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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, Department of Geography
University of Basel, Klingelbergstr. 27
CH-4056 Basel, Switzerland
Tel: +41 61 2670701, Fax: +41 61 2670689
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@Ugent.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: rainer.reuter@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: +420 326 900 167, Fax: +420 326 902 434
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

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

1 EDITORIAL

Undoubtedly the most significant international event since the publication of the previous EARSeL Newsletter has been the historic enlargement of the European Union (EU), on 1 May 2004. Apart from its many other enormous benefits, the entry into the EU of the ten "new" countries from central, eastern and western Europe, also brings the EARSeL family - which includes many Member Laboratories from the new EU arrivals - even closer together.

Speaking of new arrivals… during the recent highly successful EARSeL Symposium and General Assembly in Dubrovnik (Croatia), EARSeL was pleased to welcome seven new Member Laboratories, from Belgium, Czech Republic, France, Germany, Greece, Italy, and Russia (see Section 2.3 of this Newsletter).

Returning to the recent expansion (by 34%, by the way) of the EU's territory… this will also have significant impacts in the field of satellite remote sensing (RS) and Earth Observation. Indeed, the Draft Treaty establishing a Constitution for Europe, which is aimed at adapting the EU's design, institutions and politics to its new geographical reality, explicitly mentions Space in two separate sections. First, under Article I-13 ("Areas of shared competence"), Space is mentioned along with research and technological development (RTD). The definition of space as a shared competence essentially gives the EU the authority to implement space programmes, as long as it does not interfere with Member States' activities. Further along in the Draft Treaty, under Section 9, RTD and Space are dealt with at greater length, specifically in the context of European space policy, as well as the European law or framework law required to establish a European space programme.

The simple fact that space is mentioned for the first time in a European Treaty is widely seen as the beginning of a new chapter for Europe in space. In addition, the Draft Treaty makes provisions for the creation of a European Defence Agency, which will support the EU's CFSP (Common Foreign and Security Policy) and ESDP (European Security and Defence Policy) in improving EU capabilities in crisis management. Clearly, Space will also be a major component of these new developments. It is hoped that overall agreement on the new Draft Treaty - which has been hotly debated over the past 9 months by the EU's Inter-Governmental Conference (IGC) - will be reached at the meeting of the European Council in Brussels, on 17-18 June 2004.

Coming to more (or less?) down-to-earth, practical RS news: the joint ESA-NASA Cassini-Huygens mission to the planet Saturn, which is about to arrive at its destination after a 7-year journey, has been sending back spectacular images of Saturn and its rings and moons (including Phoebe). The latest news on this exciting application of RS are described in Section 4.7 of this Newsletter. So, until the next issue, it's good-bye from me - ☺ - and it's good-bye from Phoebe…

The Editor

2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 24th EARSeL Symposium, General Assembly

The 24th EARSeL Symposium and General Assembly took place at the Inter University Centre in Dubrovnik, Croatia, on 25-27 May 2004. It brought together just over 170 participants from thirty countries, and was followed by the first Workshop organised by the EARSeL SIG on Remote Sensing of Land Use and Land Cover, which attracted more than 70 participants. Some preliminary reports have arrived but more detailed reports will be published in our September 2004 issue.

Participants appreciated very much the venue in the beautiful city of Dubrovnik, with its magnificent views from the ramparts and rich architecture reflecting its chequered history. The social event took place on the nearby island of Lokrum, meaning a "crown", which is a national park harbouring a botanical garden with a unique collection of plants, shrubs and palm trees originating from many parts of the world. A typical Dalmatian meal, served in a former monastery, was much appreciated.

A highlight of the General Assembly was the granting of six honorary memberships to personalities who have contributed a great deal to the Association. These are:

- **Prof. Dr. Johan Bodechtel**, who was one of the founding members of EARSeL and after serving as Vice-Chairman since the foundation, served as Chairman from 1983-1987.
- **Prof. Gunnar Ostrem**, who began his teaching career already in 1947 and is an expert glaciologist, joined the Bureau as Treasurer in 1977 and served in that office until 1985.
- **Dr. Robin Vaughan**, Treasurer from 1993-1997 and Chairman from 1997-2001. He organised the 1993 General Assembly and Symposium at the University of Dundee in Scotland, and is presently Reader in Remote Sensing at the University of Dundee and is assistant editor of the International Journal of Remote Sensing.
- **Dr. Peter Winkler**, whose laboratory was the first from behind the former "Iron Curtain" to join EARSeL and who organised the first annual meeting to take place in eastern Europe in 1992 in Eger; he has been the Hungarian representative within the EARSeL Council since 1990, the co-opted member of the Bureau for East-West relations from 1993-97 and Treasurer of EARSeL from 1997-2001.
- **Prof. Dr. John van Gender**en holds the Chair in Operationalization of Remote Sensing Applications in Earth Sciences at the ITC in Enschede, the Netherlands. He edited the EARSeL Newsletter from 1990-1993 and gave it its present format.
- **Mrs. Madeleine Godefroy**, who became the EARSeL secretary in June 1981, and who is due to retire in the coming months.

We look forward to welcoming our honorary members to many more annual meetings. A full report of the General Assembly will be published separately.

2.2 EARSeL Bureau & Council meetings

The EARSeL Bureau and Council met in Dubrovnik on 24th May 2004 on the occasion of the annual General Assembly. Countries represented were Belgium, Croatia, Czech Republic, Denmark, Germany, Hungary, Poland, Portugal, Russia, Sweden, Spain, Switzerland and UK. Some of the points discussed and recommendations made are summarised below.

The General Assembly and Symposium programme was described and forthcoming EARSeL meetings and other events in which EARSeL is associated were listed and participation decided. These events included the workshops planned by the Special Interest Groups (SIGs). These are listed at the end of the Newsletter.

The Call for Papers for the annual General Assembly and Symposium in Porto (6-11 June 2005) was distributed. This will be accompanied by two Workshops: the 2nd Workshop on Remote Sensing of the Coastal

Zone (9-10 June) and the 1st Workshop on 3D Remote Sensing (10-11 June). This annual meeting will be organised by Dr. André Marçal of the Department of Applied Mathematics at the University of Porto, who made a presentation of the excellent facilities available. An invitation has been received to hold the 2006 annual meeting in Warsaw, Poland. A final decision will be made at the Council meeting in January 2005. Invitations are open for the meeting in 2007 and beyond.

The Chairman explained that at the last meeting it had been decided that what might be called a "Letter of Awareness" underlining the users' point of view as represented by EARSeL on the type of data available, its ease or otherwise of acquisition and pricing levels, should be addressed to the head of Earth Observation (EO) programmes within ESA. It had since been learned that a new Director for EO has been nominated, who will take up office at the end of the summer. It was agreed that contacts would be made with him and that such a text still needed to be drafted to underline the concerns of EARSeL member laboratories. EARSeL is also very willing to help the new team in defining their EO programme.

Another topic for discussion was the future of the EARSeL Secretariat, since the present secretary is due to retire in the coming months.

The new-look EARSeL web-pages (www.earsel.org) were also discussed and approved. Dr. Carine Petit of the Belgian Space Policy Office, who is the new web-master (editor: web-mistress? ☺), was warmly thanked for her hard work in the design and transfer of data. Dr. Lucien Wald, the former web-master was also thanked for having established the EARSeL web-pages and overseeing these for several years. More needs to be done to the new web-pages to bring these quite up to date and to ensure regular updating. Council members and all members are asked to be sure to inform the Secretariat when changes take place within their various institutions. The pages concerning Education received particular attention and Dr. Reuter asked the representatives of countries whose languages are not presently covered with suitable teaching materials and links to assist in supplying such documentation. It was suggested that EARSeL might submit a project on Education to the European Commission, for which partners would be required. It was recommended that there should be an Education Forum in Porto on the occasion of the 2005 Symposium. This would link in with the UNESCO Year of Education in Environmental Education, which is the year 2005.

The financial situation was also discussed. For the moment EARSeL does not receive any financial support from ESA and it has been necessary therefore to make economies wherever possible, on mission expenses, running and publication costs for example. Nevertheless the 2004 preliminary budget shows a deficit and it was therefore proposed to make a 10% increase in membership fees in 2005. There was some opposition to this proposal and it was agreed that every effort should be made to improve the quality of publications and services rendered to members, in order to encourage more members to join. This improvement has already started with the launching of the eProceedings, the reviewed journal of the Association, which now welcomes high-quality papers for peer review. These are then published on CD, which are distributed to member laboratories and later made available on the EARSeL web-site.

Concerning general strategy, it was recommended that EARSeL should seek more contacts and co-operation with its parallel association, EARSC (European Association of Remote Sensing Companies). Although agendas rarely permitted it, a meeting with the new Chairman, Dr. Paul Kamoun of Alcatel Space, based in Cannes, France, should be sought.

Finally, it was agreed that elections for certain offices of Bureau members should take place next year, when the present Chairman would have completed his second two-year term of office.

2.3 New EARSeL Members

The following new Members were welcomed to EARSeL at the General Assembly in Dubrovnik in May 2004:

New EARSeL Member Organisation	EARSeL Representative
Department of Environmental Sciences & Land Use Planning - Geomatics, Université Catholique de Louvain, Croix du Sud, 2 bte. 16, B-1348 Louvain-la-Neuve, Belgium. Web-site: www.mila.ucl.ac.be	Prof. Dr. Ir. P. Defourny
Department of Applied Geo-Informatics & Cartography, Charles University, Albertov 6, 12843 Prague, Czech Republic. Web-site: www.natur.cuni.cz/english_version	Dr. Jan Kolar
CNRS-PRODIG (Centre National de la Recherche Scientifique - Pôle de Recherche pour l'Organisation et la Diffusion de l'Information Géographique), Université Paris-1, 191 rue Saint-Jacques, 75005 Paris, France. Director: Jean-Louis Chaleard. Web-site: prodig.univ-paris1.fr/umr	Dr. Bernard Lacaze
EFTAS Fernerkundung GmbH, Ostmarstrasse 92, D-48145 Münster, Germany. Web-site: www.eftas.com	Dr. Klaus U. Komp
Laboratory of Forest Management & Remote Sensing, Aristotle University of Thessaloniki, P.O. Box 248, GR-541 24 Thessaloniki, Greece. Web-site: www.auth.gr/forestry	Dr. Ioannis Gitas
Salerno University - L-S-X Band RS Ground Station, Dip. di Ingegneria Civile, Via Ponte don Melillo, I-84084 Fisciano (SA), Italy. Director: Prof. Ciro Faella. Web-site: www.ing.unisannio.it	Prof. Innocenzo M. Pinto (pinto@unisannio.it)
Research & Development Centre ScanEx, 22/5 Lva Tolstogo st., 119 021 Moscow, Russia. Web-site: www.scanex.ru	Ms. Olga Gershenzon

2.4 News from the Special Interest Groups

2.4.1 EARSeL SIG: Temporal Analysis of Image Data

Report by Dr. Keith R. McCloy (keith.mccloy@agrsci.dk), Department of Agroecology, Danish Institute of Agricultural Sciences, Tjele, Denmark.

The inaugural meeting of the EARSeL SIG (Special Interest Group) "Temporal Analysis of Image Data" was held on Wednesday 26 May 2004 in Dubrovnik (Croatia), during the annual EARSeL Symposium. Nineteen members (see below) attended the meeting. The following is a record of the meeting, prepared by Dr Keith McCloy, Convenor of the SIG.

Dr. McCloy welcomed those attending the meeting, and stated that the main goal was to find out how the members wished to see the SIG operate, what topics should be addressed, and whether the SIG should plan a meeting in the next twelve months. A summary of Dr. McCloy's comments is presented below.

The SIG is a methodologically oriented group. Its role is to develop methodologies that can then be used in different disciplines for different purposes. Scientists from different fields of endeavour are therefore welcomed into the group.

That there will be different paradigms in the temporal analysis of image data is clear, but some of these may not yet be obvious. There will, for example, be one relating the frequency of image acquisition to the cyclic frequency of the phenomena influencing those image data. There is a need to identify these paradigms as soon as possible.

There is a need to develop tools – not necessarily the same – both to formulate and to test hypotheses. It was noted that classical time series analysis is an empirically based quantitative analysis technique, and that in the more classical areas of remote sensing, empirically based quantitative tools had been found to be unsatisfactory; the same may apply to the analysis of time series of data. The need to address the immediate problem of data consistency is paramount, and the most economical way to do this is to do it once, for all users.

Regarding how we can best collaborate and cooperate, it was noted that national

research policies vary from country to country and that we should investigate whether we can use these differences to our advantage in collaborative projects. There was also some discussion of methods of communication, and collaboration.

Following Dr. McCloy's comments, each attendee was invited to identify his interests and the challenges to be addressed. From this discussion came a number of points, detailed below.

Several speakers commented on the importance of addressing the issue of pre-processing of image data. Dr. Braun commented that other SIGs will be interested in this topic. It was resolved that the Convenor should approach the other SIGs seeking common ground, before requesting the Chairman of EARSel that the matter be taken up with ESA. Dr. Thamm pointed out that cloud-masking is a component of this issue. It was also felt that the SIG could take the initiative in exploring the tools and techniques that are available for the calibration and correction of image data, with a view to the development of standardised methods. It was suggested that there could be a Workshop on this issue, conducted in collaboration with the other SIGs.

It was pointed out by Dr. Thamm that Time Series Analysis (TSA) has a long history, and that we should tap this skill and knowledge in our endeavours to develop new tools and techniques. It was resolved that the convenor should look for an expert in this topic to conduct a tutorial session on TSA for the next meeting of the SIG.

Regarding a SIG web-site, the Convenor noted that the Danish Institute of Agricultural Sciences has approved the allocation of both the time (one week) to develop and the funds to host the web-page. A draft web-page has been prepared, which can be implemented very quickly. Dr. Thamm offered software that will allow other members of the SIG to contribute material to the web-page. The Convenor accepted the offer, and will evaluate its usefulness with the web-page developer.

It was generally agreed to organise a meeting of the SIG, and that this should focus on the issues surrounding the calibration of data and the development of tools and techniques. It was also agreed that the Convenor should explore the possibility of securing funding to support the formation and conduct of a Young Scientist Forum. Regarding collaboration with other scientific groups, the Convenor noted that other groups are interested in the spatial – temporal analysis of data and that he should contact key geographically-oriented groups to find out which were active in this topic, with a view to collaborating in Workshops and the development of projects.

