香港中文大學太空與地球信息科學研究所
INSTITUTE OF SPACE & EARTH INFORMATION SCIENCE CUHK

International conference of

Geo-Process Modeling in VGE:
Managing and Sharing Geographic Knowledge

Guidebook

6-8 November 2014
The Chinese University of Hong Kong

Organizers:

Co-organizers:

University at Buffalo
The State University of New York
NATIONAL CENTER FOR GEOGRAPHIC INFORMATION AND ANALYSIS

LIESMARS

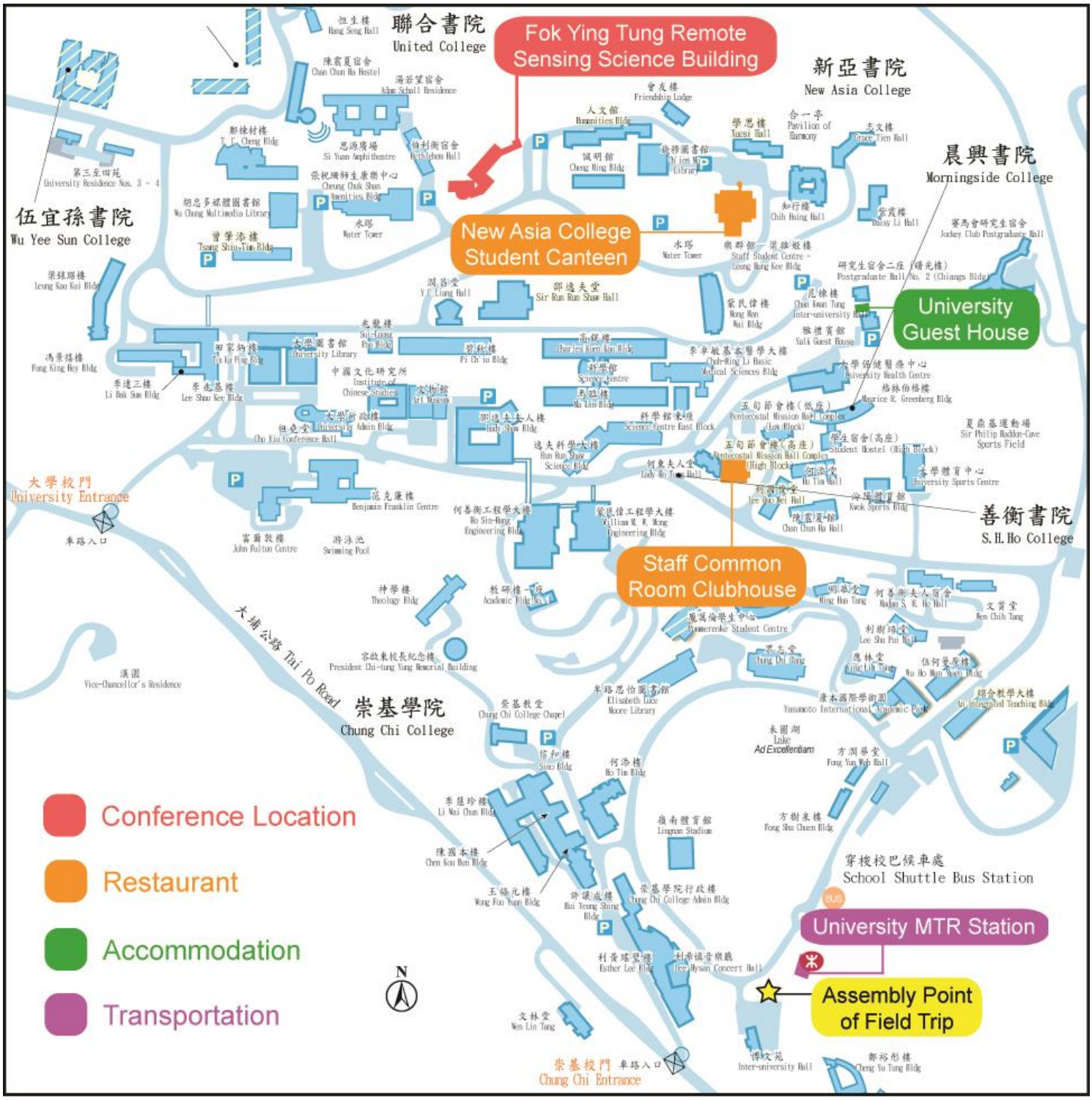
VGEKL

Supporting Organization:

CUHK Jockey Club Initiative Gaia

Location Map

The Chinese University of Hong Kong



Contents

Introduction

Geographical reasoning is an important way of thinking about the world and its inhabitants, but our abilities in spatial thinking and reasoning are still quite primitive and require extensive exploration. Geographic knowledge is the product of geographic thinking and reasoning about the world's natural and human phenomena, but it has now evolved from the phenomenological to the intellectual, from understanding "what" and "where" to "why" and "how". This is initiating a change from an emphasis on geographic form to an emphasis on geographic process.

To date, geographic modelling and simulation is now regarded as a fundamental approach to geographic process mining and complex geographic problem solving and has led to many cutting-edge geographical analysis tools, such as those involving in working with Virtual Geographic Environments (VGEs). VGEs offer a new generation of geographic analysis tool based on new types of web- and computer- based geographic environments which are built for understanding geographic processes and problem solving. Besides new kinds of databases and new forms of 'big' data, other core geo-process models have demonstrated the increasing importance of building of VGEs, with model sharing and model integration as its key issues.

To bridge the gap between model building and the design of geographic analysis tools, this conference aims at providing facilitation and communication between experts from multidisciplinary domains so that they are able to discuss several issues about how to make full use of geo-process models for geographic knowledge discovery.

Organizers

- Institute of Space and Earth Information Science, The Chinese University of Hong Kong
- Centre for Advanced Spatial Analysis, University College London

Co-organizers

- National Center for Geographic Information and Analysis (NCGIA) at Buffalo, University at Buffalo
- State Key Lab for Resource and Environment Information Systems (LREIS), Chinese Academy of Sciences
- State Key Lab of Information Engineering in Surveying, Mapping, and Remote Sensing (LIESMARS), Wuhan University
- Key Lab of Virtual Geographic Environment (VGEKL), Ministry of Education of PRC, Nanjing Normal University
- Key Lab of Poyang Lake Wetland and Watershed Research (PYL), Ministry of Education of PRC, Jiangxi Normal University
- Spatial Information Research Centre of Fujian (SIRC), Fuzhou University

Supporting Organization

- Office of CUHK Jockey Club Initiative Gaia, Institute of Environment Energy and Sustainability, The Chinese University of Hong Kong

Committees

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Michael Batty	University College London

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Deren Li	Wuhan University

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Chin-Hong Sun	National Taiwan University
Vladimir Tikunov	Moscow State University
Paul Torrens	University of Maryland
A.A. (Alexey) Voinov	University of Twente
Jiayao Wang	Jiangxi Normal University
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Chenghu Zhou	Chinese Academy of Sciences

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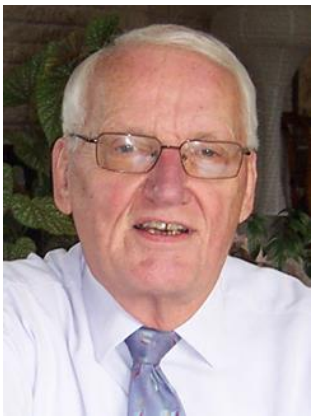
Conference Secretariat

Chloris Yip	The Chinese University of Hong Kong

Keynote Speakers

Prof. Sven Erik Jørgensen

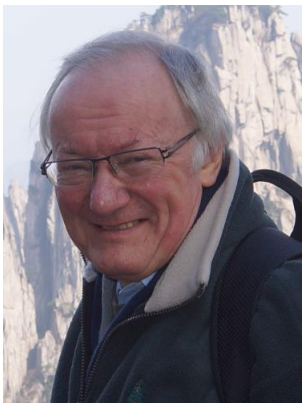


Environmental Chemistry
University of Copenhagen

First Keynote Address:
Structurally Dynamic Models – A New Promising Model Type

Second Keynote Address:
Application of Ecological Models for Assessment of Sustainability

Prof. Michael Batty



Center for Advanced Spatial Analysis (CASA)
University College London

Keynote Address:
Smart Cities and Virtual Geographic Environments

Prof. Bojie Fu

State Key Lab. of Urban and Regional Ecology,
Research Centre for Eco-Environmental Sciences,
Chinese Academy of Sciences

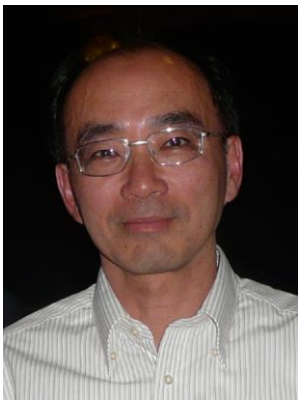
Keynote Address:
Coupling Land Use, Ecological Processes and Ecosystem Services Modelling

Prof. Jianya Gong

Chinese Academy of Science

Keynote Address:
Cloud-Based Web Service Technology for GeoSpatial Modelling and Knowledge Sharing

Prof. Huang-Hsiung Hsu



Laboratory for Climate Change Research (LCCR)
Research Center for Environmental Changes, Academia Sinica

Keynote Address:
Development and Implementation of a Global-to-Urban Climate Model Suite

Prof. A-Xing Zhu

Department of Geography
University of Wisconsin-Madison

Keynote Address:
VGE: An Environment for New Forms of Geographic Experiments

Prof. Paul M. Torrens

Center for Geospatial Information Science
University of Maryland

Keynote Address:
Slipstreaming Human Geosimulation in Virtual Geographic Environments

Mr. Mansour Raad

BigData Advocate,
Senior Software Architect, ESRI

Keynote Address:
On GeoProcessing BigData, Machine Learning and Visualization

Conference Information

Location

Conference Venue

Room 303, Fok Ying Tung Remote Sensing Science Building, CUHK

Lunches

Staff Canteen of New Asia College, CUHK

Dinners

6 Nov 2014	Serenade Chinese Restaurant, 1-2/F, Hong Kong Cultural Centre, Restaurant Block, Tsim Sha Tsui
7 Nov 2014	Staff Common Room Clubhouse, University Guest House, CUHK
8 Nov 2014	Chiuchow Garden, Shop 801B, 8/F, New Town Plaza, Phase I, Shatin

Language

The official language of presentation is English.

