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1 EDITORIAL

The EARSeL Newsletter has three important functions, which are central to my Editorial approach. Firstly, it aims to keep the considerable network of EARSeL members well informed, both of organisational developments within EARSeL, and of research activities in the field of remote sensing (RS) being carried out by EARSeL's Special Interest Groups or by the Member Laboratories. Secondly, the Newsletter strives to keep track of the sometimes bewildering plethora of European-level policies, initiatives, communications, directives, etc., emanating from the European Commission (EC), European Space Agency (ESA), and other international organisations such as the United Nations, with a bearing on RS research in Europe. Thirdly, the Newsletter keeps an eye on the latest international - not just European - RS projects and applications, and other technical issues, such as the development of new sensors, data-sets, and processing systems. These three main aims are addressed in the "core" of the Newsletter - i.e. Parts 2, 3, and 4.

This issue of the Newsletter contains a particularly wide range of articles, addressing the above three aims. Amongst the reports in the "EARSeL" section, for example, is the (abridged) key-note address from this year's EARSeL Symposium in Dubrovnik, Croatia, by Prof. John van Genderen, which provides a review of EARSeL's "journey" over the years, and some thought-provoking ideas on how the association might optimally choose its future route.

The "international-level" section of this issue includes an article on ESA's new "Observing the Earth" web-portal, focused on major current applications of Earth observation (EO), and news on the recent merging, within one Unit, of the Joint Research Centre's Monitoring Agriculture with Remote Sensing (MARS) action with the activity on Monitoring Compliance with EU Fisheries Regulations (FISHREG). Two new EC proposals are also described, which are likely to see the use of geographic information such as RS data, enshrined in future EU legislation.

The "RS Data, Products and Projects" Section contains news on a wide variety of EO (optical and microwave) applications, for diverse environmental issues, including: forest fires (SPOT and Landsat); Arctic ice (CryoSat); hurricanes and typhoons (MODIS and TRMM); giant ocean waves (ERS - SAR); effects of ocean currents on leatherback turtles (ERS and Envisat - Radar Altimeter); protection of the habitat of mountain gorillas; land use changes in the Amazon; soil moisture and ocean salinity; "urban heat islands" (MODIS); health of the Earth's atmosphere (Aura); lightning in the Earth's upper atmosphere (ROCSAT-2); monitoring of illicit drugs crops (IKONOS).

In short, the EARSeL Newsletter - which is compiled based both on reports from various Internet web-sites, as well as on specially solicited articles - strives to provide a concise, "one-stop" overview of everything of importance that is happening in the field that is the focus of the activities of most of us. Apart from its direct goal of keeping readers up to date on major RS-related news and developments, the Newsletter also has the more "lofty" ambition of promoting a more global perspective of important environmental issues, which are often only addressed from a local point of view. In my preparation of this issue of the Newsletter, I came across an animated graphic, on the web-site of NASA's Gottard Space Flight Centre, which beautifully illustrates how EO does indeed provide an entirely unique, simultaneous perspective of issues at both local and global scales. Visit and enjoy: www.gsfc.nasa.gov/gsfc/earth/pictures/2004/0801uhigreen/centralParkZoomOut.mpeg.

The Editor

2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 Keynote address at 2004 EARSeL Symposium

An abridged version of the keynote address given by invited speaker, Prof. John L. van Genderen (International Institute for Aerospace Survey and Earth Sciences / ITC, Enschede, The Netherlands), at the EARSeL Symposium in Dubrovnik, Croatia, on 25 May 2004.

Introduction

In agreement with the EARSeL Council and in keeping with the theme of this Symposium, I have entitled my talk "European Remote Sensing: the Road Ahead". I will therefore use the analogy of driving a car, when one needs to use the rear view mirror to look back, then make an assessment of the current situation and then decide how to make the best use of opportunities along the highway, rather than act as a passenger who is "along for the ride".

Part 1: Looking in the rear-view mirror

I have been fortunate enough to have attended several EARSeL Symposia over the years, beginning with the first one in Voss, Norway in 1981, where I presented a paper on "Airborne Remote Sensing of the Coastal Zones". This topic is still of great relevance to Europe in fields such as coastal erosion, coastal pollution and coastal / maritime security.

A particularly noteworthy Symposium was that in Eger, Hungary in 1992. This was a bold initiative of the EARSeL Council, going to a Central and Eastern Europe twelve years ago, thus opening up the integration of the remote sensing (RS) researchers from these countries. It is particularly pleasing that ten of these countries are now full members of the EU. EARSeL has certainly played an important role in the RS field, by involving these countries from the beginning into its activities. Currently, there are sixteen EARSeL Member Laboratories from the ten new EU Member States.

EARSeL has been fortunate to have enjoyed, from its foundation until now, considerable backing and support from ESA, the EU and the Council of Europe. Especially the support of ESA should be acknowledged. In fact the first seven Symposium proceedings were published as an ESA publication, distributed free of charge to EARSeL Members. The "EARSeL News", the forerunner of our present Newsletter was also produced by ESA services. Without this support from ESA in these early years, EARSeL may well not have survived. Prof. André Lebeau, who as ESA's Director of Planning and Future Programmes at that time, and his colleague John Plevin, were staunch supporters of EARSeL. Prof. Lebeau continued to support EARSeL, even when he had left ESA, namely by facilitating the hosting of the Secretariat office within Météo-France. *(Editor's note: André Lebeau was made an Honorary Member of EARSeL in June 1997, on the occasion of the 20th anniversary General Assembly in Lyngby, in recognition of his continuous support).*

Of course there are many other bodies and individuals who have made great contributions to EARSeL over the past 25 years, and steered it around many obstacles. Especially, the tireless efforts and devotion of "Mrs. EARSeL", Madeleine Godefroy cannot be over-stated. Especially during the "bumpy" parts of the ride over the years, she has remained steadfast and provided continuity.

The contribution made by the EARSeL Newsletter should not be overlooked. From 1990-1993, I served as Editor of the Newsletter. My predecessor as Editor, the late Georges Fraysse of what was then the Institute of Remote Sensing Applications at the Joint Research Centre in Ispra, Italy, ensured that "EARSeL News" was one of the main sources of information on what was happening in Europe and elsewhere in the field of RS, before we all had ready access to other sources of information via the Internet and electronic newsletters. During my Editorship, I learnt first-hand how useful this Newsletter was considered by its members, and by many other readers around the world. The yearly "Special Is-

sues" on topics such as "ESA-ERS-1" (1991), "International Space Year" (1992), "Operationalization of Remote Sensing" (1993) and "European Research in Remote Sensing" (1994), were very popular, and provide a historical record of EARSeL's contribution to progress in our field over the years. Under subsequent Editors, several other special issues have been produced on such topics as "CEO and ENVISAT" (1995) and "Laser Scanning" (1997).

