

## IGU COMMISSION C00-18

### MODELING GEOGRAPHICAL SYSTEMS

#### 2012-2016 REPORT

#### **Background of the Commission**

This Commission on Modeling Geographical Systems has acted as a focus for those members of the international community who share an interest in using mathematical and statistical models in geographical systems analysis, geographical systems theory, geographical systems dynamics, geographical decision (or decision support) systems, GIS and remote sensing. This synthesis will aid and enhance research on mathematical modeling, statistical methods and other technological advances. In addition, the specific systems orientation of the Commission will enable a new emphasis to be placed on more applied outputs that have relevance to geographers engaged in evaluating a variety of policy arenas. To date, geographical systems analyses have contributed significantly to the understanding of, for example, the space economy, transportation and urban planning, global environmental change, spatial epidemiology and health care delivery. The Commission, therefore, will emphasize the following general areas of concern:

- geographical systems analysis;
- geographical systems theory;
- geographical decision support systems and decision theory;
- geographical systems dynamics;
- the interface between GIS, remote sensing and spatial modeling;
- applications of systems models to policy making and evaluation;
- geographical knowledge discovery and data mining

The promotion and publication of these ideas will be facilitated by our strong links with the editorial boards of the international journals such as: *Annals of Association of American Geographers*, *Environment and Planning A-C*, *Journal of Geographical Systems*, *International Journal of GIS*, *Papers in Regional Science*, *Geographical and Environmental Modeling*, *Canadian Geographer*, and *Sistemi Urbani, Geographical Analysis, and Geoinformatica*.

### **1. Membership**

#### **A. Membership of the Steering Committee**

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## **B. Number of Commission Members on Email by country December 2015**

Country	Numbers 2015
Australia	7
Austria	5
Belgium	4
Canada	34
China	2
Denmark	1
England/Scotland/UK	52
Finland	1
France	4
Germany	8
Greece	1
Hong Kong	7
India	0
Ireland	2
Israel	3
Italy	8
Japan	7
New Zealand	4
Nigeria	1
Norway	1
Poland	1
Russia	4
Scotland	0
South Africa	3
Spain	1
Sweden	7
Switzerland	3
Tunisia	1
The Netherlands	13
United States	73
Total	258

C. <http://www.science.mcmaster.ca/~igu-cmqs/index.html>

## **2. Meetings/Conferences Organized/Co-organized in 2012-16**

### **A. Meetings/Conferences**

**2015**

**ERSA 55<sup>th</sup> Congress World Renaissance: Changing roles for people and places, Lisbon, Portugal  
August 25-28, 2015.**

IGU-CMGS organized a special session on “Novel methodologies in spatial statistics and econometrics” in the European Regional Science Association Conference held on Aug. 25-28, 2015, Lisbon, Portugal. We attracted over 40 participants from different disciplines.

### **International Geographical Union (IGU) Regional Conference in Moscow, 17-22 August 2015**

Our Commission organized three sessions in the IGU Moscow conference, August 17-21, 2015.

Session1: Modeling Regional Growth and Technological Development.

The emphasis of this session was placed on the interrelationships between regional growth and technological development. Particular attention was given to the change of communication technology and other technologies and its impact on the economic structure, spatial production processes and regional growth. Theoretical and empirical studies were considered.

Session 2. Big Data Analytics and Spatial Decision Making.

The aim of this session was on spatio-temporal big data and their analysis. Modeling and analysis of big data, mining of big data of various spatial and temporal scales, uncertainty analysis of big data are topics of interest.

Session3. Modeling fluvial and hydrological processes

This session concentrated on the modeling of the dynamics of our fluvial and hydrological systems that exert significant impacts on our sustainable growth. Fluvial and hydrological processes and climate change in space and time was subject of discussion in this session.

The sessions were attended by over 80 participants.

