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EARSel Newsletter Editor

Niall McCormick
Institute for Environment and Sustainability
Commission of the European Communities
Joint Research Centre
I-21020 Ispra (VA), Italy
Tel: +39 0332 789136
Fax: +39 0332 785461
E-mail: niall.mccormick@jrc.it

Editorial Assistant

Mme. M. Godefroy
EARSel Secretariat
2 avenue Rapp, 75340 PARIS Cedex 07, France
Tel: +33 1 45567360
Fax: +33 1 45567361
E-mail: earsel@meteo.fr

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EARSeL Bureau

CHAIRMAN

Prof. Dr. Eberhard Parlow
MCR Laboratory
University of Basel, Spalenring 145
CH-4055 Basel, Switzerland
Tel: +41 61 2726480, Fax: +41 61 2726923
Email: eberhard.parlow@unibas.ch

VICE-CHAIRMAN

Prof. Dr. Rudi Goossens
Geography Department
University of Gent, Krijgslaan 281 (S8-A1)
B-9000 Gent, Belgium
Tel: +32 9 2644709, Fax: +32 9 2644985
Email: rudi.goossens@rug.ac.be

SECRETARY-GENERAL

Dr. Rainer Reuter
Physics Department
Carl von Ossietzky Universität
D-26111 Oldenburg, Germany
Tel: +49 441 798 3522, Fax: +49 441 798 3201
Email: r.reuter@las.physik.uni-oldenburg.de

TREASURER

Prof. José-Luis Casanova
Laboratorio de Teledeteccion
Dpto. Fisica Aplicada I
Universidad de Valladolid
47071 Valladolid, Spain
Tel / Fax: +34 983 423 130
Email: jois@latuv.uva.es

EAST-WEST RELATIONS

Dr. Tomas Benes
UHUL Forest Management Institute

Nabrezni 1326
250 44 Brandys-nad-Labem, Czech Republic
Tel: +420 202 800 192, Fax: +420 202 803 371
Email: benes@uhul.cz

Representatives of the Sponsoring Organisations

EUROPEAN SPACE AGENCY

Dr. L. Marelli / Dr. Stefano Bruzzi
Applications Programmes
European Space Agency
8-10, rue Mario Nikis
75738 Paris Cedex 15, France
Tel: +33 1 5369 7383, Fax: +33 1 5369 7674
Email: mcuvelie@esa.int

COMMISSION OF EUROPEAN COMMUNITIES

Dr. Sten Folving
Institute for Environment and Sustainability
Joint Research Centre of the EC
I-21020 Ispra (VA), Italy
Tel: +39 332 785 579, Fax: +39 332 789 469
Email: sten.folving@jrc.it

COUNCIL OF EUROPE

Mr. J. P. Massué
EUR-OPA Major Hazards Agreement
Council of Europe
67075 Strasbourg Cedex, France
Tel: +33 3 88 41 26 15, Fax: +33 3 88 41 27 87
Email: jean.pierre.massue@coe.int

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113, avenue Aristide Briand - 94117 ARCUEIL CEDEX -
Tel: +33 (0)1 49 08 76 00 - Fax: +33 (0)1 49 08 76 02
Contact: sales@fleximage.fr - www.fleximage.fr

1 EDITORIAL

It seems to happen that with every fresh issue of the Newsletter, there is news to report of a major natural disaster occurring somewhere in the world, where remote sensing (RS) is playing an important role in supporting the crisis management and subsequent recovery efforts. In the previous (June 2002) Newsletter, the "burning" issue was the massive forest fires in Colorado and neighbouring US states. This time around, the destructive natural phenomenon took place much closer to home: the recent devastating flooding that afflicted several European countries, most noticeably the Czech Republic, eastern and southern Germany, Austria, Switzerland, and south-eastern France. This Newsletter features a report on how satellite images, provided by the European Space Agency (ESA) in response to requests from the Swiss, Austrian and German crisis-management authorities under the terms of the International Charter on Space and Major Disasters, are contributing to the recovery effort following the recent floods. (See article in Section 3.1.1).

This issue of the Newsletter also includes a report on how high-resolution (IKONOS) satellite images of a man-made disaster – the 11th September 2001 atrocities in the USA – have been made available to the public via the internet, as a moving commemoration of those terrible events one year ago.

Otherwise, the Newsletter contains the usual mix of RS-related recent news items, including reports from the EARSel member laboratories and Special Interest Groups (SIGs), recent "high-level" RS- and research-related developments from ESA and the European Commission (EC), the launch of new Earth observation satellites, and a wide variety of research and application projects where RS data are playing an important role.

During the summer that just finished (incidentally, in quite emphatic fashion, at least

here in northern Italy), the EU's GMES (Global Monitoring for Environment and Security) initiative has continued to evolve. The main event in this regard was the three-day "GMES Forum" conference that was held in Brussels on 15-17 July 2002. The forum, a summary of which may be found on the EC's space policy web-site (<http://europa.eu.int/comm/space>), attracted over 250 participants, and was reportedly a highly successful first milestone in creating a common understanding of GMES-related issues, and in developing an agreed approach for further actions.

Another recent development with significant long-term implications for future European scientific research was the publication by the EC in September 2002, of its new strategy to raise research spending to 3% of EU average Gross Domestic Product (GDP), from its present relatively "modest" level of 1.9%. The strategy to increase investment in research and development, which is seen as an essential step in order to enable the EU to achieve its central goal of becoming the most competitive and dynamic knowledge-based economy in the world by 2010, is described in Section 3.2.3 of this Newsletter.

By the way, for those of you who might be interested in pursuing a career in European scientific research and research management (more specifically, within my own organisation, the European Commission's Joint Research Centre), the weekly online international publication "Science's Next Wave", which provides news on scientific training, career development, and the science job market, has just published an article containing important practical information: <http://nextwave.sciencemag.org/cgi/content/full/2002/09/19/2>.

Well, I mustn't chatter on, as this Newsletter is already overdue...

The Editor

2 NEWS FROM THE ASSOCIATION AND ITS MEMBERS

2.1 New EARSeL partners in Ukraine

In June 2002 we had the pleasure of welcoming to our annual symposium in Prague, Dr. Alexey Sakhatsky, representing Professor Vadim Lyalko, Head of the Scientific Council for Remote Sensing in the Ukraine, and the EARSeL representative for the Centre of Aerospace Research of the Earth (CASRE) in Kiev, Ukraine. Prof. Lyalko invites EARSeL colleagues to visit their facilities in Kiev with a view to closer co-operation between our two organisations, which of course the Bureau welcomes. Prof. Lyalko can be contacted by e-mail at casre@casre.kiev.ua.

New EARSeL member – Ukrainian Land and Resource Management Centre (ULRMC)

Another member from Ukraine has recently joined EARSeL: the Ukrainian Land and Resource Management Centre (ULRMC). ULRMC is an International Association which is a non-profit, non-governmental joint venture between the Environmental and Resources Research Institute of Ukraine (ERRIU) and the Environmental Research Institute of Michigan (ERIM), USA. ULRMC is initially being funded by ERIM under a grant from USAID. Since its founding as a Ukrainian scientific and technological NGO in January 1999, ULRMC has continually promoted the importance of sharing data and information in Ukraine and throughout the region.

ULRMC is located at 13 Chokolivsky Boulevard, Kyiv 03680, Ukraine. The staff comprises twenty-five persons, including scientists, software and GIS engineers, environmentalists, technicians, financial experts, and support personnel. In the USA, ULRMC is represented in Washington, D.C., and in Ann Arbor, Michigan, by its American shareholder, ERIM.

ULRMC applies remote sensing (RS), GIS, digital mapping and other information technologies to land and resource management issues at national and local scales. ULRMC's applications are relevant for many industries and challenges, in-

cluding agri-business, environmental management, natural resources stewardship, emergency response, capital investments, infrastructure development, privatisation, and land use management and planning.

Using its capabilities, ULRMC provides information products and decision support systems needed to: monitor crop production and support agribusiness production and policy; detect and help mitigate environmental contamination; produce digital topographic, land cover, land use and other data; plan and monitor commercial industrial development; support transportation development.

In support of its activities, ULRMC owns and operates a High Resolution Picture Transmission (HRPT) Station that acquires Sea-viewing Wide Field-of-View Sensor (SeaWiFS) and Advanced Very High Resolution Radiometer (AVHRR) data on a daily, real-time basis from SeaStar (Orbital Sciences Corporation) and NOM (USA government) satellites. ULRMC has also developed a significant archive of high-resolution imagery from Landsat, IRS, SPOT and other satellites. For more information concerning ULRMC, please contact: Mr. Eric P. Luhmann or Dr. Oleksandr A. Kolodyazhnyy (e-mail: e.luhmann@ulrmc.org.ua / o.kokodyazhnyy@ulrmc.org.ua; web: www.ulrmc.org.ua).

2.2 News from the Special Interest Groups

SIG Coastal Zones

Following the 23rd EARSeL Symposium in Ghent, Belgium (2-6 June 2003), a Workshop focusing on coastal zones will be held on 6-7 June. This continues the tradition of the thematic workshops on Lidar Remote Sensing of Land and Sea (1991-2000) and the workshop Remote Sensing and GIS for Coastal Zone Management (1994), and covers all methods of remote sensing suitable for this complex environment, with emphasis on methods, technology and applications.

The Workshop will include oral and poster presentations, and round table discussions. An exhibition of equipment and practical training courses are planned. Reviewed papers will be published on CD ROM in the EARSel e-Proceedings Series.

Workshop topics: physical dynamics of currents, tides, waves and sediment transport; morpho-dynamical processes and their relevance for coastal engineering; flux and transformation of seawater constituents including pollutants; interaction of physical, biological and chemical conditions and processes; GIS and Coastal Zone Management.

Methods of remote sensing addressed: active and passive methods in all spectral ranges and sensor combinations; satellite, airborne and ground-based methods including ground truth; modelling of radiative transfer, image processing and related aspects.

Scientific committee: Dr. Rainer Reuter, University of Oldenburg, Germany (Chairman); Dr. Serĝey Babichenko, Tallinn, Estonia; Prof. Victor Fadeev, Moscow State University, Russia; Dr. Roberta Fantoni, ENEA, Frascati, Italy; Dr. Jacques Populus, IFREMER, Plouzané, France.

Organising committee: Ms. Madeleine Godefroy, EARSel Secretariat, Paris, France; Prof. Rudi Goossens, University of Gent, Belgium; Dr. Rainer Reuter, University of Oldenburg, Germany.

Registration form available at: las.physik.uni-oldenburg.de/projekte/earsel. Abstract due: 31st December 2002; Notification of acceptance: 1st February 2003. Final programme: 1st May 2003. Paper submission will be at the Workshop

SIG Forest Fires

Joint International Workshop of the EARSel Special Interest Group on Forest Fires, and the GOFC-GOLD Fire Implementation Team, "Innovative Concepts and Methods in Fire Danger Estimation", in University of Ghent, Belgium, on 5-7 June 2003.

Also following the EARSel General Symposium in Ghent, Belgium (2-6 June 2003), SIG Forest Fires will organise the Fourth Interna-

tional Workshop on Remote Sensing and GIS Applications to Forest Fire Management, on 5-7 June. This Workshop will follow on from three previous Workshops held by SIG Forest Fires, in Alcalá de Henares (1995), Coimbra (1998), and Paris (2001). The main topic of the Workshop will be the application of new methods of image interpretation to fire prevention, detection of active fires and burned land mapping. Special emphasis will be devoted to global and regional approaches, and to the integration of high- and low-resolution data. Innovations coming from new sensors, such as lidar, hyper-spectral and high-spatial resolution instruments will be reviewed. The Workshop will be co-organised by the Global Observation of Forest Cover (GOFC-GOLD) Fire Implementation Team.

The basic activity of SIG Forest Fires is to establish personal contacts among researchers interested in the application of remote sensing (RS) and GIS technologies to forest fire research. Within this context the Workshop will serve as a forum for discussion and for sharing ideas and technical experience in this field of research. Special emphasis will be devoted to new analysis techniques to improve the physical interpretation of RS images, and to the integration of different sensors.

The structure of the Workshop will be based on keynote lectures, round table discussion and poster sessions. Further information can be found at: www.geogra.uah.es/EARSel/Workshopghent.htm.

SIG Forestry and Land Use

International Workshop on Forestry and Land Use, in Sec, Chrudim, Czech Republic, on 11-12 March 2003.

This Workshop is being organised by UHUL / Forest Management Institute, Czech Republic, in the framework of the 9th International Conference "Info-Systems for Agriculture and Forestry".

For land use and forestry, remote sensing (RS) offers unique data about the status of the land and in particular the influence or impact of human activities. RS also offers great possibilities for creating digital elevation models (DEMs) and then producing

thematic maps or models for land use and especially for forestry. There is a high demand for data in studies on, for example, urbanisation, forest health conditions monitoring, land use modelling, land cover change, etc. In order to identify and to find solutions for these research targets, the Workshop aims to bring together scientists from all countries, in order to exchange experiences.

Workshop topics: thematic interpretation and classification of RS data; digital thematic maps creation for land use and forestry; monitoring of environmental processes; models integration; thematic GIS as a potential final result of operational thematic utilisation of RS data

Abstracts due: October 31st 2002. Notification of acceptance: January 15th 2003. Payment of registration: February 15th 2003. Full paper due: February 28th 2003. Final programme: March 2003. More information will be published at: www.uhul.cz/workshop2003.

SIG Imaging Spectroscopy

The HySens group has just held a very successful field campaign acquiring hyperspectral imagery in Poland. The SIG is planning a Workshop to be held at DLR (German Aerospace Research Establishment) in May 2003. Details will be announced shortly.

