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EARSeL Newsletter Editor

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1 EDITORIAL

The highlight of the EARSeL calendar – the 23rd EARSeL Annual Symposium, entitled "Remote Sensing in Transition" – took place on 2-5 June 2003, in Ghent University, Belgium. As is traditional, the Association's General Assembly and Bureau and Council meetings were held in conjunction with the Symposium. This year's Symposium was also followed by two thematic workshops: the 4th International Workshop on Remote Sensing and GIS Applications in Forest Fire Management, and the 1st EARSeL Workshop on Remote Sensing of the Coastal Zone. By all accounts, the EARSeL events in Ghent were a great success, with a large international attendance and a high quality of scientific work presented. Reports on the Symposium and associated meetings and Workshops, are included in this issue of the Newsletter. Preparations are also underway for next year's EARSeL Symposium, entitled "New Strategies for European Remote Sensing", to be held in Dubrovnik, Croatia, on 27-27 May 2004, followed by a Workshop on Remote Sensing of Land Use / Land Cover. For further details please visit the Symposium web-site (www.earsel.geosat.hr/stranice/symposium.html).

Apart from the EARSeL Symposium and related meetings, the past few months have been a busy time in the field of satellite remote sensing. The eventful recent period is reflected by the wide variety of articles in this issue of the Newsletter. There are reports, for example, on "normal" remote sensing applications, for monitoring forest fires, vineyards, land vegetation, water and soil conditions, urban land use, permafrost, and (mis-)management of water resources, as well as less conventional uses of Earth observation, for monitoring urban air quality, detecting heatwaves and power blackouts, and predicting earthquakes, and even "extra-terrestrial" remote sensing of the Sun, Moon, and faraway stars, galaxies, and planets! (Well, to be accurate, the remote sensing application regarding the Sun involves imagery taken by the Earth-based Swedish Solar Telescope).

Two major international events, less "applied" in nature but nonetheless fundamentally important for the long-term future of satellite remote sensing, are reported upon in this issue of the Newsletter: the high-level (in fact, top-level) Earth Observation Summit in Washington, USA, on 30 July 2003, and the final Consultation meeting on the joint European Commission – European Space Agency Green Paper on a European Space Policy, in Paris, France, on 23-24 June 2003.

The current difficulties of the satellite launch business, underlined by the losses of the Ariane 5 space launcher in December 2002 and Space Shuttle Columbia in February 2003, were further compounded by the destruction – again with tragic and terrible consequences – of the Brazilian Space Agency's VLS satellite launcher at Brazil's Alcantara Spaceport, on 22 August 2003. Despite these depressing events, there are some positive signs, and the fact that there have been three successful satellite launches by Ariane so far this year, with a fourth one imminent, is encouraging.

Perhaps the remote sensing community should see the dangers inherent in launching satellites into space, as a salutary reminder of how fortunate we are to have at our disposal such exciting and advanced technology. This thought (and others) passed through my mind recently, one wonderfully clear night in Northern Italy, as I sat outside with friends, sipping red wine, and gazing up at a truly spectacular, star-filled sky. It was shortly after the night of San Lorenzo (Saint Laurence), which falls on 10 August and which is traditionally associated with the peak of the "meteor shower" season. As I stared upwards, hoping to catch a glimpse of a shooting star, I was amazed and thrilled to observe a faraway satellite, moving quickly across the night sky, its presence announced by the sunlight reflected from its panels. Five minutes later, I was even more excited to see another one! In fact, the strange thing is, the more wine I sipped, the more satellites there were to be seen…

The Editor

2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 23rd EARSeL Annual Symposium & Workshops

The EARSeL annual General Assembly, Symposium and Workshops on 3-7 June 2003, brought together more than 250 persons in the historic Het Pand Conference Centre, Ghent, Belgium. This former Dominican monastery, the oldest parts of which date back to the thirteenth century, has been rehabilitated and restored. It is now attached to the University of Ghent and is much in demand for the organisation of scientific and cultural events.

After welcoming speeches from the Pro-Rector of Ghent University, the Dean of the Faculty of Sciences, and Prof. Antrop, Head of the Department of Geography, Dr. Stefano Bruzzi spoke on behalf of Dr. Achache, Head of Earth Observation Programmes at the European Space Agency. There then followed two keynote addresses, the first given by Prof. Ferdinand Bonn of Sherbrooke University, Quebec, Canada on "Trends in Integrated Observation of Terrestrial Ecosystems" and the second by Dr. Mario Hernandez, Head of the World Heritage Division of UNESCO in Paris, on "Remote Sensing for World Heritage Sites". These were both very much appreciated.

The oral presentations were arranged in parallel sessions and it was generally agreed that the scientific level of these is improving each year, as are the poster presentations which, with modern printing facilities, are becoming works of art. Works of art were, in fact, presented at the "SPOT ART" exhibition, which our Vice-Chairman, Rudi Goossens, brought to Ghent. The EARSeL participants were invited to the official opening by the Governor of the Province of East Flandria and the exhibition has remained open throughout the annual Ghent Festival. This consists of SPOT colour imagery taken over sites presenting outstanding features throughout the world. Remote sensing (RS) specialists are delighted by the information content, and the lay person by the aesthetic beauty and the play of colours, which make these images works of modern art. The exhibition has been highly acclaimed by the national and regional press.

Participants were also able to appreciate Belgian gastronomy, first at the Het Pand Centre, whose chef is renowned, and then at the gala dinners, organised for each of the meetings in historic restaurants. We should like to express our thanks to Prof. Goossens and his team for their excellent organisation, and to the Belgian Federal Space Policy Office and the Flanders Fund for Scientific Research for their support. The Symposium proceedings in book form including a CD-ROM with papers in full colour should be ready for distribution this autumn.

We are now looking ahead to our 24th Symposium, which is planned to take place next year at the Inter University Centre in Dubrovnik, a beautiful town on the Adriatic in southern Croatia. Professor Oluic, our local organiser gave a presentation in Ghent of what Dubrovnik can offer the visitor and for those who were not able to join us, there is now a website with the preliminary announcement: www.earsel.geosat.hr. Please mark the dates in your diaries: Symposium (25-27 May 2004); Workshop on RS for Land Use and Land Cover (28-29 May 2004).

2.2 EARSeL Bureau & Council Meetings

Prior to the Symposium, the EARSeL Bureau and Council met in Ghent. Council members from Austria, Belgium, Canada, Croatia, Denmark, Finland, Germany, Hungary, Poland, Portugal, Russia, Switzerland and the UK, were present. The status and activities of the Special Interest Groups (SIGs) were reviewed, and these contributions are presented separately in Section 2.3 below. The Chairman reported that he had received a proposal from Dr. Keith McCloy of the Danish Institute of Agricultural Sciences in Tjele, to form a new SIG on Temporal Analysis of Satellite Imagery, since there are many possibilities to explore the methodology. The Council agreed that Dr. McCloy should make a proposal to the

membership to explore the interest in setting up such a group. See separate article (Section 2.6).

Concerning the 2004 Symposium, Prof. Marinko Oluic gave a presentation of the facilities that were being offered in Dubrovnik and the beauties of the site. The convener arrangements for the organisation of sessions would be repeated, which should guarantee high-quality papers. Other topics discussed by Council included the venue for the 2005 General Assembly and Symposium. A very promising proposal had been received from Dr. André Marçal of the University of Porto in Portugal, where until now EARSeL has never organised its annual meeting. This will be further explored by the Chairman.

As far as publications are concerned, the organisers of workshops are encouraged to publish the proceedings in the reviewed EARSeL e-Proceedings series. The Council appointed an editorial board to assist in the reviewing of papers. More experts would be co-opted according to the particular topic of the Workshop. This year the proceedings of the symposium will be published in book form with a CD-ROM attached including full papers and colour figures and illustrations. In future it may be necessary to publish on CD-ROM only in order to reduce printing and mailing costs. The Council re-elected Prof. Eberhard Parlow as Chairman and Dr. Rainer Reuter as Secretary General for a further period of two years. It was agreed that the Terms of Reference for the office of national representative should be revised and distributed to all national representatives. These should also be published on the EARSeL web-pages. The Council also recommended that the EARSeL Web pages should be revised and updated more regularly, which was agreed.

2.3 News from the Special Interest Groups

SIG Data Fusion: This group no longer organises regular workshops but continues to be a forum for the remote sensing (RS) community interested in data fusion. Meetings are now organised in co-operation with other societies. One of these joint meetings was held in Berlin on 22-23 May 2003, under the title URBAN 2003, co-sponsored by IEEE Geosciences, ISPRS and ASPRS. It was co-chaired by Olaf Hellwich (T.U. Berlin) and Lucien Wald. An interactive web-site is run by L. Wald and T. Ranchin at the Ecole des Mines. The group is constantly seeking funding at European level, but proposals made have not been accepted and no action line has been found in the new FP6 where a network on data fusion may find its place.

SIG Developing Countries: The CD-ROM of the workshop held on 18-20 September 2002 at the University of Bonn is now available through the EARSeL Secretariat. The next Workshop will be held in Cairo, Egypt, on 26-29 September 2004. This will include a field excursion, and the organisers are Prof. Rudi Goossens and Prof. Gunter Menz.

SIG Forestry: Prof. Hakan Olsson, Swedish University of Agricultural Sciences, has agreed to chair this group, which hold two Workshops on laser scanning of forests on 2-4 September 2003 in Umea, Sweden. The group will be co-chaired by Prof. Werner Schneider, University of Agricultural Sciences in Vienna, and Prof. Jouni Pulliainen, Helsinki University of Technology. Prof. Olsson has agreed to organise a session during the 2004 Symposium in Dubrovnik.

SIG Forest Fires: This group held its 4th Workshop following the Symposium in Ghent. Please see the report below (Section 2.4). A selection of the papers presented at the Workshop will be published in the journal Remote Sensing of the Environment.

SIG Geological Applications: This group works closely with the Geological Remote Sensing Group in the UK, which is mainly concerned with geological and mining exploration. The convener, Prof. Freek van der Meer, has suggested that EARSeL could focus on environmental issues, including natural / geological hazard studies, which are not covered by the GRSG and are in line with ESA policy. He is willing to be active along these lines and has colleagues in ITC who are also interested. He is willing to organise a dedicated session in Dubrovnik.

SIG Imaging Spectroscopy: A very successful workshop was organised on 13-16 May by DLR, Oberpfaffenhofen, with the administrative support of the EARSeL Secretariat, which brought together more than 120 participants from all over the world. The technical sessions were on the following themes: Sensors and Missions; Data Enhancement; Terrestrial Ecosystems; Geology and Mining; Limnology; Vegetation Analysis. A CD-ROM of the proceedings is in preparation.

SIG Land Ice and Snow: The CD-ROM of the reviewed proceedings of the Workshop held in Berne (Switzerland) on 11-13 March 2002, will soon be available in the EARSeL eProceedings series. Another meeting may be organised in 2004 or 2005.

SIG Land Use / Land Cover: Dr. Matthias Braun of the University of Bonn has recently taken over the chairmanship of this group, which is planning its first Workshop to be held on 28-29 May in Dubrovnik, Croatia, following the Annual Symposium.

SIG RS of the Coastal Zone: The first Workshop of this group, which followed the Symposium, attracted around 90 participants. Several more persons from the Russian republics wished to attend but were prevented from doing so due to lack of funding. A special feature of the Workshop was the practical exercises that the SIG leader, Dr. Rainer Reuter, had organised. Papers presented will be reviewed before publication on CD-ROM in the EARSeL e-Proceedings series. A report on the Workshop is presented in Section 2.5 below.

SIG Multi-Lateral Environmental Agreements: This group is planning its first Workshop, which will be organised as a Tutorial session on 12 July 2004 during the ISPRS Congress in Istanbul. Both scientists and decision-makers, as well as service-providers generating relevant information, are invited to attend. The aim is to deliver information in order to match the technological and scientific research plans and technology transfer opportunities, to actual needs.

SIG Self-Organised Criticality in the Environment: Prof. Vasiliev is going ahead with the organisation of a first meeting in Moscow 25-26 November 2003. The aim of this expert meeting is to see how to use the SOC theory and to introduce the many applications that have made SOC accessible to the Earth sciences. The meeting is expected to be a small one with participants from Europe and the USA.

SIG 3-D Remote Sensing: This newly-formed group, under the leadership of Dr. Karsten Jacobsen, will hold a session during the Workshop on "High Resolution Mapping from Space 2003", to be held at the University of Hannover from 6-8 October 2003.

SIG RS of Urban Areas: A 4th Workshop was held on 27-29 June 2003, organised by Prof. Carsten Juergens, who has agreed to chair a joint SIG on this topic with the appropriate ISPRS Working Group, and to organise a session in Dubrovnik.

SIG Image Temporal Analysis: (Proposed new SIG – see Section 2.6 below).

2.4 EARSeL Workshop on Forest Fires

Report on the 4th EARSeL Workshop on RS and GIS Applications in Forest Fire Management, in Ghent Belgium, on 5-7 June 2003

Emilio Chuvieco, Chairman of EARSeL SIG Forest Fires, Department of Geography, University of Alcalà, Spain

The 4th Workshop on RS and GIS Applications in Forest Fire Management, "Innovative Concepts and Methods in Fire Danger Estimation", was held in Ghent, Belgium, on 5-7 June 2003. The Workshop was co-organised by the EARSeL Special Interest Group (SIG) on Forest Fires and the Global Observation of Forest and Land Cover Dynamics (GOFC / GOLD) Fire Implementation Team. The SIG workshop followed three previous technical meetings held in Alcalá de Henares (1995), Luso (1998) and Paris (2001), and was focused on fire prevention, although other topics related to fire effects assessment were also covered. More than sixteen scientists from fifteen different countries attended the meeting.

Most came from European Mediterranean states (Spain, Portugal, Italy, Greece, France). There were also representatives of other European countries (UK, Belgium, Germany, Ukraine, Switzerland), and Canada, Argentina, India, and USA.

The structure of the workshop was based on six invited lectures, four poster sessions and three round-table discussion sessions. The lectures focussed on three topics: fuel characterisation, fire risk mapping and burned land assessment. The techniques covered to improve fuel description were: use of radiative transfer models for moisture content estimation, developed by Stéphane Jacquemoud (University of Paris); use of hyper-spectral technologies for wild-land fuel mapping, presented by Dar Roberts (University of California, Santa Barbara); derivation of canopy structure for fire modelling from lidar, illustrated by Ralph Dubayah (University of Maryland).

These lectures were followed by two poster sessions, one focussed on fuel moisture content estimation, and the other on fuel type mapping, where nine and seven posters were presented, respectively. The lecture by S. Jacquemoud focused on the basis of radiative transfer models and the determination of plant water content, the importance of these physical models to understand better the contributions of different factors affecting plant reflectance, and the potential to invert these models to estimate bio-chemical properties of plants. R. Dubayah offered a global view of the different available lidar systems, stressing the role of large-footprint full wave-form digitising systems that his group are developing with NASA. Several study cases of tropical and temperate forests illustrated his lecture, showing the connection between lidar data and fire behaviour modelling. D. Roberts presented research being conducted at his department using hyper-spectral data from AVIRIS and Hyperion instruments to derive fuel moisture content and other bio-physical properties of plants. The interest of developing spectral libraries was also emphasised.

The topics discussed on fire risk mapping issues covered: "Human fire causes: a challenge for modelling", presented by Vittorio Leone (University of Basilicata, Italy); "Fire risk mapping methods", by Bryan Lee (Forestry Canada). V. Leone presented some thoughts on the different socio-economic motivations leading to fire ignition, from purely criminal attitudes to the advantage of economic interests. He made a strong case for considering fire as a natural factor in Mediterranean ecosystems. B. Lee presented different applications of the Canadian Fire Information System, which makes extensive use of remote sensing (RS) data and GIS analysis tools. In addition seven posters were exhibited on fire risk mapping.

The final lecture, by Jean Marie Grégoire (Joint Research Centre, European Commission), dealt with burned land mapping, and focussed on "Fire regimes in protected areas of Sub-Saharan Africa, derived from the GBA2000 dataset". He presented a spatial analysis of patterns of fire occurrence in several nature reserves of Africa, stressing the interest of fire managers of these areas in having access to temporal and spatial information on fire occurrence patterns. The general discussion on this lecture and the subsequent poster session (which included twenty contributions), emphasised the importance of providing well documented accuracy assessments for the burned land products, so they could be easily understandable by end-users. The average seasonal cycle and inter-annual variability deduced from the analysis of global burned surfaces and active fire long time series was identified as a key indicator contributing to the generation of global fire danger products.

The three round-tables were focused on: burned land mapping as an input to fire danger assessment, moderated by B. Lee (Forestry Canada); operational problems for the estimation of fuel properties, chaired by Jan W. van Wagtendonk (USGS Western Ecological Research Centre, Yosemite Field Station); operational integration of RS and socio-economic data for fire danger rating, coordinated by Vittorio Leone (University of Basilicata, Italy). In all cases, the importance of addressing the needs of information end-users was underlined. Different levels of end-users should

also be distinguished, from fire managers (with different interests depending on their scale of planning), to scientist working in atmospheric or ecological modelling. Additionally, a general discussion on future activities of the Forest Fires SIG, covering the potential participation in Global networks (FP6) was coordinated by Pilar Martin (National Council for Scientific Research, Spain).

As part of the meeting format, poster sessions were designed to allow detailed one-to-one discussions with poster authors and after each poster session a general summary discussion was held on the poster topics. These general discussions offered an excellent opportunity to share ideas about the application of RS techniques to improve fire danger assessment and fire mapping.

One of the general recommendations of the Workshop was to stress the importance of deriving global products for fire danger estimation, which could serve regional managers interested in strategic planning, as well as global scientists dealing with the impacts of fire upon atmosphere and vegetation. This global fire danger product may be designed in a hierarchical way, serving the various interests of end-users in different geographical regions: from more qualitative systems, where input data is scarce, to more quantitative-detailed frameworks, in those countries or regions where the required spatial information is more readily available. The global product should include a proper characterisation of fuel properties (moisture content, fuel loads, fuel geometry, etc.), as well as meteorological patterns and the assessment of those human activities related to fire occurrence. This global fire danger product might be developed in the framework of the GOFC / GOLD-Fire programme, bringing together the international pool of expertise in this research area. The workshop also underlined the importance of providing well documented products both in terms of the physical variables they include (considering temporal and spatial scales), and in terms of documenting the quality / reliability of the product.