So, where are we now? Let us take a moment to discuss the bottlenecks, detours and delays that EARSeL has and is encountering along its way, so that we can evaluate what has been achieved in order to programme our navigation systems for the road ahead, in the form of an EARSeL Action Plan for the coming years.

Part 2: Pitstop - an assessment of past achievements and problems

In my opinion, some of the main achievements of EARSeL have been:

- Regular publication of the Annual Symposium Proceedings;
- Regular publication of its quarterly Newsletter;
- Integration of central and eastern European RS researchers into its pan-European network;
- Establishment of several active Special Interest Groups (SIGs) focussing on key RS topics;
- Long-term contribution and commitment to knowledge transfer to Developing Countries;
- Promotion of European research priorities in RS;
- Setting up of the new on-line "EARSeL e-Proceedings", as successor to the EARSeL "Advances in Remote Sensing" series.

The SIG on Remote Sensing for Developing Countries was first studied at the 2nd EARSeL Symposium, held in Igls, Austria, in April 1982. EARSeL is now gathering better information on the specific needs, requirements and priorities of these countries in the field of RS, as a first phase for "joint activities in which institutions in Europe and Developing Countries can participate as equal partners" as foreseen by Prof. C. Voûte of ITC in 1983. Again, at the EARSeL Symposium hosted by ITC in Enschede in 1998, the theme was on "Operational Remote Sensing for Sustainable Development". Furthermore, the SIG on Developing Countries, convened by Prof. Rudi Goossens from Belgium, has been most successful in encouraging and promoting the use of RS to help solve problems in Developing Countries.

Recently EARSeL established the new, on-line Journal "EARSeL e-Proceedings". This is a new Journal devoted to refereed scientific publications in all fields of Earth Observation (EO), including many applications and new methodologies, modelling studies and ground truth methods and measurements. There are several exciting benefits to European RS researchers. Firstly, EARSeL e-Proceedings are free, on-line, without any subscription fee to all readers who have an up-to-date browser and Adobe Acrobat Reader. We all know the price of printed journals in our field is getting quite high, so that often it is only the library that can afford to subscribe. In addition, all EARSeL Member Laboratories receive a free CD-ROM of each issue. Perhaps an even more important benefit is the anticipated fast publication time. From time of acceptance to publication, the delay will not be more than six months after submission for EARSeL Member Laboratories, compared to the 1-2 years (or more) for other RS journals. The Journal will be available on the EARSeL Website (www.earsel.org), and will attract many more "hits" on the EARSeL website, thus enabling EARSeL to inform a much larger European and international audience of EARSeL's activities.

Of course, besides its achievements, there have also been many delays, detours and the occasional potholes that EARSeL has had to overcome. In the early years ESA was very happy to have EARSeL as a consultant when its programmes were in the definition stage, but once these satellite missions were implemented, its advice was no longer sought. EARSeL also carried out study contracts for ESA and the EU through the JRC, but when other actors came on the scene and rigorous rules were established for the allocation of contracts, these valuable sources of income for EARSeL dried up. As is common to all

Societies and Associations, the speed of EARSeL's journey has varied from high speed to false starts, and stop-go situations and even going in reverse at times, depending on the drive, personal vision, energy, etc. of its Bureau and Council members. This has resulted in fluctuations from as high as 300 to the current level of about 220 Member Laboratories.

With no financial support from its former sponsors, EARSEL now has to stand on its own two feet and find its new role in Europe. Although it is easy to say (and partly true) that this decline in membership is due to the economic situation, I feel it is also due to the lack of a dynamic programme of activities and services to its members. If EARSeL can be seen as a vibrant association, with an attractive programme of research initiatives and services for its members, no laboratory in this field will want to be excluded from such a programme.

What are some of the reasons that EARSeL is not able to attract many more laboratories at present? A major factor, in my view, has been that EARSeL has not become involved in the rapid advances in geo-information technology and has not become a partner or participant in the many European initiatives in this field. Whilst most national RS societies have merged with other geo-information societies such as photogrammetry, GIS, surveying, etc., EARSeL has stayed on its traditional course. There are now many other drivers speeding along the information super-highway, leaving EARSeL behind, many of them linked to each other in many of their activities. Whilst EARSeL and many of its Member Laboratories are involved in some of these, EARSeL as an Association needs to develop a vision and strategic plan on how to become more involved in such European activities.

Part 3: The road ahead - challenges and opportunities for the future

Below are various suggestions to the EARSeL Council for strengthening EARSeL's role in the coming years. They are not in any particular order of importance. EARSeL may decide which are useful to help it navigate its way towards the future.

EARSeL should expand its network and activities still more towards Central and Eastern Europe, to help integrate the RS laboratories and other organisations in these countries to become integrated into the European network. This should include not only the new EU members, but also future ones such as Bulgaria, Romania, Croatia and others. Here EARSeL can build on its previous experience of integrating Hungary, Poland, and others. There are many European programmes that EARSeL can access to help it do this task (PHARE, TACIS, INTAS, 6th Framework Programme, etc.).

EARSeL should strengthen its SIGs, and combine their activities with the Working Groups and SIGs of other European and international associations. For example, EARSeL's SIG on Coastal Zones could become more involved in GMES, and co-operate more with the coastal zone activities of AGILE (Association of Geographic Information Laboratories for Europe). The SIG on Developing Countries could co-operate more with regional associations such as SELPER (the Latin American Society for Remote Sensing and Space Information Systems), AARS (Asian Association on Remote Sensing), the African Association on Remote Sensing, etc. as well as with international initiatives such as UNESCO-GARS, IGOS, etc. The new ISPRS Commission VII "Thematic Processing, Modelling and Analysis of RS Data" would be a good way for EARSeL's SIG's on 3-D RS, imaging spectroscopy, data fusion, and temporal analysis of image data, to increase its international profile and scientific level, by organising joint meetings with the various Commission VII Working Groups. Similarly, several of EARSeL's "application" SIG's could co-operate more with the SIG's of various European national societies such as in the UK, the Netherlands and others.

EARSeL should have more co-operation and interaction with other European "geo" societies, all of which need RS as an input for their activities. Whilst most national societies of RS have merged with other related societies to strengthen their activities (e.g. the UK's Remote Sensing and Photogrammetric Societies have merged into

"RSPSoc", and in the Netherlands, eight societies, including RS, photogrammetry, cartography, geodesy, etc. have merged into a new Association called GIN (Geo-Information, the Netherlands). Yet EARSeL and EUROSDR (European Spatial Data Research) still work independently. Of course, for EARSeL to work more closely with the various European associations, it must have something which it can bring to the table when discussing joint activities. Hence EARSeL will need to prepare a detailed and clear strategic plan on its vision of European RS and the role it plays in the modern information society.

EARSeL should become more involved with ESA again, through such programmes as GMES, DUP, RAGON, etc. At present the individual Member Laboratories of EARSeL participate in these programmes. However, EARSeL, as the co-ordinating body for RS, should play a more central role. This would benefit both ESA, as well as the individual laboratories by harmonising research, forming networks of excellence and avoiding unnecessary duplication and competition.