SIG Land Ice and Snow

Following the successful Workshop held in Berne, Switzerland, in March 2002, this group is planning its next workshop, to be held in 2004, either at the Conference Centre in Abisko (Northern Sweden) where the facilities are excellent, or again in Berne. Dates will be announced shortly.

2.3 UK retires GLORIA, prolific sea-floor sonar

The Southampton Oceanography Centre (SOC), UK, an EARSeL Member Laboratory, announced recently that its successful sea-floor sonar, GLORIA (Geological Long Range Inclined Asdic) has been gracefully retired, after surveying 5% of the world's oceans.

GLORIA, which has been a big success story since her development in the early 1970s to map sea-floor features in the deep ocean, is a long-range side-scan sonar providing the fastest known method of mapping the shape and texture of the sea-floor. She was developed and operated by the Institute of Oceanographic Sciences (now incorporated into Southampton Oceanography Centre). But, say SOC, with advances in technology since GLORIA was designed, it is time for her to retire from active service.

One of the institution's three GLORIA vehicles left SOC at the end of July 2002 for transfer to the Science Museum at Wroughton, near Swindon, Wiltshire, which is part of the National Museum of Science and Industry, where the large objects from the world of science and technology are stored and can be viewed by arrangement. Other exhibits include early computers and MRI scanners, large vehicles, and airliners.

Keith Birch of SOC's Ocean Engineering Division said that "GLORIA was used extensively throughout the 1980s and 1990s. In particular, GLORIA undertook the world's largest sea-floor survey, mapping the entire USA Exclusive Economic Zone of around seven million square kilometres over a period of seven years". In recognition of the USA survey, and more than 600 scientific publications arising from the vehicle's outstanding success, GLORIA was awarded the Queen's Award for Technological Achievement in 1986.

The survey system worked by towing GLORIA about 200 metres behind a ship and 100 metres below the surface. It produced digital image maps of the sea-floor. GLORIA could map large features and variations, down to roughly the size of a hockey pitch. New mapping vehicles, including SOC's TOBI (Towed Ocean Bottom Instrument), can survey to a much higher resolution, recording features down to the size of a minibus, and thus providing finer detail in its extensive sea-floor surveys. Acoustic remote sensing, with sonars towed from research ships or installed in their hulls, is still the current way of surveying, mapping, and studying ocean floor

processes over a large area. However new deep-water survey tools including Autonomous Underwater Vehicles such as SOC's Autosub, are now entering commercial service.

For further information contact: Keith

Birch, Ocean Engineering Division, Southampton Oceanography Centre (telephone: +44-23-80596105) or Sue Nottingham, External Relations, University of Southampton (telephone: +44-23-80594993); web-site: www.soc.soton.ac.uk.

3 NEWS FROM ESA, THE EC AND INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 ERS and Envisat help European flood relief

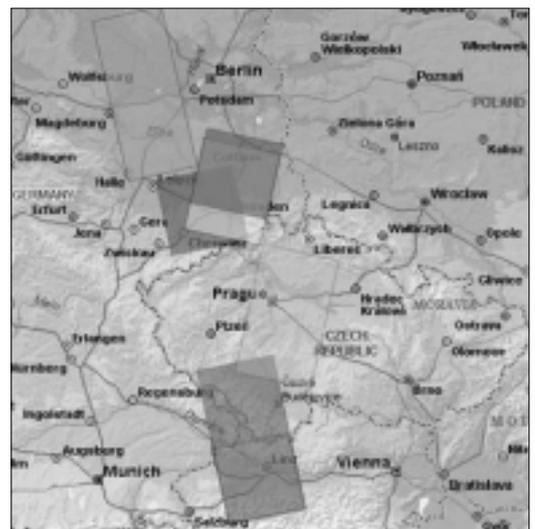
On 27th August 2002 the European Space Agency (ESA) reported that, as clean-up efforts were beginning in the wake of the devastating flooding of Europe's Elbe River, satellite imagery was providing crisis managers and other civil agencies with a new tool not only for predicting where flood peaks would occur, but also aiding follow-on relief and damage assessment efforts.

During the previous week, three European nations had activated the International Charter on Space and Major Disasters (see end of this article), and requested satellite images to assist national, regional and local authorities in coping with the flooding of the Elbe River and other areas, that left more than one hundred people dead, forced tens of thousands to evacuate their homes, and will likely cost tens of billions of Euros to pay for cleaning up and rebuilding the affected areas.

In response, ESA provided archived and newly acquired imagery from its European remote sensing (RS) satellites, ERS-1 and 2. ESA also sent images acquired by Envisat, ESA's newest environmental satellite. Envisat, which was launched in March 2002, is not yet included among the Charter's space-based assets. However, images from its Advanced Synthetic Aperture Radar (ASAR) proved useful in providing flood information over a wide swath of territory that could not be covered by conventional space or aerial imagery.

Charter activations from Switzerland, Austria and Germany

The International Charter on Space and Major Disasters is an international collaboration to put satellite RS technology into service for rescue authorities and other civil protection agencies. It was activated on 17th August 2002, for the twenty-fourth time, to support a Swiss rescue team operating in the Czech Republic. On 20th August 2002, the Austrian Ministry of the Interior requested satellite imagery under the Charter, because of concerns that the Danube River would experience the same levels of flooding as the Elbe. Two days later, Germany's Interior Ministry activated the agreement again for satellite data to assess flood levels in hard-hit Dresden and other areas. "You can't fly along the Elbe



ESA's ERS and Envisat satellites captured images of these areas around the Elbe River during the floods of August 2002, in support of requests from Switzerland, Austria and Germany, under the International Charter on Space and Major Disasters

River in a helicopter to get these images," commented Dr Stefan Voigt, Charter coordinator for the German and Austrian requests, and the team leader for crisis and disaster management at the RS centre of the German space agency (DLR).

Overall, thirty images from the ERS and Envisat satellites had been provided so far to meet the Swiss, Austrian and German requests, and more were being prepared. The Synthetic Aperture Radars (SARs) of ERS are capable of penetrating cloud-cover and operating at night – significant advantages over instruments that operate in the visible frequencies. Each image is approximately 100 mega-bytes in size, and was provided to the users over the Internet, via an FTP connection.

Data could help build flood models

The coordinator of the Swiss effort to support the delivery of pumps and power generators to flooded areas in the Czech Republic, Dr Urs Frei of the RS laboratories at the University of Zurich, said that the ERS data are being used to generate a digital elevation model (DEM) to assist authorities in planning for future flood scenarios. "The DEM could help to simulate different scenarios – which areas would be flooded depending on the water level," he said.

The Envisat imagery that was sent was captured using ASAR's alternating polarisation mode that improves the capability of a SAR sensor to classify different types of terrain, discriminating between, for instance, flooded lowlands and adjacent land. The sensor is the latest generation of radar instruments with increased capabilities over the ERS SAR sensors, while maintaining a continuity of service to users.

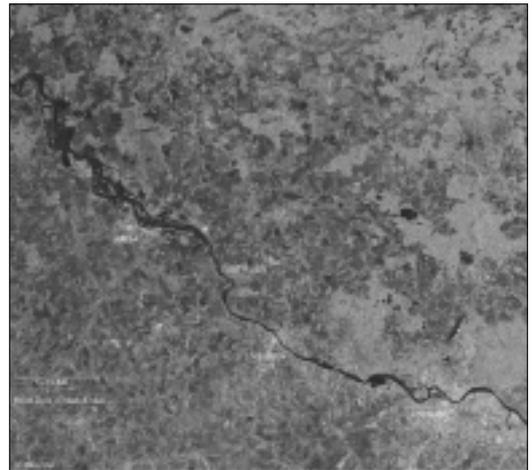
Imagery to national, regional and local users

The ERS imagery was the first data of the flooding provided under the Charter requests, said Voigt, adding that ESA images were being sent even prior to the formal activation of the Charter, by ESA's Earth Watching project that tries to anticipate trouble spots and make available both archived data and current imagery. In addition to the ESA data, imagery was pro-

vided by CNES, the French Space Agency and its SPOT Earth observation (EO) satellites, the Canadian Space Agency's Radarsat, and the Indian IRS sensor.

The imagery proved valuable during the recent flooding, by providing various crisis management teams with an overview of the situation on a large scale. Users ranged from government agencies on the national and regional levels, down to local authorities, relief agencies and civil protection groups. Specifically, the data were used to fine-tune hydrological models that look at flooding in upstream areas and attempt to predict where the worst downstream flooding will occur in a few days time, said Voigt, adding: "We have a saying: after the flood is before the next one."

The "after-the-flood" applications could prove even more beneficial for coping with this event, and providing data that could help mitigate the next one. Voigt said that the satellite data are expected to be used to assess damage claims for insurance purposes, provide government authorities with needed data for reimbursement to local agencies of reconstruction costs, and allow more precise analyses of the flood's impact on agriculture, reservoirs, wildlife reserves



This Envisat radar image of the Elbe valley in Sachsen (Germany) was taken on 19th August 2002, around 11:30 (local time). It shows the flooded areas at that time (in black or blue). The flooded areas are particularly large around the city of Riesa. This image demonstrates the increased capabilities of the Advanced Synthetic Aperture Radar (ASAR) on Envisat, as compared with the SAR sensors of ERS, while offering a continuity of service to users

and wetland areas. For more information, see the web-page www.esa.int/export/esaSA/ESAZODZPD4D_earth_2.html.

About the International Charter on Space and Major Disasters:

The International Charter on Space and Major Disasters was formed after the UNISPACE III conference in Vienna in 1999. Together with ESA, the French Space Agency, the Canadian Space Agency, the Indian Space Research Organisation, and the US National Oceanic and Atmospheric Administration have agreed to contribute imagery from a constellation of EO systems, including Radarsat-1, SPOT, ERS, IRS, POES and GOES satellites. For more information, see the web-site www.disaster-charter.org/main_e.asp.

3.1.2 Johannesburg Summit endorses role of space

On 9th September 2002 ESA reported that, despite some controversy surrounding the outcome of the previous week's World Summit on Sustainable Development (WSSD) in Johannesburg, there is one subject on which all delegates were unanimous: the important role that Earth observation (EO) satellites can play in assisting sustainable development.

The WSSD 54-page Plan of Implementation contains at least ten specific references to EO, clearly demonstrating that the Summit recognised the importance of space technology for sustainable development. This success goes back to ESA, which – in its role as current Chair of CEOS (Committee on Earth Observation Satellites) – delivered a number of official statements during the preparatory meetings and the Summit itself. Some of the statements delivered by ESA, on behalf of CEOS, were followed by supporting interventions by national delegations to CEOS, such as Japan and the USA.

All in all, ESA staff had a busy but rewarding week, as this year ESA is also Co-Chair of IGOS, the Integrated Global Observing Strategy partnership. José Achache, ESA Director of Earth Observation, addressed the plenary session of the Summit on behalf of CEOS and IGOS. Stephen Briggs,

Head of ESA's Earth Observation Applications Department, also addressed the WSSD Summit, in his capacity as co-chairman of CEOS. ESA staff also participated in a number of meetings and discussions on the use of satellite data at Ubuntu Village in Johannesburg, where ESA also had a stand.

Two important WSSD partnership initiatives concerning EO data were launched during the week: the first by IGOS concerning the use of space and ground measurements for sustainable development; and the second by CEOS to encourage partnership on education and training in EO. Both of these measures aim to widen the use of EO data to protect the environment, particularly in developing countries, and to ensure that this data is available to all.

To follow up on the action taken at the WSSD Summit, a high-level meeting has been arranged for 19th November 2002, at ESRIN, ESA's space research institute in Frascati, Italy. Here, government ministers, UN representatives and heads of space agencies will decide on how best to use satellite data to support sustainable development.

When asked about the Summit, Mr. Achache stated: "In Rio, Heads of States achieved agreement on high-level political declarations but with little underlying ground work. In contrast, Johannesburg did not lead to a strong political consensus but initiated many concrete actions and partnerships. EO for space achieved a level of visibility and recognition at the Summit that has never before been achieved in such a forum. ESA is already contemplating the launch of a concrete initiative to support sustainable development and capacity building in developing countries, by the joint use of EO and telecom satellites, particularly Envisat and Artemis." Further information on ESA's participation at the WSSD Summit is at: www.esa.int.

3.1.3 New ESA/EC network for space entrepreneurs

On 13th September 2002 it was reported that European entrepreneurs using space technology and systems now have a better chance of starting up in business, thanks to

the European Space Incubators Network (ESINET), launched this summer by the European Space Agency (ESA) and the European Commission (EC). It is Europe's first network of space business incubation centres, and at present includes 20 incubators in twelve European countries. With 33,000 employees and an annual turnover of 5.5 billion, the space sector generates many technologies and systems, which can be used by entrepreneurs to develop new products and new value-added services for use in the non-space sectors.

Business incubators are committed to nurturing entrepreneurs, start-ups and small companies at an early stage in their ventures. They offer access to finance, office space and logistics, hands-on advice and management assistance, help with recruitment and marketing, and offer support for legal aspects and services, etc. Bruno Naulais continued: "It is a tough challenge to get from a good idea to having a company running successfully. Thanks to the support of ESISET, start-ups should significantly increase their survival rate."

ESA is supporting ESISET, a European network, rather than a few national incubators, since such a network falls nicely into the frame of the ESA-EC common strategy for space. Furthermore, a recent EU benchmark study showed that the rate of success of stand-alone incubators is lower and is, therefore, less attractive to entrepreneurs. ESISET includes 20 incubators in Belgium, Bulgaria, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, the UK and the Ukraine.