The following is the list of attendees, preparation of which was intitiated by Dr. Gudmandsen, at the inaugural meeting of the SIG:

Akyurek, Zuhal (zakyuret@metu.edu.tr), Middle East Technical University; **Bajic, Milan** (milan.bajic@zg.htnet.hr), University of Zagreb; **Baronyi, Stefano** (baronyi@ifac.cnr.it), Institute of Applied Physics; **Braun, Matthias** (Matthias.braun@uni-bonn.de), University of Bonn; **Danzeglocke, Jens** (Jens.danzeglocke@dlr.de), University of Bonn / DLR; **Goksel, Sigden** (goksel@itu.edu.tr), Istanbul Technical University; **Gold, Hrvoje** (Hrvoje.gold@fpz.hr), University of Zagreb; **Gudmandsen, Preben** (pg@oersted.dtu.dk), Technical University, Denmark; **Klein, Doris** (d.klein@rsrg.uni-bonn.de), University of Bonn; **Lacaze, Bernard** (blacaze@univ-paris1.fr), CNRS / PRODIG; **Marcal, Andre** (andre.marcal@fc.up.pt), University of Porto; **McCloy, Keith** (Keith.mccloy@agrsci.dk), Danish Institute of Agricultural Research; **Musaoglu, Nebiye** (nmusaoglu@ins.itu.edu.tr), Istanbul Technical University; **Richters, Jan** (richters@rsrg.uni-bonn.de), University of Bonn; **Rohrig, Julia** (julia@rsrg.uni-bonn.de), University of Bonn; **Rossner, Godella** (Godella.rossner@dlr.de), DLR / DFD; **Thamm, Hans-Peter** (thamm@rsrg.uni-bonn.de), University of Bonn; **Wagenscil, Hendrik** (hwagense@geographic.uni-erlangen.dk), University of Erlangen; **Welle, Torslen** (welle@rsrg.uni-bonn.de), University of Bonn.

3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 ESA study of global sea surface temperature

On 14 April 2004 it was reported that a new ESA-funded office in the UK is co-ordinating international efforts to map global sea surface temperature in unprecedented detail. The oceans function as vast reservoirs of heat: the top two metres of ocean alone store all the equivalent energy contained in the atmosphere, while the whole of their waters store more than 1000 times this value.

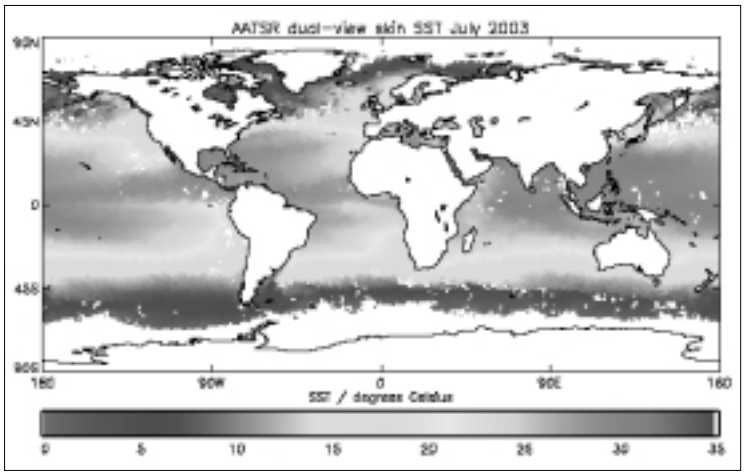
Because they cover 71% of the Earth's surface the oceans directly absorb the majority of solar heat, storing it for long periods of time compared with either the land or atmosphere. In effect, the oceans act as a giant rechargeable battery for the Earth. It takes a lot of energy and time to shift sea temperature: for this reason oceans can also be termed the "memory" of the Earth's climate system, and it means that tracking sea surface temperature (SST) over a long period is arguably the most reliable known way of measuring the precise rate at which global temperatures are increasing. Besides answering this fundamental question, measuring the SST value also improves the accuracy of our climate change models and weather forecasts. Heat energy slowly released from the sea is the dominant driver of atmospheric circulation and weather patterns. SST influences the rate of energy transfer to the atmosphere, as evaporation increases with temperature.

An international endeavour called the Global Ocean Data Assimilation Experiment (GODAE) intends to develop a range of operational ocean analysis and prediction systems for the world's oceans. Among the most ambitious is the GODAE High Resolution Sea Surface Temperature Pilot Project (GHRSST-PP), which aims to deliver to the user community a new generation of highly accurate world-wide SST products with a spatial resolution of less than 10 km every six hours. As an important step towards achieving this goal, ESA has funded a GHRSST International Project Office, located at the Hadley Centre for Climate Prediction and Research, part of the UK Met Office located in new purpose-built offices in Exeter. Formally inaugurated in March 2004, the GHRSST Project Office is headed by Dr. Craig Donlon.

Achieving a reliable operational system requires the integration of near real-time SST data gathered from a variety of different satellites as well as in situ sources. The two types of data complement each other: a single spacecraft provides wide-area sea views, but its resolution may be limited and the time it takes to revisit the same stretch of ocean is too high. Instruments aboard ships, drifting buoys and fixed moorings provide continuous data, but only across limited areas. But, all importantly, these data provide a reference to long term climate measurements of SST. The GHRSST-PP will also make good use of the 1000 plus floats that make up the global Argo system, which periodically surface to supply temperature and salinity profiles via telecommunication satellite links. ARGO data will be used to obtain a picture of the top 100-metre temperature structure of the ocean and to compare to GHRSST-PP estimates of sub-surface water temperature.

Satellite-derived SST measurements must be reconciled with the in situ sources in order to make a valid contribution to the climate data record and to account for diurnal variability – a particular problem when merging satellite observations obtained at different times within a diurnal period. The GHRSST-PP will integrate these data-sets, using the in situ data to derive sensor-specific error estimates (SSES) comprising a bias and standard deviation error that are assigned to every satellite measurement. In addition, each satellite measurement will be accompanied with an estimate of the surface wind speed, aerosol optical depth and time-averaged solar flux data that will provide additional knowledge on the state of the air-sea interface and the reliability of SSES estimates. These combined data sets, called L2P data, will be produced operationally and in near real

time to serve the needs of the operational ocean / atmosphere modelling communities.



Global coverage SST map derived from AATSR for July 2003

Every 24 hours, all available L2P satellite data will be analysed together to provide a best estimate of sub-surface water temperature free of diurnal variability, accompanied by estimates of the skin-SST at 2-hourly intervals (important for air-sea interactions). Under the GHRSST-PP framework, satellite and in situ data streams will be converted into common international format products on a regional basis by Regional Data Assembly Centres (RDACs). A Global Data Analysis Centre (GDAC) will then analyse these data and produce global coverage products.

Available space-based sensors include meteorological satellites measuring solar irradiance, as well as instruments that directly record SST such as the Advanced Along Track Scanning Radiometer (AATSR) aboard ESA's Envisat, which provides extremely accurate skin-SST measurements. Numerous RDACs are already in existence including an ESA-sponsored project called Medspiration, providing SST data for European waters and the Atlantic.

The GHRSST-PP International Project Office is based at the Hadley Centre for climate prediction and research – part of the UK Met Office – which provides a unique blend of operational ocean and weather prediction and world-class research. The Hadley Centre's climate research programme is funded by the UK Department for Environment, Food and Rural Affairs (DEFRA), who also funded the development of AATSR in collaboration with the Commonwealth of Australia. In addition DEFRA funds the AATSR science and validation programmes, in collaboration with ESA. Over the next three years, the Project Office will co-ordinate GHRSST-PP activities in the USA, Japan, Australia and Europe including close collaboration with the user operational and scientific user community driving the project forwards. During the coming months, the GHRSST-PP will start to provide a new vision for a new generation of global coverage high resolution SST data sets designed to capitalise on the enhanced satellite and in situ data available. This article is from a report on the ESA web-site (www.esa.int) on 14 April 2004.

3.1.2 Earth Explorer User Consultation Meeting

On 19-20 April 2004 at ESA's establishment in Frascati, near Rome, the ESA Directorate of Earth Observation held an Earth Explorer User Consultation Meeting at which the findings of the scientific and technical evaluations of the six candidates for the next generation of Earth Explorer missions were presented and discussed by leading scientists from the European Earth science community. The six candidate missions for Earth Explorer, part of ESA's Living Planet programme, are: **EarthCARE** (Earth Clouds Aerosols & Radiation Explorer); **SPECTRA** (Surface Processes & Ecosystem Changes through Response Analysis); **WALES** (Water VApour & Lidar Experiment in Space); **ACE**+ (Atmosphere & Climate Explorer); **EGPM** (European contribution to Global Precipitation Measurement); **Swarm** (a constellation of three magnetometry satellites).

EarthCARE aims to improve the representation and understanding of Earth's radiative balance in climate and numerical weather forecast models by acquiring ver-

tical profiles of clouds and aerosols, as well as radiances at the top of atmosphere. From a single platform in a 450 km polar orbit, a lidar (laser radar) will acquire data on aerosols and thin clouds. A high-frequency radar will do the same for thick clouds. A multi-spectral imager will provide additional information on distribution of aerosol and cloud optical properties. A broad-band radiometer will measure radiances.

SPECTRA aims to describe, understand and model the role of terrestrial vegetation in the global carbon cycle and its response to climate variability under the increasing pressure of human activity. The mission will carry an imaging spectrometer to analyse radiance from vegetation. From a near-polar 670 km altitude orbit SPECTRA will collect data over selected regions representative of all the Earth's major biomes.

WALES aims to provide global water vapour observations in the troposphere and lower-most stratosphere with high vertical resolution and accuracy to support climate and numerical weather prediction. WALES, a polar orbiting satellite at 450 km altitude, hosts a lidar using four wavelengths with different water vapour absorption adapted to the large mixing ratio of water vapour in the atmosphere.

ACE+ aims to establish highly accurate measurements of humidity and temperature in the troposphere and the stratosphere for climate trend observations. ACE+ comprises four satellites flying as two pairs in the same Sun-synchronous orbital plane but at two different altitudes. The satellites in the 650 km orbit will counter-rotate with respect to the satellites in the 800 km orbit.

EGPM aims to provide improved observations of light rain- and snow-fall and to contribute to the monitoring and understanding of storms that produce hazards such as flash floods. The overall Global Precipitation Measurement mission consists of a core platform equipped with microwave instruments and a number of smaller satellites to give a repeat observation cycle of approximately three hours. One of these satellites will be EGPM flying in a Sun-synchronous near-polar orbit at 510 km altitude with two instruments on board, a microwave radiometer, and a precipitation radar.

Swarm aims to provide the best ever survey of the geomagnetic field and its temporal evolution. Swarm will offer new insights into the composition and processes in the interior and the surroundings of the Earth, thereby improving our knowledge of climate. The satellites will drift in near-polar orbital planes at 530 and 450 km altitude. Each satellite will carry a magnetometry package, an electric field instrument and an accelerometer. (See also following article).

More information about the candidate missions and the Earth Explorer User Consultation Meeting can be found on the ESA web-site (www.esa.int).

3.1.3 Satellite "swarm" to study Earth System

On 3 June 2004 it was reported that ESA's Earth Observation Programme Board had decided which of the six Earth Explorer candidate missions, presented earlier in April at the User Consultation Meeting, will be developed and launched. **Swarm**, an Earth Explorer Opportunity Mission, is a constellation of satellites which will study the Earth's geo-magnetic field. A further selection between the Earth Explorer Core Missions **EarthCARE** (Earth Clouds Aerosols & Radiation Explorer) and **SPECTRA** (Surface Processes & Ecosystem Changes through Response Analysis) has been deferred to November 2004, to allow clarifications to be made for both missions. It was recommended that the **EGPM** (European Contribution to Global Precipitation Measurement) mission should be furthered within the ESA Earth Watch framework.

Based on the recommendations of the Earth Science Advisory Committee and ESA's Director of Earth Observation, the choice of Swarm for full implementation was unanimously agreed, due to its scientific excellence. ESA has successfully moved to the next round of missions that explore our environment and the Earth as a system. With the decision expected in November 2004 for an additional Core Ex-

plorer, ESA is at a point where the next generation of scientific missions can be initiated. In this context a Call for Mission Proposals is planned for September 2004.

The objective of the Swarm mission is to provide the best ever survey of the geomagnetic field and its temporal evolution, in order to gain new insights into the Earth system by improving our understanding of the Earth's interior and climate. The mission is scheduled for launch in 2009. After release from a single launcher, a side-by-side flying lower pair of satellites at an initial altitude of 450 km and a single higher satellite at 530 km will form the Swarm constellation.

High-precision and high-resolution measurements of the strength, direction and variation of the magnetic field, complemented by precise navigation, accelerometer and electric field measurements, will provide the necessary observations required to separate and model various sources of the geo-magnetic field. This results in a unique "view" inside the Earth from space, to study the composition and processes in the interior. It also allows the analysis of the Sun's influence within the Earth system. In addition, practical applications in many different areas (e.g. space weather, radiation hazards, navigation and resource exploration) benefit from the Swarm concept.

3.2 News from the EC

3.2.1 The security dimension of GMES

Issues of security are taking an increasingly important role in a number of policy areas at European and national level. They relate to the provision of humanitarian and development aid and crisis management around the globe, as well as civil protection and potentially to law enforcement in Europe. The Global Monitoring for Environment and Security initiative (GMES) will provide Europe with an autonomous monitoring capability in support of European security policies.

The concept of security has changed since the end of the Cold War and Europe faces new threats that are more diverse and less predictable. The borderline between civil and military responsibilities is becoming fuzzy and the term "security" finds itself used in a variety of contexts. Thus the GMES Steering Committee decided in October 2002 to create a Working Group to define the scope of security within GMES and highlight the corresponding needs. The group reviewed the main policies linked to conflict prevention and crisis management: Civil Protection, Humanitarian Aid and the EU's Common Foreign and Security Policy (CFSP).

