can be extended over 50km. especially, the underlying surface extending resulted from rapid urbanization plays positive impact factor on the total precipitation decrease, hence it is disadvantage to mitigate the arid and water resources shortage of Beijing. Above numerical results are quite consistent with those climatic analyses statistically from 1980-2000s' data. Furthermore, numerical experiments also show that green-planting is helpful to enlarge rainfall, green styles (grass or tree) play more significant impact on precipitation relative to planning schemes (annular or cuneiform).

Key words: Land surface physical process， Urbanization， Green planning， Water resource， Numerical simulation

Influences of Cropping Structure Adjustment on Shallow Groundwater

Li Xinbo[1], Hao Jinmin[1], Ding Zhongyi[1], Zhang Fugang[2], Niu Lingan[1].

1.Department. of Land Resources Management, CAU, Beijing 100094, China.
2.Institute of Geographical Sciences and Natural Resources Research，CAS，Beijing 100101，China

E-mail:liyilong@126.com

Abstract: With the development of market economy, China's cropping structure has changed enormously since 1999. In the Hebei plain, adjustment of cropping structure is still an effective measure in alleviating water resources crisis before "the South to North Water Transferring" project is completed. In this paper, the influences of cropping structure adjustment on groundwater sustainability are analysed by ArcGIS, taking Quzhou County of Hebei plain as an example. Comparing to 1999, groundwater depth and electrical conductivity increased by 1m and 0.2dS/m respectively. The areas of groundwater depth greater than 10m and electrical conductivity higher than 3dS/m increased by 7034.4hm^2 and 43570.8hm^2 respectively. Our results showed that expansion of vegetable planting area resulted in the continuous over-exploitation of groundwater. Furthermore electrical conductivity was increased as groundwater with high-salt was used for irrigation and when chemical fertilizer was heavily applied in farmland. In order to prevent groundwater table decline and to stop the deterioration of groundwater quality, more attention is required to the reasonable cropping structure of this region.

Driving Forces for Groundwater Table Drawdown in Intensive Agricultural Regions

--A Case study of Quzhou County of the Hebei Plain

Li Xinbo[1]，Hao Jinmin[1]，Niu, Lingan[1]，Zhang Fugang[2]，Yang Jun[1]

1.Department. of Land Resources Management，CAU，Beijing 100094，China；
2.Institute of Geographical Sciences and Natural Resources Research，CAS，Beijing 100101，China

E-mail:liyilong@126.com

Abstract: Climate warming and human activities in the Hebei Plain during the past few decades have resulted in significant groundwater table decline and many eco-environmental problems, which have become a major threat to social-economic sustainability. Thus, it is vital to define the main driving forces that cause groundwater table decline and to develop a practical strategy for long-term groundwater use in intensive agricultural regions. In this paper, the Grey Relation Analysis (GRA), along with multiple linear regression, are used to evaluate the influences of different factors on groundwater table decline. It is found that agricultural production consumes 90% of the total groundwater withdraw and agricultural water use is the main driving force for groundwater table decline. Specially, the expansion of winter wheat and vegetable planting area is the key player for the significant decline of groundwater level. We concluded that to reduce groundwater table decline in Quzhou County, a rational option was to reducing the planting area of winter wheat and vegetable crops in the future.

Numerical simulation of cooling water dispersion for coastal power station

LI Da-yong[1]，DONG Zeng-chuan[1]，WANG Zhi-gang[2]

1.State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering，Hohai Univ.，Nanjing 210098，China；
2.The state Power Environmental Protection Research Institute，Nanjing 210000，China
E-mail:lidayong1975@sina.com

Abstract: According to the requirement for ocean environmental impact prediction and assessment caused by coastal thermal(nuclear) power station cooling water, a second-order Osher scheme water quantity-temperature model is constructed in this paper. The model uses “dry/wet cell hydraulic model” to treat calculated boundary. The model can simulate the dispersion of coastal power station cooling water correctly by the numerical simulation of one thermal power station cooling water and provide credible technical data for ocean environmental impact assessment.

Key words: coastal power station, ocean environment, cooling water, water quantity-temperature model, Osher scheme, dry/wet cell

The Application of First Order Second Moment Methods to the Water Project Management

Pan Jian[1] Yan Wenyao[2] Zhang Naiji[1] Liu Huiting[1] Mai Rongjun[1] Chen Hui[1]

1.College of Architecture and civil Engineering, South China Univ. of Tech., Guangzhou 510640, China；
2.Engineering Management Office, The Guangdong Water Government, Guangzhou 510150, China

E-mail:znaiji8201@sohu.com

Abstract: Some 8,4000 reservoirs, 50,000 sluices, 5700 large and medium irrigated plots, 5000 large and medium pumping plants and 270,000 kilometres of levees were built in China for the last 50 years. There are more than 10,000 management units with 500,000 or more people serving for these water projects. Due to the people thinking of valuing building and underestimating managing, many problems related to management system, staffs, economic situation and engineering techniques existed in every management unit. In view of these problems, the first order second moment methods are used to analyse the water project management risk, basing on the historically statistical data in hand. Several uncertainty factors which result in both the differential settlements of the concrete dams and the landslides, seepages and settlements of the earth dams in reservior engineering are studied emphatically in this paper. The fuzzy risk analysis methods are used to calculate the random and fuzzy behavior of these factors. The related fuzzy risk models are formed. The calculation programs are written with the dispersion value solving methods and applied to the risk analysis of a particular reservior engineering in Guangdong province, China. A region value which can be considered as the scientific basis for the evaluation of the studied water project will be found in the analysis.

Keywords: management risk; fuzzy; first order second moment; application

Study on the Integrated Evaluation Index System of Wheat of High Yield, Drought Resistance and Water Saving

Dong Baodi, Liu Mengyu , Zhang Zhengbin

Agricultural resources center, Institute of genetics and developmental biology, CAS, Shi Jiazhuang, 050021，P.R..China

E-mail: mengyuliu@ms.sjziam.ac.cn

Abstract: Research for saving water in agriculture is becoming crucial with the increasing water resource shortage. Improving water use efficiency (WUE) of crops is an important way both for irrigated farming and dry farming. Different genotype varieties have obviously difference in WUE. Because WUE of winter wheat is highly related with physiology and environment, it is necessary to study the mechanism of using water by wheat genotype varieties under different levels of water stress. Field experiments with 7 popular different genotypes winter wheat varieties in Hebei province under 2 levels of irrigation were conducted in Luancheng Experiment Station during 2001 to 2002. The growth and development, yield and its components, water use, water use efficiency, physiological changes was compared among the different treatments. The result analysis as the following. Relevant analysis about measured traits showed that yield and drought resistance index were not significantly related with measured agronomic traits. Area of Flag leaf and the leaf directly below flag leaf were significantly negative related with WUE at yield level. Specific leaf weight of flag leaf and the leaf directly below flag leaf were positive related with WUE significantly at yield level. At yield level, transpiration rate and stomata conductance were significantly negative related with WUE at leaf level. Based on the parameters of water leaf potential, stomata resistance, transpiration rate, drought resistance index, the maximum yield and WUE at yield level, an index system to integrated evaluated high-yield, water saving and drought- resistance were established as following equation: IA=0.4Ym+0.2WUE+0.1(Rs+ Ψ*t* +Tr)+0.1DC.

Key words: Relevant analysis; Eco-physiology traits; Evaluation index; Model established

Characterize Interaction of Surface and Ground Water along the Pecos River by using Time-series Analysis of Observed Water Levels

Zhuping Sheng[1], Alyson McDonald[2], Gang Xiang[1], and Charles Hart[2]

1.Agricultural Research and Extension Center, Texas A&M University, 1380 A&M Circle, El Paso, TX 79927, USA

2.District VI Extension Center, Texas Cooperative Extension, PO Box 1298, Airport Drive, Fort Stockton, TX 79735, USA

E-mail:zsheng@yahoo.com

Abstract: The Pecos River flows southward through eastern New Mexico and Far West Texas, and provides primary water supply for irrigation. Elevated salinity of surface water and invasion of saltcedar (Tamarix spp.) have become major concerns on future availability of water and sustainability of the ecological system. One option is to control saltcedar to reduce evapotranspiration (ET), which is anticipated to increase water availability in the stream, improve water quality, and restore ecological system with native vegetations. This paper will focus on the fate of salvaged water as a result of saltcedar control. The authors first determine the trend and seasonality of water levels in the river and monitoring wells in the underlying shallow aquifer for selected time periods of last three years at two test sites (saltcedar treated vs. untreated). The Auto-Regressive Integrated Moving Average (ARIMA) model developed by Box and Jenkins is used in the analysis. This general model includes autoregressive as well as moving average parameters, and explicitly includes differencing in the formulation of the model. The numbers of parameters to be estimated including autoregressive and moving average are decided using auto correlation. Parameters are then estimated using Quasi-Newton method. At last the series is integrated so that the forecasts are expressed in values compatible with the input data. The results show that groundwater levels near the river correspond to river water level very well with different time lags. The time lags vary not only with travel distance between the well and the river, but also the stress in the river (rises and falls). By comparing trends and seasonality of water level data at the treated site and untreated site, the authors conclude that ET does express itself in the seasonality of local well water level data at the untreated site however its reduction at the treated site hasn't shown large-scale regional impacts on the river flow. Salvaged water contributes more to recharge into the shallow aquifer rather than increase in the river flow. Several other factors could also have affected the results. No release from the Red Bluff reservoir in 2002 and 2003 due to drought may have altered hydrological conditions of the river and the shallow aquifer below the reservoir. Recovery of native vegetation may have masked impacts of saltcedar control on the river flow. Therefore, long-term impacts of saltcedar control should be further evaluated with additional monitoring data.

Hydrological drought Frequency Distribution Analysis

Case Study: Gharasoo River Basin

M. R. Khazaee

Department of Management and Planning of Tehran-Iran
PHD Student, Iran University of Science & Technology
Email: m_r_khazaee@yahoo.com

A. Telvari

Ass. Prof. Soil Conservation & Watershed Management Research Institute

E. Jabbari

Ass. Prof. Iran University of Science & Technology
Email: jabbari@iust.ac.ir

Abstract: In this research, the Annual minimum Series of Low Flows Index was used for drought frequency analysis in Gharasoo river in Kermanshah region in Iran. 43 year period daily flow at Deh Kohne and Goorbaghestan stations was used. Using Log-Pearson (type III) distribution, which showed the best fit to the data, the minimum river flow rate for the durations of 1,7,15, and 30 days with 95% probability level and several return periods were calculated. The results revealed that the minimum daily flow rate of the two stations did not have significant differences. This investigation revealed that the 43 year average rate of minimum daily flow at Deh Kohne gauge was about 2.94 m^3/s. Similar minimum flow rates for the durations of 7, 15, and 30 days were estimated to be 3.16, 3.27, and 3.45 m^3/s respectively.

As it is noticed the minimum river flow rate as the indication of hydrological drought occurrence decreases with the probability of occurrence. In such a way that its values for a 100 year return period for duration of 1, 7, 15, and 30 days would reach 0.40, 0.43, 0.45, and 0.52 m^3/s respectively which is nearly 1/7 of these average values. It is important to note that there are not much differences between the different durations. The study showed that the value for one month duration does not much differ from one-day drought duration. Hence different activities such as urban water supply, agriculture, natural resources and etc, are considerably affected by the drought duration with regard to the occurrence of its severity. Therefore, exercising crisis and risk management, planning and execution of programs and activities compatible with any activity proportional to the amount and duration of drought is very important.

Application of Remote Sensing to Water Resources Management

Donghui Wan[a, *], Jun Xia[a, b]

[a]State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan, 430072, China

[b]Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China

*Corresponding author. Tel.: +86 10 64889010.

E-mail address: wdh_2003@126.com

Abstract: The appearance and development of remote sensing provide a new technical method and research way for water resources management. Compared with traditional methods, remote sensing has a great superiority beyond compare in many aspects: it is able to fast gain a series of dynamic, real-time and continual basin information and hydrological data，especially in ungauged basins and invalided routine measurements areas where remote sensing plays an irreplaceable and unique role, and able to provide the essential information service and policy-making basis for water resources planning and management, realizing the sustainable utilization for water resources. Moreover, the much lower ratio of input to output in practice also effectively promotes the widespread application of remote sensing to water resources management to a great extent. An introduction is given to the applications of remote sensing technique to water resources management, i.e. catchments and water resources investigation, floods dynamic monitoring and evaluating, drought and soil moisture monitoring and warning, ecological system protection and soil-water conversation, agricultural water-saving irrigation, water quality monitoring and warning etc. The combination of remote sensing and geography information system with water resources management is also introduced.

Keywords: remote sensing, water resources management, GIS

Application of Water-quality Model Based on GIS to Water Environment Management

Zhang Li

Guangdong Hydrology bureau, Guangzhou, 510150，China
Email: tina_zhangli@126.com，Tel：020-81724550，13560210659　Fax：020-81723592

Abstract：The problems of water environment are increasingly serious, and the need of water environment management relevantly increased. The research takes digital warning and forecasting system of water quality in Xijiang River as background. Based on GIS, the watercourses are digitized and the close-fitting grids are generated, and then the hydrodynamics mathematical models are set up. Considering the real characters of Xijiang River, the water quality models of 1-D and 2-D, including stationary and dynamic models, are set up separately aiming at twelve water-quality factors for warning and forecasting of water quality. The results are satisfied and the flow filed and concentration field realize the dynamic visualization on the platform of GIS. The water-quality model based on GIS supplies a new way of simulation and forecasting of water-quality, and also can supply advantaged support to the management and decision-making of water environment.

Key word: water-quality model, water environment management，GIS, warning and forecasting, close-fitting grid, visualization

Evaluation of water for drinking and irrigation purpose in Dohuk governorate (case study)

Dr. Adil Mohammed Raheem *

Mahdi Salih Yaseen**

Ramadhan Hamza Mohammed***

*Water Resource Engineering, College of EngineeringUniversity of Dohuk, Kurdistan Region Iraq

**Water Resource Engineering, College of Engineering University of Dohuk, Kurdistan Region Iraq

*** University of Dohuk, Scientific Affairs Dept. Kurdistan Region Iraq

E-mail:ramadhan56_2000@yahoo.com

Abstract: Quality of water is one of the important factor that effect on public health, especially when this water is used for drinking and irrigation purpose, so in this paper quality of raw water that provided the water supply net work of Dohuk governorate for three locations are tested and analyzed, test result show that in generally the raw water from the sources (Dohuk dam reservoir , well and Mosul dam reservoir) has a parameters greater than the desirable range but not exceeding the maximum permissible range ,for drinking water parameters the test result also show that the concentrations of hardness , alkalinity and sulfate are the major problem ,which is due to the high concentration of calcium and magnesium in geological formation. Spring which supplied Baroshki location found to be contaminated bacterially, and the parameters of Qasara well water found to be close or at maximum permissible ranges, so the well water alone can not be used unless a good mixing process carried out with Jam Barakat supplied water in order to decrease the concentration of the parameters.

Using of waste water in irrigation purpose was also investigated, test result show that there are high degree of bacterial contamination which is effect badly on human and animals life's ,especially when the crops eaten raw or cooked, so primary treatment is adopted. Investigation on the effect of waste water on soil properties was investigated; from test result it was clearly noted that the soil become less permeable and the sodium absorption ratio with sodium percentage rises from 2 to 100 times in soil solution and high degree of bacterial contamination also be noted which is effect badly on plants grow.

