

TECHNICAL COMMISSION IV: Mapping and Geographic Information Systems

President: Dieter Fritsch

Secretary: Monika Sester and Markus English

Accomplishment of Commission during 1998

The highlight of 1998 was the Technical Commission IV midterm symposium "GIS - between visions and applications", held in September at the University of Stuttgart. More than 250 participants joined the symposium, coming from 31 countries. For the first time in ISPRS history the proceedings were delivered in hard- and softcopy, the latter as CD-ROM in Acrobat Readers pdf format. It was a great pleasure to observe that the fundamentals of Geographic Information Systems were presented in high quality according to the magic triangle based on theory, development and application. The overall objective when taking over Technical Commission IV in 1996 to represent a homebase for GIS is fully accomplished. This result should have influence to restructure the current ISPRS organization. A proposal by the commission president will be made to preserve these accomplishments not only for the near but the midterm and longer future. GIS is at least as important as photogrammetry and remote sensing.

State of Science and Technology

A comprehensive report on science and technology was given in ISPRS Highlights, Vol. 3, No.4 (December 1998). This summary of the midterm symposium clearly indicated that key technologies such as the Internet, relational database systems, distributed databases strongly influence the GIS developments. The interested reader can refer to that report and to the proceedings of Technical Commission IV.

Working Group Activities during 1998

IC WG IV/III.1 GIS GIS FUNDAMENTALS AND SPATIAL DATABASES

Chair : Martien Molenaar

Co-Chair : YC Lee

Accomplishments

The main activities of the working group were the sessions organized during the Symposia of Technical Commission III in Columbus, Ohio, and Technical Commission IV in Stuttgart, Germany.

Only a few papers were submitted by working group members for the symposium of Commission III so that only one combined session with Working Group IV/III.2 was organized. Four papers were presented dealing with the following topics:

- the retrieval of digital images from geospatial databases,
- the application of image processing techniques for the interpretation of topographic maps and for the -generalization of map objects,
- The use of map features as ground control for image registration.

Substantially more papers were submitted for the sessions of this Working Group during the symposium of Commission IV. The topics of the papers presented here dealt with:

- the topology of geographical space,
- the dynamics of spatial objects,
- aspects of uncertainty in relation to topology and dynamics,
- spatial data models and their integration (especially raster and vector data),
- Hierarchical data models and data maintenance.

These observations lead to the conclusion that there is a clear difference in interest between these two commissions, both in quantity and subject. The participants of Commission III seem to be more interested in the use of GIS data to support the information extraction process from images and there is some interest to explore the possibilities for using image interpretation techniques for the analysis of spatial data in general.

State of Science and Technology of WG Topics

In Commission IV there is a strong interest in the more pragmatic aspects of spatial data management. But there is a rising awareness that more generic problems need to be tackled to grow beyond the present limitations of GIS software and spatial information systems. The conclusion could be that Commission IV should be the home base for GIS oriented activities; these would then refer to both the operational and the more fundamental theoretical developments.

The chairman of this Working Group, Martien Molenaar, participated in the 8th International Symposium on Spatial Data Handling (SDH). There are relatively few connections between this community and the ISPRS, whereas many of the subjects dealt with at SDH are of great relevance for ISPRS Commission IV and also for other ISPRS Commissions, these are topics like data uncertainty, multi-scale approaches, 2D, 3D and 4D topology, dynamical systems, etc. On the other hand the SDH Community seems to be studying some topics for which there is long experience the ISPRS environment. These are topics like Digital Terrain Modeling and its quality, data base updating and consistency, large scale databases etc. It seems to be advisable

to look for ways to combine the expertise of both organizations. This would certainly widen the scope of the ISPRS activities.

Specific WG News

Three activities have been planned for the year 1999. The Working Group will participate in the International Symposium on Spatial Data Quality, which will be organized by Dr. Wenzhong Shi of the Department of Land Surveying and Geo-Informatics of the Hong Kong Polytechnic. This workshop will be held in Hong Kong from July 18 to 20. The Working Group will also participate in the 2nd International Workshop on Dynamic and Multi-Dimensional GIS, which will be organized by Prof. Jun Chen, Chairman of ISPRS working group IV/3. This workshop will be held in Beijing from October 4 to 6. The third activity is that members of the Working Group are invited to participate in a workshop to be organized by the ICA working Group on generalization. This will be held from August 12 to 14, in Ottawa; it will be a good opportunity to exchange ideas about multi scale approaches and generalization with the cartographic community.