EARSeL should become more actively involved in international and European research initiatives such as ICSU, IGOS, CEOS, GEO, CODATA, IGU, ISPRS, EUROSDR, AGILE, GINIE, INSPIRE, etc. Most of these organisations have a research agenda (e.g. AGILE's "Action Oriented Research", EUROSDR's "Rolling Research Plan", etc.). Several of the research priorities of these Associations are closely related to EARSeL expertise.

EARSeL should concentrate more on combined symposia and conferences. With the overfull agenda of meetings, conferences, workshops, etc., EARSeL could not only contribute to reducing the number of events, but strengthen its role and presence by co-hosting conferences more regularly. EARSeL's Annual Symposium could be combined with any of many other events, increasing the number of participants, encouraging interaction, and reducing costs. Several examples spring to mind: joint meeting with EARSC (European Association of Remote Sensing Companies), to bring together European researchers and industry, to the benefit of both; the SIG on Data Fusion could combine with Sweden's annual international conference on Information Fusion and the EARSeL Symposium - such a high-level scientific meeting would bundle European expertise in this field raising the profile of European research in this area; in 2006, the Netherlands is hoping to host the ISPRS Symposium for Commission VII: "Thematic Processing, Modelling and Analysis of RS Data", together with the host society, GIN, and with EARSeL's 26th Symposium - this could become a major European event, thus raising the profile of all three organisations.

EARSeL should focus on core business: some obvious RS fields are education, image fusion, developing countries, and various other research spearheads, such as SAR, INSAR, PSInsar, D-Insar, Bi-static SAR, etc., fields in which Europe is a recognised leader. At its next EARSeL Symposium, the EARSeL could invite all European stakeholders to present posters, around a number of broad scientific domains. Such posters would represent the breadth of activity spanning EARSeL's membership. Data centres, universities, research laboratories, non-profit organisations and private companies could show-case their RS data products, services and applications. Such poster sessions could be used to generate questions and discussion, and identify potential collaborations to be explored in more detail during subsequent break-out sessions on the selected scientific domains, and explore how each could use EARSeL's SIG structure to further its objectives. This approach could result in EARSeL being much better placed to become involved in Europe's ERA-NET, which fosters co-operation between EU countries in the field of national / regional programmes, to come to common European programmes.

Another option is for EARSeL to organise "Young Researcher Forums", bringing together Europe's new generation of researchers. At such a platform EARSeL could enable young researchers from its Member Laboratories all over Europe to present their work and exchange ideas. This would give them a clearer picture of how their research compares to that in

other countries, and give EARSeL new insight into possible new RS technologies and applications. Such an EARSeL-organised event would provide a unique perspective on RS science, technology and applications. I can hear some of the EARSeL Council members thinking, "That all sounds very nice, but where's the money coming from to fund these ideas and initiatives?" In the more than thirty years since completing my PhD in RS at the University of Sheffield (UK), I have found that if you have a clear vision, supported by a good strategic plan, a good team and innovative ideas, there are many funding sources available. The key is to help the funding agencies solve their problems, not your own. The above Young Researchers Forum would help the EU's "mobility of researchers" objective. Besides EU funding sources, the European Science Foundation, the NATO Summer School / Workshops programme, ESA initiatives, etc. would all welcome such an EARSeL initiative.

A hot topic of discussion for innovation policy-makers in Europe is the development of clusters, networking centres of excellence (i.e. networks of excellence). Here it is important to distinguish between two types of clusters, one being groups of laboratories / universities / companies in a particular region (e.g. Central and Eastern Europe, the Mediterranean) or a certain scientific field (high-resolution, image fusion, SAR, etc.) which share expertise and resources for mutual benefit and a synergistic effect; and cluster initiatives efforts organised by EARSeL, ESA, the EU, etc. to increase the growth, quality, competitiveness in certain scientific domains in Europe. EARSeL should do more to develop such "clusters", attracting new laboratories to join. One example of such a cluster was a European research network (for which I acted as Co-ordinator) called "Synergy of RS data: a European scientific network in the field of RS", which involved twelve European laboratories. The stronger such clusters become, the better EARSeL, acting as the facilitator, will be able to represent EO at the European level.

Problems EARSeL will need to overcome to achieve this include current a "weak" network, lack of adequate resources, and difficulties in achieving consensus amongst its members. However, if EARSeL can overcome these obstacles, it will be able to make a key contribution to European EO integration and attract research funding into these clusters and networks, rather than to individual laboratories. Both the EARSeL Member Laboratories benefit by belonging to such clusters (easier access to research funding) as well as EARSeL as an Association by raising its status as a discussion partner with EU, ESA and others, in determining and implementing European EO policy.

The EARSeL website (www.earsel.org) has recently been vastly improved, but there is much scope to expand it. There should be more "pages" on the activities of the SIGs, on Council meetings, and on EO publications. More links should be made to other relevant RS websites, the EU, ESA, and other European / international organisations, research programmes, policy and research documents, etc. More information on educational materials and many other topics should be added. The objective should be to make the EARSeL website THE source of information on European RS activities, both for all European users, as well as foreigners wishing to know what's going on in European EO. Of course this will require a pro-active approach by all EARSeL Council Members, Member Laboratories, SIG Convenors and individual researchers. By providing a better Internet service, EARSeL will become better known as the place to go for any information on European RS. If a user types in "European remote sensing" in any search engine, it should always be the EARSeL website that appears first. Cross-links with other society websites can also help promote EARSeL.

The new e-Journal of EARSeL will help attract users to the EARSeL website, so EARSeL should try to ensure that once the user is there to look at the Journal, he will want to stay to read all the other interesting and useful data on this site.

The above ideas on some of the roads EARSeL can take to reach its goals for the coming years will, I hope, encourage debate and discussion, both amongst EARSeL's Member Laboratories as well as

the EARSeL Council, and especially between the two. The EARSeL Council can only drive safely along the road ahead with the active support of its members, acting as navigator to guide and support its initiatives.

Conclusions

(a) Information is not knowledge:

In Europe we often hear of too much EO data sitting unused in large data archives, and that a major challenge is to get data moving. New technologies in data mining, sharing, and access now make it possible to convert data into information. However, the proliferation of RS data from an ever-increasing number of EO satellites is also a serious challenge to the RS community. Regardless of how advanced our satellite sensors, or how fast our computers and image processing facilities, we should never use these as substitutes for our own basic cognitive skills of perception, reasoning and judgement to help solve real world problems and issues in Europe and the Developing World.

(b) What type of car do we select for our journey on the road ahead?