Application of SWAT and VIC to the East River in South China

CHEN, Ji and WU, Yiping

Department of Civil Engineering
The University of Hong Kong, Pokfulam, Hong Kong, CHINA
E-mail:jichen@hkucc.hku.hk

Abstract: The Soil and Water Assessment Tool (SWAT) and the Variable Infiltration Capacity (VIC) hydrologic model are applied to the East River in South China for simulating the catchment hydrologic processes and for assessing environmental changes. The focuses of both models are different. The SWAT model is mainly for studying the environmental effects of changes in land use and agricultural management on stream flow generation, and the VIC model is through simulating hydrologic processes relevant to water and energy balance over the land surface mainly for studying the effects of climate changes on the streamflow generation. We will present the comparison of hydrologic processes simulations from both models and will investigate these numerical schemes for improving the representations of land surface processes over the East River.

Understanding the Effect Factors on Water Resources for Hong Kong

CHEN, Ji

Department of Civil Engineering
The University of Hong Kong, Pokfulam, Hong Kong, CHINA
E-mail:jichen@hkucc.hku.hk

Abstract: The water supply in Hong Kong mainly relies on the East River in the southern China. The understanding of the water collection in Hong Kong and the water supply status in the East River region can improve our water management skill and benefit regional socio-economic sustainable development. In this paper, we will investigate the water supply capacities and water demand limitations in Hong Kong, and some effect factors are also studied herein.

Impact of Land Use Change on Water and Sediment Discharge in the Longchuanjiang Basin, Upper Yangtze River

Yun-Mei Zhu[a,b], X.X. Lu[a] and Yue Zhou[b],

[a] Department of Environmental Science, Kunming University of Science & Technology, 650093, Yunnan, China

[b] Department of Geography, National University of Singapore, 119260, Singapore

Email: zhuyunmei@nus.edu.sg

Abstract: Dry-hot valley is a special environmental type in southwest China, which is characterized by a hotter and dryer climate compared with their neighboring areas. However, the dry-hot valleys are usually highly populated because of the relatively flat landform, and the abundant solar radiation and heat for agriculture. Consequently, most of the dry-hot valleys in southwest China have the problem of water lose and soil erosion.

Longchuanjiang Basin is a typical dry-hot valley in the Upper Yangtze River, southwest China, which is suffering from serious water loss and soil erosion. To investigate the impact of land use change on water and sediment discharges in the basin, five satellite images, including 1 LANDSAT MSS image in 1974, 2 TM images in 1989 and 1993 respectively and 2 ETM+ images in 1999 and 2001 respectively, were explored to build the land use change history of this basin. The land uses were classified into forestry land (further classified into high density, medium density and low density according to the NDVI value), barren land, agriculture land, water and urban land. Analysis of land use, water and sediment dada in the basin over the past few decades indicated that the river basin had experienced a wide range of land use changes and the significant increase in water and sediment discharge, notably in the lower part of the basin, was closely related to the land use change. Human activities related to land surface disturbance, such as deforestation, afforestation, constructions of reservoirs and lakes, expansion of urban area and intensification of agriculture, etc., played an important role in this context. The profound changes of the hydrological regimes resulting from land use changes have significant implications for effective management of water conservation and soil erosion control. (The results will be further discussed after the data analysis is fully finished).

Keywords: Dry-hot valley; land use change; water and sediment discharge; satellite image; Upper Yangtze River.

Evaluation of important roles of Qanats in Iran

Dr.Fardin Boustani

Assistant Professor of Islamic Azad University – Yasuj branch, I.R.Iran
E-mail:f_boostani@yahoo.com

Abstract: Iran is a country in south western Asia , located on the eastern side of the Persian Gulf. Iran has a warm and dry climate and most of the places (except northern and north western regions) have less than 300 mm rainfall per year While the average rainfall in dry region of the world is 860mm, in Iran average of annual precipitation is about 240 mm .To make use of the limited amounts of water , the Iranians developed man-made underground water channels called qanats . The appearance and construction of qanats by Iranians date back to seven centuries Bc . Qanats are a Iranian invention, which conform with Iran's climate. The qanats are underground conduits which collect the water from an aquifer on the slope of a hill and exploit the natural gradient of the land to transport the water underground to the below agricultural areas. The conduits which are usually 50-80 cm wide and 90 cm to 1.5 meters in high , and vary between 1 km and 70 kms in length .Their rate of discharge is between one liter per second and 500 liters per second.

There are about 50,000 qauats in Iran although their number has diminished as the time passed and meanwhile it is due to a consequence of digging deep wells. There is still a considerable number of qanats in Iran, which are still in use. These qanats about 272000 kms long. The longest chain of qanat is situated in Gonabad region in Khorasan province. It is 70 km long. The amount of water of the usable qanats of Iran produce is altogether 750 to 1000 cubic meter per second .Qanats were first developed in Iran but their use spread to India, Arabia , Egypt , North Africa, Spain and even to New world. They are referred to by different names in ifferent areas: in Afghanistan and Pakistan, they are as known as Karezes; in North Africa , as Foggers ; and in the united Arab Emirates, as Falaj Most of the area that qanats serve to irrigate is arid and rainless. Without an effective and sustainable form of irrigation, such as is provided by the qanats, agriculture in those regions would have been impossible It must also be stressed that this incredible network of underground conduits was built entirely by hand. Moreover, the method of construction is used today is still much the same as that used 2000 years ago.

The great advantages of transporting water underground in this way are obvious. As the qanats are often dug in to hard subsoil and, when necessary, lined with relatively impermeable clay hoops, there is little seepage, no raising of the water- table, no water logging, no evaporation during transit, and hence no alkalization in the area surrounding the conduits.

Mechanisms of Forming Saline Plots in the Irrigated Land in Arid and Semiarid Regions

Tetsuo KOBAYASHI　Hiroyuki CHO*, **, Takemasa KANEKO*, Daisuke YOKOYAMA*

and Weizhen WANG***

*　Department of Agricultural Sciences, Saga University, Saga, 840-8502 Japan
**　Faculty of Agriculture, Kyushu University, Fukuoka, 812-8581 Japan
*** Cold and Arid Regions Environmental and Engineering Institute, Lanzhou, 730000 China

E-mail:kotetsu@bpes.kyushu-u.ac.jp

Abstract: Saline plots dot the irrigated land in arid and semiarid regions. There is a tendency for more saline plots to be somewhat wetter than less saline plots and the salinity of groundwater at the former plots is somewhat higher than that at the latter. This seems to suggest that soil texture is closely related to the formation of saline plots; that is, the soil in saline plots has more clay fraction than in the surrounding less saline area.

An experiment was conducted in Fukuoka, Japan, to see the role of soil texture in the mechanisms of forming saline plots. Four tanks, 43 cm in height and 45 cm in diameter, were filled with sand (Tottori Dune sand, Japan) except the core column of 22 cm diameter in which a fine soil was plugged. Each tank having the bottom with many small holes was dipped in saline water with electrical conductivity of 2 dS/m. Two tanks of them were left indoors and the other two were left outdoors. After a few months later the vertical profile of soil moisture and salinity in the four tanks were measured. As a result, the soil salinity at the sand surface was higher than that at the fine soil surface for the tanks left indoors, while just opposite was the case for those left outdoors. This suggests that more salts were transported up to the surface by capillary rise in the sand profile but further more salts were leached out of the surface by gravitational flow of rainwater there than those in the fine soil profile.

Simultaneous observations of soil salinity and soil texture were made in irrigated fields dotted with saline plots in Inner Mongolia, China, before the first irrigation applied in July of 2005. Spatial variability of soil salinity was rather large but there was a tendency for the soil salinity at the surface to increase with increasing clay fraction in the soil profile. Soil salinity just above the water table at a saline plot was also higher than the surrounding less saline spots, which suggests that the lateral flow of groundwater is linked to the vertical flow of soil moisture; that is, part of water infiltrated in the less saline area moves down to the water table, and the groundwater moves laterally to the saline plot by the pressure gradient induced by capillary rise in the plot. As a result, a subsurface water cycle is completed from the soil surface in the less saline area to the soil surface in the saline plot via the groundwater. Consequently, salts are accumulated in the soil profile at the saline plot having more clay fraction than the adjacent less saline area.

Application of Nonlinear Bilevel Programming to Calibrate the Xinanjiang Model

Jiang Yan, Hu Tiesong, Wu Xianing, Gui Faliang, Wu Fengyan

State key laboratory of Water Resources and Hydropower Engineering Science,
Wuhan University, Wuhan, 430072
E-mail:lirenjy@sohu.com

Abstract: Conceptual watershed hydrological model can be applied to many fields like flood forecasting and water resource management. It can help us to analyze much different hydrologic information and solve some complex problems of water resource and water environment. It usually consists of a number of parameters to be calibrated. Parameter calibration is an important aspect of model application research. The successful application of a hydrological model depends on how well the model is calibrated.

The Xinanjiang hydrological model is a conceptual watershed hydrological model with sixteen parameters to be calibrated. According to the model structure, these parameters can be classified into two kinds: runoff production parameters and runoff concentration parameters. Many researches have been made to calibrate the Xinanjiang model in resent years. The two main methods are manual calibration and automatic calibration. The manual calibration requires detailed understanding of the model and a good deal of experience. Its main weakness is that it is difficult to judge when the process should be terminated. However automatic calibration makes up the deficiency of user experience; enhances the reliability of simulation result and accelerates the process of parameters calibration. This method mainly consists of layered calibration and monolayer calibration, such as Rosenbrock method, simplex method, genetic algorithm, SCE-UA method etc. Layered calibration supposes parameters in different levels appear to be relatively independent and the procedure processes from runoff production level to runoff concentration level. When parameters in the first level have been calibrated, they are used to solve the runoff concentration parameters, which don't be fed back. Its weakness is that it separates the runoff production process and runoff concentration process. Monolayer calibration solves the parameters of runoff production and runoff concentration synchronously with optimizing single-objective function or multi-objective function. Although it doesn't separate rainfall-runoff process, it ignores parameters' correlation.

This paper presents an approach on calibrating the Xinanjiang hydrological model with nonlinear bilevel programming optimization technique, which is different from the above methods. Bilevel programming problem is a nested mathematical program that contains an optimization problem in the constraints with two levels in a hierarchy, the upper and lower level decision-making. Both of them have their own objective functions and constraint functions. The decision maker at the lower level has to optimize its own objective function under the given parameters from decision maker at the upper level, who, in return, with complete information on the possible reactions of the lower, selects the parameters so as to optimize its own objective function.

In the process of model calibration with nonlinear bilevel programming approach, runoff production parameters are given firstly. With the given parameters, the runoff concentration level is optimized. Then the runoff concentration parameters are fed back to adjust the runoff production parameters. Repeat this procedure until both of the two levels find the optimum solution. The proposed approach deals with water balance and routing. In addition, it overcomes the problem of separating the runoff production process and runoff concentration process in layered calibration. At the same time, it solves the problem of correlation of the different levels' parameters in monolayer calibration.

The method is then applied to calibrating the Xinanjiang model with the Gaoguan reservoir data. A hypothetical example, in which the optimum solution set of parameter values is known by assumption and discharges are simulated with the measured rainfall, evaporation and supposed parameters value, is used to examine whether the nonlinear bilevel programming based optimization method is capable of finding that optimum solution. The performance of the nonlinear bilevel programming based method in model parameter calibration is then studied using real data. Results show that the overall performance of the proposed approach for calibrating the Xinanjiang model is effective. Compared with the standard method, the parameters calibrated using the proposed method can improve the precision of flood forecasting.

A study of Rainfall -Infiltration in North China Mountainous Region using Environmental Isotopes

Houshibin[1,2]，Songxianfang[1]，Yujingjie[1]，Hukun[1]，Yangcong[1]，

Zhangguangying[3]

1. Key Laboratory of Water Cycle and Related Land Surface Processes,
Institute of Geographic Science and Natural Resources Research, CAS, Beijing 100101；
2.Graduate School of CAS，Beijing 100039；
3. Water and Soil Conservation station of Baoding , Hebei Prov.,，Baoding 071000
E-mail:housb.04s@igsnrr.ac.cn

Abstract: In the past decades, the water resources shortage in north china plain has greatly worsen. However, the relative water circulation mechanism in mountainous region of north China is not clear. Environmental isotopic technology in studying hydrological process as a new way has begun in recent years, mainly apply to identify rainfall source and rainfall form background, the division of hydrological graph, estimate soil water evaporation, infiltration, and replenishment mechanism, and ground water movement study. The change of environmental isotope hydrogen and oxygen components in water molecules has been commonly utilized to speculate water circulation mechanism.

The research area Chongling catchment, located in north of Taihang mountainous region, which is a tributary of north Yishui river. It covers 6 kilometers, with a length of 4.4 kilometers, a width of 1.5 kilometers. It is typical temperate continental climate, with a average rainfall 641.2 mm. Three typical vegetation mountainous region of north China have been chosen to soil water sample, and precipitation and ground water relative around the catchment are also observed and sampled. Then hydrogen and oxygen isotopes composition were analyzed by using Finigan253 indoors.

The Local Meteoric Water Line(LMWL) were obtained: $\delta D = 6.29 \delta O^{18} - 4.70$ $R^2 = 0.7527$，n＝60. No obvious season change in environmental isotope of precipitation was found. As a whole, they enriched in autumn and diluted in summer. The season and space (under different depth) varies of δD and δO^{18} of soil water differ under three different typical vegetation，and they responded to the rainfall in some way. In addition to relative weather data and soil humidity date, we try to find out rainfall infiltration mechanism under different vegetation, then study further inter-conversion relation of precipitation-surface runoff-soil water-ground water, and to provide scientific advice on evaluating the water resource in Taihang mountainous regions.

Key words: mountainous region of north China; catchment; rainfall infiltration; environmental isotope

GIS-based Hydrological Modelling: A Comparative Study of HEC-HMS and the Xinanjiang Model

Mohammad Bakir Zhang Xingnan

State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering Hohai University, Nanjing 210098, P.R. of China
E-mail:mohamadbakir@yahoo.com

Abstract: The last few years have witnessed an enormous study in the area of integrated hydrological modelling with GIS application. In this research, attempt was made to critically look at the application of HEC-GeoHMS which is an extension of ArcView in HEC-HMS; an HEC package which is a new generation of software being developed for rainfall-runoff simulation. The main role of HEC-GeoHMS is to formulate a watershed data structure under the platform of GIS that can be imported directly to HEC-HMS. With the topographic information supplied by HEC-GeoHMS, HEC-HMS works more readily and exactly. The performance of HEC-HMS was compared with that of the Xinanjiang conceptual model using historical flood data from the Wanjiabu catchment in China. The results obtained in the course of this study indicate that HEC-HMS is more convenient for flood stimulation especially in optimizing parameters but not quite accurate as compared with Xinanjiang model. The plausible reason for this could be due to the fact that the Xinanjiang model has more parameters thereby making it flexible to fit a flood event. Based on the results obtained as stated, it is thus suggested that with improvement in data conditions, runoff yield could be calculated on grid format and results for both models appropriately enhanced.