For more information about ESISET, contact: Bruno Naulais, European Space Incubators Network Manager, Technology Transfer and Promotion Office, European Space Agency – ESTEC, Keplerlaan 1, PO Box 299, 2200 AG Noordwijk, The Netherlands (telephone: +31-71-5654711; fax: +31 71 565 3854; e-mail:bruno.naulais@esa.int; web: www.esa.int/technology).

3.1.4 ESA's New Media Support Centre (NMSC)

The New Media Support Centre (NMSC),

an ESA initiative, offers a basis for innovation and cross-fertilisation of ideas. It will provide the support which businesses and institutions need to manage the risk of exploring new cross-discipline satellite technology. To learn more about the NMSC and express your interest in their facilities, visit the NMSC web-site and fill in the on-line questionnaire.

Applications support has been the starting point of NMSC operations. NMSC is now providing access to a number of basic facilities such as satellite capacity, satellite networks, terminals, a demonstration laboratory for real-time or off-line demonstration of applications and technical support in the use of NMSC facilities. New capabilities will be added over time. Particular emphasis will be given to providing Systems Simulations and satellite Terminals Testing facilities. By filling in the NMSC on-line questionnaire, potential users can help the NMSC fine-tune their facilities to meet user needs and market developments.

The test and development environment offered by the NMSC is for services, applications and equipment combining any of the traditional telecommunications disciplines (multimedia, mobile or broadcast), navigation and Earth imaging, which employ satellite communications in some form. Some of the uses envisaged include telemedicine, tele-education, advanced satellite networks and satellite-based emergency management systems. Read more at: www.esa.int/export/esaSA/ESAKS0KE43D_telecom_0.htm.

3.2 News from the EC

3.2.1 Monitoring Agriculture with RS: news update

Guido Lemoine, JRC, Institute for Protection and Security of the Citizen, Ispra, Italy (e-mail: guido.lemoine@jrc.it)

With the eighth successive campaign coming to its end, the "Control with Remote Sensing" programme of the EU's MARS (Monitoring Agriculture with Remote Sensing) project remains a mainstay in

civilian applications of remote sensing (RS) in Europe. This year, satellite imagery of more than 135 European sites was ordered through the programme, in order to enable the control of EU farmers' income aid in thirteen of the fifteen EU Member States (i.e. all except Austria and Luxembourg). The satellite data, from SPOT, LANDSAT, IRS and RADARSAT sensors, are supplied within days after acquisition, to EU contractors, who perform the technical work on behalf of their national administrations in charge of control. Many Member States supplement the data-sets with current or archived airborne ortho-imagery, in order to fulfil the strict accuracy conditions for parcel area measurement. The supply of high-quality airborne ortho-imagery in most of the EU Member States is more cost effective than the use of very high resolution satellite data. This is why IKONOS, QuickBird, and EROS A1 imagery, though already tested under the programme, have difficulty making in-roads into the programme.

The EU's "Control with Remote Sensing" programme is a prime example of research-originated application development that has found a niche market. Strongly tied to evolving EU legislation, the control methodology is under continuous development by the Commission and EU partners in the programme. The methodology itself is constantly being improved by integrating the latest technology in the field of geomatics. As such, RS technologies have to compete not only amongst themselves (e.g. SPOT vs. LANDSAT) but also with traditional methods and, increasingly, with GPS-supported rapid field-survey techniques. Development in mobile-connected platforms for the typically distributed tasks in the control procedure, is currently a major point of attention. Ortho-imagery provides the map base in all cases, however. The competitive set-up of the programme has contributed significantly to the cost-awareness amongst all programme partners.

A major future development in the "Control with Remote Sensing" programme is linked to the accession to the EU of the new Member States. For the past two years the MARS project has been active to provide technical assistance to the preparation process for the

so-called Integrated Administrative and Control System (IACS), of which the "Control with Remote Sensing" programme forms a part. Furthermore, the recently initiated discussion on the mid-term review of the EU's Common Agricultural Policy (CAP) includes a number of issues that may affect the future characteristics of the control programme. For more information on the MARS "Control with Remote Sensing" programme, please visit the web-site mars.jrc.it/control, or contact Mr. Guido Lemoine (e-mail: guido.lemoine@jrc.it), at the Institute for the Protection and Security of the Citizen (IPSC) of the European Commission's Joint Research Centre in Ispra, Italy.

3.2.2 EC and ESA launch GMES consultation process

On 15th July 2002 in Brussels, EU Research Commissioner Philippe Busquin and the Director General of the European Space Agency (ESA), Mr. Antonio Rodotà, officially opened a large stakeholder consultation process aiming to define European needs to enhance satellite-based global monitoring for the environment and security (GMES).

Satellites can help the EU monitor climate change, address international crises and contain natural disasters. 250 participants, representing users, suppliers and researchers, addressed policy options to upgrade Europe's capability for global monitoring by 2008. Combining space, land-based and airborne technologies, GMES will pool together Europe's activities in satellite observation and remote sensing (RS). GMES seeks to better exploit Europe's existing and planned capabilities and infrastructures, and to develop mechanisms for better collecting and distributing information. Data from ENVISAT and from other space-borne, terrestrial, air-, and sea-borne observation systems, will allow European researchers, private companies and public authorities to track in a better way environmental pollution, to react to emergencies, to improve cross-border response to catastrophic events, to follow movements of refugees, to facilitate the distribution of aid, and to support peace-keeping troops outside Europe.

Commissioner Busquin said: "GMES is both a technological and an organisational challenge for Europe. It is a good example of how Europe, by working better together in research, can develop technologies that contribute to improving quality of life and meeting security needs. For instance, through GMES, we will support the implementation of the EU fisheries policy by better monitoring the evolution and migrations of fish stocks."

Mr Rodotà recalled the dedicated efforts by ESA in the framework of GMES. ESA will start the implementation of operational services than can nowadays meet some priority users' requirements, based on current Earth observation (EO) capacities. The very concrete implementation of the GMES initiative is thus underway. Furthermore, ESA is now fully engaged with the European Commission (EC) to discuss the most appropriate set-ups to insure the long-term sustainability of the GMES initiative.

July's meeting was the first in a series that will foster the dialogue between decision-makers and the many organisations involved in monitoring and in providing information for environmental and security purposes. The Forum will result in a report to be issued at the end of 2003, to provide policy-makers with recommendations for the steps ahead.

GMES fosters Europe's ability to retrieve and process information obtained from space-borne and terrestrial observation systems with other geographical or socio-economic data. It responds to growing concerns amongst policy-makers to ensure free and independent access to information on environment and security at global, regional and local level. GMES aims to support EU policies in areas such as sustainable development, global climate change and common foreign and security policy. At the global level, GMES will provide new verification tools to contribute to the precise monitoring of the implementation of international agreements, such as the Kyoto protocol on climate change, as well as security and international aid agreements. GMES will also help local authorities to pinpoint problems (e.g. shoreline erosion, environmental stress) and better react to

catastrophic events (e.g. floods, mudslides, avalanches, and forest fires). At a European level GMES will provide new objective data to support a broad range of EU policies, including regional development, transport, agriculture, enlargement, development, and foreign policy.

GMES is a key element of the European Space Strategy developed by the EC and ESA. Along with the GALILEO global satellite navigation system, GMES will be a major pillar of the European Space Policy that is emerging from an ever-closer partnership between the two organisations. In November 2000, both the EU and ESA Ministerial Council endorsed GMES and identified it, along with GALILEO, as a top priority and test-case for the implementation of the European Strategy for Space. GMES was also presented in the EC's Communication to the Gothenburg Council in June 2001, with a goal of creating the system by 2008. The idea was further developed in the Communication "Outline GMES EU Action Plan (Initial Period: 2001-2003)", which elaborates on the objectives, general implementation principles, organisation and first priorities.

On the ESA side, GMES is at the core of a new five-year programmatic element (the "GMES Service element"), fully subscribed by the ESA Council at Ministerial level in November 2001. It will allow for the delivery of operational information, based on current EO capacities, for the thematic priorities already identified in the GMES framework. A first invitation to tender for those services will be released in September 2002.

GMES is also a key element of the "Aeronautics and Space" priority of the 6th EU Research Framework Programme (2002-2006), and will feature in the calls for proposals to be published at the end of 2002. The GMES initiative was also presented at the World Summit for Sustainable Development in Johannesburg, South Africa, in September 2002. For further information on European space policy and GMES, please visit:

europa.eu.int/comm/space/index_en.html; www.esa.int; europa.eu.int/comm/research/press_en.html.

3.2.3 EU to raise research spending to 3% of GDP

On 11th September 2002 in Brussels, the European Commission (EC) presented its strategy to respond to the March 2002 Barcelona European Council's call to raise research spending to 3% of EU average Gross Domestic Product (GDP). Today Europe lags behind at 1.9 %. The new Communication, entitled " More Research for Europe: Towards 3% of GDP" (COM(2002) 499 of 11.09.2002), looks into Europe's under-investment in science and technology and its harmful consequences for EU competitiveness, growth and employment.

Research and development (R&D) investment (private and public) in the US now exceeds EU expenditure by more than 120 billion every year. Without prompt action, this knowledge gap will hamper Europe's innovative potential and its capacity to become the most competitive and dynamic knowledge-based economy in the world by 2010, a goal set by the Lisbon European Council in March 2000. The main challenge is to increase R&D business funding in Europe, which should be raised to two-thirds of R&D expenditure, a level already attained or exceeded in the USA, Japan and several Member States, instead of 55% on average today. Co-ordinated action at European, national and regional levels is therefore necessary to make Europe more attractive to business investment in R&D. Access to finance, better regulation, human resources, intellectual property rights, fiscal policies and other incentives have to be fine-tuned to R&D needs. The Commission will now launch a broad stakeholder consultation to identify a focused set of actions by early 2003.

The full text of the new Communication from the Commission, and the supporting Staff Working Paper, are available on-line at: europa.eu.int/comm/research/era/pdf/com3percent_en.pdf; europa.eu.int/comm/research/era/pdf/staffwp3percent_en.pdf. For more information, see europa.eu.int/comm/research/press_en.html.

3.2.4 New CORDIS and EU information services

The European Commission's Research and Development Information Service (CORDIS) is publishing a gateway page to provide users with newly available information on the Sixth Framework Programme (FP6). In the interim before the launch of a fully-fledged FP6 service, the new page will lead potential participants to the right services on CORDIS. Information on the European Research Area (ERA) and FP6 has been regularly published on the RTD2002 service, but additional information is also available on other pages.

The new interface reflects the range of services that can be used to obtain relevant information in order to keep abreast of the latest decisions, review ideas, and prepare for collaboration. The enhanced Partners service, for example, already enables users to select FP6 research areas in which they would like to collaborate. The FP6 service also presents the current status of negotiations leading to the first calls for proposals, foreseen for November 2002. It also provides users with some elements of the content of the official web service that will present the FP6 structure and funding opportunities, as well as participation documentation, submission tools and key contacts. The official FP6 service will be unveiled in September 2002 and available at the same web-site (www.cordis.lu/fp6).

Another recently inaugurated EU information service, CORDIS WIRE, gives access to information submitted by European innovation and research stakeholders. It lists press releases and events covering many disciplines that can be searched via keywords. It is designed for the scientific community and aimed at the editors of journals to help them in the drafting of articles. For more information: telephone +32-2-2381746; fax +32-2-2381798; e-mail wire@cordis.lu; web www.cordis.lu/wire.

A further information service, EUROPE DIRECT, has also been inaugurated. You may use the single Free-Phone Number (+800-678-91011) from any of the fifteen EU Member States, and reach an operator who speaks your own language. The Europe Di-

rect call centre will help you find an answer to your questions about the EU. It can provide direct responses to general enquiries and, if you have more detailed questions, sign-post you to the best source of information and advice.

3.2.5 JRC announces re-structuring for FP6

In preparation for the launch of the Sixth Framework programme (FP6) in November 2002, the European Commission's Joint Research Centre (JRC) is to restructure its management arrangements. Barry McSweeney, Director-General of the JRC, said: "In planning the restructuring, I took many factors into account, important among those being the background, expertise and qualification of Directors. Another consideration was the Directors' length of time in office, in line with the new Commission policy on mobility. Directors who had about five years in their position have been moved." All new appointees have both scientific and management experience, enabling the JRC management team to provide strong leadership and direction. The changes below will come into effect on 1st November 2002.

- Manfred Grasserbauer, current Director of the Institute for Reference Materials and Measurements, in Geel, Belgium, moves to the position of Director of the Institute of Environment and Sustainability, in Ispra, Italy.
- Jean-Marie Martin, current Director of the Institute of Environment and Sustainability, Ispra, becomes Principal Advisor to the Director-General on Science and Technology, with particular emphasis on increasing the linkages with European scientific organisations. He will be based in Ispra.
- Alejandro Herrero, current Director of Science Strategy, based in Brussels, will become Director of the Institute for Reference Materials and Measurements, in Geel.

- David Wilkinson, current Director of the Institute for the Protection and Security of the Citizen, moves to Brussels as Director of Science Strategy.
- Jean-Marie Cadiou, current Director of the Institute for Prospective Technological Studies, in Seville, Spain, moves to the position of Director of the Institute for the Protection and Security of the Citizen, in Ispra.
- The position of Director of the Institute for Prospective Technological Studies will be filled as soon as possible.

For further information, please consult the web-site www.jrc.cec.eu.int.

3.3 New Swiss EO Service Providers Society

Message from Dr. Michael F. Baumgartner, President, Swiss Earth Observation Service Providers Society

The Swiss Earth Observation Service Providers Society, which has been founded recently, is an association of the Small and Medium Enterprises (SME) in Switzerland which offer services and value-added products in the field of space-borne Earth observation (EO).

The new society has the following goals: representation of the interests of the Swiss EO service providers; discussion forum for the Swiss EO service providers; improving the awareness and visibility of the Swiss EO service providers; contact for industry, administration, research and education; customer link for raster-based data and geomatics.

