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EARSeL Newsletter Editor

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1 EDITORIAL

Well here we are, entering the final weeks of the first year of the new millennium – or is it still the old one? Anyway, perhaps it is a good occasion to reflect back on some developments and events of the past year that may significantly affect the future for the European remote sensing community. First of all, please excuse me if I dwell in this editorial on some of the (apparently) more "remote" space-related developments that have taken place in Europe's major institutions in 2000, rather than mentioning some of the more tangible advances in remote sensing (impressive new sensors, exciting new applications, etc.). However, I think that these rather high-level changes will, in the long-term, have far-reaching effects on future remote sensing research and applications projects in Europe.

Above all, it seems to have been a year dominated by the dreaded "G-word": globalisation. Not to mention, of course, global warming, global climate change, global information, global communications, global monitoring, global navigation, global positioning, global security, global conflict, global markets…. Have I forgotten any? In fact, sometimes it seems that globalisation is even threatening to engulf our language.

Faced with increasing globalisation, and within the context of its continuing enlargement, the European Union this year adopted a major new strategic goal for the next ten years. That goal, as stated in the conclusions of the European Council meeting in Lisbon, in March 2000, is: "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". Two important steps towards achieving this goal were subsequently identified in the programme for the French presidency of the EU, in the second half of 2000:

- The establishment of a coherent European space policy, drawn up jointly by the European Commission and the European Space Agency.
- The development of an independent, information-control capability for monitoring the environment, natural and industrial hazards, natural resources, and sustainable development – i.e. GMES (Global Monitoring for Environment and Security).

Against this background, on 27 September 2000 the European Commission and the European Space Agency issued a joint document outlining a new European Strategy for Space (see article in Section 3.2.1 of this Newsletter). Amongst other things, the joint EC-ESA strategy document identifies a clear role for remote sensing (embodied by GMES) as an instrument for supporting a wide range of EU regional and global environmental and security policies. The shape and substance of the new EC-ESA collaboration, and particularly of GMES, will be further elaborated in the coming months. (Indeed, a Space Symposium on GMES has already been held, in October 2000, in Lille, France – see article in Section 3.2.2 of this Newsletter).

The increasingly unruly behaviour of Mother Nature in 2000 – as evidenced, for example, by the disastrous floods and landslides in Europe towards the end of the year – does at least have a few positive side-effects. One is to focus the minds of decision-makers (such as those at the recent conference of the United Nations Framework Convention on Climate Change, in The Netherlands) on the urgent need to limit greenhouse gas emissions. Another not altogether negative effect (though admittedly this is a rather parochial view), is that the value of remote sensing as an environmental monitoring tool – for example, for assessing the extent of the damage caused by such events – is further enhanced.

Finally, having started this piece with mention of the ubiquitous "G-word", I would like to conclude with a much more welcome "C-word": on behalf of the EARSeL Bureau and editorial staff, I wish you all a very happy and peaceful Christmas, and a busy and successful 2001!

The Editor

2 NEWS FROM THE ASSOCIATION AND ITS MEMBERS

2.1 21st EARSeL Symposium and General Assembly

Preparations are going ahead for the 21st EARSeL Annual General Assembly and Symposium, to be held from 14-16 May 2001 at the Ecole Nationale des Sciences Géographiques at Noisy-Champs, which is part of the new town of Marne-la-Vallée, just outside Paris and 25 minutes by Regional Express train (RER) from Châtelet-les-Halles, the hub of the Paris transport system. The station is Noisy-Champs, which is half-way between the centre of Paris and Euro-Disneyland, so that participants will have a choice of hotels, either nearby in Noisy-Champs, or in Paris, or in the Euro-Disneyland complex. More details can be found on the EARSeL web-site: www.earsel.org. (See also Section 2.2.2 below).

2.2 News from the Special Interest Groups

2.2.1 SIG Remote Sensing for Developing Countries

Report by Dominique Godfroid (Ghent) and Madeleine Godefroy (Paris)

The first workshop of the EARSeL Special Interest Group on "Remote Sensing for Developing Countries" was held in Ghent, Belgium, from 13-15 September 2000. It was organised at "Het Pand", a former Dominican Abbey, located in the historical centre of the city, which is now the property of the University of Ghent. There were nearly 80 participants from many countries (Belgium, Czech Republic, Ecuador, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Morocco, The Netherlands, South Africa. Spain, Syria, Turkey, United Kingdom, Venezuela). The organisation and facilities of the workshop were excellent, as were the refreshments and meals provided by the on-site catering services.

The scientific sessions of the workshop were all well-documented and highly interesting. Emphasis was put on practical applications for problem-solving rather than on acquisition and processing techniques. The interactive poster sessions allowed for long and lively discussions between authors and other participants. The workshop promoted international contacts and the exchange of knowledge.

A highlight of the workshop was an afternoon visit to VITO (the Flemish Institute for Technological Research), situated in the pleasant surroundings of the town of Mol, near the Dutch border. This fitted perfectly in the framework of the workshop, as three presentations were made by VITO scientists concerning the processing of SPOT 4 Vegetation images. Delegates received a demonstration CD-ROM, which is now available (see Section 3.6 of this issue). This was followed by a guided tour of the various laboratories, and the day ended with a good meal, which offered the opportunity to chat in a relaxed atmosphere.

The final conclusions emphasised the importance of ground truth and of aerial photos in large- and medium-scale applications, especially now that data extraction is improved by new processing techniques, and integration in GIS systems. Participants were very keen to hold other such workshops within the next two years, and several invitations were spontaneously offered. The interesting and well-filled programme concluded with a dinner at which a typical Ghent speciality was served.

The organisation of such a workshop is no easy task, with the specific problems of many participants from far-off countries, and the local organisers are to be congratulated on having done a fine job. Their conclusion was: "A difficult programme, but certainly worth the effort!"

A more detailed scientific report on the workshop will appear in our next issue. Meanwhile the presented papers are being prepared for publication on a CD-ROM. Further information may be obtained from Prof. Rudi Goossens (e-mail: rudi.goossens @rug.ac.be).

Opening the Ghent Workshop (left to right): Mr. Jacques Willems (Rector, University of Ghent); Prof. Dr. Rudi Goossens (Workshop Chairman); Ing. Brigitte Decadt (OSTC, Belgian Federal Office of Scientific Policy); Prof. Dr. Gottfried Konecny (EARSeL Vice President)

2.2.2 SIG Forest Fires

The SIG group on Forest Fires will organise the 3rd International Workshop on Remote Sensing and Forest Fires, on 17-18 May 2001, following the 21st EARSeL Symposium in Paris. This conference follows two previous workshops held in Thessaloniki (1993) and Alcalá de Henares (1995), and the Seminar organised in Coimbra (1998) by the SIG group. The main topic of the workshop will be the application of new sensors and technologies to fire prevention, detection and mapping. Special emphasis will be devoted to global and regional approaches and defining common standards for validating fire products. The potentials of Vegetation, MODIS, and MERIS will be reviewed, as well as the continued development of techniques to improve processing of AVHRR, ATSR and WiFs data. The integration of human factors in the analysis of risk will also be considered, in order to obtain a more comprehensive view of fire danger estimation.

Workshop Objectives

The basic activity of the Special Interest Group on Forest Fires is to establish personal contacts among researchers interested in the application of remote sensing and geographic information systems to forest fire research. Within this context, this workshop has been organised as a forum for discussion and sharing of ideas and technical experience in this field. The goal will be to identify requirements not currently met by remote sensing systems, and to explore potential collaborations.

The structure of the workshop is based on the analysis of potentials of current and future sensors for burned land mapping and fire risk assessment. Three lectures will be presented:

- Current and future activities of ESA related to forest fires, including applications of ERS and Envisat, by Olivier Arino (ESA/ESRIN, Italy).
- Review of the Terra program and presentation of future activities of NASA related to forest fires, by Yoram Kaufman (Earth Observing System - "Terra" Project Scientist).
- Review of User Needs in Operational Fire Danger Estimation: The Oklahoma Example, by J. D. Carlson (Oklahoma State University).

Papers can be presented on all topics previously addressed. In order to leave as much time as possible for in-depth discussion of the themes raised, all contributions will be presented as posters. Authors will have the opportunity to give a brief oral presentation of their work before detailed explanations of their posters during the subsequent poster session. Oral presentations will be restricted to three keynote lectures.

Organising Committee

Chairman: Emilio Chuvieco, Professor of Geography, University of Alcalá. Secretary: M. Pilar Martín, Researcher, Spanish Council for Scientific Research.

Scientific Committee

Dr. Olivier Arino, ESA, Italy; Dr. Marco Benvenutti, IATA - CNR, Italy; Dr. Michel Deshayes, Cemagref, France; Dr. Emilio Chuvieco, University of Alcalá, Spain; Dr. Robert Fraser, Canada Center for Remote Sensing, Canada; Dr. Ioannis Gitas, CIHEAM, Greece; Dr. Yoram Kaufman, NASA, USA; Dr. Chris Justice, University of Virginia, USA; Dr. J. Miguel Pereira, Depart-

ment of Forestry, ISA, Portugal; Dr. Jesús San Miguel, JRC, Italy; Dr. Stephen R. Yool, University of Arizona, USA.

Local Organising Committee
EARSeL Secretariat. Attn: Mrs. M. Godefroy, 2 avenue Rapp, F-75340 Paris Cedex 07, France. Telephone: +33 1 45 567360. Fax: +33 1 45 567361. E-mail: earsel@meteo.fr. EARSeL web-site: www.earsel.org.

Abstracts
A three-page abstract should be forwarded by 31 December 2000 to: Dr. Emilio Chuvieco, Departamento de Geografía, Universidad de Alcalá, Colegios, 2 28801 Alcalá de Henares, Spain. Telephone: +34 918854438. Fax: +34 918854439. E-mail: emilio.chuvieco@uah.es. For everything related to the workshop, please use the e-mail address: fire.workshop@uah.es.

Abstracts should begin with the author's main address for correspondence including telephone, fax and e-mail. It should include an introduction in which the state-of-the-art is summarised. The main part should analyse the methodology used and the results obtained with reference to existing papers. The conclusion should identify precisely the advancement in the subject thus demonstrated, both in the case of scientific results and applications. Text should be typed on A-4 format paper (29.7 x 21 cm), on one side only, 1.5 spaced, margins of 2.5 cm top, bottom, right, left. Title, author(s) and affiliation(s) should be centred at the top of the page. For abstracts selected by the Scientific Committee, it will be proposed to deliver a full-length paper for publication in a special issue of a peer-reviewed journal.

Language and Timetable
The working language in the workshop will be English. The Workshop is planned just after the 21st EARSeL Annual Symposium in Marne-la-Vallée, near Paris. First Announcement: October 2000. Deadline for Abstracts: 31 December 2000. Preliminary Programme and Authors Notified: 31 January 2001. Final Programme: 30 April 2001. International Workshop and Deadline for Submission of Selected Papers: May 2001.

2.2.3 SIG Forestry and Landuse

The Board of the European Forest Institute (EFI) in Joensuu, Finland, has appointed Dr. Risto Päivinen (Finland) as its new Director, from 1 October 2000. Dr. Päivinen has been the Deputy Director of EFI since its establishment in 1993. Dr. Päivinen is well known to EARSeL, having extensive international experience in forest inventory and monitoring, especially remote sensing applications, as well as management planning and information systems in forestry.
For more information, see: www.efi.fi/news/news/2000/paivinen_appointed_director.html.

2.2.4 SIG Imaging Spectroscopy

Workshop on Workshop on AVIRIS Earth Science and Applications Workshop
This is the first announcement for the 2001 AVIRIS Earth Science and Applications Workshop. The workshop will be held from 27 February to 2 March 2001, at the NASA Jet Propulsion Laboratory.
The AVIRIS Workshop is a forum to report science research and applications results with spectral images measured by the NASA Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). Calibration, engineering, and operations topics will also be included in the workshop. Last year we had 80 papers presented and over 250 attendees. Analysis and results from AVIRIS data sets acquired in Hawaii will be featured in this year's workshop. If you wish to present research, applications or other results related to AVIRIS, please send me an e-mail (rog@spectra.jpl.nasa.gov) with the title, authorship and a brief abstract. Information about the workshop will be updated at the AVIRIS web-site: makalu.jpl.nasa.gov/.

For more information contact: Robert O. Green, AVIRIS Experiment Scientist, Jet Propulsion Laboratory, Pasadena, California, USA (e-mail: rog@spectra.jpl.nasa.gov), or Valentina Grigoryan (e-mail: valentin@spectra.jpl.nasa.gov). Fax: (818) 393-4489. Mail-Stop: 306-336, 4800 Oak Grove Drive, Jet Propulsion Laboratory, Pasadena, California 91109 USA.

ATCOR On-Line Tutorial
Many years of experience in atmospheric modelling at DLR (German Aerospace Centre) have led to the development of a set of software tools for atmospheric / topographic correction of optical imagery. An online introduction and information on the commercially available packages for image data of airborne and satellite sensors, is available at the following web-site: www.op.dlr.de/atcor.
For more information please contact Rolf Richter (r.richter@ dlr.de) or Andreas Mueller, WG Imaging Spectroscopy, DLR - German Aerospace Centre, German Remote Sensing Data Centre, D-82234 Wessling, Germany. Telephone: +49-8153-281160. Fax: +49-8153-281458. Web: www.op.dlr.de/dais and www.op.dlr.de/dais/SIG-IS/SIG-IS.html.