Within European research programmes the development of a specific network addressing RS and fire danger was also recommended. This network could be presented within the available instruments of the EU's FP6 programme, and linked to the global components of European research, such as the GMES. Close connections to GOFC / GOLD and other international network development initiatives (UN International Strategy for Disaster Reduction, Global Fire Monitoring Center, FAO, etc.) would also help to reinforce the global perspective.

2.5 EARSeL Workshop on RS of the Coastal Zone

Report on the 1st EARSeL Workshop on RS of the Coastal Zone, in Ghent, Belgium, on 5-7 June 2003

Rainer Reuter (rainer.reuter@uni-oldenburg.de), University of Oldenburg, Institute of Physics, D-26111 Oldenburg, Germany

On 5-7 June 2003 the EARSeL Special Interest Group (SIG) on Remote Sensing (RS) of the Coastal Zone, held its first workshop at the University of Ghent in Belgium, in combination with the 23rd EARSeL Symposium. The event continued the tradition of the thematic workshops on Lidar RS of Land and Sea (1991-2000) and RS and GIS for Coastal Zone Management (1994). It focused on Coastal Zones and covered all methods of RS suitable for this complex environment, with emphasis on methods, technology and applications. With sixty oral and poster presentations, the following topics were covered: coastal zone management; coastal habitat; ocean colour; instruments and methods; Lidar data fusion.

The state-of-the-art and future perspectives of coastal RS were discussed in various meetings, and topics of joint project initiatives were investigated within the scope of the EU's FP6 Programme. For the first time, two exercises and training sessions were part of the workshop programme, with experimental set-ups for fluorescence, transmittance and reflectance measurements, and lidar RS. These demonstrations with optical hardware were rounded up with simulations of ocean colour image and airborne fluorescence lidar data processing. After a review, the workshop manuscripts

will be published in the EARSeL eProceedings series. The next workshop of this SIG will be held in 2005, in parallel with the 25th EARSeL Symposium. More information is at the SIG's web-site (las.physik.uni-oldenburg.de/projekte/earsel).

2.6 New EARSeL SIG: Image Temporal Analysis

Dr. Keith McCloy (Keith.McCloy@agrsci.dk), Institute of Agricultural Sciences, Denmark

Hyper-temporal image analysis is defined as the analysis of long sequences of image data so as to extract information on the dynamic processes operating in the area imaged. It can be shown that long sequences of image data contain information on the response of the environment to the forcing mechanisms that operate in an area, embedded in other types of information. The extraction of these other types of information is more likely to be the province of classification, estimation or change detection. It can also be shown that these other activities will ideally focus on single images or short sets of image data. Hyper-temporal image analysis will use classification, estimation and change detection as tools in the temporal analysis of the data, as appropriate. It builds on, not replaces, these other types of analysis.

In science it is essential that the problem being addressed be sufficiently understood so as to formulate hypotheses. More and more the validation of hypotheses is based on rigorous quantitative techniques. Long sequences of temporal image data defy the use of visual interpretation so as to understand the nature of the processes taking place in an area. There is a need to reduce the dimensionality of hyper-temporal datasets, yet retain information on the dynamic environmental processes that are in effect, in order to promote the formulation of hypotheses. Conventional time-series analysis usually starts with a visual analysis of the time-series to select the method of analysis. There are severe limitations to the use of this approach in image processing, giving rise to a need to develop analytical techniques suitable for the analysis of hyper-temporal image data.

The creation of a hyper-temporal image dataset requires that the image data be internally consistent, with some level of rectification, calibration and correction for atmospheric effects. NASA has recognised the overheads involved in having different science groups all doing this, in the creation of their Pathfinder datasets. There is a need to have this problem recognised and addressed in Europe. Finally, most existing image processing systems can deal satisfactorily with hyper-spectral data, but not with four-dimensional data. The needs of our community for temporal analysis will eventually be reflected in improved software systems.

Europe is very active in the development of this new field of remote sensing. There have been two workshops on the analysis of multi-temporal image data, in 2001 and 2003. European researchers are as active as those in the USA and Canada in the analysis of hyper-temporal datasets. What is needed is a forum to discuss ideas, develop those ideas into concepts, form the concepts into projects, and implement them. A forum is also needed to deal with some of the more practical issues like the issue of the development of internally consistent datasets, software issues and data standards. EARSeL have accepted the need for a forum in the creation of this Special Interest Group (SIG).

Those who wish to join this new SIG should contact myself, Dr Keith McCloy, Senior Scientist (Remote Sensing), Danish Institute of Agricultural Sciences, Post Box 50, 8830, Tjele, Denmark (email: keith.mccloy@agrsci.dk). If the response to this invitation is adequate for the formation of the SIG, then I expect to prepare an agenda for a meeting to be held in parallel with the next EARSeL meeting in Dubrovnik, Croatia, in June 2004. At this stage I expect this meeting to focus on the aims of the SIG, to review the status of hyper-temporal research and to formulate a plan of action for the SIG.

2.7 Honoured: Professor Gottfried Konecny

Peter Winkler, FÖMI Remote Sensing Centre, Budapest, Hungary

On 15 May 2003 the Hungarian Society of Geodesy, Cartography and Remote Sensing (MFTTT) awarded the title Honorary Member to Professor Gottfried Konecny, in recognition of his "outstanding contribution to the international acknowledgement of Hungarian scientists of geodesy, cartography and remote sensing, and strengthening the Hungarian relationships in international professional organisations".

Professor Konecny is an honorary member of several international scientific societies and professional associations. He has also been an active member of the International Society of Photogrammetry and Remote Sensing (ISPRS) and European Association of Remote Sensing Laboratories (EARSeL). During his long professional career in science and education, he taught geodesy, photogrammetry, remote sensing (RS), and recently also GIS in several countries (e.g. Germany, Canada and USA). As professor and head of department at Hannover University, he helped numerous Hungarian students to study photogrammetry abroad, who later became university readers in Hungary and transferred their newly acquired knowledge to their students.

Professor Konecny was a member of the governing body of ISPRS in 1976-1980 and the organiser and director of the especially successful Hamburg Congress in 1980. It was in this year that, on his initiative, the Congress completed the name with remote sensing and extended the competence of the International Society of Photogrammetry. ISPRS has got its current name at that Hamburg Congress. Influenced by this change, the Hungarian Society also renewed its name some years later: we have built remote sensing also into the acronym.

Professor Konecny was General Secretary of the ISPRS in 1980-1984, and from 1988 – when the Society had already more than hundred member organisations – he acted as its President, and in 1988-1992 first Vice President. In these high positions, he greatly supported the participation of the experts of the Hungarian Society not only at the Hamburg Congress, but also at each event held every four years. These international meetings were very important for us and we all know what a significant action it was in those years. He personally supported not only the participation of Hungary, but our scientific activity as well. At the Washington Congress, held in 1992, Hungary missed a few votes only in the competition for leading Commission VII on Remote Sensing and finally fell behind Brazil. The fruits of the successful support by Professor Konecny ripened for us in 1996 at the Vienna Congress, when the Hungarian Society of Geodesy, Cartography and Remote Sensing won the leadership of Commission VII and Dr Gábor Remetey-Fülöpp was elected its president. (The importance of this fact can really be appreciated if you know that in the almost one hundred year history of this international organisation, the last time a Hungarian became the president of a professional commission was sixty years ago. This person was Professor Oltay in 1934-1938.) As a result, Hungary hosted the International Remote Sensing Conference ECO BP'98 in Budapest, in the building of the Hungarian Academy. Professor Konecny has acted for many years as the "link" between the worldwide ISPRS and EARSeL, since he was Vice Chairman of EARSeL in 1989-1993, and Chairman in 1993-1997.

In the period of the political transition in the Central and Eastern European region, Professor Konecny again played a great part, when a Hungarian institution, the Remote Sensing Centre of FÖMI (Institute of Geodesy, Cartography and Remote Sensing) became a regular member of EARSeL, for the first time "from behind the iron curtain". Subsequently, in 1992, Hungary organised the 16th EARSeL Symposium in the town of Eger. Professor Robin Vaughan of Dundee University (Scotland) praised the event in the most recognised remote sensing bulletin with the following words: "…we wrote history, when we convened an EARSeL Symposium in Eger in 1992, for the first time in a Central European country." On the proposal by Professor Konecny, the EARSeL Executive Committee co-opted Péter Winkler as a member responsible for developing the East-West relations within the organisation. In addition to these actions, Gottfried Konecny helped to gain acknowledgement for the Hungarian scientific achievements at various international forums and professional meetings.

Professor Konecny has visited Hungary many times, and participated at the ESA, EURISY, ISPRS and EARSeL events held here, and always made efforts to make us familiar with recent achievements. Also in private conversation, he was always open and ready to transfer information and knowledge to the Hungarian scientists. The Hungarian Society of Geodesy, Cartography and Remote Sensing expresses deep respect, appreciating his activity by awarding him the Honorary Membership of the Society.

3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 New Head of ESA: Jean-Jacques Dordain

In July 2003, Jean-Jacques Dordain became the new Director-General of ESA, following the departure of Antonio Rodotà. Dordain's career with ESA began in 1986 when he was appointed Head of ESA's Microgravity and Space Station Utilisation Department. He takes over as ESA Head at a time when the Agency's relationship with the EC is being redefined and in the midst of the Space Green Paper/White Paper process, which will lay the groundwork for European space activities over the coming decades.

Commenting on the Space Green Paper process, Dordain said: "I only became personally involved late in the process. I participated in the Closing Conference on 24 June. The appearance, during the closing session, of Commissioner Busquin, two ministers, Mme Haigneré and Mrs Moratti, a member of the European Parliament, (then) ESA Director-General (Rodotà) and many other officials certainly sends a clear and strong signal of the interest raised by the Green Paper. Consulting widely the actors of the European space sector has provided a solid basis for the follow-up White Paper, to which ESA is ready to contribute."

Referring to the developing EC / ESA relationship, Dordain said: "I am more than optimistic. I am convinced that the EC / ESA relationship is the axis along which the development of space systems and services for the benefit of European citizens and of countries co-operating with Europe will be built. I was one of the promoters of strengthening ties when I was ESA's Director of Strategy some years ago and the progress made so far reinforces my conviction about the benefits to be reaped from such a relationship. It's not easy because of the differences in our cultures, our expertise, our respective Member States, even the vocabulary we use, but it is a relationship that is mandatory for the good of Europe, a relationship based on complementarity. The EU is able to federate the demand for space systems while ESA is able to federate the supply of space systems to best respond to the demand. Even the funding mechanisms are complementary. The GALILEO programme is the first fruit of the ESA / EC relationship. A lot more will come, taking into account the lessons learnt from the difficulties in jointly setting up GALILEO. I shall, with my ESA colleagues, dedicate a significant part of my energy to reinforcing the relationship between ESA and the EC. This is good for Europe and, therefore, good for both ESA and the EC."

Paying tribute to his predecessor, Dordain said: "Antonio succeeded in changing ESA from a closed space agency to a much wider actor on the European scene, responding to the demands of European policy, building up partnerships with industry, extending international co-operation with non-European partners, opening doors to relationships with Central and Eastern European countries etc., and last but not least, reconstructing the internal capabilities of ESA."

Dordain says his first priority as incoming Director-General will be to draw up, with ESA Directors, a four-year plan for the Agency to be presented to the Member States in mid-September. "Mine is a four-

year mandate," he explains. "That's long enough to reach concrete objectives but too short to wait six months before setting those objectives. An ESA Director-General can get a lot done, provided he is supported by ESA's staff of around 2000 world-class experts as well as the delegations of the 15 ESA Member States. ESA has played and continues to play a pivotal role in moving the European space sector forward, and ESA's objectives are the same as those of the sector as a whole. This is why I will continue to consult and work with the other main space sector players: national agencies; industry; scientists and operators; as well as our primary partner, the European Commission." This article is from a report at the EC's Space Policy web-site (europa.eu.int/comm) on 23 July 2003.

3.1.2 ESA addresses EO Summit in Washington, USA

On 30 Jul 2003 high-level delegates from thirty countries and twenty-two international organisations agreed at the Earth Observation Summit in Washington, to improve co-operation on Earth observation (EO) and to remove barriers to the exchange of information between countries and organisations. ESA already carries out its EO programmes in co-operation with other agencies and countries through mechanisms such as CEOS (Committee of Earth Observation Satellites) and IGOS-P (Integrated Global Observing Strategy Partnership). Another good example of the way co-operation between space agencies can lead to increased utilisation of EO data is the International Charter on Space and Major Disasters. This provides data, at short notice, to civil protection agencies to help them deal with emergencies. ESA is an active member of these organisations and also leads, together with the European Commission (EC), Europe's major contribution to integrated global observation of the Earth – the Global Monitoring for Environment and Security (GMES) initiative. GMES also involves Eumetsat and European national space agencies in an integrated approach to support European policy.

Important though these initiatives are, what is still lacking is a truly global partnership to encompass all countries, rich and poor, which will allow the transfer and use of EO information by all. The meeting on 30 July 2003 was an important step in the right direction because it showed that the political will is now there to bring this about. The declaration issued at the end of the meeting emphasised the need for timely long-term information as the basis for sound decision-making; the need to coordinate strategies and systems; to assist developing countries to use and contribute to EO data; to foster the exchange and integration of information obtained from the ground, as well as from planes and satellites. The Earth Observation Summit also agreed to prepare a ten-year Implementation Plan to build on existing systems and initiatives. ESA's delegation to the Summit was led by its new Director General, Jean-Jacques Dordain.

As a member of the panel on "how to identify needs and how to fill the gaps", ESA's Director of EO Programmes, José Achache, described a number of ESA's Earth Explorer missions such as: the SMOS satellite to measure soil, moisture and ocean salinity; Cryosat to measure changes in the Earth's terrestrial and marine ice fields; the ADM-Aeolus mission to provide global observations of three-dimensional wind fields, will make a unique contribution to global monitoring. These missions will improve our understanding of the Earth system, but there will remain a need to support long-term continuity of such observations beyond the research stage.

"For its part", says Achache, "ESA has already demonstrated, through its GMES and Oxygen initiatives, that it is a strong believer in global monitoring and improving access to EO data. It is important that we contribute to the proposed global coordination, while maintaining the independent capacity to make observations in support of European policies in environment and civil security. A strong independent programme is a pre-requisite for successful partnership. We support the Summit declaration and will do our part to ensure that it is implemented." Work will now proceed with preparing the framework for the ten-year Implementation Plan in time for the next Ministerial Conference to be held in Tokyo before summer 2004.

This will enable the Plan to be presented at the Ministerial Conference to be hosted by the EU towards the end of 2004. This article is from a report on the ESA web-site (www.esa.int) on 7 August 2003.

3.1.3 ESA helps put EU in the arms of Bacchus!

Space data are set to become an added ingredient of future European wines. ESA is contributing Earth Observation (EO) data and expertise to a European Commission-backed project called Bacchus, to develop a methodological approach for vineyard inventory and management. The aim is to chart the continent's vineyards in unprecedented detail, and provide vine growers with information tools to improve production management and guarantee grape quality. From Bordeaux to Frascati, there is a good reason that wines are always known for their home region. As any connoisseur will explain, a grape's distinctive flavour derives from local characteristics such as soil type, microclimate, altitude and terrain slope. So, wine-growing regions (and sub-regions) are legally demarcated as an assurance of quality, by the Controlled Denomination of Origin (DOC).

Europe is the most important wine producer in the world, and the Common Market Organisation (CMO) for wine (Council Regulation (EC) No 1493/1999) requires all wine-producing EU states to keep a register of vine production. However there is no standardised way of doing this: it is variously – and painstakingly – done by a combination of fieldwork, vine producer interviews and photo-interpretation of aerial photography.

In an attempt to create a more standardised alternative, the partly EC-funded Bacchus consortium has been started by fourteen public and private bodies from four wine-producing countries: Italy, France, Spain and Portugal. "A strong point of the Bacchus consortium is the very complete range of involved users we have, covering different aspects of vine cultivation," said Manuel Bea of prime contractor Geosys. "In Spain and Portugal, the users are governmental organisations involved in applying EC policy, while in France and Italy users belong to the wine production sector. The French GeoDASEA offers technical support to grape producers at a regional level. The Italian users are consortia of the DOC areas for Prosecco and Frascati, and the last user is a private French organisation which federates 2200 wine co-operatives."

The intention behind Bacchus is to use geo-referenced aerial and satellite images to create a specialised GIS tool for use in vine production. As well as enabling improved record keeping and statistics, this tool will also help with land management. All relevant data on any given wine-growing region – vine inventories, administrative boundaries, slope angle relative to the sun – can be integrated into GIS and made easily accessible to vineyard managers. Meteorological data can also be added to the system. For improved vineyard management, all these distinct data sets can be digitally combined – a process like overlaying maps on top of one another – to obtain new and useful information, such as locating optimal areas for particular vine types, or where best to expand a given DOC's boundaries, or conversely, identifying the least productive land so it can be grubbed up. *(Editor's note: "to grub up" = "to clear the ground of roots and stumps, etc.).*☺

French research institute Cemagref has the demanding role of developing pattern recognition technology for the automatic recognition of vineyards within satellite or aerial images. "We have previous experience of image processing for agricultural applications," said Michel Deshayes of Cemagref. "For instance by textural analysis – automated recognition of distinctive structural elements – we have been able to distinguish weeds from crops on aerial images. We also worked on a robot that killed weeds with electricity to lessen use of pesticides, using leaf shape to identify weeds in close-up. "For Bacchus our approach will be to combine both textural and shape information. At the scale of high-resolution satellite or aerial images, vineyard structure induces specific periodic patterns and spatial distributions."