The following companies are presently members of the new society: Ernst Basler und Partner; Gamma Remote Sensing; MFB GeoConsulting; Sarmap. The society and its members can be contacted via the web-site www.erdbeobachtung.ch, or by email (info@erdbeobachtung.ch).

4 RS DATA, PRODUCTS AND PROJECTS

4.1 September 11, 2001: satellite image tribute

On the recent occasion of the one-year anniversary of the appalling events that took place on September 11th 2001 in New York, Washington, and Pennsylvania, USA, and in commemoration of those directly affected, and of those involved in the Herculean recovery effort, the Colorado-based remote sensing company Space Imaging, which owns and operates the one-metre resolution IKONOS space satellite, has made freely available an on-line digital archive of pre- and post attack IKONOS satellite images of

the World Trade Centre and the Pentagon. These poignant images may be viewed at www.spaceimaging.com/gallery/9-11/default.htm.

Below are four examples of one-metre resolution IKONOS satellite images of the site of the 110-story World Trade Centre in Lower Manhattan, New York City, taken before and after the catastrophe of September 11th 2001. Since all airplanes were grounded over the USA after the attack, IKONOS was the only commercial high-resolution camera that could take an overhead image at the time.



Four IKONOS satellite images of New York City: top-left – June 30th 2000; top-right – September 12th 2001 (11:43 am); bottom-left – September 15th 2001 (11:54 am); bottom-right – September 4th 2002.

4.2 Observations

*Boudewijn van Leeuwen (leeuwen@itc.nl),
ITC, The Netherlands*

Recent Launches:

Haiyang and Fengyun-1D

On 15 May 2002, a Long March 4 rocket launched two Chinese satellites from Taiyuan, China. The Fengyun-1D satellite is a meteorological polar-orbiting platform, which is also designed to monitor flooding and other environmental phenomena. It is the sixth satellite in the Fengyun series. Haiyang-1 ("Haiyang" is Chinese for "ocean") is a marine observation satellite monitoring the Earth from a sun-synchronous orbit with a ten-band infrared ocean colour scanner and a four-band CCD camera. The first images from Haiyang-1 were received on 29 May 2002.

Ofeq-5

On 28 May 2002, Ofeq-5, the latest Israeli satellite in the Ofeq series, was launched by an IAI/MLM Shavit satellite launcher, from Palmachim missile test centre on the Israeli Mediterranean coast. The spy satellite acquires very high resolution multi-spectral images from a retrograde polar orbit of about 450 kilometres. (See web-site www.iai.co.il/iai/dows/Serve/level/english/1.1.htm).

NOAA-M

On 24 June 2002, a Titan 2 successfully launched NOAA's latest bird, NOAA-M, into a polar orbit. One day later the first image was received from the satellite. On 14 July 2002, after the on-orbit verification, NASA turned over operational control to NOAA and the satellite was renamed NOAA-17. NOAA-17 is the third polar-orbiting satellite currently in operation. Like the earlier NOAA satellites, its instruments will collect meteorological data and other environmental data. Currently the first data is being released by NOAA. (See web-site www.noaa.gov).

Cosmos-2392

On July 25 2002, a Proton K/DM-2M launch vehicle launched the Cosmos-2392 from Baykonur, Kazakhstan. Apart from performing reconnaissance activities, the

military satellite will provide data for environmental monitoring of the Earth in the framework of the civil space programme.

MSG-1

On 28 August 2002, after a 24-hour delay due to communication problems between the control centre and the launch vehicle, two satellites were successfully launched by an Ariane 5 from Guiana Space Centre at Kourou, French Guiana. Both the Atlantic Bird 1 (a communication satellite) and the MSG-1 (Meteosat Second Generation) were placed in a geostationary orbit. With its twelve-channel SEVIRI instrument, MSG-1 will improve weather forecasting and climate research. The additional GERB instrument is a broadband radiometer to measure the Earth radiation budget. About a year after launch, MSG-1 will commence operational service above the equator, at 0° longitude, taking over from Meteosat-7 as the main weather- and climate-monitoring satellite. MSG-1 is the first of three modern weather satellites in the Meteosat Second Generation programme. MSG-2 will be launched about eighteen months later, and MSG-3 will be built and put in storage until it is required to take over as MSG-1 nears the end of its life. (See web-sites www.esa.int/export/esaMI/MSG/index.html and www.eumetsat.de).

METSAT

On September 12 2002, the Indian Space Research Organisation launched the weather satellite METSAT. The Polar Satellite Launch Vehicle, PSLV-C4 successfully brought the satellite into a geosynchronous transfer orbit. From there the satellite will be raised to a 74 East geostationary orbit. This is India's first satellite specifically dedicated to meteorology. Until now, the INSAT communication satellites were used as a platform for weather-monitoring instruments. (See web-sites www.isro.org).

New data products available:

SPOT 5

SPOT 5 was launched on 3 May 2002, with the first images taken by the on-board High Resolution Geometric instruments being obtained on 7 May. On 12 July 2002, the French space agency CNES handed over responsibility for commercial opera-

tion of SPOT 5 to SPOT Image, which started the distribution of the data on 23 July. (See web-site www.spotimage.com).

PROBA

PROBA (Project for On-Board Autonomy) was launched on 22 October 2001, and is ESA's first small autonomous spacecraft for in-orbit technology demonstration. Data from the Compact High Resolution Imaging Spectrometer (CHRIS) are made publicly available via the Internet. ESA is looking for proposals for instruments to fly on board the second Proba mission. Proba 2, scheduled for launch in 2005, will give industry, universities and institutes in ESA Member States and Associate Member States, the opportunity to test advanced small instruments in orbit. (See web-sites www.esa.int/estec/proba and www.rsac.co.uk/chris/index.htm).

Change in ASTER data pricing policy:

On 12 August 2002, at the direction of NASA, the USGS EROS Data Centre began charging for the most used ASTER data products. ASTER Level 1a, 1b, and Decorrelation Stretch granules, ordered through EROS Data Centre, will cost US\$ 60 (shipping excluded). Other ASTER products can still be ordered without charge. (See web-site edcdaac.usgs.gov/aster/aster_pricing.html).

Coming up:

According to schedule, a Titan 2 launcher will launch DMSP-16, a defence weather satellite, from Vandenberg Airforce Base on 6 October 2002. An H-IIa launch vehicle will launch ADEOS-II from Tanegashima Space Center on 1 November 2002. The Japanese ADEOS-II is the successor of the Advanced Earth Observing Satellite mission. In November 2002, ORBIMAGE's Orbview-3 will also be launched from Vandenberg Airforce Base. Orbview-3, and will join the select group of very high resolution satellites.

4.3 Europe's new weather satellite launched

On 28th August 2002, the flawless launch of MSG-1 – a "super Meteosat" – took place. Almost twenty-five years after the Novem-

ber 1977 launch of the very first Meteosat, the first representative of the next generation (MSG-1) of European weather satellites had been placed in orbit, and is being made ready to lend new dimensions to the monitoring of our planet's climate.

The launch carried out by a European Ariane-5 launcher, which lifted off from the Guiana Space Centre, Europe's space-port at Kourou, French Guiana. The two payloads – one of which was MSG-1 – were placed in geo-stationary transfer orbit. Controlled from ESA's operations centre at Darmstadt, Germany, MSG-1 will now make a series of manoeuvres using its on-board propulsion system, which will take it to its definitive geo-stationary orbit a few weeks hence.

Responding to the launch, José Achache, ESA Director of Earth Observation, said: "With the world's political leaders gathered in Johannesburg to discuss the requirements for sustainable global development of our planet, ESA is proud to have deployed this satellite on behalf of Eumetsat and for the benefit of countless users. It is going to improve weather forecasting, our understanding of climate change and the issue of the planet's water resources".

Built by Alcatel Space Industries, as prime contractor, and a team of over fifty European companies, MSG-1 was developed by ESA on behalf of Eumetsat, the European meteorological satellite organisation. Eumetsat will be taking over MSG-1 at the end of September 2002, following in-orbit checking of its systems, and will then proceed with acceptance of the payload. The first image from the satellite is expected by the end of October 2002. About a year after launch, MSG-1 will commence operational service above the equator, at 0° longitude, taking over from Meteosat-7 as the main weather- and climate-monitoring satellite. Two and a half times larger than the Meteosat-1 to -7 series, MSG-1 is a cylindrical satellite 3.22 metres in diameter and 3.74 metres in height. Its mass on lift-off was 2 tonnes, almost half accounted for by the propellant needed to place it on station and keep it there during its seven-year mission.

The MSG programme aims to build on Meteosat's success to date, by flying new,

more powerful and accurate instruments for continuous observation of the Earth's atmosphere through to the year 2014. The MSG satellites are going to carry on the uninterrupted monitoring performed by their predecessors over the past quarter of a century, generating a multitude of data essential to the understanding and modelling of our planet's climatic activity. The two main instruments on board MSG-1 are the SEVIRI (Spinning Enhanced Visible & Infrared Imager) and GERB (Geostationary Earth Radiation Budget) radiometers. MSG-1 is also flying a payload for receiving and relaying, almost in real time, data from automated stations on the ground. In addition, a special transponder will relay distress signals from ships, aircraft and any other vehicles equipped with one of the beacons used by the COSPAS-SARSAT international search and rescue system.

MSG-1 is to be followed by two identical satellites, for which Eumetsat will be fully responsible. MSG-2 is due for launch in early 2005, MSG-3 in spring 2009. The building of a fourth satellite is being considered, to maintain continuity of the programme beyond 2014. For further information, contact ESA Media Relations Service (telephone: +33-1-53697155; fax: +33-1-53697690).

4.4 SPOT 5: performance news and price strategy

SPOT 5 – ready for action!

On 12th July 2002, the French space agency CNES (Centre National d'Etudes Spatiales) handed over responsibility for commercial operation of SPOT 5 to Spot Image, which will be now distributing imagery acquired by the new satellite worldwide. After being placed in orbit by an Ariane 4 launcher on 3rd May 2002 from the Guiana Space Centre (Europe's space-port in Kourou, French Guiana), SPOT 5 has successfully completed two months of in-orbit tests and is now fully operational. Tests performed during in-orbit checkout have shown that: (a) the satellite, ground telemetry and command systems, and passenger instruments are functioning perfectly and system availability is excellent; (b) geometric and radiometric quality of images from the two

HRG (high-resolution geometric) instruments and the HRS (high-resolution stereoscopic) instrument are excellent, exceeding specifications. Moreover, ways of further enhancing performance have already been identified. Since being placed in orbit, SPOT 5 has already acquired 23,000 scenes.

In-orbit checkout of the VEGETATION instrument will be completed in November 2002. Performance so far is excellent. The VEGETATION image processing centre (CTIV) in Belgium preprocesses the data received by the main receiving station located in Kiruna, Sweden.

SPOT 5 offers unrivalled acquisition capability with its two HRG instruments, each covering a wide imaging swath of 60x60 kilometres at a resolution of 2.5 metres, and its HRS instrument, which supports operational production of high-accuracy digital elevation models (DEMs). The other satellites in the SPOT constellation – SPOT 1, SPOT 2 and SPOT 4 – are still functioning nominally, with SPOT 1 as an on-orbit spare, ready to resume operation if necessary.

The SPOT programme was developed by CNES in partnership with Sweden and Belgium. The EU and Italy are also partners on the VEGETATION programme. The HRS instrument is co-funded by CNES and Astrium, who will be reimbursed by Spot Image during the exploitation phase.

SPOT Image announces new pricing strategy:

As SPOT 5 comes on-stream Spot Image has redefined its international pricing strategy, and brought out a new price list of SPOT products and services. This new strategy follows the company's announcement on 15th July 2002, that SPOT 5 imagery is now on sale, and reflects the broad range of SPOT data products on offer, at resolutions from 2.5 to 20 metres.

The main prices for level 1A archive images are:

- Entry-level images at 20 metres resolution in colour and 10 metres in black-and-white, now at €1,900, making them more competitive against similar products on the market;

- Core products at 10 metres in colour and 5 metres in black-and-white, now at €2,700 (previously the cost was for 20 metres colour and 10 metres black-and-white products, meaning a twofold increase in resolution for the same price);
- High-end SPOT products at 2.5 metres in black-and-white at €5,400 (i.e. €1.5 per km² for a 3,600 km² scene);
- At a unit price of €1,200, old SPOT archive imagery (i.e. pre-January 2001) remains very attractive. SPOT Image's global archive of nearly 10 million scenes acquired since 1986, is ideal for comparisons with recent imagery to detect and track environmental changes.
- SPOT Image is also innovating by giving users the opportunity to order SPOT 5 sub-scenes (half-scenes, quarter-scenes, eighth-scenes) covering their specific area of interest.

Note that: (a) the international price list of SPOT products and services does not apply in the countries covered by Spot Image subsidiaries; (b) level 1A imagery is pre-processed by normalising CCD response to compensate for radiometric variations due to detector sensitivity.

SPOT Image is the commercial operator of the SPOT system, distributing a full range of products and operational services including SPOT satellite programming, on-line delivery and 24-hour rush service. SPOT Image sells imagery from other optical sensors (EROS, Ikonos, IRS, Landsat, KVR, Quick-Bird) and radar sensors (Envisat, ERS, Radarsat) and from the VEGETATION 1 and 2 instruments. It also sells digital elevation models (DEMs) derived from SPOT 5's HRS stereo-imaging instrument. For more information, contact Spot Image Corporate Communications (telephone: +33-5-62194 040; e-mail: anne-marie.bernard@spotimage.fr; web: www.spotimage.com).