We all know that Europe makes excellent cars. Similarly, Europe has also an impressive track record in space and EO. But what type of car should EARSeL select to drive on the road ahead? Of course that will depend on which type of road it wishes to take to reach its goals, and what type of organisation it will become in the years ahead. Do we expect (want) EARSeL to become a smaller or larger Association? That will help us to decide to select either a Smart or a Renault Espace. Our advice will depend on EARSeL's vision, strategic plan, research priorities, the people serving on Council, the active involvement of all member labs, and many other characteristics.

(c) What makes Remote Sensing great?

High performance in any endeavour, whether it is RS or something else, often boils down to achieving excellence in 4-5 things. The essential qualities for a top-of-the-range car, for example, are clear: speed, precision, control and expression. RS shares the same qualities: SPEED is critical for processing the large amounts of data and getting the information to the end-user in a timely fashion. EO data creates an accurate record of what exists, so PRECISION in 2-D and 3-D, are fundamental. Geometric aspects are needed for many applications in Europe, so good CONTROL is needed. Solving real-world problems in Europe and elsewhere can only be done by creative interpretation and analysis of the data, hence the need for EXPRESSION. This analogy relates to my recommendation to EARSeL to focus its activities on some core domains in which it can become recognised as the leader in Europe.

(d) What's in a name?

Many organisations, feeling that "remote sensing" was too limiting a term, have adopted more broad terms such as "geomatics", "EO", etc. For example, over the years ITC has changed its name several times to reflect advances in technology and applications. Similarly, several RS societies in Europe and elsewhere have changed their names as part of mergers with other societies, changes in technology, re-structuring or re-focusing their priorities. There are so many fields, which formerly worked independently of each other, but because of the digital revolution have become so entwined, causing a name change. Just some of the terms in use today include: RS, EO, geo-informatics, geomatics, spatial technology, GIS, etc. Coupled with the integration of technologies such as photogrammetry, cartography, GPS, surveying, mapping, decision-support systems, location-based services, the list of terms will continue to grow. EARSeL will need to decide where to position itself in this gamut of spatial technologies.

(e) Co-operation with others:

Following on from the above, EARseL should actively seek closer co-operation with other associations, both in RS (e.g. ISPRS, regional associations, national societies in Europe, EARSC) as well as with related associations working in GIS, geomatics, etc. The information requirements of Europe are so complex, that it is

only by integrating various technologies that solutions can be found to the main issues facing European decision-makers. If EARSeL stays isolated in its field, it will not have much influence in European policy-making determining the research agenda of the future, and might subsequently find itself run off the road by other drivers. Hence EARSeL should take the initiative to mobilise all stakeholders through dialogue and commitment by the various European geo-spatial associations to adopt common objectives on research innovation, which should be ambitious enough to address the research challenges faced by Europe. Alternatively, EARseL could request the EU or ESA to host such a meeting of the Council Members of all related European associations to consider how, by working together, a synergistic benefit can be achieved. Prior to such an event, EARSeL should prepare itself well, in terms of its vision, strategic plan, research focus, improved website, etc., to be in a strong position during such a joint meeting.

(f) Road Map for the Future:

At present, EARSeL does not appear to have an up-to-date road map of where it sees itself going in the coming years. It should certainly draw up such a large-scale, up-to-date, detailed "road map for the future" to give its vision on the contribution it, and RS can make to sustained European growth. Fortunately it does not have to start from scratch with a blank map sheet. In addition to its 25 years of experience, EARseL can and should rely heavily on two key documents to prepare their Action Plan, and ensure its relevance. These are:

- Space: a New European Frontier for an Expanding Union: an Action Plan for Implementing the European Space Policy", (COM 673, Final), Brussels, 11-11-2003.

- Global Monitoring for Environment and Security: Establishing a GMES Capacity by 2008, Action Plan 2004-2008, (COM 65, Final), Brussels, 3-2-2004.

These two key documents both contain excellently thought out Action Plans. EARSeL can draw up its own Action Plan by adapting and fusing these two plans into a specific, detailed map for the road ahead. This will ensure relevancy to EU and ESA policy, that EARseL speaks the same language as the EU and ESA, that it understands which direction and road these organisations are taking, and thereby reducing the chance that EARSeL is driving in the wrong direction and losing its way.

The personal recommendations, suggestions and practical action items which I have proposed in this paper cannot be compared to the detailed thought, consultation, meetings, etc. that have taken place throughout Europe to produce these two detailed Action Plans referred to above. I thus urge EARSeL to study these documents very carefully, and select those items from these plans to which it can make a significant contribution.

Final Comment

Based on EARSeL's many years of solid achievement in the coordination and research development of EO in Europe, the author has proposed some ideas that may serve as a basis for EARSeL's new strategic plan. I wish the EARSeL Council, all Member Laboratories, and the many other "friends" of EARSeL, all the best for their journey on the road ahead. *(Disclaimer: All views and opinions expressed in this paper are the sole responsibility of the author, and do not necessarily represent those of either the ITC or the EARSeL Council).*

Next year's EARSeL Symposium

The 25th EARSeL Annual Symposium, entitled "Global Developments in Environmental Earth Observation from Space", will be held at the University of Porto, Portugal, on 6-11 June 2005 Important deadlines to remember are: abstracts (6 November 2004); notification of acceptance (January 2005); preliminary programme (March 2005); deadline for full papers (6 June 2005). The 2005 Symposium will be followed by two SIG Workshops:

- **2nd Workshop on Remote Sensing of the Coastal Zone**, on 9-10 June 2005, chaired by Dr. Rainer Reuter, University of Oldenburg. Website: las.physik.uni-oldenburg.de/workshop.html.

- **1st Workshop on 3D Remote Sensing**, on 10-11 June 2005, chaired by Dr. Karsten Jacobsen, University of Hannover. Website: www.ipi.uni-hannover.de/html/aktivitaeten/earsel.htm

2.2 News from the Special Interest Groups

2.2.1 Land Ice & Snow Workshop in February 2005

The 4th Workshop of the EARSeL SIG Land Ice and Snow, entitled "Remote Sensing of Snow and Glaciers - Important Water Resources of the Future" will be held on 21-23 February 2005, at the Department of Geography, University of Bern, Switzerland. Presentations are encouraged on all fields of environmental research with a focus on snow and ice as water resources, methods for retrieving cryospheric parameters from various types of RS data, theoretical basis of inversion methods and their application, state of the art of retrieval algorithms, data assimilation of RS data and in situ observations in process models, current and planned sensors for snow and ice, etc. The workshop also offers the possibility for sessions covering preparations of and results from field campaigns in mountainous and polar regions. Please send abstracts by e-mail to Dr. Stefan Wunderle (swun @giub.unibe.ch), by 1 October 2004. More information is at the website dude.uibk.ac.at/lissig/.