The Bacchus project began earlier in 2003 with a survey of pilot sites, including

Italy's Frascati vineyards (now home to ESA's EO centre ESRIN) where vines have been cultivated since Roman times. The sites are being regularly re-imaged to acquire data on how vineyards develop through the growing season. High-resolution multi-spectral satellite images of up to 0.65 metres resolution are being acquired, as well as aerial photographs at even higher resolution– simulating the next generation of EO satellite data soon to become available. The aerial cameras are fitted with GPS, so their photos can be precisely georeferenced for integration within GIS systems. The Frascati DOC consortium represents seven hundred grape producers and thirty wine makers in the area. "We know this project is the way to go in the future," said Fulvio Comandini of the consortium. "Bacchus will give us – and all the other DOCs across the country too – a customised information system to more precisely manage our entire system of production and also a fully objective means of guaranteeing the quality of our wine to the market."

For ESA, the Bacchus project represents the Agency's first involvement in the emerging precision farming area, using EO data to improve agricultural efficiency. More information is on the following web-sites: Bacchus Project (www.bacchus-project.com); precision farming (www.precision-farming.com); Geosys (www.geosys.fr). This article is from a report on the ESA web-site (www.esa.int) on 7 July 2003.

This QuickBird satellite image shows the distinctive regular lines of Frascati (Italy) vineyards at 0.61 metres resolution. French research institute Cemagref are working on pattern recognition software to automatically recognise vines from satellite or aerial images

3.1.4 Milestone for Infrared Space Observatory

Scientists are celebrating the thousandth scientific publication from ESA's Infrared Space Observatory (ISO), in May 2003. ISO is fast becoming one of the world's most productive space missions, although its operational life ended in 1998. ISO was the first space observatory able to see the sky in infrared light. Using its eyes, we have discovered many new phenomena that have radically changed our view of the Universe. Everybody knows that when something is heated it glows. However, things also glow with a light our eyes cannot detect at room temperature: infrared light. Infrared telescopes do not work well on Earth, as such light is absorbed by the atmosphere.

ISO looked at the cold parts of the universe, usually the "cold and dusty" parts. It peered into clouds of dust and gas where stars were being born, observing for the first time the earliest stages of star formation. It discovered, for example, that stars begin to form at temperatures as low as minus 250°C or less. Scientists were able to follow the evolution of dust from where it is produced (i.e. old stars – the massive "dust factories") to the regions where it forms new planetary systems. ISO found that most young stars are surrounded by discs of dust that could harbour planets. The observatory also analysed the chemical composition of cosmic dust, thereby opening up a new field of research: "astromineralogy". With ISO we have been able to discover the presence of water in many different regions in space. Another new discipline, "astrochemistry", was boosted when ISO discovered that the water molecule is common in the Universe, even in distant galaxies, and complex organic molecules like benzene readily form in the surroundings of some stars. "ISO results are impacting most fields of astronomical research, almost literally from comets to cosmology," explains Alberto Salama, ISO Project Scientist. "Some results answer questions. Oth-

ers open new fields. Some are already being followed up by existing telescopes; others have to await future facilities."

When ISO's operational life ended, in 1998, its observations became freely available to the world scientific community via ISO's data archive. In May 2003 the "milestone number" of 1000 scientific papers was reached. Even now ISO's data archive remains a valuable source of new results. For example, some of the latest papers describe the detection of water in "protostars", which are stars in the process of being born, and studies of numerous nearby galaxies. "Of course we were confident ISO was going to do very well, but its actual productivity has been far beyond our expectations. The publication rate does not even seem to have peaked yet! We expect many more results," Salama says.

ESA is now preparing to continue its infrared investigation of the Universe. The next generation of infrared space observatories is already in the pipeline. ISO is to be followed by the NASA SIRTF (Space Infrared Telescope Facility) observatory to be launched later this year (see Section 4.13 of this Newsletter). Then, in 2007, ESA will follow up the pioneering work of ISO with the Herschel Space Observatory, which will become the largest imaging telescope ever put into space, and will be launched on an Ariane-5 rocket, together with ESA's cosmology mission, Planck. Herschel's 3.5-metre diameter mirror will collect long wave infrared radiation from some of the coolest and most distant objects in the Universe. These include forming stars and galaxies.

For the record, ISO was launched in 1995 and operated from November that year to May 1998, when it ran out of the coolant needed to keep its detectors working. At the time it was the most sensitive infrared satellite ever launched and made particularly important studies of the dusty regions of the Universe, where visible light telescopes can see nothing. ESA will re-open its examination of the infrared Universe when Herschel is launched in 2007.

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3.2 News from the EC

3.2.1 JRC study: vegetation activity from space

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Introduction:

Scientists at the Joint Research Centre (JRC) of the European Commission (EC) have developed a novel approach for assessing vegetation changes from space. A suite of physically based algorithms for quantitatively estimating vegetation activity from optical remote sensing (RS) data, has been developed and applied to a range of spaceborne instruments (e.g. SeaWiFS; VEGETATION; MERIS; GLI; MISR). The processing of a six-year global SeaWiFS data-set is currently being conducted, with the first continuous time series over European countries, and is made available to the user community by the Institute for Environment and Sustainability (IES).

Scientific framework – vegetation and climate:

The bulk of the global biomass is physically located in the terrestrial biosphere. Vegetation over land areas plays a crucial role in the climate system through its partial control of the fluxes of water, energy, carbon and momentum with the overlying atmosphere. Plants also play a critical role in providing essential food for people and animals, as well as through the generation of fibre and wood products essential for many economic activities. Last but not least, vegetation is very sensitive to climate variations, natural hazards and exploitation; its state thus indicates the presence, severity and impact of natural and man-made perturbations.

Monitoring the condition and evolution of terrestrial vegetation is at the core of many European policies, including those addressing climate change (e.g. the Kyoto Protocol and subsequent agreements), forestry (in particular with respect to resource management), desertification, biodiversity and other environmental issues. Reliable information on terrestrial vegetation is an essential ingredient for the determination of land cover and land use and their changes, as well as for the establishment and management of development plans, both in Europe and elsewhere.

Monitoring vegetation from space:

Of the various properties of plant cover that are retrievable from space-based observations, the "Fraction of Absorbed Photosynthetically Active Radiation" (FAPAR) is arguably the one variable that can be retrieved with the best accuracy. FAPAR is highly relevant to most applications, as it controls the effectiveness of the photosynthetic process and thus the productivity of vegetation. The methodology of the FAPAR-retrieval algorithms, designed in the Global Vegetation Monitoring (GVM) unit of JRC-IES, is based on a two-step procedure. The first step aims at rectifying the red and near-infrared bands from the perturbing effects due to the atmosphere and the changes in the relative geometry of illumination and observation. The second step consists in optimising the formula to approximate a one-to-one relationship between the mathematical indicator value and the FAPAR itself. The procedure exploits the availability of advanced, coupled, surface-atmosphere radiation transfer models, and uses them to construct the training data set against which the optimisation is achieved for various instruments.

Although the SeaWiFS instrument was initially developed to support oceanographic applications, this carefully calibrated sensor has also proved to be an excellent source of reliable information for terrestrial surfaces. An operational processing system has been developed and implemented at the Inland Marine Water (IMW) Unit of JRC-IES, to process raw satellite data and to generate the FAPAR product (as well as other oceanographic variables). Daily data acquisitions are often not sufficient to provide global coverage, not only because of the limitations of the sensor but also because of prevalent cloud cover. Furthermore, many applications rely on the knowledge of the evolution of the vegetation cover throughout the seasons rather than on a daily basis, and require as complete as possible a geographical coverage. For these and other technical reasons, the products derived from daily acquisitions are merged into higher level products that are analysed and integrated over space and time.

CarboEurope study sites:

CarboEurope is an EC-funded cluster of projects aimed at understanding and quantifying the carbon balance of Europe (www.bgc-jena.mpg.de/public/carboeur). In the context the CarboEurope cluster, the GVM Unit of JRC-IES provides detailed information on the spatial and temporal evolution of the FAPAR variable for a set of twelve 30x30 km windows in Europe (Gobron et. al., 2003). Each window corresponds to an instrument-observed site, where investigators routinely acquire meteorological and environmental data. More information on these sites, and on the CarboEurope cluster, can be found at the CarboEurope web-site (see above).

For each CarboEurope sites, GVM provides a standard data-set of values describing the statistical properties of the FAPAR product, as well as of other RS products. Figure 1 illustrates the evolution of photosynthetic activity over a period of four years for three types of agricultural land surfaces in France, Spain and Italy, and over a deciduous forest in Germany. The profiles are taken from the ten-day products for the period from September 1998 to December 2001, and represent the mean value of a 3x3 pixel window centred on the site, defined by its latitude and longitude.

The plot in Figure 1 (top) is for a site near Toulouse (France), and shows an example of a double-cropping land use. The seasonal shapes of the FAPAR values, as well as their levels, are repeated for four consecutive years. In each annual series, a first peak of photosynthetic activity occurs in

spring (May) and another one, with a smaller value of FAPAR, in August. The subsequent decreases correspond to the senescence and harvest of the two crops, probably wheat and maize (inputs from the MARS Unit of JRC's Institute for the Protection and Security of the Citizen).

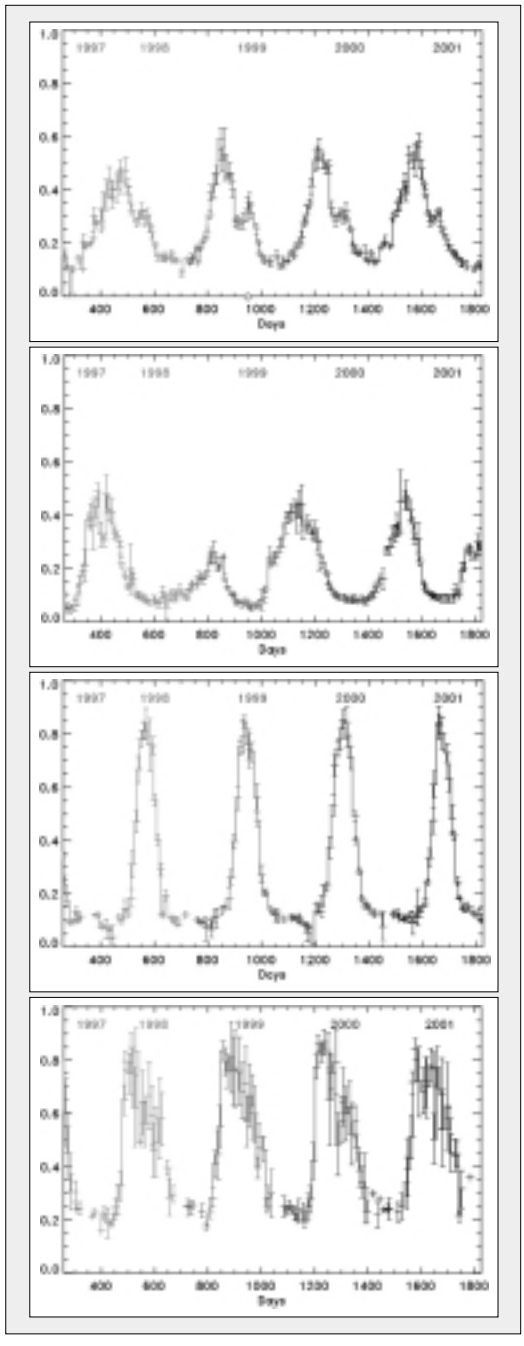
Figure 1 (second from top) exhibits the observed evolution of a winter-wheat cultivation near Serpa (Portugal). Note that the maximum of the photosynthetic activity appears during the winter months, in February. In this case, the seasonality is clearly variable over the three years. The low spring-time values of FAPAR in 1999 and 2001, compared to 1998 and 2000, are probably due to the very low soil moisture (drought) conditions in late 1998 and early 1999 (and also in 2000 and 2001).

Figure 1 (third from top) shows an example of a time series of photosynthetic activity, corresponding to rice cultivation in Northern Italy. The seasonal cycles repeat quite well during the four years, most probably due to the extensive use of irrigation, with a high level during the month of June.

Finally, Figure 1 (bottom) corresponds to deciduous woodland at Hainich in Germany. Here, the profiles exhibit similar seasonality during the entire period. The peak of FAPAR appears from March to June, and can reach values as high as 0.75-0.8. The decreases of photosynthetic activity are similar for the four years, and can reach values as low as 0.2.

Conclusion:

The methodology developed by the GVM Unit of JRC-IES, provide accurate FAPAR values irrespective of the viewing geometry of the observing sensor and the atmosphere conditions during the measurements. This remotely sensed FAPAR product is therefore perfectly suited for applications requiring the detection and monitoring of live green vegetation over diverse terrestrial conditions. The available FAPAR products constitute an improvement in spatial resolution compared to existing products, and can be re-mapped to a 10 km grid, or 0.5 x 0.5 degrees, for global change modelling.



The change in FAPAR with time for agricultural practices, reflecting (from top to bottom, respectively): (1) double cropping in Toulouse, France; (2) winter wheat in Serpa, Portugal; (3) rice in Pavia, Italy; (4) a deciduous woodland, in Hainich, Germany

Literature reference:

- Gobron, N., B. Pinty, M. Taberner, F. Mélin, B. Hirtz, M.M. Verstraete, and J.L. Widlowski. 2003. European Vegetation Activity from Space: CarboEurope Sites. Institute for Environment and Sustainability, EUR Report No. 20764 EN.

3.2.2 JRC study: urban air quality from space

A three-year project, supported by the Joint Research Centre (JRC), and with partners from Greece, Germany, Hungary and Italy, has developed an innovative system for monitoring and managing urban air quality and the related health risks. The ICAROS NET project uses information from satellite-borne sensors to monitor the concentration of harmful particles in the air, caused by heavy industry, traffic and household heating systems. It is the first time that ultra-fine pollution particles have been detected from space with such accuracy and precision. Four pilot trials of the ICAROS NET system are underway, in Athens, Milan, Munich and Budapest. Early results from the Athens project are encouraging, indicating that the system is as reliable as land-based alternatives while providing better environmental information. Research has also demonstrated that environmental policy initiatives, such as reducing sulphur in diesel and introducing fuel alternatives such as natural gas, have been successful in reducing pollution levels.

Speaking at a recent ICAROS NET workshop in Budapest, European Research Commissioner Philippe Busquin said: "Fine airborne particles represent one of the biggest threats to human health from air pollution. If we are to improve environmental and health policy-making in the EU, we need precise and accurate air pollution data. Monitoring air pollution is a good illustration of what space technology can do for citizens and provides an additional argument to boost EU investments in space. This is particularly relevant in our initiative to build a European capacity for Global Monitoring for Environment and Security (GMES)."

The ICAROS NET system merges atmospheric information derived from satellite-borne sensors with measurements from the ground and results of computer models to derive conclusive and comprehensive maps of the spatial distribution of particulate matter concentration in the lower atmosphere. The sensors monitor atmospheric pollution in areas as small as 30 metres in diameter, by measuring the proportion of light scattered by particulate matter. By incorporating data on expected health effects from epidemiological studies, ICAROS NET allows the quantitative evaluation and mapping of the anticipated health risk from ultra-fine particles. Coordinated international action is needed to resolve environmental problems linked to air pollution, and the ICAROS NET system could be used by all EU Member States and accession countries. ICAROS NET is flexible enough to be used at urban, regional and cross-border levels.

Analysis of the first trial run in Athens showed very high accuracy of results, compared with ground-based air pollution measurements. Furthermore, it was possible to identify the main particulate sources in the area, including heavy industry, road traffic and diesel-fuelled residential heating. Analysis of the average concentrations of ultra-fine particles since 1987 and the evolution of their spatial distribution over the Athens basin revealed the significance of environmental initiatives taken since the early 1990s. Over the next eighteen months, analysis of data from the recently concluded second pilot run in Athens, and from Munich, where an experimental application of ICAROS NET has just been completed, will continue. The ICAROS NET system will be fully compatible with the European Commission's INSPIRE initiative towards an integrated spatial data infrastructure in support of GMES. For more information, visit the ICAROS NET web-site: icaros-net.jrc.cec.eu.int. This article is from a report at the European Commission's Space Policy web-site (europa.eu.int/comm/space) on 31 July 2003.

3.2.3 Space Green Paper process: final meeting

The results of the Space Green Paper consultation were presented in Paris on 23-24 June 2003. The joint European Commission (EC) and European Space Agency (ESA) initiative was, by all accounts, a major success, drawing contributions from every European institution, all of the European and ESA Member States and all of the major space organisations, both inside and out-

side of Europe, and garnering significant media attention.

Addressing an audience of over 400, Research Commissioner Philippe Busquin said, "Just six months after launching the Green Paper on a European Space Policy, we have now come together in Paris to hear the results. This consultation has taken place during a difficult period, a period of crisis for the space industry and a period that has seen disappointments – the delays in getting the GALILEO programme started and the Ariane 5 failure some months ago. Nevertheless, the response to our call has been very positive. More than 1000 people attended the consultation events and we have received hundreds of written and online contributions from every walk of life. The recent decisions of the ESA Council have also been highly positive, paving the way for a new period of progress. I think we can say that Europe is now truly back on track in space."

Outgoing ESA Director-General Antonio Rodotà said: "We are completing and important phase in the process of defining where Europe is going in space. But we must not lose sight of what we have already accomplished. In programmes like Arianespace, EUTELSAT and EUMETSAT we have concrete examples of top-level global European competitors in the space arena. Clearly, our institutions, including ESA, must continue to develop and evolve, and we see the Green Paper process as a very positive step in that direction, but we must also understand our successes and not undo the solid foundation that has made Europe the major player it is today. Change is a must, but continuity also has its place."

Speaking on behalf of her government, the charismatic French Minister of Research and New Technologies and former ESA astronaut Claudie Haigneré expressed France's determination to remain a strong and active player in space. "This is a turning point," she said. "We congratulate both the EC and ESA for the incredible job they have done during this consultation initiative and we hope to see this spirit of co-operation continue until every one of our goals is met."