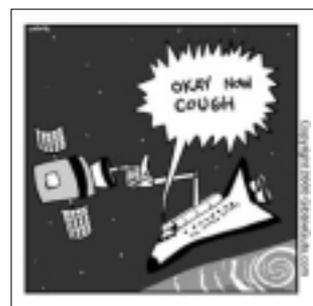
4.5 Fixed Space Shuttle Atlantis set for launch

On 11th September 2002 it was reported that NASA hopes to launch the space shuttle Atlantis as early as 2nd October 2002, now that cracks in the spacecraft's fuel lines had been repaired. The discovery of

cracks in the space programme's four shuttles had grounded the fleet all summer.

NASA delivered the newly mended Atlantis to the launch pad on 10th September, atop a spaceship hauler which itself had also undergone repairs to replace cracked bearings. The platform and its new bearings held up well during four-mile journey from the hangar, which took almost all morning. NASA had to replace old bearings in the Apollo-era spaceship hauler after the damage turned up in August. The problem in the huge caterpillar-track platform was discovered just as the space agency finished welding cracked fuel lines inside Atlantis. Significant cracking also was found in many of the bearings in NASA's other spaceship transporter, in use for 37 years. Dozens of new bearings had to be ordered; each one is about the size of a volleyball, and custom-made. The fuel-line cracks were discovered in Atlantis and the other three shuttles earlier this summer. A master welder repaired the cracks in Atlantis and then went to work on Endeavour.

Atlantis will carry up a major new part for the international space station, and a pair of astronauts will conduct three spacewalks to hook everything up. Atlantis originally had been scheduled for an August lift-off. All the other space shuttle flights also were bumped by at least a month. Shuttle program director Ron Dittmore es-



The Space Shuttle, doing a routine maintenance check-up on a satellite

timated that repairs to the shuttle cracks cost millions of dollars in overtime. Engineers are still trying to determine what caused the damage. Although the fuel-line cracks were minute, NASA feared they could grow and chip, possibly sending pieces of metal shrapnel into a main engine. That, in turn, could have resulted in a launch explosion. Launch of the shuttle Co-

lumbia, originally scheduled for July, has been put back to next January. For further information, see www.space.com/mission-launches/ap_atlantis_020911.html.

Still on the subject of the Space Shuttle, digital topographic data of the USA, obtained by the Shuttle Radar Topography Mission and released to the public in early 2002, can be accessed via the web-sites www.jpl.nasa.gov/srtm/cbanddataproducts.html and edcsgs9.cr.usgs.gov/pub/data/srtm.

4.6 Satellite survey reveals "greening" Sahara

On 18th September 2002 it was reported on the web-site of the British magazine *New Scientist* (www.newscientist.com/news), that an analysis of satellite imagery of Africa's deserts has revealed that the southern Saharan desert is in "spectacular retreat", making farming viable again in what were some of the most arid parts of Africa. Burkina Faso, one of the West African countries devastated by drought and advancing deserts twenty years ago, is growing so much greener than families who fled to wetter coastal regions are starting to go home. New research confirming this remarkable environmental turnaround is to be presented to Burkina Faso's ministers and international aid agencies in November 2002.

And it is not just Burkina Faso. *New Scientist* has learned that a separate analysis of satellite images completed this summer reveals that dunes are retreating right across the Sahel region on the southern edge of the Sahara desert. Vegetation is ousting sand across a swathe of land stretching from Mauritania on the Atlantic, to Eritrea, 6000 kilometres away on the Red Sea coast. Nor is it just a short-term trend. Analysts say the gradual greening has been happening since the mid-1980s, though it has gone largely unnoticed. Only now is the evidence being pieced together.

Aerial photographs taken in June 2002 show "quite spectacular regeneration of vegetation" in northern Burkina Faso, according to Chris Reij of the Free University,

Amsterdam. There are more trees for firewood and more grassland for livestock. And a survey among farmers shows a 70 per cent increase in yields of local cereals such as sorghum and millet in one province in recent years. The survey, which Reij is collating, was paid for by Dutch, German and American overseas aid agencies. Meanwhile, Kjeld Rasmussen of the University of Copenhagen has been looking in detail at sand dunes in the same area. Once they seemed to be marching south. But since the 1980s, he says, there has been a "steady reduction in bare ground" with "vegetation cover, including bushes and trees, on the increase on the dunes".

Desertification is still often viewed as an irreversible process triggered by a deadly combination of declining rainfall and destructive farming methods. In August 2002, the UN Environment Programme (UNEP) told the World Summit in Johannesburg that over 45% of Africa is in the grip of desertification, with the Sahel worst affected.

But a team of geographers from Britain, Sweden and Denmark has spent the summer re-examining archive satellite images taken across the Sahel. Andrew Warren of University College London told *New Scientist* that the unpublished analysis shows that "vegetation seems to have increased significantly" in the past fifteen years, with major re-growth in southern Mauritania, northern Burkina Faso, north-western Niger, central Chad, much of Sudan and parts of Eritrea. But there is confusion over why the Sahel is becoming green. Rasmussen believes the main reason is increased rainfall since the great droughts of the early 1970s and 1980s. But farmers have also been adopting better methods of keeping soil and water on their land. (This article is from a report by Fred Pearce at www.newscientist.com/news/news.jsp?id=ns99992811).

4.7 Satellites show Earth's growing waistline!

According to a report on 1st August 2002, satellite data since 1998 indicate that the bulge in the Earth's gravity field at the equator is growing, and scientists think

that the ocean may hold the answer to the mystery of how the changes in the trend of Earth's gravity are occurring.

Before 1998, Earth's equatorial bulge in the gravity field was getting smaller because of "post-glacial rebound", or PGR, resulting from the melting of ice-sheets after the last Ice Age. When the ice-sheets melted, the land underneath the ice started rising. As the ground rebounded in this fashion, the gravity field changed. "The Earth behaved much like putting your finger into a sponge ball and watching it slowly bounce back," said Christopher Cox, a research scientist supporting the Space Geodesy Branch at NASA's Goddard Space Flight Centre, Greenbelt, Maryland.

Currently, the Earth has a significant upward bulge at the equator, and a downward bulge at the poles. "Observations of the Earth's gravity field show that some phenomena are counteracting the gravitational effects of PGR. Whereas PGR has been decreasing the bulge in the Earth's gravity field at the equator, these recent phenomena are causing the bulge to increase," Cox said. Such changes in the gravity field can be sensed using ultra precise laser-tracking of satellites to observe tiny changes in the satellites' orbits, and by tracking changes in day-length, or Earth rotation.

Scientists believe movements of mass cause this recent change from the high latitudes to the equator. Such large changes may be caused by climate change, but could also be part of normal long-period climatic variation. "The three areas that can trigger large changes in the Earth's gravitational field are oceans, polar and glacial ice, and atmosphere," Cox said.

Cox and colleague Dr. Benjamin Chao have ruled out the atmosphere as the cause. Instead, they suggest a significant amount of ice or water must be moving from high latitude regions to the equator, and oceans could be the vehicles of this movement. Estimates of today's glacier and polar ice melting are too small to explain the recent changes in the gravity field. If melting ice were the cause of the recent changes in the gravitational field, it would require melting a block of ice 10 kilometres on each side

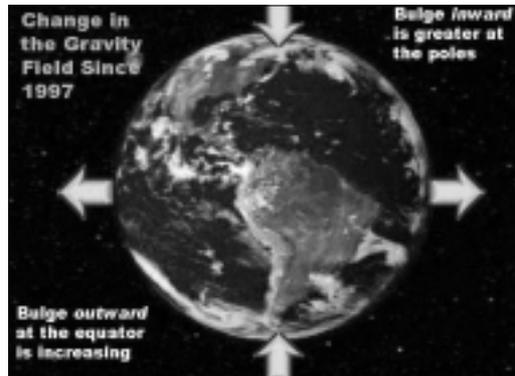
by 5 kilometres high every year since 1997, and pouring it into the oceans. "The recent reports of large icebergs calving in Antarctica can't explain this, because they were already floating in the ocean," Cox said. Furthermore, radar altimeter observations of the average sea-level rise provided by the Topex / Poseidon satellite show no corresponding change in the rate of the global sea level increase.

Consequently mass must have been redistributed within the oceans. That is where the ocean circulation theory comes in. Ocean currents can redistribute mass quickly, such as the five-year period in which these changes were first observed. The Topex / Poseidon observations of sea level height do show an increase in the equatorial bulge of the oceans corresponding to the observed gravity changes, but the data are not yet conclusive. One critical factor is the temperature of the world's oceans, and its salinity, for which detailed data are not yet available.

During 2002 NASA also launched the Grace and Jason missions, which will help to track more precisely these sorts of changes in Earth's geodesy, and will launch the ICESAT mission this winter. An article on this NASA-funded study appears in the 2nd August 2002 issue of the journal Science. This article from a report at www.gsfc.nasa.gov/topstory/20020801gravityfield.html.



Earth's gravity field pre-1997. This image depicts how the Earth's gravity field has been changing since the last Ice Age. Because of "Post-Glacial Rebound" (PGR), regions that were covered by ice during the last Ice Age have been rising, and mass on Earth was re-distributed. This lingering effect of PGR has been reducing the outward bulge in the gravity field at the equator



Earth's gravity field since 1997. Since 1997 researchers have noticed a change in the way Earth's gravity field bulges – i.e. an increasing upward bulge at the equator. Observations of the Earth's gravity field show that some phenomena are counteracting the gravitational effects of PGR, and researchers are looking to the ocean for answers

4.8 Grace's first Earth gravity maps (NASA/DLR)

On 12th September 2002 it was reported that, six months into their mission to measure precisely the Earth's shifting water masses and to map their effects on Earth's gravity field, the twin Grace (Gravity Recovery and Climate Experiment) satellites are already producing results of considerable interest. Using just fourteen days of data from Grace (a joint NASA / German Aerospace Centre mission), a preliminary Grace gravity field map has already been produced, and is proving to be substantially more accurate than the combined results of more than three decades of satellite and surface instrument gravity measurements collected before Grace.

Grace Principal Investigator Dr. Byron Tapley of the University of Texas Centre for Space Research in Austin, said: "In addition to improving our knowledge of Earth's mean gravity field, the ability to measure time variations in gravity will be a new and important Grace contribution." According to Dr. Michael Watkins, Grace Project Scientist at NASA's Jet Propulsion Laboratory, Pasadena, California: "This first Grace gravity field data is about ten times more accurate for large-scale features than any pre-Grace gravity model of Earth. While these first fields are already extremely promising, we expect to do up to ten times

better after we perform additional calibrations of the instruments." Dr. Christoph Reigber, Grace Co-Principal Investigator at the German Geo-Research Centre, and Principal Investigator for the German Champ (Challenging Mini-Satellite Payload) mission, stated: "The Grace mission will soon demonstrate its mission goal to help us to understand better how variations in Earth's gravity field reflect changes in climate." Champ was launched two years ago as the first in a series of dedicated Earth gravity field missions planned for this decade, and is operating in parallel with Grace.

Launched on 17th March 2002, Grace senses minute variations in Earth's surface mass and corresponding variations in Earth's gravitational pull. The monthly gravity maps generated by Grace will be up to 1,000 times more accurate than current maps, substantially improving the accuracy of many techniques used by oceanographers, hydrologists, glaciologists, geologists and other scientists to study phenomena that influence climate. Among the first and most important applications for Grace's data will be to improve our understanding of global ocean circulation. The hills and valleys in the ocean's surface are due to currents and variations in Earth's gravity field. Grace enables separation of those two effects to better measure ocean currents and their effect on climate. Dr. Lee-Lueng Fu, Topex / Poseidon and Jason-1 Project Scientist at JPL, commented: "These first results from Grace look very promising from an oceanographic point of view. Even with this preliminary gravity field, Grace has enabled us to use Topex / Poseidon and Jason-1 data to determine ocean circulation features more accurately."

Grace measures Earth's gravity field by measuring the separation between the twin satellites with an accuracy of one millionth of a metre (less than one-tenth of the width of a human hair). Grace's instruments must all work together and be very accurately calibrated and aligned, a process the Grace project is just now completing during the mission's commissioning phase, which began in early April 2002. Science instruments and supporting systems such as

ground data processing have been activated, evaluated and calibrated.

Grace is a joint partnership between NASA and the German Aerospace Centre (DLR / Deutsches Zentrum fuer Luft und Raumfahrt). The University of Texas Centre for Space Research has overall mission responsibility. Geo-Forschungs Zentrum Potsdam is responsible for the German mission elements. JPL manages the USA portion of the project for NASA's Office of Earth Science, Washington, D.C. Science data processing, distribution, archiving and product verification are managed under a co-operative arrangement between JPL, the University of Texas Center for Space Research and the Geo-Research Centre in Germany. JPL is a division of the California Institute of Technology in Pasadena. For more information on Grace, see www.csr.utexas.edu/grace or www.gfz-potsdam.de/grace. This article is based on a report at www.jpl.nasa.gov/releases/2002/release_2002_174.html.

4.9 NASA Terra satellite maps global land cover

On 13th August 2002 it was reported that new NASA land cover maps are providing scientists with the most refined global picture ever produced of the distribution of Earth's ecosystems and land use patterns. The land cover maps were developed at Boston University in Boston, Massachusetts, using data from the MODIS (Moderate Resolution Imaging Spectro-Radiometer) instrument on NASA's Terra satellite. The maps are based on a digital database of Earth images collected between November 2000 and October 2001. "These maps, with a spatial resolution of 1 kilometre, mark a significant step forward in global land cover mapping, by providing a clearer, more detailed picture than previously available maps," says Mark Friedl, one of the project's investigators. The last maps of this kind were produced from data collected in 1992 and 1993 by the National Oceanic and Atmospheric Administration's AVHRR (Advanced Very High Resolution Radiometer).

