Jianhua Xu

at The Research Centre for East-West Cooperation in China

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Summary

Jianhua Xu is a professor and the director of Research Centre for East-West Cooperation in China, East China Normal University. His research interest includes Geocomputation, GIS and Remote Sensing Applications, especially in the field of Physical Geography, Ecology, Environment and Regional Economics. He has finished more than 30 research projects which from National Natural Science Fund of China, National Social Science Fund of China, as well as from the support of provinces and ministries of China. He has published 13 books and more than 200 papers. He has worked as the editorial board member for academic journals, such as Journal of Desert Research, Areal Research and Development, Human Geography, Ecologic Science, Arid Land Geography, Chinese Geographical Science, Journal of Geographic Information System, Journal of Signal and Information Processing, PeerJ, etc.

Experience

Director at   The Research Centre for East-West Cooperation in China

June 2004 - Present (12 years 1 month)

   The Research Centre for East-West Cooperation in China (RCEWCC) was founded in East China Normal University in 2004. It is a international and open platorm of academic research and exchange for East-West Cooperation in China.

Professor at   East China Normal Univeristy

April 2000 - Present (16 years 3 months)

   Jianhua Xu now is a Professor in the Department of Geography, East China Normal University, and his research interesting includes in mathematical methods in geography, geocomputation, GIS, remote sensing applications, economic geography and ecological economics, etc.

Professor at   Lanzhou University

January 1989 - March 2000 (11 years 3 months)

   January 1989 - May 1990: Assistant Professor, Department of Geography.

   June 1990 - June 1992: Lecturer, Department of Geography.

   July 1992 - November 1996: Associate Professor, Department of Geography.

   December 1996 - March 2000: Professor, Department of Geography.

Skills & Expertise
Remote Sensing

Statistics
Geographical Modelling
GIS
Regional economics
Water resources
Climate Change
Ecology
Environmental Sciences

Publications

Integrating wavelet analysis and BPANN to simulate the annual runoff with regional climate change: a case study of Yarkand River, northwest China

Water Resources Management   May 5, 2014

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Qin Nie, Chunan Song, Chunmeng Wei

Selecting the Yarkand River as a typical representative of an inland river in northwest China, We identified the variation pattern of hydro-climatic process based on the hydrological and meteorological data during the period of 1957~2008, and constructed an integrated model to simulate the change of annual runoff (AR) with annual average temperature (AAT) and annual precipitation (AP) by combining wavelet analysis (WA) and artificial neural network (ANN) at different time scale. The results showed that the pattern of hydro-climatic process is scale-dependent in time. At 16-year and 32-year time scale, AR presents a monotonically increasing trend with the similar trend of AAT and AP. But at 2-year, 4-year, and 8-year time scale, AR exhibits a nonlinear variation with fluctuations of AAT and AP. The back propagation artificial neural network based on wavelet decomposition (BPANNBWD) well simulated the change of AR with AAT and AP at the all five time scales. Compared to the traditional statistics model, the simulation effect of BPANNBWD is better than that of multiple linear regression (MLR) at every time scale. The results also revealed the fact that the simulation effect at a larger time scale (e.g. 16-year or 32-year scale) is better than that at a smaller time scale (e.g. 2-year or 4-year scale).

A quantitative assessment on groundwater salinization in the Tarim River lower reaches, Northwest China

Sciences in Cold and Arid Regions   January 15, 2014

Authors: Jianhua Xu, WeiHong Li, YuLian Hong, ChunMeng Wei, Jie Tang

Based on monitored data from 840 samples, we assessed the spatial and temporal variability of groundwater salinization in the Tarim River lower reaches combining classical statistics and geostatistics. Results show that total dissolved solids (TDS) is significantly correlated with other related ions, such as Na^+, Mg^{2+}, Ca^{2+}, Cl^- and K^+. TDS and underground water level have characteristics of spatial autocorrelation, both of which present the isotropic characteristic and conform to the spherical model in each year from 2001–2009. TDS is basically greater than 1 g/L but less than 2 g/L in the Tarim River lower reaches, which indicates that salt stagnation pollution is more serious. The most serious salinization (3 g/L < TDS # 35 g/L) contaminated area is mainly in the middle and lower part of the study area.

Understanding the Complexity of Temperature Dynamics in Xinjiang, China, from Multitemporal Scale and Spatial Perspectives

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Zuhan Liu, Chunmeng Wei, Jie Tang

Based on the observed data from 51 meteorological stations during the period from 1958 to 2012 in Xinjiang, China, we investigated the complexity of temperature dynamics from the temporal and spatial perspectives by using a comprehensive approach including the correlation dimension (CD), classical statistics, and geostatistics. The main conclusions are as follows (1) The integer CD values indicate that the temperature dynamics are a complex and chaotic system, which is sensitive to the initial conditions. (2) The complexity of temperature dynamics decreases along with the increase of temporal scale. To describe the temperature dynamics, at least 3 independent variables are needed at daily scale, whereas at least 2 independent variables are needed at monthly, seasonal, and annual scales. (3) The spatial patterns of CD values at different temporal scales indicate that the complex temperature dynamics are derived from the complex landform.

Land Surface Phenology and Land Surface Temperature Changes Along an Urban–Rural Gradient in Yangtze River Delta, China

Authors: Jianhua Xu, Guifeng Han

Using SPOT/VGT NDVI time series images (2002–2009) and MODIS/LST images (2002–2009) smoothed by a Savitzky–Golay filter, the land surface phenology (LSP) and land surface temperature (LST), respectively, are extracted for six cities in the Yangtze River Delta, China, including Shanghai, Hangzhou, Nanjing, Changzhou, Wuxi, and Suzhou. The trends of the averaged LSP and LST are analyzed, and the relationship between these values is revealed along the urban–rural gradient. The results show that urbanization advances the start of the growing season, postpones the end of the growing season, prolongs the growing season length (GSL), and reduces the difference between maximal NDVI and minimal NDVI in a year (NDVIamp). More obvious changes occur in surface vegetation phenology as the urbanized area is approached. The LST drops monotonously and logarithmically along the urban–rural gradient. Urbanization generally affects the LSP of the surrounding vegetation within 6 km to the urban edge. Except for GSL, the difference in the LSP between urban and rural areas has a significant logarithmic relationship with the distance to the urban edge. In addition, there is a very strong linear relationship between the LSP and the LST along the urban–rural gradient, especially within 6 km to the urban edge. The correlations between LSP and gross domestic product and population density reveal that human activities have considerable influence on the land surface vegetation growth.

Self-organized criticality of climate change

Authors: Jianhua Xu, Zuhan Liu, Kai Shi

Self-organized criticality (SOC) of three climatic factors (average daily temperature, vapor pressure, and relative humidity) was studied by analyzing climate records from 1961 to 2011 in Yanqi County, northwest China. Firstly, we investigated the frequency-size distribution of three climatic factors and found that they were well approximated by power-law distribution, which suggested that climatic factor might be a manifestation of self-organized criticality. Furthermore, we introduced a new numerical sandpile model with decay coefficient to reveal inherent dynamic mechanism of climatic factor. Only changing the number value

of decay coefficient of climatic factors, this model would give a good simulation of three climatic factors' statistical characteristics. This study showed that it was the self-organized criticality of the climate change that results in the temporal variation of climatic factors and the occurrence of large-scale climate change events triggered by SOC behavior of the minor climatic factors. So, we believed that SOC characteristics would have practical implications for climate prediction.

An Integrative Approach to Understand the Climatic-Hydrological Process: A Case Study of Yarkand River, Northwest China

Advances in Meteorology   April 28, 2013

Authors: Jianhua Xu, Yiwen Xu, Chunan Song

Taking the Yarkand River as an example, this paper conducted an integrative approach combining the Durbin-Watson statistic test (DWST), multiple linear regression (MLR), wavelet analysis (WA), coefficient of determination (CD), and Akaike information criterion (AIC) to analyze the climatic-hydrological process of inland river, Northwest China from a multitime scale perspective. The main findings are as follows. (1) The hydrologic and climatic variables, that is, annual runoff (AR), annual average temperature, (AAT) and annual precipitation (AP), are stochastic and, no significant autocorrelation. (2) The variation patterns of runoff, temperature, and precipitation were scale dependent in time. AR, AAT, and AP basically present linear trends at 16-year and 32-year scales, but they show nonlinear fluctuations at 2-year and 4-year scales. (3) The relationship between AR with AAT and AP was simulated by the multiple linear regression equation (MLRE) based on wavelet analysis at each time scale. But the simulated effect at a larger time scale is better than that at a smaller time scale.

Combining BPANN and wavelet analysis to simulate hydro-climatic processes—a case study of the Kaidu River, North-west China

Frontiers of Earth Science   January 23, 2013

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Paul Y. Peng, Yang Yang, Chunan Song, Chunmeng Wei, Yulian Hong

Using the hydrological and meteorological data in the Kaidu River Basin during 1957–2008, we simulated the hydro-climatic process by back-propagation artificial neural network (BPANN) based on wavelet analysis (WA), and then compared the simulated results with those from a multiple linear regression (MLR). The results show that the variation of runoff responded to regional climate change. The annual runoff (AR) was mainly affected by annual average temperature (AAT) and annual precipitation (AP), which revealed different variation patterns at five time scales. At the time scale of 32-years, AR presented a monotonically increasing trend with the similar trend of AAT and AP. But at the 2-year, 4-year, 8-year, and 16-year time-scale, AR presented nonlinear variation with fluctuations of AAT and AP. Both MLR and BPANN successfully simulated the hydroclimatic process based on WA at each time scale, but the simulated effect from BPANN is better than that from MLR.

An integrated statistical approach to identify the nonlinear trend of runoff in the Hotan River and its relation with climatic factors

Stochastic Environmental Research and Risk Assessment   February 15, 2011

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Yang Yang, Yulian Hong

A number of studies have indicated a transition from warm-dry to warm-wet climate in Northwest China after the 1980s. This transition was characterized by an increase in temperature and precipitation, added river runoff volume, increased lake water surface elevation and area, and elevated groundwater table. However, some literatures showed that the Hotan River has presented a contrary situation, i.e. the runoff decreased, whereas temperature and precipitation increased. In order to discover the nonlinear runoff trend and its causes in the Hotan River, based on the related data from hydrological stations, ground and air sounding meteorological stations, this study applied a comprehensive method combing correlation analysis, wavelet analysis and regression analysis to investigate the runoff change in the Hotan River with its relevant climatic factors over the past decades. The main findings are: (a) the hydrological process of the Hotan River is a nonlinear system, with a periodicity of 24 year cycle, and it shows different nonlinear trends at different time scales; (b) the data from the ground meteorological stations in the Hotan area shows a false appearance that there is almost no correlation between runoff and temperature, and a little negative correlation between runoff and precipitation; (c) but the data from air sounding meteorological stations shows the truth that there is a close relation between the runoff in the Hotan River and the 0°C level height in summer on the north slope of Kunlun Mountains. The two variables present a same periodicity, i.e. 24-year cycle, having similar nonlinear trends and significant correlations at different time scales.

A comprehensive approach to characterization of the nonlinearity of runoff in the headwaters of the Tarim River, western China

Authors: Jianhua Xu, Weihong Li, Minhe Ji, Feng Lu, Shan Dong

Nonlinear characteristics of the runoff processes in the headwaters of the Tarim River were identified and evaluated using several selected methods, including wavelet analysis, correlation dimension, and R/S analysis. Time-series of annual data describing runoff, average temperature, and precipitation from 1957 to 2005 were used to construct and test empirical models. The primary findings of this study were as follows: (1) The annual runoff of the headwaters are complex and nonlinear in nature, and they each presented periodic, nonlinear trends at the chosen time scales, chaotic dynamics, and long-memory characteristics. (2) These nonlinear trends appe ared to have resulted from the regional climatic changes that occurred during the study period. The periodicity of changes in runoff occurred on an approximately 25-year cycle, which appeared to be correlated with temperature and precipitation cycles. In addition, the annual runoff exhibited a significant, positive correlation with the temperature and precipitation factors at the 4-, 8-, 16-, and 32-year temporal scales. (3) The correlation dimensions of the attractor derived from the runoff time series for the Hotan, Yarkand, and Aksu rivers were all greater than 3Ð0 and non-integral, implying that all three rivers are dynamic chaotic systems that are sensitive to initial conditions, and that the dynamic modelling of their annual runoff requires at least four independent variables. (4) The computed Hurst exponents indicate that a long-term memory characteristic exists in the annual runoff processes. However, there were some differences observed, with the Aksu and Yarkand rivers demonstrating a persistent trait, and the Hotan River exhibiting an anti-persistent feature.