### **ICSDM 2015, 2<sup>nd</sup> IEEE International Conference on Spatial Data Mining and Geographical Knowledge Services, July 8-10, Fuzhou, 2015, China.**

The conference was chaired by our IGU-CMGS Chair and hosted by the Spatial Information Research Center of Fujian at Fuzhou University, P.R. China, and co-organized with the

- Commission on Modeling Geographical Systems, International Geographical Union
- Commission on Geographical Information Science, International Geographical Union
- Commission on Quantitative Geography, the Chinese Geographical Society
- Commission on Cartography and Geographical Information System, the Chinese Geographical Society
- State Key Laboratory of Resources and Environmental Information System, CAS
- Key laboratory of Spatial Data Mining & Information Sharing, Ministry of Education of China
- College of Mathematics and Computer Science, Fuzhou University, P.R.China
- College of Environment and Resources, Fuzhou University, P.R. China

With a huge volume of spatial data coming from an increasing number of geographical sensors and satellites being made available on the web, spatial data mining (SDM) and knowledge discovery (KD) services on demand are becoming important issues in earth observation systems research ranging from data acquisition to in-depth analysis and applications. SDM&KD in geo-referenced data is expected to be an effective and efficient way to address “data rich but knowledge poor” problems in spatial analysis and geo-information science. Making use of Web services or Grid/Cloud services to enable users worldwide to access distributed databases, to perform data mining, and to obtain unraveled spatial knowledge, mining algorithms and analysis tools are thus instrumental to effective and efficient decision making. The purpose of the conference was to develop an interdisciplinary collaboration on research in such field. The conference featured a number of keynote speeches and attracted over 200 participants.

## **2014**

### **Joint International Conference on Geospatial Theory, Processing, Modelling and Applications, October 6-8, Toronto 2014.**

The Joint Conference was co-organized by IGU-CMGS, IGU-GIS and ISPRS was an effort to bring together professionals, researchers, scientists, and students from the international community of

geospatial information sciences and geomatics engineering to discuss on advances in geospatial information science, technology and practice. The conference featured keynote speeches and was attended by about 200 participants.

#### **International Geographical Union Regional Conference August 18-22 2014, Kraków, Poland 2014.**

The theme of our sessions was on the recent advances in geographical modeling and applications. About 50 participants took part in the sessions.

### **2013**

**Applied GIS and Spatial Modelling Conference 2013, Leeds, UK, 29 May – 02 June 2013.** The conference was co-organized with the IGU Commissions on Applied Geography, Dynamics of Economic Spaces, GIScience and University of Leeds. The emphasis of the conference was placed on various applications in relation to the solutions of practical problems. It was attended by about 150 participants. Interdisciplinary interaction was promoted in the conference.

**IGU Regional Conference August 4-9, 2013 in Kyoto, Japan.** Five sessions were organized during this IGU regional conference, with topics ranging from modeling geographical systems, advances and applications in geographical analysis and modeling, spatial cognition and analysis, to concepts and analysis of volunteer GIS. Theoretical and empirical results on the modeling of various geographical processes were presented in these sessions. In particular, analysis of spatial processes with voluntary geographical information was a topic that attracted attention of the participants. They were attended by about 70 participants. A steering committee meeting was also held to chart future course of action to promote the mission of the Commission.

### **2012**

#### **Accuracy 2012, July 10-13, 2012 Florianópolis, SC – Brazil**

IGU-CMGS co-organized “ACCURACY 2012” – The Tenth International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences with the International Spatial Accuracy Research Association (ISARA) in Florianópolis-SC, Brazil during July 10-13, 2012. This Accuracy Symposium brought together experts from environmental sciences, natural resources, spatial statistics, and geographic information science to develop theory and methods for assessing and understanding spatial uncertainty. The symposium has met every two years since 1994 in a variety of international locations (USA, Canada, The Netherlands, Australia, Portugal, China, and United Kingdom) and has attracted between 80 and 300 participants. The 2012 Symposia attracted over 200 participants and the programs included combinations of keynote speakers, invited paper sessions, contributed paper sessions, posters, and workshops. Symposia topics covered aggregation and generalization in spatial uncertainty assessment, design- and model-based approaches to spatial accuracy assessment, error sensitive GIS, incorporating uncertainty in spatial decision making, uncertainty in remotely sensed data and images model validation with imperfect ground truth data. Accepted papers were published in the Proceedings of the conference. This was the first time IGU-CMGS co-organized conference with ISARA, and will set the path for closer collaboration in the future.