Civil Protection: the EU Civil Protection Unit and civil protection authorities within Member States of EU and ESA are involved in risk mapping, early warning and crisis management. The origin of the disaster can be natural, accidental or deliberate (e.g. terrorist / malicious action): the same mechanisms will be used to deploy the necessary resources and help the population. Most of the actions are undertaken in Europe. However civil protection teams may assist countries outside Europe in the framework of co-operation agreements and in the context of CFSP in the field of civil crisis management.

In case of major crises, the civil protection authorities of the affected country (or the EU Civil Protection Unit) can invoke the International Charter on Space and Major Disasters. Through the Charter the requesting party obtains easy and free of charge access to satellite data, with top priority in satellite tasking. Weaknesses of this system are due to limited satellite resources, exclusion of conflict-driven crisis and lack of services for data interpretation other than on an ad hoc basis. In the longer run, this system which is currently implemented on a voluntary basis by the data-providers could be developed further to be fully user-driven and supplemented by the required services of data interpretation and assistance for users.

Humanitarian Aid: the impact of disasters, whether abnormal natural events such as a floods or hurricanes, human-induced events such as armed conflicts or simply poor harvests, is much greater in the developing world than in the developed one. The EU through ECHO, its Humanitarian Aid Office, and Member States of EU and ESA are involved in programmes to provide aid to developing countries, much of it channelled through Europe's NGOs.

To improve the effectiveness of aid requires increasing the quality and quantity of information available on regions outside Europe, both for those who need to decide rapidly whether to deploy resources and for those operating on the ground in remote areas with limited communications and poor infrastructure. In this context, satellite-based imagery plays an increasing role, especially to provide a rapid update when existing maps are obsolete. Of course satellite imagery has to be complemented by other topographic, socio-economic and statistical data in order to meet specific information demands.

The EU has established **a Common and Foreign Security Policy**, through which the EU expresses its position on the international stage and acts in a consistent manner where there is common interest from Member States. The Council of the EU plays a vital role in the implementation of this policy, in which the European Commission (EC) is fully involved. As part of the CFSP, the EU is developing a common security policy that embraces all issued relating to its security, including the gradual definition of a common defence policy (European Security and Defence Policy / ESDP).

The EU is acquiring the necessary resources to undertake crisis management operations including humanitarian and rescue tasks, peace-keeping tasks and tasks of combat forces in crisis management including peace-making. The EU may also decide to undertake missions in the field of policing, the rule of law, civilian administration and civil protection. By providing accurate and timely information, EO assets can support decision making from the routine situation monitoring, through the build-up to a potential crisis, to support for a crisis management operation. Space-based EO assets are mostly free from the restrictions of geography and sovereignty, and are therefore particularly useful in this context.

Conclusions:

In the context of security, several policies could benefit from GMES: prevention and responses to crises related to natural and technological risks in Europe; humanitarian aid and international co-operation; conflict prevention including monitoring of compliance with treaties; surveillance of borders; the EU's CFSP / ESDP. The following could be considered as potential users: civil protection and search-and-rescue organisations in Europe for managing natural and technological risks; European institutions, government departments of EU and ESA Member States, international organisations and NGOs engaged in co-operation, humanitarian and development aid, as well as civilian crisis management outside Europe; the EU Council and, under its mandate, entities involved in the planning and conduct of civil and military crisis management operations.

Once GMES services are in place, we can expect that they will benefit additional users. In particular, GMES could be useful in the domain of justice and home affairs. The GMES requirements for these tasks at European level are currently under development. Analysis of inputs from the Council and Commission services involved in the group, suggests a number of common needs in support of security: improved access to EO and background data (on population, infrastructure, resources); improved production of information and response to users' needs; improved inter-operability of systems for crisis management; development of methodology and tools for forecasting and decision-making.

In response to these needs, the Working Group proposed several actions including: access for the EU to EO data from the upcoming military and civil national satellites; development of an imagery and mapping centre in support of EC and Council needs; creation of a database for background data; development of services supporting actions of civil protection teams and NGOs; and evolution of the International Charter on Space and Major Disasters. For more information, contact: christine.bernot@cec.eu.int. This article is from a report in the on-line GMES Newsletter No. 2 (www.gmes.info/library/files/Newsletter/GMES_Newsletter_2.pdf).

3.2.2 New GMES documents available

The 4th GMES Forum Final Report – the report from the 4th GMES Forum which was held in Baveno (Northern Italy) on 26-28 November 2003 – has been issued. The GMES Forum played a vital role in the Initial Period of the GMES Action Plan. By bringing together the various parties involved in the production and use of information in Europe, the Forum contributed to develop a shared understanding of the issues facing the establishment by 2008 of a European Capacity for Global Monitoring of Environment and Security. Further it allowed exchanges of views on the actions to be undertaken during the Implementation Period of the GMES Action Plan.

While the first three Conferences of the GMES Forum were dedicated to reviewing and discussing the state-of-the-art on issues of information production, the 4th Forum Conference centred on the results achieved under the Initial Period of GMES Action Plan (2002-2003) and on the proposals for action. The Draft Final Report of the Initial Period, as well as supporting detailed reports and related national or international experiences served as the basis of the presentations and of the discussions. Summaries of the presentations as well as the discussions of the Final Plenary Session are included in these proceedings.

The 4th Forum was followed by the second meeting of the GEO ad hoc Group which highlighted the complementarity of the initiatives. The 4th Forum was organised as part of the EU Italian Presidency programme and particular thanks are due to the Ministero dell'Ambiente e della Tutela del Territorio and to the Ministero dell'Istruzione, dell Università e della Ricerca for their contributions to the preparation of this successful event.

Another important recent GMES document, which was issued in Brussels on 3 February 2004, is COM (2004) 65 (final), Communication from the Commission to the European Parliament and the Council: "Global Monitoring for Environment & Security (GMES) – Establishing a GMES capacity by 2008: Action Plan (2004-2008)". Further information is available in the library of the GMES website (www.gmes.info).

3.2.3 JRC recruitment news

The mission of the Joint Research Centre (JRC) of the European Commission (EC) is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the EC, the JRC functions as a reference centre of science and technology for the EU. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national. The scientific activities of the JRC are divided between 7 institutes, at 5 geographical sites, as follows: **Geel (Belgium)** - Institute for Reference Materials and Measurements (IRMM); **Ispra (Italy)** - Institute for Environment and Sustainability (IES), Institute for Health and Consumer Protection (IHCP), Institute for the Protection and Security of the Citizen (IPSC); **Karlsruhe (Germany)** – Institute for Transuranium Elements (ITU); **Petten (the Netherlands)** – Institute for Energy (IE); Seville (Spain) – Institute for Prospective Technological Studies (IPTS).

Call for Interest for Scientific Fellowships at the JRC:

In order to increase and reinforce the EC's scientific capacity in all of its areas of involvement in the Research and Technological Development Framework Programmes, and to encourage young scientists to enhance their experience in an international, multi-cultural and multi-disciplinary environment, the EC's JRC is launching a call for interest for PhD (Category 20) and Post-Doctoral (Category 30) fellowships. The minimum duration of both PhD and Post-Doctoral fellowships is six months, and the maximum is 36 months. In the case of PhD fellows, applicants must be in possession of a university degree and the scientific project proposed should consist of research in the framework of a doctoral study to be completed and for which, in principle, a professor has accepted to follow the doctoral study. For post-doctoral fellows the applicants must hold a PhD.

The call is open to young scientists, not older than 35 years, from EU Member States, Associated candidate countries or States associated to the European Community Framework Programme on Research and Technological Development and to the Euratom Framework Programme for Research and Training Activities, or residing in the Community for at least the last five years.

The required scientific profiles and deadlines for application can be found on the Institutes' web-pages. Note that there may not always be an open call for each Institute. Please carefully read candidate's and project's eligibility criteria before applying. All eligibility criteria must be fulfilled at the date of reference (deadline for applications). Candidates must complete and sign the application form and send it by registered mail within the date (as shown by the postmark) specified by the Institute to the Institute Administrative contact point. Only applications using this form can be accepted. Applications are only valid for one specific call. You may not refer to documents or applications submitted previously.

Call for Interest for Young Trainees for In-Service Training Period at the JRC:

This open Call for Interest is valid until 30 November 2004. In-service training is a period spent at the JRC, allowing young scientists to acquire experience by putting into practice the scientific knowledge they have acquired during their studies or professional careers. Traineeships are carried out in accordance with the rules set out in the Internal Directive of the Director-General of the JRC on the acceptance of young trainees for in-service training period. The minimum duration is two months and the maximum is normally twelve months.

The call is open to people from EU Member Countries, in principle less than 30 years of age at the date of the starting of the training period. A limited number of posts may be reserved for applicants from non-member countries in particular from Associated Candidate Countries, Associated States and Developing Countries. Traineeships are organised within the fields of activity of the JRC a description of which can be found at www.jrc.cec.eu.int.

Please read carefully the Internal Directive of the JRC Director-General, mentioned above, before applying. All eligibility criteria must be fulfilled at the date of application. Candidates must complete and sign the application form and send it, together with their CV, to the Institute contact point. Only applications using this form will be accepted.

Please note that an open call will be launched every year and that if you are not contacted by the end of the year, your application will be cancelled. If you wish to introduce a fresh application, you will not be able to refer to documents or applications submitted previously.

Information on the activities of the Institutes of the JRC, and on Nuclear Decommissioning and Waste Management (DR-C01) and Safety, Security and Radiological Protection (DR-C02) is available on the JRC web-site (www.jrc.it).

3.3 News from 4th GEO Summit in Tokyo, Japan

On 22-23 April 2004, representatives from 47 countries and more than two dozen international organisations, met in Tokyo, coming a significant step closer to achieving the goal of an integrated Earth monitoring network. The Japanese capital was the location of the 4th Group on Earth Observations (GEO) summit. GEO is an intergovernmental working group charged with developing a plan for a co-ordinated global Earth Observation (EO) network providing data on environmental factors for both scientific and humanitarian purposes.

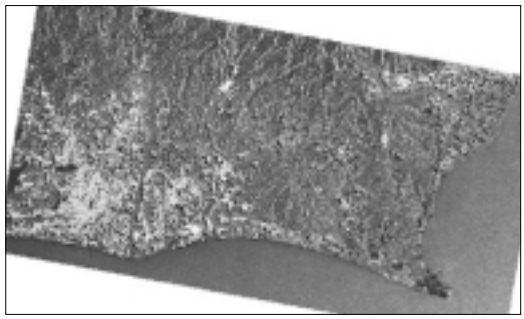
GEO was created during the Earth Observation Summit in Washington DC in July 2003, and was made responsible for producing a ten-year programme to coordinate space and ground based global monitoring systems, to be known as the Global Earth Observation System of Systems (GEOSS). ESA and the EU's Global Monitoring for Environment and Security (GMES) joint initiative serves as Europe's contribution to the worldwide GEOSS effort.

The 22-23 April Tokyo summit – the fourth such meeting and known as GEO-4 – is the

successor to previous gatherings during 2003 in Baveno, Italy and Cape Town, South Africa. GEO-4 saw the finalisation of a draft implementation plan, which was then approved by ministers gathering at the one-day Earth Observation Summit II immediately following GEO-4, on Sunday 25 April. "Securing the draft implementation plan represents a useful step forward in turning the GEOSS idea into a reality," remarked ESA Earth Observation Director of Programmes José Achache. "And all participants from Europe were united in their support of GMES as its European component." The aim behind GEOSS is to maximise the effectiveness of EO by minimising data gaps, building capacity and exchanging information as fully and quickly as possible.

Developed and developing nations alike will have access to all data gathered by the network, following the model of the World Meteorological Organisation's four-decade-old World Weather Watch, which co-ordinates the globe's weather satellites along with in situ climate stations. The increased knowledge of the environment that a similar global EO system would provide has the potential to be an invaluable resource for global decision makers. "The feeling is that the summit has made an important contribution," Achache added. "It's about more than only improving weather forecasting and the study of climate change. GEOSS will be a tool for planetary management, a resource for more efficient development and a means of mitigating disasters."

One example of the potential of a co-ordinated global Earth Observation (EO) system is depicted in the image below. More than 150 ERS images acquired between 1992 and 2000, were combined by the British Geological Survey to produce a InSAR-based depiction of crustal movement around Hamamatsu-Yaizu on Japan's south coast. It measures the annual average line of sight velocity in millimetres per year of "permanent scatterer" fixed points. Light blue indicates 1 to 3 mm, green 1 to -1 mm, yellow -1 to -3 mm, orange -3 to -5 mm, and red less than -5 mm. Applications of the data include geological risk assessment for the insurance industry and exploring links between ground movement and gas pipe failure.



InSAR-based depiction of crustal movement around Hamamatsu-Yaizu on Japan's south coast

This draft implementation plan will form the basis of additional work to be carried out by five separate GEO Sub-Groups dealing with the subjects of Architecture, Capacity Building, Data Utilisation, User Requirements and International Cooperation. ESA is a Co-Chair of the Architecture Sub-Group and also a member of the GEO Secretariat. The finalised ten-year GEOSS implementation plan will be presented for acceptance to ministers at the Earth Observation Summit III, scheduled to take place in Brussels in February of next year. This report is from an article on the ESA website (www.esa.int) on 28 April 2004.

4 RS DATA, PRODUCTS & PROJECTS

4.1 Observations

Boudewijn van Leeuwen (leeuwen@itc.nl), ITC (International Institute for Geo-Information Science and Earth Observation), The Netherlands

Recent launches:

Shiyan 1

On 18 April 2004 China successfully launched two small experimental satellites with a Long March II C rocket from Xichang Launch Centre. Both satellites were launched into a sun-synchronous polar orbit. Shiyan 1 (Experiment 1) is a 204-kg

micro satellite with a stereo-imaging instrument. The second payload is an experimental nano-satellite that weights just 25 kg.

ROCSAT-2
On 20 May 2004, a Taurus XL launch vehicle from Orbital Sciences Cooperation successfully placed ROCSAT-2 into a 735-km orbit. The Taiwanese satellite carries a 2-metre panchromatic and 8-metre multispectral scanner to acquire imagery from Taiwan and its surroundings. The second sensor on ROCSAT-2 is an instrument to obtain images of upper atmospheric lightning. ROCSAT-3, the next mission in the Taiwanese remote sensing (RS) programme is scheduled for launch in 2005. For more information: www.nspo.gov.tw/e50/home.