The nonlinear trend of runoff and its response to climate change in the Aksu River, western China

Authors: Jianhua Xu, Yaning Chen, Feng Lu, Weihong Li, Lijun Zhang, Yulian Hong

The nonlinear trend of runoff and its response to climate change in the Aksu River were identified and evaluated using several selected methods, including grey relation analysis, wavelet analysis, and regression analysis. The time series of runoff and related climate variables from two hydrologic stations and four meteorological stations during 1959–2005 for the Aksu River were used to construct and test empirical models. The key findings of this study indicate that although the time series of the runoff, temperature and precipitation present nonlinear trends, the runoff exhibits a linear correlation with the temperature and precipitation. These results reveal that there is a close relationship between variations in the annual runoff of the Aksu River and regional climate change; in other words, the nonlinear trends of the variations in the runoff is the response to that of regional climate change. The details supporting the key findings are as follows: (1) The annual runoff presented nonlinear trends that depend on time scales, which appeared to have resulted from the

regional climate changes that occurred during the study period. (2) The periodicity of changes in runoff, temperature, and precipitation are closely correlated, that of annual runoff occurred on 24-year cycle, whereas annual average temperature and annual precipitation occurred on 23- and 25-year cycles. (3) The annual runoff exhibited a significant, positive correlation with the temperature and precipitation at the 1-, 2-, 4-, and 8-year temporal scales.

Wavelet Analysis and Nonparametric Test for Climate Change in Tarim River Basin of Xinjiang during 1959-2006

Authors: Jianhua Xu, Chen Yaning, Li Weihong, Ji Minhe, Dong Shan, Hong Yulian

Using wavelet analysis, regression analysis and the Mann-Kendall test, this paper analyzed time-series (1959–2006) weather data from 23 meteorological stations in an attempt to characterize the climate change in the Tarim River Basin of Xinjiang Uygur Autonomous Region, China. Major findings are as follows: 1) In the 48-year study period, average annual temperature, annual precipitation and average annual relative humidity all presented nonlinear trends. 2) At the 16-year time scale, all three climate indices unanimously showed a rather flat before 1964 and a detectable pickup thereafter. At the 8-year time scale, an S-shaped nonlinear and uprising trend was revealed with slight fluctuations in the entire process for all three indices. Incidentally, they all showed similar pattern of a slight increase before 1980 and a noticeable up-swing afterwards. The 4-year time scale provided a highly fluctuating pattern of periodical oscillations and spiral increases. 3) Average annual relative humidity presented a negative correlation with average annual temperature and a positive correlation with annual precipitation at each time scale, which revealed a close dynamic relationship among them at the confidence level of 0.001. 4) The Mann-Kendall test at the 0.05 confidence level demonstrated that the climate warming trend, as represented by the rising average annual temperature, was remarkable, but the climate wetting trend, as indicated by the rising annual precipitation and average annual relative humidity, was not obvious.

The complex nonlinear systems with fractal as well as chaotic dynamics of annual runoff processes in the three headwaters of the Tarim River

Authors: Jianhua Xu, Chen Yaning, Li Weihong, JI Minhe, Dong Shan

This paper attempted to identify fractal and chaotic characteristics of the annual runoff processes in headwaters of the Tarim River. Methods of fractal analyses were used to explore several aspects of the temporal changes from 1957 to 2002. The main findings are as follows: (1) The annual runoff processes of the three headwaters of the Tarim River are complex nonlinear systems with fractal as well as chaotic dynamics. (2) The correlation dimensions of attractor derived from the time series of the annual runoff for the Hotan, Yarkand and Aksu rivers are all greater than 3.0 and non-integral, implying that all three rivers are chaotic dynamical systems that are sensitive to initial conditions, and the dynamic modeling of their annual runoff process requires at least four independent variables. (3) The time series of annual runoff in each river presents a long-term correlation characteristic. The Hurst exponent for the period of 1989 to 2002 suggests that we may expect to see an increasing trend in the annual runoff of the Aksu and Yarkand rivers in the years after 2002, but a decreasing tendency for the Hotan River in the same period.

Long-term Trend and Fractal of Annual Runoff Process in Mainstream of Tarim River

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Shan Dong

Based on the time series data from the Aral hydrological station for the period of 1958–2005, the paper reveals the long-term trend and fractal of the annual runoff process in the mainstream of the Tarim River by using the wavelet analysis method and the fractal theory. The main conclusions are as follows: 1) From a large time scale point of view, i.e. the time scale of 16 (24) years, the annual runoff basically shows a slightly decreasing trend as a whole from 1958 to 2005. If the time scale is reduced to 8 (23) or 4 (22) years, the annual runoff still displays the basic trend as the large time scale, but it has fluctuated more obviously during the period. 2) The correlation dimension for the annual runoff process is 3.4307, non-integral, which indicates that the process has both fractal and chaotic characteristics. The correlation dimension is above 3, which means that at least four independent variables are needed to describe the dynamics of the annual runoff process. 3) The Hurst exponent for the first period (1958–1973) is 0.5036, which equals 0.5 approximately and indicates that the annual runoff process is in chaos. The Hurst exponents for the second (1974–1989) and third (1990–2005) periods are both greater than 0.50, which indicate that the annual runoff process showed a long-enduring characteristic in the two periods. The Hurst exponent for the period from 1990 to 2005 indicates that the annual runoff will show a slightly increasing trend in the 16 years after 2005.

Climate change and its effects on runoff of Kaidu River, Xinjiang, China: A multiple time-scale analysis

Authors: Jianhua Xu, Chen Yaning, Ji Minhe, Lu Feng

This paper applied an integrated method combining grey relation analysis, wavelet analysis and statistical analysis to study climate change and its effects on runoff of the Kaidu River at multi-time scales. Major findings are as follows: 1) Climatic factors were ranked in the order of importance to annual runoff as average annual temperature, average temperature in autumn, average temperature in winter, annual precipitation, precipitation in flood season, average temperature in summer, and average temperature in spring. The average annual temperature and annual precipitation were selected as the two representative factors that impact the annual runoff. 2) From the 32-year time scale, the annual runoff and the average

annual temperature presented a significantly rising trend, whereas the annual precipitation showed little increase over the period of 1957–2002. By changing the time scale from 32-year to 4-year, we observed nonlinear trends with increasingly obvious oscillations for annual runoff, average annual temperature, and annual precipitation. 3) The changes of the runoff and the regional climate are closely related, indicating that the runoff change is the result of the regional climate changes. With time scales ranging from 32-year, 16-year, 8-year and to 4-year, there are highly significant linear correlations between the annual runoff and the average annual temperature and the annual precipitation.

The relationship between land surface temperature and NDVI with remote sensing: application to Shanghai Landsat 7 ETM+ data
International Journal of Remote Sensing   July 30, 2007
Authors: Jianhua Xu, W YUE, J XU, W TAN, L XU.

The relationship between land surface temperature (LST) and Normalized Difference Vegetation Index (NDVI) associated with urban land-use type and land-use pattern is discussed in the City of Shanghai, China using data collected by the Enhanced Thematic Mapper Plus (ETM+) and aerial photographic remote sensing system. There is an apparent correlation between LST and NDVI from the visual interpretation of LST and NDVI contrasts. Mean LST and NDVI values associated with different land-use types are significantly different. Multiple comparisons of mean LST and NDVI values associated with pairings of each land-use type are also shown to be significantly different. The result of a regressive analysis shows an inverse correlation relationship between LST and NDVI within all land-use polygons, the same to each land-use type, but correlation coefficients associated with land-use types are different. An analysis on the relationship between LST, NDVI and Shannon Diversity Index (SHDI) shows a positive correlation between LST and SHDI and a negative correlation between NDVI and SHDI. According to the above results, LST, SHDI and NDVI can be considered to be three basic indices to study the urban ecological environment and to contribute to further validation of the applicability of relatively low cost, moderate spatial resolution satellite imagery in evaluating environmental impacts of urban land function zoning, then to examine the impact of urban land-use on the urban environment in Shanghai City. This provides an effective tool in evaluating the environmental influences of zoning in urban ecosystems with remote sensing and geographical information systems.

Remote sensing of spatial patterns of urban renewal using linear spectral mixture analysis: A case of central urban area of Shanghai (1997-2000)
Chinese Science Bulletin   August 15, 1986
Authors: Jianhua Xu, Yue Wen-ze, XU Jianhua, Wu Jia-wei, Xu Lihua.

It is very important to integrate remote sensing with urban geography that the spectral mixture analysis technique is applied to urban land cover evolvement and its eco-environmental effect. Urban land cover is mainly composed of complicated artificial materials, which is the key factor to limit the development of the spectral mixture analysis technique. There are two main aspects in which the technique of spectral mixture analysis is applied to urban geography: one is to calculate vegetation fraction; the other is to build quantitative model of the urban impervious surface obtained from the combination between high albedo

fraction and low albedo fraction. The technique of spectral mixture analysis is firstly applied to study urban renewal pattern, scale and mode which happened in Shanghai City from 1997 to 2000.

R/S and wavelet analysis on the evolutionary process of regional economic disparity in China during the past 50 years

Chinese Geographical Science   December 30, 2004

Authors: Jianhua Xu, LU Yan, SU Fanglin, AI Nanshan

This paper shows the dynamic process of regional disparity of economic development in China in the past 50 years from a new insight by using the rescaled range statistic (R/S) analysis and wavelet analysis of the Theil index sequence with different time scales. The main conclusions are: 1) The regional disparity of economic development in China, including the inter-provincial disparity, inter-regional disparity and intra-regional disparity, has existed for many years. Theil index by the comparative price has revealed the true trend for comparative disparity of regional economic development from 1952 to 2000. 2) Decomposition of Theil index indicates that the dynamic trend of comparative inter-provincial disparity in the coastal region is in line with dynamic trend of inter-provincial disparity in the whole China. 3) The R/S analysis results tell us that during 1966-1978, the Hurst exponent H=0.504#0.5, which indicates that in that period the evolution of comparative inter-provincial disparity of economic development showed a random characteristic, and in the other periods, i.e. 1952-1965, 1979-1990 and 1991-2000, the Hurst exponent H>0.5, which indicates that in those periods the evolution of the comparative inter-provincial disparity of economic development in China had a long-enduring characteristic. 4) By using wavelet analysis at different time scale, we arrived at a conclusion that the evolutionary process of the disparity of economic development of China is not a simple inverted U shape but a compound of several U shapes. The result tells us that the evolutionary plot of inter-provincial disparity in China follows the inverted U on the whole at the higher scale, 24 (16 years). That is to say, the disparity tends to rise in the first stage of economic development, and fall slowly over the peak in the second stage of economic development. However, if we shorten the time scale to 2^3 (8 years), then a link of several U shapes will appear.

Quantitative Analysis and Fractal Modeling on the Mosaic Structure of Landscape in the central area of Shanghai Metropolis

Chinese Geographical Science   September 30, 2003

Authors: Jianhua Xu, Ai Nanshan, Chen Yong, Mei Anxin, Liao Hongjuan

The mosaic structure of landscape of the central area of Shanghai Metropolis is studied by quantitative methods of landscape ecology based on Remote Sensing (RS) and Geographic Information System (GIS) in this paper. Firstly, landscapes are classified into eight categories: residential quarter, industrial quarter, road, other urban landscape, farmland, village and small town, on-building area, river and other water bodies (such as lake, etc.). Secondly, a GIS is designed and set up based on the remote sensing data and field investigation, and a digital map of landscape mosaic is made. Then the indexes of diversity, dominance, fragmentation and isolation, and fractal dimension of each type of landscape in different periods are calculated by using spatial analysis method of GIS. With reference to the calculated results, a series of relative issues are discussed.