Smoking

Smoking is **strictly forbidden** in the whole CUHK campus.

Mobile Phone

As a courtesy to other participants and presenters, please ensure that all mobile device(s) is/are turned off or is/are in “SILENT” mode during the sessions.

Secretariat

Chloris Yip
Institute of Space and Earth Information Science
Fok Ying Tung Remote Sensing Science Building,
The Chinese University of Hong Kong, Shatin, Hong Kong
Tel: (852) 3943 6538
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Shuttle Bus

Shuttle bus service will be provided with the following schedules:

6 November 2014 (Thursday)			
From	**To**	**Departure Time***	**Assembly Point**
Royal Park Hotel	Fok Ying Tung Remote Sensing Science Building	8:25am	Main Lobby of Royal Park Hotel
University Guest House	Fok Ying Tung Remote Sensing Science Building	8:40am	Outside Chan Kwan Tung Building
Fok Ying Tung Remote Sensing Science Building	Serenade Chinese Restaurant	5 minutes after the end of programme	Reception of Fok Ying Tung Remote Sensing Science Building
Tsim Sha Tsui	Royal Park Hotel and University Guest House	8:30pm	Near Salisbury Garden

7 November 2014 (Friday)			
From	**To**	**Departure Time***	**Assembly Point**
Royal Park Hotel	Fok Ying Tung Remote Sensing Science Building	9:00am	Main Lobby of Royal Park Hotel
University Guest House	Fok Ying Tung Remote Sensing Science Building	9:10am	Outside Chan Kwan Tung Building
Fok Ying Tung Remote Sensing Science Building	Staff Common Room Clubhouse	5 minutes after the end of programme	Reception of Fok Ying Tung Remote Sensing Science Building
Staff Common Room Clubhouse	Royal Park Hotel	5 minutes after the dinner	Outside Staff Common Room Clubhouse

8 November 2014 (Saturday)			
From	**To**	**Departure Time***	**Assembly Point**
Royal Park Hotel	Fok Ying Tung Remote Sensing Science Building	9:00am	Main Lobby of Royal Park Hotel
University Guest House	Fok Ying Tung Remote Sensing Science Building	9:10am	Outside Chan Kwan Tung Building
Fok Ying Tung Remote Sensing Science Building	Chiuchow Garden	5 minutes after the end of programme	Reception of Fok Ying Tung Remote Sensing Science Building
New Town Plaza, Shatin	University Guest House	5 minutes after the dinner	New Town Plaza, Shatin
9 November 2014 (Sunday)			
From	**To**	**Departure Time***	**Assembly Point**
Royal Park Hotel	Entrance Piazza, CUHK (Near CUHK School Bus Stop No. 2)	8:30am	Main Lobby of Royal Park Hotel
Ma Liu Shui Ferry Pier	Royal Park Hotel	4:30pm	Ma Liu Shui Ferry Pier

The shuttle bus will depart punctually. Please arrive the assembly point 5 minutes before the departure time

Programme

5 Nov 2014 (Wednesday)	
Venue: Room 303, Fok Ying Tung Remote Sensing Science Building, CUHK	
09:00 - 12:30	**Preconference Workshop:** **Hands-on Workshop on Spatial BigData with Hadoop** *Mr. Mansour Raad* *BigData Advocate, Senior Software Architect, ESRI*
12:30 - 13:30	**Visit of Jockey Club Museum of Climate Change** *(Address: 8/F, Yasumoto International Academic Park, CUHK)*

6 Nov 2014 (Thursday)	
Venue: Room 303, Fok Ying Tung Remote Sensing Science Building, CUHK	
Opening Ceremony ***(chaired by Prof. Hui Lin)***	
09:00 - 09:20	**Welcome Remarks** *Prof. Tung Fung - Associate Vice-President, The Chinese University of Hong Kong* **Welcome Remarks** *Prof. John P. Wilson - USC University of Southern California*
09:20 - 10:10	Keynote Address **Structurally Dynamic Models – A New Promising Model Type** *Prof. Sven Erik Jørgensen - Environmental Chemistry, University of Copenhagen*
10:10 - 10:40	Group Photo Taking and Tea Break
Keynote Addresses (1) ***(chaired by Prof. Milan Konecny)***	
10:40 - 11:30	Keynote Address **Smart Cities and Virtual Geographic Environments** *Prof. Michael Batty - Center for Advanced Spatial Analysis (CASA)* *University College London*
11:30 - 12:20	Keynote Address **Development and Implementation of a Global-to-Urban Climate Model Suite** *Prof. Huang-Hsiung Hsu - Laboratory for Climate Change Research (LCCR), Research Center for Environmental Changes, Academia Sinica*
12:20 - 14:00	Lunch *(Venue: Staff Canteen of New Asia College, CUHK)*

Session 1: Geo-process Modelling and Applications (1) ***(chaired by Prof. Alexey Voinov)***	
14:00 - 14:20	**Modeling of Cross-country Transport in Raster** *Prof. Marian Rybansky - Military Geography and Meteorology, University of Defence in Brno*
14:20- 14:40	**RCEIS – A German-Chinese Initiative for a Research Centre for Environmental Information Science** *Dr. Cui Chen- Department Environmental Informatics (ENVINF), Helmholtz Centre for Environmental Research – UFZ*
14:40 - 15:00	**Research on Adaptive Tide Numerical Simulation based on Steering Dynamic Monitoring** *Prof. Fei Guo - Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University*
15:00 - 15:20	**A Review on HASM** *Mr. Mingwei Zhao - Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences*
15:20 - 15:40	Tea Break
Session 2: Geo-process Modelling and Applications (2) ***(chaired by Prof. Marian Rybansky)***	
15:40 - 16:00	**A Multi-scale Spatio-temporal Modelling Approach to Exploring Vegetation Dynamics** *Dr. Bingwen Qiu - Spatial Information Research Centre of Fujian, Fuzhou University*
16:00 - 16:20	**Modeling and Simulation of Crowd Evacuation in Multi-floor Buildings** *Dr. Wenhang Li - Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences*
16:20 - 16:40	**Continuum Crowd Simulation with Large Amounts of Groups** *Dr. Qishen Duan - Institute of Remote Sensing and Digital Earth, Chinese Academy of Science*
16:40 - 17:00	**Simulation of Actual Terrain Ocean Tide in the Bays with SPH** *Dr. Tao Wang - Guangzhou Institute of Geography*
Panel Discussion ***(chaired by Prof. Sven Erik Jørgensen)***	
17:00 - 18:00	**What is the Ongoing Development in Geographic Process Modeling?**
	Dinner *(Address: Serenade Chinese Restaurant, 1-2/F, Hong Kong Cultural Centre, Restaurant Block, Tsim Sha Tsui, HK)*

7 Nov 2014 (Friday)	
Keynote Addresses (2) ***(chaired by Prof. Qing Zhu)***	
Venue: Room 303, Fok Ying Tung Remote Sensing Science Building, CUHK	
09:30 - 10:20	Keynote Address **Coupling Land Use, Ecological Processes and Ecosystem Services Modelling** *Prof. Bojie Fu - State key Lab. of Urban and Regional Ecology, Research Centre for Eco-Environmental Sciences, Chinese Academy of Sciences*
10:20 - 10:40	Tea Break
10:40 - 11:30	Keynote Address **Slipstreaming Human Geosimulation in Virtual Geographic Environments** *Prof. Paul M. Torrens - Center for Geospatial Information Science, University of Maryland*
11:30 - 12:20	Keynote Address **VGE: An Environment for New Forms of Geographic Experiments** *Prof. A-Xing Zhu - Department of Geography, University of Wisconsin-Madison*
12:20 - 14:00	Lunch *(Venue: Staff Canteen of New Asia College, CUHK)*
Session 3: Model Integration and Related Technologies ***(chaired by Prof. Guoan Tang)***	
14:00 - 14:20	**Exploring Climate Mitigation and Low-carbon Transitions: New Challenges for Model Integration** *Prof. Alexey Voinov - Faculty of Geo-Information Science and Earth Observation, University of Twente*
14:20 - 14:40	**Analysis and Method of Description on Geographical Model Data Format** *Dr. Di Hu - Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University*
14:40 - 15:00	**A Spatial-Temporal Framework in Hydrological Models** *Prof. Xiaoxiang Zhang - Institute of Geographical Information Science & Engineering, Hohai University*
15:00 - 15:20	**A Data Description and Interchange Method for the Reusing, Sharing and Integration of Geo-Analysis Models** *Mr. Songshan Yue - Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University*
15:20 - 15:40	Tea Break

Session 4: Virtual Geographic Environment and Visualization (1) *(chaired by Prof. Xiaoxiang Zhang)*	
15:40- 16:00	**Urban-scale 3D Solar Radiation Modeling and Web-based Data Sharing in VGEs** *Mr. Jianming Liang - Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences*
16:00 - 16:20	**A Virtual Geographic Environment System with Adjustable Emission Inventory for Air Quality Management in the PRD, China** *Dr. Chunxiao Zhang – Institute of Space and Earth Information Science, The Chinese University of Hong Kong*
16:20 - 16:40	**A Method for Generalising Terrain Sketch Based on Visual Conditions** *Mr. Kejian Qian - Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University*
16:40 - 17:00	**Pre-Quaternary Underlying Terrain Virtualization and Reconstruction of Ordos Platform in the Loess Plateau of China using Geologic Information and its Implementation in the Landscape Evolution Modelling** *Mr. Liyang Xiong - Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University*
Panel Discussion ***(chaired by Prof. Michael Batty)***	
17:00 - 18:00	**What Virtual World Can Contribute to Scientific Simulation?**
	Dinner *(Address: Staff Common Room Clubhouse, University Guest House, CUHK)*