Irrigation Planning Based on Genetic Algorithms：A Case Study of Xingdian Irrigation District

Guozhu Li, Wei Qu and Shuwen Niu

College of Resources and Environment, Lanzhou University, Lanzhou, China
Fax：0931-4660506
Tel：13239649130

Abstract： This paper studies the application of Genetic Algorithms (GA) for irrigation planning. The GA technique is used to evolve efficient cropping pattern for maximizing benefits for the Xingdian irrigation project in the Ye11ow River Va11ey on the basis of 20 years (1985－2004) of historic date. Constraints include water-transported ability, land and water requirements and crop diversification. Parameters of the model is run for various values of population, generations, cross over and mutation probabilities. Penalty function approach is used to convert constrained problem into an unconstrained one. Results obtained by GA are compared with Linear Programming solution.

Main conclusions are as follows:

(1) Appropriate GA parameters identified from this study are: Number of generations = 160, Population size = 40, Crossover probability = 0.4 and Mutation Probability = 0.01.

(2) It is observed that solutions obtained by both GA and LP are reasonably close. Maximum benefits obtained by LP solution is 94.668 Million Yuan where as these are 88.3568 Million Yuan by GA.

(3) Genetic Algorithms is found to be an effective optimization tool for irrigation planning and can be used for more complex systems involving non-linear optimization.

Key words: cropping pattern, genetic algorithms, irrigation planning，Xingdian irrigation district

A Study on Hydrological Effects to Land Use/Cover Dynamic Change in the Upper Reaches of Minjiang River

Ainong Li[1, 2,3], Angsheng Wang[2], Wenlan Feng[1], Jinfeng Liu[1], Ji Zhu[1], Qiang Feng[2]

[1]Chengdu Institute of Mountain Hazards and Environment, CAS &Ministry of Water Resources,
Chengdu, 610041, China
[2]The Reduction Center for Hazards, Chinese Academy of Sciences, Beijing, 100029, China
[3]Department of Geography, University of Maryland, College Park, MD 20742, USA
E-mail:ainong1974@yahoo.com.cn

Abstract: At present water problem has become a core issue for social economic development in many countries and areas, arousing the widespread concern of human society. One essential aspect of the global water research is the effects of land use/ cover change on river basin balance and water recycling as well as on floods and droughts. Recently the research centered on land use/ cover change has put emphasis on regional-scale comprehensive effect study, related with region-economy sustainable development planning, decision and administration, so as to provide scientific evidences to social economic sustainable development.

The upper reaches of Mingjiang River is one important component of that of Yangtze River as well as a key processing region for *Eco-environment administrative planning of China.* As eco-environment, water resources and land use/cover is closely linked, the study on the hydrological effect of land use/cover changes in the upper reaches of Mingjiang River is a key point for building eco-defense, protecting and strengthening river basin “water Tower” function.

Based on geological information pattern theory, from the angle of systematic theory and sustainable development theory, applying math models under the support of RS and GIS techniques, this research aims to study the hydrological effects of land use/cover changes in the upper reaches of Mingjiang River in the nearly past 30 years (1972-2000a). The research data we used include MSS data in 1972, TM RS data in 1986, 1995 and 2000, and the corresponding hydro data from Zhi Pingpu hydro-station. The research result presents: the steady decrease of minimum low-water discharge and increase of maximum discharge fluctuation is bound to bring about certain difficulties to water resources arrangement and water disaster prevention; wood reduction directly leads to the weaken role of forest water conserve, the system converting function decline on moisture, and the in-flow strength and amount reduction of underground reservoir. Through the above analysis, the article points out the improvement of the forest hydrological effects in the upper reaches of Mingjiang River will be realized by decision support provided by reasonable planning and adjusting of land use, optimization of plantation structure, and betterment, recover and rebuild of surface vegetation cover.

Key wards: Land use, the upper reaches of Minjaing River, hydrological effects, Remote sensing, GIS

The dynamic change of water recourses in XiJiang by using GIS technique and Remote Sensing data

DILINUER Aji [1)] KONDOH Akihiko [2)]

[1)] Graduate School of Science and Technology Chiba University, Japan
[2)] Center for Environmental Remote Sensing, Chiba University, Japan
E-mail:dilnura@hotmail.com

Abstract: Water resources in XinJiang are composed of surface water, ground water and glacier. Mainly, little precipitation and melt water from high mountains that are limited in summer season have sustained agriculture production of XinJiang. Especially, the characteristics of amount of water on rivers and lakes are very important for the agriculture production of XinJiang. It is thought strongly that there is a lack of water resources by the agricultural development act with the population increase, and water resources is creased, the climate is made dry as time goes on in XinJiang . If seeing by the outflow of the rivers and area of the lakes, we can see that the time of the long range doesn't always connect with the decreasing of water resources in XinJiang. So that, The study explores the spatial and temporal characteristics of water resources from both sides of the human activities and the climatic factors by using GIS (Geographical Information System) technique and Remote sensing data analysis of Wulungu lake basin, Ayding lake basin, Bostan lake basin and Ebnur lake basin, the observation data in the past 50 years of 26 rivers, the CRU TS2.0 data set, World Climate Data and each year statistical yearbooks of XinJiang . As a result, bordering on the second half of the 1980s, spatial-temporal characteristics of water resources in XinJiang had a remarkable difference. Namely, The influence of human activities is strong from 1950s to the second half of 1980s; It appears as rapid decrease in outflow of rivers, Water shortage on downstream of the rivers and reduction or disappearance of lakes area by the growth of population and the increase of tillage area which was accompanied by population increase and the construction of the water supply facilities. As opposed to it, the influence of climate is strong from the second half of the 1980s till present. It appears as rapid increase in outflows of rivers and expansion of lakes area by the increase of precipitation and the rise of temperature. Both aspects are important to consider the durability of agricultural production in XinJiang since the characteristics in the volume of the rivers and lakes, which as water resources in XinJiang has received both influences of natural factor with climate and the factor in human activities.

Key words: Water resources, XinJiang, GIS, Remote sensing data

Remote sensing inquisition and the pollution reason analysis of Water pollution status of West River in Pearl River Delta

Zhang Yinan Deng Ruru

Department of Environmental Sciences, Sun yat-sen University
Remote Sensing Centre, Sun Yat-sen University
E-mail:eeszyn@163.com

Abstract: Pearl River Delta, which belongs to the river net region and possesses very complicated flow pattern, can be affected by tide and its polluted water body changes greatly in the space. It is very difficult to grasp the whole water pollution circumstance accurately and completely only by using the general analysis method of water surface sampling. The water pollution information of the Pearl River segment is refined by using the satellite remote sensing data which possess comparatively high space resolution ratio and the field measured data of water surface is analysis in this paper. The results show that the pollution status increases obviously after the entry of West River into Pearl River Delta and it gets worse when the river goes downwards. The distribution of pollution concentration possesses great uniformity and the pollution concentration increases distinctly in the reach round the city. Through the further analysis, it can be known that the water pollution status of the west river is closely related to the industry development circumstances and the industrial types and the main reason is related to the industrial waste water and domestic sewage which were discharged into the west river every year. Moreover, the sewage discharged quantity centralizes in the water body round the city, making the river which flows through the city polluted seriously. Food, paper making, spinning, bleach and dye, chemistry, building materials and aquatic conveyance etc. are the main pollution sources of West River.

Runoff Change law based on Hilbert-Huang Transform

Zhao,Xuehua[1]; Huang Qiang[2]

1 Taiyuan University of Technology, Taiyuan, Shanxi, 030024;
2 Xi'an University of Technology, Xi'an, Shaanxi, 710048
E-mail:zhaoxh688@163.com

Abstract: As a main link of water cycle, river runoff is the most important base for comprehensive development and utilization, scientific management and optimal operation. However, river runoff is affected by human activity and global climate change, so it is very important theoretical and practical sense for researching change law of the river runoff.

Annual runoff process is affected by not only weather variations but also a lot of un-predicting factor, such as underlaying surface, human activity and vegetation cover. So it is a high dimensional nonlinear complex dynamical system. With deeper research, it is discovered that runoff process is not in statistical balance state in an area, but in variant time scale such as inter-annual and few decades. Because of impact of climatic change and human activity on the runoff, runoff change shows non-stationary. Considering nonlinear and non-stationary of the runoff, Hilbert-Huang transform is introduced to research runoff change law in the upper reaches of the Yellow River in this paper. Hilbert-Huang transform (HHT) has been developed as a new method for analyzing time domain and frequency domain of nonlinear and non-stationary data. It utilizes multi-resolution merit of wavelet transform, and also overcomes the difficulty that the basic wavelet function need be selected in the wavelet transform. Furthermore, resolution of Hilbert spectrum is far higher than one of wavelet spectrum, and Hilbert spectrum can't make a large number of false harmonic in the general conditions. Therefore its result can accurately reflect natural physical characteristics of the time series.

The analysis and calculation are conducted in combination with a real example, the Lanzhou station in the upper reaches of the Yellow River, HHT and the empirical mode decomposition (EMD) method are used to analyze runoff time series in this paper. Firstly original series is step-by-step decomposed by means of EMD method, so the result is four intrinsic mode functions (IMF) and a residual component, that is to say, runoff series is decomposed as four variant scale components and a trend of runoff change at the Lanzhou station. It is computed that natural annual runoff have the periodicity of 2.23 year, 5.57 year, 10.23 year and 19.76 year at the Lanzhou station and physical cause is analyzed. The result provides scientific ground for planning and management water resource in the Yellow River basin.

Study on stable isotope hydrological processes in North China mountainous area

Yang Cong[1,2,3], Yu Jingjie[1,2], Song Xianfang[1,2], Liu Xiangchao[1,2]

1Key Laboratory of Water Cycle and Related Land Surface Processes,
2Institute of Geographic Science and Natural Resources Research, CAS, Beijing 100101, China，
3 Graduate University of CAS, Beijing 100049,China
E-mail:yangc@igsnrr.ac.cn

Abstract：The stable isotope hydrological processes in Dongtaigou, a small typical catchment in North China mountainous area, were studied based on the observations of $\delta^{18}O$ and δD in both precipitation and soil water during 2004. We discussed the relationships between:

(1) $\delta^{18}O$ and δD in precipitation;
(2) $\delta^{18}O$ /δD in precipitation and in soil water/groundwater;
(3) $\delta^{18}O$ /δD in soil water and soil water movement;
(4) $\delta^{18}O$ /δD in groundwater and groundwater level.

Based on the 64 precipitation samples, we get the local meteoric water line is $\delta D = 7.10\delta^{18}O + 7.31$, with $\delta^{18}O$ ranging from -26.27 to -5.74, and δ D from -112.83 to -16.78. The results show that $\delta^{18}O$ /δD in soil water in the upper layer (depth less than 40cm from surface) is affected strongly precipitation and both vary in the same trend, whereas$\delta^{18}O$ /δD in soil water in deeper layer (depth more than 400cm from surface) and groundwater are not directly effected by precipitation. The variation of $\delta^{18}O$ /δD in deeper layer and groundwater is a combined effect of $\delta^{18}O$ /δD in precipitation, precipitation amount and surface evapotranspiration. The difference between the weighted $\delta^{18}O$ /δD in precipitation and groundwater reflects the strong soil surface evapotranspiration in the research catchment. The variation of $\delta^{18}O$ /δD in different layers of the profile soil reflects the movement of precipitation water from surface towards bottom in the soil.

Key Words：North China Mountainous Area; stable isotope ; soil water;

Estimation of aquifer parameters using Ant Colony Optimization

S.Mohammad Mortazavi.N

M.Sc. Water Resources Management, K.N. Toosi University of Tech., Tehran, Iran.
E-mail:smohammad.mortazavi@gmail.com

Abstract: Adequate and reliable estimation of aquifer parameters are of outmost important for proper management of vital groundwater resources. In this paper, an aquifer in IRAN has been chosen. Using PMWIN, this aquifer is modeled. Afterwards a computer code was developed to optimize various aquifer parameters by Ant Colony Optimization (ACO). Ant Colony Optimization (ACO) is one of the recent optimization methods which is inspired by the fact that ants are able to find the shortest route between their nest and a food source. This is accomplished by using pheromone trails as a form of indirect communication. The results are compared with PEST and GA methods.

Discharge Calculation Methods for Real-Time Discharge Monitoring Using Horizontal Acoustic Doppler Current Profiler (H-ADCP)

HENING HUANGP[1P] and FAJUN WANGP[2P]

[1P] Principal Hydraulic Engineer, Teledyne RD Instruments, 9855 Businesspark Avenue, San Diego, CA 92127, USA (Tel: 01-858-693-1178, Fax: 01-858-695-1459, e-mail: TUhhuang@rdinstruments.comUT)

[P2P] Associate Professor, Dalian Maritime University, 1 Linghai Road, Dalian 116026, CHINA
(Tel: 86-411-84729596, Fax: 86-411-84727395, e-mail: TUfw25@yahoo.comUT)

Abstract: H-ADCP (Horizontal Acoustic Doppler Current Profiler) is a new instrument introduced in recent years for real-time discharge monitoring in rivers, streams, and open channels. H-ADCP measures velocity horizontal profile across a channel by its two horizontal acoustic beams. It also measures water level by its up-looking acoustic beam. Users need to select an appropriate method for discharge calculation using the velocity and water level data.

This paper describes two discharge calculation methods. One is the so-called Index-velocity method. The other is numerical method. The principle of Index-velocity method is to establish a rating or regression equation for the relationship between the channel mean velocity and Index-velocity that is measured by an H-ADCP. The numerical method employs a power law for open channel velocity vertical profile to obtain velocity distribution in the wetted area in channel cross-section. Discharge is then calculated by integration of the velocity distribution. In principle, the numerical method does not require calibration.

Index-velocity method and numerical method are independent. Each method has its advantages and disadvantages. Table 1 shows a comparison of Index-velocity method and numerical method.

As an application example of both methods, this paper presents results from field test at an irrigation canal in California, USA. An Index-velocity rating was developed at this site. Discharges calculated using both methods agree well with the moving float ADCP discharge measurements at this site.

Flood Frequency Analysis For Malaysian Rivers

Mohd Fozi Ali

Graham Copeland

Department of Civil Engineering
University of Strathclyde
Glasgow, UK
E-mail:mdfozi@yahoo.com

Abstract: The aim of a flood frequency analysis is to make inferences about the frequency with which extreme river flows occur at a location of interest. The accuracy of the estimation would be improved if longer records of data were used and the most appropriate probability distribution function (pdf) is used. The annual flood series from 85 rivers in Peninsular Malaysia were used in this study. The selection of catchment is made such that at least 20 years of historical data are available.

This study will investigate, evaluate and review the flood frequency analysis measures currently practiced in Malaysia particularly in developing Flood Frequency Curves and Mean Annual Flood equations. Based on a deconstruction of the earlier study method, the results of this study show that the previous flood frequency analysis practices in Malaysia need to be revised. Both the flood frequency curves and the Regional Mean Flood Equations should not be grouped by regions but by characteristics of the rivers themselves, such as mean slope and vegetation cover. It is found that GEV is the best pdf to fit rivers in Malaysia followed by Log-Pearson 3 and Gumbel. A number of factors interact in a complex way to determine whether, when and where flooding occurs. Thus there is no straightforward explanation for the differences exhibited in flood frequency 'predictions' for catchments across Peninsular Malaysia. Clearly the amount of rainfall is important, but it is not simply that increase in rainfall will result in increased flooding.