A study on landscape mosaic structure in urban-rural area in northwest China with RS and GIS ---- A case study of Xigu region in Lanzhou city

Chinese Geographical Science   December 30, 2001

Authors: Jianhua Xu, Lu Yan, Ai Nanshan, Yue Wenze

At the study area of Xigu District in Lanzhou City, using RS & GIS as tools we apply Diversity, Dominance, Fragmentation, Isolation and so on to study the quantitative, fractal and spatial characters of landscapes structures in the four sub-regions divided by the morphological features. Using the Fractal Theory to establish the fractal structure models, we analyze the complexity and stability of various landscapes distribution with fractal dimension value. The spatial distribution characteristics of landscape mosaic structure are also expounded. At the end of the paper we discuss the relevant problems on the main factors which control and effect on the spatial pattern of landscapes as well as on landscape optimization and management.

Using GM (1,1) Models to Predict Groundwater Level in the Lower Reaches of Tarim River: a demonstration at Yingsu Section

Fuzzy Systems and Knowledge Discovery, 2008. FSKD '08. Fifth International Conference on   October 1, 2008

Authors: Jianhua Xu, Yaning Chen, Weihong Li

Grey System theory is a multidisciplinary theory dealing with those systems for which we lack information, which uses a black-grey-white color spectrum to describe a complex system whose characteristics are only partially known or known with uncertainty. From the point of view of grey system theory, the dynamic of groundwater level in the lower reaches of Tarim River is typical grey system, which maybe provides us one of methods to approach the problem. As an attempt, through demonstration at Yingsu section, the paper has comparatively studied the grey forecasting models to predict the groundwater level in the lower reaches of Tarim River. The conclusions are: (1) The grey forecasting models, which include equal and unequal time lag GM (1,1) model, are applicable models to predict the groundwater level in lower reaches of Tarim River. The accuracy test parameters, P and C for equal and unequal time lag GM (1,1) model both achieved the desired impact for prediction. (2) The forecasted depth of groundwater for each well by unequal time lag GM (1,1) model is somewhat less than that by equal time lag GM (1,1) model. If the average of forecasted depth of groundwater by the two kind models is regarded as the predicted result, the depth of groundwater of monitoring well C4, C5 and C6 in 2007 will be 4.1696 m, 4.317 m and 4.4839 m respectively, and that in 2008 will be 4.0612 m, 4.2308 m and 4.3604 m respectively.

Signal Processing for the annual runoff process by wavelet and R/S analysis: A case study of the Tarim headwater basin

Signal Processing, 2008. ICSP 2008. 9th International Conference on   October 10, 2008

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Shan Dong

The paper studies signal processing for the annual runoff processes of the Tarim headwater basin. By utilizing the wavelet and R/S analysis, the main findings are generalized as follows: (1) The annual runoff processes of the three headwaters of the Tarim River are complex nonlinear systems, which show nonlinear trends, as well as fractals, and long-term correlation. (2) In the time scale of 16 (24) years from 1957 to 2002, the

annual runoff in the Aksu and Yarkand Rivers show an increasing trend in general, while in the Hotan River a slightly decreasing trend is observed for the same time period. If the time scale reduces to 8 (23) or 4 (22) years, the annual runoff in each river does not show an apparent trend of either increasing or decreasing. (3) The time series of annual runoff in each river present a long-term correlation characteristic. The Hurst exponent in the period from 1989 to 2002 indicates that the annual runoff in the Aksu and Yarkand River will show an increasing trend, and that in the Hotan River will show a decreasing trend in the years after 2002.

Grey modelling the groundwater level dynamic in the lower reaches of Tarim River affected by water delivery from upper reaches
Fuzzy Systems, 2008. FUZZ-IEEE 2008. (IEEE World Congress on Computational Intelligence). IEEE International Conference on   June 4, 2008
Authors: Jianhua Xu, Yaning Chen, Weihong Li

Using the grey system theory and the monitored data from the monitoring section of Yingsu, this paper models the groundwater level dynamic in the lower reaches of Tarim River affected by water delivery from upper reaches. The main conclusions are: (1) discharging volume, running days for water delivery and daily discharging volume, which related with water delivery from the upper reaches of Tarim River, are three main factors that markedly control and affect the groundwater level. (2) The sensitivity of groundwater level changing respond to itself becomes more and more lower versus the distance apart from river center, and the affection from discharging volume and running days for water delivery to the change rate of groundwater level becomes more and more significant with increase of the distance apart from river center. Water delivery not only markedly controls and raises the groundwater level near river, but also affects the groundwater level as far as the range in the distance of 1050 m apart from river center.

The dynamic of vegetation coverage and its response to climate factors in Inner Mongolia, China
Springer   April 22, 2011
Authors: Jianhua Xu, Yang Yang, Yulian Hong, Guanghui Lv

This paper examined NDVI dynamic and its response to climate factors during a 10 year period (1998–2008) in Inner Mongolia. The main findings are as follows: (1) The NDVI multi-scale characters can be revealed well by wavelet transform, and the average NDVI and the NDVI amplitude show a gradually decreased trend from northeast to southwest in Inner Mongolia during the past 10 years, furthermore, this trend is consistent with the heat and water distribution caused by latitude difference in north–south direction and Asia monsoon effect in east–west direction. (2) The relation between NDVI and temperature is the most close, followed by precipitation, sunshine hours and relative humidity. Different vegetation cover types show different strengths in correlation between NDVI and climate variables with the correlation values decreasing from forest, meadow steppe to desert steppe in whole. (3) The precipitation and temperature have the same change cycle, both nearly 290 days in the 20 selected stations. The NDVI has the same change cycle with the precipitation and temperature or either 10 days earlier or later than precipitation and temperature, which supports the significant correlation between NDVI and its climatic factors from a new perspective. The nearly 290 days change cycle implies that the vegetation growth cycle is nearly 10 months and there are no obvious differences change cycles in different vegetations. (4) Vegetation dynamic is significantly correlated

to the temperature and precipitation at the time scale of 10, 20, 40, 80, 160, and 320-day, respectively, and the S3 scale (i.e., the time scale of 80-day), nearly 3 months (one season), is most significant and suitable for evaluating the vegetation dynamic to climatic factors.

Spatial Relationship of Tourist Distribution in Chinese Cities: A GIS-based Exploratory Spatial Data Analysis

Tourism Geographies /Taylor & Francis   March 30, 2011

Authors: Yan Zhang, Jianhua Xu, Pei-Jun Zhuang

This study investigates the spatial dependence and mechanisms of international and domestic tourist distributions in 299 cities in mainland China through a set of Geographical Information Systems (GIS)-based spatial statistical tools. The results show that during the period of investigation (1999–2007), there was a significant degree of neighbouring effect (i.e. positive spatial correlation) in both international and domestic tourist distributions. We have also highlighted that tourism development in a given city is dependent on the developments in neighbouring cities. Specifically, the tourist distribution shows a polarized (core – periphery) spatial pattern, which is strongly connected to the economic development level and tourism resources of the cities. Furthermore, the findings reveal tourist distribution clusters that underscore the importance of geographical focus. Overall, the results imply that policy makers are encouraged to pay attention to patterns of tourist distribution.

Statistical analysis of groundwater chemistry of the Tarim River lower reaches, Northwest China

Environmental Earth Sciences/springer   July 15, 2012

Authors: Jianhua Xu, Yaning Chen, Weihong Li

This study applied a comprehensive quantitative approach including statistical, principal component and gray relation analyses to assess the groundwater chemistry based on monitored data from 840 samples collected from the lower reaches of Tarim River from 2000 to 2009. The main findings were: (1) there were six types of groundwater chemistry in the lower reaches of Tarim River where Cl·SO4–Na·Mg was the dominant type accounting for 73.57% in all samples. There were linear relationships among chemical parameters, where TDS had significant multiple correlations with Na^+, K^+, Mg^{2+}, Ca^{2+} and Cl#, respectively. (2) Three principal components (PC1, PC2 and PC3) were extracted. They included comprehensive measurements for salinization, alkalinity and pH, respectively. Most parameters showed decreasing trends during the period of 2000–2009, as well as the scores on PC1, because the concentrations of various chemical substances were diluted due to the uplift of the groundwater table in the lower reaches and the implementation of the ecological water delivery project in 2000. (3) HCO3 # was the most sensitive chemical parameter affected by the groundwater table followed by TA, Mg^{2+}, TH, SO42#, K^+, TDS and TS. PC2 was the most sensitive principal component to the change of the groundwater table followed by PC1 and PC3.

The nonlinear variation of annual average temperature in the Yangtze Delta and its correlation with global oscillations

IEEE   May 14, 2011

Authors: Jianhua Xu, Chunan Song

Climate change has been a major issue for scholars under the background of global warming. Yangtze Delta is one of major economic regions in China. How the temperature of the Yangtze Delta changes in

the past decades and if this change has some relation to global climate change? To answer these questions, this paper tries to find the relationship between the temperature's change in the Yangtze Delta and five global oscillations from the point of multiple time scales, by using wavelet regression analysis method. The main findings are as follows: (1) at the larger time scale, like 32-year and 16-year scale, the annual average temperature in the Yangtze Delta presents an increasing trend. But at 8-year and 4-year scale, the temperature fluctuates obviously, and the 4-year scale is much more obviously. (2) The annual average temperature change in the Yangtze Delta associates closely with 5 global oscillations and the correlation becomes better while the time scale enlarged. Moreover, we could find that four oscillation indices (NAOI, PDOI, AOI and AAOI) have an active correlation with the annual average temperature in the Yangtze Delta. But for SOI, the correlation is negative. The reason for these is because of their different formations. Because latitude circulation is the main reason, the oscillations (NAO, AO

and AAO) have closer association with the temperature in the Yangtze Delta.

Understanding the dynamic coupling between vegetation cover and climatic factors in a semiarid region —a case study of Inner Mongolia, China

Ecohydrology   January 12, 2012

Authors: Jianhua Xu, Lei Cao, Yaning Chen, Weihong Li, Yang Yang

Vegetation is sensitive to changes in the ecological environment in arid and semiarid regions, so information on the dynamics of vegetation cover changes can provide important information for ecological environmental protection and early warning of ecosystem degradation. With the SPOT/VEGETATION normalised difference vegetation index dataset of the typical semiarid land in Inner Mongolia (IM) during 1998–2008, this study applied an integrated statistical method combing asymmetric Gaussian filtering, seasonal Kendall test, R/S analysis, correlation analysis and regression analysis, to investigate the impact of climatic factors on trends in vegetation cover. The main findings are as follows: (1) Over the 1998–2008 period, the vegetation coverage is relatively stable in IM, with only 24.5% of the total area exhibiting a significant variation in cover. The spatial distribution of the vegetation cover change has the following regional characteristics: in the northeast forest region, the vegetation cover is stable; in the middle steppe region, significant changes are observed and in the southwest desert region, the vegetation exhibits significant degradation. (2) Normalised difference vegetation index time series in most regions of IM reveal a vegetation change trend. In the high vegetation covered regions, the change trend will be reversed, whereas in the low vegetation covered regions, the original change trend will be preserved. (3) Analysis of correlation coefficients and stepwise linear regression reveals relationships between vegetation change and climatic factors. Temperature and precipitation have a direct influence on vegetation change, acting as the main climatic driving forces for the regional vegetation evolution.