2.3 Finland's Automatic Forest Fire Alert System

An operational, satellite-based, real-time system to observe and alert forest fires, has been developed by a consortium led by VTT (Technical Research Centre of Finland). The new automatic forest fire alert system, the development of which was funded by ESA as part of its activity on the Promotion of Space Technologies for Supporting the Management of Natural Disasters, is being implemented operationally in Finland by the Finnish Meteorological Institute. The system uses NOAA-AVHRR and ERS-ATSR satellite data, and meteorological data such as forest fire index and lightning data. Central to the system is the forest fire detection system, which consists of three main modules: AVHRR pre-processing and fire detection; ATSR pre-processing and fire detection; a common fire report distribution.

For a full, on-line technical description and demonstration of Finland's automatic forest fire alert system, go to: www.vtt.fi/aut/rs/proj/FF-Operat. For more information contact Mr. Yrjo Rauste, VTT Automation – Remote Sensing, P.O. Box 13002, FIN-02044 VTT, Finland. Telephone: +358-9-4566286. Fax: +358-9-4566475. E-mail: yrjo.rauste@vtt.fi.

2.4 Feature: Global Changes in Water Resources

Sustainable Water Use under Conditions of Changing Land Use in the Volta Basin: Global Change in the Hydrological Cycle

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Introduction
The German Federal Government has initiated an eight-year science programme on Global Change in the Hydrological Cycle (GLOWA), consisting of four projects, each concerned with the impact of global and regional change on the water resources of one major watershed. Here we introduce the GLOWA-Volta Project, which seeks to develop a scientifically sound decision support system for the management of water resources of the Volta Basin.

Water Resources of the Volta Basin
The Volta Basin is a large watershed, covering 400,000 km^2 of the West-African savannah. The bulk of the basin is equally divided between Ghana and Burkina Faso, whereas smaller areas lie in Côte d'Ivoire, Mali, Benin, and Togo. The population of the basin doubles every thirty years, which causes major changes in land use intensity. Rainfall averages 1000mm per year, of which nine per cent finds its way to the Volta river.

In 1964 the Volta was dammed for hydropower generation, creating Lake Volta, which has the largest area of any man-made lake. Electricity from the dam stimulated development of industry and service sectors, mainly in the towns in the South of Ghana. Demand for electricity continues to rise and can hardly be met, increasing the pressure to maximise hydro-power production. At the same time we see increased irrigation development, especially in rural Northern Ghana and Burkina Faso. Irrigation is needed to increase food production and to reduce the risk of failing rains.

Presently, only 45,000 ha are under irrigation but further exploitation of water re-

sources for irrigation purposes will have an (unknown) effect downstream where hydro-power is generated. Irrigation and household water supply have little effect on total river flow today, but the upward trend has caused anxiety in Ghana about hydraulic development upstream from the dam. However, the total irrigable area in Burkina Faso is estimated at 160,000 ha, which is only 20% of the area of the lake behind the Volta dam, so the ultimate impact of irrigation may be acceptable.

A Decision Support System

Development of a scientifically sound decision support system for the assessment, sustainable use, and development of water resources in the Volta Basin, is the principal objective of the GLOWA-Volta Project. To reach this objective, predictions of water demand and water supply throughout the basin are required, both of which are dependent on socio-economic development. It is, therefore, necessary to analyse and model not only the physical environment but key aspects of society as well.

In effect, the GLOWA-Volta research project addresses many aspects of water resource development; from meteorology and hydrology, through pedology and agronomy, to economy and law. The foremost scientific challenge of the GLOWA-Volta Project is to quantitatively link models from all these disciplines. Different disciplines usually work at different temporal and spatial scales. For example, the detailed meteorological model, applied to West Africa for the first time, will run with time steps of fifteen minutes, whereas changes in land use are measured over years or decades. Matching different scales is more than a mere technical problem because scale is directly linked with the core unit of analysis of each discipline. This becomes especially clear when linking socio-economic and physical models. The individual, household, or village, are logical starting points for social analysis, but they do not coincide with physical slopes, watersheds, or river basins.

An interdisciplinary team will work from the very beginning to ensure meaningful exchange of data and information, instead of trying to forge links at the final stage of the project. Only on the basis of such integrated analysis can we build a decision support system to guide the regional managers of water resources in the Volta Basin.

The Role of Remote Sensing

Within GLOWA-Volta, fourteen sub-projects have been defined which model key processes and variables that are needed directly or indirectly by other sub-projects. Remote sensing is expected to play a key role in four sub-projects: 1. land use and natural resources; 2. land use change and socio-economic development; 3. prediction of land use change; 4. vegetation characterization. These sub-projects are grouped in the Land Use and Cover Change Cluster. In addition, remote sensing will be used to measure the moisture status of the land surface.

Existing satellite observation systems and systems that are, at present, still under development will provide data on land cover change. These earth observation (EO) data will be used to examine development both over time through the use of historical data (time series of NOAA-AVHRR, Landsat MSS and TM images), and over space by exploiting the wide range of spatial resolutions of different sensors - i.e. high resolution IKONOS and Landsat 7 (1m and 15m respectively), medium resolution Landsat 5 (30m), and medium-low resolution MODIS (250m, 500m and 1km) and NOAA sensors (1km). Satellite observations of vegetation cover types and urbanised areas, and their modification over time and space, will be analysed and used for modelling land use and land cover change. Factors that operate at a global scale often drive local land use changes and, in turn, collective actions at local level can have profound global impacts. EO satellites are our only tool to observe the complex system that produces land use and land cover change over multiple temporal and spatial scales.

Remote sensing will not only be used to map present and historical land cover but also to examine the driving forces behind land use change. This is particularly relevant for West Africa, where relatively few datasets exist that are complete and consistent over space and time. Remote sensing

can provide reliable and up-to-date information, such as number and size of farms, intensively cropped areas, irrigation systems, settlements, and densely populated regions, at very high spatial and temporal resolutions. These social descriptors and geographical data are an invaluable help to model and understand land use change as an outcome of social and economic development.

Satellite-derived data such as surface temperature and vegetation cover will be fed into a Soil-Vegetation-Atmosphere-Transfer (SVAT) model. Coupling processed EO data and the model will produce output parameters such as evapo-transpiration, soil moisture and temperature, albedo, latent and sensitive heat flux. These are required by climate and hydrology models.

Linkage with Policy-makers

The link between research and policy often comes as an afterthought once the scientific questions have been answered. In the GLOWA-Volta Project, a continuous dialogue between policy-makers and scientists is possible, mainly because of recent legal and institutional changes concerning the management of water resources in Ghana. Following a World Bank study, the Water Resources Commission (WRC) was recently established. WRC acts at a national and international level in the area of water management policies of the country, and it needs a sound data and information system to be effective. As a pilot project, WRC has now commissioned the development of a Master Plan for the integrated development of water resources in the Densu Basin.

The link from research to policy is often difficult to forge but in Ghana, most water policies still have to be formulated, which creates a clear demand for scientific inputs. WRC supports the GLOWA-Volta Project and has, through informal discussion, exchange of documents and workshop participation, directly contributed to the goal-setting of the project. Moreover, WRC can serve as a direct policy outlet to operationalise research results from the project.

For more information contact Prof. Paul Vlek, Director ZEF (p.vlek@unibonn.de), or Dr. Nick van de Giesen, Hydrologist, GLOWA-Volta Project Co-ordinator (nick@uni-bonn.de), or Fabio D. Vescovi (fabio@rsrg.uni-bonn.de), responsible for the remote sensing applications in the research cluster Land Use Change. Address: ZEF - Centre for Development Research, Bonn University, Walter-Flex-Str 3, 53113 Bonn, Germany.

2.5 EARSeL Welcomes a New Member

Remote sensing is a young but rapidly growing research field at the Institute of Geography of the Humboldt University of Berlin. While for a long time, conventional air photo and satellite image interpretation have been taught only at an undergraduate level, professional research activities have been intensified since 1998, and now include the following projects: land use classification and environmental protection in the Carpathian Mountains (Ukraine) using IRS-1 C/D, Landsat-7, and Spot imagery; landscape degradation in Western Patagonia, Chile, using Landsat-7 and ERS-1/2 data; assessing the state of the Devon Island ice cap, Nunavut, Canada, using optical, thermal, and radar data (ASTER, MODIS, RADARSAT); urban climate studies in Berlin, Germany, using the new ASTER imagery; use of remote sensing data for ecosystem monitoring. At the present time, the group consists of one full-time professor, a research staff of five members, and several students working in this field. The laboratory is equipped with three workstations, a student computer lab (twelve PCs), and several appropriate remote sensing and GIS software packages. For more information contact Wilfried Endlicher or Klaus Zahnen (web: www2.hu-berlin.de/geo).

3 NEWS FROM ESA, THE EC AND INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 ERS-Envisat Symposium in Gothenberg, Sweden

Report by Mrs. Madeleine Godefroy, EARSeL Secretariat.

Nearly 700 delegates coming from the five continents gathered at the Gothenburg Conference Centre in Sweden for the ERS-Envisat Symposium, organised by the European Space Agency and the Chalmers University of Technology, from 16-20 October 2000. There were also twenty-six exhibitors coming from scientific institutions and industry, international agencies, consortia, service providers, and value-added companies. The organisers, Dr. Maurizio Fea and Dr. Gianna Calabresi of ESA / ESRIN are to be congratulated for their fine job of organisation, assisted by their Swedish colleagues - in particular, Prof. Jan Askne of Chalmers University of Technology, who is well-known to EARSeL members, since he organised our 1994 General Assembly and Symposium at Chalmers University, so that this attractive harbour town was familiar to many of us.

The Opening Session featured an overview of the ESA Earth Observation (EO) strategy given by Mr. Claudio Mastracci, Director of Application Programmes at ESA headquarters. Details were provided by Dr. Steve Briggs of the EO Applications Department at ESA / ESRIN. The subsequent sessions included technical, scientific, applications and market-oriented papers, accompanied by a well-attended display of poster presentations. The proceedings are currently being prepared on a CD-ROM by ESA Publications Department.

EARSeL had a well-placed stand in the exhibition area, and was represented by our Vice-Chairman, attending as one of the partners in the Data User Programme, and by the EARSeL secretary. This offered a good opportunity to renew contacts with many EARSeL members, and to present our activities to a broader audience.

3.1.2 Consortium to Distribute ERS, Envisat Data

The European Space Agency (ESA) has awarded the Sarcom consortium a contract to distribute data world-wide from the ERS and Envisat radar satellites. The consortium, formed by Spot Image in response to the call for proposals by ESA in 1999, has brought together eight major players in the Earth Observation market, all of whom distribute SPOT, ERS and RADARSAT data. The consortium members are: Spot Image, France; Geoserve BV, Netherlands; National Aerospace Laboratory (NLR), Netherlands; NPA Group, UK; Radarsat International, Canada; Satellus, Sweden; Spot Asia, Singapore; Tromsoe Satellite Station (TSS), Norway.

The broad range of expertise and the complementarity of Sarcom partners will give users a full spectrum of image processing services, from reception right through to distribution of radar data. The consortium will also offer innovative and sophisticated products and services tailored to pollution monitoring, natural hazard management, marine applications, and mapping, through joint product and service offerings. This agreement is anchored in a sales strategy geared to providing multi-source, complementary optical and radar at low, high and very high resolutions, in order to boost development of the global market for satellite imagery. In pursuit of this aim, Sarcom will be leveraging its large international sales network, formed by Spot Image's subsidiaries and the consortium partners' distribution networks.

The Envisat system will ensure continuity of service for ERS data users, with a launch scheduled for mid-2001. Envisat is a multi-mission satellite that will carry a payload of several science instruments and a high-performance radar antenna providing enhanced acquisition flexibility (in terms of

mode, resolution and viewing angle). The system will also provide on-board storage capacity. Envisat's revisit frequency will ensure faster response to fast-evolving events such as natural disasters.

For more information contact Spot Image – Corporate Communications, Anne-Marie Bernard (telephone: +33 (0)5 62 19 40 10; e-mail: Anne-Marie.Bernard@spotimage.fr).

3.2 News from the EC

3.2.1 New Joint EC-ESA European Strategy for Space

Niall McCormick, DG-JRC, Space Applications Institute, SSSA Unit, Ispra, Italy

On 27 September 2000, the European Commission (EC), in agreement with the European Space Agency (ESA), adopted a Communication entitled "Europe and Space: Turning to a New Chapter" (COM (2000) 597 Final). This joint document by the EC and ESA represents the proposed new European Strategy for Space (ESS), the development of which had been requested by the ESA Council at Ministerial Level (May 1999) and by the EU Council on Research (December 1999). The broad aim of the proposed ESS is to define a common approach to the European space sector, that takes into account the economic, social, political, and scientific importance of space within the particular context of the continuing enlargement, closer integration, and increased global influence of the European Union (EU), and that reinforces the use of space in the service of the EU's various policy needs. Resolutions on the proposed ESS are due to be adopted by ESA and the EU in November and December 2000.