2.2.2 Imaging Spectroscopy Workshop in April 2005

Current research as well as newly undertaken projects should ensure a broad range of presentations during the 4th Workshop on Imaging Spectroscopy - entitled "New Quality in Environmental Studies" - which will be held at the University of Warsaw in Poland on 25-27 April 2005. Taking place two years after the 3rd Workshop of the EARSeL SIG on Imaging Spectroscopy, in May 2003 in Herrsching (near Munich), Germany, and organised jointly by DLR and EARSeL, there will be many new achievements in the field of imaging spectroscopy, which will be of great interest to the whole remote sensing (RS) community.

The main topics of the 4th Workshop will be: sensors and missions; data enhancement and calibration; terrestrial ecosystems; vegetation; environmental modelling; geology and mining; limnology. The working language at the Workshop will be English. Please send abstracts by e-mail to the EARSeL Secretariat in Paris (earsel @meteo.fr), by 15 October 2004. More information is at www.wgsr.uw.edu.pl/zts/workshop/index.htm.

2.2.3 Forest Fires Workshop in June 2005

The 5th International Workshop on RS and GIS Applications to Forest Fires Management, entitled "Fire Effects Assessment", will be held at the Department of Geography, University of Zaragoza, Spain, on 16-18 June 2005. The structure of the Workshop will be based on four invited lectures, three poster sessions and four Round-Table discussions. The lectures will cover the following topics: burned scar mapping and fire severity discrimination; environmental dynamics after fire (regeneration, fire soil effects, landscape patterns); new sensors for fire detection (UAV, geo-stationary satellites, fire-dedicated satellites, etc.); modelling efforts for fire danger estimation. For more information, please see the EARSeL SIG web-pages: www.geogra.uah.es/earsel, or contact the Workshop organiser Emilio Chuvieco (Emilio.chuvieco@uah.es).

2.3 New EARSeL Members, in Belgrade & Rome

(1) Remote Sensing Centre, Belgrade, Serbia and Montenegro:

The Remote Sensing Centre at the Faculty of Mining and Geology (FMG) in Belgrade (Serbia and Montenegro) was established in 1976 to introduce new space technology into geology and Earth Sciences. The major task is to train students, teachers and graduate researchers from the FMG and other Faculties at Belgrade University (agricul-

ture, forestry, civil engineering and geodesy, ecology, etc.), as well as experts from other schools and scientific institutes, in the application of remote sensing (RS) and GIS techniques. The main fields of application taught concern topography, cartography, geology and land use and land cover.

In April 2004 the Centre organised the 1st Mediterranean Conference on Earth Observation and RS, "MeCEO 2004" (website: www.meceo.info). This was supported by several important international organisations, including EARSeL, and was attended by our Treasurer, Prof. Casanova, and Prof. Oluic, who organised the EARSeL Annual Symposium in Dubrovnik. The Conference was divided into four main sections: the acquisition, processing and applications of RS data and finally co-operation and education for EO, each of which was dealt with in depth. Papers presented in the applications sessions addressed essentially environmental monitoring and risk prevention. The conclusions of the Round-Table that wound up the Conference called for the creation of a European Natural Disaster Environmental Management Centre for better coordination of the regional and national disaster management institutions and networks to minimise disaster risk.

Several of the speakers present at this Conference later attended the 2004 EARSeL Symposium in Dubrovnik. The organisers are to be congratulated on the quality and scope of the papers presented and we look forward to our fruitful co-operation in the future.

The contact person for this new EARSeL Member Laboratory is: Prof. Dr. Radmila Pavlovic (prada@rgf.bg.ac.yu), Remote Sensing Centre, Faculty of Mining and Geology, University of Belgrade, Bjusina 7, Belgrade, Serbia and Montenegro. Telephone: +381-11-3219273. Fax: +381-1-32 35539.

(2) Area di Geodesia e Geomatica, Università di Roma "La Sapienza", Rome, Italy:

The overall research and technical activities of the laboratory cover different topics in Geodesy and Geomatics (data modelling, positioning - GPS and GLONASS, deformation monitoring, digital photogrammetry, remote sensing, cartography, GIS).

With special concern to remote sensing (RS), the laboratory is now engaged in activities related to processing of high resolution satellite and hyperspectral airborne (MIVIS) imagery from the metric point of view, mainly for cartographic purposes; in detail: development of a new rigorous model for the ortho-rectification of high resolution satellite imagery and for DEM extraction from high resolution satellite imagery stereopairs (EROS A, IKONOS); use of high resolution satellite imagery for map updating at 1:25,000 and 1:50,000 scales, in co-operation with Italian Army Geographic Institute; ortho-photo maps production from high resolution satellite imagery for developing countries; use of ortho-rectified high resolution satellite imagery for shoreline evolution monitoring; DEM extraction and validation from high resolution satellite imagery stereo-pairs by available commercial packages; ortho-rectification of MIVIS imagery for integration with other data in GIS and data fusion.

The contact persons of this new EARSeL Member Laboratory are: the Director, Dr. Mattia Crespi (mattia.crespi@uniroma1.it), telephone +39-0644585097, fax +39-0644 585515; Dr. Valerio Baiocchi (valerio.baiocchi@uniroma1.it), telephone +39-064458 5068, fax +39-0644585515. The postal address is: Area di Geodesia e Geomatia, DITS - Università di Roma "La Sapienza", via Eudossiana 18, 00184 Roma, Italy.

2.4 UK's international geo-hazard RS projects

UK involvement in international geo-hazard RS projects

Stuart Marsh (British Geological Survey), Ian Downey (British National Space Centre), Ren Capes (Nigel Press Associates)

Editor: The following is the abstract of a paper that was to have been presented at the 2004 EARSeL Symposium in Dubrovnik, Croatia, but none of the co-authors was able to be present.

The UK is currently playing a leading role within a number of international initiatives aimed at mitigating the impacts of geological hazards using remote sensing. These operate from the strategic level, through the responsive mode, to operational projects.

The Integrated Global Observing Strategy (IGOS) is a strategic planning process that links research, long-term monitoring, operational programmes, data providers and users in a structure that helps determine gaps in Environmental observations and identifies the resources to fill them. Partners include the Committee on Earth Observation Satellites (CEOS), the Global Observing Systems and the International Agencies that sponsor them, the International Group of Funding Agencies for Global Change Research, and various international global change research programmes. The British Geological Survey Chairs the IGOS Geohazard Theme. Its goal is to integrate disparate, multi-disciplinary, applied geohazard research into global, operational systems by filling gaps in organisation, observations and knowledge. The theme was approved in November 2003, and will be implemented over the next decade.

As well as supporting the development of the IGOS for geo-hazards, the British National Space Centre has been involved in more responsive, disaster management initiatives. They are one of the key players in the UN (UNISPACE III) Action Team 7 on Disaster Management, which will publish its final report in 2004. They have also supported the development of the Disaster Monitoring Constellation (DMC). In September 2003, Surrey Satellite Technology Limited (SSTL) successfully launched the latest three DMC satellites. SSTL and its partners propose a network of affordable, micro-satellites providing imaging on a daily basis as an affordable solution to the problem of disaster assessment and monitoring from space.