8 Nov 2014 (Saturday)	
Keynote Addresses (3) ***(chaired by Prof. Michihiko Shinozaki)***	
Venue: Room 303, Fok Ying Tung Remote Sensing Science Building, CUHK	
09:30 - 10:20	Keynote Address **Application of Ecological Models for Assessment of Sustainability** *Prof. Sven Erik Jørgensen - Environmental Chemistry, University of Copenhagen*
10:20 - 10:40	Tea Break
10:40 - 11:30	Keynote Address **Cloud-Based Web Service Technology for GeoSpatial Modelling and Knowledge Sharing** *Prof. Jianya Gong - State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University*
11:30 - 12:20	Keynote Address **On GeoProcessing BigData, Machine Learning and Visualization** *Mr. Mansour Raad - ESRI*
12:20 - 14:00	Lunch *(Venue: Staff Canteen of New Asia College, CUHK)*
Session 5: Virtual Geographic Environment and Visualization (2) ***(chaired by Prof. Paul Torrens)***	
14:00 - 14:20	**A Prototype 3D Spatialisation for Time Management in a Virtual Environment** *Dr. Antoni Moore - School of Surveying, University of Otago*
14:20 - 14:40	**Multi-sourced Heterogeneous Data Seamless-Integration in 3D** *Mr. Mingwei Liu - Faculty of Geosciences and Environmental Engineering, Southwest Jiaotong University*
14:40 - 15:00	**Network Simulation and Visual Analysis of Dam-break Flood Spatio-temporal Process** *Ms. Ling-zhi Yin - Faculty of Geosciences and Environmental Engineering, Southwest Jiaotong University*
15:00 - 15:20	**Towards Live Virtual Geographic Environment** *Dr. Weitao Che - Institute of Space and Earth Information Science, The Chinese University of Hong Kong*
15:20 - 15:40	Tea Break

Session 6: Development of VGEs and its Usage *(chaired by Prof. Jianhua Gong)*	
15:40- 16:00	**CHIA: A Virtual Historical Geographic Environment** *Dr. Kai Cao, Department of Geography, National University of Singapore*
16:00 - 16:20	**3D Stand-level Growth Simulation for Chinese fir Plantations** *Dr. Liyu Tang - Spatial Information Research Centre of Fujian, Fuzhou University*
16:20 - 16:40	**Redis based SVG Spatial Visualization Database** *Mr. Jian Jiao - School of Computer Science, South China Normal University*
Panel Discussion *(chaired by Prof. Hui Lin)*	
16:40 - 18:00	**Bridge Geo-process Modelling and Virtual World for Naturally Research**
	Dinner *(Address: Chiuchow Garden, Shop 801B, 8/F, New Town Plaza, Phase I, Shatin, HK)*

9 Nov 2014 (Sunday)	
Field Trip to Crooked Island and Tung Ping Chau	
9:00	Assembly near CUHK School Bus Stop No. 2
9:30	Departure from Ma Liu Shui Ferry Pier to Crooked Island
10:30 - 11:30	Field Study at Crooked Island
11:30 - 12:30	Lunch at Crooked Island
12:30	Departure from Crooked Island to Tung Ping Chau
13:30 - 15:00	Field Study at Tung Ping Chau
15:00	Departure from Tung Ping Chau to Ma Liu Shui Ferry Pier
16:30	Dismiss at Ma Liu Shui Ferry Pier

Note to Field Trip:

- The dressing code is sportswear
  請穿著運動便服及運動鞋
- Please bring water, sun protection lotion, umbrella and medicine for sea sickness if necessary
  如有需要，請自備水、外套、防曬用品、雨傘及暈浪丸以備不時之需。
- If black rainstorm signal or typhoon signal no. 3 or above is hoisting 2 hours before assembly time on 9 November 2014, the field trip will be cancelled. Notice will be posted at the conference website (http://www.iseis.cuhk.edu.hk/GPMinVGE/). For HK weather news, please visit the website of Hong Kong Observatory (http://www.hko.gov.hk/)
  出發當天，集合時間 2 小時前，如天文台懸掛黑色暴雨警告或 3 號風球或以上，考察將會取消，通告會刊登於會議網頁(http://www.iseis.cuhk.edu.hk/GPMinVGE/)。
  天氣詳情可參閱香港天文台網頁(http://www.hko.gov.hk/)

Background Information of Tung Ping Chau

Ping Chau, or Tung Ping Chau to differentiate from Peng Chau, sits in Mirs Bay of the northeastern waters. It is the easternmost outlying island of Hong Kong. This crescent-shaped island, measuring 600 metres long and 200 metres wide, is renowned for strange rock formations. Unlike most other rock types across the territory, the island is made up of sedimentary rock including siltstone, dolomitic siltstone, mudstone and chert. This sedimentary rock strata is known as Ping Chau Formation. Many extremely well preserved fossils have been found within the formation. Fossil studies, investigations of rock properties and regional geophysics, as well as research in climatic changes during ancient times have confirmed that this formation is the product of sedimentation which took place in Early Tertiary. Layer upon layer of rock form a bewildering structure. The strata looks just like a huge book, guarding great mysteries of geological history within its numerous pages. Since no sediments after Early Tertiary have successfully solidified into enduring rock, Ping Chau Formation is the youngest rock in Hong Kong's geological history. Tung Ping Chau is a popular holiday destination. Its many fascinating attractions, such as wave erosion landscape, the shale that resembles a layered sponge cake and the unusually flat lay of the island itself, have drawn thousands of visitors to the island.

Source: Hong Kong Global Geopark of China

Background Information of Crooked Island

Crooked Island is an island of Hong Kong located in the north-east of the territory. Administratively, it is part of North District.

Crooked Island is located in the west of Mirs Bay. With an area of 2.35 km², it is the largest island in North District, the second largest being Wong Wan Chau (Double Island). Neighbouring islands include: Ap Chau, Ngo Mei Chau (Crescent Island), Pak Sha Chau (Round Island), Wong Wan Chau. The village of Tung O is located on its northwest coast. Its highest point is Kai Kung Leng, 122 m above sea level.

Source: Wikipedia

Abstracts

Opening Keynote Address

Structurally Dynamic Models – A New Promising Model Type

Sven Erik Jørgensen

Environmental Chemistry, University of Copenhagen

Abstract: If we follow the generally applied modeling procedure presented in most textbooks on ecological modeling, we will develop a model that describes the processes in the focal ecosystem, but the parameters will represent the properties of the state variables as they are in the ecosystem during the examination period. They are not necessarily valid for another period because we know that an ecosystem can regulate, modify, and change them, if needed as response to changes in the existing conditions, determined by the forcing functions and the interrelations between the state variables. Our present models have rigid structures and a fixed set of parameters meaning that no changes or replacements of the components are possible. We need, however, to introduce parameters (properties) that can change according to variable forcing functions and general conditions.

The model type that can account for the change in species composition as well as for the ability of the species, i.e., the biological components of our models, to change their properties, i.e., to adapt to the existing conditions imposed on the species, is denoted structurally dynamic model, to underline that they are able to capture structural changes. They also may be called the next or fifth generation of ecological models to notify that they are radically different from previous modeling approaches and can do more, namely describe adaptation and shifts in species composition.

Structurally dynamic models can be developed by two methods:

1) Use of expert knowledge, where the knowledge about which species and which properties are present under which conditions, is used to shift the parameter values (it means the properties of the dominant species
2) Use of a goal function which is able to express the survival of the fittest. It means to use a mathematical expression to find which properties (parameters) that are best able to give survival of the biological state variables under the prevailing conditions. The state variables (components) try to optimize continuously the ability of the system to move away from thermodynamic equilibrium according to thermodynamics of ecosystems. The state variables can change by adaptation or by change of the species composition. There are always several species waiting in the wing ready to take over, if they are better survivors. The idea is therefore to test if a change of the most crucial parameters would be able to move the system more away from thermodynamic equilibrium, and if that is the case, to use that set of parameters, because it expresses the adaptation and the shifts in species composition that take place.

Both methods have been applied and examples will be presented. The second method has been used most widely and here has the work energy of the ecosystem or rather the work energy calculated for the model of the ecosystem been the most applied goal function. How to use this method in practical modeling? will be presented and several examples will illustrate the advantages of using this method for the development of structurally dynamic models. An overview of the application of structurally dynamic models will be given and it will be discussed how this promising method can be used to model the consequences of climate changes.

Keynote Addresses (1)

Smart Cities and Virtual Geographic Environments

Michael Batty

Center for Advanced Spatial Analysis (CASA), University College London

Abstract: This lecture will outline the rapid development of new tools for visualising cities and their functions with an emphasis on how they can be used in the analytical phases of urban design. It will embed these new developments in geo-visualisation within the development of tools for extracting new data – big and open data for example, with new forms of analytics that are being fashioned to study and plan for the development of smart cities where a focus on short term change is to the fore. We begin with the most obvious examples of digital visualisation – 2D and 3D maps – from geographic information systems (GIS) and computer-aided design (CAD) technologies. These merge into augmented and virtual realities and imply that much of what has been developed for desktop applications is now shifting to the web. We then examine networks, noting the early development of space syntax but then moving to flow systems of various kinds that record interaction between the elements of a design. We look at models of flows, specifically traffic and pedestrian movement and then consider how new social media produced in real time is being used to inform small-scale interactions at the level of spatial and social networks. Scientific visualisation is also affecting design in that more abstract infographics are being used to display and visualise the complexity of design, and to this end, we show various new forms of network and connectivity. Finally we note how real time data is being delivered to designers using various forms of dashboard which summarise how cities are performing and we conclude by suggesting that these new kinds of visualisation are beginning to enrich the field of urban design by innovative display of ideas and their access through online participation.

Development and Implementation of a Global-to-Urban Climate Model Suite

Huang-Hsiung Hsu

Laboratory for Climate Change Research (LCCR), Research Center for Environmental Changes, Academia Sinica

Abstract: In order to establish the capacity and capability in producing climate change information in local scale, a model suite consisting of an Earth System model (ESM), a high-resolution atmospheric general circulation mode (hi-AGCM), a regional climate model (RCM) and an urban canopy model (UCM) is being developed and implemented in Taiwan. The NCAR-CEASM1 is adopted and is being modified by changing several parameterization schemes (e.g., convection, cloud, aerosol, etc.), land model, surface radiation calculation, etc. Collaboration between LCCR and GFDL allows us to use HiRAM (High-Resolution Atmospheric Model) for time-slice experiments to project future global climate change in 20 km and even higher spatial resolution. There is also a joint effort to further improve HiRAM simulation. Climate change data simulated in the time-slice experiments are further used to simulate climate information at regional (5km) and urban scales based on the NCAR/WRF and an improved UCM. The data produced by this suite are being and will be provided to Taiwanese research community and government agencies for climate impact assessment and adaptation studies in local scale.