An effective space strategy should embrace the following five areas, which cover all of the various elements of the European space sector: (a) independent and affordable access to space; (b) a broad research and technology base, with industrial capability for designing, manufacturing, and operating satellite systems; (c) an adequate ground infrastructure; (d) a regulatory framework for harmonious development of the information society; (e) organised market access and an export control regime.

The three inter-linked specific objectives of the new European Strategy for Space are:

- Strengthening the foundation for space activities, for example by improved space technology, and independent, affordable access to space;
- Enhancing the scientific knowledge underlying space activities, for example by space exploration, and study of global change;
- Reaping the benefits for markets and society, through a demand-driven exploitation of the opportunities offered by space technologies.

To date, most of Europe's efforts have focused on the first two objectives, with ESA as the main protagonist. However the third objective – reaping the benefits for markets and society – is a key new element, as it reinforces the role of the EC by using its considerable political and regulatory powers to promote space projects of Europe-wide interest and in support of Community policies. The three main application areas within this new objective are: (a) satellite communications; (b) a civil global navigation satellite system (i.e. GALILEO); (c) an observation system for global monitoring for environment and security (i.e. GMES).

Satellite communications are already a huge, well-established, market-driven application area. GALILEO, a joint programme by the EC, ESA, and the Member States, is currently in the definition phase. The GMES initiative, however, has the biggest potential implications for the European remote sensing community, as it is intended to provide a broad framework for defining Europe's information requirements on environment and (civil) security. This in turn should create the political momentum to bring together all the main organisations and actors in the European space sector, to work on satellite initiatives and projects of European-wide interest. The objectives of GMES are: (a) to be an operational source of strategic information

on the global environment, provided by Europe; (b) to serve national and European policy-makers in support of the development and implementation of environment and security policies. The GMES initiative is organised at three levels:

- A task force that provides the European Strategy for Space context;
- An eleven-member partnership made up of the main European space organisations (including ESA and the EC);
- Technical working groups that address the observation and reporting requirements of policy-users in three domains: environmental conventions (e.g. the Kyoto Protocol); environmental stress; natural disasters.

The next main step in the European Strategy for Space, as proposed in the joint document, is the establishment of a High-Level EC-ESA Joint Task Force, whose tasks will include setting up ways for Member States to review the strategy and its implementation, elaborating framework arrangements for managing joint space projects, and formulating a coherent approach for candidate countries. Following the joint EC-ESA strategy document, a Space Symposium on GMES was held on 16-17 October 2000 in Lille, France (see report in this issue – Section 3.2.2).

The joint EC-ESA document on a European Strategy for Space can be downloaded from the following web-site: europa.eu.int/eur-lex/en/com/pdf/2000/com2000_0597en02.pdf. For more information on GMES, go to gmes.jrc.it.

3.2.2 Space Symposium on GMES in Lille, France

Geoff Sawyer, DG-JRC, Co-ordination of Space Activities Unit, Brussels, Belgium

Global Monitoring for Environment and Security (GMES) was the subject of the recent Space Symposium "Monitoring and Protection of the Environment", in Lille, France, on 16-17 October 2000. The Symposium was organised by the French Presidency of the European Union. Around three hundred people attended the two-day meeting, to hear presentations and discussions from experts in the fields of environment and global monitoring.

The meeting marked a significant event, following the adoption by the European Commission of a Communication on a European Space Strategy, which features GALILEO and GMES as two prominent pillars for the EU future in space. Mr Roger Schwartzenberg, French Minister for Research, who took the initiative to organise the meeting, offered congratulations to ESA and the EC for the successful preparation of the Communication.

Indeed, one of the objectives of this meeting was to build upon the success of the Communication, and in particular the inclusion of GMES as a topic representing a significant political step forward. Mr Bensoussan (President CNES) expressed the view that GMES could contribute to gathering together the political views by focussing them on the topic. It would be necessary to co-ordinate all the actors, at European level. Mr Allgeier (outgoing Director General EC/JRC) added that the various players all had their roles to play and that, since they would need to meet in different configurations, a flexible structure would be necessary.

On day one, the meeting focused on technical aspects of GMES. Presentations were made under three themes: global change; environmental stress; disasters. As Mr Allgeier noted in his opening address, these themes have been considered in the recent Communication as a means to analyse GMES, and so he welcomed this structure to the meeting. Many speakers talked about the need for global information to support treaty monitoring, to support analysis of conflict risk, or to support humanitarian missions. There was also widespread support for making better use of existing satellite observation systems, as a means of gathering such global information. A fourth session concluded the first day with a series of views on existing space and ground-based systems for monitoring the environment.

On day two, there were two round-table discussions, on "User Requirements" and

on "Technical and Institutional Answers". Beforehand, some views were given from two perspectives. Mr Lames of the Western European Union (WEU) said that the WEU satellite centre, which already prepares dossiers in support of humanitarian actions, would be put at the disposition of the EU as well as the Member States. Mr Perera (European Commission, DG – Environment) said that his organisation makes little use of satellite imagery but that there are many aspects of environment policy that could benefit from global monitoring information, and that this could only be for the benefit of European citizens.

It became evident that GMES means different things to different people. Indeed this may be why it has attracted so much interest – from the space community (as evidenced by this meeting) and from the policy-makers in various political frameworks. When members of the panel were asked to explain their views on GMES, it became clear that these differ markedly. For some, the global component is important, reaching outside Europe into an international framework. For others, GMES represents an opportunity to establish European independence

European Commissioner for Research, Mr Busquin, expressed his pleasure at the support being given to GMES, and confirmed that research would continue to be a driver for space-based observation. He also noted that the success of GMES would depend on continued and effective co-operation between the European Commission and ESA. Lord Sainsbury, President of the ESA Council, expressed his optimism that the process would both link the political and strategic elements of space-related policies, and bring in the user interests at an early stage. Mr Yllief, Government Commissioner in Charge of Scientific Research, Belgium, said that he wished to see further progress under the Belgian presidency in the second half of 2001, and that, as had been indicated by Mr Liljelund of the Swedish Environment Protection Agency, this could be linked to an effort under the Swedish presidency, in the first half of 2001.

Mr Schwartzenberg then closed the meeting by offering his conclusions from the discussions. He called on his fellow ministers in the EU Council to demand that the EC together with ESA put in place a high-level task force to develop further the strategy, and by mid-2001, to prepare concrete proposals for GMES.

3.2.3 New ITEP Network for Humanitarian Demining

Dr. Alois Sieber, DG-JRC, Institute for Systems, Informatics and Safety, TDP Unit, Ispra, Italy

On 17 July 2000, a Memorandum of Understanding was signed between the Joint Research Centre (JRC) on behalf of the European Commission, the Ministry of Defence of Belgium, the Department of National Defence of Canada, the Ministry of Defence of the Netherlands, the Ministry of Defence of Sweden, the Secretary of State for Defence of the UK, and the Department of Defence of the USA, for the International Test and Evaluation Programme for Humanitarian Demining (ITEP). The Ceremony took place at the Belgian Royal Military Academy, in the presence of EC Commissioner Philippe Busquin and Belgian Defence Minister André Flahaut, and high-ranking representatives from ITEP member states.

The ITEP secretariat was inaugurated on 23 October 2000 in Ispra by Mr. Herbert J. Allgeier, outgoing General Director of the JRC, and Mr. Robert Doheny, Principle Director, USA Department of Defence. It is hosted by the JRC's Institute for Systems, Informatics and Safety (ISIS). A brief description of the ITEP network is provided below.

What Is the ITEP Network for Humanitarian Demining?

ITEP is a global network of test and evaluation capabilities for measuring the performance and suitability of humanitarian demining equipment, systems and methods. It aims to strengthen worldwide demining efforts by providing for the efficient generation, collection and distribution of independent and scientifically-based test and evaluation data.

The purpose of the ITEP network is to foster and enhance co-operation in the international research and development (R&D) community, by supporting the procurement of better, safer and more cost-effective equipment as a contribution to solving the global problem of land-mine detection and clearance. ITEP will assess existing standards for testing and evaluating demining technologies, and will facilitate the creation and adoption of new ones. This initiative, in line with the philosophy of the European Research Area initiative of Commissioner Busquin, will meet some of the needs identified at a recent high-level meeting with representatives from EU Member States, European Parliament, European Commission, European industry, and the research community:

- A better co-ordination between EU and national programmes both for research and for operational mine clearance actions.
- An improved strategy to accelerate the path from research and development towards the deployment of new equipment in the field.

The origins of ITEP date back to the Washington conference on Humanitarian Demining in May 1998, when the European Commission and the US Department of State, supported by the United Nations, announced their readiness to collaborate in the field of RTD support for demining tools. Among the key areas for collaboration was the project to establish an international network of test and evaluation facilities for demining technologies. This first announcement was re-emphasised at the international conference on demining technologies at the European Commission's Joint Research Centre in September 1998. Since then, other countries such as Canada, Netherlands, Belgium, Sweden and UK joined this US-EC initiative, with the aim of drafting a relevant programme.

JRC's Role in ITEP

As the focal point for all ITEP activities and the host of the central ITEP secretariat, the European Commission's Joint Research Centre facilitates and co-ordinates ITEP working meetings. The JRC operates key facilities, which will be an integral part of ITEP - e.g. the European Microwave Signature Laboratory (EMSL), the European Optical Goniometer (EGO), the Karl-Friedrich Gauss laboratory and the outdoor test range. These facilities will not only be used for the testing and validation of technologies, but will also serve as a reference for other facilities requesting certification.

Croatia, Bosnia-Herzegovina, Cambodia and Mozambique have approached the JRC, informing it about test ranges either under construction or ready for use. These countries are requesting JRC's assistance for helping them to become associated partners to ITEP.

ITEP Results So Far

ITEP has already supported two projects at the request of the deminers' community:

- The support of a systematic test of metal detectors on request by the UN mine action centre for Afghanistan, independently of any specific country or project.
- The completion of a pilot project for the systematic performance assessment of nearly all metal detectors available on the market.

Persons to Contact

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- Hosting Institute at JRC, Ispra: ISIS (Institute for Systems, Informatics and Safety), TDP (Technologies for the Detection and Positioning of Anti-Personnel Land-Mines) Unit. Head of Unit: Dr. Alois J. Sieber. Telephone: +39-0332-789089. Fax: +39-0332-785469. E-mail: alois.sieber@jrc.it.

3.2.4 Annual MARS Conference in Dublin, Ireland

Guido Lemoine, DG-JRC, Space Applications Institute, ARIS Unit, Ispra, Italy

The 6th Annual Conference on "Control with Remote Sensing of Area-Based Subsidies" will be held at Jurys Conference Hotel, Dublin, Ireland, on 16-17 November 2000. This year's conference, for which participation is restricted to those in-

volved in the control programme, has drawn over 170 delegates from Member States administrations, commercial companies, image suppliers, research organisations and the European Commission (EC). The conference, which always takes place at the end of the agricultural "campaign", highlights the latest developments in the programme and related techniques. It will also, for the first time, give the floor to selected EU candidate countries to present their activities in this field. This is also the first time the conference has been held outside Italy, allowing the participants to co-celebrate the Centenary of the Irish Department of Agriculture, Food and Rural Development.

The "Control with Remote Sensing of Area-Based Subsidies" programme is part of the obligatory control measures that the fifteen EU Member States have put into effect as part of the Integrated Administration and Control System (IACS) for the management and monitoring of the expenditures of the European Agricultural Guidance and Guarantee Funds (EAGGF). Under the regulation establishing the IACS (EU Reg. 3508/92), Member States commit themselves to control a pre-determined percentage of the farmers' applications for area aid under the EAGGF, which are made on an annual basis. Since 1994, the EC has introduced the use of "remote sensing" imagery, both from airborne and satellite sensor systems, as a possible method to support this control.

The use of remote sensing was initially tested on an experimental basis, but became rapidly a well-established method. The firm establishment of the "Control with Remote Sensing" was confirmed from 1999 onwards, when EC co-funding for the contractual work ended (the EC continues to fund the supply of satellite imagery). In that year, more than 5.5 million hectares were checked with the help of remote sensing, at an overall cost of approximately twenty-six million Euro. As of the 2001 campaign, thirteen EU Member States (except Austria and Luxembourg) participate in the "Control with Remote Sensing" programme, and the total area checked is still increasing (although at a slower rate than earlier in the programme).

The principle of using remote sensing imagery for control of area-based aid applications is relatively simple. The location, area and cultivation of the agricultural parcel, as indicated by the farmer in his application, is compared with recent imagery. For the check on the parcel area, the parcel outline is compared with the outline on the image, preferably that with the best image detail (resolution). In many countries, airborne digital ortho-photos of 1m resolution or better are used for this purpose. For the identification of the cultivation, a series of satellite images, either optical and infrared or from "active" radar sensors, is acquired and analysed for the typical spectral signature that is expected for the particular cultivation. The results are used to direct the field inspector to those cases that require particular attention. It is important to realise that "Control with Remote Sensing" is never used to directly sanction an applicant. However, remote sensing serves as an optimisation technique that "filters" out cases where irregularities, whether intentional or not, are identified. For the technique to be cost-efficient relative to "conventional" techniques, it must adhere to a number of strict operational requirements (e.g. timely delivery of the data, use of quality processing procedures, rapid dissemination of analysis results).