The Italian Minister for Education, University and Research, Letizia Moratti, who is responsible for space under the current Italian EU Presidency, said: "Europe must take up the challenge and work to preserve its independence in this highly strategic area. Space is a fundamental instrument for the implementation of public policies." Moratti stressed three ways in which space, with its wide variety of applications is of critical importance today: "First, the many practical applications of space technologies can improve the quality of life of our citizens. Second, a strong space policy will allow us to remain highly competitive in science and technology. This means keeping the balance between industrial competitiveness on the one hand and responding to public and social interests on the other. And finally, a strong space policy will attract the best and brightest of our young people to the research fields."

Also making personal contributions in Paris were European Parliamentarian Guido Bodrato, Stéphane Buffetaut of the European Economic and Social Committee and incoming ESA Director-General, Jean-Jacques Dordain, who replaced Antonio Rodotá in July 2003.

The bulk of the Paris conference was devoted to reports from the various Green Paper consultation events, which were held in several European capitals and which focussed on specific themes and communities. Following the opening workshop in Brussels, the Madrid meeting focussed on the contribution of the industrial sector. EUROSPACE President Pascale Sourrisse reported the space industry's views on all of the questions posed in the Green Paper. Former ESA Director of Science Roger Bonnet spoke for the Berlin workshop, which brought the scientific community together. Participants in Rome addressed complex institutional issues. Their views were reported by former Swedish Prime Minister Carl Bildt. A special workshop, sponsored by the Greek Presidency, was held in Athens and addressed European security and defence. The results of that meeting were reported by Alexandros Kolovos of the Greek Ministry of Defence. The London meeting featured a debate on applications, reported on by Giuliano Berretta of the Eu-

ropean Satellite Operators' Association. Finally, the Prague workshop looked at the role of international co-operation and was presented by rapporteur Reinard Loosch.

Among the common conclusions were:

- The public sector must become a prime customer of the space industry, as it is in the USA, not just a provider of financial support – the space sector should not have to rely solely on the volatile and unpredictable commercial market as a source of growth;
- Europe must face the challenge of a common security and defence structure, including a strong space component;
- New institutional arrangements must be undertaken in order to render the sector more strategically sound, efficient and responsive to the needs of European citizens;
- The main areas for near- to mid-term investment remain satellite navigation (GALILEO), Earth observation for the environment and security (GMES) and satellite communications;
- Long-term, ambitious and possibly manned space programmes must be undertaken in order to provide incentive among young scientists and engineers, as well as for the further development of a common European identity;
- Europe should strive to achieve some level of autonomy in space, if not absolute autonomy, while maintaining international relationships where beneficial to both sides; and
- Space must remain a source of both inspiration and discovery, with a strong orientation towards and an increased budget for basic science.

With the workshops over, the EC / ESA Joint Task Force is set to produce a summary report on the consultation, expected to be available in the second half of July 2003. The Commission will then prepare an action plan (White Paper) proposing a future strategy for space activities in the EU. This will acknowledge the contributions that have been received, and include proposals for the content, organisation and level of future European activities. The Space White Paper should be ready for approval by the EC in October 2003, with consequent submission to the Council and Parliament. The Competitiveness Council is expected to discuss the question of a European Space Policy in November 2003 under the Italian Presidency. A review of options could also take place at a joint EC / ESA Ministerial Council.

While many see the Green Paper process as only the beginning of the long road towards a strong and sustainable European Space Policy, there was a clear sense of satisfaction in Paris at the success of the consultation. "This process has been dynamic and, I'm proud to say, very democratic, stimulating a lot of interest on many levels," said the EC's Director of Space and Transport, Jack Metthey. "Space is a risky business and providing a long-term perspective is very important. We see a role for everyone in the future of space. After all, we are all working for Europe and we are all working for space." Haigneré said: "There are many questions that remain to be resolved, but if we can just look back and see what has been accomplished over the past few months, I think the sense of determination and co-operation we've seen bode well for what we can accomplish in the future. We will get there!" Busquin commented: "We will arrive at a common vision and we will speak with one voice. Europe needs a space policy because European policies need space!"

The EC recently launched a Newsletter aimed at keeping readers up to date on the latest developments in European Space Policy. Subscribers receive regular summaries of the latest news and information, including links to the official European Space Policy website. To subscribe, go to EC's Mailing Lists web-site (europa.eu.int/comm/coreservices/mailing). The full text of the Space Green paper is available on-line at the EC's Space Policy web-site (europa.eu.int/comm/space/doc_pdf/greenpaper_en.pdf). This article is from reports at the EC's Space Policy web-site (europa.eu.int/comm/space).

3.3 Water & soil conditions observed from space

A European consortium with twenty-eight members, lead by the German Infoterra GmbH, has now started work on one out of

ten ESA GMES Service Elements (GSEs), worth € 1.5 million each. First project milestones have been completed and results have been positively received by the European Space Agency (ESA) as the contracting authority and various national environmental authorities. The project results will support the implementation of new European environmental policies on water (Water Framework Directive / WFD) and soil (Soil Thematic Strategy / STS).

Recent European environmental policies and corresponding directives oblige national, regional and local authorities across Europe to provide reports containing information of a new quality. The local in-situ measurements and statistical methods that have been applied as a reporting basis so far will need complementary information. This can be acquired through spatial monitoring at an appropriate resolution, and delivering information applicable for management decisions such as the allocation and monitoring of endangered areas in order to maintain a certain status, or to initiate mitigation activities.

The SAGE (Service for the Provision of Advanced Geo-Information on Environmental Pressure and State) project aims at supporting the authorities in fulfilling the reporting standards of the Water Framework Directive (WFD) and the Soil Thematic Strategy (STS), by introducing a new source of information into existing monitoring systems: Earth observation (EO) data. The integration of information derived from such data with existing in-situ measurements and established models is a cost-efficient and reliable way to deliver the required up-to-date geospatial environmental information. With its product portfolio comprising the two product lines – AquaSAGE and SoilSAGE – the project offers a unique opportunity to bridge the gap between the policy demand and the technology offered today.

This opportunity has been recognised by the various national and regional users across Europe that make up the SAGE consortium, and participate in the project as core users: European Topic Centre for Terrestrial Environment (ETC-TE); Umweltbundesamt – Federal Environment Agency (UBA), Austria; Umweltbundesamt – Federal Environment Agency (UBA), Germany; Swedish Environmental Protection Agency (SEPA); Confederación Hidrográfica del Ebro (CHE), Spain; Institut Francais de l´Environment (IFEN), France; Landesanstalt für Wald- und Forst-wirtschaft (LWF), Germany; Amt der Vorarlberger Landesregierung, Austria; County Administration of Dalarna, Sweden. These users are closely integrated into the project, giving them the opportunity to steer the development of the SAGE services according to their defined needs and standards.

In a first step, SAGE seeks to establish its services in five countries, representing different European conditions: Austria (Alpine), France (Central European / Mediterranean), Germany (Central European), Spain (Mediterranean) and Sweden (Boreal). The SAGE services will cover all European environmental conditions. However, these will be customised according to the environmental and socio-economic conditions in the respective region. As a basis for all services developed within the project, basic geo-information products containing land use / land cover information (e.g. agri-ecosystem maps, maps of forest conditions, or maps displaying soil organic matter or the degree of sealing) will be created. These will then be combined with other GIS data (e.g. existing in-situ measurements, digital elevation models, topographic maps, or infrastructure maps) both fed into existing models already established within the user community, resulting in the final SAGE product lines:

- AquaSAGE: This is the framework for the development of water-related information products. For test sites in France and Spain, service providers EADS-Astrium SAS (France) and Tragsatec (Spain) are developing maps compatible with existing user systems, displaying irrigated surface and irrigation volume of the test areas, thus providing input for the estimation of water availability in the course of the vegetation period. By setting the irrigation volume against the available water resource (stored resource and rainfall in the corresponding period), a prediction of water abstraction pressure is possible. The Swedish partner Metria Miljöanalys acquires information on ni-

trogen leakage from boreal forests (influenced by forest management) into the surface water, allowing conclusions on the risk of water pollution. The river Dalälven drainage basin in central Sweden is used as study area. A similar approach is done in Germany, where statistics and maps quantifying nitrogen and phosphorus emission into the surface water of the test catchment area in Thuringia are detected. These emissions are usually caused by the intensity of agricultural activities, which will be surveyed by the responsible service provider Infoterra GmbH. The results will serve as an input to water pollution models used to identify areas at risk.

- SoilSAGE: This represents the soil-related SAGE services. GeoVille GmbH (Austria) will be evaluating three pilot provinces with respect to administrative land consumption, the ecological impact of soil sealing as well as the geo-physical impact connected to the sealing degree. This information can be used as a basis for regional and spatial planning decisions.

As products and services using spaceborne data are not yet a well-established information source for public authorities, one of the consortium´s main goals is to enlarge the existing user community of such services among the public authorities in Europe. The strategic goal of SAGE is to establish a European service based on adequate partnerships throughout the EU Member States. After a successful implementation of the services in the five selected countries, a roll-out to other EU member states is planned. In order to address specific national, regional or local conditions, the consortium aims to establish new partnerships with relevant institutions and companies in the respective countries.

The SAGE project is one of ten ESA GMES Service Element (GSE) projects. GMES is an initiative set up jointly by the European Commission (EC) and the European Space Agency (ESA) to establish a European capacity of Global Monitoring for Environment and Security by 2008. A main focus of this initiative is to provide information relevant to newly implemented European directives, regarding priority themes such as Environmental Stress and Land Cover, which are addressed in this particular project. The SAGE consortium comprises twenty-eight users, service providers and researchers from eight European countries, and is lead by Infoterra GmbH, a 100% subsidiary of EADS-Astrium, the leading European satellite company. Infoterra has a workforce of around twenty-five employees in Friedrichshafen, Germany, and about 150 employees in Barwell and Farnborough in the UK. Infoterra collects and processes data obtained from EO satellites and flight missions. These tailor-made information products are used e.g. in agriculture and forestry, urban and regional planning, cartography and resource management. For more information, contact Mareike Doepke, Infoterra GmbH, Communications, 88039 Friedrichshafen, Germany (phone: +49-754583924; fax: +49-75 4581337; e-mail: mareike.doepke@ infoterra-global.com). This article is from a recent report at the Infoterra web-site (www. infoterra-global.com).

3.4 EuroGeographics launches EuroGlobalMap 1.0

In July 2003, EuroGeographics, the association of European National Mapping Agencies (NMAs), launched the first release of EuroGlobalMap data-set. EuroGlobalMap is the digital topographic data-set that covers Europe at the scale 1:1 million. It is a seamless and harmonised data-set that is produced through co-operation of the NMAs of Europe, using official national databases. The production of the dataset was co-funded by the European Commission (eContent programme).

EuroGlobalMap contains six themes: administrative boundaries, hydrography, transport, settlements, elevation and named location (geographical names). The dataset will be licensed on annual subscription basis. It is also available for evaluation. The first release covers thirty European countries: Andorra, Austria, Belgium, Croatia, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Great Britain, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Northern Ireland,

Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, The Netherlands, and the Vatican. The coverage will gradually be extended to cover the whole of Europe.

EuroGlobalMap is ideal for a range of uses including planning, monitoring and presenting environmental policies, marketing planning, network analysis and as a background for displaying information. Further information is available by e-mail (contact@eurogeographics.org) or from the EuroGeographics web-site (www.eurogeographics.org), or by contacting the EGM project manager: Heli Ursin (heli.ursin@maanmittauslaitos.fi), National Land Survey of Finland, PO Box 84, 00521 Helsinki, Finland.

3.5 News: European Association of RS Companies

We should like to inform our readers that Mr. Paul Kamoun, Director of Business Development and Strategy at the Directorate of Earth Observation and Science at the ALCATEL SPACE company in France has been elected as Chairman of the EARSC (European Association of Remote Sensing Companies). He replaces Mr. Marcello Ricottilli of TELESPAZIO, whose term of office had expired. Both Mr. Kamoun and Mr. Ricottilli are long-standing representatives of their respective companies within EARSeL. We should like to extend our congratulations to Mr. Kamoun. We look forward to fruitful co-operation between our two Associations.

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

What was launched?

Orbview-3
Orbimage's first attempt to launch a high-resolution satellite failed in 2001, when Orbiew-4 did not reach orbit, but on 26 June 2003, a Pegasus rocket from Orbital Sciences Corporation successfully launched Orbimage's Orbview-3 into a sun synchronous 470 km orbit. After Ikonos, Quickbird and EROS 1A, Orbview-3 is the fourth non-military high-resolution satellite in orbit. It will provide 1-metre pan-chromatic and 4-metre multispectral data. The swath width is about 8 kilometres and the re-visit time will be less than 3 days. After a 3-4 month calibration and validation period, imagery will be commercially distributed via Orbimage. Web-site: www.orbimage.com.

SCISAT-1
On 14 August 2003, the Canadian SCISAT (Atmospheric Chemistry Experiment) was put in a 650-kilometre polar orbit. Again a Pegasus air launcher from Orbital Sciences was used. SCISAT is a research satellite with two instruments for the measurements of the density of chemicals and aerosols on board. The principal goal of the two-year mission is to study the ozone distribution at mid-latitude and the arctic region. Web-site: www.space.gc.ca/asc/eng/csa_sectors/space_science/atmospheric/scisat/scisat.asp.

What was in the News?

MERIS Level 2 products available
On 10 July 2003 ESA announced that the MERIS sensor on the ENVISAT satellite is ready for operational use by science and industry. This means that data from the Medium Resolution Imaging Spectrometer is now processed to level 2 data. Level 2 data products are so called Geophysical products and reflectances, like ocean colour data and aerosol optical thickness. The data will become available via the web-site cat.envisat.esa.int.

GRACE
On 21 July 2003 the first science product from the GRACE mission was released.

The joint NASA-DLR Gravity Recovery and Climate Experiment produced the most accurate map of the Earth's Gravity field ever. The model has been created based on gravity measurements with a resolution of 200 km during the first 111 days of the mission. The final mission goal is to create a very precise definition of the Earth's geoid. Web-sites: op.gfz-potsdam.de/grace/index_GRACE.html; www.csr.utexas.edu/grace.

Problems, problems, problems….

Landsat 7 Scan Line Corrector anomaly
As reported in the previous issue of this Newsletter on 31 May 2003, an instrument anomaly was discovered with the Enhanced Thematic Mapper (ETM+) on Landsat 7. Since then, the Scan Line Corrector (SLC) ceased functioning and no data is available. During data acquisition, the SLC corrects for the forward motion of the satellite. Without the SLC, data is acquired double while other parts are not acquired at all. The anomaly investigation team formed by USGS published some uncorrected images, showing that about 30% of the data is missing, while a narrow strip in the image centre seems to be unaffected. Two paths are being followed to deal with the problem. One team is trying to get the SLC back to work using redundant electronics of the instrument. Another team is investigating the usefulness of the uncorrected data, in case the on-orbit repairs fail. Meanwhile satellite data broker EURIMAGE announced that it has made an agreement with USGS for the acquisition of pan-European Landsat 5 data. The newly acquired data will have a price similar to that of Landsat 7 data. Other alternatives for ETM+ data could be ASTER, SPOT or ALI. More information is at the Landsat 7 web-site (landsat7.usgs.gov/updates.php). (See also Section 4.2 of this Newsletter).

MODIS
On 6 May 2003, the door allowing direct sunlight to enter into the Solar Diffuser of the MODIS instrument got stuck in the closed position. MODIS is on NASA's Terra satellite, and uses the Solar Diffuser for absolute radiometric calibration of its observations. On 2 May 2003 NASA managed to open the solar diffusion door again and preliminary analysis indicates that the calibration is functioning normally. The door will remain open during the rest of the mission. The MODIS instrument on Aqua has an identical calibration system, but there are no indications of similar problems. Web-site: modis.gsfc.nasa.gov.

Coming up soon:

The launch of DMSP-16 (Defence Metereological Satellite Programme) of the US Air Force and three DMC (Disaster Monitoring Constellation) satellites was scheduled in July 2003, but both launches have been delayed to September. The American military weather satellite DMSP-16 is now scheduled for launch on 14 September 2003 and the DMC satellites UK-DMC, NigeriaSat-1, BILSAT-1 will be launched on 26 September 2003. (See also Section 4.6 of this Newsletter for a report on the use of DMSP imagery to capture the recent power blackout in North America).

4.2 Update: Landsat 7 anomaly investigation

At the time of going to press of this Newsletter (August 2003), it was reported that the team investigating the instrument anomaly which was recently discovered with Landsat 7, and which appears to have started on 31 May 2003, had completed testing with the engineering model of the Scan Line Corrector (SLC). The anomaly team was in the final stages of the investigation, and was due to hold an internal peer review of their findings and recommendations. Following that review, the team would prepare recommendations for management approval. The team hoped to gain approval to proceed with recovery operations in early September. Under discussion were three possible options for how to proceed: (1) do nothing, and continue taking data with SLC off; (2) re-try the SLC using the primary electronics (A-side); (3) try the SLC using the redundant electronics (B-side). The team is evaluating the risks associated with each of the options and will present recommendations at the management review.

During the testing with the Scan Line Corrector (SLC) assembly model at Raytheon's

Santa Barbara Remote Sensing (SBRS) facility, analysis activities focussed on potential mechanical failure scenarios. Analysis and testing results were eventually to be combined to prepare an on-orbit recovery test plan. Once the test plan is approved, recovery operations will commence.

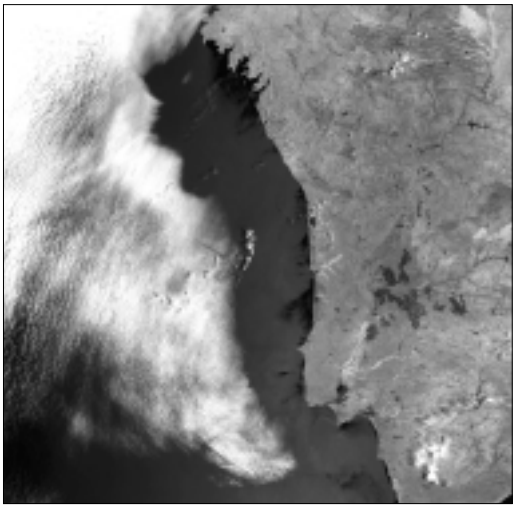
Ground systems engineers worked on modifications to the Landsat 7 algorithms to allow for processing of the SLC-off data. Since 14 July 2003, US ground stations have collected approximately 250 scenes per day of this data. When finished, the modifications will allow for processing of the SLC-off data collected to date. After recovery operations are complete, the team will determine when SLC-off data will be available to the public. Processing of the SLC-off data is not possible using the current data processing systems; therefore, the data collected are archived, but are not available for processing or user ordering. The United States Geological Survey (USGS) will archive these data for possible processing at a future date.