Session 1：Geo-process Modelling and Applications (1)

Modeling of Cross-country Transport in Raster

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Abstract: The content of this paper refer to the modeling of the off-road vehicles movement across natural terrain in raster format. Analyzed are the common influences of relief slopes, micro relief forms, soils, vegetation, hydrology, built-up areas, meteorological factors, etc. on the vehicle speed deceleration. To determine the impact of different geographical factors on the vehicle movement some field tests and laboratory analyzes were provided using military and rescue cars. The modeling principle of cross-country vehicle movement in raster format was based on this procedure: each geographical factor "F" located at given elementary terrain area and affecting vehicle speed has its own value of deceleration coefficient Ci. The value of this coefficient expresses the fact of how many times (or percent) a certain factor will decelerate a vehicle. The final vehicle deceleration was calculated using synthesis of the correspondent raster cells in an elementary terrain area in which the geographical factors' influences on vehicle speed were constant. For the Cross-Country Movement database and map construction the ESRI SW was used. This database, which has been developed for some selected vehicles by the Military Geographical Service of the Czech Army Forces, should serve as the military geographical support tool during the military and civil operations to improve vehicle navigation.
Keywords: terrain, geographic factor, military vehicle, transport, Cross-Country Mobility, military map, vehicle navigation

RCEIS – A German-Chinese Initiative for a Research Centre for Environmental Information Science

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Abstract: Rapid economic development and population growth in China go hand-in-hand with increasing urbanisation, involving growing mega-cities, industrialization, and intensified agriculture. As a result, natural resources are increasingly stressed and productive management strategies towards sustainable planning are urgently needed. Pollution containing hazardous substances for environmental and human health, depletion of water resources as a result of overexploitation, soil degradation and air pollution in many mega-cities of China are increasing at an alarming rate.
Consequently, the protection of aquatic ecosystems and the security of drinking water provision are becoming an increasing challenge in water management. The Chinese government recognizes the importance and complexity of the situation and has initiated a program entitled “Major Water Program of Science and Technology for Water Pollution and Governance” (2006-2020). While shortages resulting from regional resource depletion have led to plans for large-scale water transport from distant water-rich areas of China (e.g. South-to-North Water Diversion Project), the water quality problems in other areas require efficient, flexible, and site-specific solutions and overall management concepts.

An essential prerequisite for mitigating and solving the above described environmental problems is the availability of information about the current environmental situation. Therefore, the establishment of long-term terrestrial Earth observatories in China similar to TERENO and ACROSS in Germany is important to create required monitoring platforms for collecting data. The “Helmholtz-CAS Research Centre for Environmental Information Science” will go one significant step further by combining monitoring and modelling platforms through information systems to provide information in a comprehensive way and to develop management scenarios which can be used for planning and decision-making tools needed by the responsible authorities.

For demonstration of the RCEIS concept we present ongoing activities and proposals concerning the development of comprehensive Environmental Information Systems in the following regions:

- Liaohe-Songhuajiang River Basin in North-East China,
- Chaohu Lake and
- Poyang Lake in the Yangtze River Basin.

Research on Adaptive Tide Numerical Simulation based on Steering Dynamic Monitoring

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Abstract: In recent years, a lot of progress has been made in the research in the integration on 3D hydrodynamic numerical simulation with GIS. However, some problems in existing research on integration are still to be improved .For example, integrated closely with the numerical model and accuracy evaluation adaptive, and numerical computation in generation of model grids and are unrealized. Traditional numerical simulation commonly uses post-processing approach as to data files, which neither involves real-time tracking and dynamic monitoring in computation process nor adjusts and intervents the operation of computation program. 3D visualization focuses on the expression data source of single level and doesn’t give fusion expression of many elements of the mechanism process and lacks dynamic process simulation of fusion expression of complex geo-spatial information integration.

In this research, the trend of the mathematical model is studied as an example. In model grid generation, we introduce an adaptive grid technology based on geographic features, build grid size control by extracting geographic features in study region, generate grids of high quality which meet the needs of geographical features and model computation accuracy. When the trend numerical model runs, we introduce steering computation technology into trend numerical simulation, build steering dynamic monitoring mechanism to realize real-time visualization and dynamic intervene of running status and internal variables of numerical models, which improves the accuracy and efficiency of trend numerical simulation. In the dynamic process simulation visualization, we study the methods of data organization and fusion expression of multi-source data (wind, wave, flow , density field, underwater topography, etc.) in mixing scene ,which can integrate geographic features into numerical computation result in visualization, and truly demonstrate the dynamic process of trend.

Case studies show that the researches in computational grid generation, dynamic monitoring of model simulation, fusion expression of model simulations data have made some progress, and can achieve dynamic process simulation excellently.

Key words: Numerical simulation; adaptive grid; Steering dynamic monitoring; Fusion expression

A Review on HASM

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Abstract: Ground observation is able to obtain highly accurate data with high temporal resolution at observation points, but these observation points are too sparsely to satisfy the application requirements at regional scale. Satellite remote-sensing can frequently supply spatially continuous information on earth surface, which is impossible from ground-based investigations, but remote sensing description is not able to directly obtain process parameters. In fact, in terms of fundamental theorem of surfaces, a surface is uniquely defined by the first fundamental coefficients, about the details of the surface observed when we stay on the surface, and the second fundamental coefficients, the change of the surface observed from outside the surface. A high accuracy and speed method (HASM) for surface modeling has been developed initiatively to find solutions for error problem and slow-speed problem of earth surface modeling since 1986. HASM takes global approximate information (e.g. remote sensing images or model simulation results) as its driving field and local accurate information (e.g. ground observation data and/or sampling data) as its optimum control constraints. Its output satisfies the iteration stopping criterion which is determined by application requirement for accuracy. This paper reviews problems to be solved in every development stage and applications of HASM.

Session 2：Geo-process Modelling and Applications (2)

A Multi-scale Spatio-temporal Modelling Approach to Exploring Vegetation Dynamics

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Abstract: Knowledge of vegetation dynamic and its response to climate change and human activities is needed for sustainable development. Despite the relatively high number of studies analyzing the relationships between climate and vegetation dynamics, a majority were conducted on one particular scale, inter-annual or the scale of the original time series datasets. An open question is how sensitive are seasonal and interannual cycles to climate variability. The intra-annual variations of climatic constraints that limit or hence favor the development of different vegetation were poorly investigated. Interactions between vegetation dynamics and climate variability must be studied at a smaller scale in order to identify properly the limiting factors to vegetation growth.

In this research, we intended to fill this gap through a multi-scale spatiotemporal modeling approach that could help to answer the following questions: (1) How interactions between climate and vegetation dynamics vary at inter-annual, seasonal and intra-seasonal scales? (2) Is the relationship between vegetation dynamics and climate factors consistent among different vegetation/land use types and altitudinal gradient? (3) If the answer of question two is no, what factor actually account for the inconsistency of the "EVI-climate" relationship? The study area is Min-Gan region, which includes Fujian province (Min for short) and Jiangxi province (Gan for short), both held the first rank for its proportion of forest cover. It is located between latitude 23o32'-30 o 04 'N and longitude 113 o34' -120o43'E, the southeast of China. This study developed a spatiotemporal modeling framework which could comprise pixel, scale and time specific heterogeneity, implemented with 16 day MODIS EVI time series datasets. Firstly, long term and intra-annual variations of vegetation dynamics, namely semi-monthly, monthly, bi-monthly, seasonal, bi-annual and inter-annual, were obtained through multi-resolution analysis based on wavelet transform. Secondly, for variation at each scale, a proper model could be developed through examining the characteristic of the EVI component and its relationship with climate variable.

In this study, for semi-monthly and monthly components, the temporal auto-regression models (AR) were applied to construct the original time series signals. For the bi-monthly and bi-annual components, the temporal auto-regression model with controlled variables (ORX) was applied to construct the original time series signals. For the seasonal component, the ordinary linear regression model was utilized. For the inter-annual component, a spatial model combined with an ARMAX or ARIMAX model were applied. In order to identify the location of hot spot of vegetation dynamics, the Mann-Kendall nonparametric test was applied to recognize significant monotonic increase/decrease in the intra-annual time series. The magnitude of the slope was assessed using the Sen's non-parametric method.

Results demonstrated that the overall model fitness for each model at each scale were above 95%. The proposed multi-scale spatiotemporal modeling framework was very efficient in characterizing vegetation dynamics. Vegetation dynamics at interannual, seasonal scales had more close relationship with temperature. Vegetation dynamics at scales lower than seasonal level (e.g. bi-monthly, monthly) were attributed to precipitation variations. Additionally, the relationship between vegetation dynamics and climate factors was also inconsistent among different vegetation/land use types and altitudinal gradient. The difference in spatiotemporal variation patterns of natural and agricultural vegetation, variation patterns of climatic factors provided answers for these inconsistencies.

Modeling and Simulation of Crowd Evacuation in Multi-floor Buildings

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Abstract: Previous researches on crowd evacuations were mainly 2-dimensional. To simulate crowd evacuations in multi-floor buildings, a projection field model was proposed, based on which all crowd behaviors and objects were projected to a referenced plane. To simulate the activities of running downwards stairs, a triple-segment-stair model was proposed. Based on the models, the emergent evacuation in a primary school in Zhejiang province, China was simulated. The virtual scenarios were realistic, and results showed that the evacuation duration was affected by the pupils' velocities and the distributions of different grades in the building.
Key words: projection field, triple-segment-stair, emergent evacuation, social force model

Continuum Crowd Simulation with Large Amounts of Groups

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Abstract: This paper presents a new approach for crowd simulation based on the continuum model. The continuum model which inspired by fluid dynamics calculates the potential function for a group once, and it then derives optimal paths of all the members of the group simultaneously. It is efficient for the simulation of large dense crowds while the amount of groups of the crowds is limited and the destinations need to be externally assigned for each group. Compared to the original method, our approach employs a new treatment that breaks the simulation area into small pieces with exits and entries, it then reforms a structure based on their topological relationships. The structure can be regarded as a directed graph with all the exits/entries are the nodes and the areas between them are specified to be the edges. The individuals walk inside an area until reaching the exit/entry and entering another area. During it their paths are generated by the continuum model. The weight of each edge is also assigned by the continuum model. The individuals' global paths deciding which exit/entry they choose are assigned by the A-Star path finding algorithm performing on the structure. With this treatment we manage to present more amounts of global groups than used to as the overall amounts of groups become a multiplication of the numbers of groups from the small areas. Thanks to the new structure we can make more differences between simulated individuals and integrates some ideas of the agent based model with the continuum model. Our solution adopts the discreet choice model to make more heterogeneous crowd behaviors. The discreet choice model which has been widely studied in econometrics is proved to be a useful model for the destination selection of each individual during the research on integrating it with the agent based simulation models. Different scenarios are designed with the discreet choice formulation to represent the real-world behaviors of the crowds. This new approach is implemented with a GPU-based technique to accelerating its calculation. The experiment results demonstrate that our solution is capable to represent large amounts of groups of the simulation crowds, while relieving the tedious work of assigning the destination for each group.