The programme itself is a rather unique collaboration effort, in which Member States administrations, commercial data distribution and value-adding companies, and the EC, are closely involved. As it is strongly focused on the introduction of the latest technologies in digital (space) imagery, and the use of advanced information technology, while being closely linked to the policy-making process of the European Common Agricultural Policy, it has become a programme with a sound basis and a bright future. In this respect, the recent introduction of GIS into the IACS (Council Regulation 1573/2000, 17 July 2000), the ongoing move towards very high resolution digital imagery, the use of internet data distribution and capturing technology, and further improvements in cost-efficiency, all point to a further consolidation of the programme in the next years. Finally, a new challenge for the programme is the introduction of the IACS and related con-

trol measures in the EU candidate countries, in preparation for their imminent accession to the EU.

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3.2.5 Activities on International Humanitarian Aid

Daniele Ehrlich, DG-JRC, Space Applications Institute, SSSA Unit, Ispra, Italy

This article describes the new Crisis Preparedness and Humanitarian Aid activities at the JRC's Space Applications Institute, as part of the GMES initiative. The aim of the activities is to improve the preparedness for crises and the efficiency of humanitarian aid missions, by conducting research in the provision of: (a) geo-spatial data; (b) information systems, using appropriate information technology; (c) ad-hoc analysis of geo-spatial data. These activities contribute to EC services operating outside the territory of the EU, and to International Organisations and non-governmental organisations operating in the Developing World

Background

Natural and man-made crises are occurring at an increased rate. Recently compiled statistics indicate that the number of reported crises have increased exponentially from just a dozen in the first decade of the 1900s to almost 500 in the 1990-96 time frame. These statistics may be influenced by the improved information flow we now have - as opposed to 100 years ago - of events occurring in remote areas and the immediate broadcast of such events across the globe. Also, the loss of life and core assets following a disaster are greatly increased today as a result of our highly developed and populated landscapes, often concentrated in hazard prone regions such as coastal areas.

The world community is responding to crises with humanitarian relief missions in the aftermath of a crisis. Development programs aim at preparing mitigating measures in crises prone areas. In 1994 the European Commission formed the European Commission Humanitarian Office (ECHO) aiming to bring immediate relief to people during times of crisis. Currently the EU, including ECHO and the aid programs of the EU member states, is the main international aid donor.

Why Geo-spatial Data?

Effective prevention and preparedness is based on having advanced information; a part of this is geo-spatial information. Often, this information is in short supply especially in developing countries. The provision of accurate and updated geo-spatial information can significantly contribute to improve the efficiency of humanitarian disaster relief missions. Also, geo-spatial information is increasingly used in combination with socio-economic data to provide indicators of environmental resource crisis and sustainable development. This can form part of the information presented to decision makers for resource allocation for crisis preparation and mitigation.

Role of the JRC

The aim of the JRC's Crisis Preparedness activities is to make geo-spatial information available to decision-makers and field officials. The latest spatial information technology is used to assist in the early warning of and the response to crises, by providing tools to officials involved in the prevention, emergency, rehabilitation, and reconstruction phases of humanitarian crises. This technology includes Earth Observation as a data collection methodology, satellite navigation for positioning, and satellite telecommunication and the internet for data transfer. Data collected by these means, together with data collected by traditional methods, are then stored, managed, processed and visualised within an information system, thus providing ready-to-use information. The current work is centred on compiling coarse-scale maps of large parts of developing countries, accessible by internet. Finer-scale studies are conducted in the Southern Balkans, with particular attention on Kosovo, and on the Great Lakes Region of Africa, with a focus on Rwanda.

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3.2.6 Satellite Mapping of Surface UV Radiation

Jean Verdebout, DG-JRC, Space Applications Institute, SSSA Unit, Ispra, Italy

Ultraviolet (UV) radiation affects human health and biological activity in general. This has become a much discussed issue, due to the stratospheric ozone depletion which induces an increase in the UV radiation at the Earth's surface. Medical studies show a considerable increase in the occurrence of skin cancers during the last decade. The link with ozone depletion is far from evident. The reason is most probably a change in people's behaviour with respect to exposure to the sun. The fact remains that to support epidemiology studies and to contribute to general public information, there is a need to document better the geographical and temporal variability of surface UV radiation. It is also more and more evident that the level of UV radiation has substantial impacts on some biological systems (e.g. phytoplankton productivity, mortality of fish larvae, effects on higher plants).

The efficiency of radiation with respect to these various effects is strongly dependent on wavelength. Medical researchers and biologists have therefore determined "action spectra", with which the spectral irradiance is weighted to obtain radiative quantities (dose rates) that adequately measure the radiation intensity for the studied effect. For instance, the intensity related to sunburn is usually measured as the CIE87 erythemal dose rate (CIE87 identifies a standard action spectrum). Other commonly used action spectra relate to skin cancer (SCUP-h), DNA damage and effect on plants. In order to estimate the various dose rates, it is necessary to perform spectral measurements. However, UV spectro-radiometers are delicate instruments that require permanent care to maintain a good calibration. The number and density of such ground instruments are and will remain limited. This is where mapping techniques using satellite data can help, by providing a better geographical coverage, although ground networks will continue to provide the reference in terms of accuracy.

JRC-SAI has initiated an activity in this field in the framework of the MAUVE project, supported by DG Research during the 4th Framework Programme. It is now continued as part of the JRC institutional work and in the context of the new UVAC European project, aiming at assessing the effects of meteorological conditions on the stocks of Arctic cods. MAUVE has gathered a number of partners developing space-derived information on UV radiation, and a number of laboratories performing ground measurements. A major task in MAUVE was to assess the quality, accuracy and usefulness of the satellite-derived UV maps, in particular by comparison with ground measurements. In this framework, a UV map product has been developed that uses the specific space stratospheric ozone sensors (i.e. TOMS and GOME) for the total column ozone and the METEOSAT / MVIRI data for estimating the cloudiness. The modelling also takes into account the aerosols (using ground observations of visibility), the altitude and the surface albedo. European maps have been generated on an area extending from 34 to 74 degrees North, and from 12 degrees west to 32 degrees east. A regular grid in latitude and longitude, with a 0.05 degree resolution, was chosen. It roughly corresponds to the typical resolution of the METEOSAT images over Europe.

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3.3 Alliance of Europe's National Mapping Agencies

A new organisation has been established in order to strengthen the co-operation between the National Mapping Agencies of Europe. The proper economic, social, and commercial development of our world depends upon the availability of good information. To meet the expanding demands for geographic information at national, Eu-

ropean, and global levels, the infrastructure for handling it has to be improved. The new organisation will play an important and active part in this work.

Demands for adequate geographic information have increased enormously over recent years, driven by technological developments but also by changes in the expectations of society. Interest in environmental control, cultural heritage, ecology, and sustainable use of natural resources and energy, as well as a rapidly expanding service-sector, means that geographic information is urgently needed for a range of analyses and decision supports. More and more information is needed on a European and global level, so that problems of harmonising data across national borders must be addressed. Answers to questions about technical standards, and information about the availability of data, are urgently required. So too is the creation of a highly accurate framework of positions to which all other "geography" can be linked.

CERCO (Comité Européen des Responsables de la Cartographie Officielle) was founded twenty years ago and represents the Heads of thirty-seven of Europe's National Mapping Agencies. The organisation provides a forum for sharing experiences between the national agencies, and the development of solutions to common problems including quality systems and questions of copyright. In 1991 CERCO established MEGRIN (Multi-Purpose European Ground-Related Information Network) to manage pan-European projects, including the establishment of harmonised geographic databases and the development of Web-based metadata services. Over half of CERCO's Members are also members of MEGRIN.

The new organisation can be considered as a merger between CERCO and MEGRIN, and its creation was driven by a desire to make as easy as possible contact with the users of geographic information, and their understanding of how their needs can be satisfied. It was also felt that a single administration of the two previous partners would be more efficient. This important organisational change was made in Malmö, Sweden, where CERCO and MEGRIN had their General Assemblies on 9-14 September. The newly created non-profit association under French law will be based in Marne la Vallée, outside Paris. (Coincidentally, this is also the location of the 21st EARSeL Symposium and General Assembly next May). Thirty-three countries registered as Founder Members and it is hoped that the other four will join soon. Between General Assemblies, a Management Board of seven elected members will lead the organisation. President for the coming year is Dick Kirwan, Director of Ireland's Ordnance Survey. Vice-Presidents are Jean Poulit, Director General of IGN France, and Joakim Ollén, Head of Sweden's Lantmäteriet.

The organisation will form a bridge for cooperation between the national producers of fundamental geographic data, but also with other potential contributors in both the public and private sectors. "Good geography comes from the sharing of information and skills, not from competition," says CERCO's Secretary General John Leonard. For more information, see: www.cerco.org/REPORTS/Neworg_press.html.

3.4 Launch of On-line Baltic Environmental Atlas

Anyone with a standard web browser can now create environmental maps of the Baltic Sea Region. At the Baltic Environmental Atlas web-site (maps.grida.no/baltic), visitors can choose themes such as land use and population density, and display them along with other features of interest on customised maps. The new service concentrates on factors related to the problem of eutrophication, which threatens biodiversity, reduces fish catches, and damages the recreational potential of coastal areas. Eutrophication is considered to be one of the most serious environmental and economic problems in the Baltic Sea. The Baltic Environmental Atlas draws on data from one of the most popular environmental web-sites in the region over the last five years – i.e. the Baltic Sea Region GIS, Maps and Statistical Database (www.grida.no/baltic). It was developed by GRID-Arendal, a United Nations Environment Programme (UNEP) information centre, as part of the Baltic Online Interactive Geographical and Environ-

mental Information Service (BOING) project, funded by the European Union.

For more information, please contact: Hugo Ahlenius, Project Manager (telephone: +47-37035713; e-mail: ahlenius@grida.no), or Sindre Langaas, Project Co-ordinator (telephone: +46-8-7908612; e-mail: langaas@grida.no). See also these web-sites: maps.grida.no/baltic (Interactive On-line Mapping Tool for the Baltic Region); www.grida.no/boing (the BOING project); www.grida.no/baltic (Baltic Sea Region GIS, Maps and Statistical Database); www.grida.no (GRID-Arendal).

3.5 Demonstration CD-ROM of SPOT-4 Vegetation

The Vegetation instrument was launched in March 1998, on board the SPOT-4 satellite. VITO, the image processing and archiving centre located in Mol, Belgium, acts as co-ordinator of the Vegetation Production Entity, and operator of the Vegetation Image Processing and Central Archiving Facility (CITV). The entire Vegetation archive is freely accessible at two web-sites: www.spot-Vegetation.com and www.vgt. vito.be. Vegetation imagery can be acquired through a worldwide network of commercial distributors. The recent approval of the Vegetation-2 programme further guarantees continued access to a centralised and long-term Vegetation image archive, up to the year 2008 and beyond. The Vegetation programme is an initiative of the European Commission and the space agencies of Belgium (OSTC), France (CNES), Sweden (SNSB) and Italy (ASI).

A demonstration CD-ROM, "An Eye on the World", is now available, which contains: an animation showing the seasonal variation of the world vegetation; sample images of the Vegetation instrument; two standard Vegetation products in HDF format; the FreeLook 2.0 software to view standard Vegetation products; two Vegetation screen-savers; information on the production entity; contact to commercial distributors to order Vegetation products. To obtain your copy of the CD-ROM, contact Dirk Van Speybroeck, Co-ordinator of the VGT Production Entity (e-mail: vito@vito.be).

3.6 EOS Unveils New Catalogue of Earth Images

The Earth Observing System (EOS), the centrepiece of NASA's Earth Science Enterprise (ESE), recently unveiled a new, centralised catalogue of NASA Earth Science-related images, called "Visible Earth" (web-site: visibleearth.nasa.gov). Visible Earth is a searchable directory of images, visualisations and animations of the Earth, that acts as a portal to the distributed collection of Earth images and data visualisations that NASA and affiliated institutions produce and store digitally. Visible Earth will ultimately provide one-stop search and retrieval access to the super-set of these images, gathered from EOS and Earth Enterprise missions.

3.7 New Address for EARSC Secretariat

The Secretariat of the European Association of Remote Sensing Companies (EARSC) has moved to the offices of Telespazio in Rome. The new address is: EARSC Secretariat, c/o Telespazio SpA, Attn. Mr. Giovanni Cannizzaro, Via Tiburtina 965, 00156 Rome, Italy. Telephone: +39-06-40793384. Fax: +39-06-40793843. E-mail: maura.valentini@telespazio.it. Web: www.cs.telespazio.it/earsc.

4 RS DATA, PRODUCTS AND PROJECTS

4.1 Observations

Wim Bakker, ITC, The Netherlands.