IC WG IV/III.2 INTEGRATION OF IMAGE ANALYSIS AND GIS

Chair : Emanuel P. Baltsavias

Co-Chair : Michael Hahn

Secretary : Dirk Stallmann

Accomplishments

The WG members have increased to 90. Two circular letters were sent out related to the Commission III and IV Symposia and a planned Workshop in 1999 respectively. The WG supported and informed its WG members on the following activities:

- Journal "Computers, Environment & Urban Systems"

A theme issue of the journal "Computers, Environment & Urban Systems" on "Data Integration", due to be published in 1998.

- The OEEPE WG "Automatic Absolute Orientation on Data Base Information" and the associated test

- The WG Chairmen contributed in the organisation of the Com. III and IV Symposia. WG members actively participated in both Symposia. Especially in the Com. IV Symposium the WG had the most papers and (co-)organised five Technical Sessions.

- The WG Chairmen collected research information on selected WG topics, especially among the WG members, and prepared an overview paper. Due to time limitations the depth of this paper was low, but a more detailed one will be prepared in 1999.

- An amount of 5,000 DM, which was the surplus of a Workshop co-organised with other ISPRS WGs in Stuttgart in September 1997, was donated to Commission IV to fund five Best Young Author awards for its Symposium papers.

State of Science and Technology on WG topics:

Due to lack of space we point to a paper that briefly summarises progress, trends, problems and needs:

Hahn M., Baltsavias, E., 1998. Cooperative Algorithms and Techniques of Image Analysis and GIS. In: IAPRS, Vol. 32, Part 4, pp. 210-217.

Specific WG News:

A Joint ISPRS/EARSeL Workshop "Fusion of Sensor Data, Knowledge Sources and Algorithms for Extraction and Classification of Topographic Objects" is planned on 3-4 June 1999 at Valladolid, Spain, directly following the 19th EARSeL Symposium. It will be organised in cooperation with WG III/5, WG VII/4 and the EARSeL SIG "Data Fusion" (see details at <http://www-datafusion.cma.fr/sig/spain99.html>).

New address Co-Chair

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WG IV/1

DATABASE DESIGN AND SPATIAL DATABASE ACCESS

Chair : Lutz Pluemer

Co-Chair : Stephan Winter (since Sept. 1998), replacing Max Egenhofer

Accomplishments

The working group actively participated in the preparation of the Commission IV symposium in Stuttgart and moderated a session on user interfaces and next generation GIS.

State of Science and Technology of WG Topics

The focus of the working group is on the interrelation between database technology on one hand and GIS technology and requirements on the other. Recent developments both in GIS and in database systems bring these two streams of technology much closer together than it was the case in the past. Object relational database systems have come to the market which offer the traditional functionalities of relational database systems together with the advantages of object oriented techniques, opening the perspective of handling GIS objects with the technology of mainstream database systems. On the other hand commercial GIS is commencing to incorporate object-oriented technologies at least in small steps. Interoperability is another important issue, and the OpenGIS Consortium marks an important trend in achieving accepted standards for the interchange of heterogeneous spatial data in a networked environment. Java could play an important role in the exchange of GIS data and software in the near future although it is unclear whether the performance of the existing technology is already sufficient for the requirements of GIS. With regard to the theoretical aspects of GIS semantic data models for spatial objects will be a major

topic for the future, both with regard to further interoperability and for the design of advanced user interfaces.

Specific WG Topics

In 1999 it will co-organize the Second International Workshop on Dynamic and Multi-Dimensional GIS in Beijing, October 4-6.

New address of Co-Chair:

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WG IV/2

DIGITAL TERRAIN MODELS, ORTHOIMAGES AND 3D GIS

Chair : Roy Welch

Co-Chair : Klaus Tempfli

Secretary : Marguerite Remillard

Accomplishments

In 1998, the efforts and activities of ISPRS WG IV/2, "Digital Terrain Models, Orthoimages

and 3D GIS" were centered on preparing for and conducting technical sessions at the Commission IV Symposium entitled, "GIS - Between Visions and Applications", held September 7-10, 1998 at the Institute for Photogrammetry in Stuttgart, Germany. A total of 43 abstracts were submitted to WG IV/2 for the Symposium and were organized into six oral technical sessions, two of which were shared with ISPRS Intercommission WG IV/III.2, "Integration of Image Analysis and GIS". In addition, WG IV/2 participated in a shared poster session.

State of Science and Technology of WG Topics

Overall, WG IV/2 contributed several high quality papers to the Commission IV Symposium focused on the following topics: 1) 3D urban modeling; 2) digital terrain modeling (DTM) using laser scanning, radar interferometry and optical imagery; 3) generation of orthophotos and orthophoto maps; and 4) advanced DTM structures and applications. A WG IV/2 Invited Paper entitled "Challenges of 3D Modeling in a Dense Urban Environment" authored by Harold Spradley and Roy Welch was presented at the Symposium. The topic of 3D urban database development and the production of true orthoimages was noted to be of special interest at the Symposium and was the focus of much discussion during WG IV/2 sessions.