New data sets:

CBERS-2
In autumn 2003, the Second China Brazil Earth Resource Satellite (CBERS-2) was successfully launched into space. The Brazilian Space Research institute now offers a web interface for downloading satellite data of South America. The archive makes data from all 3 instruments on CBERS-2 available. Also data from CBERS-1, launched in 1999 can be acquired from the web-site. Two more satellites of the same programme are scheduled for launch in 2008 and 2010. For more information visit: www.cbers.inpe.br/en/index_en.htm.

SRTM
NASA / NIMA released another part of the global digital elevation model (DEM) dataset based on radar data acquired by Shuttle mission STS-99. Recently the 90-metre DEM of Africa was made available via ftp://edcftp.cr.usgs.gov/pub/data/srtm.
The last data release including Australia, New Zealand, and other islands, is planned for June 2004. Currently the DEM is only available in 1x1 degree patches via FTP but eventually all 90-metre data will be made available via the USGS Seamless Data Server: seamless.usgs.gov.

Orbview-3
On 18 December 2004, ORBIMAGE published the first images of their latest satellite Orbview-3. Orbview-3 acquires 1-metre panchromatic and 4-metre multispectral imagery. Currently the data can be ordered via ORBIMAGE Customer support, but in the future a searchable online data archive will be provided. Information can be found at: www.orbimage.com.

MSG-1
On 29 January 2004, the European Meteorological satellite MSG-1 has been renamed to Meteosat-8 marking the start of its operational mission. The Meteosat Second Generation programme will ensure continuous meteorological satellite coverage until 2018 via MSG-1 through MSG-4. Data from Meteosat 8 is distributed via EUMETSAT. One of the data distribution programmes is the High Rate Information Transmission Image Data Dissemination Service where users can receive the 12 spectral channels every 15 minutes with a standard satellite dish. For more information see: www.eumetsat.de.

Other news:

Worldview
DigitalGlobe, owner of the high resolution Quickbird satellite announced its plans for the launch of Worldview. This new satellite will be capable of collecting 50-cm panchromatic and 2-metre multispectral images. These images will have the highest spatial resolution commercially available. The satellite is scheduled for launch by a Delta II rocket from Boeing in 2006. For more information visit: www.digitalglobe.com.

DMC constellation
Surrey Satellite Technology Ltd. announced that all four micro-satellites of the international Disaster Monitoring Constellation (DMC) have reached their intended orbit. ALSAT-1 (Algeria), BILSAT-1 (Turkey), NigeriaSat-1 (Nigeria) and UK-DMC (UK) are now at their nominal positions of 0, 90, 180 and 270 degrees around the 686 km DMC orbit, that enables a maximum 24-hour re-visit everywhere around the globe. According to schedule, a system of full co-operation in tasking, imaging, data retrieval and processing between the four partners will be implemented this summer. Once the constellation is completely operational, it will begin supplying daily images to support disaster management. More information is at: www.sstl.co.uk.

Coming up soon:

Aura
After Terra and Aqua, NASA's Aura is the third mission in a series of major EO satellites to study the environment and climate change. The satellite's four instruments will obtain measurements of the atmosphere to study the Earth's climate. Aura is scheduled for launch on 19 June 2004. For more information, see: eos-chem.gsfc.nasa.gov. (See also Section 4.2).

Cryosat
The European radar altimetry mission Cryosat is scheduled for launch in July 2004. Its primary objective is the determine variations in the thickness of the Earth's continental ice sheets and marine ice cover. For more information see: www.esa.int/export/esaLP/cryosat.html

4.2 Launch of Aura, NASA's atmosphere satellite

NASA is due to launch Aura, a next generation EO satellite, on 19 June 2004. Aura will supply the best information yet about the health of Earth's atmosphere. Aura will help scientists understand how atmospheric composition affects and responds to Earth's changing climate. The satellite will help reveal the processes that connect local and global air quality. It will also track the extent to which Earth's protective ozone layer is recovering.

Aura will carry four instruments each designed to survey different aspects of Earth's atmosphere. The instruments will provide an unprecedented and complete picture of the composition of the atmosphere. Aura will survey the atmosphere from the troposphere, where mankind lives, through the stratosphere, where the ozone layer resides and protects life on Earth. Aura's space-based view of the atmosphere and its chemistry will complete the first series of NASA's EO System satellites. The other satellites are, Terra, which monitors land, and Aqua, which observes Earth's water cycle.

"Gaining this global view of Earth will certainly reap new scientific discoveries that will serve as essential stepping stones to our further exploration of the Moon, Mars and beyond, the basis of the Vision for Space Exploration," NASA Administrator Sean O'Keefe said. Aura will help answer key scientific questions, including whether the ozone layer is recovering. Aura data may prove useful at determining the effectiveness of international agreements, which banned ozone-depleting chemicals like chlorofluorocarbons (CFCs). Aura will accurately detect global levels of CFCs, and their by-products, chlorine and bromine, which destroy ozone. Aura will also track the sources and processes controlling global and regional air quality. It will help distinguish between natural and human-caused sources of these gases. When ozone exists in the troposphere, it acts as an air pollutant. Tropospheric ozone is linked to high levels of precursors such as NO2, CO and volatile hydrocarbons. Aura will help scientists follow the sources of tropospheric ozone and its precursors.

"Aura, the first comprehensive laboratory in space to help us better understand the chemistry and composition of the Earth's atmosphere, is fundamentally a mission to understand and protect the very air we breathe," said NASA Associate Administrator for Earth Science Dr. Ghassem Asrar. "It is also a perfect complement to our other EO System satellites that, together, will aid our nation and our neighbours by determining the extent, causes, and regional consequences of global change".

As the composition of Earth's atmosphere changes, so does its ability to absorb, reflect and retain solar energy. Greenhouse gases, including water vapour, trap heat in the atmosphere. Airborne aerosols from human and natural sources absorb or reflect solar energy based on colour, shape, size, and substance. The impact of aerosols, tropospheric ozone and upper tropospheric water vapour on Earth's climate remains largely unquantified. Aura's ability to monitor these agents will help unravel some of their mystery.

Aura's four instruments are: High Resolution Dynamics Limb Sounder (HIRDLS); Microwave Limb Sounder (MLS); Ozone Monitoring Instrument (OMI); Tropospher-

ic Emission Spectrometer (TES). These will work together to provide measurements in the troposphere and stratosphere to help answer important climate questions. HIRDLS was built by the UK and USA. OMI was built by the Netherlands and Finland in collaboration with NASA. NASA's Jet Propulsion Laboratory in Pasadena, California, constructed TES and MLS. NASA's Goddard Space Flight Centre, in Greenbelt, Maryland, manages the Aura mission.

NASA's Earth Science Enterprise is dedicated to understanding the Earth as an integrated system and applying Earth System Science to improve prediction of climate, weather, and natural hazards using the unique vantage point of space. For Aura information and images on the Internet, visit: www.gsfc.nasa.gov/topstory/2004/0517aura.html and aura.gsfc.nasa.gov/

4.3 ESA's miniature Earth observer: Proba

Since its launch in October 2001, ESA's Proba micro-satellite has been returning remarkable imagery of some of our planet's major landmarks, with a compact instrument called the High-Resolution Camera (HRC). Notable examples range from the monolithic Uluru or Ayers Rock in the Australian Outback to the tidal island of Mont St. Michel on the northern coast of France, and the Pyramids on Egypt's Giza Plain.

Proba HRC image of the Pyramids of Giza in Egypt, acquired 20 March 2004. The three main pyramids seen consist of the Great Pyramid of Khufu, the Pyramid of Kafhre and the Pyramid of Menkaura. They stand on the border of Greater Cairo at the verge of the desert

Measuring just 80 x 60 x 60 cm, Proba is the size and shape of a small washing machine. It orbits 600 km above the Earth's surface. Its main payload is the Compact High Resolution Imaging Spectrometer (CHRIS), a compact hyper-spectral imager that returns detailed data on the Earth's environment, down to a resolution of 18 metres. Also aboard is the compact HRC, which acquires black and white 25-km square images, at a resolution of 5 metres. HRC is a small-scale monochromatic camera made up of a miniature Cassegrain telescope and a 1024 x 1024 pixel Charge-Coupled Device (CCD), as used in ordinary digital cameras

Launched in October 2001, ESA's Proba (Project for Onboard Autonomy) micro-satellite measures just 60 x 60 x 80 cm

Proba was originally created as a technology demonstration mission, and has a high degree of on-board autonomy. Operators on the ground send up the raw inputs of a target to be imaged – latitude, longitude, and altitude – and Proba itself does the rest. Proba keeps track of its orbital position with a Global Positioning System (GPS) receiver. This works on the same basic principle as GPS navigation systems widely used down on our planet's surface. However because Proba is travelling at a very high velocity in relation to the GPS satellite constellation, the receiver has been designed to cope with much higher rates of Doppler shifting as well as the constant changing of the individual GPS satellites being tracked.

To image a target on the ground, Proba must be correctly lined up with it. To determine precisely its attitude (or pointing direction) in space, the satellite supplements GPS with an on-board star tracker system called the Advanced Stellar Compass (ASC). The ASC compares observed luminous objects to a star catalogue database containing thousands of stars in order to accurately calculate its orientation in relation to its desired target. Proba then adjusts its position to line itself up with its ground target by use of reaction wheels capable of a high level of precision control: increasing the rate a wheel spins causes the spacecraft to rotate in the opposite direction, then braking by the same amount cancels out this rotation. Dur-

Acquired 30 July 2003, this Proba image shows the China's Three Gorges dam

ing the actual imaging procedure Proba employs its reaction wheels to compensate for natural orbital movement and keep itself "staring" at its target.

Proba (Project for On-Board Autonomy) is an ESA micro-satellite built by an industrial consortium led by the Belgian company Verhaert, launched from India on 22 October 2001, and operated from ESA's Redu Ground Station in Belgium. Proba, with its "intelligent" payload, has the ability to observe the same spot on Earth from different angles and with different combinations of optical and infra-red spectral bands. A follow-on mission, Proba-2, is due to be deployed around 2005. This report is based on an article on the ESA web-site (www.esa.int) on 1 June 2004.

4.4 ERS-2 supports Europe's meteorologists

After nine years in orbit, veteran ESA satellite ERS-2 has taken on a new role, supporting real-time "now-casting" of swiftly moving weather systems in the seas around Europe. Most major European weather events have their birth in the North Atlantic or seas to the north of our continent. Limited observations across these regions mean that weather forecasters are often blind-sided by sudden storms

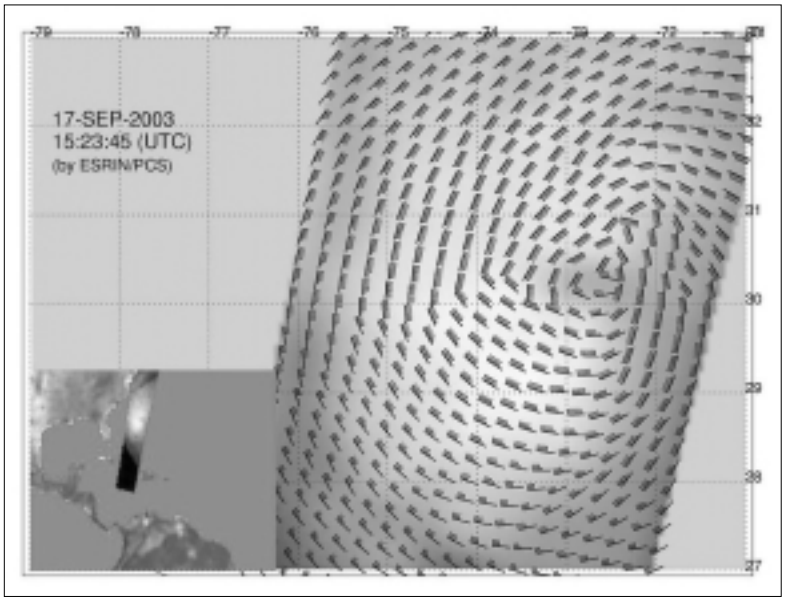
CHRIS image of Italy's Stromboli volcano, acquired by Proba on 3 December 2003. Stromboli is one of the Aeolian Islands, and stands about 900 metres above the Tyrrhenian Sea

and associated phenomena that may wreck havoc upon reaching land.

However an instrument aboard ERS-2 called a radar scatterometer can "see" windfields over the ocean surface in all weathers. It is now giving Europe's meteorologists an enhanced ability to generate real-time "now-casts" of the current climate state as well as more reliable short-range weather forecasts. An increase in the number of European and Canadian-area acquisitions carried out by ERS-2, coupled with speedier processing and delivery means that meteorologists now receive wind field products on their desks within an average 30 minutes of the scatterometer acquiring raw data.

"You want observations of current weather on your desk immediately, otherwise you are already getting behind the actual facts," says Ad Stoffelen of the Royal Dutch Meteorological Institute (KNMI), which has made its ERS-2 wind field products publicly available since the start of April. "For weather forecasting the World Meteorological Organisation defines now-casting as within one hour, with short-term forecasting falling between one hour and a day. For the first time ERS-2 results are available for now-casting, which represents a whole new application for the satellite."

The old saying that every cloud has a silver lining may be faulty in meteorology terms, but it turns out to be true in the case of ERS-2. Back in June 2003 the satellite lost its on-board data storage capability, effectively ending its global coverage. Now the spacecraft returns data when in line of sight of an appropriately equipped ground-station. Because the majority of such stations are found around Europe and Canada, ensuring good observation of the North Atlantic, ERS-2 coverage of these regions has been able to continue.



ERS-2 C-band scatterometer data of Hurricane Isabel. Credits: ESA

"ERS-2's orbit period is about 100 minutes," Stoffelen explains. "In the past it would store 100 minutes worth of data on its tape then perform a single data dump for ten minutes down to its assigned ground stations, mostly in the northern hemisphere around the North Pole. So the first data on the tape would already be pretty old, then it would have to be sent to ESA's ESRIN centre in Frascati, Italy, for processing before it gets distributed to users. Now we only get data on the Atlantic and European seas for ten minutes at a time, but to make up for it the new mission scenario has optimised the number of real-time ground stations acquisitions, increasing them radically from 14 up to 50 a day, thereby providing very good coverage in our region. And because 10-minute segments of data take much less time to be processed than 100-minute segments, they become available for use sooner than before."