In an effort to better understand the impacts to the mission if SLC operations prove to be non-recoverable, the USGS and NASA polled a cross-section of the user community on the impacts of the SLC-off version of Landsat 7 data. A diverse group of scientists with ongoing experience using Landsat 7 data evaluated the scientific usability and validity of Landsat 7 products containing the SLC anomaly. The disciplines represented by these scientists include geography, agriculture, forestry, rangeland ecosystems, glaciology and ice-cap monitoring, ecological remote sensing (RS), phenological characterisation, coastal / oceanographic RS and coral reef monitoring, tropical forest monitoring, water quality monitoring, RS methodology and techniques development, and global change monitoring. EROS Data Centre (EDC) scientists and engineers also performed evaluations of the radiometric and geometric validity of these products.
Anomalous Landsat 7 data products retain some utility for scientific applications. The presence of the anomaly and associated missing pixels does degrade the usefulness of the imagery. However, some of the scientists who examined these anomalous data concluded that the data were still useful for their particular application. Additionally, the potential to develop new tools or methods of compensation for this anomaly (e.g. developing a mosaic of overlapping scenes or data from subsequent imagery to "fill in" missing pixels) may enable more scientific uses of these data.

On the same subject, Eurimage recently announced that, following the technical problems with Landsat 7 which meant that its data were unavailable for now, it had made an agreement with USGS and the European Space Agency for the acquisition of pan-European Landsat 5 data at the Matera Ground Station, in Italy. Matera Station has been acquiring Landsat 5 data since 25 June 2003, maintaining continuity for the Landsat programme over most European and Mediterranean countries. Landsat 5 system-corrected imagery will be available at the USGS standard price of US$ 425 per scene. Additional scenes (maximum two) from the same path and on the same date, purchased as part of the same order, will have a unit price of US$ 200 per scene. Further details on data availability, Quick Looks and metadata, as well as on ordering procedures will follow soon. This article is based on various reports at NASA's Landsat 7 web-site (landsat.gsfc.nasa.gov) and the Eurimage web-site (www.eurimage.com).

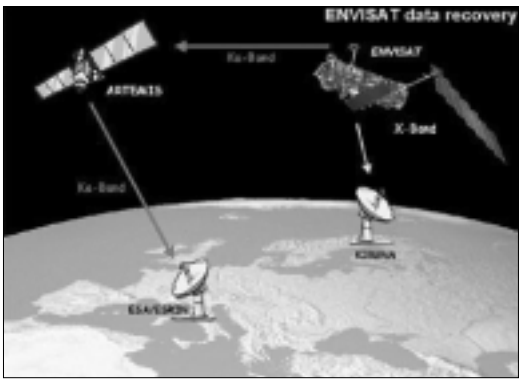
4.3 Artemis assists Portuguese fire-fighters

Fire fighters tackling the blazes that ravaged Portugal in July and August 2003, did so with the aid of a satellite data-link. For the first time, ESA's satellite Artemis has been used to support an emergency request under the International Charter on "Space and Major Disasters". Portugal's civil protection unit (SNBPC) was able to receive information and groups of images that showed the scope of the fires. The data, transmitted from ESA's Earth observation (EO) satellite, Envisat, via the Artemis data-relay spacecraft in geo-stationary orbit, were received in near real-time at the ESA data processing centre, located at ESRIN near Rome. On 4 August 2003 ESA's Earthwatching service requested a full resolution MERIS (Medium Resolution Imag-



In this image burnt areas appear as very dark patches to the north-east of Lisbon, close to the centre of the land part of the image, along the Tagus River. Lisbon itself is visible south of the large whitish area at the mouth of the Tagus. The image covers all of Portugal and part of Spain's Galicia region

ing Spectrometer) acquisition over the areas in Portugal affected by the fire. The Portuguese Civil Protection then requested emergency planning on 6 August 2003, through the Charter. The first acquisition was made via Artemis on 7 August 2003 (see accompanying graphic).
Artemis is ESA's latest telecommunications satellite, designed to qualify new space technologies and promote new services. It also carries payloads for land mobile communications and a navigation payload as an element of the European Geostationary Navigation Overlay Service (EGNOS). Use of Artemis for data relay offers EO missions greater visibility and reduces delays in image reception (see accompanying graphic). Artemis has been providing a data relay service to Envisat and the French national mission SPOT 4, since March 2003.
The International Charter on "Space and Major Disasters" is an international collaboration to combine international satellite resources to assist participating rescue authorities and other civil protection agencies. ESA participates in the Charter together with Argentina, Canada, France, India and USA. This article is from a report on the ESA web-site (www.esa.int) on 19 August 2003.



Envisat communicates Artemis and the ESRIN data-procesing centre via Ka-band

4.4 NASA satellites eye forest fires from orbit

If a forest catches fire and no one is around to see it, can it call for help? The forest cannot call, but thanks to new technology developed by NASA, fire-fighters may get the word faster, through new, high-tech eyes in the sky. New software developed by NASA's Jet Propulsion Laboratory, Pasadena, California helps link NASA's Earth science satellites together to form a virtual web of sensors with the ability to monitor the globe far better than individual satellites. An imaging instrument flying on one satellite can detect a fire or other hazard, and automatically instruct a different satellite that has the ability to take more detailed pictures to take a closer look. If the images show that a potential hazard does exist, the responding satellite provides data to ground controllers, who then report the fire to forest officials and to an interested science team.

"Essentially, we are adding the response mechanism to the detection process," said Dr. Steve Chien, JPL principal scientist in artificial intelligence. "This is a first step to enabling users of satellite remote sensing data to specify the kind of data they want, such as forest fires or floods, rather than the traditional request to, say, look at northern Montana."

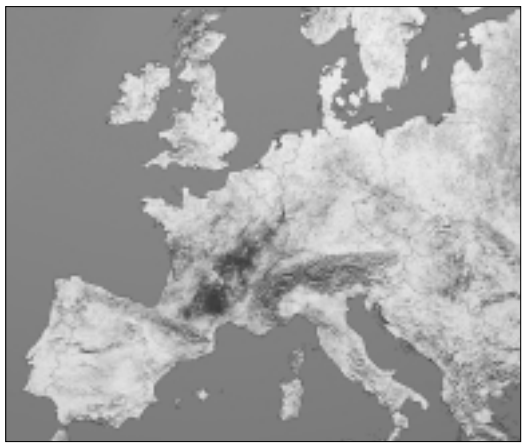
A core component in this collaborative effort is the Science Goal Monitor system being developed at NASA's Goddard Space Flight Centre, Greenbelt, Maryland. The system enables scientists to specify what to look for and how to react, in descriptive rather than technical terms. Then the system monitors streams of data to identify occurrences of the key events previously specified by the scientist. "When an event occurs, the system autonomously coordinates the execution of the scientist's desired reactions between different observatories or satellites," said Jeremy Jones, Goddard's task leader for the

monitor system. "This is designed to be adaptable to many different types of phenomena and supports a wide variety of sensor web configurations." Using the sensor web method, investigators no longer have to rely on after-the-fact data analysis to determine what happened. The information can be used to rapidly respond to hazardous events such as forest fires.

For example, moderate-resolution imaging instruments that fly on both NASA's Terra and Aqua spacecraft observe the entire globe every day. The instruments' data is automatically processed on the ground within hours of acquisition by the Rapidfire Centre at the University of Maryland. If this processing detects a hot-spot, scientific criteria can be used to automatically redirect the Earth Observing 1 satellite to provide high-resolution images. When that information comes back to a scientist for interpretation, it is made available to forest officials to determine the appropriate response. All this can happen in 24-48 hours, compared to a typical lead time of fourteen days for pre-planned observations. The satellite sensor web demonstration is a collaborative effort between JPL and the Goddard Space Flight Centre. The Rapidfire Centre is led by Dr. Chris Justice. This article is from a report at the Spaceflight Now web-site (spaceflightnow.com) on 22 August 2003.

4.5 Satellites capture Europe's heatwave…

During the summer of 2003, Europe experienced a historic heat wave that was estimated to be responsible for thousands of deaths in France alone. Compared to July 2001, temperatures in July 2003 were sizzling. The image in the accompanying graphic shows the differences in day-time land surface temperatures collected in the two years by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite. A blanket of deep red across southern and eastern France (left of image centre) shows where temperatures were 10 degrees Celsius (18 degrees Fahrenheit) hotter this summer. White areas show where temperatures were similar, and blue shows where temperatures were cooler in 2003 than 2001.



MODIS satellite imagery of Europe, showing day-time temperature anomaly between July 2001 and July 2003, and highlighting the devastating heat-wave in southern and eastern France

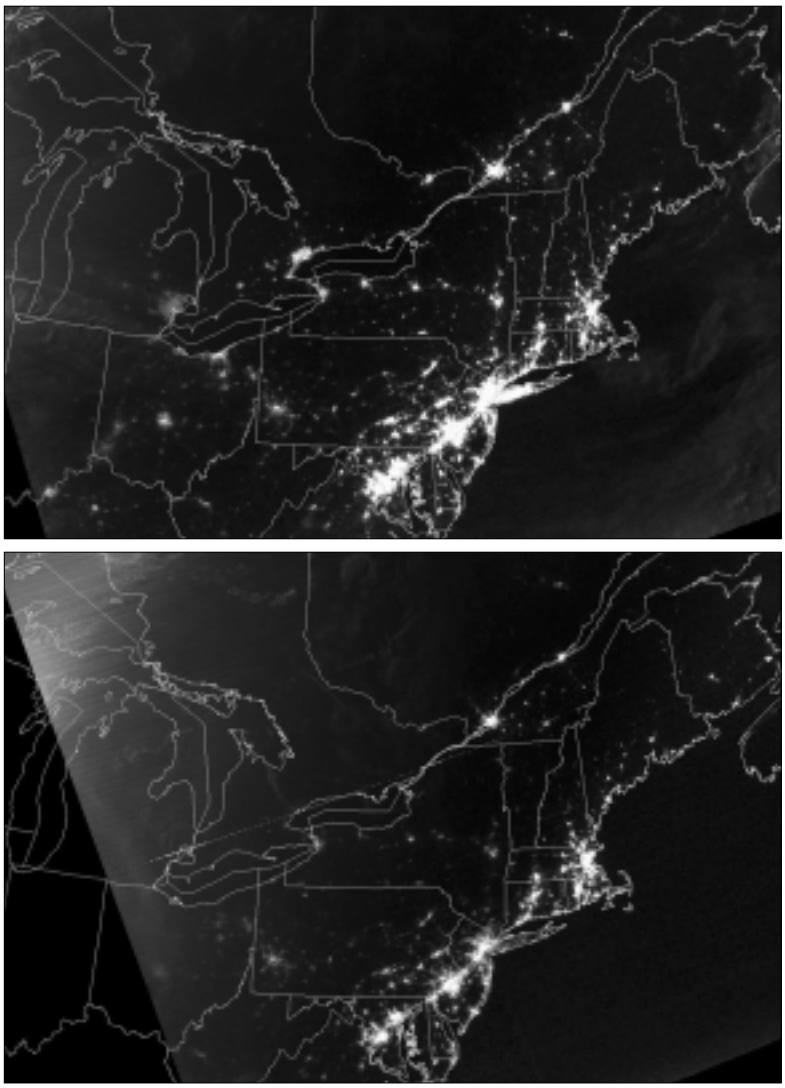
Even the Alps, which arc across south-eastern France, Switzerland, Austria, and northern Italy (just below image centre), were very warm in 2003. Glaciers melted rapidly, swelling rivers and lakes to dangerously high levels. Climbers had to be evacuated from Switzerland's famous Matterhorn after melting triggered the collapse of a rock face. The popular climbing destination was closed while geologists assess the possibility of further collapses. The heatwave stretched northward all the way to the UK, particularly southern England and Scotland. In London, trains were shut down over fears that tracks would buckle in the heat, while in Scotland the high temperatures combined with falling water levels in rivers and streams are threatening the spawning and survival of salmon. Throughout France, Spain, Portugal, and Italy, the intense heat and dry conditions sparked devastating forest fires that killed several people.

Image courtesy of Reto Stockli and Robert Simmon, NASA's Earth Observatory Team, based upon data provided by the MODIS Land Science Team. This article is from a report at NASA's Earth Observatory website (earthobservatory.nasa.gov).

4.6 …and North America's blackout

A power failure left many American cities in the dark on the evening of Thursday, 14 August 2003. The North American Electric Re-

liability Council focussed its investigation on the "Lake Erie loop" – a series of power transmission lines encircling the lake from Detroit to New York and into Canada. There is some evidence that the loss of a power line in Cleveland, Ohio, was the first in the series of events that led to the widespread power outage. Authorities report that at around 4 pm the power flow on the northern side of the loop in Canada was moving from west to east. Then, for reasons that are unclear, the power flow suddenly reversed direction and nearly doubled. The blackout began spreading rapidly across the grid with the sudden surge in power. Within minutes, computer programs in twenty-one different power stations across the region detected the cascading problem and automatically shut down to protect the power grid from damage.



DMSP satellite imagery of north-east United States and Canada. Above: 14 August 2003, at 8:29 pm EDT (about 20 hours before blackout). Below: 15 August 2003, at 8:14 pm EDT (about 7 hours after blackout). Images courtesy of Chris Elvidge, US Air Force

Although power was restored to some local areas within hours after the blackout, several major cities were left without power overnight. The change in the nighttime city lights is apparent in this pair of DMSP (Defence Metereological Satellite Programme) satellite images (see accompanying graphic). The top image was acquired on 14 August 2003, about 20 hours before the blackout, and the bottom image shows the same area on 15 August 2003, roughly 7 hours after the blackout. In the bottom scene, notice how the lights in Detroit, Cleveland, Columbus, Toronto, and Ottowa are either missing or visibly reduced. Long Island, New York, was also significantly affected; however, Boston was left relatively untouched. This article is from a report at NASA's Earth Observatory web-site (earthobservatory.nasa.gov).

4.7 European RS technology analyses the Sun…

On 18 June 2003 it was reported that solar physicists from Lockheed Martin, the National Centre for Atmospheric Research, the Institute of Theoretical Astrophysics of the University of Oslo, and the Institute for Solar Physics of the Royal Swedish Academy of Sciences, had analysed the highest resolution images ever taken near the "solar limb", or visible edge of the Sun, and found a surprising variety of structure. Their results, which were reported on 18 June 2003 at the American Astronomical Society's meeting in Baltimore, Maryland, USA, address long-standing theories on how the brightness of the Sun varies over the course of its magnetic cycle. Such changes may influence the Earth's climate on long time-scales.

"Until recently we thought of the solar photo-sphere as the relatively flat and featureless surface of the Sun, punctuated only by an occasional sunspot," said Dr. Tom Berger, principal investigator on the study, and solar physicist at the Lockheed Martin Solar and Astrophysics Lab (LMSAL) at the company's Advanced

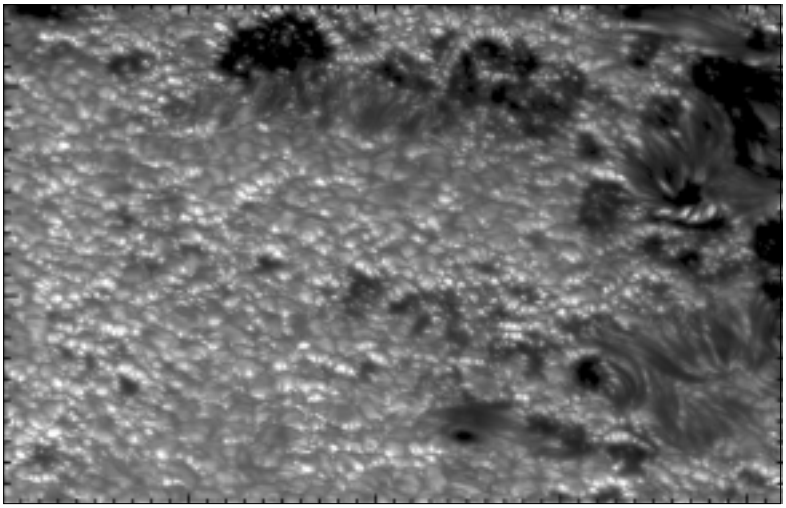
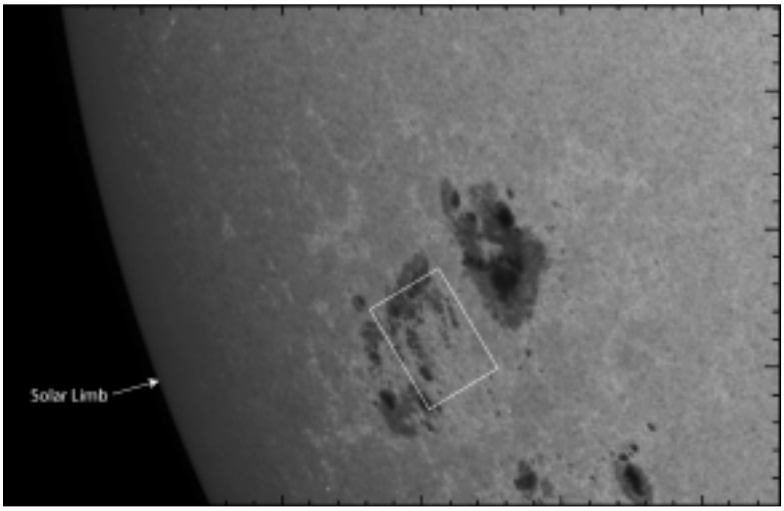


Image of a solar active region, showing granulation, sunspots, and faculae, taken on 24 July 2002, near the Sun's eastern "limb" (towards the top of the image). Tick marks are 1000 km apart. The smallest resolvable features are about 70 km in size. The image is a filtergram acquired in 488 nm light at the Swedish 1-metre Solar Telescope (SST) on the island of La Palma, Spain. It was taken by Prof. Goran Scharmer and processed by Dr. Mats G. Löfdahl, both of the Institute for Solar Physics of the Royal Swedish Academy of Sciences

Technology Center in Palo Alto, California. "Now, using the newly commissioned Swedish one-metre Solar Telescope (SST) on the island of La Palma, Spain, we have, for the first time, imaged the three-dimensional structure of the convective granules that cover the photo-sphere."