Keywords: Frequency analysis; Floods; Probability distribution function; GEV;Log-Perason3; Gumbel

The Fuzzy Optimization For Yellow River Diversion Projects

Li yanbin (Institute of Water Resources and Hydro-electric Engineering, Xi'an University of Technology, Xi'an 710048, China)
Xu jainxin (Department of postgraduate management, North China University of Water Conservancy and Electric Power, Zhengzhou 450008, China)
Huang qiang (Institute of Water Resources and Hydro-electric Engineering, Xi'an University of Technology, Xi'an 710048, China)
Corresponding author：li yanbin ,Born in 1973, Ph.d. candidate, Lecturer, Major in Sustainable Water Resource Theory and Application
Tel, 13939030525, (Office) 0371-65727655-3652
E-mail, liyanbin@ncwu.edu.cn or liyb101@sina.com

Abstract: The Yellow river diversion projects play important in industrial, agricultural and urban development on both banks. In order to seek the best scheme of diversion projects, and realize sustainable development of resources, environment, economy, and society, the paper set up the evaluation index system based on high sediment content, easy flow cutting off, a great disparity flow between flood and dry season, and great changes of soil riverbed erosion and deposition. The diversion projects were studied by using the semi-structural and multi-objective fuzzy decision-making and optimal selection theory. The system and theory were applied on Long-hu diversion project in eastern part of zhengzhou city, China. The result indicated that the system could reflect overall resources, environment, economy, and society relevant to Yellow river diversion projects. With the studied theories, human knowledge could be considered; witch creates possibility to decision-making person's direct participation. Considering the different weight of multi-objective, quantitative objectives could be quantified. Conjunctive use of quantitative and qualitative objectives in decision-making, more scientific decision-making reasonable results has been achieved, which increases dependability.

Hybrid particle swarm optimization algorithm for conceptual rainfall-rainoff model

Jiang Hai，Huang Jie Sheng

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, Hubei, China

E-mail:fox031@sina.com

Abstract: The successful application of a conceptual rainfall-rainfall(CRR) model depends on how well it is calibrated. For the highly complex nonlinear characteristic of CRR, it is really hard to obtain unique optimal values for their parameters using automatic calibration methods, if not impossible. PSO is a kind of stochastic global optimization based on swarm intelligence; PSO searches the solution space intelligently and find out the best. In this paper，the basic PSO algorithm and several hybrid algorithms with simplex algorithm, simulated annealing algorithm, genetic algorithm and shuffled complex evolution algorithm are used to evaluated the parameters of the Xinanjiang model(a conceptual rainfall-rainoff model widely used in the humid area of China).The result shows that SPO algorithm is an effective method for solving the CRR model optimization problem, and the hybrid SPO algorithms are more efficient and effective.

Keywords: Hybrid; particle swarm optimization; simplex; simulated annealing; genetic algorithm; shuffled complex evolution, conceptual rainfall-rainoff model, model optimization

Application of genetic algorithms to parameter optimization of hydrology model

Jiang Hai，Huang Jie Sheng

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan 430072, Hubei, China

E-mail:tianjun@student.unsw.edu.au

Abstract: In this study a new method namely Micro Hybrid Accelerating Genetic Algorithm(MAGA) is developed to identify hydrological model parameters. The method is compared with Binary Coding Based Accelerating Genetic Algorithm(AGA), Real Coding Based Accelerating Genetic Algorithm(RAGA), Simplex Algorithm(SA), Hooke-Jeeves Algorithm(HJA), Powell Algorithm(PA), shuffled complex evolution algorithm(SCE-UA), Simulated Annealing Algorithm(SAA),The numerical simulation and case study by means of Xinanjiang model show that MAGA is remarkably improves the convergence speed and calculation accuracy.

Keywords: parameter optimization; hydrological model; genetic algorithm; simplex algorithm; Hooke-Jeeves algorithm; Powell Algorithm; shuffled complex evolution algorithm; Simulated Annealing Algorithm

Effect of Different Tillage on the Variation of Soil Moisture and the Water Use of Winter Wheat in the North China Plain

SUN Hongyong[1, 2] LIU Changming[1] ZHANG Xiying[2] CHEN Suying[2]

PEI Dong[2]

1. Key lab of Water Cycle and Related Land Surface Processes of CAS, Institute of Geographical Sciences and Natural Resources Research of CAS, Beijing 100101;
2.Center for Agricultural resource Research, Institute of Genetic and Developmental Biology, CAS, Shijiazhuang, 050021

E-mail: hysun@ms.sjziam.ac.cn

Abstract: On-station trials were conducted at Luancheng Agro-ecology station near Shijiazhuang during the 2002 and 2004 seasons to determine the effect of different tillage management systems on the variation of soil moisture change in winter wheat field and water use in the North China Plain. There were four tilliage treatments and they were conventional tillage (plowing, CT), rotary tillage (RT), no-tillage (NT) and straw crushed plus no-tillage (SNT), respectively. The results indicated that the impact of different tillage management systems on development dynamics of field soil moisture was remarkable and the effects on conserving soil water mainly took place in crop earlier growth stages and the depth of soil layer between 0 - 50cm. The effects of CT, RT, NT and SNT on evaporation under crop canopies were significant and the inhibiting effect of the straw crushing and no-tillage on evaporation under crop canopies was obvious, the amount of daily evaporation was only the daily amount of plowing 59% or the daily amount of rotary tillage 74%. Water consumption of CT was the most among the treatments although water use efficiency (WUE) of RT in winter wheat was higher than that of other treatments.

Keywords: tillage management systems; development dynamics of field soil moisture; winter wheat yield; water-saving

Modeling solute transport through long heterogeneous soil column during steady saturated water flow

Guangyao Gao Shaoyuan Feng

College of Water Conservancy & Civil Engineering , China Agricultural University , Beijing 100083 , PR China

E-mail:ggy_sl@126.com

Abstract: Nonequilibrium behaviors such as early arriving and long time tailing were frequently observed for solute transport process due to the heterogeneity of the porous media. In management of water environment, it is rather important to accurately characterize both the early arrival time behavior for contaminants to escape from subsurface waste deposits and the late time tailing behavior for ground water remediation problems. Therefore, one of the most important research topics for transport modeling in the last several decades was to develop and use alternative ways to quantify such complex transport process in porous media. In this paper, we used the two-region model (TRM) and the macroscopic convection–dispersion equation (CDE) to characterize the transport process in heterogeneous porous media. Extensive experimental data from the tracer experiment conducted by Huang *et al*. (1995) through a 1250cm-long one-dimensional heterogeneous soil column were used for testing validity of the TRM and CDE. The parameters and simulation result of the two models were obtained by using the nonlinear least-squares parameter optimization code CXTFIT 2.1 to fit the experimental data. The dispersion coefficients for both TRM and CDE increased with the travel distance ranging from 3 to 200cm^2min^{-1}, and obviously this scale-dependent dispersion is another evidence of nonequilibrium transport. Analysis of the experimental data showed that the average fraction of immbolie water was 0.39 in the heterogeneous soil column resulting in above phsical nonequilibrium behaviors. Comparing to CDE, the breakthrough curves (BTCs) can be better fitted by using TRM with higher resolution revealed by lower values of sum of square residuals (*SSQ*) and higher values of determination coefficient (r^2), and TRM is better to capture the full evolution of the BTCs, especially for the long time tailing part. However, because of scale-dependency, the assumption considering dispersion coefficient as constant in the TRM was not reasonable.

Key words: solute transport, two-region model, physical nonequilibrium, immobile water, scale-dependency, heterogeneous media

Reconstruction and analysis of spatial-temporal distribution of groundwater table in north and northeast of China

Zhenghui Xie[1], Xing Yuan[2]

Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, 100029, China.
E-mail : [1]zxie@lasg.iap.ac.cn,[2]xyuan@mail.iap.ac.cn

Abstract: High resolution estimate of spatial-temporal distribution of groundwater table is important for terrestrial ecosystem and water resources research. While in China, we haven't established an open data bank of groundwater table due to various reasons. In this paper, an approach is presented to reconstruct reliable and highly resolved data of monthly groundwater table back to 1961 for the north and northeast of China based on elevation of topography and precipitation data. These were achieved by using asynchronous transfer function-noise (ATFN) models and cokriging interpolation method. First, the ATFN models were calibrated by Kalman filter method coupled with SCE-UA (shuffled complex evolution method developed at The University of Arizona) global optimization algorithm. After validation, These ATFN models were used to not only estimate the values of each monitoring well at non-observed time steps, but also simulate the time series of groundwater table at the same frequency as the precipitation data. Subsequently, in order to obtain spatial distribution of groundwater table, the extended series of table were interpolated by means of cokriging, using elevation of topography as auxiliary information, so that the accuracy of simulated groundwater table could be promoted. Moreover, analysis of spatial and temporal variation of groundwater table in north and northeast of China were carried out using statistical method such as EOF analysis and clustering. Further work will be concentrated on reconstruction of groundwater table for the entire area of China.

Study on robust estimation and forecasting method of real-time flood

ZHAO CHAO, BAO WEI MIN

College of Water Resources and Environment, Hohai University, Nanjing 210098, China
zhaocfang@163.com

Abstract: Because of the tendency of outliers in the measurements to strongly influence the outcome of real-time flood, Robust theory has been introduced to real-time flood forecasting system, and theories and methods that aren't adapt to flood forecasting have been modified and perfected. It is focus that adequate robust characteristic function is proposed for real-time flood forecasting system, and the dynamitic monitor module is established for all kinds of errors, and dynamitic robust estimation method for model parameters is researched, and robust estimation and forecasting method of real-time flood are studied. This paper has formed a real-time flood forecasting method with hydrologic characters and good robustness.

Key word: robust theory; robust characteristic function; real-time robust forecasting

Three-dimensional Numerical Simulation of Thermal Discharge in Coastal Area

Lai XiJun

Nanjing Institute of Geography & Limnology, CAS，Nanjing, 210008, China
E-mail:xjlai@niglas.ac.cn

Abstract: To free from electric power shortage actuality and optimize electric power structure in China, many of thermal power plants are built in recent years. Recycling cooling water of thermal plants (thermal discharge) are usually pumped to environment water body directly and heat was diffused by natural process. Thermal drainage not only change flow structure, but also lift the original temperature of water in local area of the outlet. Excess of heat may damage aquatic ecology to cause thermal pollution. Also it may reduce significantly the operational efficiency of the cooling system if thermal water is withdrawn to reuse. So the size and location of the water intake and discharge systems are needed to be selected deliberately. To be environmentally acceptable and economically feasible, a hydrothermal analysis of the cooling water discharge should be performed. This analysis is usually conducted by using physical models and numerical models. They supplement each other. Due to their flexibility, numerical models are popularly applied for large-scale problems, which employ the hydrodynamic equations of continuity and momentum for the calculation of flow field and the equation of heat transport for the calculation of excess temperature field. These schemes range from quite simple 2-D models to complicated 3-D models.

In this paper, three-dimensional unstructured finite volume method was proposed, which is based on Roe's Riemann approximation solver and has high-resolution. The irregular bottom slope is represented using a sigma coordinate transformation. The horizontal grids are the hybrid grids of triangle/quadrilateral. Thus, it can handle arbitrary topology and keep conservative laws for mass, momentum and heat during numerical simulation very well. Finally, the developed model was applied to the coastal region in which a new thermal power plant (4000MW) will be constructed. The simulation was done in different planning cases. Results were compared between numerical and physical models, and consistent conclusions were made.

Keywords: Thermal pollution, Roe's Riemann approximation solver, three-dimensional, numerical model

Optimization running of multi-reservoirs-system based on a hybrid dynamic programming

ZHANG Li-bing[1,2]， CHENG Ji-lin[2]， JIN Ju-liang[1]， Zhang Jian[2]

1. College of Civil Engineering, Hefei University of Technology, Hefei 230009,China, Zhanglibing777@163.com;
2. College of Conservancy and Hydraulic Engineering, Yangzhou University,Yangzhou 225009, China)

E-mail:zhanglibing777@163.com

Abstract: Optimization running on reservoirs in mountainous area is a multi-dimensional non-linear complex optimizing problem. Using general method of traditional dynamic programming, such as Lagranges dynamic programming(LDP), dynamic programming by successive approximation(DPSA), state increment dynamic programming(SIDP), discrete differential dynamic programming(DDDP), binary state dynamic programming(BSDP) and progressive optimality algorithm(POA) etc, to resolve this kind of complicated problem would meet great difficulties, and the global solves could not be confidently obtained. So A new hybrid method combined with experimental genetic algorithms (EGA) and dynamic programming (DP) was studied. EGA, a new improved genetic algorithms based on the spirits of experimental optimizing method, was proved owning characters of fine optimizing efficiency and good precision adaptivity in previous paper. A real example of optimization running on a multi-reservoirs system was showed in this paper utilizing the so-called EGA-DP method. Result given by EGA-DP was much better than POA or DDDP. Conclusion could be drawn out that the hybrid method of EGA-DP has the ability to keep the individual variety better to get the global solutions, and has good values in area of complex hydraulic conservancy engineering.

Key words: optimization; multi-reservoirs running; experimental genetic algorithms; dynamic programming

Fuzzy pattern recognition model for water quality evaluation based on principle of maximum entropy[1]

JIN JULIANG[1],ZHANG YOUFU[1], WEI YIMING[2], TANG LIHUA[1]

[1] College of Civil Engineering, Hefei University of Technology, Hefei 230009, Anhui, China;

JINJL66@126.com

[2]Institute of Policy & Management, Chinese Academy of Sciences, Beijing 100080, China;

Abstract: Fuzzy pattern recognition model based on principle of maximum entropy for water quality evaluation is founded on the basis of the least weighted general distance and the objective influence of uncertainty introduced by the principle of maximum information entropy of Jaynes, where the difficulty is how to balance least weighted general distance and the maximum entropy. So a new way is discussed of using the model of maximum entropy fuzzy pattern recognition as the practical modeling process, using grade judgment standard as the principle of theoretic grade and using accelerating genetic algorithm to determine the plus balanced parameter α between the least weighted general distance and the maximum entropy. The theoretic analysis and applications show that the way to determine the balance parameter α is credible, feasible and being of higher reliability. The new model is of theoretic sense and applicable value in wide practices of fuzzy pattern recognition for different water resource comprehensive evaluation problems.

Key words: water quality evaluation; fuzzy pattern recognition; principle of maximum entropy; genetic algorithm; water resource comprehensive evaluation

Foundation Item: Supported by the National Natural Science Foundation of China (50579009, 70425001), the Fifteen Tackle Key Problem Project of Chinese National Science and Technology (2004BA608B-02-02) and the Excellence Youth Teacher Sustentation Fund Program of Ministry of Education of China (Department of Education and Person [2002]350).

The Influence of Priori Knowledge on Hydrologic Parameter Inversion Using DNA Technique

Faliang Gui[1,2] Xiaolin Wang[1,3] Teisong Hu[1]

1. Department of Drainage and Irrigation, Wuhan University, Wuhan 430072,China
2. Department of Water Conservancy, Nanchang Institute of Technology, Nanchang 330029,China
3. Department of Management, China Geological University, Wuhan 430086, China

Tel：0791－8307608

E-mail: falianggui@sina.com & ggffll65@tom.com

Abstract: Hydrologic system is an intricate and nonlinear model. River flood regime is a resultant reflection of a composite catchment hydrologic response to flood producing process, which involves a lot of influencing factors, such as soil water holding capacity, rainfall spatial and temporal variability, the relief and human activities, etc. The uncertainty of every factor has great impact on the security and accuracy of modeling results. I.e. the exact value of hydrologic parameters determines the validity of modeling hydrologic variables. Hence the orientation of the parameters in hydrological model is very important. There are various means of gaining their data. But some values of the parameters are achieved by using statistical method applied to the observing data that cannot image actual status. Herein the more attention to hydrologic parameter inversion is paid. DNA approach resolved this problem is a robust tool in modeling nonlinear system. The slow rate of convergence is the main disadvantage of the algorithm, whose results from complex hydrological model with many parameters is based on some parameters and prior knowledge unknown. This make the algorithm must devise a new policy from scratch. This paper presented an idea based on prior knowledge relevant to this system. It can not only find an optimization in an integral domain, but also can avoid the duplication of these efforts and accelerate the convergence. There is a marked improvement in the hydrologic parameter inversion.