KNMI combines ERS-2 scatterometer data acquired from multiple ground stations. The instrument bounces "triplets" of radar signals in three directions simultaneously (fore, aft, and sideways) and different ground stations may acquire different directions. These acquisitions are combined to increase the number of backscatter triplet measurements while throwing away overlapping material. The data are then run through KNMI's wind processor algorithm to obtain the final wind-field product. KNMI ran this system in-house for the past couple of months before making it publicly available in April 2004.

The ERS-2 results are particularly useful when it comes to identifying such fast-paced turbulent features as winter polar lows. Sometimes dubbed "Arctic hurricanes", these are often associated with gales and blizzards and powered by intrusions of Arctic air masses, along with so-called baroclinic storm developments in the Gulf Stream region, plus cyclones and anti-cyclones. All of these events can develop in under 24 hours, greatly impacting the accuracy of weather forecasts.

ERS-2's includes a radar scatterometer that works by firing a trio of high-frequency radar beams down to the ocean, then analysing the pattern of backscatter reflected up again. Wind-driven ripples on the ocean modify the radar backscatter. As the energy in these ripples increases with wind velocity, backscatter also increases. Scatterometer data enable the measurements of wind speed and direction across the water surface. What makes ERS-2's scatterometer especially valuable is that its C-band radar frequency is almost unaffected by heavy rain, so it can return useful wind data even from the heart of the fiercest storms. It is the sole scatterometer of this type currently in orbit.

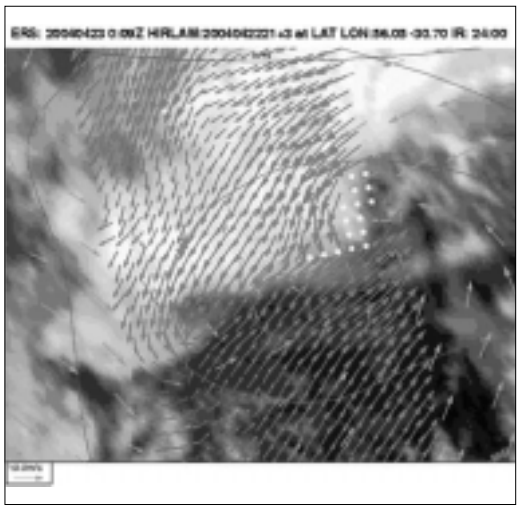
On 21 April 2004 ERS-2 celebrated its ninth year in orbit, its scatterometer working better than anyone could have hoped a few years earlier. Following its launch from Kourou in 1995, the payload worked well but problems began with gyros used for positioning in space. After six years of service ESA engineers evolved an innovative "gyro-less" mode of operating the spacecraft, but the new mode's pointing accuracy was initially insufficient to maintain an operational scatterometer service, since the instrument requires simultaneous pointing accuracy across three axes. In summer 2003 a development took place that led to ERS-2 wind-field products publicly available once more: a new software algorithm developed by the Belgian Royal Military Academy succeeded in compensating for the pointing degradation, regaining access to scatterometer measurements.

The return to service came in time for ERS-2 to provide a unique view of the pressure system at the centre of Hurricane Isabel as it descended upon the USA in September 2003. The following image shows a map of the wind field at the heart of Hurricane Isabel, using data acquired on 17 September 2003 by the C-band scatterometer on ERS-2. The map indicates wind direction and also velocity - the more lines on each bar, the highest the velocity. The data provides insight into the pressure system powering the hurricane.

Meanwhile researchers at KNMI began working with wind experts at the European Centre for Medium-Range Weather Forecasts (ECMWF) to improve the accuracy of the mathematical model that turns raw scatterometer data into geophysical facts. Their success led to greater accuracy than before, and in March 2004 ECMWF resumed routine assimilation ERS-2 scatterometer data into its medium range forecasts. With key engineering issues resolved, the last six months have shown ERS-2 to be an extremely stable platform and payload, with the satellite's overall performance as good as ever, and ESA has received several new research proposals for ERS-2.

The following image shows a scatterometer plot of a complex low developing west of Ireland, on 23 April around midnight. The red arrows show wind speeds up to 15 m/s and a cyclonic wind direction. The blue arrows in the background represent a 3-hour forecast of the winds by the KNMI High-Resolution Limited Area Model (HiRLAM). In the next 12 hours after midnight on 23 April, the winds strengthened and the depression central surface pressure dropped by more than 10 hPa to 974 hPa. In this case the timely available ERS scatterometer winds thus provide guidance on routing conditions to ships at sea.

To maintain continuity of scatterometer coverage into the future, a new more advanced instrument called ASCAT is part of the payload for the ESA-designed and EUMETSAT-operated MetOp mission, due for launch in 2005. When ASCAT comes into service, ground station acquisitions are planned that support use of its wind data for nowcasting and short-range forecasting.



Scatterometer plot of complex low west of Ireland. Credits: KNMI

This report is based on an article on the ESA web-site (www.esa.int) on 28 April 2004.

4.5 NASA's Terra satellite monitors pollution

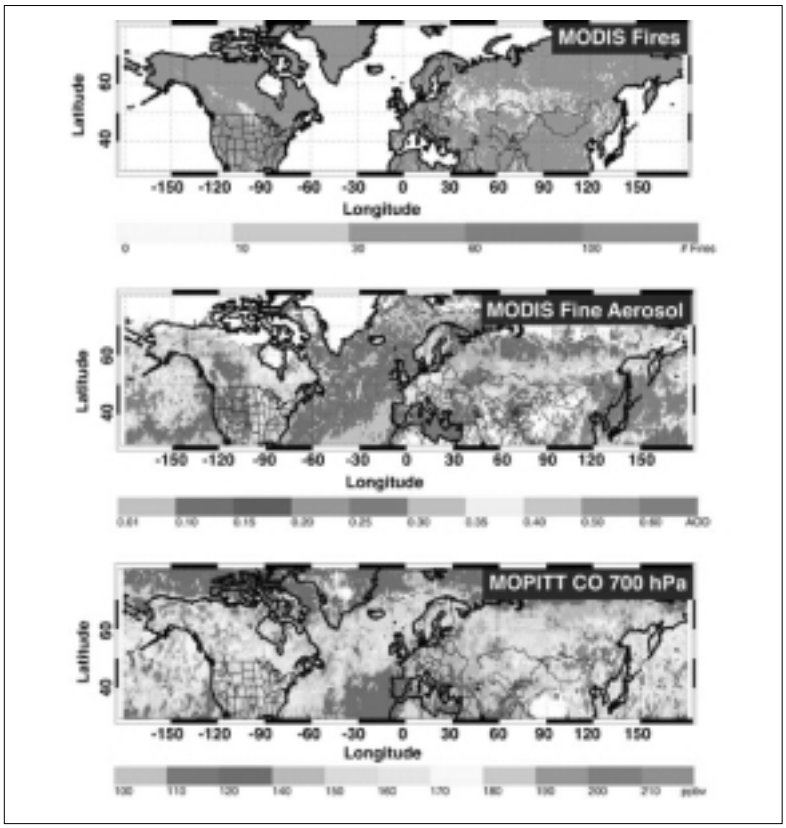
Data from NASA's Terra satellite is adding to our understanding of how pollution spreads around the globe. The information will help scientists protect and understand the Earth. NASA-funded scientists from the National Centre for Atmospheric Research (NCAR), Boulder, Colorado, presented two studies focusing on global air pollution, at the 2004 Joint Assembly of the American and Canadian Geophysical Unions, in Montreal, Canada on 17-21 May 2004.

David Edwards discussed "Observations of Carbon Monoxide and Aerosol from the Terra Satellite: Northern Hemisphere Variability", while Cathy Clerbaux discoursed on "Tracking of Pollution Plumes Using Measurements of Pollution in the Troposphere (MOPITT) Measurements". Both studies used instruments on NASA's Terra satellite to examine trends in global carbon monoxide (CO) and fine particulate (aerosol) pollution. Industry and vehicles in urban regions and fires produce these pollutants.

Terra and other NASA Earth observing (EO) satellites provide vital tools for monitoring global levels, sources and destinations of CO and other pollutants. The growing data record shows seasonal and

annual variations, clues about how our planet may be changing. CO molecules can last from a few weeks to several months in the atmosphere, allowing them to travel long distances and impact air quality far from the point of emission.

Edwards, an NCAR researcher, used two sensors on NASA's Terra to track CO and aerosols from smoke originating in Russia.



Pollution Outflow from the spring 2003 fires in Siberia. Credit: David Edwards, NCAR

The plumes were tracked as they spread across the Pacific Ocean, filling the Northern Hemisphere. In late summer 2002 and spring 2003, Terra observed big fires in western Russia and Siberia. The fires led to a "dirty" 2002/2003 winter atmosphere in the Northern Hemisphere with high amounts of CO and aerosol. Peak levels of CO hung over the USA. By using two complementary instruments on Terra, Edwards was able to tell the difference between pollutants originating from wildfires and those from urban and industrial sources. The MOPITT instrument provided CO data, while the Moderate-resolution Imaging Spectroradiometer (MODIS) instrument recorded aerosol data. "The satellite observations showed Russian fires have a huge impact on air quality on a global scale," Edwards said. "This work helps get the message across, that when it comes to pollution, we need to think globally".
As shown in the following image, the large numbers of fires in Siberia, especially in the Baikal region, in the spring of 2003 were detected by the MODIS instrument on the Terra satellite (top). This graphic shows the number of fires detected during the month of May 2003. These fires produced large amounts of fine carbon aerosol which spread out over the Pacific Ocean (centre). The suspended particles, also detected by MODIS, only last for a few days. The MOPITT instrument on the Terra satellite measures CO, which was also produced by the fires (bottom). This pollutant can last for over a month. The longer lifetime allows the gas to cross the Pacific Ocean and reduce air quality over North America before continuing on around the globe.

Work has started to see if the MOPITT instrument can track CO pollution originating from cities. Clerbaux, a scientist visiting NCAR from the French National Centre for Scientific Research, points out that tracking pollution from cities is very important, since half the people on Earth will live in urban centres by 2007. Though MOPITT was not designed specifically to detect pollution plumes from cities, the results look promising. By selecting the data and averaging it over long time periods, the observations were made more reliable, and help distinguish the city emissions from other distant sources.

MOPITT data shows how wildfires in Kalimantan on Borneo Island in Indonesia, contaminated the air in 2002 above Jakarta, Indonesia. "The instrument also shows how pollution gets dispersed from cities," Clerbaux said. "Mexico City and Jakarta are both surrounded by mountains. Due to topography, Terra revealed pollution could only escape upward or through openings in the landscape. For example, like the area to the north for Mexico City".

NASA's Earth Science Enterprise is dedicated to understanding the Earth as an integrated system and applying Earth System Science to improve prediction of climate, weather, and natural hazards

using the unique vantage point of space. This report is based on an article on NASA's Earth Observatory web-site (eob.gsfc.nasa.gov) on 18 May 2004.

4.6 Moon's "Earth-shine" used in climate study

According to a new NASA-funded study, insights into Earth's climate may come from an unlikely place: the moon. Scientists looked at the ghostly glow of light reflected from Earth onto the moon's dark side. During the 1980s and 1990s, Earth bounced less sunlight out to space. The trend reversed since 2001, as the Earth appears to reflect more light toward space. Though not fully understood, the shifts may indicate a natural variability of clouds, which can reflect the sun's heat and light away from Earth. The apparent change in the amount of sunlight reaching Earth in the 1980s and 1990s is comparable to doubling the effects of greenhouse gas warming since 1850. Increased reflectance since 2001 suggests change of a similar magnitude in the opposite direction.

Researchers from the New Jersey Institute of Technology (NJIT), Newark, New Jersey, and California Institute of Technology (Caltech), Pasadena, California, combined NASA cloud data from satellites with records of Earth's reflectance off the moon, called "Earth-shine". The study, under NASA's "Living with a Star" Programme, appeared on 28 May 2004 in the journal Science.

This composite image of dark side's Earth-shine (left of image) and bright side's Moonshine (right of image) shows what scientists are looking at. Researchers used a blocking filter to dim the Moonshine crescent, typically about 10,000 times brighter than Earth-shine. Credit: BBSO / NJIT

"Using a phenomenon first explained by Leonardo DaVinci, we can provide valuable data on the overall reflectance of the Earth, and indirectly, on global cloud cover," said Phil Goode, a physicist at NJIT, one of the paper's authors. He is director of Big Bear Solar Observatory (BBSO), Big Bear City, California. "Our method has the advantage of being very precise, and light reflected by large portions of Earth can be observed simultaneously".

Recent news reports suggested sunshine reaching Earth declined from the late 1950s to the early 1990s. This new study suggests the opposite. Earth's surface may have been sunnier, or less cloudy, in the 1980s and 1990s. BBSO has conducted precision Earthshine observations since 1994. Regular observations began in late 1997. The research team improved upon an old method for monitoring Earth-shine. They compared earthshine measurements from 1999 to mid-2001 with overlapping satellite observations of global cloud properties. The cloud satellite record from 1983 to 2001 came from the NASA's International Satellite Cloud Climatology Project. By matching these two records, the researchers used the cloud data to extend the record and construct a substitute measure of Earth's albedo, the fraction of light reflected by a body or surface.

The data showed a steady decrease in Earth's albedo during 1984-2000. In 1995-1996 Earth dimmed even more sharply. The data were consistent with satellite measurements of changing global properties. In 1997-2000 Earth continued to dim. The researchers suggest, during this time period, the decreases in Earth's reflectance may be related to an observed accelerated increase in mean global surface temperatures. In 2001-2003, Earth brightened to pre-1995 values. The researchers attributed the brightening to changes in cloud properties. "At the moment, the cause of these variations is not known, but they imply large shifts in Earth's radiative budget," said co-author Steven Koonin, a Caltech physicist. "Continued observations and modelling ef-

forts will be necessary to learn their implications for climate."

The research offers evidence that Earth's average albedo varies considerably from year to year and decade to decade. "Our most likely contribution to the global warming debate is to emphasise the role of clouds in climate change must be accounted for, illustrating that we still lack the detailed understanding of our present and past climate system to confidently model future changes," said Enric Palle, a post-doctoral associate at NJIT, lead author of the paper. NJIT post-doctoral associate Pilar Montanes-Rodriguez is a co-author. "Even as the scientific community acknowledges the likelihood of human impact on climate, it must better document and understand climate changes," Koonin said. "Our ongoing Earth-shine measurements will be an important part of that process."