The satellites, for Nigeria, Turkey and the UK, join AlSAT-1, another Surrey-built satellite launched for Algeria last November. Together, they will transform the ability of international disaster relief organisations to monitor and provide emergency assistance to disaster-stricken zones whenever and wherever they occur. The DMC may be activated by organisations such as Reuters Foundation AlertNet and the International Charter on Space and Major Disasters. Now that the constellation is almost complete, operational use of the system is expected to develop during 2004.

A third UK player behind the IGOS for Geo-Hazards is Nigel Press Associates, who also lead a key European project that aims to put in place a pre-operational system for mitigating geohazards. The Terrafirma Project, one of ten services being supported by the European Space Agency's Service Element within the Global Monitoring for Environment and Security (GMES) Programme, aims to provide a pan-European ground motion hazard information service through the national geological surveys. Initially, the focus is on urban subsidence, but once the project has demonstrated a successful service this may be broadened to include other types of ground motion hazard.

For more information, please contact Dr. Stuart Marsh (shm@bgs.ac.uk).

2.5 New EARSeL web-pages (www.earsel.org)

Have you consulted the EARSeL Web pages recently? If so, you will have seen the new layout and ease of consultation, for example, of our Members' Directory, and other headings. If you find that the details entered concerning your laboratory / company need updating, please inform the Secretariat (earsel@meteo.fr) as soon as possible, since our aim is to ensure that information provided is as accurate as possible.

Preparation of the 2004 issues of the e-Proceedings is progressing, and the review procedure is now underway for the papers received following the Land Use / Land Cover specialist workshop held in Dubrovnik, Croatia, at the end of May 2004. The e-Proceedings are not exclusively for the publication of papers from our specialist workshops, but may also include articles on new applications as well as on advanced methodologies, modelling studies and ground truth methods and measurements.

This on-line, refereed Journal is free for all readers who have access to an up-to-date browser and Adobe Acrobat Reader. All EARSeL Member Laboratories receive a free copy on CD-ROM of each issue. We are aiming for a fast publication time of no more than six months after submission of a paper.

Another service that we are undertaking is to open a digital library of recent PhD theses that have been defended by students from our Member Laboratories. Quite often these reach only a limited audience, which is a pity considering the hard work involved and the fact that reproduction on paper is expensive. So please provide us with the link to the web-link (e.g. pdf file) where your thesis may be found or send us an abstract with a contact address so that interested persons may order a copy.

3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 ESA unveils new Observing the Earth Portal

What is the use of Earth Observation? Quite a lot is the short reply; the full list gets longer all the time. For the complete answer, visit ESA's new "Observing the Earth" Portal (www.esa.int/export/esaEO/), redesigned to highlight the growing number of applications of this unique technique, and featuring a mass of information on ESA's remote sensing (RS) activities. To mark its launch, ESA Earth Observation (EO) Director José Achache explains the thinking the new Portal has been designed around, and shares his views on the past, present and future of EO.

Probably one of the most significant achievements of the space age has been the re-evaluation of planet Earth. When the exploration of space started in the 1960s, space was regarded solely as the means of leaving the Earth to investigate the ends of the universe. Since then, a remarkable change in perspective has taken place. The process of space exploration served to underline the unique value and fragility of the Earth environment. And today, space has come back to Earth in a very practical way: the data returned from satellites turns out to have qualities that classical ground-based observation techniques simply cannot match. Measurements from space are global, continuous, objective and precise. This rich source of information gives us the ability to perceive our planet in many new and varied ways, and this is an ability that can be put to a wide variety of potential uses. Maximising its take-up has been a priority of the EO Directorate in recent years, with a strategy of fostering the development of new applications and services based on user needs.

The new EO Portal has an important role in reaching out beyond purely scientific users. The biggest single block to the wider take-up of satellite data is lack of familiarity with it. The Portal has been designed to inform people, in a clear way, not just about individual missions but about EO as a whole: how it is a tool to improve scientific understanding of our planet, but at the same time helping to secure our environment, and also increasingly enabling value-added services to benefit our economy. In fact, the Portal is directly based around this set of themes: space to understand, to secure and to benefit. Each of these themes features within them a number of introductory background articles and highlighted examples, as well as links to related ESA resources.

Satellites can monitor the state of our world in all sorts of exact ways. They can map land cover and biomass health, identify millimetre-scale buckling in the Earth's crust, measure sea-surface temperature to a few tenths of a degree, plot any increases in average sea level or decreases in ice sheet thickness, chart the chemical composition of the atmosphere down to a few molecules per million, and identify microscopic aerosols drifting in the air. Accurately char-

acterising these various inter-related components of the Earth system improves our knowledge of its current state, but also our potential to predict its future evolution.

There was a time when the Earth sciences were concentrated on the past, modelling how various geomorphic phenomena gave rise to the world, its landscapes and climate. Now the field is coming to be attached to the future tense, as it responds to new needs concerning the forecasting of climate change, the evolution of the global environment and the incidence of natural disasters. Nowadays the knowledge of the laws of physics enables increasingly sophisticated numerical models of the Earth system that allow scientists to extrapolate its future state. The more closely these models match observed reality the more confident we can be in their predictions. By assimilating data from satellites these models are being established as reliable forecasting tools.

This same detailed wide-area perspective that aids science is a tool for more effective stewardship of our environment and better protection of our citizens from natural hazards. Effective governmental decision-making requires the acquisition of accurate up-to-date information, and EO makes possible the gathering of high-quality intelligence on a global scale. The most high-profile example is ESA's joint endeavour with the EU called Global Monitoring for Environment and Security (GMES). The aim of GMES is to set up information-gathering infrastructures and services for governments, administrations and municipal authorities. Its remit includes the forecasting and management of natural risks, management of resources, monitoring and implementing major international environmental agreements, the management of wetlands and rural areas, and the conservation of biodiversity and national heritage.

ESA has commenced with the five-year GMES Services Element (GSE) comprising operational services integrating space and ground-based observations. Many of these services have evolved from existing pilot projects – also detailed in the new Portal – dealing with activities such as international treaty implementation and supporting civil protection agencies. To give one current example of how EO is helping to secure people and the environment, ESA has been a founding member of the international Charter on Space and Major Disasters, committing world space agencies to supply satellite data to civil protection groups responding to natural or man-made disasters. In less than four years the Charter has been activated more than 50 times.

Regarding economic benefits, the single clearest practical benefit from EO is the improved accuracy of weather forecasting made possible by meteorological satellites like ESA's Meteosat series – in this instance every single citizen is a daily consumer of satellite data, and it has brought huge benefits to agriculture and industry. Beyond this now self-sustaining aspect of EO, we have been working hard to develop other applications for commercial activities. There has been a long history of attempting to commercialise EO during the last 20 years, but with an early emphasis on direct selling of satellite imagery rather than value-adding services.