Simulation of Actual Terrain Ocean Tide in the Bays with SPH

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Guangzhou Institute of Geography

Abstract: The real-time simulation of large-scale fluid scenes with complex boundary is of great value in both research and application.

Water when relatively still has a well-defined surface; however, water changes its shape as it moves. In the case of ocean waves, features on the water's surface move, but the water itself does not travel. The simple surface topology can become arbitrarily complex when the water becomes turbulent. Splashing, foaming, and breaking waves are complex processes best modeled by particle systems and volumetric techniques, but these techniques are inefficient in nonturbulent situations. Ocean tide in different bays can experience rotary tidal currents or other situation.

We choose the physical-based SPH (smoothed particle hydrodynamics) fluid simulation method. SPH method belongs to particle method which is has no grid. The advantages of SPH are as follows: simulating liquid convection by particles directly to eliminate numerical fluctuation at free interface; grids unnecessary avoid grid distortion and reconstruction; simulating the fluid problem of significant transformation, especially in dealing the problems such as maximum distortion, the interface of motion material, the deformation boundary and free surface flow.

Application of rapid neighboring particle search method, set the number of Department of Physics, as well as the presentation and rendering of fluid material, and finally use the Lagrangian method SPH system initialization and calculate the fluid density, pressure, internal forces and external forces, define the time integration and collision handling.

To avoid collision detection, ROAM (Real-time optimally adapting mesh) is used to process the actual terrain data.

With the analysis of physical-based ocean tide simulation, we can create the animation of the environment, and predict damage of ocean tide.

Keynote Addresses (2)

Coupling Land Use, Ecological Processes and Ecosystem Services Modelling

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Abstract: Ecosystem Services are the benefits people obtain from ecosystems. They are affected by land use change. The ecosystem services of 60% are degradation in the world. The one of major challenges facing the world's people are meeting the needs of people today and in the future, and sustaining atmosphere, water, soil and biological products which provided by ecosystems. This paper is linkage land use, ecological processes and ecosystem services, including biogeochemical cycling, water regulation, soil conservation and food production. The Loess plateau of China, an area suffered from severe soil erosion in the world was taken as the study area. Several methods including the Universal Soil Loss Equation (USLE), hydrological modeling and multivariate analysis were used. The changes of ecosystem services were assessed and trade off were analysed. The changes in four key ecosystem services including water regulation, soil conservation, carbon sequestration, and grain production are assessed due to the Chinese government's implementation of the Grain to Green Program (GTGP). We found that significant conversions of farmland to woodland and grassland have resulted in enhanced soil conservation and carbon sequestration. However the water yield of region is decrease and the climate becoming warmer and drier. The total grain production increased in spite of a significant decline in farmland acreage, resulting in improved overall socioeconomic conditions in the region. These seemingly contradictory relations have been attributed to the strong socioeconomic incentives embedded in the ecological rehabilitation policy. Although some positive results of the policy have been achieved over the last decade, large uncertainty remains regarding long-term policy effects on the sustainability of ecological rehabilitation performance and ecosystem service enhancement. To reduce such uncertainty, an adaptive management approach to regional ecological rehabilitation policy should be adopted, with a focus on the dynamic interactions between people and their environments in a changing world. Our study also calls for paradigm shifts for restoration ecology and ecosystem service science.

Slipstreaming Human Geosimulation in Virtual Geographic Environments

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Abstract: Virtual geographic environments (VGEs) have long enjoyed significant synergy with geosimulation as a visual medium for model results, but more could be done to fashion two-way harmony between them, with the potential benefit that geosimulation could usefully serve as a process engine for VGEs and as a unifying scaffold for connecting VGEs to other systems. In this paper, I argue for three potential synergies between geosimulation and VGEs. First, geosimulation could be relied upon in introducing synthetic human characters in VGEs to augment the significant physical detail that VGEs currently provide with ambient behavioral processes. Second, building blocks of geosimulation, based around polyspatial automata, could help to resolve long-standing requirements for common data and process models for VGEs.
Finally, slipstreaming of geographic information across geosimulation and VGE scaffolds could be useful in reconciling diverse and many-model processes, with disparate form and scales, in a cohesive pipeline.
Together, these three variations can facilitate the exchange of diverse model objects, processes, and information between geosimulation and VGEs, greatly expanding their interoperability and explorative reach. I demonstrate the usefulness of these developments with example scenarios that focus on urban mobilities, urban complexity, and urban failures in both ordinary and extraordinary scenarios. Applications to urban phenomena, in particular, may have particular value as we approach new vantages on cities supported by big data, big awareness, and immersive media that greatly expand the volume, breadth, and depth of questioning that our VGEs may be called on to support.

VGE: An Environment for New Forms of Geographic Experiments

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Abstract: Geographic experiments are one of the most important forms, if not the most important form, of geographic knowledge discovery. Discovery of geographic knowledge can be categorized into three major phases: the spatial expansion phase, the description phase, and the quantification phase. The geographic experiments used for the spatial expansion was journeys on the land and sailing over the ocean, such as the journeys of Christopher Columbus. Clearly these “journeys” were not blinded conducted, but rather in the form of “hypothesis testing”. The experiments used for the descriptive phase was surveys which were used to record the geographic characteristics of an area, and to understand the general geographic processes to create these characteristics. The experiments used for the quantification phase are much more focused on the specific geographic processes in our efforts to quantify the processes. Examples of these experiments are many such as in-situ or in house physical models and its numeric models. What is the next phase? This paper argues that the next phase of geographic knowledge discovery is interactive phase in which humankind is trying to predictively see what the consequence of its action on the environments. This interaction includes two parts: interaction with the environment and interaction among different scientific disciplines and stakeholders. For this a new form of geographic experiment is needed, that is virtual geographic environment!

Session 3：Model Integration and Related Technologies

Exploring Climate Mitigation and Low-carbon Transitions: New Challenges for Model Integration

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Abstract: Energy is a major driver of change and an important 'currency' that runs economic and social systems and influences environmental systems. Being so used to the abundant and uninterrupted supply of fossil energy, we tend to forget the important role that it plays in our everyday lives. Future transitions and climate induced changes are unlikely to be smooth and require new modeling paradigms and methods that can handle step-change dynamics and work across a wide range of spatio-temporal scales, integrating the knowledge of many stakeholder communities.

Here we are operating in a generalized 'socio-environmental model space', which includes empirical models, conceptual stakeholder models, complex computer simulations, and data sets, and which can be characterized in several dimensions, such as model complexity, spatial and temporal resolution, disciplinary coverage, bias and focus, sensitivity and uncertainty, usability and relevance. Model integration across disciplinary boundaries faces two big challenges. First we need to learn to deal with a variety of modeling paradigms and techniques, allowing different types of models to exchange information in a meaningful way (agent based models talk to systems dynamics, to computed global equilibrium models, to empirical models, etc.). Secondly, we need to provide integration techniques and tools that bring qualitative, conceptual, mental models of stakeholders together with the quantitative simulation models. Greater transparency and accessibility can be achieved through enhancing documentation and communication of model functioning and strengths and limitations of various models and approaches. This extensive model documentation following improved and enhanced meta model standards is an important first step that makes sure that models (both qualitative and conceptual) 'talk the same language'and can exchange information and knowledge at various stages of research. This also helps us create the ontology, which can be further used for computer aided semantic mediation of models. This semantic mediation should include such functionality as consistency checks (checking for units, concepts, spatio-temporal resolution, etc.). This should also help to explore the different models along the complexity continuum to understand how information from more aggregated qualitative models can be transmitted to more elaborated and detailed quantitative simulations, and vice versa. This bears the promise of insight on the complex behavior of non-linear systems where regime shifts and non-equilibrium dynamics is usually better understood with simple models, while the more complicated models are easier to parametrize with data and can take into account more detailed information about particular systems and situations.

Analysis and Method of Description on Geographical Model Data Format

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Abstract: With the development and maturity of geographic data sharing, GIS has strengthened its focus and trend on the sharing of geographical models. Domestic and foreign geographers have already created mass geographical models in terms of various research purposes. However, the differences of model design and implementation create much difficulty in model sharing and integration, and further lead to "Solitary Island of Geographical Model" obviously. The key problems are that geographical model and data are highly coupled, and various heterogeneous data formats. The paper analyzes the characteristics of the geographical model data and its format. It discusses why the traditional methods (i.e. data format transform method and standard data format method) could not fundamentally resolve the format problems of the geographical model data. So, it separates format information from data, and introduces data format description mechanism in an attempt to solve these problems. A data format description model centering on data location with a core of data type and delimiter is proposed. To overcome the poor description ability of existing data format description languages that centering on data, a new data format description language called Data Format Markup Language (DFML) is designed. The DFML describes format information (i.e. data type, structure and layout) based on XML by using markup elements. The elements are root element, import element, location element, data type element, delimiter element and group element. The paper introduces some main markup elements, syntax rules of the DFML and explains how to describe a data format in details. A case study with hydrological model data as an example is given to validate the method. Practice result shows the DFML is suitable for describing both ASCII data format and binary data format. It realizes the unique description and express of geographical model data format, and establishes the foundation for uniform interface of geographical models and description of geographical model service.

A Spatial-Temporal Framework in Hydrological Models

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Abstract: Although some spatial analysis and modeling methodology has been incorporated into GIS, the interaction between the data management tools and the physical model are often loosely integrated and non-dynamic in regard to the process-based environmental modeling, such as hydrological modeling, marine modeling, atmospheric modeling etc. Thus, Linking GIS with a spatially distributed, physically-based process model is a very important research issues.