Risk Comprehensive Evaluation of Water Supply in Middle and Low Reach of Hanjiang River after the Middle Route of South-to-North Water Diversion

Liu Tao　Shao Dong-guo　Gu Wen-quan

State Key Laboratory of Water Resource & Hydropower Engineering Science， Wuhan University， Wuhan， China， 430072
E-mail:yymclt@163.com

Abstract: After running the middle route of South-to-north water diversion, the quantity and process of water from Danjiankou reservoir will be decreased and affected, which will inevitably lead to weaken the capacity of water supply to the middle and lower Hanjiang river. It is essential to evaluate the water supply risk in this basin and arrange auxiliary project with optical scale and layout in order to guarantee sustainable development in both waterhead region and water supply region. Firstly, several risk indexes of water supply are proposed. Secondly, every index relative right is confirmed by application of the Analytic Hierarchy Process and a comprehensive evaluation model are proposed to measure and assass the risk of water supply. Finally, this article integrates several risk indexes to evaluate the risk of the water supply system in the middle and lower Hanjiang River.The results testify the feasibility and practicality of the model and are useful in decision making for the Middle Route of South-to-North Water Diversion.

Keywords: South-to-north water diversion; Hanjiang River; risk of the water supply; the Analytic Hierarchy Process; comprehensive evaluation

Research on GIS-Based Environmental Safety Management Information System of Coastal Waters

GUAN Youhai FENG Qimin

College of Environmental Science and Engineering, Ocean University of China, Qingdao 266071 P.R.China

Corresponding author. Tel and fax : 0086-532-85902218.

E-mail address: gyh_lhl@yahoo.com.cn.

Abstract： Owing to the exploitation of ocean resources and the change of coastal industry base construction, plenty of pollutants discharged lead to serious environmental pollution of coastal waters and destroy local ecological balance that threatens to existent environmental safety of local inhabitants and marine biology of coastal waters. So, environmental safety problems of coastal waters are focused by the whole world and must be solved. However, environmental information of coastal waters is so abundant, complicated, temporal, spatial and dynamic that makes traditional management and analysis methods invalid. So, environmental safety problems of coastal waters must be solved with the help of more effective Management Information Systems (MIS). To these problems above, this paper puts forwards establishing Environmental Safety Management Information System of Coastal Waters by integrating GIS into environmental management of coastal waters to solve environmental safety problems of coastal waters. And taking the establishment of Coastal Waters Environmental Safety Management Information System (CWESMIS) for instance, this paper discusses its technology structures, functions and its further function extension in detail. CWESMIS, based on the valid pollutant information management of monitor station of coastal waters, realizes to predict and analyze pollutant discharge state of every pollution source, and display spatially results of analysis and prediction. The system provides an effective method for coastal waters to realize environmental safety management.

Key words: GIS, Coastal Waters, Coastal zone, Environmental Safety , MIS

Distribution of water resource and the impacts of water factor on the community characteristics of desert riparian forests in the Tarim River valley

Liu Jiazhen[1, 2], Li Weihong[1] and Chen Yaning[1]

1 Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi, 830011

2. Graduate School of Chinese Academy of Sciences, Beijing, 100039, China.

E-mail:kljkzx@sohu.com

Abstract: We studied the distribution pattern of water resource in the Tarim River Valley and relationships between the characteristics of plant communities and water factor by using Multivariate Statistic Analysis. The data of 28 plant plots and environmental factors, originated from the fieldworks in 2003—2004, were analyzed. The results showed the impoundments and diversions of surface water for human use in the upper and middle stream valley during the last 50 years greatly contributed to the water shortage of the lower stream valley, and brought the watercourse from Daxihazi Reservoir to Taitema Nor. on dry since 1972. In addition, inter-annual fluctuations of stream-flow were another reason caused water resource shortage severely in the study region.

The Regression Analysis showed soil moisture and the groundwater level were liner relation, where the groundwater depth was deeper and where the soil moisture was lower. The vegetation coverage had relation to the groundwater depth and the water content in soils. The variations of water content in soils and groundwater table resulted in the different characteristics of plant communities at different monitoring sections. Species richness was high in the environments where water conditions were relatively adequate but species evenness was low. Conversely, species richness was low in environments where water conditions were poor but species evenness was high. Because many species of the desert riparian forests in the Tarim River were photophilous plants, species competitions were drastic in the places that were provided with high groundwater level, where some herbs couldn't remain due to dense coverage of shrubs. So at the vertical distance from stream, the spatial distribution of species diversity of communities showed the high species diversity was not in the region near stream channel. Furthermore, diversity of plant communities has linear relationship to the soil moisture and the concentration of potassium in soils by using Stepwise Regression.

Keywords: water resource, groundwater depth, soil moisture, characteristics of plant communities, desert riparian forests

This work was supported by the National Basic Research Program of China (No. 2004CB720201) and the National Natural Science Foundation of China (Grant No. 90102007).

Characteristics of multi-timescale of the annually variations of Huolin River flow and its effects analysis

LU Xiao-ning[1,2] Deng Wei[1] Zhai Jin-liang[3]

1.Northeast Institute of Geography & Agricultural Ecology，CAS，Changchun, Jilin 130012，China;
2.Graduate School of the Chinese Academy of Sciences, Beijing 100039, China；
3.Chinese Academy of Sciences，Beijing 100864，China
E-mail:lxn801012@163.com

Abstract: Huolin River is one of the most important water supply sources for the Xianghai, Kerqin, and Chaganhu wetlands in the west Songnen Plain. A multiple time-scale analysis was used to analyze an annual runoff series of 46 years of the Baiyunhushuo hydrologic station, which is located at the middle reaches of Huolin River. Our main objective was to discuss the periodic characteristics of the runoff series, and examine the temporal patterns of the river recharge to floodplain wetlands in its lower reaches, and its effects on floodplain wetlands environmental evolution. Wavelet analysis showed that the annual runoff of Baiyunhushuo hydrologic station varied mainly in three time scales. The intensity of periodical signals of different time scales was strongly partially distributed in its time-frequency domain. Interdecadal variation longer than 30 years played a leading role in the temporal pattern, and in this scale, the runoff of Baiyunhushuo hydrologic station varied in turn of rain, draught and rain. Accordingly, the landscape of floodplain wetlands presented periodic features, especially prominent before 90s. Compared with intense human activities, the runoff periodic pattern of middle and small scales, which is of relatively low energy, have unobvious effects on wetlands environmental evolvement, especially distinct after 90s. Prediction indicates that the runoff of Baiyunhushuo hydrological station of Huolin River will still be in a relatively rainy period under a large scale of draught period in the following 5 years or so. Rationally distributing and managing water resources, reducing the river regulation and abstraction actions will be favor of the protection of existing wetland ecosystems and the restoration of degeneration ones in the basin.

Key words: Huolin River；floodplain wetlands；wavelet analysis；multi-timescale；environmental evolution

Mapping water reuses within reservoir cascades in irrigation district

Cai Xueliang Cui Yuanlai

State Key Laboratory of Water Resources and Hydropower Engineering Science
E-mail:whucxl@yahoo.com.cn

Abstract: This paper presents a method for analyzing water reusing within irrigation district through reservoirs cascades using RS/GIS. Reservoirs (including farm level reservoirs (ponds) and system level reservoirs) play important roles in water reusing by capturing and diverting water (both irrigation water and other water resources like rainfall, drainage flow etc.) to fields. Water flow paths are analyzed through reservoir cascades from upstream to downstream in the study area. Each time when water goes down one level along the cascade, the chance to be reused decreases. So the total *virtual available water volume* decreases. An integrated indicator RP (Reusing Possibility) is introduced to describe the maximum reusing possibilities of the out flowing water from each pixel. It relates to the number of downstream reservoirs and their storage capacity, topographical factors and land use. With this factor the whole area can be mapped so as to provide clear spatial distribution information about water reuses possibilities. A case study is carried out in Zhanghe irrigation scheme of Southern China. Water bodies are delineated on screen from high spatial resolution image (IKONOS, 1m) and surface area is calculated. Catchments are extracted with DEM and reservoir cascades are identified. Storage of each reservoir is estimated using a Surface area ~ Volume function. Land use is distinguished as irrigated or non-irrigated. Then the indicator is calculated pixel by pixel. The RP map shows lower value in hilly or non-irrigated area, while higher value in flat or irrigated area. The method is applicable and the result is helpful to understand water recycling and water productivity variation at different spatial scales within irrigation district. It also helps us to better understand water scarcity in regional district.

Comparative study on multi-branch river runoff forecasting method

WANG Rui[1]、XIA Jun[1,2]

1.Wuhan University, Wuhan 430072, China;
2.Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China

E-mail: wang-o-rui@163.com

Abstract：In the runoff forecasting，the prediction on multi-branch river is much more difficult and complicated than that does not have branches. And the more branches, the more difficult and complicated to predict. But many areas with significant control reach, or areas where economy is more developed, are all on the multi-branch rivers. Today, making proper use of water resource is becoming more and more important. So improving the precision of multi-branch river runoff forecasting to meet the request of the operation and management of reservoir is an urgent subject to be solved.

In the recent several years, various mathematic techniques have been widely applied to runoff forecasting. Like fuzzy mathematics, stochastic model, regression analysis in the early researches, and now artificial neural network model has become a new focus. These methods have their own superiority and insufficiency on various aspects, such as the establishment and solution of model, forecast accuracy, applied effect，suitable condition and so on .This paper attempts to do some research on three kinds of models with different influence factors.

The methods to be discussed include multivariate linear regression analysis model, water balance model and 3-layers BP neural network model. In multivariate linear regression analysis, it carries on correlation analysis to select predicting factors tentatively; then sieves the predicting factors out according to the result of calculation; finally sets up the optimum multivariate linear regression model. Water balance model is founded on the basis of water balance equation, obtains the output variables by the input variables. Because some input variables are unknown, the model ascertains them through establishing response relation between the unknown terms and the known variables. The BP network model readjusts weight value continually through training the sample repeatedly, causes the network to restrain, thus forms the function mapping of input - output.

The application of three models to the watershed of Tarim indicates that the discharge hydrograph simulated and predicted are satisfying. Although the effects of some other factors are considered, the forecast accuracy will not be improved obviously. Above all, through analyzing the structures, parameters and forecast precisions of these models, artificial neural network model is better as compared with other two. In the end, this article puts forward some proposals about how to strengthen the predict abilities of multi-branch runoff forecasting methods.

Keywords: runoff forecasting; multivariate linear regression model; water balance model; artificial neural network model

Baseflow separation in the source regions of the Yellow River

Liqun Chen[1,3], Changming Liu[1,2]

1 Institute of Geographic sciences and Natural Resources Research, CAS, Beijing 100101 China

2 College of water science, Beijing Normal University, Beijing,100875 China

3 Graduate school of Chinese Academy of sciences, Beijing, 100039 China

mail:chenlq.04b@igsnrr.ac.cn

Abstract: Baseflow separation has long been a topic of interest in hydrology. To quantify baseflow in the source regions of the Yellow River, improvement on a two parameters water balance technique, Kalinin method, was carried out based on the climate characteristics and the relationship between the river and groundwater. After the improvement, the two parameters filter required only one input parameter, namely recession constant, and the other parameter was optimized based on the streamflow processes. Relationships between the two parameters and between the optimized parameter and baseflow index were estimated. There existed a strong relationship between BFI(baseflow index, the ratio of this volume to the total volume of streamflow for the period is defined as the base-flow index.) and the optimized parameter. Sensitivity analysis showed the BFI was not sensitive to the variation of recession constant, with the increase of recession constant, increase or decrease of baseflow of the whole year were all possible, it depends on the shape of the daily hydrograph. To evaluate the performance of the improved method, baseflow of the study regions was also estimated using 3 other methods. The annual volume of baseflow showed a good linearship of between the improved Kalinin method and other 3 baseflow separation techniques. The overall shape of the daily baseflow generated by Kalinin methods and digital filter were very similar. Volumes of annual baseflow of Kalinin baseflow separation method were the lowest among the 4 baseflow separation method. Differences and lack of clarity in the definition of base flow complicated the comparison between the filters. An advantage of the method introduced in this paper is the clear interpretation of the separated components.

Application of Genetic algorithm optimizing support vector machine in water demand

Lingling ZHANG

Business school, Hohai University, Nanjing, 210098, China
State key lab of hydrology-water resources and hydraulic engineering, Nanjing, 210098, China
Tel: 13813099186, Email:Llzhang007@163.com

Abstract: With the scarcity and the sharply increasing conflict of supply and demand of water resources, the forecast of water demand is becoming an effective means to the water resource programming and management. Yet the scarce samples and the self limitation of the forecast method make the precision low. The support vector regression machine (SVRM) is based on Statistics Learning Theory, regards the structure risk minimum as regulation. It has some merits, such as dealing with the data of small sample, high dimension, the global optimization and the excellent generalization ability. The paper takes them as the influence forecast factors, such as the gross industry output value, the gross agriculture output value, the irrigation area, the gross population and the city population. It models the 5 dimensions of input and 1 dimension of gross demand water. As far as the problem of the memory which the accessing kernel matrix increases with the number of samples, is concerned, how to get the Lagrange multipliers (the coefficient of the samples) is the difficulty problem. The traditional has difficulty in solving the problem or does not solve the complex high dimension non-linear problem. The paper adopts the common optimal method---genetic algorithm solves the sample coefficients. Compared with the traditional models, GA-SVRM is based on the stable math theory, has the high precision forecast, better applicability, general value in the complex water demand.

Key Words: Water demand forecast; Support vector machine; Statistics learning theory; Genetic algorithm.

Effect of Precipitation and Mulching Measures on Soil Moisture Variation

Zhang Qiuying[1]，Li Fadong[2,3,4]，Ou Guoqiang[1]，Song Xianfang[3]，Tang Changyuan[4]

1 Chengdu Institute of Mountain Hazards and Environment , Chinese Academy of Sciences , 610041;

2. Shijiazhuang Institute of Agricultural Modernization, Chinese Academy of Sciences (CAS), Shijiazhuang 050021, China;

3. Institute of Geographical Sciences and Natural Resources Research, CAS, Beijing 100012; 4. Chiba University, Japan

E-mail:qiuying.zhang@gmail.com

.**Abastract:** response of soil moisture to precipitation and mulching measures was investigated based on the continuous observation information in plots with no-mulching, straw-mulching and granule-mulching. The results show that individual rainfall event is difficult to infiltrate into up to 30 cm depth from surface during the dry season ,especially when soil moisture is lower than 20 % at 30 cm depth. As for the responsive time, at 30 cm, it is the shortest in granule-mulching plot, followed by straw-mulching plot and longest in no-mulching plot. At 60 cm, shortest responsive time is observed in straw-mulching plot and longest in no-mulching. At 100 cm, soil moisture increases first in granule-mulching plot and 10-h delay takes place in straw-mulching plot compared with that of straw-mulching and it's the slowest in no-mulching. The soil moisture at 30 cm depth in no-mulching plot is 0.13 and 0.07cm^3/cm^3 lower than those of granule- and straw-mulching. It indicates the mulching measure is good for the storage of soil moisture. Although infiltration ability at 60 cm is more powerful in straw-mulching plot than that in granule-mulching plot, the latter's ability of water conservation is better than the former's.