Apologies

For those of you who missed a contribution by my hand in the last Newsletter, I sincerely apologise, I didn't have time for it. The problem with this apology is that I show I didn't have time for you, dear reader. And to show a person that you don't have time for him is a form of disrespect. We have that a lot nowadays, disrespect. So now I have to apologise for my apology, I will not do that anymore.

You know, I'm quite surprised by the positive reactions I get from readers. There seems to be a wide interest in this type of article, when a lot of recent events pass by in quick succession. Personally I don't consider my articles of much weight, and you may have noticed the light-hearted and mildly critical tone that I use. But I can assure you that it is not easy to find a good balance in presenting the technological facts by regarding them with a sense of humour (why should technology or science be dry as death?). It is easy to overstep borders and create a truly malicious tone. I surely hope you understand that it never was my intent to insult people. I always like to think of the world as a global village, one whole, and whenever I show criticism it is meant for everybody, not just you alone.

Then you may wonder why I bother writing these articles at all. My answer could be, simply because I was asked to. But there's more, I write these articles because I care, not about being famous, but about the world and humanity. And I care about telling people what is going on in the world in that specific field that I happen to specialise in, just because it has my interest. I can only hope that some of the things I write are indeed useful for some other caring persons. If not, an occasional smile would already be perfect. What more can a person hope for? If an occasional bad string is pulled, please don't shoot the player. The following quote, by Stealers Wheel, "We know that you believe you understand what you think we said, but we're not sure you realize that what you heard is not what we meant", summarises it rather well, I believe.

Software, Errors and Data

OSSIM: As reported in September's Newsletter, OSSIM, the Open Source Software Image Map experiment by ImageLinks, Florida Tech, and US Federal agencies was launched in May 2000. OSSIM, pronounced "awesome", focuses on development of tools for the processing and mapping of high-resolution data. Open Source software development is a paradigm shift, and thrives on joining forces in the Web community. Other Open Source initiatives, such as Linux, have proved to be very successful, and show a large acceptance combined with a high quality. Information about the project, together with other goodies, can be found at the ImageLinks web-site: www.RemoteSensing.org. Check it out!

NASA error: NASA is no fun anymore, it's so easy to bash NASA nowadays. Listen to this, NASA made a $590 million bookkeeping error in its 13,665 million dollar 1999 financial report. They can keep track of the tiny spacecraft Pioneer-10, which is about 11.34 Gkm -10.5 lighthours!- away from Earth to within 0.1% accuracy, but they can't keep track of more than 4% of their total budget, which to a mere mortal is like a megaton of Dollars! The mistake is blamed on "human error". Sure NASA. Put the blame on US again, thank you very much!

Russian 1-metre: Next to the two-metre resolution data acquired by Russian spaceborne cameras, now also one-metre resolution data will be made available commercially by Sovinformsputnik. The data covers substantial areas of the United States, Europe, Middle East and parts of South America and Asia. The one-meter imagery is archived material taken by various satellites from the 1980s through 1999.

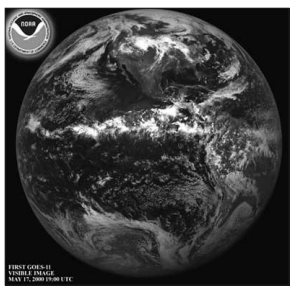
The data will be made available through www.CentralTradingSystems.com. More information on the satellite systems can be found at www.Sovinformsputnik.com. Yet another deposit for data mining!

Launches

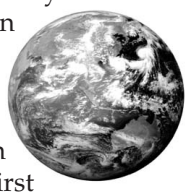
MTI: MTI, launched 12 March 2000, has completed its orbital checkout phase and has started to provide images. During its three-year mission, the MTI satellite will periodically record images of participating government, industrial, and natural sites in fifteen spectral bands, ranging from visible

to long-wave infrared. Only three of the bands are visible to the human eye. This image shows the interchange of US Interstates 25 and 40 in Albuquerque, New Mexico. More images at: www.sandia.gov/media/NewsRel/NR2000/images/mti_images.htm.

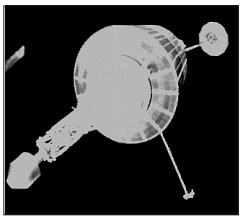
GOES-L: GOES-L was launched 3 May 2000, and has already delivered its first image. Now renamed GOES-11, it will be stored in orbit and will replace either GOES-8 or GOES-10 as needed. The new series of GOES satellites provides significant improvements over the previous GOES system in weather imagery and atmospheric sounding information. GOES I-M represents the next generation of meteorological satellites and introduces two new features. The first feature, rapid scan operations (RSO), offers small-scale area imaging that lets meteorologists take pictures of local weather trouble spots. RSO is a mode in which the GOES satellite can provide images over the conterminous US region approximately every 7.5 minutes. This doubles the number of GOES images generated per hour. This floods meteorologists with data, allowing them to improve short-term forecasts over local areas. The second feature, simultaneous imaging and sounding, is designed to allow weather forecasters to use multiple measurements of weather phenomena to increase the accuracy of forecasts.



Fengyun-2B: China successfully launched the Fengyun-2B on 26 June 2000. FY-2B is an improved version of the original Fengyun-2 satellite, FY-2A launched by China in 1997. That satellite was the first geo-synchronous orbit weather satellite launched by China. Previous weather satellites by China had been placed in lower sun-synchronous orbits. While the Fengyun-2 series is designed to operate for three years, FY-2A shut down in August 1999, depriving Chinese meteorologists of a view of weather systems from geo-synchronous orbit. The Fengyun-1C satellite, launched into Sun-synchronous orbit in May 1999, had filled the gap to some degree until Sunday's launch. In the meantime the satellite has seen the "first light" and is delivering images. In this image, Australia stands out prominently in the IR "first light" image. Tropical Storm Tembin, near Japan, is seen at the top right. Image resolution in IR and WV channels is about 5km at the sub-satellite point.



SNAP-1: A Russian Kosmos rocket successfully launched a trio of Russian, Chinese, and British satellites on 28 June 2000. The primary payload of the Kosmos rocket was a Nadezhda-M navigation satellite. Two small satellites, both built by British company Surrey Satellite Technology Ltd. (SSTL), were also placed into orbit as secondary payloads. One, Tsinghua-1, was a joint venture with China's Tsinghua University, while the other, SNAP-1, is considered by the company to be Britain's first



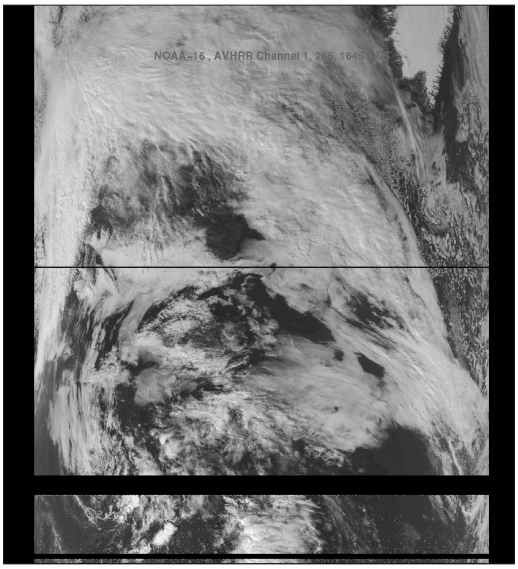
nano-satellite. Tsinghua-1 carries a camera capable of 39-meter resolution images in three spectral bands. SNAP-1, dubbed the "world's most advanced nano-satellite" by the company, packs a full-featured satellite, including camera, GPS-based navigation, propulsion, and computer systems, into a package that weighs just 6.5 kg. In addition to Earth imaging, SNAP-1 will rendezvous and fly in formation with Tsinghua-1, the first time such formation flying has been attempted in orbit. The first pictures taken in orbit by SNAP-1 show the Russian Nadezhda COSPAS-SARSAT satellite just two seconds after deployment when the spacecraft were approximately 2.2m apart (see below). US defense officials are already eying the tiny British satellite, saying that "some of the innovative technology on the spacecraft would be useful for future military missions".

BIRD-Rubin: Germany's CHAMP mini-satellite was launched on 15 July 2000 from Plesetsk. CHAMP is a geophysics research satellite operated by GFZ, the Potsdam geophysics centre to study the magnetic field and the gravitational field. Along with CHAMP were launched MITA, an Italian Space Agency experimental micro-satellite built by Carlo Gavazzi Space of Milano, and Rubin, a micro-satellite to measure launch vehicle parameters developed by OHB and students of the Hochschule Bremen. Rubin is also called BIRD-Rubin in some references, but confusingly seems to be NOT related to the BIRD micro-satellite originally slated for this launch. Can somebody, please, tell me whether this particular satellite does have an imaging sensor or not and at what resolution? I'm confused.

Mightysat-2.1: Mightysat, launched 19 July 2000, is a small, multi-mission satellite. Among a multitude of instruments is the Fourier Transform Hyperspectral Imager (FTHSI), which is capable of recording images in 256 spectral bands over a wavelength range from 350 to 1050 nanometres, at a resolution of about fifteen metres. Mightysat is a military satellite for "support of military planning and field operations". Do I hear people from the civil hyperspectral community drooling over their keyboard? Don't despair, the Earth Observing-1 spacecraft will be launched real soon!

Ziyuan-2: A Long March rocket successfully launched China's newest remote sensing satellite on 1 September 2000. The satellite, called Ziyuan-2, meaning "resource", is the second in the series of Ziyuan remote sensing satellites. The first satellite, also called CBERS-1, launched last October, was a collaborative project between China and Brazil. The newly launched satellite, however, is not the successor to CBERS-1. The second CBERS satellite is not expected to go into space until the end of next year. ZY-2 will be used primarily in territorial surveying, city planning, crop yield assessment, disaster monitoring, and space science experimentation. It is believed to have a resolution of five metres.

NOAA-L: NOAA-L, now called NOAA-16 was launched 21 September 2000. It has already delivered its first image (see below: the white area in the upper right is Greenland). NOAA-16 will primarily provide long-range weather forecasting. It will operate in tandem with currently orbiting



NOAA satellites. NOAA-L will ensure that non-visible data, for any region of the Earth, is no more than six hours old. More information on NOAA-16 and the other satellites of the Polar Operational Environmental Satellites system, is at: POES. gsfc.nasa.gov.

TiungSat-1: A Russian Dnepr booster, a converted ICBM, successfully launched

five micro-satellites on 27 September 2000. One of the satellites is the 54-kg TiungSat-1, built by Surrey Satellite Technology (SSTL) for the Malaysian company Astronautic Technology for remote sensing work. Another successful satellite launch, the third this year, takes Surrey's spacecraft launched into orbit to a total of nineteen, achieving an average of one per year over the nineteen years since the launch of UoSAT-1 in 1981. The sensors have a resolution of 80m and 1.2 km. The satellite also carries a cosmic-ray experiment.

Kometa-20: Kosmos-2373 was launched on 29 September into a low Earth orbit. The satellite is the twentieth Kometa mapping payload. It is described as a dual civil-military geodetic mission. The first Kometa (Kosmos-1246) was launched in February 1981. The previous flight was Kosmos-2349 in February 1998. I suspect that this one is to deliver new data to be sold by the US Aerial Images company. See www. SPIN-2.com and www.TerraServer. com.

Future Launches

This is what we may expect in the near future. A hyperspectral mission by Earth Observing-1 to be launched on 16 November 2000, together with the SAC-C scientific satellite from Argentina. New high-resolution satellites: QuickBird is scheduled for 30 October 2000, EROS-A1 for mid-November. And more mini-satellites in December, when BADR-B and Maroc-Tubsat may be launched together with the Meteor-3M-1 satellite.

The Rest

Apart from the dropping prices for Landsat-5 data, satellites dropping from the sky, rockets that go to smithereens creating a cloud of debris of about three hundred pieces, a meteorite that smashes a car windshield, the first web-server in space, and a new theory about the origin of life, there's not much else to report, so I say goodbye for now. Got to run. Take care, and watch you head! This image shows the largest known iron meteorite, which was discovered at Hoba Farm near Grootfontein in Namibia…

4.2 Article: Demystification of IKONOS

(Editor's note: This article was first published in Earth Observation Magazine, Vol. 9, No. 7, July 2000. The article is reproduced in the EARSeL Newsletter by kind permission of the authors.)

Dr. Thierry Toutin, Canada Centre for Remote Sensing, Canada, and
Dr. Philip Cheng, PCI Enterprises, Canada

IKONOS, the commercial satellite with the highest publicly available resolution, was successfully launched in September 1999. The satellite's sensor can generate one-

Sample image of IKONOS data of Richmond Hill, Ontario, Canada

Sample 1:8000 scale aerial photo of Richmond Hill, Ontario, Canada

metre panchromatic and four-metre multi-band images with off-nadir viewing up-to-60° in any azimuth, for a better revisit rate and stereo capabilities. The high-resolution imagery that IKONOS provides theoretically will have "unlimited" uses in a number of markets (including state and local government) and in various applications such as mapping, agriculture, forestry, and emergency response. Instead of using aerial photos, highly detailed maps of entire countries can be frequently and easily updated using this data. Farmers can monitor the health of their crops and estimate yields with greater accuracy and over shorter intervals. Scientists can look at environmentally sensitive areas and predict trends with greater certainty. Government officials can monitor and plan more enlightened land use policies. City planners can further the development of new housing communities with greater precision and attention. In short, the potential uses for IKONOS imagery are limited only by the imagination.