The vegetation coverage dynamic coupling with climatic factors in Northeast China Transect

Environmental Management   October 15, 2012

Authors: Jianhua Xu, Qin Nie, Jianhua Xu, Minhe Ji, Lei Cao, Yang Yang, Yulian Hong

Based on SPOT-VGT images and meteorological data, this paper applied an integrated method to investigate the vegetation dynamic and its response to climate factors during 1998–2008 in Northeast China Transect, one of 15 ecological transects listed in the International Geosphere–Biosphere Programme. The main

findings are as follows: (1) The NDVI time series presented nonlinear patterns that vary with timescales. The series fluctuated greatly at the smallest timescale (20 days), showing no salient trend, whereas a trend manifested itself more and more with the increase of time scale and finally stabilized at the 320-day scale. Little difference was found between vegetation types about the NDVI periodicity, as they occurred on either a 280-day or a 290-day cycle. (2) NDVI exhibited a significant correlation with temperature, precipitation, and sunshine hours. Overall, the correlation between NDVI and temperature was the highest, followed by precipitation, sunshine hours, and relative humidity. For different vegetation types, the correlations between NDVI and climate variables diversified, increasing from desert steppe to typical steppe, meadow steppe, and forest. (3) The periodicity of temperature and precipitation occurred in either a 280-day or 290-day cycle, which was approximately coincident with that of NDVI. This further supported the significant relationship between NDVI and these two climate factors. (4) At all the time scales under examination, NDVI and temperature and precipitation are significantly, positively correlated, especially at the 160-day scale, which can be regarded as the most suitable time scale for investigating the responses of vegetation dynamics to climate factors at most stations.

The nonlinear hydro-climatic process in the Yarkand River, northwestern China

Stochastic Environmental Research and Risk Assessment   February 2, 2013

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Qin Nie, Yulian Hong, Yang Yang

Based on the hydrologic and meteorological data in the Yarkand River Basin during 1957–2008, the nonlinear hydro-climatic process was analyzed by a comprehensive method, including the Mann–Kendall trend test, wavelet analysis, wavelet regression analysis and correlation dimension. The main findings are as following: (1) The annual runoff, annual average temperature and annual precipitation showed an increasing trend during the period of 1957–2008, and the average increase extent in runoff, temperature and precipitation was 2.234 9 108 m3/10 year, 0.223 °C/10 year, and 4.453 mm/10 year, respectively. (2) The nonlinear pattern of runoff, temperature and precipitation was scale-dependent with time. In other words, the annual runoff, annual average temperature and annual precipitation at five time scales resulted in five patterns of nonlinear variations respectively. (3) Although annual runoff, annual average temperature and annual precipitation presented nonlinear variations at different time scales, the runoff has a linear correlation with the temperature and precipitation. (4) The hydro-climatic process of the Yarkand River is chaotic dynamic system, in which the correlation dimension of annual runoff, annual average temperature and annual precipitation is 3.2118, 2.999 and 2.992 respectively. None of the correlation dimensions is an integer, and it indicates that the hydro-climatic process has the fractal characteristics.

Vegetation Coverage Change Trend in Inner Mongolia of China during 1998-2008

Springer   September 24, 2011

Authors: Jianhua Xu, Lei Cao, Jianhua Xu, Yang Yang

Vegetation is sensitive to reflect the change of ecological environment, so it is significant to study the vegetation dynamics for ecological environment protection and ecological early warning. Based on the time series of the SPOT/VEGETATION NDVI dataset, this paper has obtained the spatial distribution of NDVI in Inner Mongolia (IM), analyzed the characteristics of NDVI change trend in the period of 1998-2008 by Maximum Value Composites (MVC) and Mann-Kendall test. The main findings are as follows: (1) NDVI

time series in most regions of IM has tendency in the recent 10 years. (2) The significant increased areas of vegetation cover are mostly distributed in the area of severe desertification, and the significant decreased areas of vegetation cover are mainly located in the typical steppes.

A brightness–darkness–greenness model for monitoring urban landscape evolution in a developing country – A case study of Shanghai

Landscape and Urban Planning   May 1, 2014

Authors: Wenze Yue, XinYue Ye, Jianhua Xu, Lihua Xu, Jay Lee

To monitor and model the evolution of urban landscapes, we develop a brightness–darkness–greenness (B–D–G) model. It is based on the vegetation–impervious surface–soil (V–I–S) model, proposed by Ridd (1995) to simplify urban environments to three basic ground components.

The model integrates the knowledge of urban landscape composition and spectra of remote sensing. The B–D–G model is a fast and effective method to analyze urban landscape composition and its evolution based on remotely sensed images, by employing an explicit endmember evolution

implication via the endmember spectrum dynamics. We verify this new method through in situ measurements of spectrum and high resolution images. Then, B–D–G model is used to detect the pattern and types of urban renewal. Despite some limitations, B–D–G model provides a new perspective of modeling urban dynamics and monitoring urban landscape evolution.

The dynamic of groundwater level in the lower reaches of Tarim River affected by transported water from upper reaches

International Journal of Water, 7(1/2): 66-79. DOI: 10.1504/IJW.2013.051979.   January 27, 2013

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Yan Zhang

Using the grey system theory and the observed data from the monitoring section of Yingsu, the paper studied the dynamics of groundwater level in the lower reaches of Tarim River affected by transported water from upper reaches. The main findings are as follows: 1) the groundwater level has revealed an upward trend versus time since 2000, but downward trend versus the distance from the river centre at the same time; 2) the discharging volume, running days of water diversion and discharging water per day, are the three main parameters that markedly affect the groundwater level; 3) transported water from upper reaches not only markedly raised the groundwater level near river bank, and caused the groundwater level rising within the range of 1,050 m from the river centre.

Based on the above results, some suggestions about the protection of the groundwater in lower reaches of the Tarim River could be put forward as following: 1) It is better to continue implementing the ecological water conveyance project. 2) Water resources in the drainage area should be placed under unified management and scheduling, by centring on the rational allocation of water resources. 3) It is proposed to arrange rationally and make full use of monitoring sites for water environment. 4) It is important to implement laws and regulations and law enforcement supervision, and regulate the management behaviour of groundwater resources.

Spatial-temporal variations of vegetation cover in Yellow River Basin of China during 1998–2008

Sciences in Cold and Arid Regions   June 28, 2012

Authors: Jianhua Xu, Qin Nie,JianHua Xu,Zhuo Li, YuLian Hong

Using an integrated method combining wavelet analysis and non-parameter Mann-Kendall test, this paper analyzed spatial-temporal variations of vegetation cover in the Yellow River Basin based on SPOT-VEG images from 1998 to 2008. The results indicate: (1) Vegetation cover presented marked seasonal variation during the study period, with minima around winter and maxima in summer. The detail component D5 (with semi-period of 240 days) has presented a major contribution to the intra-annual variability. Forest vegetation presents a marked decreasing trend, while alpine shrubs, meadow, typical steppe, desert steppe, and forest (meadow) steppe vegetation all show a marked increasing trend. (2) Mean vegetation amount increased from the upper to lower reaches of the basin. It is low in the Ordos Plateau and Loess Plateau, and high in the southern Loess Plateau and the lower reaches. Amplitude of the annual phenological cycle presents an opposite pattern in spatial distribution with that of the mean vegetation amount. (3) Vegetation cover presented a dominant positive inter-annual change trend, which implies that the eco-environment in the region has steadily improved. Only a few areas show a negative trend, which are located in the upper reaches and the southern Loess Plateau.

On the Dynamic Mechanism of Erosion Process

International Journal of Sediment Research   June 18, 1992

Authors: Jianhua Xu, Ai Nanshan

Erosion process is controlled and affected by various forces of different nature. Erosion processes induced or affected by these forces can be classified into three categories: erosion process induced by endogenic agent, by exogenic agent and associated with human activities. In this article, various dynamic mechanisms are systematically reviewed. Effects of tectonic stress and gravitational stress fields on erosion, effects of human activity on erosion, effect of exogenic forces such as water and wind erosion are discussed respectively.

A Systematic Analysis of Human Activity on Landform Evolution of the Loess Plateau

Journal of Xinjiang University   December 28, 1989

Authors: Jianhua Xu, Ai Nanshan

An Approach to the Theory of Agroecological Environmental Suitability and Its Application

Journal of Xinjiang University   March 30, 1992

Authors: Jianhua Xu, Maccoll R, Hu Xijian

Spatial analysis of the urban landscape pattern

Ecologic Science   June 28, 2005

Authors: Jianhua Xu, Yue Wenze, Xu Jianhua, Tan Wenqi

Because of the multiplicity in spatial pattem and ecological pmcesses, scale plays an important role to understanding the pattem-proce interactions and, indeed, becomes one of the comer-stone in landscape ecology. Based on the research of Shanghai city, this paper studies the pattem characteritics at different grains by using the methods of landscape ecology; and the semi-variogram is used to analyze the pattern characters at different extents#The results of analysis indicate: (1) Different landscape indices responds dissimilarly to the changes of grains. (2) Spatial variation of landscape diversity shows the most complexity at the smallest extent#(3) The response of landscape indices and SHDI semi-variance to scle is respective. So landscape spatial pattem has scale dependency.

Retrieving groundwater depth in the lower reaches of Tarim River by NDVI

Authors: Jianhua Xu, Qi Shen , Yaning Chen , Jianhua Xu , Yan Zhang

The changes of the coverage of vegetation and groundwater depth during the period of ecological construction and environmental protection are the most important two indicators of the level of success in ecological water transportation project in lower reaches of Tarim River.In this study, a new way to predict the groundwater depth in the arid regions has been presented. The spatial and temporal change of vegetation states in lower reaches of Tarim River under the ecological water transpiration have been discussed by using NDVI data derived from SPOT VEGETATION (VGT) NDVI S10 time sequence image data for the year 1999, 2003 and 2006. It is found that the groundwater depth played a dominant role in determining vegetation growth status in the lower reaches of the Tarim River. After the ecological water transportation, the vegetation has been restored in both sides of the watercourse stretching to Taitema Lake, which extend to 3 km in Akedun section, but decline along the stream flow as 1km in Kaogan section. However the area, which is 3km to 15km away from watercourse, has not been influenced obviously. And the area far away (excess 15km) has no influence. Statistic analysis shows that the groundwater depth has negative relationship with NDVI. And the groundwater depth in lower reaches of Tarim River has been successfully inversed through the statistic method; the simulation precision is 75%.

Evaluation of impacts of ecological water conveyances on hydrological processes and land cover in Tarim River basin, China, using groundwater levels and MODIS vegetation indices

Authors: Jianhua Xu, Qi Shen, Jianhua Xu, Yuping Lei

Lower reaches of Tarim River, Western China is a very serious arid and desertification region. During 2000-2006, 2.36 billion cubic meters water has been transported to this area by nine terms to control regional desertification. We apply grey correlation analysis for temporal and spatial variations of groundwater levels from nine monitoring sections and corresponding MODIS vegetation indices (VI) in the third, fourth, and seventh terms of water conveyance to evaluate the impacts of ecological water conveyances on basin hydrological processes and land cover. During the terms of water conveyance, both groundwater level and VI along the canal are rising and a calculated grey incidence degree reaches 0.9. However, the increases of groundwater levels and VI gradually reduce from the source of water input in the direction of the canal and calculated grey incidence degrees were below the level of significance for a single term of water conveyance. At same time, the incidence degrees reduced significantly with increasing distances from the canal. The analysis results shows that spatial variations of changes of hydrological processes and land cover conditions caused by water input were very large, which may reduce the use efficiency of precious water resource in this region.