Key words: soil moisture，precipitation , mulching measures , Taihang Mountain area

Study on the Integrated Prevention and Treatment Divisions of Miyun Reservoir Basin: Base on RS and GIS

Li Yongfu[1] Dang Anrong[1] Jia Haifeng[2]

1.Center for Human settlements Tsinghua University;
2.Department of Environmental Science and Engineering Tsinghua University, Beijing 100084

E-mail:liyongfu@mail.tsinghua.edu.cn

Abstract: In recent year, there is a deteriorate trend in water quality of Miyun reservoir. It is the urgent matter to launch the research on integrated protection and treatment of Miyun reservoir basin and to strengthen its management and protection according to law. In this paper, we firstly started with the status quo water-soil losses and non-point source pollution, integrated with agricultural and industrial activities of mankind in Beijing Miyun basin, and then made designs for the index system of integrated protection and treatment divisions. Secondly, we adopted many new work methods which rely mainly on the spatial information techniques of Remote Sensing (RS) and Geographic Information System (GIS) while making pluralistic statistics and gray theory and spatial analysis subsidiary, and then succeeded in the combination of qualitative analysis and quantitative calculation. Finally, this preliminary division scheme laid a foundation for policy formulation to carry out comprehensive ecological improvement including pollution and water-soil losses treatment in Miyun valley. Indubitably, Miyun reservoir is one of the most important sources of water in Beijing. From whichever angle to look on Miyun reservoir of water-source protection, people's livelihood and urban construction, we can say it has become the life water and played a very important part in people's livelihood and economical development. It is timely and necessary to formulate concerning policies of treating and protecting Miyun reservoir in the light of its division's plan.

Keywords: RS/GIS, Water-Soil Losses, Non-Point Source Pollution, Prevention and Treatment Divisions, Miyun Reservoir

Studies On Soil Water Resources and Soil Moisture Control

Yan Meijun

China Agricultural University, Beijing 100083 , PR China
E-mail:yanmeijun2008@126.com

Abstract: This paper elaborated the definitions and characteristics of soil water resources. In face of water shortage and vegetation degeneration, through analyzing the relationship between soil water use and vegetation growth based on a lot of data and field experiments, the author provided the reasonable and efficient ways of the utilization of soil water resources aimed to control evaporation from soil and ineffective transpiration from plants as well as established the control model, which would be beneficial to the sustainable utilization ways of water resources and reduce the lack of water resources in China.

Application of extension method to similar analysis of rainstorms in a river basin

JUN NIU, ZENGCHUAN DONG, ZHONGMIN LIANG

State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Nanjing 210098, China
niujun@hhu.edu.cn, Tel: (0)13770501597

Abstract: By means of extension theory and extension method, considering distribution areas and the amount of rainstorm synthetically, this article sets up a matter-element model for similar analysis of rainstorms in Song-nen river basin. The application shows that this model has a quality of solving contradiction problems quantitatively, and the test of the output proves that this model possesses higher resolution, especially to rainstorms which have similar storm areas, which effectively gives technical support to coupling information on historical rainstorms and floods with the real-time flood-control forecasting system.

Keywords: extension method; similarity of rainstorms; matter-element; degree of correlation

Study on un-sustainability of surface water and ground water resources in Huaisha river basin by environmental isotopic technology and hydrochemistry

Liu Xiangchao, Xia Jun, Song Xianfang, Yu Jingjie, Yang Cong

Changsha University of Science and Technology, Changsha 410076, China; Key Laboratory of Water Cycle and Related Land Surface Processes; Institute of Geographic Science and Natural Resources Research, CAS, Beijing 100101, China
E-mail:liuxc@igsnrr.ac.cn

Abstract: Surface water and ground water resources are important natural resources in semi-arid and semi-humid climate regions in north China. As effective tracers in the water resources studies, Environmental isotopes and hydrochemistry can reveal the transformation interrelationships between the surface water and ground water effectively and then indicate the sustainability and un-sustainability of them demonstrably. On the field survey and sampling of spring water, river water and well water and measuring on the Hydrogen and Oxygen isotope and hydrochemistry components, we analyzed the spatial distribution discipline and evolvement tendency of Hydrogen and Oxygen isotopes components and water chemistry components along the river line at various regions. According to the relationship between the altitude the spring exposed and the Oxygen isotope components, we revealed the altitude effect of Oxygen isotope of the spring, and then offered theory foundation for deducing the recharge source of the spring; by applying the mass balance method, we estimate the annual mean ground water recharge ratio of the basin. On the conclusion that the annual mean ground water recharge ration is far less than the annual mean runoff coefficient, and on the combination with the hydrogeology conditions and the recharge sources of the ground water, and the field survey results, and on the contrast of the rainfall runoff coefficients of the Huaisha river basin and the region of Chaobai river basin above Miyun reservoir from the 1960s to 1990s, we get the primary conclusion that quite a part of ground water in Huaisha river basin is from the higher region outside of the basin, and the basin is a typical un-enclosed basin. On the basement of synthetical analyses, with the combination of the components of Hydrogen and Oxygen isotopes and the hydrochemistry and the characteristics of the geomorphology and geology and watershed systems, we analyzed the relative contribution of surface water and ground water runoff in various regions in the basin to the streamflow, and analyzed the transformation relationship of recharge and discharge of between surface water and ground water. At last, the conclusion that the sustainability of surface water and ground water resources in Huaisha basin is very limited.

Key words: Environmental isotope hydrochemistry resources sustainability

Regional Mode of Limited Irrigation in the North China Plain

Ding Zhongyi[1], Hao Jinmin[1], Niu Lingan[1], Zhang Fugang[2]

1. Department. of Land Resources Management, China Agricultural University, Beijing China, 100094.

2.Institute of Geographical Sciences and Natural Resources Research，CAS，Beijing China, 100101

E-mail: dzy2002@126.com

Abstract. Grain yield is controlled by a variety of factors, especially by water supply in semi- and arid zone. We selected Quzhou County as our research area, located in the North China Plain. This paper examines the role of climate and human activities that potentially influence water resources. The analyzed data were grouped into two scales: a regional scale (precipitation and groundwater and runoff) and a field scale (irrigation quota and volume). In the regional scale, the method involves the regional water balance model. Although rainfall and runoff decreased as time went on, there were some evidences showed a significant relationship with groundwater depletion. The results point to the human activities, mainly agricultural production, which can explain the gradient of the groundwater table. Water consumption and grain yield are important to consider under the scenario of groundwater table depletion and food supply. So the main emphasis is placed on the compromise between the available regional water supply and the maximum grain yield. Under the constraint of water supply available from the region, a methodology, crop water-production function, is introduced to estimate the change of grain yield in the field scale. According to our pilot study, this will result in less grain yield contrasting to efficient irrigation, and marginal crop output decreases as irrigation volume increases. Optimization irrigation volume can be gained. Results of experimental applications are given to identify the proposed irrigation scheduling.

Numerical Simulation on 2-D Seepage Flow of Earth Dam with Finite Analytic Method

XIANG Bo, HUAI Wenxin, YANG Zhonghua

State Key Laboratory of Water Resources and Hydropower Engineering Science,
Wuhan University, Wuhan Hubei 430072, China
E-mail:xiangbo_79@163.com

Abstract: The new five-point element scheme of finite analytic method for Laplace equation in irregular domain is used to calculate the constant seepage flow in heterogeneous dam body. The 5-point scheme of finite analytic method is given to simulate the unsteady seepage flow. The calculated result fitted well with the one obtained by finite element method. It shows that the five-point element scheme of finite analytic method can be used well to simulate the seepage flow.

Key words: Five-point element scheme, Finite analytic method, Laplace equation, unsteady flow

The Design and Development of Visual COM of Underground Water

Weidong Zhao, Yunxia Li , Jiazhong Qian

Dept. of Geographic Information Science., School of Resources & Environmental Engineering, Hefei University of Technology, Hefei, P.R. China.
E-mail:troet68@163.com

Abstract: With the rapid development of Chinese economy and society, the problem of water becomes more and mere seriously. Many new high technologies, such as Geographic Information System (GIS), Remote Sensing (RS) and computer technologies and so on, have been used to solve the problem. GIS is very useful for solving the problems related with space position and is applied to many Management Information Systems (MIS) of underground water. It is not easy to integrate the MIS of underground water with GIS because that most of experts of underground water know little about GIS and its seamless integrating technologies in one hand. It is not easy to integrating professional models with GIS effectively because that most of experts of GIS know little about professional models of underground water in the other hand. In order to solve this problem, a visual Component Object Model (COM) has been designed and developed in this paper.

With the rapid development of COM, almost all famous GIS companies have developed their GIS COM. Many famous GIS COMs, such as MapObjects, ArcObects, MapX, and Mapgis, have been widely used in recent years. Although it is comparatively easy for experts of underground water to develop their MIS of underground water by use of GIS COM, it is necessary to encapsulate some complex thing into simpler COM because of the complexity of GIS COM. In order to observe the spatial distribution of underground water, a visual COM based on GIS COM called Mapgis has been designed and developed.

The name of the visual COM is UWRVIS, which consists of several convenient interfaces. The main interfaces of UWRVIS are shown as the following:

1. File Interfaces: methods: OpenMap(), SaveMap(), ShowMapLayer(), etc;
2. Input and Output Interfaces: methods: InputWRData(), OutputWRData(), InputWRDataFile(), etc;
3. Zoom Interfaces: methods: MapZoomIn(), MapZoomOut(), MapZoomAll(), ect;
4. Visual Interfaces: methods: DrawContour(), DrawHillShade(), Draw3DGraph(), DrawProfile(), Draw4DGraph(), etc;
5. Data Interface: property: map; methods: AddWRLayer(), AddMPNT(), RemoveWRLayer(), etc

UWRVIS is encapsulated on the base of Mapgis COM, which has the following main functions:

1. I t can open map easily by use the file interfaces:;
2. It can input underground water data by using the input and output interfaces, for example, all of the observation points of underground water can be easily input into map by use of method called InputWRDataFile();
3. The map can be easily Zoomed by using zoom interfaces;
4. Many important visual graphics, such as contour, hillshade, 3D graphics, and even 4D graphics can be drawn easily by using the visual interfaces.

In conclusion, the case study shows that UWRVIS can be used very conveniently by experts of underground water, and is very powerful and practical.

Application of the multi-objective fuzzy optimization model to water resources system planning and management

ZHOU Hui-cheng ,ZHU Yong-ying
School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian, Liaoning Province, 116024, China.
E-mail:zhuyongying1311@163.com

Abstract: Water resources system planning and management is a very complex decision-making problem related to economic, social and environmental factors, and has a direct influence on the sustainable development of water resources. The fuzzy optimization model is a feasible and efficient method to deal with the multi-objective decision-making problems, which has been widely applied in practice. In this method, the physical meaning is clear that 1 and 0 are regarded as the extreme points of the relative membership degree. But when the objective values of all alternative are different slightly, the evaluate results are too close simultaneously to make choice. This paper considers the maximum and the minimum of the relative membership degree as the ideal and non-ideal points respectively which are applied to a real case to test its efficiency compared with the former one. Experimental results indicate that the latter is more efficient than the former when the objective values are approximate.

Key words: multi-objective decision-making; the fuzzy optimization model; water resources planning and management

Application of the fuzzy reasoning based on rough sets theory in groundwater quality assessment

ZHU Yong-ying, ZHOU Hui-cheng
School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian, Liaoning Province, 116024, China.
E-mail:zhuyongying1311@163.com

Abstract: The rough sets theory is a new mathematical tool for analyzing the uncertain and imprecise problems. The fuzzy reasoning is an uncertain inference using fuzzy knowledge. This paper combines rough sets theory and fuzzy reasoning together to assess the quality of the groundwater. In this method, discernibility matrix and logic operation in rough sets are used to evaluate the importance of particular quality indexes and to eliminate the redundant indexes. This method considers the dependence degree of attributes and the subjective preference simultaneously to choose the indispensable attributes in reduction of attributes. Fuzzy rules are extracted from the reduced decision table and exploited in fuzzy reasoning processes to solve the bottle-neck problems for modeling the assessment system. An illustrative example is presented and the result shows that this method can give appropriate assessment of water quality and it is effective as well as objective.

Keywords: rough sets theory; fuzzy reasoning; groundwater quality assessment; fuzzy rules

Study on Method and Theory of the Flood Disaster Evacuation System

LI Fa-wen[1] , ZHANG Xing-nan[2]， FENG Ping[1]

1．School of Civil Engineering，Tianjin University，Tianjin 300072，China

2．State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China

E-mail:hohailfw@163.com

Abstract: The flood disaster loss is the most serious calamity in all natural calamity of our country. With the development of urbanism and society-economy, the loss caused by flood is more and more serious. The paper study the basic principles of the flood disaster assessment under GIS, flood disaster evacuation and evacuation decision based on analysis of the property feature and mechanism of flood disaster aroused break-dam.

The break-dam flux is calculated by Fread formula based on analysis of the mechanism of break-dam. The connectedness of flood submerging region is analyzed by using boundary tracking based on 8-connected. Distance in the mathematical morphology is applied in flood spreading, and the distance from one point to place of break-dam in the flood submerging region can be calculated. The flood submerging range and depth are simulated by using flood submerging model based on DEM and flux of break-dam. The idea of flood disaster analysis based on “point-line combination” is put forward. The roads in flood submerging range are regarded as "line", the submersed villages and refuges are regarded as "point", and the submersed villages are regarded as start-point, refuges are regarded as end-point. The concept of wagon flow random degree is introduced in dynamic route analysis, and according to this random degree, warning levels are plot out three grades, which are showed by green, yellow, red signal lamp. Based on characteristic and existent problems of flood disaster evacuation, the sustainable development mode of refuges under the nature-manpower duality is put forward. Based on jieke theory, the jieke theory of evacuation resettlement area system is put forward, and numbers of victims that enter into resettlement area are restricted by on-off model of jieke. According to GIS use in flood disaster evacuation system, the projects that satisfy some limited conditions are picked out through the overlay algorithm of hierarchical maps in GIS. Final, the optimal scheme is selected from the projects by application of fuzzy similarity nearness degree matter-element model. These research results have laid a foundation for further research of the flood disaster practice and theory.

Keyword: flood disaster; flood submerging range; flood control; evacuation

Hydrodynamic and Environmental Effects of Reclamation around Semienclosed Bay

Qinhua Fang, Yuwu Jiang, Luoping Zhang, Huasheng Hong

State Key Laboratory for Marine Environmental Science
Environmental Science Research Center, Xiamen University, Xiamen 361005, China
Tel:0592-2181902
Fax:0592-2181875
Mail:qhfang@yanan.xmu.edu.cn

Abstract: Usually there are large populations settled in the land areas close to bays. Intense population density and rapid economic growth require more lands for development. In order to find a solution to the conflict between human being and nature in the coastal areas, land reclamation has become a common phenomenon although in the early history. Land reclamation around bays should be paid special attention because of its special hydrological conditions. Hydrodynamic conditions including velocity of flow and seawater exchange in the semi-enclosed bay are easily to be affected by the sea areas and coastline variation caused by land reclamation. Characteristics of bay ecosystem are also obvious determined by its hydrodynamic conditions. In this paper, an indicator system involving human activities and environmental effects will be established to analyze the relationship by methods for example correlation analyzing. The analysis will be based on the case study of Xiamen bay in the southeast China. The results can be applied to control the land reclamation in the bay areas.