For hydrologists and hydraulic engineers, GIS provides the ideal computing platform for data inventory, parameter estimation, mapping and visualizing results for hydrological/hydraulic modeling, thus greatly facilitating the design, calibration, and implementation of various hydrological/hydraulic models. Xinanjiang rainfall-runoff model is chose to perform hydrological simulation. Xinanjiang rainfall-runoff model is a famous conceptual rainfall-runoff model widely used in China and some other countries to perform flood forecasting and watershed management. The original Xinanjiang model consists of a runoff generating component and a runoff routing component. The basin is divided into a set of sub-areas and runoff is first transformed into discharge by a linear system calculated from the water balance component. The outflow hydrograph from each sub-area is finally routed down the channels to the main basin outlet by the Muskingum method.

The development of distributed modeling gives the opportunity to the solutions of the integration of model and GIS. This research aims at developing and outlining a strategy in which field variables are used to enable modelers to work directly with the spatial data as spatially continuous hydrological process. Distributed physical model is a novel methodology used for the space-time distribution of water, energy, vegetation, and mass flow. It has the following three procedures to model: (1) Discretising space-time, (2) Spatial data models for dynamical spatial modeling; (3) Dynamic Models Computation Strategy.

This research presents the design of a hydrological data model that can support the integration of GIS and hydrologic model. Hydrologic models are simplified, conceptual representations of a part of the hydrologic cycle. The conceptualization and characterization of this integration strategy can be used with other physically distributed models and can be extended to water resource management. The object-oriented strategy clarifies the relationships between classes and provides a base for the unified management of data and model. Such a software design strategy will provide standardized static and dynamic structure of classes, their operations, and activity in the larger software framework. The spatio-temporal process modeling based on generalized data model is successfully used to develop a prototype open-source, platform-independent integration spatial modeling system based on Xinanjiang Model.

A Data Description and Interchange Method for the Reusing, Sharing and Integration of Geo-Analysis Models

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Abstract: Geo-Analysis models are the abstraction of the real geographic phenomenon, and the model should reflect the pattern and discipline inside of the geographic process which is the model's research target. To solve the geo-problem, providing the properly data and driving the model execution are the two basic work for whom try to use the models. Data preparation and data processing become more and more important and essential in the model reusing, sharing and integration, in particular the rapid development of data accessing methods and increasing number of data sources, with the background of "big data".

As the different model belongs to different research field, the structure and representation of the model-data various widely, because of the different modeling methods and different research view. On the whole, to apply the model to practical application or integrate one model with other models, there are some data-problems that the model users have to get over, such as the different data format, the unfamiliar data content, and the variety time-space scale and measure method, to name a few. There are already some research results about this data-processing or data-interchange problem. The OGC group has proposed the SFS, WFS, WMS, WPS and some other standards to solve the data format conversion and transmission problem. Also, a number of institutions put forward some model-integration framework, and a unique data-define system is applied in the framework. The previous research solved this data-problem in various viewpoints and methods. But the OGC standards more focused on the data-format conversion and data transmission, the model-integration framework can only settle limited data which existed in the framework. The widely data-processing work hasn’t changed or reduced by the previous solutions when we try to integrate or share the multi-type, multi-field, multi-background models to solve a comprehensive geo-problem.

This paper focus on the data preparation and processing work in the geo-model reusing, sharing and integration, considered the data format, content and its' semantic characteristics. By taking advantage of the data description strategy, the model data would be fully described. And based on this universal data-description-model, the model-data should be processed and organized in the same information-structure. Thus, our article contains three parts: (1) the data description strategy; (2) The data processing script language; (3) The method to build a data processing library. With these parts of work, we studied the Integration of TauDEM, SAGA, MapWindow and SWAT. All of these models (tools) are open source. Also we use the data process language which has already in the data processing library, convert the output data of the integration SWAT model into the ESRI ArcGIS shapefile format and ArcGRID format data, and the result data can be visualized in the ArcMap software.

Session 4：Virtual Geographic Environment and Visualization (1)

Urban-scale 3D Solar Radiation Modeling and Web-based Data Sharing in VGEs

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Abstract: Solar radiation is the primary source of energy that drives the Earth's atmospheric, hydrological and biological processes. As carbon emissions continue to cause global concerns over climate change and pollution issues, green and renewable energy sources, including wind and solar energy, have experienced rapid growth as promising alternatives to fossil fuels. Present two-dimensional (2D) Geographic Information System (GIS)-based solar radiation models, such as the ArcGIS Solar Analyst (SA) and the GRASS GIS r.sun, are limited by their data representations and computational methods to accommodate geometric complexity-caused spatial-temporal variability at urban scale. New three-dimensional (3D) solar radiation models have been developed during the past few years using various data representations, including voxel, triangle, triangle-texture and point, etc. To interactively assess photovoltaic potential at urban scale, an appropriate 3D solar radiation model needs to be integrated into Virtual Geographic Environments (VGEs) that provides access to various georeferenced data contents, including high-resolution imagery, vectorial building footprints, street maps and other social-economic datasets. Through comparing several existing 3D solar radiation models, we found the visualization-oriented SURFSUN3D most suitable for incorporating into a VGE to support interactive solar potential assessment for urban planning and photovoltaic engineering. The SURFSUN3D transforms every 3D surfaces of urban building models into 2D raster maps to facilitate the incorporation of the GRASS GIS r.sun to perform raster-based calculations. Similar to the "texture baking" process in a Computer-Aided Design (CAD) software, the irradiation raster maps are converted into RGB-colored textures which can be remapped onto the associated 3D building models using Graphics Processing Unit (GPU)-based real-time rendering techniques. Because ray-tracing techniques are employed in the SURFSUN3D to accurately capture shading effects, the computational process can be overly slow for interactive analysis when multiple buildings are included in calculations over a large number of days. Pre-computed irradiation raster maps can save runtime computational cost, but can also compromise the flexibility in parameter adjustments. Therefore, we combined real-time computation and pre-computation in VGEs to allow users to weight computational efficiency against flexibility. To facilitate web-based sharing of urban-scale solar irradiation data, methods and procedures were developed to build and publish a database that maintains the pre-computed daily irradiation maps for a 3D city. On the client side, users can issue queries to quickly retrieve irradiation maps from the server-side database using various criteria, for instance, time period, building attributes and spatial extent, etc.

A Virtual Geographic Environment System with Adjustable Emission Inventory for Air Quality Management in the PRD, China

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Abstract: Air quality problem is attracting massive attention in Hong Kong (HK) and the Pearl River Delta (PRD), China. The complex and regional characteristics of the air quality process call for a comprehensive modelling system supporting reliable estimation inventory and effective communication for participants from multiple disciplines. In this paper, an integrated modelling system is developed to couple meteorological and air quality models with a visualised analysis to improve the cognition and management of air quality problems. Based on the 17 categories of emission inventories with detailed information about multiple pollutants in the 11 cities of the study area, such a system provides an authentic and adjustable emission inventory to draw scientific pictures for decision makers. The database management of both data and modelling parameters is another innovative advantage of this system. The preference of this design is illustrated by a case study on emission control of NO2 from vehicles in HK and the PRD; the results suggest that vehicle emission control only is expected with limited improvement of the air quality on a regional scale, and effective regional cooperation may be more important than tight emission control on a local scale to creating better air quality.

A Method for Generalising Terrain Sketch Based on Visual Conditions

Kejian Qian, Guoan Tang, Yeqing Qian, Xiaoli Huang

Key Laboratory of Virtual Geographic Environment, Ministry of Education, Nanjing Normal University

Abstract: Terrain sketch is of great artistic and scientific value and used to be generated manually by cartographers. Using computer rendering techniques and algorithms, digital terrain sketch is available to be automatically rendered in virtual geographic environments with random visual conditions instead of a specific one. However, a challenge of depicting terrain sketch in three dimensional environment is how to keep a natural generalisation process on terrain sketch, that being further away from an object results in less detailed information being observed. This paper is mainly focused on a solution to naturally generalising terrain sketch based on visual conditions instead of depicting sketch only. As terrain sketch is mainly determined by terrain surface, surface generalisation is aimed as the primary work. This paper presents a solution to generalising terrain sketch with three steps: 1) transform Digital Elevation Model into a new structure consisting of levels of lines with regard to a specific view condition; 2) generalise each line with Douglas-Peucker generator, of which domain value is a function of visual depth; 3) reconstruct a terrain surface with the left points from generalisation and render the generalised terrain sketch under the corresponding view condition. The experiment results show that this solution is encouraging to naturally generalise the terrain sketch with a good efficiency and renders an artistic virtual geographic environment. The transformed data structure depends on visual conditions instead of manually set levels. The generalisation process is quantitatively determined by visual depth, which is consistent with the natural generalisation process. Some weakness could be further studied i.e. the lack of surface consistency across neighbouring levels could be overcome with line generator constrained with some terrain features such as ridges and valleys.
Keywords: terrain sketch, generalisation, visual conditions

Pre-Quaternary Underlying Terrain Virtualization and Reconstruction of Ordos Platform in the Loess Plateau of China using Geologic Information and its Implementation in the Landscape Evolution Modelling

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Abstract: Virtual Geographic Environments (VGEs) have been paid more attention to the geographic information virtualization of the earth surface. However, the information underlying the earth surface is also the indicator of the environment of the past. Especially the pre-Quaternary underlying terrain of the Ordos platform in the Loess Plateau of China, a base level of soil erosion process and a start geologic node of loess deposition process during the landscape evolution process, which acted as the erosion base to control the development and evolution of the loess landform. In this study, on a basis of multi-source information including detail geologic information, several drillings, RS images and DEMs, we used GIS spatial analysis methods to virtualize and reconstruct a digital elevation model of a pre-quaternary paleotopographic surface in a severe soil erosion area of the Loess Plateau. Then, several indicators are used to quantitatively express the controlling effect of the underlying terrain to the modern terrain. Finally, we used the underlying terrain as the initial topography, employed a landscape evolution model to virtualize the process of the loess landscape formation process. The result shows, the usage of geologic information, together with the GIS spatial analysis method, could help the VGEs in the virtualization of the paleotopography as well as the past environment. A relatively strong landform inheritance relationship could be found according to the significant linear positive correlation between both terrains. The Quaternary loess-deposition process exhibited an apparent accumulation in the windward direction, which supported the hypothesis of an eolian origin for loess in China. With the initial topography and landscape evolution model, we virtualize the evolution process of loess landform. Our results deepen the understandings of the paleotopography and the past environment of the Ordos platform in the Loess Plateau of China, as well as boarding the theory and method in VGEs.