BBSO, operated by NJIT, is partially supported by NASA. NASA's "Living with a Star" Programme develops the scientific understanding necessary to effectively address those aspects of the connected sun-Earth system that directly affect life and society. This report is from an article on the web-site of NASA's Goddard Space Flight Centre (www.gsfc.nasa.gov) on 27 May 2004.

4.7 ESA / NASA Cassini-Huygens almost at Saturn

The international Cassini-Huygens mission is poised to begin an extensive tour of Saturn, its majestic rings and 31 known moons. After a nearly seven-year journey, Cassini is scheduled to enter orbit around Saturn on 30 June 2004. "The Saturn system represents an unsurpassed laboratory, where we can look for answers to many fundamental questions about the physics, chemistry and evolution of the planets and the conditions that give rise to life," said Dr. Ed Weiler, associate administrator for space science at NASA Headquarters, Washington, D.C.

Launched on 15 October 1997 on a journey covering 3.5 billion km, Cassini is the most highly instrumented and scientifically capable planetary spacecraft ever flown. It has 12 instruments on the Cassini orbiter and six more on the Huygens probe. The mission represents the best technical efforts of 260 scientists from the USA and 17 European nations. The cost of the Cassini mission is approximately US$3 billion.

The Cassini-Huygens mission is a four-year study of Saturn. The 18 highly sophisticated science instruments will study Saturn's rings, icy satellites, magnetosphere and Titan, the planet's largest moon. For the critical Saturn orbit insertion manoeuvre, the spacecraft will fire its main engine for 96 minutes. The manoeuvre will reduce Cassini's speed and allow it to be captured into orbit as a satellite of Saturn. Cassini will pass through a gap between two of Saturn's rings, called the F and G rings. Cassini will swing close to the planet and begin the first of 76 orbits around the Saturn system. During Cassini's four-year mission, it will execute 52 close encounters with seven of Saturn's 31 known moons.

There are risks involved with orbit insertion, but mission planners have prepared for them. There is a backup engine in case the main engine fails. The region of passage through the ring plane was searched for hazards with the best Earth- and space-based telescopes. Particles too small to be seen from Earth could be fatal to the spacecraft, so Cassini will be turned to use its high-gain antenna as a shield against small objects.

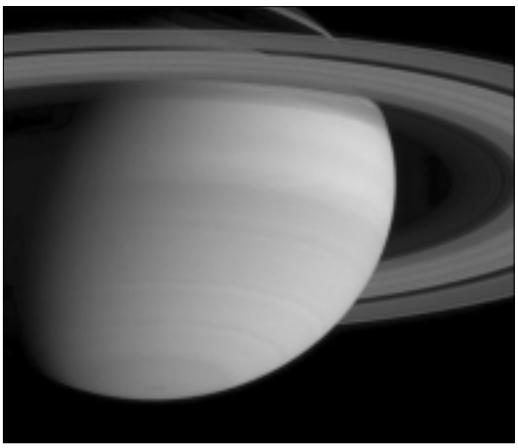
Saturn is the sixth planet from the sun. It is the second largest planet in our solar system, after Jupiter. The planet and its ring system serve as a miniature model for the disc of gas and dust surrounding the early Sun that formed the planets. Detailed knowledge of the dynamics of interactions among Saturn's elaborate rings and numerous moons will provide valuable data for understanding how each of the solar system's planets evolved.

The study of Titan, Saturn's largest moon, is one of the major goals of the mission. Titan may preserve, in deep-freeze, many of the chemical compounds that preceded life on Earth. Cassini will execute 45 fly-bys of Titan, coming as close as approximately 950 km above the surface. This will permit high-resolution mapping of the moon's surface with an imaging radar instrument,

which can see through the opaque haze of Titan's upper atmosphere. "Titan is like a time machine taking us to the past to see what Earth might have been like," said Dr. Dennis Matson, Cassini project scientist at NASA's Jet Propulsion Laboratory, Pasadena, California. "The hazy moon may hold clues to how the primitive Earth evolved into a life-bearing planet."

On 25 December 2004 Cassini will release the wok-shaped Huygens probe on its journey toward Titan. Huygens will be the first probe to descend to the surface of a moon of another planet. It will also make the most distant descent by a robotic probe ever attempted on another object in the solar system. On Jan. 14, 2005, after a 20-day ballistic freefall, Huygens will enter Titan's atmosphere. It will deploy parachutes and begin 2.5 hours of intensive scientific observations. The Huygens probe will transmit data to the Cassini spacecraft, which will relay the information back to Earth.

As Cassini coasts into the final month of its nearly seven-year trek, the serene majesty of its destination looms ahead. The spacecraft's cameras are functioning beautifully and continue to return stunning views from Cassini's position, 1.2 billion km from Earth and now 15.7 million km from Saturn. In this narrow angle camera image from 21 May 2004, the ringed planet displays subtle, multi-hued atmospheric bands, coloured by yet undetermined compounds. Cassini mission scientists hope to determine the exact composition of this material. This image also offers a preview of the detailed survey Cassini will conduct on the planet's dazzling rings. Slight differences in colour denote both differences in ring particle composition and light scattering properties. Images taken through blue, green and red filters were combined to create this natural colour view. The image scale is 132 km per pixel.



Narrow-angle camera image of Saturn, taken by Cassini on 21 May 2004

JPL designed, developed and assembled the Cassini orbiter. The European Space Agency managed the development of Huygens and is in charge of operations of the probe from its control centre in Darmstadt, Germany. The Italian Space Agency provided the high-gain antenna, much of the radio system and elements of several of Cassini's science instruments. JPL manages the overall programme for NASA's Office of Space Science, Washington, D.C. For information about the Cassini-Huygens mission to Saturn and Titan, visit the web-sites www.nasa.gov/cassini or www.esa.int/Cassini-Huygens. This report is from an article on JPL's Cassini-Huygen's web-site (saturn.jpl.nasa.gov) on 3 June 2004.

4.8 NASA satellite to test Theory of Relativity

On 20 April 2004, NASA successfully launched Gravity Probe B (GP-B) Mission, the spacecraft designed to test two important predictions of Albert Einstein's Theory of General Relativity, from Vandenberg Air Force Base, California, aboard a Boeing Delta II expendable launch vehicle. The spacecraft is being inserted into an almost perfect circular polar orbit around the Earth at an altitude of 400 statute miles. "The solar arrays are deployed, and we have received initial data that indicates all systems are operating smoothly. We are very pleased," said GP-B programme manager Rex Geveden of NASA's Marshall Space Flight Centre (MSFC), Huntsville, Alabama. "The GP-B space vehicle houses one of the most challenging science instruments ever devised and seeks to answer some of the most important questions about the structure of our universe," he said.

The GP-B mission will use four ultra-precise gyroscopes to test Einstein's theory that space and time are distorted by the presence of massive objects. To accomplish

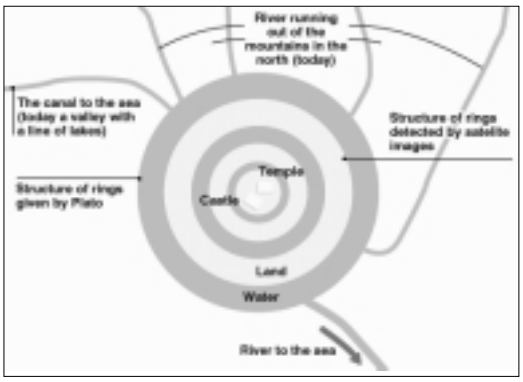
this, the mission will measure two factors, how space and time are very slightly warped by the presence of the Earth, and how the Earth's rotation very slightly drags space-time around with it. "This is a great moment and a great responsibility, the outcome of a unique collaboration of physicists and engineers to develop this near-perfect instrument to test Einstein's theory of gravity," said the experiment's principal investigator Dr. Francis Everitt of Stanford University in Stanford, California. "We are very grateful for all the support we have received at NASA and elsewhere for this exacting effort, truly a new venture in fundamental physics."

In-orbit check-out and calibration is scheduled to last 60 days, followed by a 12-month science-data acquisition period and a two-month post-science period for calibrations. During the mission, data from GP-B will be received a minimum of twice daily. Either Earth-based ground stations or NASA's data relay satellites can receive the information. Controllers will be able to communicate with the orbiting space vehicle from the Mission Operations Centre at Stanford University.

Data will include space vehicle and instrument performance, as well as the very precise measurements of the gyroscopes' spin-axis pointing. By 2005 the GP-B mission will be complete. A one-year period is planned for scientific analysis of the data. For more information about the GP-B mission, visit: einstein.stanford.edu/ and www.gravityprobeb.com. This report is from an article on the NASA web-site (www.nasa.gov) on 20 April 2004.

4.9 Satellites "show lost city of Atlantis"

A scientist says he may have found remains of the lost city of Atlantis. Satellite photos of southern Spain reveal features on the ground appearing to match descriptions made by Greek scholar Plato of the fabled utopia. Dr Rainer Kuehne thinks the "island" of Atlantis simply referred to a region of the southern Spanish coast destroyed by a flood between 800 BC and 500 BC. Satellite photos of a salt marsh region known as



The site of Atlantis, near Cadiz, Spain? Image: Werner Wickboldt

Marisma de Hinojos near the city of Cadiz show two rectangular structures in the mud and parts of concentric rings that may once have surrounded them. "Plato wrote of an island of five stades (925 metres) diameter that was surrounded by several circular structures - concentric rings - some consisting of Earth and the others of water. We have in the photos concentric rings just as Plato described," said Dr Kuehne.

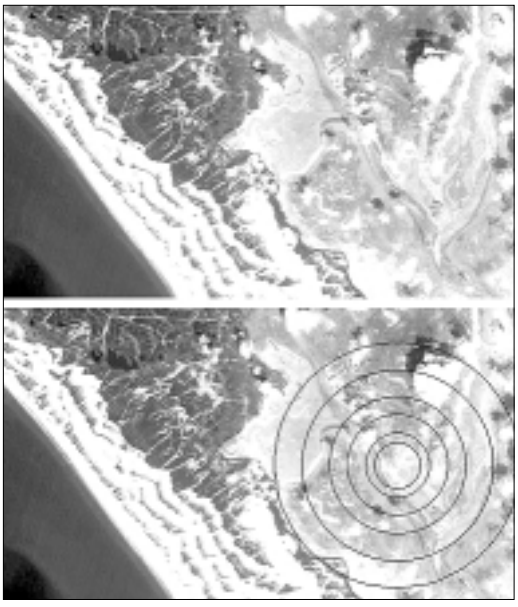
Dr Kuehne, of the University of Wuppertal in Germany, believes the rectangular features could be the remains of a "silver" temple devoted to the sea god Poseidon and a "golden" temple devoted to Cleito and Poseidon - all described in Plato's dialogue Critias. The sizes of the "island" and its rings in the satellite image are slightly larger than those described by Plato. There are two possible explanations for this, says Dr Kuehne. First, Plato may have underplayed the size of Atlantis. Secondly, the ancient unit of measurement used by Plato - the stade - may have been 20% larger than traditionally assumed. If the latter is true, one of the rectangular features on the "island" matches almost exactly the dimensions given by Plato for the temple of Poseidon.

The features were originally spotted by Werner Wickboldt, a lecturer and Atlantis enthusiast who studied photographs from across the Mediterranean for signs of the city described by Plato. "This is the only place that seems to fit [Plato's] description," he told BBC News Online. Mr Wickboldt added that the Greeks might have confused an Egyptian word referring to a coastline with one meaning "island" during transmission of the Atlantis story.

Commenting on the satellite image showing the two "temples", Tony Wilkinson, an expert in the use of remote sensing in archaeology at the University of Edinburgh, UK, told BBC News Online: "A lot of the problems come with interpretations. I can see something there and I could imagine that one could interpret it in various ways. But you've got several leaps of faith here. "We use the imagery to recognise certain types of imprint on the ground and then do [in the field] verification on them. Based on what we see on the ground we make an interpretation. "What we need here is a date range. Otherwise, you're just dealing with morphology. But the [features] are interesting."

The fabled utopia of Atlantis has captured the imagination of scholars for centuries. The earliest known records of this mythical land appear in Plato's dialogues Critias and Timaios. His depiction of a land of fabulous wealth, advanced civilisation and natural beauty has spurred many adventurers to seek out its location. One recent theory equates Atlantis with Spartel Island, a mud shoal in the straits of Gibraltar that sank into the sea 11,000 years ago.

Plato described Atlantis as having a "plain". Dr Kuehne said this might be the plain that extends today from Spain's southern coast up to the city of Seville. The high mountains described by the Greek scholar could be the Sierra Morena and Sierra Nevada. "Plato also wrote that Atlantis is rich in copper and other metals. Copper is found in abundance in the mines of the Sierra Morena," Dr Kuehne explained.



Researchers say concentric rings appear around the rectangular structures, just as Plato described

Dr Kuehne noticed that the war between Atlantis and the eastern Mediterranean described in Plato's writings closely resembled attacks on Egypt, Cyprus and the Levant during the 12th Century BC by mysterious raiders known as the Sea People. As a result, he proposes that the Atlanteans and the Sea People were in fact one and the same. This dating would equate the city and society of Atlantis with either the Iron Age Tartessos culture of southern Spain or another, unknown, Bronze Age culture. A link between Atlantis and Tartessos was first proposed in the early 20th Century. Dr Kuehne said he hoped to attract interest from archaeologists to excavate the site. But this may be tricky. The features in the satellite photo are located within Spain's Donana national park.

This research has been reported as an ongoing project in the on-line edition of the journal Antiquity (web-site: antiquity.ac.uk/ProjGall/kuhne). For more information, contact Rainer W. Kühne (kuehne70@gmx.de), Lechstrasse 63, 38120 Braunschweig, Germany, or consult the on-line paper: Kühne, R.W. 2004. "Location and dating of Atlantis". Antiquity Vol. 78 No. 300 (June 2004). This article is from a report on the BBC News web-site (news.bbc.co.uk/science/nature/) on 6 June 2004.