A study on the relation between temporal NDVI and economy and population: A case on Chongqing city in three gorges region, China

Authors: Jianhua Xu, Han Guifeng, Xu Jianhua

In the context of global climatic change, the distribution and variety of vegetation on continental ecosystem are important indices well responding to the climatic change. It is an effective approach to study the impact of human activities upon natural environment by analyzing dynamic trends of vegetation on time series. In this paper, we use 1 km resolution NDVI products from the Earth Observing System SPOT/VGT to analysis the relationship between NDVI and economy (indicated by Gross Domestic Product, GDP) and population (POP) in Chongqing city in three gorges region of southwestern China. It is found that the vegetation does not increase steadily and rapidly like GDP and POP with sustainable increasing trends from 1998 to 2005. In the second section, we deeply analyze the correction between NDVI and GDP and POP in six main districts on spatial distribution in 2000. It is pointed out that there are all negative correlation between some measurements of NDVI and GDP and POP respectively. But the similar correlation cannot be found, if the region is enlarged to the whole Chongqing city. Thus we evaluate correlation coefficient between NDVI and GDP and POP respectively by the mean of moving windows in every window. As a result, correlation coefficient is smaller if location is more far from the economic center of city.

Vegetation classification in eastern China using time series NDVI images

Authors: Jianhua Xu, Guifeng Han, Jianhua Xu

The SPOT/VGT NDVI (S10) time series data of eastern China (1998-2005) are smoothed with two methods, the moving average and the Savitzky-Golay filter, after they are downloaded from the official website of VITO. Then the monthly maximal NDVI images (total 93 images) are extracted from 279 NDVI (S10) images and the Principal Component Analysis (PCA) is applied on the 93 images. There are 3 components that each explains more than 1% of the variance, in which the principal components 1, 2 and 3 explain respectively 93.25%, 2.77% and 1.21% of the variance in the original 93 maximum NDVI images. The principal component 1 is interpreted as the "climate" component, and principal components 2 and 3 are interpreted as the "growth season" and "non-growth season" components respectively. Principal components 1, 2 and 3 are composed to a 3-band color image which is classified into 7 classes (including 18 subclasses) by ISODATA. The overall accuracy of classification in five samples is 83.6%, and the kappa index is 0.82. Finally, the unique intra-annual NDVI curve of each vegetation class is displayed.

Influence of population and economic development on vegetation -- A case study in Chongqing city

Authors: Jianhua Xu, Han Guifeng, Xu Jianhua

Vegetation is an important variable in earth system. Influence of human activities on vegetation is obvious on certain scales. This paper, taking Chongqing City as an example, analyzed the correlation between artificial factors and vegetation spatio-temporal distribution based on time series NDVI data. It is shown that vegetation dist ribution and growth does not increase steadily nor rapidly like GDP and pop ulation with sustainable increasing trends from 1998 to 2005. There is always negative correlation between vegetation and GDP and population in terms of time series. However, the correlation appears significantly

heterogeneous in space. The obvious negative correlation is observed in relatively developed areas nearby the center of the city where rapid economic development and urbanization make vegetation decrease both in distribution and productivity; whereas positive correlation is observed in those areas away from the city especially in underdeveloped areas.

Spatiotemporal change of vegetation distribution in central area of Chongqing City in 1988-2001

Authors: Jianhua Xu, Han Gui-feng, Xu Jian-hua, Yuan Xing-zhong, Wang Zhi-hai

By using Landsat images, this paper analyzed the spatiotemporal change of vegetation distribution in the central area of Chongqing City in 1988, 1993 and 2001. The results indicated that from 1988 to 2001, the vegetation coverage in the study area decreased speedily, vegetation patches fragmentized gradually, and the distribution of the patches became more and more dispersive. The vegetation change was less distinct in the first phase (1988-1993) than in the second phase (1993-2001). The three periods' land covers were classified into two types (vegetation and non-vegetation), and the land cover images in the three periods were overlaid into one image which contained the patches with eight types of change trajectories. The spatial pattern of the trajectories could illuminate the spatiotemporal change of vegetation well. The non-vegetation and vegetation patches without changed trajectories in the three periods had high spatial autocorrelation, while the patches with other six types of change trajectories had low spatial autocorrelation, and suffered a complicated change from 1988 to 2001.

Impact of urbanization on vegetation phenology in major cities in Yangtze River Delta region

Authors: Jianhua Xu, Han Gui-feng, Xu Jian-hua, Yuan Xing-zhong

Based on the time series NDVI images from 1998 to 2005 and by the method of moving average, the vegetation phenology in urban areas and buffer zones of Shanghai, Hangzhou, Nanjing, Changzhou, Wuxi and Suzhou in Yangtze River Delta region were calculated. The difference of average phenology in urban areas and buffer zones was analyzed, and the relationship between this difference and the distance away from urban edge was studied. The results showed that in 1998-2005, the urbanization of the cities made the vegetations in their urban area had an earlier start of growing season (SOS), later end of growing season (EOS), longer growing season length (GSL) and smaller NDVIamp (difference of maximal and minimal NDVI in a year). These changes were more obvious in buffer zones if they were closer to urban area. In general, urbanization made the SOS within 4 kilometers away from the urban edge started obviously earlier, and the EOS, GSL and NDVIamp within 10 kilometers away from the urban edge changed obviously. The differences of GSL between urban and buffer zones had a significant logarithmic relationship with the distance away from the urban edge, so did the NDVIamp.

Quantitative Analysis of Regional Economic Development Disparity in China from 1952 to 2000

Authors: Jianhua Xu, Ai Nanshan, Lu Yan, Chen Yong, Ling Yiying, Yue Wenze

The main conclusions are: # Regional disparity in economic development in China, including the inter-provincial disparity, inter-regional disparity and intra-regional disparity, has existed for years. # Gini coefficient and Theil coefficient have revealed a similar dynamic trend for comparative disparity in

economic development between provinces in China. From 1952 to 1978, except for the "Great Leap Forward" period, comparative disparity basically assumes a upward trend and it assumed a slowly downward trend from 1979 to1990. Afterwards from 1991 to 2000 the disparity assumed a slowly upward trend again. In other words, the strategy of regional balanced development before the reform and opening up did not bring us a reduction in comparative disparity of regional economic development, nor did the lopsided development strategy implemented since then bring us an expansion of comparative disparity of regional economic development in China. # A comparison between Shanghai and Guizhou shows that absolute inter-provincial disparity has been quite big for years. The disparity of economic development between the two provinces expanded till 1978 and reduced after the reform and opening up. Since 1990 the disparity began to expand for the second times with a slight drop in 1998. # The R/S analysis result tell us that In the "Great Cultural Revolution" period, i.e. 1966-1978, the Hurst exponent H=0.504#0.5, indicates that in this period the evolution of comparative inter-provincial disparity of economic development showed a random characteristic, and In the other period, i.e. 1952-1965, 1979-1990 and 1991-2000, the Hurst exponent H>0.5 indicates that in this period the evolution of the comparative inter-provincial disparity of economic development in China has a long-enduring characteristic.

Study on the driving forces and prediction of built-up area for urban expansion in Kunming

2011. Remote Sensing, Environment and Transportation Engineering (RSETE), 2011 International Conference on. DOI: 10.1109/RSETE.2011.5965098.   June 24, 2011

Authors: Jianhua Xu, Yulian Hong, Jianhua Xu, Zhanyong Wang

Based on the analysis of driving forces of urban land expansion by Principal component analysis (PCA), this paper established a predicting model of urban built-up area for future by using socio-economical data. Being good at the performance of nonlinear approximation, artificial neural network (ANN), especially the back propagation algorithm (BP), is applied in the prediction of bulit-up land and had attained satisfactory results. Taking Kunming for example, the results showed that the urbanization is the decisive factor influencing urban land expansion, and a predicting model combined PCA and BP-ANN used to predict urban built-up area in the year of 2009-2015. The method employed in this paper can provide a reference to study on urban land expansion for urban development and planning in the inland cities lacking of multi-sources data.

Design and Implementation of Lujiazui Land Management Information System Based on WebGIS

2010 International Conference on E-Business and E-Government, DOI: 10.1109/ICEE.2010.174.   August 28, 2010

Authors: Jianhua Xu, Shouyi Lin, Jianhua Xu, Zhihong Li, Yang Yang

The number of internet-based Geographical Information Systems (Web GIS) applications has rapidly increased in recent years, in particular with the emergence of sites such as those underpinned by Google Maps technology. Web GIS is seen as a useful tool for E-Government. The Land Management Information System based on WebGIS achieves the purpose of geographic data transmission on internet, and can improve the land information management level. It allows more people to enjoy the service of Geographic Information Sharing. From the status quo and developing needs of land in Lujiazui district of Shanghai, this paper puts forward the significance of building Lujiazui land system. In the paper, user needs, framework

and functions have been analyzed emphatically. It is proved that the WebGIS system structure discussed in this paper is practicable.

Combining AHP with GIS for evaluating environmental carrying capacity in Shaanxi Province, China

Authors: Jianhua Xu, Lijun Zhang, Jianhua Xu

The analytic hierarchy process (AHP) has the special advantage in multi-indexes evaluation, and geographical information system (GIS) is good at spatial analysis. Combining AHP with GIS provides an effective means for studies of regional environmental carrying capacity (ECC) evaluation. Aiming at the regional features of ecosystem of Shaanxi Province, the synthetic evaluation index system is set up including eco-elastic force, resource carrying capacity and environment carrying capacity factors. Supported by GIS, taking the city as the evaluation unit, the information system database of ECC of Shaanxi Province is established. Based on the database and evaluation system, AHP, ECC evaluation index method and spatial analysis are integrated into the ECC evaluation in the study area. The results showed that only 23% of the total land area in Shaanxi Province maintains a good or better grade of the ECC. However, 50% of the total area is of a bad or worse grade of ECC. From the spatial distribution, the ECC gradually decreased from the south to the north with exception in a few areas, which presented the obvious characteristics of terrain. It is concluded that the current status of the integral ECC of Shaanxi Province is in the bad level, and highly intense human activities speeded up the degradation of regional ecosystem in recent years.

Investigation and comparison between GM(1,1) and BPANN forecast models in Shanghai low-rent housing families

Authors: Jianhua Xu, Zhuo Li, Jianhua Xu, Qing Wei

Based on the data of household income of Shanghai low-rent housing families, a GM(1,1) forecast model and a Back-Propagation Artificial Neural Network (BPANN) forecast model are established respectively to predict the average household income of low-rent housing families. The comparison between the GM(1,1) and the BPANN model showed that the BPANN model is better than the GM(1,1) model at the aspects of prediction accuracy and data adaptability. The BPANN model could be applied successfully to predict the average household income of Shanghai low-rent housing families in a short-term and it will provide scientific and effective basis for formulate policy on low-rent housing.

Application of GA Optimized Wavelet Neural Networks for Carrying Capacity of Water Resources Prediction

Authors: Jianhua Xu, Lu Feng, Xu Jianhua, Wang Zhanyong

The prediction of urban water demand using a small number of representative properties is fundamental in evaluating carrying capacity of water resources. Artificial neural networks (ANNs) have recently become popular tools in the prediction of urban water demand. In this paper, an iterative method which combining

the strength of back-propagation (BP) in weight learning and genetic algorithms' capability of searching the satisfying solution is proposed for optimizing wavelet neural networks (WNNs). Taking the city of Hefei in China as an example, the proposed genetic algorithms optimized WNN that required a few representative properties as possible for input data is applied to predict urban water demand in the future several years. The prediction performance of the GA Optimized WNN is compared with traditional neural networks, and simulation results demonstrate the accuracy and the reliability of the prediction methodology based on the proposed model. Finally, urban water demand in Hefei, 2008-2010, is obtained which provide reference for coordinated development of socio-economic and water resources in Hefei.

Using the Method Combining PCA with BP Neural Network to Predict Water Demand for Urban Development

Authors: Jianhua Xu, Zhanyong Wang, Jianhua Xu, Feng Lu, Yan Zhang

Combining Principal Component Analysis (PCA) with BP Neural Network, the paper has established a model to predict water demand for urban development with a demonstration in Hefei city. The results indicate that the error absolute value of prediction model is less than 0.9 percent with an ideal effect. Viewed from PCA results, the principal factors affecting urban water demand can be summarized up as economic development (first principal component F1) and population size (second principal component F2). By model training of BP network with the scores of F1 and F2 as inputs and water demand as outputs, we has provided three prediction programs, while we think the medium program is relatively better suitable for guiding Hefei's water resources planning according to a comparative analysis on the balance between water supply and demand.