Keynote Addresses (3)

Application of Ecological Models for Assessment of Sustainability

Sven Erik Jørgensen

Environmental Chemistry, University of Copenhagen

Abstract: There has lately been an increased interest in sustainability assessment and models have been developed to assess the sustainability of ecosystems, a natural area for instance a landscape and of a well defined area that includes not only ecological processes but also socio-economic activities. Our experiences with sustainability assessment projects are still very limited, but from many sides it has been proposed which key variables to include in such an analysis. The use of work energy as a sustainability indicator that includes expressions of natural and socio-economic activities has been proposed and also tested with a reasonable success. The efficiency of the use of work energy in general and the amount of work energy needed to maintain the various subsystem and their capacity of work energy were included in this analyses. It is, however, clear that one indicator is insufficient to assess a sustainability of a very complex system. It has therefore been proposed to supplement the use of work energy as indicator with development of models of the most important cycles for natural and socio-economic systems, namely the cycles of carbon, nitrogen and water. Two ecological factors are in focus when it is discussed what is important to include in a sustainability analysis, namely the services offered by the ecosystems and the biodiversity, that is important for the spectrum of resistances to possible impacts on the systems. It is probably important to include these two ecological factors as direct indicators in the sustainability analysis, although they are both to a certain extent covered by the work energy analysis. Socio-economic indicators are of course also needed but it is beyond the scope of this presentation.
The result of use of models for the sustainability assessment of a Danish island, Samsø that is using renewable energy will be presented as an illustrative example. The overall conclusion of the presentation is that modeling is a very useful and powerful tool to assess the sustainability and it can strongly be recommended to use the positive experience gained up to now when sustainability analyses will be increasingly needed in the future.

Cloud-Based Web Service Technology for GeoSpatial Modelling and Knowledge Sharing

Jianya Gong

State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University

Abstract: Geospatial cyberinfrastructure has been proposed to share geospatial data in supporting advanced GIScience research and education activities in the past few years. However, the heterogeneity and distributed nature of geospatial data pose enormous obstacles for building unified and interoperable geospatial cyberinfrastructure. What is more, if we push the boundary further to online sharing of geospatial processing algorithm, geospatial modelling, geospatial knowledge, we face great more challenges. The latest advancements of computing technologies help in some way to tackle some of these challenges. This talk shares some of our experiences using cloud-based web service technology for sharing geospatial modelling and knowledge.
First, we propose a concept, Geospatial Service Web (GSW), to underpin the development of future geospatial cyberinfrastructure. GSW excels traditional spatial data infrastructure in that it goes further by providing a highly intelligent geospatial middleware that integrates various geospatial resources through the Internet based on interoperable Web services technologies. The geospatial resources include earth observation sensors, geospatial data, geospatial information and geospatial knowledge etc. Second, a prototype platform of GSW, GeoSquare, is introduced, which demonstrates the potential of how future development of GSW can help in collaborative education and scientific research. Through this platform, data, information, and knowledge can be shared and exchanged in an interoperable and online manner. The platform is supported by cloud computing technology. Finally, a brief conclusion and future research agenda are presented.
Keywords: Geospatial CyberInfrastructure, Geospatial Service Web, Cloud Computing

On GeoProcessing BigData, Machine Learning and Visualization

Mansour Raad

ESRI

Abstract: Geospatial BigData and types are special "animals" when it comes to storage, discovery and processing. This session will explore the various non-traditional ways to stream, extract, batch and visualize Geospatial and temporal Information for deeper geo-insight, such as "Where are the 3 nearest facilities to each of my customers based on current traffic conditions.nationwide ?"
A demo will be presented at the end of the session to cement these concepts.

Session 5：Virtual Geographic Environment and Visualization (2)

A Prototype 3D Spatialisation for Time Management in a Virtual Environment

Antoni Moore, Mike Bricker

School of Surveying, University of Otago

Abstract: There are many digital tools to help people deal with the multiple projects they may have to do, each possibly with multiple sub-tasks - all have to be scheduled (an example is the Gantt chart). On the other hand, spatialisation has been shown to effectively represent non-spatial phenomena (e.g. the contents of a book) in a way that is cognitively agreeable. This research aims to apply spatialisation to the temporal and task difficulty aspects of project management, in an online virtual environment.

It is proposed that, through the actions of geographic metaphors (landscape in particular), such a representation would make for a more efficient, effective and satisfying communication of project attributes, a valuable visual aid for something as intangible as time. The overall landscape view would also allow users to visualise all of their projects at once. The avatar-driven exploration that VEs can afford only adds to the potential positive cognitive involvement of the user. Also, the online VE offers opportunities for virtual project meetings in the spatialised environment.

A demonstration prototype spatialisation is presented here. A 2x2-tile VE was built in Open Simulator, with a synthetic surface forming the landscape. The surface was created by interpolation of work project point locations, with each point given a difficulty attribute (analogous to height), and their Voronoi boundaries (which are given a difficulty of zero). The points are spaced so that lengthier projects have larger Voronoi areas. In this way, unique zones are created for each project, where the surface rises from the Voronoi boundary to the centre of the area. Progress on the project is assumed to be marked from the boundary to the project finish, which is the 'summit' of the zone. There are explicit path objects in the VE to reinforce this, as well as a beacon object at the summit.

The landscape metaphor has time expressed in horizontal space as well as the vertical difficulty dimension. The combination of larger area (more time allowed) and steepness of slope (difficulty, being communicated through a metaphor of implied physical effort of travelling upslope) conveys non-geographic objects in a geographic sense.

The research is still in its early stages, though a mock-up interface to access the virtual content has been built and tested. Other issues to be addressed include representing project sub-tasks (e.g. by surface indentation), project team members (e.g. via multiple path objects within a zone) and the loss of a unified time structure for many projects (i.e. each project has its own 'time-space').

Multi-sourced Heterogeneous Data Seamless-Integration in 3D

Mingwei Liu

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Abstract: Multi-sourced heterogeneous data seamless-integration is to make integration of multi-sourced, diverse storage formats, variety scales and distinct space referenced data logically or physically, to construct the scenery for multi-dimensional visualization, dynamic phenomenon simulation in Virtual geographic environments (VGEs).However there will be some problems during the integration caused by the features of multi-sourced such as inconsistent of spatial reference, diverse storage formats, multilevel semantic information, different characteristics of spatiotemporal. In order to take advantages of the abundant semantic information and geometric information in multi-sourced data and not only ensuring for the data features but also make integration of different of spatiotemporal reference, seamless connectivity of geometry, topology , appearance and other aspects of features, it is supposed to handle following four aspects of multi-sourced data in seamless integration. They are: Grammar Level which is supposed to make all diverse storage formats no difference when it is to be accessed by one single data format structure or implement; Model Level which is to unify the geometric and topological representation between model data. Semantic Level is to make common properties and constrains of different kind of semantic information the multi-sourced data contains. And the last is to make seamless 3D space which is the level of visualization.

In this paper we discussed the Multi-sourced Heterogeneous Data Seamless-Integration in 3D Traffic GIS and select the railroad as a example. First made the basic concepts of objects and semantic enhancements categories along railway, based on which secondly use the designed center line data, cross section data and other related design parameters of railway to create the models of railway line automatically, coupled with diverse format of model data such.x,.obj,.3ds and also .fbx to construct the three-dimensional scenery along the railway. It is also presents a seamless scenery by automatically calculate the intersection of diverse models with the terrain which is formed by grid format data, and reparation of the height of terrain will be carry out by the intersection. The successful of auto construct a virtue railway with railroad, bridge and tunnel use multi-sourced model data turned the theory of this paper out to be valid.

Key Words: multi- sourced heterogeneous data; data seamless-integration; 3D traffic GIS; virtual geographic environment

Network Simulation and Visual Analysis of Dam-break Flood Spatio-temporal Process

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(1) Faculty of Geosciences and Environmental Engineering, Southwest Jiaotong University
(2) Shell China Exploration & Production Co Ltd
(3) Chinese Academy of Sciences

Abstract: At present, there are a large number of reservoirs and barrier lakes in China, which may be a risk of dam failure. Thus, the dam-break flood routing simulation and three-dimensional visualization analysis are of great significance for assistant decision-making and emergency handling. Meantime, with the popularization of Web-GIS technology, the real-time integration on the web and the visual expression of geographic spatio-temporal process simulation are also demanded by public people urgently. With the rapid development of web service, network technology and their applications in GIS, it is possible to realize the visualization analysis, sharing and manage distributed spatial data in different clients. After analyzing the latest Web-GIS technology, this paper focused on simulation and visual analysis of dam-break flood spatio-temporal process under network environment, which can be implemented by HTML5, WebGL, Ajax, Web Service technology and so on. Some key technologies including rapid computing of spatio-temporal process model, B/S network architecture construction, three-dimensional scene rendering optimization and dynamic interaction analysis were also discussed in detail. Finally, a prototype system was constructed and an experiment of network simulation and visual analysis of dam-break flood spatio-temporal process was conducted on a case study region. Experimental results showed that the methods addressed in this paper could publish spatio-temporal process information, online impact analysis and three-dimensional visualization representation under network environment, which could meet different requirements of browsing, querying and analyzing. It can efficiently support for dam-break management and emergency decision-making.

Towards Live Virtual Geographic Environment

Weitao Che, Hui Lin

Institute of Space and Earth Information Science, The Chinese University of Hong Kong

Abstract: In this paper, the emergency of integrating real-time geosensor data and VGE is illustrated. To this point, Live VGE is proposed to be a new branch of VGE study to meet the demands of the ever-changing environment to study the spatio-temporal change of the dynamic geographic environment, and to perceive and assess the quality of the environment. A framework of Live VGE is given based on the proposed concept. Four key issues are listed to support Live VGE study and construction.

Session 6： Development of VGEs and its Usage

CHIA: A Virtual Historical Geographic Environment

Kai Cao (1), Patrick Manning (2)

(1) Department of Geography, National University of Singapore
(2) Department of History, University of Pittsburgh

Abstract: The Collaborative for Historical Information and Analysis (CHIA), led by Prof. Patrick Manning, is trying to create a spatial and temporal environment to archive and analyze the consistent and documented world historical data in past hundreds of years. The primary task of this ongoing project is to work with data that are global, covering a substantial period of time, are systematic in their reporting by time and space, enable the exploration of significant interactions among variables.