What Do We Expect from IKONOS?

Largely extrapolated on results from similar systems mounted on aircraft or Space Shuttle platforms, IKONOS images have shown a very high potential for national mapping. The main attraction for the user community is the one-metre pixel, which enables the extraction of objects appearing in most digital mapping products. Users may expect sub-pixel accuracy (as done with earlier satellites such as SPOT and Landsat), but are these accuracy expectations too high? The off-nadir viewing capability is also an important characteristic of IKONOS, as it improves the revisit rate of the same ground area to between two and three days, and also (theoretically) enables the acquisition of stereo images. Users should then apply traditional photogrammetric techniques with these stereo images to extract planimetric and altimetric information, such as a digital elevation model (DEM). Are these stereo data available?

What Do We Obtain from IKONOS?

IKONOS data is produced for five different product levels, and is available at five different prices. Table 1 shows an example of the basic panchromatic product. Extra charges will be applied for additional special products or services. IKONOS is distributed in 8-bit or 11-bit GeoTiff format with ASCII metadata file (including order parameters and also source image and products file descriptions). A minimum order of US$ 1000 for North America and US$ 2000 for international is required. Following confirmation, delivery of orders that are available from archive typically takes several days to just over a week. Delivery of newly collected data typically takes two or more weeks, depending upon order-size, weather, accuracy, and both ground control points (GCPs) and DEM acquisition time.

Product code	CE90 accuracy	Price for North America	Price for international
Geo	50 m	$12	$29
Reference	25 m	$29	$73
Map	12 m	$39	$98
Pro	10 m	$49	$122
Precision	4 m	$66	$149

Note: CE90 is the circular positioning accuracy with a confidence level of 90%. Prices are in US$ / sq. km.

Table 1: Detailed prices for basic panchromatic product from Space Imaging web-site (www.spaceimaging.com)

The Geo product, which is the most affordable but offers the lowest positioning accuracy, is not corrected for terrain distortions. It has an accuracy of fifty metres CE90, which means that any point within the image is within fifty metres horizontally of its true position on the earth's surface, ninety per cent of the time. Accuracy becomes worse in mountainous areas if the images are acquired with off-nadir viewing, which is quite common for the IKONOS data. Hence, the product will only meet the geometric requirements of mapping scale at 1:100,000. In addition, stereo images of the Geo products are not distributed to the users, and the raw images (preferred by the photogrammetrist community) are not available.

The Precision product is the most expen-

Correction Method	RMS Residuals (m) X	Y	Maximum Residuals (m) X	Y
Simple Polynomial	1.0	3.2	2.4	6.2
Rational Polynomial	0.5	0.7	1.1	1.4
Rigorous Model	0.8	1.1	1.9	2.8

Table 2: Comparison of residuals results with 30 GCPs using simple polynomial, rational polynomial, and rigorous model

sive but offers the highest positioning accuracy (four metres CE90). To achieve it, the user will have to provide GCPs and a DEM to Space Imaging for generating the orthoimage. Because most of the images are acquired at off-nadir viewing, the accuracy of GCPs should be within one metre accuracy and the DEM should be within five metres accuracy. Sub-pixel accuracy (which may be obtained with satellites such as SPOT and Landsat) will not be achievable for IKONOS, even for flat terrain.

What Are the Problems?

Unlike other commercial satellites, IKONOS does not provide detailed orbital information. In addition, supplying GCPs and a DEM to Space Imaging in order to obtain precise ortho products could represent a delay in using the product. This point also presents a problem for users who are not allowed to release cartographic information of their country. Finally, prices of Precision ortho products are very high in comparison to the Geo product. All these aspects can discourage users to acquire IKONOS data or to use them appropriately. However, is it possible for users to purchase the Geo product (about 5.5 times cheaper than the Precision product) and to geo-correct the data themselves? The short answer is yes. Users will save time, money, they will face less administrative problems associated with releasing GCPs and DEM information, and will appropriately use this new source of data.

What Are the Solutions?

Three methods can be used to correct the IKONOS Geo data: simple polynomial method; rational polynomial method; rigorous (or parametric) method. The purpose of this article is to apply the three methods to an IKONOS Geo product, and to compare the different results.

Often considered outdated, the simple polynomial method is a very uncomplicated method for correcting images. It corrects for basic planimetric distortions of the GCPs. Because this method does not take ground elevation into consideration, it is limited to small and flat areas.

The rational polynomial method is similar to the simple polynomial method, except that it involves a ratio of polynomial transformations, and it also takes ground elevation into consideration. Therefore, this method can be useful for areas with gentle terrain. Both simple polynomial and rational polynomial methods do not require satellite and sensor information. Since both methods are not rigorously modelled, they require many GCPs and only correct at the GCPs. Distortions between the GCPs are not entirely eliminated.

Rigorous models reflect the physical reality of the complete viewing geometry, and correct distortions due to the platform, sensor, Earth, and sometimes the deformations due to the cartographic projection. It then takes into consideration the satellite-sensor information. When compared to simple polynomial and rational polynomial methods, the rigorous model method produces the highest accuracy results with relatively few GCPs.

The fact remains that detailed sensor information for the IKONOS satellite has not yet been released. Despite this, the author of this article - a principal research scientist with the Canada Centre for Remote Sensing (CCRS), Natural Resources Canada - has successfully developed a rigorous IKONOS model using basic information from the metadata and image files. For example, approximate sensor viewing angles can be computed using the nominal collection elevation and nominal ground resolu-

tion in the across- and along-scan directions. The CCRS model is based on principles related to orbitography, photogrammetry, geodesy and cartography. It has been successfully applied with only a few GCPs (three to six) to VIR data (Landsat 5 & 7, SPOT, IRS, ASTER, and KOMPSAT), as well as SAR data (ERS, JERS, SIR-C and RADARSAT). Using good quality GCPs, the accuracy of this model was proved to be within a third of a pixel for VIR images, and one resolution-cell for SAR images.

The Experiment

To test the three different methods, an IKONOS Geo product was ordered in April 2000, for the City of Richmond Hill, located north of Toronto, Ontario, Canada. This study area has an elevation range of 180-240 metres. The data was delivered within thirty days of order confirmation. The metadata file was processed to compute the satellite parameters for the rigorous model method. Thirty GCPs were collected uniformly on the image. The map coordinates were obtained from 20cm ortho-photos and a two-metres spacing DEM.

To test the geometric correction process, PCI OrthoEngine Satellite Edition V7.0 software (a product that supports all three of the correction methods) was used. PCI OrthoEngine Satellite Edition V7.0 also supports the reading of different satellite data, GCP collection, geometric modeling, ortho-rectification, and either manual or automatic mosaicking.

Results and Analysis

Table 2 shows the root mean square (RMS) and maximum residual of the calculation of the three different methods. Second-order polynomial transformations were used for both simple and rational polynomial methods.

As seen in Table 2, the rational polynomial method provided the best residuals. However, assessing accuracy with only GCP residuals is misleading and biased, because both polynomial methods correct locally at the GCPs.

During the acquisition of GCPs, a mistake was made in collecting one of the GCPs. The error was about 20m in the Y-direction. Both simple and rational polynomial methods were unable to detect the erroneous point. Table 3 shows the RMS and the residuals of the erroneous point. The Y-residual of the erroneous point from the rigorous model was four times higher than the RMS residuals, and was detected immediately with its error value and direction.

Correction Method	RMS	Residuals (m)		Erroneous Point (m)	
		X	Y	X	Y
Simple Polynomial	1.2	3.9		2.2	6.7
Rational Polynomial	0.6	1.3		0.3	1.4
Rigorous Model	1.1	3.0		2.2	11.8

Table 3: Comparison of residuals results with 30 GCPs including one erroneous point using simple polynomial, rational polynomial, and rigorous model

Unbiased validation of positioning accuracy is done with independent check points (ICPs), which are not used in the model calculations. Consequently, twenty-three of the thirty GCPs were changed to ICPs in the second test. Second-order was used for the simple polynomial method and first-order for the rational polynomial method, due to the reduced number of GCPs. Table 4 shows the RMS and maximum errors over the twenty-three ICPs, using the three methods. The errors are smaller with the rigorous method than with both polynomial methods, and are also consistent with the residuals of Tables 2 and 3. This shows that the rigorous model is both stable and robust without generating local errors and filters errors. An evaluation of image parameters computed from the rigorous method (such as the viewing angles) validates the basic assumptions and estimations computed from the metadata file.

A final evaluation was done by performing a quantitative and qualitative comparison of the ortho-image generated from the rig-

Correction Method	RMS Errors (m) X	Y	Maximum Errors (m) X	Y
Simple Polynomial	1.7	4.1	4.1	7.5
Rational Polynomial	2.2	5.2	5.1	10.4
Rigorous Model	1.3	1.3	3.0	3.0

Table 4: Comparison of error results with 23 ICPs and 7 GCPs using simple polynomial, rational polynomial, and rigorous model

orous method and a DEM with the 20cm ortho-photos. It confirms the previous results over the ICPs: there is no error larger than four to five metres. Thus, the accuracy of the rigorous model is within that of the IKONOS Precision product.

Conclusions

IKONOS Geo products have an accuracy that is relatively low and inconsistent with their image content quality and their large-scale maps. Precision products can be difficult to generate outside some countries and are otherwise expensive. Thus, one major drawback of the efficient and appropriate use of IKONOS products is the inherent impossibility for users to process and ortho-rectify the images. Now, users can apply a rigorous model (one that is available in an operational environment) to correct the low-cost Geo products. When accurate ground data is available, users may produce consistent ortho-images which are as precise as the expensive Precision products. Therefore, this technology should promote the acquisition and the use of this new source of data for many applications.

Evaluation is still ongoing at CCRS, using other IKONOS images and studying different topographic terrain (mainly high relief) and applications (mapping, forestry, agriculture, etc.). Recent results in mountainous areas are promising for large-scale mapping.

About the Authors

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This article is on the CCRS web-site: www.ccrs.nrcan.gc.ca/ccrs/eduref/ref/bibpdg/4807.pdf. PCI web-site for IKONOS module: www.pcigeomatics.com/news/ikonos_module.htm. EOM web-site for original article: www.eomonline.com/Common/currentissues/July00/toutin.htm.

4.3 Object-Oriented Image Analysis: eCognition

DEFiNiENS AG (formerly Delphi2 Creative Technologies), Munich, Germany, has launched eCognition, the first object-oriented multi-scale classification software for all kinds of remote sensing data. eCognition is the first (and optimum) tool for cost-effective classification, specifically for very high spatial resolution Earth Observation data (either one-metre satellite imagery or sub-metre aerial photos) or radar data. eCognition is based on the conceptual ideas of Nobel Laureate Gerd Binnig, co-founder and scientific advisor of Delphi2 (now DEFiNiENS AG). The major features of eCognition are protected by international patents.

eCognition is an innovative approach to segmentation, image understanding and object recognition. All kinds of raster data can be merged and used for the image understanding process: basic satellite and airborne image data, elevation and surface models and thematic information such as previously analysed data and information derived from maps. eCognition first segments the image in an automated process at various scales. These image segments – or object primitives – now carry substantially more information than available in traditional pixel-based analysis. Besides spectral values of the segments, area, form, direction, neighbourhood and relation within the multi-scalar segments and imported thematic information can be used to define rules, describing user-defined classes in the image, based on fuzzy logic. All results can be exported into common GIS and mapping systems.

The knowledge to define the rules is introduced once by a human expert. Once the system is trained, object identification and classification can be done by a fully automated process. Due to this "parameterisa-

tion of human knowledge", eCognition automates processes, saves time and resources, and gives objective, reproducible results. eCognition thus avoids the problems and limitations of current analysis tools and labour-intensive human image interpretation. Since eCognition introduces new concepts in remote sensing data classification, an appropriate training for users is offered by DEFiNiENS and its appointed resellers.

With its new product, DEFiNiENS AG expects to become the leading worldwide supplier for tools for the cost-effective classification of especially high-resolution space or airborne derivative products. These products are the core of the business of the existing and new satellite and airborne services. DEFiNiENS AG will therefore contribute to emerging markets such as infrastructure mapping, cadastral update, and solving security issues.

After introduction to about eighty beta-testers, eCognition has been available since September 2000 for the global market, via distributors appointed by DEFiNiENS. A global distribution licence was issued to PCI Geomatics, Canada. Current versions run on Windows 98, 2000 and NT. Significant discounts for non-profit research centres and education are available.

For more information on eCognition, visit the DEFiNiENS web-site (www.definiens.com), or contact Mr. Nicos Spiropoulos (nspiropoulos@definiens.com), Director of Sales and Marketing. Telephone: +49-89-23118041. Free eCognition trial software can be downloaded from: www. definiens.com/ecognition/download.htm.