Design and Implementation of Campus Spatial Information Service Based on Google Maps

Authors: Jianhua Xu, Yang Yang, Jianhua Xu, Jianghua Zheng, Shouyi Lin

Using the programmable interfaces provided by Google Maps, we create a campus spatial information service system. It uses free high resolution remote sensing images as the base map and it adopts open source software and function components. Making full use of the network data and combining Google Maps and MySQL database, it provides users with rich and interactive information such as the picture, description, link and the useful measurement tool. With a breakthrough compared with the traditional system which is manager-oriented and closed, the system uses the current prevalent B/S model and absorbs the mashup idea on the platform architecture design .These expand the scope of service people and reduce the developing difficulties and cost remarkably. The system integrates some promising key technologies of Web2.0 and pushes forward the applying of public participate GIS. All these make better service of personalized and humanistic digital campus.

The spatial relationship analysis of regional development potential and resource and environment carrying capacity in China

Authors: Jianhua Xu, Yan Zhang, Jianhua Xu, Gang Zeng, Qi Shen, Qing Hu

The main goal in this study is to explore the spatial relationship of Chinese regional development potential (DP) and resource & environment carrying capacity (REC) in 2000 and 2006 by using meta-synthesis of spatial statistical analysis and GIS technique. The results show that: The spatial distribution trend of DP and REC are overall gradient descending from coastal to inland, then to the western provinces. They all demonstrate that spatial agglomeration with global significant, namely high-DP regions aggregated in the east, low-DP regions aggregated in the west. The high-REC of central, eastern and southern China are improved and aggregated, but the low-REC aggregated in northwest. Chinese regional DP and REC are divided into five different kinds of regions based on the results of k-means clustering analysis and spatial clustering, which demonstrate that each area's DP and REC's spatial association measure is not very obviously. Compared to the high-DP region, the low-DP region is more restricted to the REC.

Applications of Spatial Interpolation for Climate Variables Based on Geostatistics: A Case Study in Gansu Province, China

Authors: Jianhua Xu, Yue Wenze, Xu Jianhua, Liao Hongjuan, Xu Lihua.

Based on reviewing the origin, development and basic principles of Geostatistics, this article probed into two kinds of interpolation methods concretely: ordinary Kriging and Cokriging. As no single method among so many available ones to spatial interpolation of climate variables is optimal for all regions and all variables, the article probed into interpolation methods based on Geostatistics by using annual average precipitation and evaporation in Gansu province from 1961 to 1990. Based on different semivariogram theory models we adopt ordinary Kriging and Bivariate Cokriging, by comparing of them we could draw conclusions as fellows:

(1) No matter annual average precipitation or evaporation all presented obvious gradient change on space, the change ranges of both were great, the former was larger than the latter. Annual average precipitation decreased gradually from southeast to northwestward, but evaporation was opposite, increased gradually from southeast to northwest.

(2) According to semivariogram cloud plots and experiment variance minimum principle selected suitable semivariogram theory models based on Geostatistics interpolation method to interpolate, which could simulate space pattern spreading continuously of regionalized variable well, then get better interpolation effect. Compared ordinary Kriging with Cokriging, as the latter input altitude which had an influence on precipitation and evaporation, it was more rational on space distribution and had a higher interpolation precision.

(3) With Geostatistics methods the spatial interpolations could reflect the general space pattern of climate variables better in general, but the spatial interpolations precision of two methods were still not high, which still remained further improving.

V-I-S model for cities that are experiencing rapid urbanization and development

Authors: Jianhua Xu, Wu Jiawei, Xu Jianhua, Yue Wenze

This is a study of modeling urban environments from TM satellite images. Urban environments are so heterogeneous that it is necessary to simplify them as combinations of basic land cover materials in order to enable quantitative studies. The V-I-S model proposed by Ridd in 1995 is a conceptual model to simplify urban environments as combination of three basic ground components: vegetation, impervious surface, and soil. Most urban grounds can be interpreted as combinations of these three basic components. This model is used in this study on Shanghai City, China. As a step further, water bodies are masked. From the mixing space, however, we find some difference from the traditional V-I-S model according to the fact that most urban features have their own unique V-I-S composition. The difference can come down to the rapid urbanization and fast development in Shanghai. This is an uncommon course or stage in the development of cities' urbanization for it may be a case evidence to testify something. Specific urban ecosystem or environment model is built. Percentages of main ground components are extracted from TM data. Various charts and plots are generated to demonstrate the capacity of V-I-S composition on urban land cover analysis. This unique V-I-S composition may provide another ideas for further urban land cover analysis aiming at cities that are experiencing rapid urbanization and development.

Analysis of Mechanism for Formation of Urban Thermal Environment

Authors: Jianhua Xu, Wenqi Tan, Jianhua Xu, Wenze Yue

The transformation of natural landscapes into highly human-dominated environments is placing increased pressure on local and global ecosystems. One direct result of this transformation, so called "Urban heat island (UHI) phenomenon", is regarded as one of the most pervasive environmental problems nowadays. There is increasing evidence that the existence of UHI may bring a lot of troubles to the urban environment, further influence the sustainable development of urban and force urban planners to focus on the broad research on UHI.

This paper based on TM image, choosing Shanghai as study area, analyzes the impact factors of urban thermal environment and attempts to explain the mechanism of urban thermal environment by a few but effective factors. For the sake of the accuracy and accordance with actuality, Principal Components Analysis is applied after spatial autocorrelation of the factors is eliminated. The results show that urban construction, industry distribution, land surface characters and landscape diversity become the most important factors to the formation and mechanism of urban thermal environment of Shanghai. This result can undoubtedly provide an excellent platform from which we can launch other investigations to better our environment. Meanwhile, the understanding of mechanism of urban thermal environment and more, taking measures to lessen the intensity of urban thermal environment are of great significance to improve life-quality of humankind and further maintain the sustainable development of urban.

Analysis of urban and rural residents' consumption in Shanghai based on grey system theory

Authors: Jianhua Xu, Xueli Bi, Jianhua Xu.

Based on the grey system theory, this paper systematically analyzed and compared the change trends and driving factors of the urban and rural residents' consumption in Shanghai. Using the consumption data from 2001 to 2009, two GM(1,1) grey models were firstly bulit to predict their change trends. For analyzing the driving factors of the trends, we integrated the current research, considered the comprehensiveness, importance and measurability of all related factors, finally screened 10 relatively important factors, then grey relational analysis was adopted to analyze their relative importance quantitatively, according to which two GM(1,N) dynamic models were established for further analyzing the influence mode to consumption.

A Model for the Evaluation of Urban Green Spaces' System Using RS and GIS Methods
Authors: Jianhua Xu, Luo Ya, Xu Jianhua, Yue Wenze.

The availability of attractive green spaces is an integral part of urban quality of life. But the traditional methods of evaluating the level of green spaces shared by urban dwellers have some disadvantages. They are as follows: (1) Area of green spaces is always taken as an only indicator so that the importance of green gross inside the green space is ignored. (2) The spatial scale of the indicators is so macro that the microspatial pattern of the green spaces can't be reflected. (3) Evaluation of green spaces' system generally depends on the total area of green spaces. But other constraint factors are not taken into account. Keeping the limitation above in mind, this paper adopts a new approach for calculating the green spaces' qualities then tries to design a new model as to how green spaces attract citizens in the neighborhood with the help of RS&GIS technology.

The green gross is equal to the sum of vegetation fractionsderived from Thematic Mapper images of the green space. The model is based on the theory of spatial interaction. The meanings of all the parameters are as follows: The attractiveness is in direct ratio with the green spaces' qualities while in inverse ratio with the exponential distance. Furthermore, the model also considers several restriction factors such as the accessibility, entrance fees, quietness, spaciousness and so on. The weights are given by simulation of Hopfield neuron network.

At last the approaches and model above are applied into the city of Shanghai in China. Taking the green spaces of parks inside the outer ring road as the study sample, the results are in accord with the actual spatial characteristic satisfactorily. The model is made operational easily, which can not only monitor space-time variety of urban green space, but also provide a new indicator for urban green space system planning.

Spatial variance characters of urban synthesis pattern indices at different scales
Authors: Jianhua Xu, Yue Wenze; Xu Jianhua; Xu Lihua; Tan Wenqi; Mei Anxin.

This paper modeled the semivariogram of these three landscape indices at different scales, and the results indicated that the spatial variance characters of diversity index, contagion index and fractal dimension were similar at different scales, which was spatial dependence. The spatial dependence was showed at each

scale, the smaller the scale, the stronger the spatial dependence. With the scale reduced, more details of spatial variance were discovered. The contribution of spatial autocorrelation of these three indices to total spatial variance increased gradually, but when the scale was quite small, spatial variance analysis would destroy the interior structure of landscape system. The semivariogram models of different landscape indices were very different at the same scale, illuminating that these models were incomparable at different scales. According to above analyses and based on the study of urban land use structure, 1 km extent was the more perfect scale for Studying the spatial variance of urban landscape pattern in Shanghai. The spatial variance of landscape indices had the character of scale-dependence, and was a function of scale. The results differed at different scales we chose, and thus, the influence of scales on pattern could not be neglected in the research of landscape ecology. The changes of these three landscape indices displayed the regularity of urban spatial structure at different scales, i. e., they were complicated and no regularity at small scale, polycentric at moderate scale, and circle-zoning at big scale.

Scales of spatial autocorrelation and self-similarity of urban landscape pattern

Authors: Jianhua Xu, Tan Wenqi, Xu Jianhua, Yue Wenze, Mei Anxin, Zhao Jing, Su Fanglin.

Choosing the center area of Shanghai as regional background, this paper analyzed the urban landscape pattern characters with different grains by the technology of RS and GIS. The results showed that landscape indices of Moran I and fractal dimension were all related to the grains. The spatial autocorrelation and self-similarity of urban landscape pattern depended on different scales within certain range of scale, with the depending degree differed greatly. The spatial autocorrelation highly depended on the scaling, while the spatial self-similarity did not follow the scaling regularly. The spatial autocorrelation and self-similarity of urban landscape pattern had different sensitive points to the scaling. For the landscape of residence, Moran 1, which characterized the spatial autocorrelation of the urban landscape structure, had the sensitive point to the scaling at the level of 50 in. However, sensitive points to fractal dimension differed greatly among different types of landscape patches.

Scaling and Simulation on Measuring Regional Economic Disparities based on Grid

Authors: Jianhua Xu, Qin Nie, Jianhua Xu.

The measurement of regional economic disparities is a scientific issue, closely related with scale. Based on Geographical information system (GIS) technology, selecting Lorenz curve, GINI coefficient and THEIL coefficient as the measuring index, this paper discusses the spatial scaling effect using grid method by up scaling. The main findings are as follows: With the increase of spatial grain in size, GINI coefficient and THEIL coefficient both present a decreasing tendency and the degree of downward bending of Lorenz curve is also decreasing, which all show regional economic disparities decrease. With the first 3–7 increase of spatial extent, GINI coefficient and THEIL coefficient change greatly and they are no obvious regularity. Since then, the measuring results tend to stabilization with the increase of spatial extent. On the large scale, the whole spatial rule is easy to find, but the details on the small scale are omitted. Meanwhile, on the small scale, the micro rules are easy to find, but the macro rule cannot be presented. Therefore, the suitable scale in

the study of regional economic disparities can be determined by the specific research purpose and research object.

A grey relational analysis and artificial neural networks of corn production prediction in China

Authors: Jianhua Xu, Wu Yu-Ming, Li Jian-xia, Xu Jian-Hua.