The MODIS sensor's vantage point of a given location on Earth changes with each

orbit of the satellite. An important breakthrough for these maps is the merging of those multiple looks into a single image. In addition, advances in remote sensing (RS) technology allow MODIS to collect higher-quality data than previous sensors. Improvements in data processing techniques have allowed the team to automate much of the classification, reducing the time to generate maps from months or years to about one week.

Each MODIS land cover map contains seventeen different land cover types, including eleven natural vegetation types such as deciduous and evergreen forests, savannahs, and wetlands. Agricultural land use and land surfaces with little or no plant cover, such as bare ground, urban areas and permanent snow and ice, are also depicted on the maps. Important uses include managing forest resources, improving estimates of the Earth's water and energy cycles, and modelling climate and global carbon exchange among land, life, and the atmosphere.

Carbon cycle modelling is linked to greenhouse gas inventories – estimates of greenhouse emissions from human sources, and their removal by greenhouse gas sinks, such as plants that absorb and store carbon dioxide through photosynthesis. Many nations, including USA, produce the inventories annually in an effort to understand and predict climate change. According to Professor Steve Running of the University of Montana, Missoula, who uses the Boston University land cover maps together with other weekly MODIS observations: "This product will have a major impact on our carbon budget work. With the MODIS land cover product we can determine current vegetation in detail for each square kilometre – e.g. whether there is mature vegetation, clear-cutting, a new fire scar, or agricultural crops. This means we can produce annual estimates of net change in vegetation cover. This gets us one step closer to a global picture of carbon sources and sinks."

This first map is an important milestone, but the Boston land cover mapping group has other projects in progress. "With data collected over several years," says Friedl,

"we will be able to create maps that highlight global-scale changes in vegetation and land cover in response to climate change, such as drought. We'll also be establishing the timing of seasonal changes in vegetation, defining when important transitions take place, such as the onset of the growing season."

Launched on 18th December 1999, Terra is the flagship of the Earth Observing System series of satellites. It is a central part of NASA's Earth Science Enterprise, whose mission is to develop a scientific understanding of the Earth system and its response to natural and human-induced changes, to enable improved prediction capability for climate, weather, and natural hazards. For more information and images, see the web-sites earthobservatory.nasa.gov/Newsroom/LCC and geography.bu.edu/landcover/index.html. This article is from a report at www.gsfc.nasa.gov/news-release/releases/2002/02-126.htm.

4.10 Ocean eddy mapping by reflected GPS signals

Just as sunlight glints off the ocean's surface, so do radio signals from the constellation of global positioning system (GPS) navigation satellites orbiting Earth. According to a report on 13th September 2002, researchers from NASA's Jet Propulsion Laboratory, Pasadena, California, have shown that although these reflected signals are very weak, they can be detected by airborne instruments and used to map ocean eddies. Eddies, which affect shoreline weather and the fishing industry, represent "one of the largest unknowns in Earth's climate models," said JPL physicist Dr. Stephen Lowe. Lowe led two aircraft experiments to test how well GPS could be used for altimetry, or measuring sea-surface height.

Eddies are currents that run in a circular path against the main flow of current. Warm eddies have a higher surface height than the surrounding water, while cool eddies are lower. Ranging from 10 to 100 kilometres in size, many ocean eddies are either too small or don't last long enough to be spotted by the current generation of

satellite ocean altimeters, whose measurements of sea-surface height provide a picture of global circulation. Lowe and his colleagues aim to determine whether, in the future, reflected GPS signals could be used to map small ocean circulation features such as eddies from space. Co-author Dr. Yi Chao, a JPL oceanographer, said: "Eddies are small features with a big impact. They're where a lot of ocean physics happens, and are an integral part of our climate system. But we don't have enough information about them to include in our models. Coastal eddies also have a major role in regulating the weather near the shore, and they are important for fisheries because they're where fish go to feed. In the open ocean, eddies bring nutrient-rich cold water up to the surface and are an important part of the global carbon cycle."

In the first experiment, designed to collect reflected GPS signals from a variety of terrain, the scientists demonstrated that these signals could be detected and used to calculate ocean height. In the second experiment, planned specifically for ocean altimetry, they showed that their technique has the potential to provide ocean-height measurements precise enough to map ocean eddies. The results of the latest experiment appear in the May 2002 issue of *Geophysical Research Letters*.

Today's satellite ocean altimeters, including the USA-French Topex / Poseidon and Jason 1 spacecraft, measure sea-surface height by sending a radar pulse to the ocean's surface and timing its return. While they measure ocean surface topography very accurately, to within two centimetres, they see only the swath of ocean directly below, and take ten days to make a complete map of the global ocean. Since an ocean eddy lasts only a week or two, they may only catch a portion of an eddy's lifespan. In contrast, an orbiting GPS altimeter would have no radar, making it relatively inexpensive. The receiver would obtain position and timing information from the GPS satellites, and would measure ocean height using the arrival time of GPS signals reflected from the surface. At any one time it would be able to produce about ten simultaneous measurements across an area thousands of kilometres wide. A constellation of

about ten such instruments, capable of making up to one hundred simultaneous ocean-height measurements, could map ocean eddies globally.

GPS is a navigation system controlled by the Department of Defence, which comprises twenty-eight Earth-orbiting satellites and a network of tracking stations. By measuring the time it takes for signals to travel directly between satellites and receivers, the positions of the satellites and receivers can be determined. In coming experiments, the JPL researchers will fly their equipment on aircraft at different altitudes and speeds. They will be making ocean-height measurements and comparing their results with those from other instruments. They also have plans to improve their on-board receiver so that the instrument can be flown on spacecraft. Chao said: "Our plan is not to replicate the very precise measurements that Topex / Poseidon and Jason 1 make, but rather to help fill in some of the gaps in time and coverage by looking between the satellites' ground-tracks and close to the shore. We would like to provide a new data set to push the next generation of climate models." JPL is a division of the California Institute of Technology in Pasadena. This article is from a report at www.jpl.nasa.gov/releases/2002/release_2002_175.html.

4.11 NASA scientists investigate Muddy Waters!

A report on 5th September 2002 describes a satellite-based system, developed by NASA scientists, for the wide-area monitoring of lakes across the USA, where water-quality is a major environmental concern. In some US lakes, for example, the sand and silt in the lake-bed contain a rainbow of different noxious industrial chemicals, which are stirred up by motor-boats and wind-driven waves. City officials and environmental regulators hope that the satellite data will help answer some important questions: Are the fish from such lakes fit for the dining room table? How much sediment is dumped into the lake by the adjoining river? Do pollutants buried in a patch of lake-bed near an abandoned paper mill pose any threat to swimmers?

Around the USA, there are dozens of reasons to monitor stirred-up sediments. Shellfish harvests in North-Eastern bays, for example, are affected by sediment levels. So is the rich biodiversity of Atlantic, Pacific and Gulf coastal estuaries. Further inland, nutrients released by stirred-up sediments can nourish microscopic phytoplankton in freshwater lakes and trigger algal blooms that choke-off the lakes' plant and animal life.

This need for wide-area monitoring is what has motivated scientists at NASA's Stennis Space Center in Mississippi to explore how satellites might help. And after six months studying Lake Pontchartrain, just north of New Orleans, Louisiana, they think they have a system that works. "We've talked to city planners, [environmental regulators, and other] decision makers – and they've said they would like this," says Richard Miller, chief scientist for NASA's Earth Science Applications Directorate and the manager of the project.

Miller's team monitored Lake Pontchartrain using two space instruments: NASA's SeaWiFS and NOAA's AVHRR (Advanced Very High Resolution Radiometer); both measure water reflectance, an indicator of turbidity and stirring. A certain amount of stirring occurs just due to the action of wind-driven waves. This is called "natural re-suspension." To account for it, Miller's group uses a computer model to calculate the expected amount of stirring, based on wind speed, wind direction, and the depth and shape of the water-body. The computer runs its simulation and calculates an "index of re-suspension intensity." Plotted over the area of the water-body (in the form of false colours or contours) this index maps out the expected re-suspension due to wind and waves.

"At least for the environments in Lake Pontchartrain, our index of re-suspension intensity correlates really well with our satellite imagery," Miller says. Sometimes, though, they spot suspended particles in a place not predicted by the computer model. Such anomalies might be evidence of human activity – such as fishing in shallow waters – or perhaps a movement of turbid water from another area, set in mo-

tion by a passing storm-front. The results so far are "very encouraging," says Miller, but there is more to do. For example, each pixel in the images from these satellites represents one square kilometer on the ground, so the application of this remote sensing technology is currently limited to large bodies of water.

The research team is now starting a new phase of field trials incorporating data from the MODIS (Moderate Resolution Imaging Spectro-Radiometer) satellite sensor, which has a better ground resolution (one sixteenth of a square kilometre). MODIS is on two NASA satellites – Terra and the recently launched Aqua – which together will provide two snap-shots per day, one in the morning and one in the afternoon. The field trials have also expanded to a new site at Pamlico Sound in North Carolina. In collaboration with Reide Corbett of East Carolina University, this phase of the trials will focus on the effects of fishing trawls or bottom nets. Ultimately, the researchers want to construct a system for delivering an executive-summary version of the satellites' observations to the regulators and decision-makers who need it. Miller says that his team's goal is to collaborate with decision makers in the region to design a system to suit their needs. He expects that the project could be producing these executive reports within six months. This article is based on a report at science.nasa.gov/headlines/y2002/05sept_estuaries.htm?list158594.

4.12 EADS FLEXIMAGE's IMINT - Online software

The past two years have seen a booming supply of commercially available new high-resolution imagery, which has drawn a lot of interest within the military intelligence community worldwide, as well as users who process images for a wide range of civilian applications. However, the consequences of this new high-resolution imagery, too often ignored, are a growing complexity of image interpretation due to the high density of features now visible on the images, and subsequently, the increased importance of experts involved in their analysis. Today, the key to perfor-

mance and optimum use of the available information entirely depends on the experience and efficiency of the image analysts themselves. The efficiency is more than ever dependent on intellectual capital: the knowledge and experience of the experts.

Several major governmental organisations already use EADS FLEXIMAGE solutions for the capture of experience and management of information in the field of image analysis. This is done using the revolutionary IMINT-Online services: Knowledge Database Management, Consulting and Training. IMINT-Online gives access to a database designed for use by image analysts. Based on a multi-media concept, and structured by themes, it describes environmental features, typical infrastructures or facilities, which can be observed by the image analyst.

The analyst may also enrich the database by creating and storing specific data structures related to his application. By using IMINT-Online, the image analyst faced with an interpretation problem may consult the database in order to identify the feature with certainty, and obtain multi-media information about it. If the feature represents a specific interest, the analyst can capture it from the image and insert it into the database, with associated comments and multi-media representation such as animated drawings, voice-over, etc. In this way IMINT-Online answers various needs. For example, an image analysis centre specialised in crop monitoring can archive all relevant spectral signatures on wheat fields, whose properties may vary according to many factors such as the sensor, number of spectral bands or conditions of acquisition. Other analysts specialised in, say, radar images can consult the database to determine step-by-step, with greater confidence, the nature of the object they want to identify. They may also save this experience by filing all significant signatures corresponding to a specific facility or infrastructure, such as an industrial plant.

Another asset of FLEXIMAGE's solutions is the ability to share experience among the team, and to give the necessary specific background to newcomers. The growing

complexity of imagery calls for more training, which is not compatible with shrinking budgets. IMINT-Online allows the training of more people in a faster, smarter and cheaper way, thus improving the staff's operational capacity for better budget value. As an additional service, advanced "e-learning" teaching courses, derived from expert knowledge or existing courses, can be developed and integrated into IMINT-Online's database. Trainees can follow the

training sessions, with or without an instructor.

EADS (European Aeronautic Defence and Space) FLEXIMAGE was established in 1989, and is highly involved in image analysis technologies applied to the defence and civilian domains. For more information, contact FLEXIMAGE's sales team (sales@fleximage.fr), or visit their web-site: www.fleximage.fr.

5 REVIEWS, PUBLICATIONS AND REPORTS

5.1 Book: passive microwave RS of oceans

Passive Microwave Remote Sensing of the Oceans. Authors: Igor V. Cherny and Victor Y. Raizer. 1998. Wiley-Praxis Series in Remote Sensing. 195 pp. ISBN: 0-471-07170-7.

Reviewed by Prof. (em.) Preben Gudmandsen, Technical University of Denmark (pg@oersted.dtu.dk)

Passive Microwave Radiometry (PMR) has never played a great role in European remote sensing (RS), in spite its great potentials for surveying large areas. Early studies of the techniques and applications carried out in introductory studies at ESA, under the title Coastal Ocean Monitoring Satellite System, for what became in the end the ERS missions, did demonstrate these potentials. However the instrument failed to be included in the mission since the main parameter – the sea surface temperature – could not be deduced with sufficient accuracy to satisfy the oceanographers and especially the climate people. Weight and space were other important factors.

It is therefore interesting to read this relatively new book written by Russian scientists, that is concerned with oceanographic and meteorological applications of the PMR techniques, describing ship- and airborne experiments carried out until very recently. The subjects include detection of oceanic internal waves and solitons, the surface effect of rain, monitoring of frontal

zones and oceanic synoptic rings, and surface effect of tropical cyclones.

The book begins with an introduction to ocean surface phenomena such as wind-generated waves overlaying gravity waves, wave-breaking, and foam and white-caps that form at large wind speeds. The influence of spray is also considered. Some of the material is based on previous "western" publications, but most is based on in-depth theoretical studies of the physics of some of these phenomena, that have been described mainly in Russian literature (several by the two authors). However, the presentation is rather brief – and full of formulae – and difficult to follow in detail, partly because some symbols are not defined. To this reviewer, much of this chapter seems to be excerpts from more detailed reports, still giving interesting information of phenomena that have not attracted great interests in the West. It also includes an account of microwave diagnostic of oil spill.