4.10 Infoterra: exclusive rights for TerraSAR-X

On 10 May 2004, it was reported that the Friedrichshafen-based Infoterra GmbH (www.infoterra-global.com) has exclusive commercial exploitation rights of the new radar satellite TerraSAR-X, due to be launched during the second quarter of 2006. Infoterra, a 100% subsidiary of Europe´s leading satellite provider EADS Astrium, is currently installing a global distribution network for the radar satellite, two years prior to launch. The satellite´s Synthetic Apertur Radar (SAR) will deliver X-band radar data with a swath width of 10-100 km, at a resolution of 1-16 metres.

Infoterra was launched in 2001 for the commercial exploitation of TerraSAR-X. In prototype projects, the company develops production chains for a new generation of geo-information products and services, which will evolve once the new TerraSAR-X data is available. Today, future markets are being stimulated with products and services derived from satellite and airborne data available today. "Large-scale mapping projects like Cartosur II, in which we recently mapped an area of 262.000 km_ in Venezuela using airborne interferometric synthetic aperture radar (InSAR) technology, have demonstrated the great advantages of radar technology particularly in usually clouded regions," states Joerg Herrmann, Infoterra GmbH´s CEO, reflecting the impact the satellite's new-quality data will have, "with TerraSAR-X data available, we will be able to enhance this type of service with regular updates."

While the scientific use of TerraSAR-X data will be co-ordinated by the German Aerospace Centre DLR, Infoterra GmbH will be the exclusive commercial provider of this data. Infoterra invites leading SAR experts to join a worldwide co-operation network and participate in the TerraSAR-X innovation step. Surrounding the Earth on a polar orbit at an altitude of 514 km, TerraSAR-X will be collecting new-quality X-band radar data of the entire planet. The satellite will operate independent of weather conditions, cloud coverage, and illumination and will be capable of delivering data at a resolution of up to 1 metre. TerraSAR-X is currently being developed by EADS Astrium, while the DLR prepares the ground segment.

For more information, contact Mareike Doepke (mareike.doepke@infoterra-global.com), Infoterra GmbH, 88039 Friedrichshafen, Germany, or visit the web-site www.terrasar.de.

4.11 SOAR Programme for RADARSAT-2

MDA, CSA, RSI and CCRS have formed a programme called SOAR (Science and Operational Applications Research for Radarsat-2). Data will be made available at no cost to groups or organisations interested in application development using Radarsat-2 data. Radarsat-2 will have a number of new modes including 3-metres, fully polarimetric (Quad-Pol) and dual polarisation. Radarsat-2 will continue Radarsat-1's beam modes in C-Band SAR. Interested parties may submit a Letter of Intent to the sponsors, within this year, and the sooner the better. For more information see the web-site www.radarsat2.info.

4.12 Software from FÖMI: CLC2000 Support Package

CLC2000 (CORINE Land Cover 2000) Support Package has been developed for the Remote Sensing Centre of Hungarian Institute of Geodesy, Cartography and Remote Sensing (FÖMI). The CLC2000 Support Package aims to help the implementation of the European CLC2000 project (web-site: www.ec-gis.org/clc) managed jointly by the European Environment Agency (EEA) and the European Commission's Joint Research Centre (JRC).

The use of the support package significantly facilitates update, change detection, quality control and correction of land cover databases. FÖMI provides the national teams participating in the EU's CLC2000 programme, with the version in English. CLC2000 Support Package is a macro package written in Avenue, the macro-language of ArcView. The software is a supplement to ArcView 3.2 GIS. Working with CLC2000 Support Package requires a basic knowledge of using ArcView GIS.

ArcView software is designed primarily for viewing GIS databases. The program has tools for creating maps, menus for handling databases and graphical editing tools. However, it includes only limited and less effective tools for creating and filling new polygon databases or modifying existing polygon databases. ArcView supplemented with CLC2000 Support Package provides a cheap tool for quick and comfortable editing and handling of the CORINE databases.

CLC2000 Support Package consists of four inter-related programs, all which can be used independently:

- InterPrepare for the national central team;
- InterChange for interpreters of land cover changes;
- InterControl for supervisors of interpreted databases;
- InterCheck for EU-level check of final databases.

InterPrepare can be used for the preparation of source files and work directories for change detection, to be carried out with InterChange. When interpreting changes with InterChange, a pre-described directory structure has to be built for the interpreters. The directory structure should contain all files needed for change detection. The source data must have a pre-set record structure. All the above tasks can be simply solved with InterPrepare.

The CORINE code table editor allows substitution of standard English CORINE nomenclature category names and descriptions with national language nomenclature in InterChange. Nomenclature can be edited and can also be extended with fourth and fifth level categories if required. However, for compatibility reasons it is not possible to delete third level categories not existing in the country or to add any new third level categories.

InterChange provides a tool for the revision of CLC90 land cover database and supports the interpretation of land cover changes in order to create the CLC2000 database. The program provides a convenient and easy to use interface for editing and creating polygons in CLC90 and Change databases, for viewing and modification of polygons' data, and for finding and correction of errors generated during interpretation and editing.

InterControl provides a tool for thematic control of CLC90 and land cover change databases submitted by the interpreters of the CLC2000 project. InterControl is suitable for checking exclusively those land cover themes that have been created with InterChange. InterControl has similar editing and database-handling capabilities to InterChange. These two programs differ only in a few details. A supervisor can add a short remark to defective polygons, and can save to disk the pre-formatted list of all remarks.

(The InterChange and InterControl programs were designed specially for revision of existing land cover databases and interpretation of land cover changes. They are unsuitable for primary interpretation of satellite images and for building up an independent land cover database. For these purposes FÖMI developed a separate program, called InterView, which has been used in the national CORINE 1:50,000 programme since 1999.)

InterCheck is used for checking completed CLC2000 and Change map sheets (working units) - i.e. databases specified by EEA as final deliverables. InterCheck has been prepared primarily for supporting the CLC2000 Technical Team, although national central teams might apply it as a tool for final checking of the completed CLC2000 and change databases. Checking should be completed immediately before edge-matching individual working units for the whole country. InterCheck can be used to check not only those databases prepared with the help of the CLC2000 Support Package, but also for checking CLC2000 and change databases in any file format that can be added to ArcView as a theme (ArcView shapefile, ARC / INFO coverage, AutoCAD drawing etc.). Of course, to convert some data formats, specific extensions should be switched on in ArcView.

For more information, please contact: Institute of Geodesy, Cartography and Remote Sensing (FÖMI), 1592 Budapest, Pf. 585, Hungary. E-mail: halomester@fomigate.fomi.hu. Web-site: www.fomi.hu.

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 New book: Processing of SAR Data

Achim Hein. 2004. Processing of SAR Data: Fundamentals, Signal Processing, Interferometry. Springer-Verlag, New York. ISBN 3-540-05043-4. 176 figures, 291 pp. Hardcover: EUR 69.95. Review by P. Gudmandsen

This interesting book is recommended to the remote sensing (RS) specialist who wants to know the detailed theories behind synthetic aperture radar (SAR) data. It has the format of a textbook, in that the mathematics and statistics may be followed step by step by the reader. However, it goes beyond that level by expansions into new algorithms of signal processing including a "non-linear, two-dimensional, locally independent SAR-processing algorithm". At places it requires some knowledge of these disciplines. The derivation of formulas is supported by many instructive figures of the geometries involved including satellite orbit considerations. It includes a valuable list of references from the early one by Harger (1970), to work in the process of being published in open literature.

To an old professor who taught RS and supervised research students it is interesting to note that this book apparently "reports" on a number projects carried out at the University of Siegen, Germany, through a number of years, including those of Prof. O. Loffeld, head of the Centre of Sensor Systems, ZESS. Reference is made at many places to student reports, theses and dissertations from the university, some unpublished, some published in various conferences proceedings. This is worth commenting upon. One wonders how much valuable work by students and research students in other universities is never published. The establishment of a Young Scientist Forum, presently considered by EARSeL, may be a way forward as well as the new EARSeL eProceedings.

The book is translated from a manuscript in the German language. This gives some difficulties of comprehension at places where sentences seem to be close to the German syntax. Also, it seems that the translators are not always familiar with radar terminology in English. However, this is of little importance and after some twenty pages the persistent reader get used to this "new dialect of English". The present reviewer has learned a lot. The future will no doubt see many more examples of "foreign" English – including the present review.☺

5.2 New book: environmental monitoring using EO

We have become accustomed to the presence of satellites observing the Earth, its environment, the changes it undergoes and the upheavals that disrupt the lives of human beings. In his new book, José Achache, director of Earth observation (EO) programmes at ESA, presents his vision of the crucial role played by satellites in disaster prevention and crisis management. He also shows how developing and deploying a global monitoring system for the environment and security could constitute a source of technical innovation desperately needed in Europe.

Every year, natural disasters such as earthquakes, floods, droughts and storms take a heavy toll on the human population. Climate change linked to the greenhouse effect is giving rise to new extreme situations, one recent example being the heat-wave that struck Europe in summer 2003. At the same time demographic change, with half of all human beings now packed into urban areas, and the emergence of new risks - from new epidemics to industrial or public-health disasters - have made our modern society more vulnerable in the face of threats now reaching global proportions.

A geophysicist by training, José Achache was appointed as head of EO programmes at the end of 2001, his career having previously taken him from the Institut de Physique du Globe de Paris, to the Bureau de Recherches Géologiques et Minières and the Centre National d'Études Spatiales. His experience has given him a broad, clear vision of the potential offered by current and

foreseeable technological advances. According to him, these capabilities could as of now meet needs extending well beyond just the scientific sphere and benefiting all of mankind.

As with terrorism, which most of the industrialised nations are battling against, environmental risks endanger people's lives on a global scale. Those risks, like terrorism, call for a global response, explains José Achache, in his newly-published book "Les sentinelles de la Terre". He thinks the fight against climate change will be a long one, conducted on several fronts - scientific, technological, economic and political. Keeping the environment safe will require a great deal more investment, innovation and technological input.

Preventing natural or man-made disasters involves improving our knowledge of our environment and how it operates. This will not only help to predict events, but also avoid or reverse policies likely to affect its delicate balance. To achieve that, Achache proposes that countries acquire an environmental intelligence capability. In his view, the first step would be to develop an environmental information system, to serve both as a global surveillance and forecasting system and a political instrument for worldwide governance and security. It would require the co-ordination of space and terrestrial observation facilities and the modelling capacity of all partner nations.

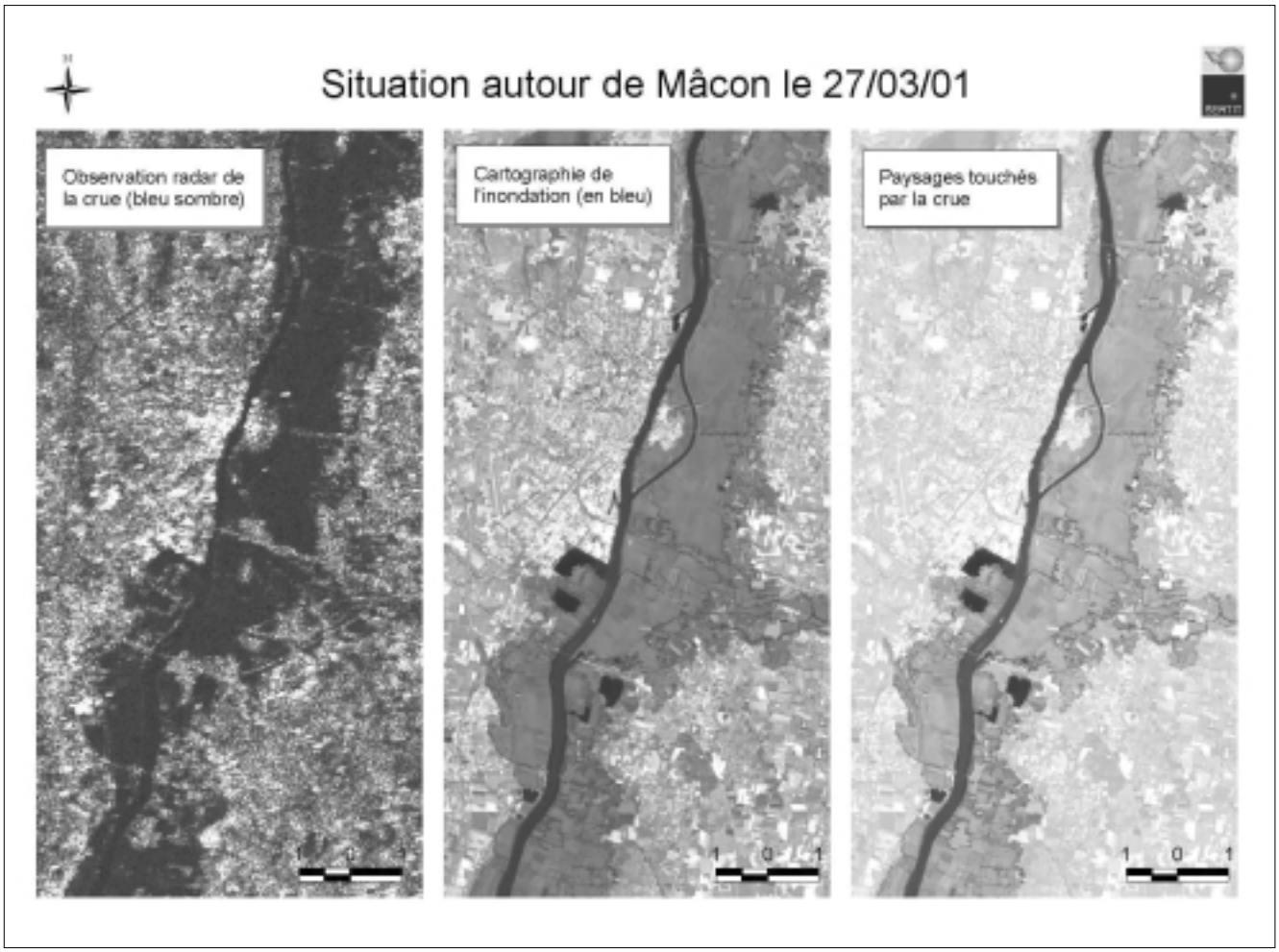
Such a project already exists in Europe: the Global Monitoring for Environment and Security (GMES) programme. Backed by ESA, this global, independent, information and decision-support system is intended to provide a framework for defining and implementing EU policy. Designed as a genuine intelligence and operations system on the model of military systems, GMES is dedicated to the security of citizens and the control of global change and works by combining satellite observations with data gathered in situ. The scope of GMES is extremely broad: negotiation and verification of international environmental agreements (in particular the Kyoto Protocol), civil and transport security, management of agricultural, forest and water resources, health and food safety, pollution control, development and humanitarian aid, peacekeeping, etc.