The example of weather forecasting shows how this initial strategy was flawed – the ordinary person watching the weather on television is not interested in the satellite image alone but the analysis and forecast derived from that image. Our emphasis now is on tailoring EO-based information products and services for specialised market segments, and doing this by fostering links between the EO industry and new user groups. The result has been the start of specific services serving such activities as oil and gas exploration, forest management, agricultural - most notably rice - forecasting, and ship navigation through sea ice and bad weather.

More broadly, EO can also underpin our future economic development by ensuring it occurs in a sustainable way, with natural resources being exploited at a replaceable rate. The 2002 World Summit on Sustainable Development in Johannesburg made clear the role space-based systems could play in helping to manage growth so that finite resources such as agricultural land and clean water are not diminished. De-

tailed information on all this work is available at the new EO Portal. I hope people will visit it so they can judge the importance of these activities for themselves. This article is based on a report on the ESA website (www.esa.int) on 19 July 2004.

3.1.2 New satellite marks China - ESA co-operation

On 25 July 2004 the Chinese National Space Administration successfully launched Tan Ce 2, the second of the Double Star science satellites. This marks the latest important milestone in the scientific collaboration between China and the ESA. Tan Ce ("Explorer") 2 was launched from the Taiyuan spaceport west of Beijing (Zhangye province) using a Long March 2C rocket. The spacecraft will join Tan Ce 1, launched on 29 December 2003, to complete the Double Star configuration. Double Star will operate alongside ESA's quartet of Cluster satellites to closely study the interaction between the solar wind and the Earth's magnetic field. Together, these missions will provide the most detailed view to date. TC-1 is already returning a wealth of scientific data. Back in January, both missions tracked a coronal mass ejection from the Sun and gathered valuable data about the Earth's bow shock. *(Editor: Earth's bow shock is a sharp front formed in the solar wind ahead of the magnetosphere, marked by a sudden slowing-down of the flow near Earth. It is quite similar to the shock forming ahead of the wing of a supersonic airplane. After passing near Earth, the slowed-down flow gains speed again, to the same value as the surrounding solar wind).*

The positions and orbit of the Double Star satellites have been carefully defined to enable exploration of the magnetosphere on a larger scale than is possible with Cluster alone. One example of this co-ordinated activity is the study of the sub-storms that produce aurorae. The exact region where these emissions of brightness form is still unclear, but the simultaneous high-resolution measurements from these two missions are expected to provide an answer. ESA is contributing eight scientific instruments to the mission, seven of which are Cluster-derived units. These are the first ever European experiments to fly on a Chinese satellite. ESA will also be providing ground segment support, four hours each day, via its Villafranca satellite tracking station in Spain.

Scientific co-operation between China and ESA goes back a long way. A first Agreement signed back in 1980 facilitated the exchange of scientific information. In 1993, the collaboration focused on a specific mission, Cluster, to study the Earth's magnetosphere. Then, in 1997, came a big step forward. The CNSA invited ESA to participate in the Double Star dual-satellite mission to study the Earth's magnetic field, from a perspective different from but complementary to Cluster's. The Agreement for this joint mission was signed on 9 July 2001 by ESA's then Director General Antonio Rodotà and CNSA Administrator Luan Enjie. For Professor David Southwood, ESA's Science Programme Director, the successful launch marks the culmination of these joint efforts and a further important step forward in this historic collaboration between China and Europe.

Cluster comprises a quartet of satellites launched on two Russian rockets during summer 2000, now flying in formation around the Earth. They are relaying the most detailed ever information in 3D about the impact on Earth of the solar wind, that perpetual stream of sub-atomic particles given out by the Sun which can damage communication satellites and disrupt power supplies. Operations have been extended to end-2005. The Double Star position and orbits have been defined in relation to Cluster, which are located far away at about a third of the distance from the Moon. The two are much closer to Earth. TC-1 in elliptical orbit will operate for 18 months. TC-2 in polar orbit will operate for 12 months. This allows an overlap period, the quartet's lifetime having been extended by three years to end-2005. ESA is also contributing 8 million euros of funding to the programme. This covers the refurbishment, re-building and pre-integration of the European instruments, four hours per day data acquisition and the coordination of scientific operations. This article is based on a report on the ESA website (www.esa.int) on 26 July 2004.

3.1.3 Space research needs more political support

ESA's director of science has appealed to researchers to try harder to persuade politicians to invest in space exploration. Professor David Southwood made the impassioned plea at a panel discussion on the future of European space studies at a conference in Paris, France. He said that scientists should take advantage of the currently large public appetite for space exploration.

"Now is the time to strike with your politicians," he said. "Now suddenly everyone is interested in space. This is frightening to us European scientists because it isn't ours anymore. But this is actually the great opportunity because once the population is excited about space, you will find that politicians become excited about space." He added that it was now up to the scientists sitting in the room to capitalise on the headway made by Beagle 2, Mars Express and Cassini-Huygens. "The last place you can make this point is from a top-down organisation. It has to come up from the bottom. It has to be the scientists going out and demanding: Look, the ordinary people want Europe out in space. And they do. I don't have the slightest doubt. This is an opportunity for all European scientists and instead, we're sitting around arguing about the mechanisms by which we may distribute an imaginary budget, because that budget has to come out of our parliaments." Professor Southwood was referring to the bleak tone of an earlier discussion here at the Committee on Space Research (Cospar) scientific assembly over the lack of funding for space research in Europe.

Space scientist Dr Bo Andersen of the Norwegian Space Agency, who also sat on the panel, said that European research was under-funded compared with its voiced ambitions. "This is an enormous danger," he said. "The increased efficiency of those scientists at ESA and in industry cannot be stretched further and further. We may hit the wall before we know it."

The European Commission (EC) now funds about 4% of total public money available for space research in Europe. Some observers see this as a possible new funding stream that could increase with time. But others on the panel said the problems needed to be tackled at a more fundamental level. "We must not see the EC as the saviour of space research. This is all taxpayers' money and unless we have a fundamental change in the will of politicians in Europe to fund space at an adequate level, it doesn't matter what channels the money goes through," said Dr Andersen. "I sincerely hope that the EC will increase its space activities, and that the Member States do not use this as an excuse to decrease theirs," he added. This article is from a report on the Science and Nature section of the BBC News website (news.bbc.co.uk) on 23 July 2004.