Specific Working Group News

Upcoming WG IV/2 activities include two special technical sessions that will be devoted to ISPRS WG IV/2 topics at the annual American Society for Photogrammetry and Remote Sensing (ASPRS) meeting to be held May 17-21, 1999

in Portland, Oregon, USA. Papers accepted for these sessions are related to DTM generation and use in hydrologic modeling, the production of digital orthophoto maps and the development/visualization of 3D GIS databases.

WG IV/3 TEMPORAL ASPECTS AND DATA REVISION

Chair : Jun Chen

Co-Chair : Fabio Crosilla

Accomplishments

The following progress has been made during 1998. In particular, the working group concentrated its work on the items below:

1. Moderating two technical sessions related to the ToR of the WG. for Comm. IV Symposium of ISPRS in Stuttgart, Germany, Sept 7-10, 1998 . One of the two sessions is 'Operational aspects of spatial database revision', the other is 'Spatio-temporal data modeling for GIS data revision'.
2. Preparing the Second International Workshop on 'Dynamic and Multi-Dimensional GIS (MDGIS '99)' which will be held 4-6 October 1999 in Beijing. The workshop was approved by ISPRS council and will be jointly organized with the following six other working groups: ISPRS Inter-Comm. Working Group IV/III.1 (GIS Fundamentals and Spatial Databases), ISPRS Inter-Comm. Working Group IV/III.2 (Integration of image analysis and GIS), ISPRS Working Group II/2 (Software and Modelling Aspects of Integrated GIS), ISPRS Working Group IV/1 (Database Design and Spatial data access), ISPRS Working Group VI/3 (International cooperation and technology transfer), IGU Study Group on Geographical Information Sciences.

The following topics will be dealt with during the workshop: Conceptual and logical spatial data models, multi-scale and multi-media representation, 3D and 4D spatial data modelling,

digital terrain modelling (DTM), spatio-temporal databases, spatial database revision, dynamic data modelling, Web-based distributed and heterogeneous spatial databases, system integration, spatial analysis.

State of Science and technology of WG IV/3 Topics

Updating and revision of digital spatial databases is now becoming a key issue for many national geomatics institutions and local municipalities. Technical and institutional issues were discussed at Stuttgart Symposium and other international workshops (conferences). Automated change detection and feature extraction from digital images, incremental update of changes, quality control and database integrity are among the main topics.

Maintaining the spatially referenced data with temporal dimensions and make them accessible to users is another hot research topic. Efforts were devoted to investigate the temporal behavior of spatial objects, spatial-temporal process modeling, representation of spatio-temporal topology etc.

Specific WG News

- Co-organize the International Symposium on Spatial Data Quality will be held at The Hong Kong Polytechnic University from 18th to 20th July 1999.
- Organize the Second Workshop "Dynamic and Multi-dimensional GIS (MDGIS '99)" in Beijing, October 4-6, 1999.
- Collection of the publications of the members of the working group and others related to temporal aspects and topographic databases.

WG IV/4

MAPPING USING HIGH RESOLUTION SATELLITE IMAGERY

Chair : Gottfried Konecny

Co-Chair : Donald Light (resigned in Sept. 1998)

Accomplishments

The major event in WG IV/4 were the technical sessions held during the Symposium in Stuttgart. In three special sessions, the problems around high resolution imagery have been tackled. A main focus was the investigation into the mapping potential of the high resolution satellite programs. Furthermore, their potential for other applications and product was presented, e.g. as a basis for urban and regional planning, or the production of orthophotos. Another topic of great interest was the German MOMS-Project, where presentations concerning the automatic DTM generation, as well as a view to future developments were given.

WG IV/5

EXTRATERRESTRIAL MAPPING

Chair : Jan-Peter Muller

Co-Chair : Randy Kirk

Secretary : Karl Mitchell

Accomplishments

The WG upgraded its web-site at <http://www.ge.ucl.ac.uk/isprs-etm> to include extra links to planetary missions, new data products and the abstracts of the workshop held in London (16-17 April 1998) at University College London.

The WG held a very successful first workshop at UCL on "Mapping of Mars" which reviewed the latest results on Mars mapping. This included an excellent tutorial on the metadata and tools for all planetary data, SPICE from its chief scientist at the Jet Propulsion Laboratory, Dr Chuck Acton and 14 papers and 3 posters. The Powerpoint presentation is now on the Tutorial section of our Web-page.