#### **32<sup>nd</sup> International Geographical Congress, August 26-30, 2012 Cologne, Germany**

The 32<sup>nd</sup> International Geographical Congress was held in Cologne, August 26-30, 2012. IGU-CMGS organized four sessions on spatial statistics and applications, geocomputations and applications, modeling human and physical processes, and spatial data mining in this congress. A multitude of novel applications and theoretical approaches were presented in these sessions. “Spatial statistics and applications” session focused on the recent advances in the theory and applications of spatial statistics. The purpose was to stimulate discussions on the development and use of spatial statistics in solving geographical problems. “Geocomputations and applications” session placed emphasis on recent developments in geocomputation methods other than statistics. It contained four presentations with the view to encourage discussion on the formulation of novel geocomputation methods for solving

geographical problems in general and GIS/remote sensing problems in particular. "Modeling human and physical processes" dealt with the modeling of human activities and physical processes in space and time. The purpose was to show how models could be built to analyze spatial and temporal processes in human and physical systems, with the purpose to solve practical problems in a systematic manner. "Spatial data mining and knowledge discovery" session had four presentations centering on the theme of discovering patterns and processes from spatial and temporal data. Algorithmic developments and practical applications were discussed. The fundamental issues in this area of research were explored in the exchange of ideas. The sessions attracted over 60 participants.

### **C. Planned Conferences for 2016**

**17<sup>th</sup> International Symposium on Spatial Data Handling, Aug.18-20, 2016, Beijing, China**

**International Geographical Conference, August 21-25, 2016, Beijing P. R. China**

### **3. Networking**

The Commission continued to be active in organizing and co-organizing conferences during 2012-2016. In addition to our existing collaborating organizations/associations, we have further established new linkages with major associations, such as the European Regional Science Association, International Spatial Accuracy Research Association (ISARA), and the International Environmetrics Society, by co-organizing conferences with them. We also held a steering committee at the Kyoto conference to make future plans for the advancement of the mission of the Commission. It was in general a fruitful year for the Commission.

### **4. Publications**

The Commission is strongly committed to the encouragement of scholarly publication derived from the work of its members and their contributions to symposia. Theoretical and empirical research will be published as special issues in journals and edited volumes in books.

F. Harvey and Y. Leung (eds.) *Advances in Spatial Data Handling and Analysis*. Heidelberg: Springer, 2015. (Selected papers from the IGU Spatial Data Handling Symposium jointly organized by IGU-CMGS, IGU-CGIS and ISPRS)

Yeh, A.G.O.; Shi, W.; Leung, Y.; Zhou, C. (eds.). *Advances in Spatial Data Handling and GIS*. Springer, 2012. (Selected papers from the IGU Spatial Data Handling Symposium jointly organized by IGU-CMGS, IGU-CGIS and ISPRS)

### **5. Archival Contributions**

All publications, newsletters and reports have been archived in the website of the Commission.  
<http://www.science.mcmaster.ca/~igu-cmgs/index.html>

## **6. Continuation**

- A. The name of the Commission/Task Force, or new name if it is the view of your steering committee that it is to be changed.

Commission on Modeling Geographical Systems

- B. A concise (100-200 words) statement of the mission of the Commission/Task Force.

The Commission on Modeling Geographical Systems acts as a focus for those members of the international community who share an interest in using mathematical, statistical and algorithmic models in geographical systems analysis, geographical systems theory, geographical systems dynamics, geographical decision (or decision support) systems, particularly with big data. We aim to advance the research frontier in geographical analysis with mathematical modeling, statistical methods and other technological advances. In addition, the specific systems orientation of the Commission will enable a new emphasis to be placed on more applied outputs that have relevance to geographers engaged in evaluating a variety of policy arenas, including the space economy, smart cities, transportation, urban planning, global environmental change and sustainability, spatial epidemiology and health care delivery.

- C. A list of the individuals who will comprise the steering committee from 2016-2020. Provide complete contact information for all proposed steering committee members. **Please note that the Statutes indicate that the maximum period of time that any steering committee member may serve is 12 years (that would include a maximum four years as Chair).**

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D. A summary of the work plan for the Commission/Task Force for the 2016-2020 period.

Our Commission will continue our past effort in organizing/co-organizing two or more conferences per year on important and current issues in basic and applied research in geographical modeling. We will continue to collaborate with current professional associations and further extend our network of collaboration in running activities that advance our mission. We will stay active in publishing results derived from such activities. Particular attention will be paid to the issue of big data in the modeling of geographical systems.