The solar surface consists mostly of an irregular cellular pattern caused by temperature variations. The cells, called granules, are evidence of convection that transports heat to the surface in the same manner as boiling water on a stove-top or thermal plumes rising over hot fields to form thunderstorms. Each granule on the sun is about the size of Texas. At the 75 kilometres resolution of the SST, sunspots and smaller dark "pores" are seen to be sunken into the surrounding granulation. This so-called "Wilson depression" has been inferred from lower resolution observations of large sunspots but never directly resolved until now.



The active region shown in the image above is seen here in a white light image from the TRACE satellite. Tick-marks are 10,000 km apart. TRACE has a much larger field-of-view (FOV) than the SST and so the solar limb is captured in the same image. The white box outlines the approximate SST FOV in the above image.

Most importantly from a terrestrial climate perspective, the images show clearly that the granulation in regions of smaller magnetic fields outside of sunspots is both raised up and has brighter walls than the granulation in non-magnetic regions. Bright structures near the limb of the Sun have been seen for centuries in lower resolution images and are called "faculae" (Latin for "little torches"). Faculae are significant because scientists believe that their brightness is responsible for the increased solar irradiance (on the order of 0.1-0.15%) that occurs during periods of maximum solar magnetic activity.

As the ultimate source of all energy input to the Earth, understanding solar irradiance and its variation with magnetic activity on the Sun is an important factor in understanding climate variation on Earth. "Raising the hot material above the photosphere enhances facular emission at low angles to the solar surface" according to Prof. John Lawrence of California State University Northridge. "Low angles cover the greater part of the solar 'sky' as seen from the perspective of a facula, so this discovery impacts our estimate of the contribution of faculae to solar brightness changes. With this new discovery, we can hope to incorporate the effects of magneto-convection into solar irradiance models to better predict variations in solar output."

Preliminary analyses of the some of the images are in a paper by Dr. Bruce Lites of NCAR, Prof. Göran Scharmer of the Royal Swedish Academy of Sciences, and Drs. Alan Title and Tom Berger of LMSAL that has been submitted for peer-review to the journal Solar Physics. Low- and high-resolution JPEG image files of the discovery are

available at LMSAL's web-site (www.lmsal.com/Press/SPD2003.html). This article is from a press release at the same web-link. More information is available at the web-site of the Institute for Solar Physics of the Royal Swedish Academy of Sciences (www.solarphysics.kva.se).

4.8 ...and the Moon

On 18 August 2003 Arianespace announced that the Ariane-5 launch, with ESA's SMART-1 spacecraft – Europe's first probe to the Moon – and two commercial satellites on board, had been postponed. A new launch date was expected to be announced soon. ESA officials stated that the Ariane-5 launcher and the SMART-1 spacecraft, which was delivered to Kourou, French Guiana, on July 15 2003, are in perfect shape, ready for the new launch date.

SMART-1, the first of ESA's Small Missions for Advanced Research in Technology, will take around 16 months to reach its destination, having followed a long spiralling trajectory. Once there it is expected to carry out a number of unprecedented studies of the Moon, and demonstrate innovate and key technologies for future deep space science missions. It will also investigate the theory that the Moon was formed following the violent collision of a smaller planet with Earth, four and a half thousand million years ago. SMART-1 is a very small spacecraft (measuring just one cubic metre). Its solar arrays, spanning 14 metres, will deliver 1.9 kW of power, about 75% of which will be used for the probe's "solar electric" propulsion system.

SMART-1's unique journey will take it into orbit around our closest neighbour powered only by an ion engine, which Europe will be testing for the first time as main spacecraft propulsion. The 367 kg SMART-1 will share Ariane's V162 launch with two commercial payloads: the Indian Space Research Organisation's Insat 3E and Eutelsat's e-Bird communication satellites. The smallest spacecraft in the trio, SMART-1, will travel in the lower position, inside a cylindrical adapter, and will be the last to be released. A generic Ariane 5 will be in charge of placing these three payloads in a standard geo-stationary transfer orbit, from which each will begin its own journey towards its final operational orbit.

In its role as technological demonstrator, SMART-1's primary goal is to test the new solar electric propulsion system. This is a form of continuous low-thrust engine that uses electricity derived from solar panels to produce a beam of charged particles that pushes the spacecraft forward. Such engines are commonly called ion engines, and engineers consider them essential for future, long-range space missions. SMART-1 will also test miniaturised spacecraft equipment and instruments, a navigation system that, in the future, will allow spacecraft to autonomously navigate through the solar system, and in addition to a new short-wavelength communication system, a space communication technique by means of which SMART-1 will try to establish a link with the Earth using a laser beam.

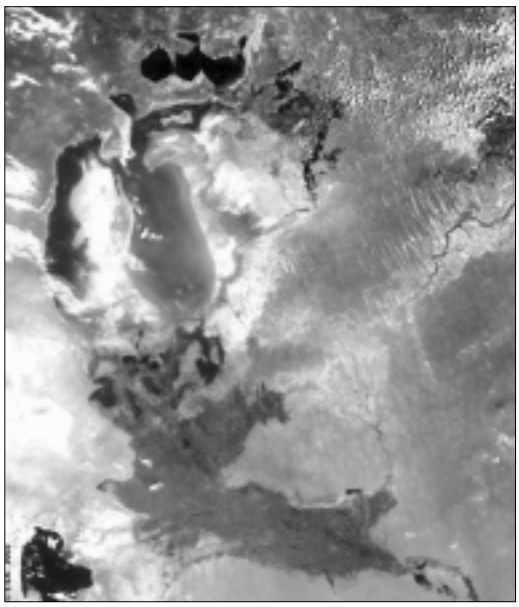
SMART-1's ion engine will be used to accelerate the probe and raise its orbit until it reaches the vicinity of the Moon, about 350,000 to 400,000 km from Earth. Then, following gravity assists from a series of lunar swing-bys in late September, late October and late November 2004, SMART-1 will be "captured" by the Moon's gravity in December 2004 and will begin using its engine to slow down and reduce the altitude of its lunar orbit. Once it enters into a near-polar orbit around the Moon in January 2005, SMART-1 will also become a science platform for lunar observation. SMART-1 will search for signs of water-ice in craters near the Moon's poles, provide data to shed light on the still uncertain origin of the Moon, and reconstruct its evolution by mapping its topography and the surface distribution of minerals and key chemical elements. SMART-1 will be the second ESA-led planetary mission to be launched in 2003, after Mars Express in June. This article is based on several reports from the ESA web-site (www.esa.int).

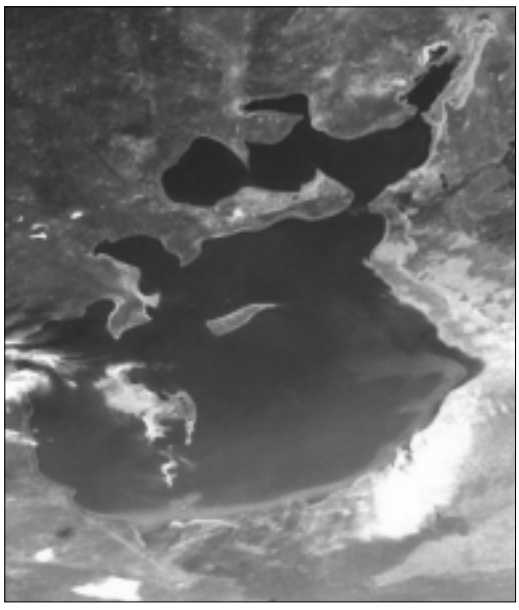
4.9 Satellite shows dramatic Aral Sea loss

These two images from space (see accompanying graphic) show how unsustainable

water use in Central Asia has caused a dramatic retreat in the Aral Sea. In the eighteen years which separate the images, the sea has virtually split in two and a great white expanse of salty desert has claimed the seabed revealed by the contracting waters. The more recent image was taken this month by ESA's Medium-Resolution Imaging Spectrometer (MERIS) on board Envisat, the world's most powerful environmental monitoring satellite. The older image is from 1985 and was taken by the US space agency NASA's space shuttle crew.

The Aral Sea lies on the border between the former Soviet Republics of Uzbekistan and Kazakhstan, but the waters which feed it rise thousands of kilometres away in the Pamir Mountains. The great Amu Darya and Syr Darya rivers were known in history as the Oxus and Jaxartes. They flow through much of Central Asia before they reach the Aral. Along the way much of their water is taken for the irrigation of thirsty cotton crops. Large scale irrigation began in the 1960s and has led to the Aral losing half its area and three-quarters of its volume. Former fishing villages are now dozens of kilometres away from the shoreline. Sands laden with salt and pesticide residues are whipped up into storms by a climate no longer subject to the sea's moderating influence. The independent states of Central Asia are now joined in an association to manage the waters that feed the Aral but in practice there is little agreement among them on how best to share the resource. The cotton irrigation systems are old and leaky, so much of the water is wasted.





The upper image shows the Aral Sea as seen by the European Space Agency's Envisat satellite in July 2003, while the lower image shows the Aral Sea as seen by a NASA space shuttle in 1985

The MERIS instrument's primary mission aboard Envisat is to monitor sea colour. "It essentially sees the world the way we see it, though it can also see into the infrared," explained Peter North, lecturer in geography at the University of Swansea, UK, and member of the MERIS validation team. "What it's good at is spotting changes over time," he told BBC News Online. Meris can observe how plankton spread through the Earth's oceans, providing a valuable insight into the way the seas act as a counterweight to global warming by storing carbon dioxide. MERIS's field of view means that it can provide an almost daily view of any given point on Earth. Its host satellite, Envisat, was launched on an Ariane 5 in 2002. The satellite is the biggest and most expensive Earth-observation spacecraft ever built by Europe. This article is from a report on the BBC News web-site on 30 July 2003 (news.bbc.co.uk/2/hi/science/nature/3107915.stm).

4.10 NASA's Global Earthquake Satellite System

"...temperatures will be in the high 40s to low 50s, fair and breezy – another chilly day here in the San Francisco Bay Area," the TV

weatherman says. "The satellite earthquake forecast shows low to normal risk, with no critical crustal stresses or infrared signatures around the San Andreas fault..."

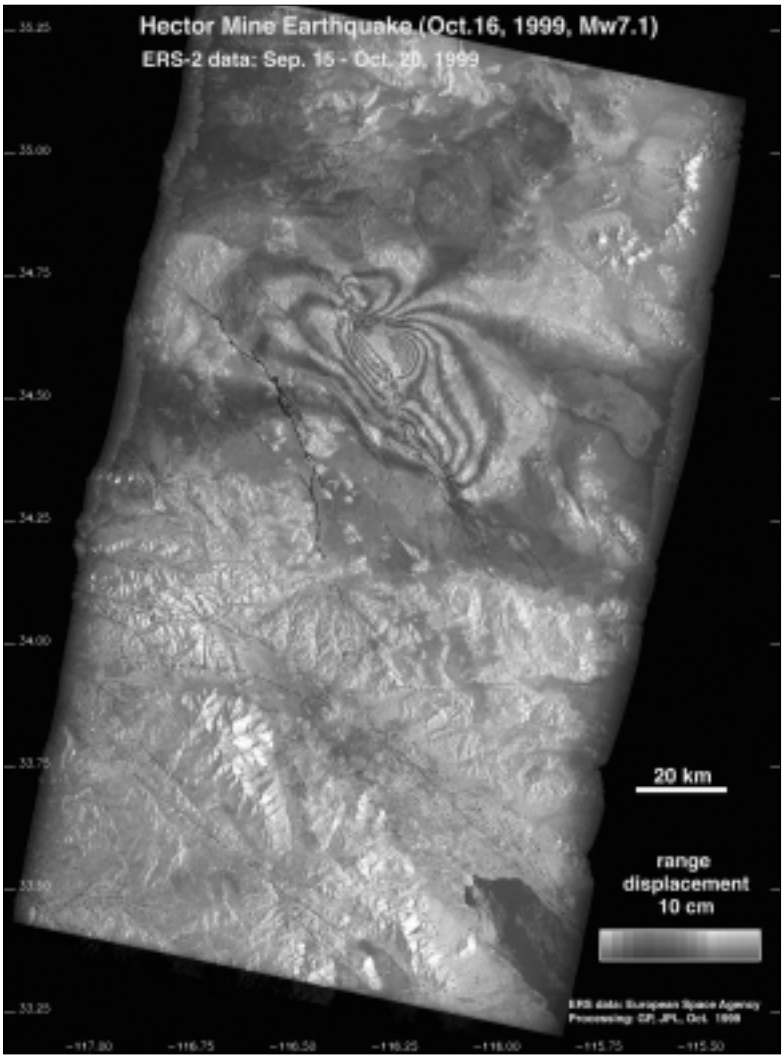
For many people, earthquakes are synonymous with unpredictability. They strike suddenly on otherwise normal days, and despite all the achievements of seismology, scientists still can't provide warning of an impending quake in the way that weathermen warn of approaching storms. Although earthquakes seem to strike out of the blue, the furious energy that a quake releases builds up for months and years beforehand in the form of stresses within Earth's crust. At the moment, forecasters have no direct way of seeing these stresses or detecting when they reach critically high levels. That may be changing, however. Satellite technologies being developed at NASA and elsewhere might be able to spot the signs of an impending quake days or weeks before it strikes, giving the public and emergency planners time to prepare.
"There are several satellite-based methods that show promise as precursors to earthquake activity," says Jacob Yates, a researcher at NASA's Goddard Space Flight Centre. "One method is Interferometric Synthetic Aperture Radar (InSAR). Basically, InSAR is when two radar images of a given tectonic area are combined in a process called data fusion, and any changes in ground motion at the surface may be detected." This technique is sensitive enough to detect slow ground motions as tiny as 1 mm per year. That kind of sensitivity, combined with the landscape-wide view that satellites can offer, lets scientists see the tiny motions and contortions of land around a fault line in more detail than ever before. By watching these motions, they can figure out where points of high strain are building up.

A group of NASA and university scientists led by Carol Raymond of JPL recently studied the feasibility of forecasting earthquakes from space. Their report, which was released in April 2003 (see end of article for web-link), outlines a 20-year plan to deploy a network of satellites – the Global Earthquake Satellite System (GESS) – using InSAR to monitor fault zones around the world. With some practice, says Raymond, scientists eventually should be able to use the InSAR data to infer when stresses in the Earth's crust have reached a dangerous level, issuing a monthly "hazard assessment" for a given fault. Forecasters might report that the likelihood of having a major quake on, say, the San Andreas fault during the coming month is 2%, or 10%, or 50%. Current methods are less certain. For example, the US Geological Survey (USGS) recently released an updated assessment of the earthquake risk in the San Francisco Bay Area based on the seismic history of the area, its geology, and computer models. The study reported a 62% chance of a major quake (magnitude 6.7 or greater) hitting the area sometime within the next 30 years – not exactly something to plan your day around.

InSAR is one way to forecast quakes, but perhaps not the only one. While InSAR satellites merely improve the data available to orthodox seismology, there are other techniques that break with orthodoxy. One of these ideas is to look for surges in infrared (IR) radiation. Friedemann Freund, adjunct professor of physics at San Jose State University and a scientist at NASA's Ames Research Centre, explains: "In the 1980s and 1990s, Russian and Chinese scientists noticed some strange thermal anomalies associated with earthquakes in Asia – for example, the 1998 Zhangbei earthquake near the Great Wall of China. This earthquake occurred when ground temperatures in the region were around -20 degrees Celsius. Just before the quake, thermal sensors detected temperature variations as large as 6-9 degrees, according to Chinese documents." Satellites equipped with IR cameras could be used to detect these hot spots from space. In fact, when Freund and colleague Dimitar Ouzounov of the Goddard Space Flight Centre (GSFC) examined infrared data collected by NASA's Terra satellite, they discovered a warming of the ground in western India just before the powerful 26 January 2001, quake in Gujarat. "The thermal anomaly was as large as +4 C°," says Freund.

What causes rocks under pressure to emit infrared radiation? No one is certain. The frequency spectrum of the emissions shows

that internal heat from friction – e.g. rocks rubbing together – is not responsible for the radiation. In one laboratory experiment, Freund and colleagues placed red granite blocks under a 1,500 ton (1.5 million kg) press – mimicking in some ways what happens miles below Earth's surface. A sensitive camera developed at JPL and GSFC monitored the rock and detected infrared emissions. Furthermore, a voltage built up on the rock's surface. This leads Freund to believe the cause might be electrical. Ordinary rocks are insulators. Rocks placed under great stress, however, sometimes act like semi-conductors. Freund believes that, before a quake, pairs of positive charges called "defect electrons" or "positive holes" split up and migrate to the surface of stressed rocks. There they recombine with each other and, in the process, release infrared radiation. This explanation has some support from experiments, but it's still a young theory that has not gained widespread acceptance among scientists, he notes.