Keynote presentations were given on the status of the Mars control network from Dr Mert Davies (RAND, Los Angeles) and Dr Juergen Oberst (DLR), from the PIs on Mars Global Surveyor Laser Altimeter (David Smith, Maria Zuber); from the Mars

Pathfinder lander camera team, Dr Peter Smith and from the photogrammetric experiences of USGS (Dr Randy Kirk) and DLR (Dr Juergen Oberst). Stereo photogrammetric mapping results from Viking Orbiter data on Mars were shown by Dr Paul Schenk from LPI, Houston and on the first application to Mars by Dr Tony Cook from the Smithsonian National Air & Space Museum, Washington DC. Examples of the use of Virtual Reality for Mars exploration was shown by Dr Ed Zbinden from NASA AMES Research Center and future stereo photogrammetric mission plans from Mars Pathfinder 2 (Dr Peter Smith, LPI, Tucson) and HSRC on Mars Express 2003 (Dr Juergen Oberst).

Lively discussion of all these topics by the 30 participants which extended late into the evening ensured that the workshop was regarded as an outstanding success by its participants.

The ISPRS Commission IV Symposium held a session on 8 September 1998 at Stuttgart on WG activities. Four excellent papers were presented including Mars Global network by Dr Timm Ohlhof; photogrammetric processing of Pathfinder landing images by Dr Juergen Oberst and on the use of shape-from-shading and DEMs of Mars to produce cartographic "correct" representations of Martian topography from Prof. Egon Dorrer.

Specific WG News

It is planned to hold another workshop covering the same theme but updated to include work from the Mars Global Surveyor laser altimeter and camera at the USGS Flagstaff in July details of which will be announced shortly by email and on our web-site.

Educational outreach activities planned for the next year include the addition of new tutorial web-pages on Extra-terrestrial Mapping, additional ETM data products to be added to the web-page including example DEMs from Mars and the Moon as well as a DEM and examples of photogrammetric products from Mars Pathfinder and further links to Mars Climate Orbiter, MOLA & MOC, NEAR, Starburst and the ESA Mars Express and Beagle 2 missions.

WG IV/6

GLOBAL DATABASES SUPPORTING ENVIRONMENTAL MONITORING

Chair : Ryutaro Tateishi

Co-Chair : David Hastings

Global datasets of geospatial environmental variables are necessary input to global environmental studies. They are also necessary for policy decision making and environmental education. In turn, global data are developed from satellite remote sensing, ground measurement, or social survey like census. Among them, satellite remote sensing is most powerful tool for global data acquisition. Global dataset development is now the main purpose of satellite remote sensing, for example EOS series, ADEOS-II, SPOT-4, ENVISAT. The recently available global datasets are DEM(GLOBE, GTOPO30), population, land cover, in-site observation data(TEMS by GTOS).

Accomplishments

The WG does not aim to develop a specific global dataset. The WG aims to summarize various on-going global dataset development efforts, to identify obstacles for better development and usage of global environmental datasets, to propose measures or methodology to cope with these obstacles, and to disseminate these survey and proposal to researchers and related peoples through publication.

What the WG has done

The WG started the discussion on the above matters on internets, that is the WG started a virtual workshop at the web-site linked from ISPRS web page through WG IV/6 web page.

What the WG has learned

At the end of 1997, the WG announced to all ISPRS officials by email about the WG's plan to develop meta-database of global geospatial environmental datasets to solicit the cooperation to this attempt. After that, many response reached to the WG chairman, and it was found that similar meta-databases exist or are planned such as Global Change Master Directory(GCMD) by NASA, web-page of global mapping by Geographical Survey Institute of Japan, project by the Biodiversity Conservation Information System(BCIS). What we need is to avoid duplicated efforts and to cooperate each other. The WG already communicated to improve GCMD. The WG decided to postpone the development of meta-database of global datasets, and to start discussion about cooperation with other similar attempts.

What the WG is doing

The WG decided to start discussion through virtual and real workshop(15-18 Nov. 1999 at Hawaii) with almost all related key organizations/groups to the development of global datasets such as scientific group(ex. IGBP, IHDP, LUCC), international organizations(ex. UNEP, FAO, World Bank), space agencies under CEOS. Subjects of discussion are divided into thematic subjects and generic subjects. The thematic subjects are obstacles for the development of a specific global data and measures to reduce it. This discussion will be done for each data type such as land surface data, oceanographic data, hydrographic data, etc. The generic subjects are common problems in the development and usage of global datasets. Any person who has an interest in the workshop can contact to: Ryutaro Tateishi(email: tateishi@rsirc.cr.chiba-u.ac.jp).

Specific WG News

The goal of the WG in the term 1996-2000 is to disseminate the WG discussion in a style of book in 2000 to record the present stage of global geospatial environmental database and the state of the art of the technology for global dataset/database development.

Appreciation

The WG appreciates comments and inputs from ISPRS people through email message and discussion at the Stuttgart Symposium. The WG also appreciate ISPRS officials for their understanding the importance of the WG activity.