4.4 CARTERRA Five-Metre Basemap

Space Imaging announced in October the addition of its CARTERRA Five-Metre Basemap product. This new product, derived from the Indian Remote Sensing (IRS) satellite, is cloud-free, tonally balanced, ortho-rectified, and optimally enhanced for GIS desktop mapping of anywhere in North America.

In the past, CARTERRA five-metre imagery could only be ordered by scene or digital ortho-quad. Now, the CARTERRA Five-metre Basemap gives the GIS professional the ability to order a specific area of interest. If that area of interest falls across multiple scenes, a mosaic will be created and balanced, and only the specified area will be delivered, all within thirty days. The imagery, available as panchromatic, true colour or false colour, is specifically designed for developing a basemap showing rural development, suburban growth, rural access roads, utility corridors, forest and grassland burns, or forest cutblocks and access roads.

"The five-metre resolution of IRS imagery provides the optimum resolution for the majority of our clients' rural mapping applications," says Gerry Mitchell, President of Resource GIS and Imaging Ltd., Vancouver, British Columbia, a value-added reseller for Space Imaging. "Combined with the CARTERRA one-metre imagery, the CARTERRA Five-Metre Basemap provides a complete mapping solution for many of our clients. The two IRS satellites provide current imagery for most projects while using their deep archive to overlay in-fill imagery for cloud-covered areas. This product allows our customers to continually replenish their basemaps with more current imagery."

"In the past we created our access maps with photos. The new CARTERRA Five-Metre Basemap product makes the project more efficient, especially with the quality of the ortho-rectification," said Ken Dutchak, programme leader for Alberta's Department of Environmental Protection. "CARTERRA Five-Meter Basemap is an ideal product to economically cover a large area with cloud-free, ortho-rectified imagery," said Brian Soliday, Vice-President of North American sales and marketing for Space Imaging. "We can deliver a current CARTERRA Five-Metre Basemap image in less time than it takes a customer to fly a large region with aerial, and for less expense."

Prices range from $ 6.25-9 per square mile ($ 2.50-3.50 / sq. km.), with a minimum order of 200 miles or 500 kilometres. For a limited time, this new product offering is made available with an offer of discounted CARTERRA one-metre ortho-rectified im-

agery. When a CARTERRA Five-Metre Basemap image is purchased at the standard price, that amount, per square kilometre, will be deducted on the future purchase price of CARTERRA ortho-rectified imagery (CARTERRA Map, CARTERRA Pro, and CARTERRA Precision). This discount offer on CARTERRA one-metre imagery is valid through November 2001.

For more information, contact Gary Napier (gnapier@spaceimaging.com) at Space Imaging.

4.5 PCI News Releases

Release of Geomatica FreeView (September 2000)
PCI Geomatics has announced the official release of their free software viewing environment technology, Geomatica FreeView, available for immediate download from the PCI Geomatics web-site (www.pcigeomatics.com), where updates will be made available.

Geomatica FreeView, publicly available since May 2000 as a Preview release, is a new viewing environment for working with a variety of data, including imagery, vectors, and ancillary data such as graphical bitmaps. Geomatica FreeView allows the viewing, enhancing, and examination of remotely sensed imagery such as LANDSAT, SPOT, RADARSAT, IKONOS, ERS-1, NOAA AVHRR, and aerial photos. Readable geo-spatial data formats include Oracle 8i Spatial® (with Oracle GeoImage® data management), MrSID®, TIFF, NITF, Arc / Info shape files, and SICAD, to name a few. Users can use FreeView to integrate GIS data with imagery, and view associated attributes. Geomatica FreeView also offers basic enhancement features, cursor controls, efficient roam capabilities, and detailed on-line help.

Release of Geomatica GeoGateway (September 2000)
PCI Geomatics has announced the release of Geomatica GeoGateway, their advanced and affordable geomatics image viewing tool, that includes a powerful integrating, visualising, and translating environment. This software release marks the completion of the second and latest milestone of the Geomatica development timetable. Geomatica GeoGateway is available for purchase from PCI Geomatics sales representatives around the world. Visit the PCI Geomatics web-site (www.pcigeomatics.com) to find a representative in your area.

Geomatica GeoGateway allows for viewing, integrating, and translating geographic data. The Geomatica GeoGateway interface is a fully georeferenced file-based viewer that can visualise any number of geographic data layers in a single viewing environment. This viewing environment is matched with the capability to import and export over eighty image, vector, and other data formats (without the need for conversion), including read-and-write support for Oracle 8i® Spatial with Oracle GeoImage® data management. This seamless and direct geo-spatial data transfer application is unique in the market place, making geospatial imagery much more accessible to a wider range of users. Other supported formats include MrSID®, TIFF, NITF, Arc / Info shape files, and SICAD, to name a few. Building upon Geomatica FreeView (released May 2000, updated September 2000), Geomatica GeoGateway has additional image manipulation tools built into the user environment, improved re-projection and subsetting tools, and impressive image enhancement, magnification, and panning features.

Phase Three – Geomatica Prime – is currently scheduled for release in December 2000. Geomatica Prime contains the essential elements needed for accomplishing most tasks in remote sensing, GIS, and cartography. Its emphasis is on ease of use, multi-resolution data handling, automation, extensibility, and the ability to integrate Geomatica with other technologies. Additional modules include advanced capabilities for remote sensing, GIS, Cartography, Photogrammetry, DEM, and WebServer.

For further information, contact: Anthony Melihen, PCI Geomatics, Corporate Communications. Telephone: (905) 764-0614, ext. 242. E-mail: melihen@pcigeomatics. com.

5 REVIEWS, PUBLICATIONS AND REPORTS

5.1 EOPOLE Special Report

On 11-13 September 2000, the eighth and final workshop of the EOPOLE project, which was initiated within the context of the former CEO (Centre for Earth Observation) Programme of the European Commission's Joint Research Centre, was held in Brussels, Belgium. The following recommendations concerning Earth Observation (EO) data policy and Europe are the result of work done during the EOPOLE project, and discussions held at the workshop. The full report is at the project web-site: www.geog.ucl.ac.uk/eopole.

User Issues
It is recommended to initiate European research into the possible development of a compatible data policy for EO and non-EO environmental data. This data policy should include aspects such as metadata, data documentation and (long term) archiving. As a first step, such a development could be focused on the marine and coastal environment, in view of the important progress made in this field by organisations such as ICES, IOC and Euro-GOOS.

It is recommended to initiate a European effort in the field of EO capacity-building, awareness creation, and training aimed at users, both within and outside Europe, especially in less-developed countries. Such an effort is deemed essential to energise the EO market and to ensure that each country and end-user can have independent access to EO data, and enjoy the benefits thereof.

Pricing Policy
Pricing policy should always be the servant of the mission objectives. Therefore, there should be an explicit link between mission objectives and pricing policy, at least for publicly funded missions. Europe at large has strategic objectives in supporting EO, including the contribution made by EO to environmental security, defence security and independence. There is a case for European funding to be used to contribute positively to these broader European strategic objectives.

The value of EO data is not recognised fully, because the value is largely judged in market terms rather than in other value terms. A greater recognition of the wider value of EO data, including its public good value, is likely to help the sector significantly. The transition to sustainable EO may not be achievable without a consideration of the humanitarian, scientific, security and environmental value of the data and information services provided. Therefore, there should be further research on how to capture explicitly the value of EO data beyond the simple price that a user will pay.

New Technologies
National and international regulations on EO (e.g the UN Principles), including national concerns on military security, should be carefully reviewed to adapt to new very high resolution imaging technologies and Internet trade, to protect the interests of emerging companies, national security and users. European space agencies and the European Commission should work towards a joint European policy for space data, free from national bias and concerns, to remove any obstacles for the emerging European geo-matics industries.

Archiving Policies
No EO mission should be launched without a statement of its archiving policy, including the organisation(s) responsible for short-term archiving and, if known, medium- and long-term archiving. The European Commission should invite national and international European space agencies managing EO data sets to consultations aimed at finding political, financial and institutional arrangements to support the medium- and long-term archiving of satellite data.

Formal Context of Earth Observation
The European Commission should prepare initiatives of a legal nature to deal with priority issues as indicated in other recommendations. This should be done in the context of the Internal Market, with a view

to the economic, social and public benefits of EO data usage, and taking into account the existing legal and quasi-legal rudimentary frameworks on the national, European and global levels.

In addition and by way of support for such initiatives, the European Commission should prepare the following initiatives of a legal nature:

- To expand the concept of the Internal Market as it is elaborated in current European Commission legislation, so as to incorporate harmonisation measures regarding (prospective) national legislation.
- To establish a new balance in dealing with the satellite value-added data market in Europe as between intellectual property rights instruments and competition instruments. The use of intellectual property right with regard to EO data, as an a priori means of controlling market behaviour, increasingly tends to result in obstruction of development of relevant markets and fair and healthy competition. A greater emphasis on competition law, as an a posteriori means to control undesirable market behaviour, would be more conducive to protecting consumers and users, and thus to establishing viable markets for EO value-added services.
- To tie together the various current EC Directives and other EC legislation relevant to EO data, but not as such dedicated to this sector. Such Directives – e.g. the Directive on database protection – have been drafted without having inter alia EO data issues in mind and, at best, taking them into consideration at a later stage.

Conclusion

The technology for EO and applications of EO are well developed in Europe, but little attention has been paid to economic, policy and international relations issues of EO. Europe needs independent assessments of these issues to inform organisations in both the public and private sectors. It would be very beneficial to Europe to consider a European-scale institute or "think-tank", with independent capability to carry out investigations of the economic and policy issues of EO.

5.2 EU Report on Eradication of Land-Mines

The European Union (EU) has pledged to remove the threat of land-mines to civilian populations around the globe, within ten to fifteen years. It foresees a prominent role for EU research institutions in helping to achieve this goal. The main thrust of the research is to determine the characteristic "signatures" of different devices, when tested with different types of radar, thermal infrared and metal-detecting sensors, and to analyse the effects of varying environmental conditions on their accuracy. The recently published report is on the web: www.europa.eu.int/comm/external_relations/mine/intro/index.htm. For details of research at the Joint Research Centre, go to: demining.jrc.it. (See also Section 3.2.3 of this Newsletter).

5.3 Annual Congress of IAF in Rio de Janeiro, Brazil

Report by Prof. Dr. E. Parlow, MCR Laboratory, University of Basel.

On 2-6 October 2000, the International Astronautical Federation (IAF) held its 51st Annual Congress in Rio de Janeiro, Brazil, hosted by the Brazilian Instituto Nacional de Pesquisas Espaciais (INPE). Together with its associates, the International Academy of Astronautics (IAA) and the International Institute of Space Law (IIL), IAF organises this Congress each year in a different country. Following the 1999 Congress in Amsterdam, Rio was the second venue in South America after 1969 (Argentina). IAF was originally established in 1951 as a forum for academia and researchers in the field of space technology and space science.

The congress started with an exciting opening ceremony which was a mixture of official welcome addresses, samba and Rio Carnaval. The theme of the Congress was "Space - a Tool for the Environment and Development". In parallel with the congress, a big informative exhibition of world-leading space industries and space agencies was organised. It was surprising to the rapporteur that ESA was not present at this event.

About 900 papers of all fields of space research and technologies were announced in 104 technical sessions. But this conference also suffered from various no-shows, which is an increasing problem for international conferences. Technical sessions tackled topics such as: astro-dynamics; Earth observation; natural disaster reduction; life sciences; materials and structures; microgravity; satellite communications; space education; space exploration; space power; space propulsion; space station; space systems; space transportation; economics and commercialisation of space activities; history of astronautics; space plans and policies; safety rescue and quality; search for extraterrestrial intelligence; small satellites; advanced materials; Moon/Mars exploration; law of outer space.

From an EARSeL point of view, the sessions on Earth observation were of major interest. Six sessions of sixty-two papers covered this topic, though not all were presented. Without doubt it was a very important conference on a high scientific level, with more than three thousand participants from all over the world. The organisation was very good, especially considering that most participants had to be transported by bus from downtown hotels to the conference centre outside the city, despite serious traffic problems in the mega-city of Rio de Janeiro.

The theme of the conference – "A Tool for the Environment and Development" – seemed to the rapporteur a bit misleading. It was a space-technology conference with less than ten per cent of the papers dealing with environmental research and applications. Even some of these were simple reports of the technologies to be used in future satellites.

If this short report was stimulating to you, the next chance to join an IAF congress is in Toulouse, France, from 1-5 October 2001. If you would be more interested in a really big event, you should mark in your calendar the World Space Congress 2002, from 11-20 October 2002, in Houston, Texas – a joint conference of the 53rd IAF Congress and the 34th Scientific Assembly of the Committee on Space Research (COSPAR), expecting 13,000 participants and 4000 papers in 175 technical sessions.

For more information, contact: International Astronautical Federation, 3/5 rue Mario Nikis, 75015 Paris, France. Telephone: +33 (0)1 45 67 42 60. Fax: +33 (0)1 42 73 21 20. E-mail: iaf@wanadoo.fr. Web: www.iafastro.com.