Key words: land reclamation; bay; environmental effects; hydrodynamic

Study on hydraulic resistance

Fengfeng Gu

School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian 116024, China
Tel: 0411-84708509, 13942691614
Email：gufengfeng@yahoo.com.cn

Abstract: The characteristics of roughness coefficient are very important for practical application. To study the variation of Manning's n with the influence of flow depth, mean velocity and density of vegetation, some experiments are conducted. The measured velocities in this study seem to influence little on curve of n ~ h at a limited range, and a newly linear increase of Manning's n with flow depths is observed clearly. According to the agreement that the flow resistance of densely unsubmerged vegetation is dominated by the resistance exerted on individual of a vegetation community, the influence of density of vegetation on Manning's n is significantly estimated. A velocity distribution is assumed to be applicative here to describe the vegetative flow for submerged vegetation and confirmed by experimental results. Based on this distribution, the relationships between n and h for unsubmerged condition are extended to describe the flow for submerged condition. These results are also well confirmed by experimental results and significant for practical application.

Keywords: hydraulic resistance; Manning's n; vegetation

Review on the isotopic hydrograph separation methods

QU Si-min[1,2], BAO Wei-min[1,2], Shi Peng[1,2]

1.State Key Laboratory of Hydrology-Water And Hydraulic Engineering, Hohai Univ., Nanjing 210098, China, wanily@hhu.edu.cn

2. College of Water Resources and Environment, Hohai Univ., Nanjing 210098, China

E-mail:wanily@hhu.edu.cn

Abstract: The objective of this study is to introduce briefly the basic concept and expression of isotope and the theory of isotopic hydrograph separation, to review the advantages and disadvantages of serious hydrograph separation methods which is applied all over the world and to introduce two-component isotopic hydrograph separation model and three-component isotopic hydrograph separation model in details. Deficiency of the domestic study about isotopic hydrograph separation is pointed out and research direction and the state-of-the-art of its application are viewed.

Key words: isotope; hydrograph; two-component isotopic separation model; three-component isotopic separation model

Study on Marine Oil Spill Response Information System Based on WebGIS

Liao Guoxiang, Xiong Deqi

Dalian Maritime University, Dalian 116026, China
E-mail:liaogx@dlmu.edu.cn

Abstract: The oil spill contingency has great potential impact on the ocean environment. The numerical modeling and simulation of the spilled oil at sea plays an important role in the oil spill contingency decision-making. Internet has been widely utilized in prevention and control of environmental pollution instead of traditional technology, while most of the traditional oil spill response information system based on GIS can only be used in personal computer or Intranet. In order to develop the oil spill response information system that can be used in the Internet, the paper proposed the scheme of the oil spill response information system based on WebGIS, and analyzed the running model of the system, and designed the functions of the system. Based on the analysis of the numerical modeling of marine oil spill and method of creating response information databases and function of application in both server and client, the system is developed by using the GIS technology， network technology，database technology and together. The key techniques such as the integration between the models and the WebGIS, and the visual display of the simulated results on the Internet have also been discussed.

Keywords: Oil spill; Response; Numerical simulation; WebGIS; Integration

Study on Minimum Ecological Water Demand in Zha Long Wetlands

Xiangqian Dai[1,3], Minjian Chen[2]

1 Institute of geographic sciences and natural resources research, CAS, Beijing 100101 China

2, Hydrology and water resources department, Nanjing Hydraulic Research Institute Nanjing, 210024 China

3 Graduate school of Chinese Academy of sciences, Beijing, 100039 China

E-mail:daixq.05b@igsnrr.ac.cn

Abstract: Wetlands have many ecological functions, including keeping biodiversity, conserving water resources, supplying material, flood control and fighting a drought so on. They play an important role during the course of production. With the social-economic development, wetlands are under threat from human-induced changes to their hydrology. Namely, wetlands are dramatically degrading even dying out. To alleviate these threats, restore wetlands degraded and enhance biodiversity, it is very necessary to study the minimum ecological water demand in wetlands.

The wetland is a special ecological system which is different from the terrestrial system and aquatic system. It is a transitional ecological system. According to the former research, the hydrology and terrain is crucial for wetlands to form and develop. The wetland ecological system changes with the fluctuant hydrology. When the hydrology reduces some degree, the status of wetlands ecological system becomes very terrible and is hardly restored. To avoid the situation and keep the basic structure and function in wetlands, this paper mainly studies an appropriate method to seek the critical of hydrology.

The surface area is a function of water level in wetlands; whereas, the ecological situation in wetlands is closely related with the surface area. Therefore, surface area or water level control is essential to keep good ecology and environment. According to the function of surface area and water level, some inflexion can be found. Then, their rationality is tested by the actual data. Finally, the critical of hydrology is figured out, and the minimum ecological water demand is worked out in accordance with water balance equation. From the point of view of the whole, this paper uses GIS software, some vector's terrain information, remote sense images and hydrological datum to accomplish the purpose in Zha Long Wetland which is located in Heilongjiang province.

The result of the critical of hydrology in Zha Long Wetland is to at least keep 340 km^2 water surfaces for basic ecological function and structure. Moreover, the minimum ecological water demand volume is 0.234 billion cubic meters with mean annual hydrological datum. When the ecological situation in Zha Long Wetland becomes very terrible in recent years, some measures are taken. For example supplement water. Compared with the actual supplement water for Zha Long wetland, the calculated results are very close to the realistic situation. This proves the methodology and model is feasible and effective.

Change on Water Circulation Mode Affected by Water Resource Development in Shiyang River Basin

Qian Yunping, Gao Yajun, Jiang Xiuhua

Hydrology Bureau of YRCC Zhengzhou China 450004
E-mail:yunping1965@163.com

Abstract: Shiyang River Basin, 41600 km^2 in area, located in inland arid region of Hexi corridor and the plain in the Basin is important agricultural irrigation region of Gansu with low precipitation and high evaporation, the water resources are seriously shortage. The total water resource in the Basin is 1.66 billion m^3, mainly used for irrigation, which occupied 90% of total water resources. Because of overuse of water resources, in particular over-exploitation of groundwater, the exploration volume of groundwater was up to 1.48 billion in 2000, resulting in continual descending in groundwater table and dried up of springs in the Basin, the water circulation modes in the Basin have changed greatly from the complicated mode of surface water to groundwater to surface water to a single mode of surface water to groundwater. The variety of mode have changed the spatial distribution of water resource in the Basin which leading the flow entering the lower Minqin Basin decreasing, the inflow was 542 million m^3 per year in 1950s, but only 99 million m^3 per year from 2000 to 2003, and groundwater had to be over-exploited, the volume of exploitation of groundwater was 700 million m^3 in Minqin Basin, far than the inflow, and resulting in continuous descending of the groundwater table of Minqin basin The change of water circulation mode already causes a serious of severe problems, the water-use contradiction between middle and lower basin became increasingly acute. Degeneration of vegetation, desertification, and drying up of springs and lakes as well as degradation of ecology occurs in the basins, especially in Minqin basin. Water shortage and the severe environmental problems have affected greatly the sustainable development of economy and society in the basin.

To settle the problems caused by unreasonable utilization of water resource in Shiyang River, some effective measures must be taken. We must strengthen comprehensive management of water resources by scientific planning, to work out water division scheme between middle and lower basin, rational allocate and use the limited water resources, to develop high efficiency and water-saving irrigation agriculture and so on. Through these measures, water resources management for sustainable economy and ecology environment in the Basin can be improved.

Application of Infiltration Velocity Curve for Calculation of Runoff-Generating in the North China Plain

HU Hao-yun [1, 2] GUO Feng-tai [1] REN Xiao-li [1]

1 Hebei University of Engineering,Handan,China 056038;
2 Wuhan University,Wuhan,China 430072
E-mail:hhaoyun@126.com

Abstract: Over recent years, it goes without saying that groundwater in the North China Plain has been over-draught because of serious water shortage. How to stop overdrafting groundwater or replenish groundwater through field engineering impounding local rainfall-runoff has been a hot topic. So it is very important to calculate the time and the process of runoff-generating accurately. In the paper, with the analysis of rainfall infiltration in the North China Plain, both initial percentage of soil moisture content, and accumulated amount of infiltration in the process of rainfall are the main factors that affect soil infiltration velocity, as to concerning certain soil. Based on the soil water dynamics theory, the soil water movement is simulated numerically. A formula for calculating the infiltration velocity according to initial percentage of soil moisture content and accumulated amount of infiltration in different soil texture is established, that is infiltration velocity curve. The approach to calculation of runoff-generating is further studied with the application of the curve, and the validity of the simulation result is verified by experimental data. It is concluded that the application of the curve for calculating runoff-generating in the model of infiltration-excess runoff is reliable, accurately and easy.

Key words: plain region; infiltration-excess runoff; infiltration velocity; calculation of runoff-generating

Human-induced Hydrological Characteristic Alternation of Longitudinal Range—Gorge Region, Southwest, China

DING Wen-rong

The Faculty of Environment science and Engineering,
Kunming University of Science and Technology, Kunming, Yunnan 650093 China
E-mail:dingwenrongdwr@sina.com

Abstract: Longitudinal Range-Gorge Region locates in the southwest of China. It includes the traverse mountainous area and north-south directional alps and gorges which correlate to the rise of Qinghai-Tibet plateau. This area is the international river's up streams of Lancangjiang-Mekong River, Yuanjiang-Songhong River, Nujiang-Salween River and Irrawaddy River, and the up stream of Jinshajiang-Yangtse River of China.

This paper selects Lancangjiang River's branch Yangbijiang River, Songhong River's branch Panlonghe River and Jinsha River's branch Longchuanjiang River as the research objects, the hydrological data from 1950 till 2003 as the research foundation, and using many mathematic methods analysis the human-induced hydrological characteristic alternation from the aspect of suspended sediment concentration. The results show: human remarkably influence the watershed hydrological characteristic via returning the farm land to grass land and forest, building up dams, fishing sand out from the river bed, and changing cultivation mode.

Key words: Human activities; Longitudinal Range—Gorge Region, Southwest, China; Hydrological Characteristic; suspended sediment concentration.

Concept of System and Methodology for Watershed Water resource Integrated management

DING Wen-rong

The Faculty of Environment science and Engineering,
Kunming University of Science and Technology, Kunming Yunnan 650093 China
E-mail:dingwenrongdwr@sina.com
Tel:86-13678755822

Abstract: This paper systematically explains that under the situation of the water resource problem highlights increasingly, the concept of system for watershed water resource integrated management should establish on with watershed system as the object, watershed's water circulation as the scientific foundation, reasonable allocation as the centre，and men-earth regional system coordination as the destination. At last, the author puts forward the methodology for watershed water resource integrated management from the following five aspects:(1) Reforming the watershed water resource management mechanism, strengthening and implementing integrated management; (2) Strengthening the legislation work, establishing and perfecting related policy;(3) Using the market mechanism and the economic means to manage watershed water resource, building up water saving society;(4) Setting up the information feedback network system of the watershed water resource integrated management;(5) Adopting the strategy of multilayer decision in the process of watershed water resource allocation.

Key words: Watershed; Water resource; Integrated management; Concept of System; Methodology

A fast iterative tidal harmonic analysis method base on continuous functions least-square method

Wang Ruyun[1, 2], Chen Yaodeng[1, 2], Shen Hongwei[1, 2]

1.State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering ,Hohai University, Nanjing, 210098；

2.College of Ocean, Hohai University, Nanjing, 210098

E-mail:wangruyun@163.com

Abstract: About the existing computational method derived from least-square method base on discrete data, the computational time is mostly resulted from two aspects, one from the computation of forming the coefficient matrix and the right terms of the normal equations, the other is to solve the normal equations. If the data are unequal interval, we need enormous computational time to form the coefficient matrix, so the equal interval data are usually requested (in general, that is one hour). Based on continuous function least-square method, a fast iterative tidal harmonic analysis method is set up. This method overcomes the disadvantages of the traditional method. Especially, although the data are unequal interval, the coefficient matrix of the normal equations is formed by the new method is quick too, and it can better ensure the nonsingularity of the coefficient matrix and the computing convergence by using a great deal of partial tides to do harmonic analysis. The fundament of the method is to unify the forecast time interval and the foregone time interval as a whole interval to do harmonic analysis and hindcast. At beginning，the data in the forecast time interval are assigned initial value，then to do the harmonic analysis combining with observational data，and then using the hindcast value to replace the data in forecast time interval to do harmonic analysis again，to do this iterative process until the computing convergence. when the computation is convergent，the hindcast value shall be as the forecast value. Through lots of computing test, it has been shown that this method has high precision and less computing time.

Research on wavelet subband prediction model for monthly discharge time series

ZHOU HUI-CHENG[1], **PENG YONG**[2]

[1]Professor, School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian 116024, Liaoning, P.R. China; PH 86-411-84708517; hczhou@dlut.edu.cn
[2]Doctoral Student, School of Civil and Hydraulic Engineering, Dalian University of Technology, Dalian 116024, Liaoning, P.R. China; pyongcuidi@163.com

Abstract： Based on wavelet analysis theory, a wavelet prediction model is developed for the simulation and prediction of monthly discharge time series. In this model, the non-stationary time series of monthly discharge is decomposed into an approximated time series and several stationary detail time series according to the principle of wavelet decomposition. Each one of the decomposed time series is predicted respectively through the ARMA model for stationary time series. Taking the monthly discharge at Yichang station of Yangtze River as an example, the monthly discharge is simulated by using ARMA model, seasonal ARIMA model, BP artificial neural network model and the wavelet prediction model proposed in this article, respectively. And the effect of decomposition scale for the wavelet prediction model is also discussed. It is shown that the wavelet prediction model has higher prediction accuracy than the some other models and the decomposition scale has no obvious effect on the prediction for monthly discharge time series in the example.

Key words monthly discharge prediction; wavelet decomposition; ARMA

Modeling Links Between Hydrology and Irrigated Soil Salinity in a Data Sparse Environment, Inner Mongolia, China

Benjamin Runkle, Xu Liang, Fanghua Hao, Yong Yue, Peng Li

UC-Berkeley, California, USA
Department of Civil and Environmental Engineering brrunkle@ce.berkeley.edu

Abstract: Hydrological behavior and soil salinity are intricately linked in many agricultural environments, where irrigation water can unintentionally produce a waterlogged sub-surface and a salt-encrusted surface layer. The feedbacks and nonlinearities in the relationship between hydrological fluxes and salt concentrations are understudied in the context of an arid agricultural region. A physically based hydrological model is developed to examine the problem of soil salinity as it relates to evaporation, surface/sub-surface water interactions, and crop growth or agricultural productivity. The model uncovers from a physical and chemical perspective the principle transport mechanisms of salt through the sub-surface as functions of irrigation input, soil moisture, and energy fluxes. The model includes several feedbacks between the hydrologic system and the soil salt environment. The increase in osmotic pressure resulting from increased ionic presence reduces the surface layer's evaporation potential, which may act to increase the effects of waterlogging or over-irrigation. Interactions between the surface and sub-surface layers are critical to predicting crop response to raised salinity levels. Additionally, the model captures spatial relationships using remotely sensed data from the Earth Observation System and correlates this data to ground-based time series data to estimate evaporation under a salty environment. While the ultimate goal of this modeling effort is to simulate water quality and irrigation needs a range of climate and land management scenarios, this paper focuses on the influence of soil salinity on local evaporation rates. This study will be useful in improving the representation of these issues in water and land resources management models.