An InSAR image showing the shift in ground height due to the 1999 Hector Mine earthquake in California. The radar data were acquired by ESA's ERS-2 satellite on 15 September and 20 October 1999

Electrical currents in rock might explain another curious observation: scientists doing research with magnetometers just before major earthquakes have serendipitously recorded tiny, slow fluctuations in Earth's magnetic field. One example happened during the Loma-Prieta earthquake that devastated San Francisco in 1989. Almost two weeks before the quake, readings of low-frequency magnetic signals (0.01-0.02 Hz) jumped up to twenty times above normal levels, and then spiked even higher the day of the quake. The cause of these signals is unknown. In addition to Freund's idea, theories include the movement of deep, ion-conducting groundwater into cracks opened up by the crushing of rocks, electromagnetic energy released by electrons that are sheered from crystalline rocks such as granite, and a piezo-magnetic effect triggered by pressure applied to certain rock types. A company called QuakeFinder (www.quakefinder.com) is hoping that these faint magnetic signals (typically less than a nano-tesla) can be detected by a low-Earth orbit satellite. (Editor's note: a tesla is the SI unit of magnetic flux density). Ground sensors can also detect these fluctuations, but polar-orbiting satellites have the advantage of covering most of the Earth's surface each day. On 30 June 2003, Quakefinder launched QuakeSat. Measuring only 10.6 by 10.6 by 31.8 centimetres, the satellite will operate for a year to see if it can sift out magnetic signals generated by tectonic activity. Its first six months will be spent calibrating the satellite and gathering baseline data. After that ground controllers will be looking in earnest for quakes.

Both the infrared and magnetic methods of quake detection are controversial. For now InSAR seems to be a safer bet for earthquake forecasting. All three, however, offer a tantalising possibility: some day the local weather report will forecast not only of the storms above us, but also the ones brewing beneath our feet. This article is from a re-

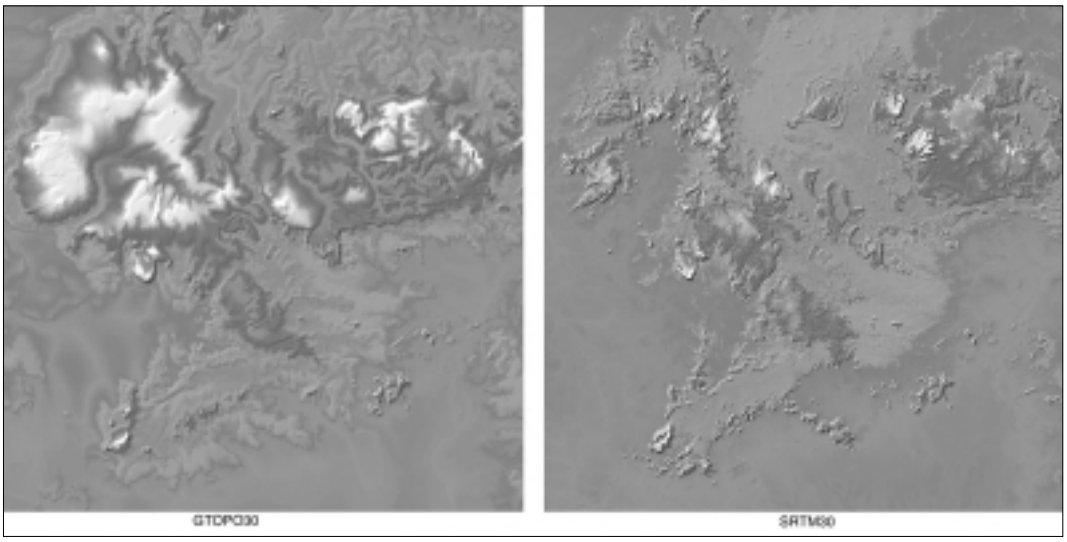
port at the "Science@NASA" web-site (science.nasa.gov) on 11 August 2003. The report on NASA's Global Earthquake Satellite System (GESS) is available on-line, at solidearth.jpl.nasa.gov/GESS/3123_GESS_Rep_2003.pdf.

4.11 New global topographic data-set from NASA

A brand new look and understanding of the place we call home. That's what you get in a complete global topographic data set generated by NASA and the National Imagery and Mapping Agency. Produced by the Shuttle Radar Topography Mission (SRTM), the global data-set, called SRTM30, greatly improves maps of Earth's land mass located between 60 degrees north and 60 degrees south of the equator. That's roughly from the southern tip of Greenland to below the southern tip of South America. Until now, the primary source of digital elevation data for scientists and analysts involved in global studies has been the USGS's GTOPO30, published in 1996, which consists of elevation measurements spaced every 30-arc-seconds. An arc-second is a measure of latitude and longitude used by geographers, corresponding to about 928 metres at the equator. The SRTM30 map matches the GTOPO30 resolution, but with its seamless quality represents a leap in global-scale accuracy.

"SRTM30 is a powerful demonstration of the benefits which accrue from NASA's human space flight programme and satellite radar mapping technology," said Dr. John LaBrecque, manager of NASA's Solid Earth and Natural Hazards Programme. "The quality of previous maps of the Earth varied considerably, because they were compiled from various data gathered by generations of explorers and surveyors. In some places these maps are inaccurate. Using NASA technology, six Space Shuttle astronauts mapped 80% of Earth's land surface in just ten days to produce the first 3-D map of the Earth's surface at a known and uniform accuracy." The need for accurate topographic maps is everywhere from planning a hike to building a highway. Knowing the exact shape and location of mountain peaks and river valleys is as important to the safe and efficient flight of aircraft as it is to the management of water resources and the control of forest fires.

Newly released images illustrating the new SRTM30 data products depict Earth in two ways: as an image with all the continents shown (a common map-making method known as a Mercator projection), and as three globe images of Earth as viewed from points in space centred over the Americas,



Two images of the Guiana Highlands (on the borders of Venezuela, Guyana and Brazil) showing shaded relief and coloured height. The image on the left was made using the USGS's GTOPO30 data-set. In contrast, the image on the right was made using the new SRTM30 data-set, which represents a significant improvement in our knowledge of the topography of much of the world. Image Credit: NASA / JPL / NIMA

Africa and the western Pacific. Two visualisation methods were combined to produce the images: shading and colour-coding of topographic height. The shaded image was derived by computing topographic slope in the north-west to south-east direction, so that north-west slopes appear bright and south-east slopes appear dark. Colour-coding depicts the lowest elevations in green, rising through yellow and tan, to white at the highest elevations.

The STRM30 map is one of a series of land surface products emerging from the very successful Shuttle Radar Topography Mission. SRTM has produced more detailed topographic data for North and South America, with a spatial resolution ten times greater than the global STRM30 database. SRTM is a co-operative project of NASA, NIMA, and the German and Italian space agencies, and is part of NASA's mission to understand and protect our home planet. The new images are available on the JPL Planetary Photojournal web-site (photojournal.jpl.nasa.gov). Information about SRTM is available at www.jpl.nasa.gov /srtm. This article is from a report at the web-site of NASA's Jet Propulsion Laboratory (www.jpl.nasa.gov) on 22 August 2003.

4.12 Is there life after the Hubble Telescope?

"Not since Galileo turned his telescope towards the heavens in 1610 has any event so changed our understanding of the Universe as the deployment of the Hubble Space Telescope." So says NASA's official introduction to the Hubble. But officials at the US space agency are now planning its demise and that is upsetting many scientists. The facts are straightforward. Launched in 1990, the telescope was always destined to have a limited life. Planning is well under way for a new space telescope – the James Webb – to launch in 2011 and the Hubble mission is slated to end by 2010.

But it need not be that way, argue Hubble's supporters. Such are the passions surrounding the subject that NASA has chartered a panel of experts to determine the best way to manage the transition. The panel has already received hundreds of e-mails offering suggestions and raising concerns about the changes. Edward Cheng, who worked as a development scientist on the Hubble programme, told BBC News Online that there were simple reasons why many astronomers felt so strongly. He said: "They don't know a world without Hubble. Such is the volume of data that the telescope has been able to gather, that scientists' first reaction now when faced with an idea or question is always: what can Hubble tell us?"

Of course Hubble was not always such a font of information. Soon after its launch an aberration was discovered on the crucial primary mirror. It was three years before corrective optics were designed, made and installed. But the years since then have made all the difference, according to Sir Martin Rees of Cambridge University, who is England's Astronomer Royal and a member of the transition panel. "There's no doubt it has been a flagship programme for NASA for more than the last decade." And the data which has kept scientists so busy has also – in refined form – caught the imagination of the public with clues to the "big questions" like the origin of the Universe. "NASA has an awareness that the big questions are the questions which are not only of great scientific importance but they are also the ones the public is interested in," Sir Martin said.

But while the scientific community wants to make the best use of the good will and interest that Hubble has generated, as well as the investment already made, harsh facts have to be faced. Anne Kinney, director of NASA astronomy and physics division, brought a room full of Hubble fans back down to Earth when she stressed there was no way that NASA would be able to recover Hubble to show off in a museum as had once been planned. She told the public meeting in Washington DC that the loss of the Columbia shuttle and its crew of seven in February 2003 had placed more emphasis than ever on the desire not to put astronauts at unnecessary risk. At least one more visit to the telescope will be necessary to attach rockets to allow it to be brought out of orbit safely, but the extra danger of using that visit to recover Hubble is unacceptable given that it would bring no scientific advantage, she said. NASA has also rejected the idea of pushing Hubble into a higher orbit. "We are

not prepared to leave a problem for future generations" – or to just leave Hubble working until it eventually fell by itself. "We are not going to be in a position where our missions cause deaths on Earth."

With manned spaceflight on hold while the shuttle disaster is investigated, no future mission can even be guaranteed to Hubble – named after Edwin Hubble who pioneered the study of galaxies in the 1920s. But Dr Cheng said he expected NASA to recover from the Columbia tragedy – just as it went back to work after the loss of the Challenger in 1986. "There is a price to be paid for discovery," he said, adding that the question of acceptable risk should be put to astronauts, not to scientists or managers. "To them it's discovery, it's their life. They know they are taking risks but they will do that if there is a lot to gain." Adding propulsion to the Hubble so it could be destroyed harmlessly as it fell back to Earth might not be worth it to an astronaut, but servicing Hubble so it could continue to be used might be, he said.

Scientists say Hubble captured the "best ever" image of Mars. It also: gave the age of the Universe; provided proof of black holes; gave first views of star birth; showed how stars die; caught spectacular views of Comet Shoemaker-Levy 9's collision with Jupiter; confirmed that quasars are galactic nuclei powered by black holes; gathered evidence of the Universe's accelerating expansion. This article is from a report at the BBC News web-site (news.bbc.co.uk) on 31 July 2003.

4.13 Launch of Space Infrared Telescope Facility

A $2bn space observatory that can study the early history of the Universe has been placed in orbit by NASA. The Space Infrared Telescope Facility (SIRF) successfully launched from Florida's Cape Canaveral Air Force Station on 24 August 2003 aboard a Delta II launch vehicle. Flying eastward over the Atlantic Ocean, the new observatory entered an Earth-trailing orbit – the first of its kind – about 43 minutes after launch. Five minutes later, the spacecraft separated from the Delta's second and final stage. About 64 minutes after take-off, the NASA Deep Space Network station in Canberra, Australia, received the first data from the spacecraft. SIRTF, the largest, most sensitive, infrared telescope ever to be sent into space, will detect infrared energy (heat) emitted from stars, galaxies and planets. Astronomers will be able to study distant objects hidden by gas and dust that cannot be detected with visible light telescopes. Young stars emerging from dusty galaxies that existed when the Universe was only about three billion years old are of particular interest.

The last of NASA's suite of Great Observatories, SIRTF will use infrared detectors to pierce the dusty darkness enshrouding many of the universe's most fascinating objects, including brown dwarfs, planet-forming debris discs around stars and distant galaxies billions of light years away. Past Great Observatories include the Hubble Space Telescope, Chandra X-ray Observatory and Compton Gamma Ray Observatory. SIRTF will orbit for two to five years, drifting ever further into deep space. It is an important bridge to NASA's Origins Programme, which seeks to answer the questions: "Where did we come from?" and "Are we alone?" In-orbit checkout and calibration is scheduled to last sixty days, followed by a thirty-day science verification period, after which the observatory is expected to begin its regular science mission.

UK astrophysicists will be among those making use of the observatory. They will survey the sky for infrared galaxies found up to ten billion light years away. "It allows us to look through dust," says Dr Sebastian Oliver of the Astronomy Centre at the University of Sussex. "This allows us to study objects that would otherwise be hidden." Astronomers will be able to look back to a time when the Universe was a very violent place and many new stars were being born. Michael Rowan-Robinson of Imperial College London says they will be able to look far deeper in the infrared than any previous survey. "By looking back through almost 90% of the Universe's history, we shall be able to look back to a period when star formation was much more frequent than it is today," he says. "This will enable us to trace the evolution of star formation from very early times."

The launch of SIRFT marks the completion of NASA's Great Observatories Programme. The Hubble Space Telescope, the Chandra X-ray Observatory, and the Compton Gamma Ray Observatory study the Universe at other wavelengths. Two are still in operation but Compton was taken out of commission in June 2000. The European Space Agency will launch a larger infrared telescope – Herschel – in 2007. For more information, visit the SIRTF web-site (sirtf.caltech.edu). This article is based on reports at web-sites of NASA's Jet Propulsion Laboratory (www.jpl.nasa.gov) and BBC News web-sites (news.bbc.co.uk/2/ hi/science/nature/3163257.stm).

4.14 Coming Soon: ERDAS IMAGINE® V8.7

On 21 August 2003, Leica Geosystems (Atlanta, Georgia, USA) announced that ERDAS IMAGINE® V8.7 will be released worldwide in autumn 2003. The latest version of ERDAS IMAGINE will feature JPEG2000 support (including GeoJP2), further improvements to its mosaic tool and a faster, smoother multi-threaded IMAGINE Geospatial Light Table™ (GLT) viewer. Set to be simultaneously released with the Leica Photogrammetry Suite, ERDAS IMAGINE 8.7 will be fully compatible with Leica Geosystems' new process-driven photogrammetric software suite.

ERDAS IMAGINE 8.7 will support the JPEG2000 and GeoJP2 data formats developed by Mapping Science, Inc. It will add both the capacity to display and create JPEG2000 images. The ability to quickly and easily read geospatially-registered image data in the JPEG2000 format is currently available for ERDAS IMAGINE 8.6 customers. ERDAS IMAGINE's mosaic tool has also been further improved. These improvements will include providing users the ability to import / export cut lines, image smoothing along cut lines, colour balance imagery using ImageEqualizer's Dodging algorithm and support for rotated output sheets. Additionally, the new features found in the IMAGINE GLT™ interface will enhance and expand the efficiency of image exploitation. The expanded use of DirectX 8.1 or higher will allow users to roam smoothly through extremely large image sets. IMAGINE GLT will make use of two threads, one for rendering and one for reading data from a disk. This improvement also enables users to visually improve zooming and rotation of data. Additional improvements in ERDAS IMAGINE 8.7 include: fuzzy recode for de-conflicting land cover classification; dozens of new raster "dlls", importers and exporters for seamless data access; expanded list of projections, spheroids and datums, including new vertical datum transformations; improvements to IMAGINE VirtualGIS® for rendering large amounts of data.

For more information about Leica Geosystems GIS & Mapping, or its products and services, contact: Leica Geosystems, GIS & Mapping, LLC, 2801 Buford Highway, NE Atlanta, GA 30329, USA. Phone: +1-404-2489000 / +1-877-463-7327. E-mail: info@gis.leica-geosystems.com. Web: gis.leica-geosystems.com.

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 2nd Int'l Workshop: Multi-Temporal RS

Report on the 2nd International Workshop on the Analysis of Multi-Temporal Remote Sensing Images, at the European Commission's Joint Research Centre, Ispra, Italy, on 16-18 July 2003

Prof. Leonid Vasiliev, Institute of Geography, Russian Academy of Sciences, Moscow

The environment represents the most complex of many-body-problem. A complex world is interesting because it is highly structured. "Complexity" is a word rich with

ambiguity and dependent on context. Earth sciences have their own understanding of this word. Faced with the impossibility of handling any such real system exactly, Earth sciences have evolved a series of approaches to the treatment of complex systems, which range from reasoning by analogy, through averaging, linearisation, drastic approximation and pure empirism to detailed analytical solution. To extract physical knowledge from a complex system one must focus on the right level of description. There are three modes of investigation of systems like this: experimental, computational and theoretical. It is all up for grabs.

As science turns to complexity, one must realize that complexity demands attitudes quite different from those heretofore common in geo-physics, geography, and geology. Each complex system is different; apparently there are no general laws for complexity. This need is driven by the growing urgency of finding answers for such troublesome issues as the sustainability of ecosystems, inadequacy of water supplies, degradation, extreme events and the effects of environmental change at local, regional and global scales.

Modelling complex systems by tractable closure schemes or complicated free-field theories in disguise does not work. These may yield a successful description of the small-scale structure, but this description is likely to be irrelevant for the large-scale features. To get these gross features, one should most often use a more phenomenological and aggregated description, aimed specifically at the higher level. The inclusion of too many processes and parameters will obscure the desired qualitative understanding. The next few years are likely to lead to an increasing study of complexity in the context of environmental dynamics. The development of effective methodologies for the analysis of multi-temporal, multi-resolution satellite remote sensing (RS) data is one of the challenging issues. The RS communities address the role of time-space series for a better understanding of the environmental dynamics.

The workshop on the Analysis of Multi-Temporal Remote Sensing Images (Multi-Temp-2003) was held in the Joint Research Centre, Ispra, Italy, on 16-18 July 2003. The workshop was organised by JRC and the University of Trento and sponsored by IEEE Geoscience and Remote Sensing Society and Italian Remote Sensing Association. It was also supported by the US Environmental Protection Agency, EARSeL and NASA. Approximately seventy participants from fifteen countries throughout the world attended. Compressed into a high-energy 2.5 days, the workshop was divided into five oral sessions and one poster session covering four topics: image analysis and algorithms; monitoring and management of land resources; optical sensors and applications; analysis of SAR data. To establish a scientific context for the meeting oral sessions provided the overviews of vegetation monitoring perspective, global observations of Earth's Natural Resources and opportunities and challenges in exploiting multi-temporal SAR data. Roger King (Mississippi State University, USA), NASA's chief technologist, gave an overview in an invited lecture about some of NASA's observational systems presently in-orbit and in preparation that are being used for multi-temporal observations of Earth's natural resources. NASA has established a set of goals that are outlined in the recently released Strategic Plan. In the NASA Strategic Plan, the Earth Science Enterprise (ESE) plays a leading role in the goal to "understand Earth's system and apply Earth system science to improve the prediction of climate, weather and natural hazards".