A short chapter on instruments and in-flight calibration of radiometers is presented, together with data for the multi-channel radiometer system that was designed for the two Russian satellites "Meteor-3M" / MTVZA, scheduled for launch in 1999 and 2000. It is noted that the system includes channels at 42 and 75 GHz, in addition to what has become "standard" in Europe for the Multi-Channel Imaging Microwave Radiometer (MIMR), developed for the "Polar Platform" – but never implemented in full. It also presents salient data for the radiome-

ters on the US DMSP (Defence Meteorological Satellite Programme) satellites up to F-14, launched in April 1997.

In the opinion of the reviewer, the most interesting part of the book is the final chapter, dealing with "microwave observations of processes in the ocean-atmosphere system". It presents results of experiments carried out from ships and aircraft, of the phenomena previously dealt with. Internal waves were studied in a cruise on the Indian Sea (1981), with a radiometer-scatterometer at 37 GHz (vertical polarisation) and a radiometer at 1.7 GHz (horizontal polarisation) operated at an angle of incidence of 75°. Another experiment was carried out with a 37 GHz radiometer (vertical polarisation) and a high-resolution echo-sounder recording internal solitons in the Sea of Japan (1981). Still other experiments were carried out in the Atlantic Ocean (near Long Island) in a Joint USA / Russia Internal Wave Remote Sensing Experiment (JUSREX, 1992) with the "aircraft laboratory Tupolev-134" equipped with a real-aperture radar at 13 GHz and radiometers at 1.6, 3.9, 20 and 37 GHz. Rather convincing results are presented and commented on.

One section deals with the surface effect of rain. Rain changes both the surface salinity and occasionally also its temperature, which changes the ripple structure on the ocean surface and thereby the microwave thermal emission. Examples show that the effect is limited in time to an hour or so. Ship-borne measurements (1984) with a radiometer system at 48, 37, 34 and 20 GHz, all vertical polarisation, and another channel at 37 GHz, horizontal polarisation, reveal the rather surprising result that the "relic rain" is observed at all frequencies except 20 and 37 GHz, vertical polarisation.

The author spends a few pages discussing the reason for the observation that the effect is seen on one frequency and not another, only 3 GHz away – unfortunately not very convincingly. In contrast, a so-called tropical shower (20 mm/h) may be seen on all frequencies and polarisations: at 34 GHz, horizontal polarisation the brightness temperature increases by more than 100 K.

Similarly, a frontal zone was detected by

the ship-borne radiometer / scatterometer at 37 GHz in the Pacific Ocean (1983), revealing strong 'signatures' of more than 20 K and 10 dB in one case, and about 3 dB in another. An oceanic synoptic ring was recorded from a radiometer on a TU-134 research aircraft at 37 and 48 GHz, but not at 20 and 75 GHz (1990). The cyclone Warren (1984) gave surface effects that were observed at 48 and 34 GHz, but not on 20 and 37 GHz (all vertical polarisation). Finally, SMM/I data (1997) revealed an interesting signature in a 600 kilometres long area along the continental break in the northern part of Norwegian Sea.

In some of the cases presented, the observations are supported by simultaneous oceanic and meteorological data. In other cases they are discussed in the context of oceanic research in the area in question, often carried out by Russian research vessels.

This interesting but specialised book is a revision of a previously published book (1994, in Russian) with some additions of which the SMM/I data are worth mentioning. The observations presented are thoroughly discussed in an oceanic context, referring to a great number of relevant research papers. In fact, the extensive list of references (over 275) is a valuable source of information about oceanic and meteorological research carried out in Russia, many of which have been translated into English. The book has some shortcomings, in that the language is rather elaborate; at few places sentences (apparently interpreted from Russian) are difficult to understand by another foreigner.

5.2 Book: study of Kara Sea, Russian Arctic

Polar Seas Oceanography: An Integrated Case Study of the Kara Sea. Authors: Vladimir A. Volkov, Ola M. Johannessen, Victor E. Borodachev, Gennadiy N. Voinov, Lasse H. Pettersson, Leonid P. Bobylev and Alexei V. Kouraev. May 2002. Praxis Publishing Ltd. 496 pp., including 12-page colour section. ISBN: 3-54042-969-7. List price: 104.50 Euros.

The Kara Sea of the Russian Arctic, with its unique oceanographic regime, is a site of

major scientific and commercial importance. Global climate change, transport and spread of radio-nuclides and other pollutants, and the exploration and exploitation of its rich natural resources, are all important issues. Here, for the first time, is a comprehensive study of this Polar Sea, based on in situ data, satellite remote sensing and numerical sea-modelling. It includes the results of much previously unpublished research, carried out over the past decade, and an analysis of the results of many studies carried out during the last century. The book describes the oceanographic regime, including river discharge, study of water dynamics, transport of pollutants, and results of numerical model simulations. One issue specifically addressed is the shrinking of the sea-ice because, as a marginal sea of the Arctic Ocean, the Kara Sea is expected to provide an early warning of the enhanced high-latitude impact of global climate change processes. For more information on this book, or to place an order, please visit the web-site www.praxis-publishing.co.uk/series.htm.

5.3 Climate change impacts on European forestry

German Journal of Forest Science. Volume 121, Supplement 1 (May 2002):

The recently published supplement of the German Journal of Forest Science (Forstwissenschaftliches Centralblatt) documents the results of the research network German Forest Sector under Global Change (GFS), which was funded by the Federal Ministry of Education and Research from July 1997 to June 2000. The objective of the study was to investigate the nature and extent of possible impacts of global climate change on forests and the forest sector in Germany.

The assessment was based on inventories of national forest resources, as well as on several simulation models: the forest growth simulator SILVA 2.2, the forest patch models FORSKA-M and 4C, the forest scenario model ActioSilva, a forest estate model, and a forest product market model. Three management strategies and two climate change scenarios were used for

the assessment, which focused on the most common and economically important forest types of Germany, representing 60% of the whole forest area in Germany.

The inter-disciplinary collaboration and the development of a balanced integration framework for the impact assessment are quite unique in quantitative forest science. Thus the journal supplement documents significant progress in global change research in Germany, which was achieved by an inter-disciplinary team of twenty-six scientists from seven research groups. The project was co-ordinated by Dr. Marcus Lindner and Prof. Wolfgang Cramer of the Potsdam Institute for Climate Impact Research.

Note that no electronic copy of the paper is available. To order a copy, please contact the publisher (e-mail: customerservice@blackwell.de; web: www.blackwell.de/fc_e.htm). For more information about the study, contact: Dr. Marcus Lindner, Potsdam Institute for Climate Impact Research, Telegrafenberg, P.O. Box 601203, 14412 Potsdam, Germany (telephone: +49-331-2882677; fax: +49-331-2882695; e-mail: marcus.lindner@pik-potsdam.de). Project web-site: www.pik-potsdam.de/~lindner/forestsector.html.

National and Regional Climate Change Impact Assessments in the Forestry Sector. Edited by Marcus Lindner and Wolfgang Cramer. Forest Ecology and Management, Volume 162, Issue 1, 1st June 2002 (www.elsevier.nl/locate/foreco):

Climate change is likely to affect forests and the forest industry during the 21st century. Different processes in forest ecosystems and the forest sector are sensitive to climate, and many different projects have been conducted, in which the scale of study varied from the individual leaf to the whole globe. Several attempts have been made to link impact models (e.g. ecological and socio-economic models), and to integrate them in national or regional climate impact assessment studies. However, integration of climate impact assessments for the forestry sector is still a relatively new issue on the research agenda.

From 10-13 November 1999, the Potsdam Institute for Climate Impact Research, and

the European Forest Institute, organised a workshop in Wenddoche, near Belzig, Germany, to bring together individuals and research groups from the currently developing research community, in order to provide a forum for the exchange of experience, and to stimulate further research collaboration.

An important objective of the NIMA workshop was to review the state-of-the-art of integrated climate impact assessments in the forest sector. Three working groups were tasked with discussing the state of knowledge, the currently available methodology, and the remaining uncertainties regarding: (a) scaling up impact assessments from stand to regional and national scale; (b) integrating cross-disciplinary impact assessments; (c) climate impact assessments and policy-making. Among the issues discussed were scaling up methodologies (e.g. simplification of information, application of models in scaling up, error analysis), different ways of integrating cross-disciplinary impact assessments (linking, coupling, and roofing of simulation models), how to deal with uncertainties, and what information climate impact assessments can provide to policy-making. The journal contains several of the articles arising from the NIMA workshop.

Note that no electronic copies of the papers are available. Please refer to the printed journal for the articles. For more information about the study, contact: Dr. Marcus Lindner, Potsdam Institute for Climate Impact Research, Telegrafenberg, P.O. Box 601203, 14412 Potsdam, Germany (telephone: +49-331-2882677; fax: +49-331-2882695; e-mail: marcus.lindner@pik-potsdam.de). Work-shop web-site: www.pik-potsdam.de/cp/chief/nima.html).

5.4 UNEP's on-line World Atlas of Biodiversity

BBC London News reported the publication of an interactive atlas of the world's natural wealth, which paints a graphic picture of humanity's inexorable spread. Entitled "World Atlas of Biodiversity: Earth's Living Resources for the 21st Century", it is the work of the United Nations Environment Programme / World Conservation

Monitoring Centre (UNEP-WCMC), based in Cambridge, UK. The atlas has been collated from WCMC's research, the work of independent scientists, and governmental and other reports. The work follows last June's publishing of an online Ocean Atlas. Further information is at www.unep.org.

5.5 ENVIROMIS-2002 Conference, Russia

Report on the Second International Conference ENVIROMIS-2002, "Looking beyond the Ural Mountains", which took place in Tomsk-Akademgorodok, Russia, on 6-12 July 2002.

Gérard BEGNI, Deputy Manager, MEDIAS-France

Introduction

The ENVIROMIS-2002 International Conference was devoted to the state-of-the-art and usage of modern environmental observation techniques, modelling tools and information technologies, for air, water, soil and vegetation cover pollution assessment, within integrated information systems addressing environmental management for industrial areas on cities and regional scale. It was aimed at filling a gap between basic science achievements and their practical applications in this domain, as well as at creating a solid foundation for mitigation of pollution in selected areas.

The organisers were the Institute for Optical Monitoring, the Institute for Numerical Mathematics, the Siberian Centre for Environmental Research and Training, and the Institute of Atmospheric Optics. The INTAS and INCO-2 programmes of the European Commission supported the Conference. Prof. Evgueni Gordov, Institute of Atmospheric Optics, chaired the Organising Committee, and spent considerable worthy efforts to turn the Conference into reality. I had the honour to be involved both in the Organising and Programme Committees.

The Conference was actually an international event. Unfortunately, some colleagues from outside Russia had to cancel their participation, due to last-minute circumstances. Nevertheless, many of the projects and research works presented were in close co-op-

eration between regional scientists and colleagues in Europe and Israel. Perhaps even more important, many high-level papers presented by Russian colleagues showed that enlarged co-operation with European colleagues could be very fruitful to both parties. So, ENVIROMIS-2 was a widely open gateway to an exciting co-operative future. It sent a clear signal to the European community to firmly lead and strengthen on-going plans and initiatives, for fostering such potential co-operative research.

Programme overview

Despite the last-minute cancellations, the programme was very dense. It was made up of ten regular sessions, plus an opening ceremony with three invited lectures, and two poster sessions. Detailed information can be found on the Conference website (enviromis2.iao.ru/eng). Nevertheless, it might be interesting to list here the titles of the regular sessions (oral and poster presentations) and lectures of the opening ceremony.

The four lectures of the opening ceremony were: (a) "Modelling and assessing global climate change impact on regional environment" by Professor V.N. Lykosov; (b) "Integrated Information Systems for air quality monitoring: NIS-adapted ISIREMM system and city of Tomsk case study" by Professor E. Gordov; (c) "Organisation of environment preservation on the regional scale" by Professor D.V. Volostnov; (d) "Focus surface water scenarios: development and use in the registration process in the European Union", by Professor Jan B.H. Linders.

The nine conference sessions were: (1) Observations, and local and remote sensors for air, water, soil and vegetation assessment; (2) Remote sensing; (3) GIS and multi-dimensional databases; (4) Urban and regional scale modelling; (5) Hydrological systems; (6) Assessment of soil and vegetation cover; (7) Urban and regional atmosphere: environmental state and climatic change assessment; (8) Integrated information systems for assessment / management; (9) Environmental management and legal aspects. Between sessions 6 and 7, a joint session was organised with the participants of the conference "environ-

mental control and management". A special session on "monitoring of INTAS environmental projects" and "monitoring of EC project ISIREMM", was organised prior to the closing of the conference.

I would like to underline here the high scientific level of the Conference. Almost systematically, each paper addressed basic physical phenomena and related equations, underlining hypotheses and simplifications leading to proper modelling, before drawing practical results and conclusions. Such a "systemic" way of thinking is the sole way to evaluate the robustness of results, and should be a rule in such activities. In addition, I also would like to underline that remote sensing at large was not only the topic of Session 2, but was also explicitly or implicitly present in several works presented during the other sessions.

Some personal conclusions

Even during the hardest times of the Cold War, some faint scientific co-operation existed between USSR (now the NIS) and Western Europe, as a result of several centuries of cultural and scientific links. Today the European Union has open ambitions to have privileged scientific links with Russia and other NIS States. On the other hand, dramatic budgetary shortages make scientific work in such prestigious centres as Tomsk and Novossibirsk Akhademgorodok, more and more difficult, in spite of the unbreakable willingness of senior and junior scientists to stay here developing their undisputed top level of excellence, to which I can personally bear testimony.