José Achache, who co-chairs the GMES Steering Committee, can see satellites, with their unique capabilities, playing a crucial role. He points out that satellite observations make it possible to take in natural phenomena at a single glance, regardless of scale (from the ocean basin to understand El Niño, to a dwelling to assess flood damage) or duration (from a decade to monitor changes in the ozone layer, to just one hour to anticipate the onset of storms).

Also, the precision of measurements - a few cm in the case of ocean levels or a few mm for ground motion - and their continuity over time, make it possible to construct models to understand environmental change and eventually identify the processes likely to lead to degradation. Apart from observation, satellites also have global communication capability, independently from terrestrial infrastructure, enabling monitoring networks to be set up to warn of crisis situations or, if a crisis does develop, ensuring emergency communication networks are formed to deal with it.

Europe's pioneering role goes back a long way. For a quarter of a century, ESA and its Member States have been developing tools and expertise recognised worldwide for observing the Earth, its atmosphere, surface, oceans and ice caps. In 1978, Meteosat had already placed Europe at the forefront of operational meteorology and now, with the second generation, it has the most modern observation system in geostationary orbit, according to Achache. The next satellites, which are being prepared, would improve Europe's atmospheric sounding capabilities and consolidate its leading position in weather and climate modelling.

Over the years, the Old Continent has built up a solid reputation for its oceanography and glaciology programmes, particularly its radar satellites. Europe is at present the main source of civil data in this area. It is significant that it is leading the field with derived applications, such as the observa-



Satellite images of flooding near Mâcon (Bourgogne), France in winter 2001, made using ESA's ERS-2 radar imagery from different dates, as well as optical imagery from French satellites. Credits: ESA / CNES / SERTIT

tion of motion linked to seismic or volcanological activity, and also land subsidence in urban areas resulting from construction work or the extraction of water or gas. GMES provides this European capacity with a framework for developing and strengthening its competitiveness in the area of environmental applications and security, at a time when Europe is seeking to free itself from dependence on US data sources, particularly military data, needed for risk and crisis assessment.

José Achache believes these resources and the know-how developed in Europe can be mobilised to set up the global system for disaster prediction and environmental surveillance that he is hoping for. These "Earth watchers", intended to provide warnings of further disruption on the part of nature, will work to ensure the planet and its inhabitants are safe and secure. For Europe, the development of these Earth watchers will also be a driving force for technological innovation and progress. "Les Sentinelles de la Terre", by José Achache, is published in French by Hachette Littératures. This report is from an article on the ESA web-site (www.esa.int) on 11 May 2004.

6 FORTHCOMING MEETINGS & COURSES

6.1 New EUSC-JRC course on RS of nuclear sites

The European Union Satellite Centre (EUSC) Training Unit and the IPSC Non-proliferation and Nuclear Safeguards Unit of the European Commission's Joint Research Centre (JRC), have organised an advanced course on the interpretation of nuclear installations using commercial satellite imagery. The course, which will be held on 21-24 September 2004 at Torrejón Airbase, Madrid, Spain, was originally designed for EUSC and JRC personnel, but is now open to officially nominated personnel from EU nations interested in the use of commercial satellite images to monitor the status of nuclear facilities. It has been designed as a continuation of the basic course on the nuclear fuel cycle (NFC), already offered as part of the EUSC training programme.

Applicants are requested to send their application before 21 June 2004, by e-mail (training.info@eusc.org), fax (+34-91-6786006, Attn. Head of Training Unit), or post (EUSC, Apdo. de Correos 511, 28850 Torrejón de Ardoz, Madrid, Spain). Please include as SUBJECT: "EUSC Advanced Nuclear Course – Training Unit". More information is at www.weusc.es/html/news_course_nuclear.html.

6.2 Vespucci GI Summer School: places available

There are still a limited number of places available for the 2nd International Vespucci Summer School in GI Science, Fiesole, Italy, from 5-23 July 2004. There are three one-week modules on: Spatial Analysis (Senior Instructors: Mike Goodchild and Robert Haining); research methods and progress in SDIs (Senior Instructors: Ian Masser, David Mark, Mike Gould, Werner Kuhn, Max Craglia); Geodemographics, incorporating neighbourhood classifications in GIS applications (leader Richard Webber, with senior instructors from the private sector). Interested parties are recommended to apply as soon as possible. See web-site: www.vespucci.org.

Best regards, Max Craglia

6.3 UDMS 2004 Symposium in Venice, Italy

The 1st Announcement and Call for Papers have been issued for the 24th Urban Data Management Symposium, on 27-29 October 2004, in Chioggia (near Venice), Italy. Since 1971 the Urban Data Management Society (UDMS) has organised international symposia at various locations in Europe, in order to promote the development of information systems in local government. An important aim of UDMS has been to provide a forum for people to discuss new approaches, to consider new technologies and to share practical experiences in the field of urban data management. The focus has been on urban applications but regional and rural issues have always been well represented and have grown recently in importance. For the upcoming symposium in Chioggia, Italy, the organising committee invites you to submit a paper concerning the topics listed below.

Nature, Collection Exchange, Use and Maintenance of Urban Data: applications of high resolution remote sensing data; the new era of cartography and maps: their transformation to geographic / cartographic databases and the impact on many areas; integration of data from multiple sources (e.g. public agencies / city authorities, etc.) and issues of scale, terminology / ontology, structure, formats, etc.; field data collection and quality control of urban data; underground urban assets: the way to collect, store and visualise location, construction and condition data; data availability and transparency issues - barriers to decision-making; data interchange.

Spatial Data Infrastructures: spatial data infrastructures, especially at the regional and local level; data Infrastructures for urban location-based services.

E-Governance: spatially-enabled e-governance; GIS components of e-Government.

Applications: disaster and risk management; real time GIS, especially for environmental monitoring and control; location-based com-

puting and services; intelligent transportation systems; temporal GIS.

Modelling: three-dimensional urban data modeling; agent-based urban models.

Web-based and participatory systems: community engagement - participation in gathering and using data, benefits and problems, accessibility and relevance of data at the community level; public participation GIS.

Urban Systems Technology: local government enterprise database with the capability for storing, accessing and manipulating spatial data, and the exploitation of these capabilities in a web environment; the use of open source software in local government.

All accepted papers will be published and distributed to all participants at the Symposium. For more information, contact UDMS Executive Secretary Mrs Elfriede M. Fendel (e.fendel@otb.tudelft.nl), Section GIS Technology, OTB Research Institute for Housing, Urban and Mobility Studies, Delft University of Technology, Jaffalaan 9, NL-2628 BX Delft, The Netherlands, or visit the web-site: www.udms.net.

6.4 LUCC/EFIEA Land Use Workshop in Amsterdam

Dear colleague,

It pleases me to invite you to participate in the upcoming international workshop: "Integrated assessment of the land system: the future of land use", on 28-30 October 2004, at the Institute for Environmental Studies, Amsterdam, the Netherlands.

The workshop is co-sponsored by the Land Use and Cover Change (LUCC) community and the European Forum on Integrated Environmental Assessment (EFIEA) and aims at providing a state-of-the-art of LUCC activities, and an integrated assessment of the future of land use in Europe, and linking the networks of EFIEA and LUCC.

We aim to bring together scientists that are involved in LUCC or land use / cover modelling and those involved in EFIEA or Integrated Assessment. Your research should be dealing with (agricultural) land use issues, should be multidisciplinary and preferably involve multiple actors at multiple scales. We especially invite those who employ participatory methods and involve stakeholders and policy makers. The workshop focuses both on land use modelling and related data issues (Day 1) and on more qualitative methods and how those can be linked to those quantitative tools (Day 3 and Day 3). For Day 2, we are inviting only those whose work is within Europe.

The LUCC community is a global network and this part of the workshop aims at a geographically broad mix of researchers; the EFIEA community is European and for this part of the workshop only those studying land use in Europe are invited, which should preferably be affiliated with an institute that is an official EFIEA Member.

Details on the workshop aims and programme as well as on the registration fee and abstract submission deadline can be found on www.lucc.nl under Workshop.

On behalf of the organising committee,
Kasper Kok (lucc@wur.nl), LUCC Focus 3, Wageningen University, Laboratory of Soil Science and Geology, P.O. Box 37, 6700 AA Wageningen, The Netherlands.

6.5 GIM 2004 Workshop, in Zarogoza, Spain

The Call for Papers has been issued for the 1st International Workshop on Geographic Information Management (GIM 2004), on 2-3 September 2004, Zaragoza, Spain. The aim of GIM 2004 is to present innovative research and development contributions in the context of Geographic Information Management. GIM should inspire a fruitful dialogue between developers, users, expert scientists working in this field. The Workshop proceedings will be published by the IEEE Press. GIM 2004 is being held in conjunction with DEXA 2004 (www.dexa.org/dexa2004) and EGOV 2004 (falcon.ifs.uni-linz.ac.at/news/cfp_egovernment2004.html). For registration for the GIM 2004 Workshop, see gim04.unizar.es.

6.6 Environmental Conference in New Orleans

The Call for Abstracts has been issued for the 1st International Conference on Environmental Science and Technology (IC EST '05), sponsored by the American Academy of Sciences, which will be held on 23-26 January 2005 in New Orleans, Louisiana, USA. The conference will provide a multidisciplinary platform for environmental scientists, engineers and management professionals to discuss the latest developments in environmental research and applications. For more information, visit the web-site www.AASci.org/conference, or send e-mail inquiries to conference@AASci.org.

6.7 Calendar of forthcoming meetings

23-25 June 2004 Warsaw, Poland	**10th GI & GIS Workshop, "ESDI: the State of the Art"** Web-site: www.ec-gis.org/Workshops/10ec-gis
23-25 June 2004 Constanza, Romania	**EURISY Conference: The Danube and Europe: Integrated Space Applications in the Danube Basin** Web-site: www.eurisy.asso.fr
5-23 July 2004 Fattoria Montebeni, near Fiesole (Florence), Italy	**2nd Vespucci Summer School on Geographic Information Science** Web-site: www.vespucci.org
12-23 July 2004 Istanbul, Turkey	**20th ISPRS Congress: Geo-Imagery – Bridging Continents** Web-site: www.isprs2004-istanbul.com
18-25 July 2004 Paris France	**35th Scientific Assembly of COSPAR (Committee on Space Research) – Scientific Commission A3.1: Biological and Physical Processes on Land** Contact: R. Gupta (gupta_rkg2000@yahoo.co.in), NRSA, Hyderabad, India; N. Gobron (nadine.gobron@jrc.it), JRC, Ispra, Italy. Web-site: www.copernicus.org/COSPAR/COSPAR.html
16-16 August 2004 Frascati (Rome), Italy	**2nd Envisat Summer School** Organised by: ESA-ESRIN. Web-site: envisat.esa.int/envschool
NEW 2-3 Sept 2004 Zaragoza, Spain	**1st Int'l Workshop on Geographic Information Management (GIM 2004)** Web-site: gim04.unizar.es
6-10 Sept 2004 Salzburg, Austria	**2004 ENVISAT & ERS Symposium** Web-site: www.congrex.nl/04a06/
7-10 Sept 2004 Aberdeen, Scotland	**RSPSoc (Remote Sensing & Photogrammetry Society) 2004 – Mapping and Resources Management** Web-site: www.rspsoc.org/ Contact: rspsoc@rspsoc.org
New 21-24 Sept 2004 Madrid, Spain	**Advanced Course: Interpretation of Nuclear Installations using Commercial Satellite Imagery** Organised by: European Union Satellite Centre (EUSC) & JRC's Institute for Protection & Security of the Citizen (IPSC). Web-site: www.weusc.es/html/news_course_nuclear.html
New 26-29 Sept 2004 Cairo, Egypt	**3rd EARSeL Workshop on Remote Sensing for Developing Countries** Web-site: geoweb.rug.ac.be/earsel/docs/cairo2004_flyer.pdf

28-30 Sept 2004 Edinburgh, Scotland	**Forestry Woodchain Conference: Quantifying & Forecasting Quality from Forest to End** Organised by British Forestry Commission. Web-site: www.forestry.gov.uk/forestry-woodchain
New 3-6 Oct 2004 Freiburg, Germany	**Int'l Conference: Laser-Scanners for Forest & Landscape Assessment - Instruments, Processing Methods & Applications** Web-site: www.natscan.de
New 27-29 Oct 2004 Chioggia (near Venice), Italy	**24th Urban Data Management Symposium** Organised by Urban Data Management Society (UDMS). Web-site: www.udms.net
New 28-30 Oct 2004 Amsterdam, the Netherlands	**Int'l Workshop: Integrated Assessment of the Land System - the Future of Land Use** Web-site: www.lucc.nl
2-4 Dec 2004 Bordeaux, France	**Int'l Conference: From Knowledge of Landscapes to Landscaping Action** Web-site: landscape.lyon.cemagref.fr
New 23-26 January 2005 New Orleans, USA	**1st Int'l Conference on Environmental Science & Technology (IC EST '05)** Web-site: www.AASci.org/conference
14-16 March 2005 Tempe, Arizona, USA	**Joint Symposia: "Remote Sensing and Data Fusion over Urban Areas" (URBAN 2005) & "Remote Sensing of Urban Areas (URS 2005)"** Web-site: www.urban-remote-sensing.org
New 6-11 June 2005 Porto, Portugal	**25th EARSeL Symposium: Global Developments in Environmental Earth Observation from Space** Web-site: www.fc.up.pt/earsel2005
New 9-10 June 2005 Porto, Portugal	**2nd EARSeL Workshop on Remote Sensing of the Coastal Zone** Web-site: las.physik.uni-oldenburg.de/workshop.html
New 10-11 June 2005 Porto, Portugal	**1st EARSeL Workshop on 3D Remote Sensing** Web-site: www.ipi.uni-hannover.de/html/aktuelles/workshop.doc