As noted by several speakers, we need to understand the major uncertainties of situation in environmental changes. Earth satellite observation has major implications for our understanding of critical phenomena, complexity of nature, reducing uncertainty remaining in the knowledge of the forces acting on the Earth System and its response. The presentations and poster sessions clearly demonstrated that considerable multi-temporal, multi-resolution RS research is already under way in many countries. Discussion associated with these was animated and stimulating. The presentations represented a diverse set of topics involving a number of spatial and temporal scales and various environmental

processes, including processing of multi-dimensional time series, mapping and monitoring land cover / land use change, deforestation / regeneration. A variety of change detection techniques in multi-temporal sequences are being discussed: multi-temporal composing, multi-temporal classification on sub-pixel scale.

The workshop brought together people from many diverse scientific and engineering backgrounds; the enthusiasm and focused energy demonstrated by the attendees suggest that multi-temporal RS will stay strong into the future. No doubt there will be continuing intense research in this area. The workshop provided excellent opportunities to build community and encouraged the sharing of ideas and discussion of potential collaboration in multi-temporal RS.

5.2 2nd Int'l Workshop: Urban RS & Data Fusion

Report on the 2nd Workshop on Remote Sensing and Data Fusion over Urban Areas (URBAN2003), held in Berlin, Germany, on 22-23 May, 2003

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After the huge success of the 1st IEEE / ISPRS Joint Workshop on "Remote Sensing and Data Fusion over Urban Areas" (URBAN2001), held in Rome in November 2001, it was straightforward to continue talking about urban remote sensing (RS), and to propose a follow-up for that workshop. The importance of such an event comes from the jointly sponsorship by ISPRS (International Society for Photogrammetry and Remote Sensing) and IEEE (Institute of Electrical and Electronic Engineers), through GRSS (Geoscience and Remote Sensing Society). And in May 2003, after a slight change in the long title but with the already familiar nickname of URBAN2003, the second workshop provided us as usual with an overwhelming quantity of good papers, new ideas, contacts and discussions. The workshop was held in Berlin, Germany, on 22-23 May 2003, hosted by the Photogrammetry and Cartography Department of the Technical University of Berlin. The site of the conference, close to the Unter den Linden boulevard, and to the most important places of the recent history of the capital city of Germany, made us not forget the wide changes that the city of Berlin experienced in the last years, after the collapse of the Wall and the reunification.

The workshop was dedicated to present recent advances in the topic of urban RS and data fusion issues. In particular, we considered the organisation of special sessions on new sensors, especially very high resolution satellites, and the results of the evaluation of different panchromatic / multi-spectral fusion algorithms for the future French high resolution constellation, called Pleiades. Sadly, a third session, a poster session dedicated to the early results of the Envisat satellite for urban RS, was cancelled due to problem in data delivery in the first commissioning phase of this satellite.

The workshop was organised in a two days track, without any parallel session, with two poster sessions allowing an extensive interaction among participants. More than 110 researchers attended, from more than twenty different countries, traveling to Berlin from all over the world. There were more than ninety submitted abstracts. From these the Technical Committee faced the hard task of choosing the thirty oral papers to be presented in the seven sessions. The total number of papers printed in the conference proceedings (available through the IEEE press service) is sixty-five, for a total of more than three hundred pages.

The workshop was scientifically co-sponsored by many scientific institutions: IEEE, ISPRS, the German Society for Photogrammetry and Remote Sensing (DGPF), the European Association of Remote Sensing Laboratories (EARSeL), and the American Society for Photogrammetry and Remote Sensing (ASPRS). Moreover, it was financially sponsored by international institutions, like the European Space Agency (ESA), and industrial companies, whose work or tools are recognised in the urban RS area. We thank, therefore, Eurimage, PCI Geomatics, Geosystems, FPK, and

Pietruska. The final programme consisted of one plenary, seven oral and two interactive sessions. The oral sessions were dedicated to (1) new observation capabilities for urban areas; (2) potential of multispectral / hyper-spectral data for urban application; (3) SAR data in urban areas; (4) building extraction and characterisation; (5) data fusion over urban areas; (6) urban modelling and reconstruction; (7) road network extraction in urban areas.

This organisation of the topics reflects the need for urban area characterisation at different scales, and exploiting different sensors. In particular, the workshop showed that there is a remarkable interest in using complex and interferometric SAR data for different urban applications, from mapping to building extraction to subsidence monitoring. Though all the problems coming from its side-looking nature, radar deserves some more attention for its potentials in this area, especially considering the availability in the near future of high resolution data from TerraSAR-X or Cosmo / SkyMed low-orbit satellites. This calls also for advanced SAR simulators suited for urban areas, and systematic evaluation of the best geometrical (position, look angle) and electromagnetic (frequency, bandwidth, polarisation) configuration for the radar system.

A second, extremely interesting topic is related to the fusion of panchromatic and multi-spectral data from satellite sensors, with the aim to provide as much as possible "the best of both worlds" (i.e. high resolution multi-spectral data). The need for such a tool for urban area characterisation is of course very urgent, and current methods are now passing from the theoretical to the implementation stage. Finally, we have to stress the increasing importance of interpretation techniques well suited for very high resolution data, which means techniques very similar to those already in use for aerial images, but with the advantages of reduced re-visit time (so, better monitoring capabilities) and more bands (better land cover discrimination). Still, it is questionable at this moment if we will able to reduce problems in co-registration and vertical and horizontal accuracy, and this will be one of the open questions in the future, mainly requiring data fusion issues at a feature level for a better overall result.

So far, the future of the workshop seems bright, and the support that the scientific community is dedicating to it remains strong. The interest for urban RS has been increasing in these years, and this is also thanks to the efforts of those that made possible the realisation of our workshop. Therefore, thanks should be given not only to our sponsors, but also to our organising local committee, headed by Hartmut Lehmann, and especially to Marion Dennert. The workshop dinner especially deserves a comment, as it was excellent, but it provided also one more possibility to exchange ideas and experiences for future works.

URBAN2003 was another success, and we think that its legacy should not be lost. We will surely have an event in 2005, since the biennial temporal schedule allows sufficiently quick sampling of new techniques and sensors for urban RS and data fusion, Moreover, as we had in the first workshop, there is a special issue associated with the event. So, please consider the call for the International Journal of Information Fusion on "Fusion of Urban Remotely Sensed Features", available on the urban2003 web-site, at (tlc.unipv.it/urban_2003). The deadline is 30 September 2003 – you should not miss it!

5.3 4th Int'l Symposium: RS of Urban Areas

Report on the 4th International Symposium on Remote Sensing of Urban Areas (URS2003), held in Regensburg, Germany, on 27-29 June 2003

Tarek Rashed, San Diego State University, USA

At a time when interest in the use of remote sensing (RS) for the study of human settlements is growing overwhelmingly, the 4th international symposium on RS of urban areas (URS2003), held in Regensburg, Germany on 27-29 June 2003, proved that what was once thought of as a "narrow" area in the field of RS is no longer so. More than 120 urban RS researchers and practitioners,

representing 36 different countries, convened to take advantage of three days of an intensive programme that included oral and poster paper presentations, commercial product updates, and social events that provided numerous opportunities to network and exchange ideas with other research partners and colleagues. The beautiful city of Regensburg, with its medieval centre and modern suburbs provided an attractive setting for the symposium, and a reminder of the insights that RS can add to our understanding of urban systems, when the use of technology is augmented by a through understanding of urban form and function, as well as the spatial context within which urban systems develop.

URS2003 was hosted by the Geography Department at the University of Regensburg, and was scientifically co-sponsored by many scientific institutions, including: the International Society for Photogrammetry and Remote Sensing (ISPRS), the European Association of Remote Sensing Laboratories (EARSeL), the German Society for Photogrammetry, Remote Sensing and Geoinformation (DGPF), University of Regensburg, and Istanbul Technical University. In addition, several scientific publishers and industrial companies whose journals or tools are recognised in the urban RS arena, have sponsored the symposium.

The launch of the new generation of very high resolution imagery and the wide dissemination of a variety of digital data sources that can be used to augment detailed satellite data, have brought together an interesting and exciting period in the development of urban RS. This has been expressed by an increasing number of published articles and books on urban RS, new urban specialty groups within many national and international RS societies and a growing number of workshops organised around topics that relate in a way or another to the broader field of urban RS. While this trend is indeed very encouraging to the future of the field, there is also a vital need for those involved in these activities to build ties among themselves to foster progress toward a common agenda. Therefore, the success of the URS2003 in this regard was spectacular due to its focus on building relationships between different researchers and practitioners toward a unified research agenda for the international community of urban RS. This was evidenced by the symposium's final programme, which reflected the different perspectives on how RS is currently applied to tackle urban problems, and various ideas on the future trends within the field.

These perspectives and ideas were covered in ten oral sessions and an interactive poster session, organised sequentially, thus allowing an extensive interaction among participants. In addition, the two-day exhibition provided a unique opportunity for participants to update their knowledge with the stat-of-the-art in the technology. The oral sessions were dedicated to the following topics: (1) ecological aspects / landscape metrics; (2) urban information and decision-support systems; (3) change detection analysis; (4) road extraction techniques / traffic applications; (5) radar and thermal applications; (6) special applications; (7) extraction of height and density; (8) monitoring urban land cover dynamics and urban growth; (9) vulnerability to urban areas to natural hazards; (10) new information extraction strategies.

The organisation of these sessions, as implied by their titles, reflected a planned balance between technique- / data-driven approaches to urban applications, and thematic- / theory-driven ones. This balance between applied and academic realms is indeed a very important issue to be considered in the wider agenda of the urban RS community. Oral papers and poster presentations are included in the proceedings of the symposium, available through the international archives of the ISPRS, Volume No. XXXIV-7/W9 under the following title: Proceedings of the ISPRS WG VII/4 Symposium, "Remote Sensing of Urban Areas", 27-29 June 2003, Regensburg, Germany. Editor: Carsten Jurgens.

The URS2003 symposium was another success, added to a series of conferences devoted to RS of urban areas. Thanks are due to Carsten Jurgens, his students, and all who helped with the organisation of the symposium, those who sponsored the symposium, and those who participated and presented

their work. There is a follow-up session on this symposium planned to take place next year during the ISPRS Congressional meeting in Istanbul (August 2004), and the Fifth International Symposium will likely take place in 2005 in the United States.

5.4 8th Int'l Conference: Permafrost

The 8th International Conference on Permafrost met in Zurich, Switzerland, on 21-25 July 2003. Approximately 300 representatives from twenty-four countries participated. A total of 230 papers were published and an additional eighty-five extended abstracts were published and available for poster presentations. The local co-chairs were Professors Wilfried Haeberli, University of Zurich, and Sarah Springman, Swiss Federal Institute of Technology. During the conference the International Permafrost Association held its Council meetings, and approved activities for the following ten working groups (the last five of which are new): (1) permafrost and climate; (2) peri-glacial processes and environments; (3) permafrost engineering; (4) cryosol; (5) coastal and offshore permafrost; (6) Antarctic permafrost and peri-glacial environments; (7) glaciers and permafrost hazards in high mountains; (8) isotopes and geochemistry of permafrost; (9) mapping and modelling of mountain permafrost; (10) permafrost astrobiology.

The Council approved membership of Iceland as its twenty-fourth member, and elected the new Executive Committee for 2003-2008. Members are: Dr. Jerry Brown, President (USA); Professor Charles Harris, Vice President (UK); Dr. Georgy Perltshtein, Vice President (Russia); Mr. Don Hayley, Member (Canada); Dr. Hans-W. Hubberten, Member (Germany); Professor Zhu Yuanlin, Member (China). The Council approved the invitation from the University of Alaska Fairbanks, to convene the 9th International Conference on Permafrost in Fairbanks, Alaska, in early summer 2008. An interim field conference will be held in China in 2006 to highlight the construction of the Qinghai-Tibet railroad. More information is available at www.geodata.soton.ac.uk/ipa.

5.5 3rd Int'l Workshop: Arctic Coastal Dynamics

The report of the 3rd International Workshop on Arctic Coastal Dynamics (ACD), including a summary of the workshop results and about thirty-five extended abstracts, is now available. Copies can be obtained from: Volker Rachold, Alfred Wegener Institute, Tele-grafenberg A43, 14473 Potsdam, Germany. E-mail: vrachold@awi-potsdam.de. Web: www.awi-potsdam.de/www-pot/geo/acd. html.

5.6 Symposium: Life in Science, Science in Life

A look back at the Symposium "Life in Science - Science in Life", which was held in Copenhagen, Denmark, on 7 November 2002

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On 7 November 2002, a Symposium entitled "Life in Science – Science in Life" was held in Copenhagen, Denmark, organised by the Danish Natural Science Research Council, with the support of the European Commission. There were over 100 key persons invited to this Symposium, which may be regarded a follow-on to Europe's stated goal, agreed at the Barcelona Summit in spring 2002, "to become the most competitive and dynamic knowledge-based economy in the world. The 24-page Symposium report is available at www.forsk.dk/snf/publ/infmat/konf_rap.pdf. The report reviews the activities in five Workshops comprising the main part of the conference: (1) national strategies for science recruitment; (2) science communication – a broad approach; (3) science learning and didactics; (4) science in the 21st century; (5) science education and careers. The Symposium made the following recommendations:

- On the national level: (1) Science communication should be upgraded on the political agenda and identified as a key element in science policies. (2) Science education should be an important part of

science policy; research grants should contain funding for outreach activity (for instance in the form of scientists presenting their research in schools). (3) Further development of attractive careers opportunities for young scientists is essential. (4) Programmes in journalism should contain science education.

- On the EU level: (5) The creation on the EU level of an "observatory" for science education and communication is recommended; the observatory should collect and compare successful methods of science communication, science education, and the factors considered by young people when choosing careers. (6) EU grants should contain obligations to communicate the funded research to the public. (7) Analysing the scientific labour market in Europe and establishing mechanisms to improve transparency in recruitment will be important in improving the job possibilities for young scientists.

6 FORTHCOMING MEETINGS AND COURSES

6.1 EUSC-JRC course: RS of nuclear facilities

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 a training course on the interpretation of nuclear installations using commercial satellite imagery, on 22 September to 3 October 2003, at Torrejón Airbase, Madrid, Spain. The course, originally designed for EUSC and JRC personnel, is now open to officially nominated personnel from EU member nations interested on the use of commercial satellite images to monitor the status of nuclear facilities. No previous knowledge on the nuclear fuel cycle (NFC) is required to attend the course. However, a basic familiarity with remote sensing (RS) is strongly recommended.

Starting from the functional description of the NFC, this course will provide interpretation guidelines of nuclear facilities: mining; milling; conversion; enrichment; fuel fabrication; power reactors; fuel reprocessing; residues management. The course will be presented over two weeks. The core module will be given during the first week and it will be based on PowerPoint presentations, student notes on "fact sheet" style, and exercises. The course will present the background of the NFC, satellite interpretation guidelines and practical exercises of selected facilities covering the full NFC over different areas. An optional second week will be devoted to more detailed analysis and reporting of selected facilities using the methodologies and tools employed at the EUSC. For this second week a good knowledge of ERDAS and / or OCAPI (Open Chip Architecture Platform Interface) software is required. Course instructors will be experienced staff of the EUSC and JRC. The maximum number of attendees is strictly fixed to twelve. The course and auxiliary material will be in English.

More details can be obtained by phone (+34-91-6786040 / 6004) or e-mail (training.info@eusc.org), or from the EUSC web-site (www.weusc.es/html/news_ course.html).

6.2 Calendar of forthcoming meetings

NEW
22 Sep. - 3 Oct. 2003
Madrid, Spain

Joint EUSC-JRC Training Course: Interpretation of Nuclear Installations using Commercial Satellite Imagery
Organised by: EUSC (European Union Satellite Centre) – JRC (Joint Research Centre).
Web: www.weusc.es/html/news_course.html

NEW
6-8 Oct. 2003
Hannover, Germany

Joint ISPRS-EARSeL Workshop:
High Resolution Mapping from Space 2003
Contact: Karsten Jacobsen (jacobsen@ipi.uni-hannover.de), University of Hannover, Germany. Web: www.ipi.uni-hannover.de/html/aktuelles/tagungen.htm

NEW
12-15 Nov. 2003
Florence, Italy

IUFRO Conference:
Monitoring and Indicators of Forest Biodiversity in Europe – from Ideas to Operationality
Web: www.efi.fi/events/2003/Monitoring_and_indicators

27-28 Oct. 2003
Washington DC, USA

IEEE Workshop: Advances in Techniques for Analysis of Remotely Sensed Data
Web: ewh.ieee.org/soc/grss

29-31 Oct. 2003
Bucharest, Romania

International Scientific Conference: Scientific Research for Sustainable Forest Management
Organised by: Forest Research and Management Institute (ICAS), Bucharest, Romania
Contact: Claudia Morar, ICAS, Bucharest. Phone / fax: +4021-2406845. E-mail: claudia@tma.ro. Web: www.icas.ro

NEW
25-26 Nov. 2003
Moscow, Russia

EARSeL Expert Meeting: Self-Organised Criticality in the Environment
Contact: Prof. Leonid Vasiliev (vasiliev@igras.geonet.ru), Institute of Geography, Russian Academy of Sciences, Moscow

24-27 Feb. 2004
Rome, Italy

Microrad 2004: 8th Specialist Meeting on Microwave Radiometry and Remote Sensing Applications
Web: www.microrad04.org

NEW
25-27 May 2004
Dubrovnik, Croatia

24th EARSeL Symposium: New Strategies for European Remote Sensing
Web: www.earsel.geosat.hr

NEW
28-29 May 2004
Dubrovnik, Croatia

EARSeL Workshop: Remote Sensing of Land Use and Land Cover
Web: www.earsel.geosat.hr

12-23 July 2004
Istanbul, Turkey

20th ISPRS Congress: Geo-Imagery – Bridging Continents
Web: www.isprs2004-istanbul.com

NEW
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: www.copernicus.org/COSPAR/COSPAR.html