During an informal discussion held with Prof. Jan Linders (RIVM, the Netherlands) and myself, Prof. E. Gordov expressed some concerns about the future of the ENVIROMIS initiative. My own opinion is that all efforts should be made to keep alive this nascent tradition, and the EU should have the lead here. I see obvious links with the European GMES initiative. Such European systems as SPOT-5 and Envisat, as well as operational results from Eumetsat, are major tools to serve the issues addressed by the ENVIROMIS conferences.

Considering the objectives of this series of conferences, and the unique way of thinking it developed, an innovative synergy with EARSeL activities would bring an

added value to both sides. So, I can only conclude by inviting EARSeL to look beyond the Ural Mountains for a fruitful and exciting top-level scientific co-operation.

6 FORTHCOMING MEETINGS AND COURSES

6.1 4th Symposium on RS of Urban Areas, Germany

The 4th International Symposium "Remote Sensing of Urban Areas" will be held in Regensburg, Germany, on 27-29 June 2003. The Symposium is part of a series of conferences devoted to remote sensing (RS) of urban areas. Starting in 1997, it continued in 2001 with an international audience from over twenty countries and around 130 participants. In addition to the oral and poster presentations an exhibition with company presentations was established. From 2001 onwards the Symposium will be held on an annual basis. This year (2002) it was hosted by Istanbul Technical University in Turkey. Due to a rising awareness of urban areas, agglomerations and mega-cities, an increased number of participants were welcomed to Istanbul for the 3rd Symposium.

As a result of the overwhelming success of the first three Symposia, and due to the support from ISPRS, which in 2000 initiated a new working group "Human Settlement and Impact Analysis" (ISPRS-WG VII/4) during the ISPRS Congress in Amsterdam, it is a pleasure to announce the 4th Symposium devoted to RS of urban areas. The rapid advances in image acquisition and image analysis techniques call for the continuation of the discussions from the earlier Symposia. Urban growth and its associated problems are a very challenging task and suitable RS and GIS applications could possibly assist in a wide range of applications for the benefit of urban areas. You are cordially invited to participate in a Symposium with challenging topics, and feel free to submit your individual input and to share your experiences with others from around the world.

According to the thematic focus of the symposium possible presentations should be

within the following topics: monitoring of urban and suburban growth; RS and GIS for urban sustainability; quantification / estimation of sealed surfaces in urban / suburban areas; digital photogrammetric applications in urban / suburban areas; differentiation of the inner structure of cities / agglomerations; national and international urban projects with RS and GIS; high-resolution airborne digital sensors for urban applications; human settlements and impact analysis; RS for urban / suburban information systems / urban land administration; mega-cities; monitoring of informal settlements; new observation systems for urban monitoring; RS of urban vegetation; ecological aspects of urban / peri-urban landscapes; RS of contaminated land in urban areas; radar applications in an urban environment; thermal RS of urban areas

The Symposium language will be English. It is intended to publish reviewed and accepted manuscripts of oral presentations in the ISPRS International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Please submit abstracts (maximum 750 words) by electronic e-mail, before 1st March 2003, to the Symposium Chairman (see below). For further information, please visit the Symposium web-site (www-urs2003.uni-r.de), or contact the Symposium Chairman: PD Dr. Carsten Juergens, Associate Professor, Dept. of Geography, University of Regensburg, D-93040 Regensburg, Germany (telephone: +49-941-9433630; fax: +49-941-9434933; e-mail: carsten.juergens@geographie.uni-regensburg.de).

6.2 Urban RS workshop (URBAN 2003), Germany

The Second Joint Workshop on Remote

Sensing and Data Fusion over Urban Areas (URBAN 2003), will take place in Berlin, Germany, on 22-23 May 2003. URBAN 2003 intends to be a unique forum for urban remote sensing (RS) with respect to the information technology and geo-science communities. Among these people there is still the feeling that we need a way to interact on this topic, and gather the different know-how that has been developed internationally. This need is even more urgent, especially now that new sensors have been launched (e.g. Quickbird and Envisat) and are already operational.

For information on the topics of the URBAN 2003 workshop, and for instructions on how to submit papers, please visit the conference web-site: tlc.unipv.it/urban_2003. Abstracts must be submitted by e-mail to urban_2003@ele.unipv.it, by 15th November 2002.

6.3 Land Use Conference: April 2003, Holland

Call for Abstracts for: International Conference "Framing Land Use Dynamics: Integrating Knowledge on Spatial Dynamics in Socio-Economic and Environmental Systems for Spatial Planning in Western Urbanised Countries", Utrecht University, The Netherlands, 16-18 April 2003

Pressure on land in western urbanised societies is increasing. Conflicts arise from incompatibility in land use in different socio-economic and environmental systems, leading to undesirable social, economic and environmental impacts. Examples of these are the loss of life and property through river flooding following deforestation, the drainage of wetlands and floodplain embankments, conflicts between housing and economic land use, the loss of biodiversity following the fragmentation of ecological habitats by urbanisation and transport infrastructure, and deterioration in the quality of life.

The aim of this conference is to identify (potential) land use changes in western urbanised countries, and the conflicts which may arise from these changes, by considering such questions as:

- How can "smart" spatial configurations of socio-economic and environmental systems reduce spatial conflicts and enhance sustainable development?
- What improvements are necessary in integrated modelling to analyse, simulate and assess spatial land use dynamics?
- In what way can we improve the application of scientific knowledge on land use dynamics in spatial planning processes?

Central issues of the conference are the integration of knowledge on land use dynamics from different disciplines, and application of that knowledge to spatial planning in western urbanised countries. Theoretical, methodological and practical views will be shared from such disciplines as environmental and social sciences, housing and transport, planning and integrated modelling. Discussions are planned between academics, policy-makers and planners, aimed at enhancing the integration of scientific knowledge in spatial planning aimed at sustainable development.

The conference will consist of plenary sessions, for which keynote speakers are invited, and thematic parallel sessions where participants present and discuss papers. The thematic sessions will be clustered around the following themes: (a) integrating socio-economic and environmental knowledge for spatial planning; (b) integrated river basin management and spatial planning; (c) planning spatial configurations of ecological habitats; (d) dynamics in urbanisation patterns and spatial planning; (e) infrastructure, mobility, and land use planning.

You are invited to submit your paper or poster according to the criteria mentioned in the on-line submissions section (networks.geog.uu.nl/conference/submissions.html). An on-line form has been created which can be used to submit your abstract (networks.geog.uu.nl/conference/abstractform.html). Deadline for abstracts is October 1st 2002.

For further information, including details on the submission of papers and posters, the programme, sessions, registration, travel and accommodation, and optional excursions, please visit the conference section of our web-site (networks.geog.uu.nl/conference).

6.4 IUFRO Forest Conference: June 2003, Finland

Dear Colleague,

We are happy to announce the IUFRO Conference "Uneven-Aged Forest Management: Alternative Forms, Practices, and Constraints" to be held in Helsinki, Finland, on 8-12 June 2003, and the subsequent Post-Conference Tour to Northern Finland and Sweden. We would welcome your participation. For details on the scope and objectives, programme, registration etc., please visit our web-site at www.metla.fi/tapahtumat/2003/uneven-aged, or contact the Secretariat as follows:

- Sauli Valkonen or Anja Sanaslahti, Finnish Forest Research Institute (Metla), P.O. Box 18, FIN-01301 Vantaa, Finland. Telephone: +358-9-85705318 / 5351. Fax: +358-9-85705361. E-mail: uneven@metla.fi.

Please forward this message to those whom you think might be interested.

Best regards,

Conference Organising Committee: Sauli Valkonen (chair), Finnish Forest Research Institute (Metla); Scientific Board: Pasi Puttonen (chair), Institute of Forest Ecology, University of Helsinki.

6.5 Arctic Coastal Dynamics Workshop, Norway

The Third Arctic Coastal Dynamics (ACD) Workshop will take place in Oslo, Norway, on 2-6 December 2002. The workshop, which is sponsored by IASC (International Arctic Sciences Committee) and IPA (International Permafrost Association), will be

hosted by the Department of Physical Geography of the University of Oslo. The workshop will comprise presentations and discussions according to the ACD Implementation Plan, followed by a meeting of the ACD Steering Committee. Limited funds are available for participation of non-Steering Committee members. If you are interested in participating please e-mail Volker Rachold (see below), including an extended abstract (maximum 1000 words) and indicating if you require funding to participate. Deadline for abstracts and registration: 30th September 2002.

Arctic Coastal Dynamics (ACD) is a joint project of the International Arctic Sciences Committee (IASC) and the International Permafrost Association (IPA). Its overall objective is to improve our understanding of circum-arctic coastal dynamics as a function of environmental forcing, coastal geology and cryology, and morphodynamic behaviour.

Information on the latest development of ACD, including the main results of the Second ACD Workshop in Potsdam, in November 2001, has been circulated in the Second ACD Newsletter, in April 2002. For more information on the IASC-IPA Arctic Coastal Dynamics (ACD) project, visit the web site: www.awi-potsdam.de/www-pot/geo/acd-no3.html For more information, contact Dr. Volker Rachold, Alfred Wegener Institute for Polar and Marine Research, PO BOX 120161, 27515 Bremerhaven, Germany (telephone: +49-471-48311202; fax: +49-471-48311149; web-sites: www.awi-bremerhaven.de, www.awi-potsdam.de, www.awi-potsdam.de/www-pot/geo/acd.html).

6.6 Calendar of forthcoming meetings

NEW

22-23 October
London, UK

RSPSoc Autumn Meeting: "Digital Imagery Data Standards"

E-mail: rspsoc@nottingham.ac.uk; Web: www.rspsoc.org

NEW

28-30 October
Miesbach (near
Munich) Germany

2nd eCognition Users Meeting

E-mail: usermeeting.ecognition@definiens.com. Web: www.definiens-imaging.com/um2002.

18-22 November
2002
Delft, The
Netherlands

2nd European Conference on Radar Meteorology (ERAD)

Web: www.copernicus.org/erad. Abstracts: 14 April 2002

2-6 December 2002
Dunedin, New
Zealand

16th IAHR International Symposium on Ice

Global Climate Change and Ice-Covered Waters

Contact: Pat Langhorne, University of Otago, Dunedin. Fax: +64-3-4790964 Web: www.physics.otago.ac.nz

NEW

5-6 December 2002
London, UK

Annual General Meeting of GRSG (Geological Remote Sensing Group): "ASTER Unveiled"

E-Mail: dtaranik@angloamerican.co.uk

NEW

3-7 January 2003
Bangalore, India

90th Indian Science Congress

Co-hosted by the Indian Space Research Organisation and Bangalore University. Programme includes a one-day Space Summit (4 January).

E-mail: isroeos@blr.vsnl.net.in. Web: www.isc2003.org.in

NEW

14-16 January 2003
Frascati, Italy

ESA Workshop: "POLinSAR2003 – Applications of SAR Polarimetry and Polarimetric Interferometry"

Contact: Veronica Arpaia, ESA / ESRIN, Frascati, Italy. Phone: +39-06-94180605. Fax: +39-06-94 180552. E-mail: envmail@esa.int. Web: earth.esa.int/polinsar

NEW

22-23 May 2003
Berlin, Germany

Joint ISPRS WG III/6 / IEEE / EARSel Workshop on Remote Sensing and Data Fusion over Urban Areas

Contact: Prof. Olaf Hellwich, WG III/6 Chair. Phone: + 49-30-31422796. Fax: +49-30-31421104. E-mail: hellwich@fpk.tu-berlin.de; Web: www.fig.net/figtree/events/events2003.htm

3-6 June 2003
Ghent, Belgium

23rd EARSel Symposium: "Remote Sensing in Transition"

Contact: Prof. Rudi Goossens, University of Ghent. E-mail: Rudi.goossens@rug.ac.be / earsel@meteo.fr

NEW

5-7 June 2003
Ghent, Belgium

4th EARSel Forest Fires Workshop: "Remote Sensing and GIS Applications to Forest Fire Management – Innovative Concepts and Methods"

Co-organised with the GOFC / GOLD Fire Implementation Team. (See Section 2.2 of this Newsletter). E-mail: Emilio.chuvienco@uah.es. Web : www.geogra.uah.es/EARSel/SIG_group.htm

NEW

6-7 June 2003
Ghent, Belgium

1st EARSeL Workshop on Remote Sensing of the Coastal Zone

(See Section 2.2 of this Newsletter). E-mail: r.reuter@las.physik.uni-oldenburg.de. Web: las.physik.uni-oldenburg.de/projekte/earsel

NEW

27-29 June 2003
Regensburg, Germany

4th International Symposium "Remote Sensing of Urban Areas"

Contact: PD Dr. Carsten Juergens (phone: +49-941-9433630; fax: +49-941-9434933; e-mail: carsten.juergens@geographie.uni-regensburg.de).

NEW

21-25 July 2003
Cambridge, UK

Cambridge Conference for National Mapping Organisations

Email: cambridge2003@ordsvy.gov.uk. Web: www.ordnancesurvey.co.uk/cambridge

NEW

21-25 July 2003
Toulouse, France

IEEE / IGARSS (International Geoscience and Remote Sensing Symposium) 2003: "Learning from Earth's Shapes and Colours"

Web: www.ewh.ieee.org/soc/grss/downloads/igarss03.pdf (also www.igarss03.com – currently under construction).

NEW

10-12 September
2003
Nottingham, UK

RSPSoc Annual Conference: "Scales and Dynamics in Observing the Environment"

Contact: Dr. Paul Aplin (paul.aplin@nottingham.ac.uk).