Aiming at the difficulties in deciding the variables of BP artificial neural network, using method of grey relational analysis to decide the input variables, this paper puts forward a grey relational analysis BP artificial neural network model, and gives its construction method. Taking prediction of China's total corn production as an example, it introduces a method of modeling of corn production prediction based on BP model, grey relational analysis and BP artificial neural network model. The results show that after being exercised, the network can provide nonlinear mapping relation between independent variables and dependent variable of corn production in China. The model is novelty, which has higher precision and good effect. It can be widely applied in modeling of many forecasting areas, and it also has high generalization value.

Improvement of Linear Spectral Mixture Analysis and experimentation in Estimation of Urban Vegetation Fraction

Authors: Jianhua Xu, Wenze Yue, Jianhua Xu, Jiawei Wu.

Abundance of vegetation plays an important role in urban ecosystem, urban planning and development. Traditional classification methods on remote sensing data by assigning each pixel membership in one, and only one have the primary shortcomings of their inability to accommodate spectrally mixed pixels in gradational land covers. The traditional classification methods are giving way to spectral mixture analysis (SMA) gradually which is better in acquiring quantitative information for specific land covers. Vegetation fraction, in a general way, is defined as the areal fractions of vegetation within each pixel. This paper, besides introducing the traditional technique of SMA, discusses the improvement of traditional technique from the aspects of data noise removal, least-squares solution with constraining sum of endmembers fractions to unit, pixel purity index and the selection of endmembers. LSMA is tested further with the Shanghai city as an example. Unmixing pixels with root mean square (RMS) error less than 0.02 accounts for the proportion of 98.5%. The spatial distribution of vegetation is corresponding to actual situation. Then we conclude that: the improved LSMA is appropriate for estimating quantitative vegetation fraction and the technique will be widely applied in urban environment.

Regional economic disparities in China and their evolution from 1952 to 2000: evidence by Theil coefficient based on comparable prices

Authors: Jianhua Xu, Y Lu, N S Ai, Y Chen

Since the late 1970s scholars have conducted many studies on the issue of regional economic disparities, but different scholars have reached different conclusions on the subject. This is mainly because the studies adopted different analytic approaches, perspectives, spatial units and statistical indicators, and examined different periods. On the basis of previous analyses and findings, this paper calculated and decomposed Theil

coefficients based on comparable prices, and revealed inter-regional disparities and intra-regional disparities in economic development in China and trends in their evolution from 1952 to 2000.

An analysis of the mosaic structure of regional landscape using GIS and remote sensing

Authors: Jianhua Xu, Fang Changlin; Yue Wenze

Based on the application of GIS, remote sensing and quantitative methods, this paper studies the landscape mosaic structure of the Xigu district in the city of Lanzhou. First, the region's landscape to TM image was classified into ten types of land use patterns, they are; farm land, orchard, grassland, woodland, scattered woodland, bare land, water area, urban area, rural settlement, and industribal area farfrom settlement. Next, the classified informatio together with surveyed data was served as the inputs of a geographical information system. Then, a digital elevation model (DEM) and landscape mosaic map was processed in a GIS environmetn, which was followed by a subdivision of the regio ninto four categories: valley area, northern mountain area, southern mountain area, and dais area. Finally, each of those arease was analyzed in terms of diversity, dominance, fragmentation, isolateio and fractal dimension, with their results given bleow: Due toits falt terrain, conveinet transportaion, short distance to rivers, the valley area has been recognized as the center of human activities. this area is revealed wit high values in the diversity and fragmentation indices as well as a low dominace figure as resutlts of its flat terrain, low altitude and convenient irrigation. Though, few landscapes show strong dominance, their diversity indices are usually low ude to mountainous steep slone and high altitude. On the other hand, farmland, grassland and woodland dominate the outhern mountain area, and grassland dominates the northern mountain area. Due to its composition of more farmland, orchard and rural settlement landscape pathces, the diais area's diversity and dominance indices come in between those of the valley and the mountain areas.

A Statistical Study on Spatial Scaling Effects of Urban Landscape Pattern: A Case Study of the Central Area of the External Circle Highway in Shanghai

Authors: Jianhua Xu, YUE Wenze; TAN Wenqi

Based on SPOT remote sensing images and GIS, choosing the central area of the external circle highway in Shanghai as a case study area, the paper studied the spatial scaling effect of the urban landscape pattern with different grains and extents. The conclusions are drawn as follows: (1) The spatial autocorrelation of urban landscape pattern depends on different scales within a certain range of scales, and Moran I and Geary c related to the grains, which characterized the spatial autocorrelation of the urban landscape structure, have the same sensitive points to the scaling at the level of 50 m. (2) The patches of all kinds of landscapes have the fractal character. The fractal dimensions of landscapes respond to scaling differently, and the present nonlinear change trends with grains. The fractal dimensions of landscapes are obviously different at a small grain, but the differences become not obvious with the increasing grain. (3) The landscape diversity are closely linked to the location and the pattern of human activities, especially to economic and social activities. Due to the high land cost in the urban center, the dominant landscapes are mainly for business and culture, and their patches have the characters of high congregation and high fragmentation. While agricultural landscapes with low economic benefit can only be located at the fringe or outskirt of the urban area, and they

have the characters of simplex, larger patches and less fragmentation. (4) The landscape diversity depends on spatial scale. With the increasing extent, the Shannon diversity index (SHDI) increases and the spatial pattern of landscape varies dramatically. At 0.5 km extent, the maximum of diversity is in the center of the urban area. The landscape diversity is distributed with a ring mode up and down from the center to the outer. With the increasing extent, the maximum of diversity moves to the urban-rural transition zone where landscape types change dramatically.

Spatial and temporal scale analysis on the regional economic disparities in China
Geographical Research, 24(1): 57-68.   March 15, 2005
Authors: Jianhua Xu, LU Feng; SU Fang-lin; LU Yan.

The main conclusions of this paper are: (1) the regional economic disparities in China, including the disparities within-province, between-provinces, within-region (the eastern, central and western regions) and between-regions, have existed since 1952. (2) The first stage decomposition of Theil index shows that the dynamic trend of disparity in the eastern region is consistent with that of whole China. The disparity in the central and western regions remains small, and the evolution is rather slow. The disparity between the three regions has been continuously increasing. (3) The second stage decomposition of Theil index reveals that the within-province disparities is the most significant component of all in the overall regional inequalities, which is more significant than that of the between-province and between-region disparities components, constituting the important part of the overall regional inequalities. In addition, the influence of within-province disparities in the eastern region on the overall regional inequalities is more significant than that of in the other two regions, and, the influence in the western region is more significant than that of in the central region. (4) Based on the decomposition and approximation of Theil index sequence using wavelets by different time scales, we elicit a conclusion that the evolutionary process of regional economic disparity in China is not a simple inverted U-shaped pattern but a compound of several U-shaped patterns. The result tells us the evolutionary process of regional economic disparity in China does follow the inverted U-shaped patterns a time scale of 16 years. That is to say that the regional inequality tends to rise in the first stage of economic development, and falls slowly over the peak in the second stage of economic development. However, if we shorten the time scale to 8 or 4 years, then a link of several U shaped patterns will appear.

Air Temperature Change in the Southern Tarim River Basin, China, 1964–2011
The Scientific World Journal   November 20, 2013
Authors: Benfu Zhao, Jianhua Xu, Zhongsheng Chen, Ling Bai, Peng Li

The temperature data from 3 meteorological stations (Kashi, Ruoqiang, and Hotan) in the South of Tarim River Basin (STRB) during 1964–2011 were analyzed by Mann-Kendall test and correlation analysis. The results from Mann-Kendall test show that the surface temperature (ST), 850 hPa temperature (T850), and 700 hPa temperature (T700) exhibited upward trends, while 300 hPa temperature (T300) revealed a downward trend. On the whole, the change rate of ST, T850, T700, and T300 was 0.26~0.46°C/10a, 0.15~0.40°C/10a, 0.03~0.10°C/10a, and #0.38~#0.13°C/10a, respectively. For the periods, ST and T850 declined during 1964–1997 and then rose during 1998–2011. T700 declined during 1964–2005 and then rose during 2006–2011, while T300 rose from 1964 to 1970s and then declined. The results from correlation analysis show that T850 and T700 positively correlated with ST () at the all three stations and there was a negative correlation

between T300 and ST at Hotan (), while the correlation is not significant at Kashi and Ruoqiang. The results indicate that there were gradient differences in the response of upper-air temperature (UT) to ST change.

Multifractal and long memory of humidity process in the Tarim River Basin

Stochastic Environmental Research and Risk Assessment   December 11, 2013

Authors: Zuhan Liu, Jianhua Xu, Zhongsheng Chen, Qin Nie, Chunmeng Wei

Based on the daily data of relative humidity from 23 meteorological stations in the Tarim River Basin of northwest China during the period from 1961 to 2010, this paper analyzed the multifractal and long memory property of humidity process. Main findings are as follows: (1) The processes present scaling and multifractal property. (2) The left-skewed multifractal spectrum f(#) indicates that the time series of relative humidity is predominated by small fluctuations. (3) There exists long memory with the # # (0, 0.5) in the processes, except for Kalpin and Aksu's exhibiting non-stationary long memory with the parameter # being 0.67 and 0.69 respectively. (4) We found that on the whole, the degree of multifractality exhibits a strengthening trend with the longitude and latitude increasing, but decreasing trend with elevation rising; For length of long memory, we investigated that on the whole, the # values increased with the longitude and latitude increasing, which indicates that the bigger the longitude and latitude is, the longer the memory of humidity process is, but the higher the elevation is, the shorter the memory of humidity process is.

The Nonlinear Hydro-climatic Process: A Case Study of the Tarim Headwaters, NW China

Water Resources Research in Northwest China, Y. Chen (ed.), Springer Science+Business Media Dordrecht.   April 1, 2014

Authors: Jianhua Xu, Yaning Chen, Weihong Li

Based on the hydrologic and meteorological data in the areas of the Tarim headwaters, this chapter investigated the nonlinear hydro-climatic process by a comprehensive method including correlation dimension, R/S analysis, wavelet analysis, regression and artificial neural network modeling. The main findings are as follows: (1) The hydro-climatic process in the Tarim headwaters presented periodic, nonlinear, chaotic dynamics, and long-memory characteristics. (2) The correlation dimensions of the attractor derived from the AR time series for the Hotan, Yarkand, Aksu and Kaidu rivers were all greater than 3.0 and nonintegral, implying that all four headwaters are dynamic chaotic systems that are sensitive to initial conditions, and that the dynamic modeling of hydro-climatic process requires at least four independent variables. (3) The Hurst exponents indicate that a long-term memory characteristic exists in hydro-climatic process. However, there were some differences observed, with the Aksu, Yarkand and Kaidu rivers demonstrating a persistent trait, and the Hotan River exhibiting an anti-persistent feature. (4) The variation pattern of runoff, temperature and precipitation was scale-dependent with time. Annual runoff (AR), annual average temperature (AAT) and annual precipitation (AP) at five time scales resulted in five variation patterns respectively. (5) The nonlinear variation of runoff is resulted from regional climatic change. The variation periodicity of AR is close with that of AAT and AP. The multiple linear regression (MLR) and back-propagation artificial neural network (BPANN) based on wavelet analysis reveal the correlations between annual runoff (AR) with annual precipitation (AP), annual average temperature (AAT) at different time scales.

Upper-air temperature change trends above arid region of Northwest China during 1960–2009

Authors: Zhongsheng Chen, Yaning Chen, Jianhua Xu, Ling Bai

This study summarized upper-air temperature change trends based on the monthly datasets of 14 sounding stations in the arid region of Northwest China during 1960–2009. Over the investigated period, the change in upper-air temperature measured at eight standard pressure levels shows that an obvious warming at 850–400 hPa, which decreases with altitude, changes to an apparent cooling at 300–50 hPa. There is a positive correlation between the surface and 850–300-hPa temperatures, but a negative correlation between the surface and 200–50-hPa temperatures. Over the full 1960–2009 record, patterns of statistically significant mid-lower tropospheric warming and upper tropospheric and mid-lower stratospheric cooling are clearly evident. Also, the annual temperature cycle indicates that the peak temperature shifts from July in the troposphere to February in the mid-lower stratosphere, suggesting the importance of seasonal trend analysis. We found that the warming in the mid-lower troposphere is more pronounced during the summer, autumn, and winter, whereas the cooling in the upper troposphere and mid-lower stratosphere is larger during the summer and autumn. Furthermore, there are also many regional differences in the upper-air temperature change, regardless of both season and layer.