5.4 Symposium on High Mountain Remote Sensing Cartography, in Ethiopia, Kenya, and Tanzania

Report by Dr. Manfred Buchroithner, Technical University Dresden

On 3–18 September 2000, the 6th International Symposium on High Mountain Remote Sensing Cartography (HMRSC) took place in Ethiopia, Kenya and Tanzania. Organised by Prof. Dr. Hugh Bloemer from the Ohio University in Athens, Ohio, a small group of scientists from seven countries in four continents convened to deal with the Symposium motto – "The Need for Eco-Tourism in High Mountain Environments" – by paper sessions, technical excursions to institutions, and field trips with line-maps of different provenance and satellite imagery. Eco-tourism is one of the magic buzzwords which give some hope for countries with only few other economic possibilities. In this respect the use of remote sensing data and GIS is essential. It was only a pity that due to the Ethiopian-Eritrean War, which ended a short time before the Symposium, many of the announced participants withdrew their registration. Still, not only for the African participants, the meeting was a great benefit.

Six sessions of presentations were given in the Semien Hotel in Addis Ababa and in the Guest House of the "Literature Ministery Seminary" in Nairobi, accompanied by a small exhibition of cartographic products and satellite imagery. The topics covered a wide spectrum, including theoretical studies, reports about completed or current application projects, the presentation of (further) interesting tasks for which remote sensing could significantly contribute, and papers about the expectations in remote sensing in the field of high mountain cartography.

A visit of UNEP / GRID to Nairobi, the unit for the world-wide UN environmental programmes, and the geo-data centre of the UN, permitted insight into the tasks, working conditions and capacities of this international organisation. It was interesting to learn about the strong future involvement of ESRI in the work of UNEP / GRID. One of the most striking examples of the application of remote sensing data to mountain areas was a study of Mt. Kenya (Africa's second-highest peak) and its surroundings, aimed at monitoring tropical forest clear-cuts. Today, this mountain massif, once worshipped as "The God's Mountain" represents an ecological disaster area with heavy erosion.

As in previous HMRSC symposia, the oral presentations were complemented by extensive field excursions. These led to the unique geological feature of the African Rift Valley, both in connection with a trip to the high mountain region of the Bale Mountains in South-East Ethiopia and in Central Kenya. A visit to the Kilimanjaro National Park in Tanzania, and a climb of its highest summit, the Uhuru Peak (5895m) concluded the post-symposium excursions. This trip very drastically revealed the interaction between nature protection and touristic usage. Moreover, it also demonstrated the urgent need for the generation of modern high-standard maps and, in particular, the updating of existing topographic maps.

During the decade 1990-2000 the international symposium series on High Mountain Remote Sensing Cartography (HMRSC) provided the possibility to study programmes of high mountain cartography at various places in five continents, and to trace the developments of remote sensing application in this period. The first event took place in 1990 in Schladming, Austria, followed by Lhasa, Tibet, and Kathmandu, Nepal. Next came the Andes in Western Argentina and Chile, in 1994 (Mendoza). Subsequently HMRSC visited Northern Scandinavia from Kiruna to Tromsø, organised by the University of Karlstad, Sweden. In 1998 the high mountain community went to Northern California and High Sierra of the USA. Finally, the year 2000 - the 10th Anniversary - brought HMRSC to the high mountain regions of East Africa. For 2001 the publication of symposium proceedings is envisaged.

At present various international and national expert organisations deal with the application of remote sensing to the mountain regions of our world. In 1999 the High Mountain Remote Sensing Cartography gained its deserved importance through integration into the Commission on Mountain Cartography (CMC) of the International Cartographic Association (ICA). Through HMRSC I-VI, it has been possible to follow, study and develop the activities of High Mountain Remote Sensing Cartography, from the first relief mapping of mountain chains from space, to the fascinating present possibilities.

5.5 Publication: Environmental Data for Albania

Just published: "Remote sensing for Environmental Data in Albania: A Strategy for Integrated Management". Edited by Manfred F. Buchroithner. NATO Science Series 2 – Environmental Security – Volume 72. Published by Kluwer Academic Publishers. ISBN 0-7923-6528-3. These are the Proceedings of the workshop that was organised in Tirana, Albania, in October 1999, at which most of the speakers were from EARSeL member laboratories.

5.6 Report: Laboratory of Space Technology, Finland

The Laboratory of Space Technology, Espoo, Finland, has published its 1999 Annual Report. This comprehensive report describes the activities of the foremost laboratory in Finland teaching space technology. Personnel and funding are listed, the various courses and degrees are described, and research projects are summarised. Also listed are the activities undertaken in various national and international scientific organisations, participation in conferences and meetings, and many publications. The Director of the Laboratory, Prof. Martti Hallikainen, Past President of the IEEE Geoscience and Remote Sensing Society, was awarded in 1999 their Distinguished

Achievement Award "For significant contributions to passive and active microwave remote sensing of vegetation and land surfaces." Anyone interested in receiving a copy of the Annual Report may contact Prof. Hallikainen (martti.hallikainen@hut.fi). Web: www.space.hut.fi (in English and Finnish).

5.7 Brochure on Global Change in the Arctic

"Understanding Global Change in the Arctic" is a full-colour brochure outlining the accomplishments and future objectives of the National Science Foundation (NSF) Arctic System Science (ARCSS) Programme, for a broad general audience. This brochure provides the Arctic research community with an informative and useful aid in out-reaching and education efforts. It was published by the Arctic Research Consortium of the United States (ARCUS) for the NSF ARCSS Program. Copies are available on request from ARCUS (telephone: 907-474-1600; fax: 907-474-1604; e-mail: arcus@arcus.org), or from the ARCUS web-site: www.arcus.org/ARCSS/brochure/index.html.

5.8 On-Line: Polar and Cold Regions Organisations

An on-line Directory of Polar and Cold Regions Organisations is now available, at www.spri.cam.ac.uk/lib/organ/keyindex.htm. This directory provides brief details of organisations with interests relating to the polar and cold regions – i.e. to the Arctic and Antarctic, and to all parts of the world where ice, snow, and permafrost are to be found. The directory was compiled by William Mills, Keeper and Librarian at the Scott Polar Research Institute, as part of a new reference work, "Key-Guide to Information Sources on the Polar and Cold Regions" (London: Mansell, 1998). Names of international organisations are given in English, wherever possible, together with commonly used names in other languages where appropriate. National organisations are usually given in the national language together with, in square brackets, the English name if one is in common use. Exceptions have been made where the English names are in such frequent use that these are given first. Information provided includes contact details (addresses, telephone, fax, e-mail, web-sites), date of foundation, summary of activities, and publications. The information was gathered by desk research at the Scott Polar Research Institute and other libraries, and by questionnaire. Where little information is provided, it generally means that no reply to the latter was received. The directory is kept up-to-date, whenever new information comes in. Additional information and corrections, etc.) should be sent to William Mills (wjm13@cam.ac.uk).

5.9 World's Freshwater Systems in Peril

A report released on 21 October 2000 by the World Resources Institute (WRI) states that the world's freshwater systems are so degraded that their ability to support human, plant, and animal life is greatly in peril. As a result, many freshwater species are facing rapid population decline or extinction, and an increasing number of people will face serious water shortages. The report, "Pilot Analysis of Global Ecosystems (PAGE): Freshwater Systems," says that while many regions of the world have ample freshwater supplies, four out of every ten people currently live in river basins that are experiencing water scarcity. By 2025, at least 3.5 billion people or nearly 50% of the world's population will face water scarcity. In addition, twenty-nine of the world's river basins - with a projected population of ten million each by 2025 - will experience further scarcity.

According to the institute, further analysis of existing freshwater studies reveals that more than 20% of the world's known 10,000 freshwater fish species have become extinct, been threatened, or endangered in recent decades. In the United States, which has the most comprehensive data on freshwater species, 37% of freshwater fish species, 67% of mussels, 51% of crayfish, and 40% of amphibians are threatened or have become extinct. The PAGE report estimates that dams, diversions, or canals fragment almost 60% of the world's largest 227 rivers. The only remaining large free-

flowing rivers in the world are found in the tundra regions of North America and Russia and in parts of Africa and South America. About 40,000 large dams over fifteen metres high fragment the world's rivers.

Although rivers, lakes, and wetlands contain only 0.01% of the world's freshwater and occupy less than 1% of the Earth's surface, the global value of freshwater services is estimated in the trillions of dollars. "We need to value freshwater ecosystems not only from the goods they produce, like fish and clams, but also the services they give, like the filters and nurseries that wetlands provide," said Carmen Revenga, one of the report's co-authors. She added that in some countries, the growing concern for species extinction, the maintenance of pristine habitats, and the need to maintain the other goods and services ecosystems provide are driving governments to restore and rehabilitate freshwater systems. The PAGE report on freshwater systems (www.wri.org/wri/wr2000) is the first of five technical reports that will be released in the next six months. Other reports will cover agroecosystems, coastal areas, forests, and grasslands. Taken together, these reports are the first such comprehensive assessment of the state of the world's ecosystems.

The aim of the World Resources Institute is to provide information, ideas, and solutions to global environmental problems. For more information contact: World Resources Institute, 10 G Street, NE (Suite 800), Washington, DC 20002, USA. Telephone: +1-202-729-7600; Fax: +1-202-729-7610. Web: www.wri.org.

6 FORTHCOMING MEETINGS AND COURSES

6.1 Forthcoming Remote Sensing Meetings

NEW
26-28 March 2001
Rome, Italy

1st European Permafrost Conference
Contact: The Editorial Committee,
1st European Permafrost Conference,
Department of Earth Sciences, Cardiff University,
P.O. Box 914, Cardiff CR10 3YE, UK.
E-mail: harrisc@cardiff.ac.uk. Web: www.cf.ac.uk/uwc/earth/pace

14-16 May 2001
ENSG,
Marne-la-Vallée
(Paris), France

21st EARSeL Symposium and General Assembly: Observing our Environment from Space - New Solutions for a New Millennium
Co-sponsored by the SFPT and IGN.
Contact: EARSeL Secretariat,
Web: www.earsel.org

17-18 May 2001
ENSG,
Marne-la-Vallée
(Paris), France

3rd EARSeL Workshop on Remote sensing and GIS Applications to Forest Fire Management - New Methods and Sensors
(See Section 2.2.1 of this issue)
Contact: EARSeL Secretariat,
Web: www.earsel.org

11-15 June 2001
Québec, Canada

International Symposium: Spectral Sensing Research - ISSSR 2001
Sensing from Space
Contact: www.isssr2001.org

18-20 June 2001
Halifax, Nova
Scotia, Canada

4th International Symposium: CoastGIS'01: Managing the Interfaces
Contact: E-mail: Coastgis2001@agc.bio.ns.ca

NEW 22-23 June 2001 Regensburg, Germany
2nd Symposium on Remote Sensing of Urban Areas
Contact: Carsten Juergens,
E-mail: carsten.juergens@geographie.uni-regensburg.de

NEW 28-29 June 2001 University of Insubria, Varese, Italy
International Workshop on Geo-Spatial Knowledge Processing for Natural Resource Management
Organised by: European Commission's Joint Research Centre, Ispra, Italy; National Research Council, Milan, Italy; University of Insubria, Varese, Italy,
Web: proterra.itim.mi.cnr.it,
E-mail (for paper submission): proterra-info@itim.mi.cnr.it,
E-mail (for attendance): proterra-info@mal. crii.uninsubria.it

NEW 9-13 July 2001 Sydney, Australia
IGARSS 2001
(IEEE Geoscience and Remote Sensing Society)
Contact: Tammy Stein, IGARSS, USA,
E-mail: tstein@phoenix.net,
Web: www. igarss.org.

15-19 July 2001 Cleveland, Ohio, USA
Coastal Zones 2001
Contact: Jan.Kucklick@noaa.gov,
Fax: +1 843 740 1313,
Web: www.csc. noaa.gov/cz01

NEW 10-13 September 2001 Toulouse, France
18th Symposium GRETSI'01 on Signal and Image Processing
Contact: Christine Correcher, CNES,
Délégation à la Communication et à l'Education,
18 avenue Edouard Belin,
31401 Toulouse Cedex 4, France,
Web: www.cnes.fr/gretsi

NEW 12-14 September 2001 London, UK
RSS2001
Contact: The RSS Office: rss@nottingham.ac.uk

NEW 1-3 October 2001 Vienna, Austria
5th Conference on Optical 3D Measurements Methods
Contact: Herbert Kahman,
Fax: +43 1 5880112 895,
info.tuwien.ac.at/ingeo/optical3d/o3d.htm

4-6 June 2002 Prague, Czech Republic
22nd EARSeL Symposium and General Assembly:
Geo-Information for European-Wide Integration
Contact: Dr. Tomas Benes,
UHUL Forest Management Institute,
Telephone: +420202800121,
Fax: +420202803371,
E-mail: benes@uhul.cz,
Web: www.uhul.cz.

NEW 24-28 June 2002 Toronto, Canada
IGARSS 2002
(IEEE Geoscience and Remote Sensing Society)
Contact: Tammy Stein, IGARSS, USA,
E-mail: tstein@phoenix.net,
Web: www.igarss.org.