3D Stand-level Growth Simulation for Chinese fir Plantations

Liyu Tang, Lingxia Wang, Chongcheng Chen, Qi Chen

National Engineering Research Centre of Geospatial Information Technology , Key Laboratory of Spatial Data Mining & Information Sharing of MOE, Fuzhou University

Abstract: To make virtual forest environment to be a potential tool for analyzing and interpreting the growth processes of trees, the dynamic growth of the forest should be focused on when we develop a virtual forest environment system. In this paper, we proposed a strategy of integrating three-dimensional forest environment and forest growth model. We have also developed a prototype of a software system. First, the increment of the mean diameter and the density at given age was predicted for even-age pure Chinese fir (Cunninghamia lanceolata) plantations using local stand growth model and density prediction model. Then Weibull distribution function was used to simulate the diameter distribution of a stand at given age and to estimate the number of trees at each diameter class. Moreover, according to the relation between the height and diameter of the trees, the height and the number of trees at each diameter class can be estimated. Based on the architectural development law of Chinese fir, the stand dynamic growth was simulated by linking the stand dynamics model for variables including height and DBH, height under branch and the number of branch whorls, and a 3D architectural model and stand spatial distribution pattern. In addition, Stand random spatial distribution pattern is used to simulate the spatial distribution of trees in forest and determine the location of each stem. And these location points are used to construct Voronoi polygons, and those which have lager area stand for the location of trees with bigger size of diameter class and height. The 3D individual architectural models were dynamically adjusted in line with predicted variables, and simulated trees were integrated with stand level for visualization. The prototype system was implemented based on VisForest, which is useful for the statistical analysis of stand structure, natural evolution of the stand and forest management. The study was designed for a given tree species, however our approach is universal and versatile, and 3D modeling and growth simulation shall be used for other species with some modification in growth models.
Keywords: Chinese fir plantations; stand-level; growth model; three-dimensional visualization; growth simulation

Redis based SVG Spatial Visualization Database

Jian Jiao, Yan Li, Yufang Deng

School of Computer Science, South China Normal University

Abstract: hen SVG documents being published on network, SVG spatial visualization database solved the problems of handling and storing huge vector data and map information. In this paper, A new solution of SVG spatial visualization database is designed by using Redis, a in-memory database with excellent concurrency and fast response. Meanwhile new granularity definitions for storing XML documents in key-value database are established. Studies have shown that the solution in this paper not only implement the basic function of publishing vector data on net such as transmission by needs, medium-granularity query and interactivity, but also fix the disadvantages of original database on concurrency and response. Experimental results shows that the new database increases the concurrency and speed of response and it handle 10000 queries with 8000 clients only in 8 second, which meets the demands of publishing vector data on network.

Designated Hotels

University Guest House
大學賓館

Chan Kwan Tung Building, The Chinese University of Hong Kong, Shatin, Hong Kong
香港沙田香港中文大學陳昆棟樓

Tel: (852) 2603-6411
Fax: (852) 2603- 5272
Website: http://www.cuhk.edu.hk/ugh/

University Guest House provides free shuttle pick up from MTR University Station (the lay-by at Exit "C") to the Guesthouse. You can make reservation by calling at 26036411. The timetable is shown as below:

From Yali Guesthouse to MTR University Station **
由雅禮賓館開出 至 港鐵大學站 **
(Circular Route 循環線)

0800	1600
0830	1700
0900	1800
0930	1830
1000	1900
1100	1930
1200	2000
1245	2030
------	2100
1330	2130
1400	2200
1500	**2245**

** Please make reservations in advance 須預訂留位

For reservations or further information, call Yali Guesthouse Reception on 2603 6411.
欲預訂客車或作相關查詢，請聯絡雅禮賓館接待處，電話為 2603 6411。

Royal Park Hotel
帝都酒店

8 Pak Hok Ting Street, Shatin, Hong Kong
香港沙田白鶴汀街八號

Tel: (852) 2601-2111
Fax: (852) 2601-3666
Website: http://www.royalpark.com.hk

Royal Park Hotel is well-connected with public transport. Guests can walk between Shatin MTR station and Royal Park Hotel:

More about Hong Kong

Area

Hong Kong can be divided into four distinct parts:
- Hong Kong Island
- Kowloon Peninsula
- New Territories
- The Outlying Islands

Map of Hong Kong

Transportation in Hong Kong

Variety of public transportations can be found in Hong Kong. MTR Subway and bus are examples of the most popular public transportations in Hong Kong.

Time Difference

GMT/UTC + 8 hours

Local Language

Hong Kong's official languages are Chinese and English. In hotels, major restaurants, stores, and tourist centers, most people speak English and Mandarin. This is not always the case, however, with taxi drivers, bus drivers, and workers in small shops, cafes, and market stalls, people just say native Cantonese.

Electricity

220 volts, 50 cycles. Three-rectangular pin plugs are the norm.

Currency & Currency Exchange

The Hong Kong dollar (HK$) is the official currency. It is pegged to the US dollar at HK$7.8 to US$1.00 and is freely convertible. Traveler's checks are honored at most banks, hotels and shops. Major credit cards are also widely accepted and ATM (ETC) facilities are widespread.

Weather

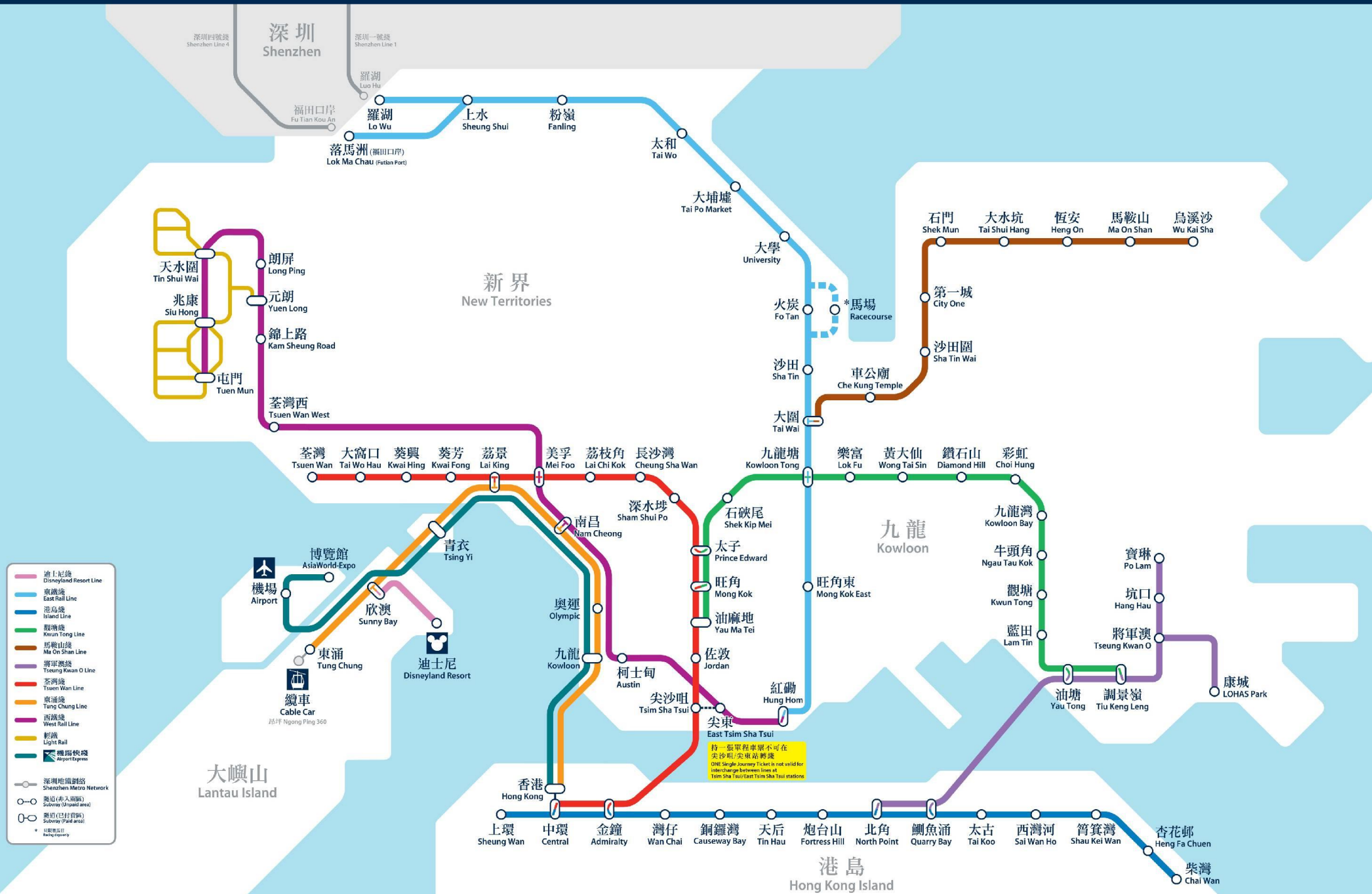
Hong Kong is sub-tropical and temperatures in November range from 68° F / 20° C to 75° F / 24° C with humidity range from 67% to 77%. A sweater or light jacket is recommended for air conditioned restaurants and hotels. An umbrella is recommended in case of rain.
The most updated information of weather can be found in the website of Hong Kong Observatory: http://www.hko.gov.hk

Useful Telephone Numbers

Emergency Telephone - Police/ Fire/ Ambulance:	(852) 999
Citizen's Easy Link:	(852) 1823
Directory Inquiries:	(852) 1083 (Chinese) (852) 1081 (English)
Dial-a-Weather Service:	(852) 1878 200
Kowloon Bus (KMB):	(852) 2745 4466
City Bus:	(852) 2873 0818
First Bus:	(852) 2136 8888
MTR Corporation Limited:	(852) 2881 8888 (852) 2947 7888
Taxi:	(852) 2383 0168 (852) 2476 2265 (852) 2457 2266 (852) 2476 4247 (852) 2475 0417 (852) 2657 2267 (852) 2450 2288 (852) 2478 8332 (852) 2332 2571 (852) 2574 7311 (852) 2760 0455 (852) 2368 1318 (852) 2362 2337
Hong Kong International Airport:	(852) 2181 8888 (Chinese) (852) 2181 0000 (English)

港鐵路綫圖 MTR system map

www.mtr.com.hk



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