The model will be validated by comparison with data in the Inner Mongolia Irrigation District, an arid 5000 km^2 region along the north bank of the Yellow River in northern China. The region receives very little (<200 mm) rainfall and relies heavily on irrigation water from the Yellow River and groundwater. Drainage water polluted with fertilizers, salts, and pesticides is threatening the ecology of nearby Wuliangsuhai Lake, a wetlands ecosystem important for bird habitat. Initial conversations with local water and land managers indicate the severity of high soil salinity on agricultural productivity. Many fields are visibly white as a result of high water table levels and the resulting saline surface layer. Local land managers describe narrow bands of acceptability for the groundwater table, above which salinity and waterlogging problems take hold. This study aims to provide a decision support tool for use in many parts of Asia, extending beyond the validation region.
This project is supported in part by the National Natural Science Foundation of China and a graduate research fellowship from the U.S. National Science Foundation.

Estimation of Water Resources Distribution in River Basin through GCM data

Takashi KOBAYASHI[1], Toshiharu KOJIRI[2]

1.Kyoto-University Email:kobayashi@wrcs.dpri.kyoto-u.ac.jp
2.Kyoto-University National Institute for Environmental Studies Toru NOZAWA

A lot of climate change studies using a coupled ocean-atmosphere general circulation model (CGCM) show that, due to the global warming the amount and distribution of precipitation will change all over the world in the 21st century. Change in precipitation is a big matter of concern for the water resource management. In the recent global arming studies using a CGCM, the spatial resolution of it is increasing because the computing power and resources are increasing. However, there is still a big gap between the resolution of a CGCM and that required by the water resource management studies especially in Japan, because the Japanese country consists of small mountainous islands which generally makes precipitation distribution more complicated. For this reason, the “Downscaling” techniques have been desired as a mean of bridging this gap.

In this study, we provided a downscaling technique which temporally and spatially interpolates the precipitation dataset simulated by a CGCM, using the sea level pressure (SLP) of the ECMWF re-analysis (ERA40) dataset and the precipitation of the AMeDAS dataset. The re-analyzed SLP are classified into some clusters by the ISODATA method, a kind of pattern classification methods. For each SLP simulated by a CGCM, one cluster is selected which minimizes the difference between the simulated SLP and the cluster center, the mean value of classified re-analyzed SLP. Then, an observational precipitation data which corresponds to the selected cluster is randomly sampled and regarded as the downscaled output. The downscaled precipitation has the temporal and special resolution of 1hour and about 17km respectively. And, the future hydrological indices of the Tone River are estimated by putting the downscaled dataset into the Hydro-BEAM (Hydrological Basin Environment Assessment Model), a kind of distributed basin models.

When we applied this method to the present-day output simulated by a CGCM, the downscaled results becomes similar to the observed data. The downscaled precipitation derived from the future projection experiments by a CGCM based on the SRES (Special Report on Emissions Scenarios)A1B scenario show that comparing to the present-day results, the precipitation decreases over the areas along the Sea of Japan in winter, and it also does throughout Japan in early summer. On the other hand, the downscaled results suggested that the precipitation increases in summer, over a lot of areas in Japan. About the Tone River flow discharge, it is estimated that the discharge will decrease from spring to summer, while it will increase in winter because of the reduction of the precipitation and the early snowmelt due to global warming. In addition, it is suggested that the frequency of the high water event will increase but the averaged flow discharge will decrease. As a result, it should be noted that the water management in early spring and the disaster measures to high water event have to be more concerned in the end of the 21st century.

Study of small river restoration after water resources development: Yasumuro River experience

NAOKI HAMANO[1], HIDEYUKI WATANABE[2], FUMIHIRO TOI[2], KENTARO TAKI[2],SHUICHI MAMA[3], MOTOI SEKI[3] & NOBUYOSHI SUGINO[4]

[1]Hyogo Prefectural Government, Shimoyamate-dori 5-10-1 Chuo-ku Kobe City Hyogo 650-8567, Japan
[2]Foundation for Riverfront Improvement and Restoration, 8, Ichibancho, Chiyoda-ku, Tokyo 102-0082, Japan (taki@rfc.or.jp or toi@rfc.or.jp)
[3]Yachiyo Engineering Co., Ltd., 2-18-12, Nishiochiai, Shinjuku-ku, Tokyo 161-8575, Japan
[4]The General Environmental Technos Co., Ltd., 1-3-5, Azuchimachi, Chuo-ku, Osaka 541-0052, Japan

Abstract The Yasumuro River, which runs in the town of Kamigori, Hyogo Prefecture, is a typical small river in Japan. Various river projects including the construction of small water utilization dams to obtain a stable supply of agricultural water and channel widening for flood damage mitigation have been carried out for this river. As a result, streambed disturbances have become less frequent, causing the degradation of the river environment including rare species of life such as *Chisujinori* (Thorea okadae), a rare algal species. In view of this situation, people from different walks of life such as administrators, farmers, fishermen and local residents jointly carried out flushing releases of water by the continuous operation of movable weirs and manually polished and overturned bed gravel. As a result, the fine-grained sediment deposited on the streambed and periphytic algae have decreased, and the distribution range of *Chisujinori* has expanded. Thus, it has been shown that it is possible to restore a sound river environment hospitable to the growth of *Chisujinori*.

Key words small water utilization dam; flushing release; hydraulics of small flood; streambed disturbance; Thorea okadae

Measures for lake ecotones restoration: Lake Biwa experience

MASANORI SETA[1], KENTARO TAKI[1], TAKAHIRO NAKATSUJI[2] & YOSHIYUKI TAKEUCHI[3]

[1]Foundation for Riverfront Improvement and Restoration, 8, Ichibancho, Chiyoda-ku, Tokyo 102-0082, Japan (taki@rfc.or.jp)
[2]Osaka Office, CTI Engineering CO., LTD. 1-2-15 Otemae Chuo-ku, Osaka, 540-0008 Japan
[3]Chugoku Office, CTI Engineering CO., LTD. 1-13-20 Hikarimachi Higashi-ku, Hiroshima, 732-0052, Japan

Key words Lake Biwa; water resources development; nature restoration; water–land ecotone; reed community; lakeshore erosion

Abstract Located at the center of Shiga Prefecture, Lake Biwa is the largest lake in Japan and is one of the oldest lakes in the world. Providing habitat for about 50 species endemic to the lake, Lake Biwa has fostered a rich ecosystem. In view of the rapid growth of population and economy in recent years, a comprehensive development project was implemented (1972–1997) mainly for the purposes of conserving the natural environment of the lake, reversing the water pollution trend, and achieving water resources development and flood damage mitigation goals in the Hanshin region downstream. The project included water level management, lakeshore levee construction, artificial lakeshore construction and reclamation. These measures reduced and severed the water–land ecotone and unnaturally lower the water level, causing functional degradations and declines of species endemic to Lake Biwa. Joint efforts of the government agencies concerned, local governments and local residents are underway, therefore, to restore the water–land ecotones. This paper reports on the division of responsibilities and cooperation of the departments concerned in connection with the ongoing efforts for the restoration of the water–land ecotones of the Lake Biwa area and on some of the restoration measures actually being taken.

A New Resource of Freshwater in High Latitude Area

Xie Lixin[1], Ma Jia[1], Li Pingli[1], Wang Shichang[1], Chen Weibin[2], Cheng Fang[3]

1. Desalination and Membrane Technology Research Center, Tianjin University, Tianjin 300072; E-mail:jiajia_maj@126.com;
2. National Marine Environmental Monitoring Center, Dalian , 116023;
3 .Tianjin Institute of Urban Construction, Tianjin 300384, China

Abstract

Every winter there are large numbers of sea ice in the ocean of high latitude areas. During the process of seawater freezing, the water becomes the crystal and is separated out while the liquid brine drains out into the underlying water from the sea ice structure. But because the process of sea ice formation is far from the equilibrium state, the liquid brain is trapped with the sea ice structure to form so-called brain pocket. So the sea ice can not be used as freshwater directly when it is melted. In order to further decrease the salinity of sea ice, the methods of solid state desalination and sea ice melt-water desalination can be used.

For the solid state desalination, the brain pocket, which is trapped with the sea ice structure, is broken up after the sea ice felling into piece. Then we can use the centrifugal force to separate the brain from the sea ice or keeping environment temperature low reasonably so that a bit of sea ice melts, the liquid brain can drain out with the sea ice melt-water from the sea ice by its gravity. For desalination of sea ice melt-water, water treatment methods can be used.

In the centrifugal desalination experiments, centrifugal rotational speed is one of major controlling parameters in the desalting process of sea ice. At the centrifugal rotational speed 2000 r/min and the time 2~3 minutes, the desalination effect is better. When sea ice is desalinated by gravity, the environment temperature and time are the dominate factor. By using RO process the sea ice melt-water can be desalinated to a low salinity. As a result, not only the method of solid state desalination but also the sea ice melt-water desalination can decrease the sea ice salinity to 0.2‰~2‰ at a reasonable cost.

On the basis of statistics, the amount of natural stocked ice in Bohai Sea of China is from a few billion to hundreds of billion cube meter. Exploiting and utilizing sea ice as freshwater is of great significance to relieve the serious water shortage situation in coastal areas.

Key words: sea ice, natural freezing, desalination, centrifuging, reverse osmosis

GIS and web-based decision support system for regional water resource management and planning

WENMING ZHANG, ZENGCHUAN DONG, DEZHI WANG,

SHENGXIANG DING, QUNFANG FAN, YALI XUE

State Key Lab. of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China;wmzhang@hhu.edu.cn

Abstract

This paper presents a prototype of GIS (Geographic Information System) and web-based decision support system (GWDSS) for regional water resource management and planning, which is a conjunctive application of GIS, Web and DSS technologies. The components involved and implementation of GWDSS are analyzed. The scenario analysis approach and embedded GIS functions are explained. Through the application of GWDSS in the case study region, we found that GWDSS enables managers and decision makers to improve the regional strategic management and planning of water resources with respect to optimizing the use of water to satisfy the demands of competing stakeholders and protecting water resources.

Key words

GIS; Web-based; Decision support systems; water resource management and planning

Uncertainty Analysis on Spatially Variable Control Parameters: An Application of the Genetic Algorithm Coupled with SWMM

Tianjun Fang[1] and James E.Ball[2]

[1] Doctoral Candidate, Water Research Laboratory, School of Civil and Environmental Engineering, The University of New South Wales, Australia, Telephone: 0061-2-99691836, Email: tianjun@student.unsw.edu.au

[2] Associate Professor, Water Research Laboratory, School of Civil and Environmental Engineering, The University of New South Wales, Australia

Calibration is a common process in implementation of a catchment modelling system, which aims at identifying the appropriate values of the model parameters so that the catchment modelling system can be used to forecast the catchment responses effectively. The traditional calibration approaches tend to identify a unique optimal parameter set or near optimal parameter set which represents the hydrological and hydraulic processes and the catchment characteristics. A physically distributed catchment modelling system usually requires users to deal with a large number of spatially variable control parameters. It is unrealistic to search for a unique optimal parameter set in a high dimensional search space due to interactions between parameters and the errors associated with imperfect model structure, input data and observed data. The concept of 'equifinality' proposed by the Generalised Likelihood Uncertainty Estimation (GLUE) indicates that a number of 'equivalent' parameter sets reflect all sources of error and can be used to analyse the uncertainty of the model prediction.

The 'population-based' genetic algorithm coupled with the Storm Water Management Model (SWMM) was used to undertake uncertainty analysis on spatially variable parameters in this study. The real-value code genetic algorithm randomly generated the initial one thousand parameter sets for the SWMM simulation by a single storm event. Behavioural (acceptable) parameter sets were identified based on the designed threshold value (less than 10%) of the objective function of RMSE after forty generation simulations. The initial behavioural parameter distribution for each of these spatially variable parameters was obtained. Each initial behavioural parameter set was used to run SWMM by another two storm events individually and only those behavioural parameter sets passing these multi storm event simulations were chosen. This procedure refined the initial behavioural parameter distribution as the multi storm simulation was added, with purpose to identify the parameter distribution which really reflects the whole process and the characteristics in a complex catchment modelling system. The interactions between these spatially variable parameters were also investigated.

Automatically assigning elevation value to discontinuous submarine contours by Triangulated Irregular Network when CAD data was transformed to GIS data

Ru An, Qin Zhang, Xianrong Ding, Xiaoxun Tao, Wei Li

Geographical Information Science Department Water Resource and Environment College HoHai University,1 Xi Kang Road，Jiangsu, Nanjing，210098;Chinaanrunj@163.com

Abstract: CAD topographical maps have been more and more directly used in many fields because of large amount of landform information contained in them. But the format of CAD data often cannot meet the needs of spatial data analyzing of GIS. So, the data transformation from CAD to GIS database is needed. During the course of the transformation, the obtaining of accuracy attribute of spatial data has become the key point. How automatically assigning elevation value to discontinuous submarine contours by Triangulated Irregular Network (TIN), which created by the surveyed value of submarine elevation points, was discussed in the paper.

The methods discussed in the paper are as follows:

(1) Broken-line linking. The methods of broken-line linking based on the restraint of minimum distance and angle is studied. Since many elements of the topographical map are crossovers each other, and submarine elevation contours were broken up, there are a great many breakpoints on contours, which produce much data redundancy and influence on the correct assigning elevation values to the contours, so it is necessary to connect broken-line as much as possible before assigning elevation values to them. The basic thought of broken-line linking method is to link the line with its searching line, which has the shortest distance with each other and minimum angle variation along the line's extend direction.

(2) Assigning elevation value to discontinuous submarine contours by Triangulated Irregular Network (TIN). TIN is a spatial raster data structure, which can be used to imitate complex terrain surface precisely by irregular distributing data points or lines. Any point on the ground can obtain its elevation by interpolation the network. So contour's elevation value can be gained as an average value of its nodes' sum elevation.

(3) The theoretic elevation of intermediate contour is determined by the position and relationships between index contours and intermediate contours. Due to the mixed contour-interval existed, it is difficult to obtain correct elevation of contour and test its validity. The elevations of each four intermediate contours, which between the nearest two index contours, can be calculated exactly through extracting intermediate contours and index contours respectively.

(4) Interpolated TIN by feature points. There are also some short contours cannot be checked because of having no intersection point with the edge of TIN. These contours must be assigned by person to examine. In order to decrease the amount of manual work, the nodes of contours, which have been assigned accurate elevation, have been used to interpolate TIN that may have more intersection points with short contours.

(5) Connecting contours by elevation. The contours may be assigned correct elevation after the above processing. Then they can be connected again by judgment whether they have the same elevation or not.

The method of automatically assigning elevation value to discontinuous submarine contours is discussed in the paper, which is based on the surveyed value of submarine elevation points and capability of special data analyzing offered by ArcGIS. The method studied in the paper offers a new thought of data transformation from CAD to GIS. The results of experiment and project practice have showed that on the premise of a little manual work for data quality control, the methods are practicable and efficiency. The work is programmed by Visual C++ and ArcGIS Engine.

Keywords: Transformation CAD data to GIS data; Assigning elevation value to discontinuous submarine contours; Broken-line linking; Triangulated Irregular Network; ArcEngine.