Sensitivity analysis for leaf area index (LAI) estimation from CHRIS/PROBA data

Authors: Jianjun Cao, Zhujun Gu, Jianhua Xu, Yushan Duan, Yongmei Liu, Yongjuan Liu, Dongliang Li

Sensitivity analyses were conducted for the retrieval of vegetation leaf area index (LAI) from multiangular imageries in this study. Five spectral vegetation indices (VIs) were derived from Compact High Resolution Imaging Spectrometer onboard the Project for On Board Autonomy (CHRIS/PROBA) images, and were related to LAI, acquired from in situ measurement in Jiangxi Province, China, for five vegetation communities. The sensitivity of LAI retrieval to the variation of VIs from different observation angles was evaluated using the ratio of the slope of the best-fit linear VI-LAI model to its root mean squared error. Results show that both the sensitivity and reliability of VI-LAI models are influenced by the heterogeneity of vegetation communities, and that performance of vegetation indices in LAI estimation varies along observation angles. The VI-LAI models are more reliable for tall trees than for low growing shrub-grasses and also for forests with broad leaf trees than for coniferous forest. The greater the tree height and leaf size, the higher the sensitivity. Forests with broad-leaf trees have higher sensitivities, especially at oblique angles, while relatively simple-structured coniferous forests, shrubs, and grasses show similar sensitivities at all angles. The multi-angular soil and/or atmospheric parameter adjustments will hopefully improve the performance of VIs in LAI estimation, which will require further investigation.

Fractal and multifractal characteristic of spatial pattern of urban impervious surfaces

Authors: Qin Nie, Jianhua Xu, Zuhan Liu

Urban impervious surface (UIS) has been widely utilized to quantify urban expansion and assess environmental impacts of urbanization. In order to understand the complexity of spatio-temporal change of UIS spatial pattern, we investigated the fractal and multifractal characteristics of UIS spatial pattern in the downtown area of Shanghai, China during 1997–2010. Results suggested that UIS spatial pattern is a

typical fractal structure with self-similarity during the study period. The fractal dimension reveals the spatio-temporal complexity of UIS pattern. With the threshold changing from small to large, the spatial complexity of UIS pattern is decreased. The increasing dimension values over time showed the UIS pattern becomes more complex and the spatial distribution becomes more clustered form 1997 to 2010. The multifractal approach transforms irregular UIS fraction data into a compact form and amplifies small differences between different data series. We also specially selected the W-E profile and the N-S profile to check the multifractality of UIS pattern. The results showed that the multifractality was detected in 1997 and 2002 on the W-E profile and only in 1997 on the N-S profile. The UIS pattern is more irregular on the W-E profile than that on the N-S profile according to the probability distribution, and the high fraction pixels are dominant on the two selected profiles by the positive ratio between the regions that the probability measure distributed most concentrated and most rarefied.

The regional features of temperature variation trends over Xinjiang in China by the ensemble empirical mode decomposition method

International Journal of Climatology   November 11, 2014

Authors: Ling Bai, Jianhua Xu, Zhongsheng Chen, Weihong Li, Zuhan Liu, Benfu Zhao, Zujing Wang

Based on a temperature anomaly time series from 16 international exchange stations in Xinjiang from 1957 to 2012, the multi-scale characteristics of temperature variability were analysed using the ensemble empirical mode decomposition (EEMD) method. Regional differences in variation trends and change-points were also preliminarily discussed. The results indicated that in the past 50+ years, the overall temperature in Xinjiang has exhibited a significant nonlinear upward trend, and its changes have clearly exhibited an inter-annual scale (quasi-3 and quasi-6-year) and inter-decadal scale (quasi-10 and quasi-30-year). The variance contribution rates of each component demonstrated that the inter-annual change had a strong influence on the overall temperature change in Xinjiang, and the reconstructed inter-annual variation trend could describe the fluctuation state of the original temperature anomaly during the study period. The reconstructed inter-decadal variability revealed that the climate mode in Xinjiang had a significant transformation before and after 1995, namely the temperature anomaly shift from a negative phase to a positive one. Furthermore, there were regional differences in the nonlinear changes and change-points of temperature. At the same time, the results also suggested that the EEMD method can effectively reveal variations in long-term temperature sequences at different time scales and can be used for the complex diagnosis of nonlinear and non-stationary signal changes.

Understanding temporal and spatial complexity of precipitation distribution in Xinjiang, China

Theoretical and Applied Climatology   January 8, 2015

Authors: Jianhua Xu, Yaning Chen, Weihong Li, Zuhan Liu, Jie Tang, Chunmeng Wei

Based on the observed data during the period from 1958 to 2012 in Xinjiang, China, we investigated the temporal and spatial complexity of precipitation distribution by using an integrative approach combining the phase space reconstruction (PSR), correlation dimension (CD), variogram, and cokriging interpolation. The CD values showed that the precipitation dynamic is a complex and chaotic system, and its complexity decreases along with the increase of temporal scale. To describe the precipitation dynamics, it needs at least four independent variables at daily scale, and at least three independent variables at monthly scale, whereas

at least two independent variables are needed at seasonal and annual scales. The spatial variation of CD value at daily and monthly scales is described by the exponential variogram model, whereas that at seasonal and annual scale needs to be respectively described by the spherical and Gaussian variogram model. The higher CD values mainly distribute on complex landform such as mountain areas, whereas the lower CD values mainly distribute on the flat landform such as basin area, which indicate that the spatial complexity of precipitation distribution is derived from the complex landform.

Long-range cross-correlation between urban impervious surfaces and land surface temperatures

Frontiers of Earth Science   May 20, 2015

Authors: Qin Nie, Jianhua Xu

The thermal effect of urban impervious surfaces (UIS) is a complex problem. It is thus necessary to study the relationship between UIS and land surface temperatures (LST) using complexity science theory and methods. This paper investigates the long-range crosscorrelation between UIS and LST with detrended crosscorrelation analysis and multifractal detrended crosscorrelation analysis, utilizing data from downtown Shanghai, China. UIS estimates were obtained from linear spectral mixture analysis, and LST was retrieved through application of the mono-window algorithm, using Landsat Thematic Mapper and Enhanced Thematic Mapper Plus data for 1997–2010. These results highlight a positive long-range cross-correlation between UIS and LST across People's Square in Shanghai. LST has a long memory for a certain spatial range of UIS values, such that a large increment in UIS is likely to be followed by a large increment in LST. While the multifractal long-range crosscorrelation between UIS and LST was observed over a longer time period in the W–E direction (2002–2010) than in the N–S (2007–2010), these observed correlations show a weakening during the study period as urbanization increased.

Detrended fluctuation analysis of spatial patterns on urban impervious surface

Environmental Earth Sciences   March 10, 2015

Authors: Qin Nie, Jianhua Xu

This paper analyzes satellite data from downtown Shanghai, China, to investigate the long-range dependence of spatial patterns on urban impervious surfaces (UIS) using two-dimensional detrended fluctuation analysis (DFA). The UIS fraction is estimated from Landsat Thematic Mapper and Enhanced Thematic Mapper Plus data from 1997 to 2010 using linear spectral mixture analysis. The results indicate that the spatial distribution of the UIS exhibits a positive spatial dependence, as revealed by Moran's index, capturing the evolution from aggregation to dispersion and back to aggregation during the study period. The use of two-dimensional DFA reveals a strong long-range power-law dependence in the UIS spatial pattern during the study period. The DFA scaling exponent can be seen as a measure of the uniformity of the UIS spatial distribution, and exhibits an approximate 1/f behaviour. Two-dimensional multifractal detrended fluctuation analysis (MFDFA) confirmed that the UIS spatial pattern is not multifractal in nature, meaning that only a single scaling exponent is required to disclose the long-range dependence in the UIS spatial pattern. The application of two-dimensional DFA to UIS patterns should be viewed as a complementary tool to existing techniques, such as Fourier analysis, wavelets, and structure function, that can provide additional information about the structure of UIS patterns, including its 1/f behaviour.

Understanding the effects of the impervious surfaces pattern on land surface temperature in an urban area

Authors: Qin Nie, Jianhua Xu

It is well known that urban impervious surface (IS) has a warming effect on urban land surface temperature (LST). However, the influence of an IS's structure, components, and spatial distribution on LST has rarely been quantitatively studied within strictly urban areas. Using ETM+ remote sensing images from the downtown area of Shanghai, China in 2010, this study characterized and quantified the influence of the IS spatial pattern on LST by selecting the percent cover of each IS cover feature and ten configuration metrics. The IS fraction was estimated by linear spectral mixture analysis (LSMA), and LST was retrieved using a mono-window algorithm. The results indicate that high fraction IS cover features account for the majority of the study area. The high fraction IS cover features are widely distributed and concentrated in groups, which is similar with that of high temperature zones. Both the percent composition and the configuration of IS cover features greatly affect the magnitude of LST, but the percent composition is a more important factor in determining LST than the configuration of those features. The significances and effects of the given configuration variables on LST vary greatly among IS cover features.

Multi-scale response of runoff to climate fluctuation in the headwater region of Kaidu River in Xinjiang of China

Authors: Ling Bai, zhongsheng chen, Jianhua Xu, Weihong Li

Based on the hydrological and meteorological data in the headwater region of the Kaidu River during 1960–2009, the multi-scale characteristics of runoff variability were analyzed using the ensemble empirical mode decomposition method (EEMD), and the aim is to investigate the oscillation mode structure characteristics of runoff change and its response to climate fluctuation at different time scales. Results indicated that in the past 50 years, the overall runoff of Kaidu River in Xinjiang has showed a significant nonlinear upward trend, and its changes have obviously exhibited an inter-annual scale (quasi-3 and quasi-6-year) and inter-decadal scale (quasi-10 and quasi-25-year). Variance contribution rates of each component manifested that the inter-decadal change had been playing a more important role in the overall runoff change for Kaidu River, and the reconstructed inter-annual variation trend could describe the fluctuation state of the original runoff anomaly during the study period. The reconstructed inter-decadal variability effectively revealed that the runoff for Kaidu River changed over the years, namely the states of abundance and low water period appear alternately. In addition, we found that runoff has a positive correlation to precipitation and temperature at different time scales, but they are most significant and relevant at inter-decadal scale, indicating the inter-decadal scale is most suitable for investigating the responses of runoff dynamics to climate fluctuation. At the same time, the results also suggested that EEMD is an effective method to analyze the multi-scale characteristics of nonlinear and non-stationary signal.

A hybrid model to simulate the annual runoff of the Kaidu River in northwest China

Authors: Jianhua Xu, Yaning Chen, Ling Bai, Yiwen Xu

Fluctuant and complicated hydrological processes can result in the uncertainty of runoff forecasting. Thus, it is necessary to apply the multi-method integrated modeling approaches to simulate runoff. Integrating the ensemble empirical mode decomposition (EEMD), the back-propagation artificial neural network (BPANN) and the nonlinear regression equation, we put forward a hybrid model to simulate the annual runoff (AR) of the Kaidu River in northwest China. We also validate the simulated effects by using the coefficient of determination (R^2) and the Akaike information criterion (AIC) based on the observed data from 1960 to 2012 at the Dashankou hydrological station. The average absolute and relative errors show the high simulation accuracy of the hybrid model. R^2 and AIC both illustrate that the hybrid model has a much better performance than the single BPANN. The hybrid model and integrated approach elicited by this study can be applied to simulate the annual runoff of similar rivers in northwest China.

Interests

Geographical Modelling, Geocomputation, GIS, Remote Sensing Applications.

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