3.2 News from the EC

3.2.1 New JRC unit on agriculture & fisheries

On 1 June 2004, a new Unit - AGRIFISH (Agriculture and Fisheries) - was created at the European Commission's Joint Research Centre (JRC). The new Unit, which is part of the JRC's Institute for Protection and Security of the Citizen (IPSC), is a result of the merging of four JRC actions (including three on the JRC's Monitoring Agriculture with Remote Sensing / MARS activity):

- MARS-PAC (Compliance and Control of Agricultural and Regional Policies)
- MARS-STAT (Crop and Yield Monitoring Activity)
- MARS-FOOD (Crop Monitoring for Food Security)
- FISHREG (Monitoring Compliance with EU Fisheries Regulations)

The MARS project started in 1988, and was initially designed to apply emerging space technologies for providing independent and timely information on crop areas and yields. Since 1993, driven by user requirements, the team has contributed towards a more effective and efficient management of the Common Agricultural Policy through the provision of a broader range of technical support services to DG Agriculture and Member State Adminis-

trations. Since 2000, the expertise in crop yields has been applied outside the EU. Services have been developed to support EU aid and assistance policies and provide building blocks for a European capability for global agricultural monitoring and food security assessment.

The JRC's work in fisheries began in 1999 with a study to determine the feasibility of monitoring fishing vessel positions from space. Working closely with DG-FISH and authorities in Member States, this work has moved closer towards an operational capability and, from 2002 onwards, has been complemented by studies of electronic logbooks for catch reporting and DNA for traceability. Starting in 2004, the team has begun to support DG-FISH's efforts to improve the timeliness and accuracy of its scientific advice.

The tools and expertise developed within the AGRIFISH Unit integrate research and techniques in: statistics (e.g. area frame sampling); image processing and interpretation (satellite or air-borne); GIS management & web-based information technology; Geomatics and GPS (orthophotos, large scale mapping, parcel measurement); agro-meteorological models (crop growth / yield); standardisation and Quality Control.

A complete description of the activities of the JRC's new AGRIFISH Unit is available at the Unit's website (agrifish.jrc.it). The website also provides links to web-pages presenting more detailed information. The Activities web-pages bring you to the introductory pages of the main AGRIFISH Unit activities (MARS-PAC, MARS-STAT, MARS-FOOD, FISHREG). The Bulletins web-page links you to downloadable bulletins for various regions (Europe, Russia, Africa). The Announcements web-page serves you the hottest AGRIFISH news items chronologically. The Contacts webpage provides the postal address of the department as well as all contact details for AGRIFISH Unit members. The Conferences web-page lists all meetings, workshops and conferences organised by the AGRIFISH Unit. This article is based on a report on the JRC website (www.jrc.cec.eu.int/pressroom) on 19 July 2004.

3.2.2 Proposed EU directive on geographic data

On 23 July 2004, the European Commission (EC) proposed a new Directive calling on EU Member States to put geographical information (GI) on a publicly accessible electronic network and progressively to harmonise it. At present, information on rivers, road networks and other geographical features is collected in an uncoordinated way and based on different methods and specifications, resulting in data gaps and lack of comparability. The aim of the EC's INSPIRE (Infrastructure for Spatial Information in the European Union) initiative is to improve mapping in Europe. INSPIRE, a database with consistent GI, will support environmental protection policies as well as infrastructure development, agriculture and maritime navigation.

Margot Wallström, the outgoing European Environment Commissioner, welcomed the Proposal: "INSPIRE will harmonise GI in the EU, which will vastly help us to better plan, implement and monitor environmental measures. It will improve our capability to protect biodiversity, fight pollution and prevent floods and fires. There is a clear need for a common EU approach in this field so we can maximise the use of existing data." According to outgoing Research Commissioner Philippe Busquin: "INSPIRE will provide a framework for translating research and development (R&D) results into operational tools. Well-organised R&D at the EU level is needed to implement our policy agenda, from the Lisbon objective to the Sustainable Development Strategy. European research will also benefit from the initiative as INSPIRE will make geographical databases, essential for scientific and environmental investigations, more readily available."

(Editor's note: as announced on 12 August 2004 by new EC President José Manuel Barroso, the new Commissioner for the Environment is Stavros Dimas, while the new Commissioner for Science and Research, Janez Potočnik).

The proposed Directive requires EU Member States to publish GI on publicly accessible websites, co-ordinated by the INSPIRE

"geo-portal" (see end of article for web-address). Member States will also develop, with the support of the EC, common rules to gather new or update existing GI. The system should be fully operational within ten years. INSPIRE will cover themes such as administrative boundaries, road networks, hydrography, land cover, population, risk zones, diseases, and habitats and species. Both public authorities and the general public will benefit, by increased capability for rapid reaction to natural disasters, and more efficient implementation of EU legislation that relies on consistent data and more efficient meteorology. The new Proposal is the outcome of an Internet consultation with about 180 responses from more than 1,000 stakeholders.

The 6th Environmental Action Programme (EAP) identifies better information as one of the keys to improve environmental policy in the next decade. GI plays a special role here, because of its potential to present information in a lively and understandable way to citizens and stakeholders. INSPIRE is one of two new initiatives being prepared by the EC to stimulate the availability of environmental information - the other is GMES (Global Monitoring for Environment and Security). Implementation of these initiatives will represent an important support to some of the key approaches advocated in the 6th EAP:

- Ensure the implementation of existing environmental legislation;
- Integrate environmental concerns into all relevant policy areas;
- Ensure better and more accessible information on the environment for citizens;
- Develop a more environmentally conscious attitude towards land use.

Both initiatives are broader than environment only, but for both, support to environmental policy is one of the key objectives. INSPIRE, for example, will make available relevant, harmonised and quality GI for the purpose of formulation, implementation, monitoring and evaluation of Community environmental policy-making and for the citizen. Furthermore, by establishing from the onset cross-sectoral co-ordination mechanisms, INSPIRE will provide access to compatible information across sectors such as environment, transport and agriculture. It will also help the integration of environmental considerations in other sectors and supporting the new approach to more coherent policy-making advocated by the EU sustainable development strategy.

The official reference for the new Proposal on INSPIRE is: European Commission. 2004. Proposal for a Directive Establishing an Infrastructure for Spatial Information in the Community (INSPIRE). COM (2004) 516 final of 23.7.2004. The full text of the Proposal may be found at the EC's internet portal to EU law (website: europa.eu.int/eur-lex/en) under "Legislation in preparation - recent proposals not yet included in the Directory". The web-address for the INSPIRE "geo-portal" mentioned earlier is: eu-geoportal.jrc.it/gos.

3.2.3 Proposed concerted EU action on floods

On 12 July 2004 the European Commission (EC) - for the first time – proposed concerted EU action on flood risk management to improve protection against flooding. The EC proposes a number of actions. These include flood risk management plans for affected river basins and coastal zones, flood risk maps showing the areas at risk of flooding, co-ordination of information exchange, ensuring the contribution of all relevant EU policies, and increasing public awareness. Between 1998 and 2002, Europe suffered over 100 major damaging floods, including the catastrophic floods along the Danube and Elbe rivers in 2002. Since 1998, floods have caused some 700 deaths, the displacement of about half a million people and at least € 25 billion in insured economic losses.

Outgoing Commissioner for the Environment Margot Wallström said: "Catastrophic floods endanger human lives and cause human tragedy. They also affect economic life and undermine Europe's progress towards sustainable development. Although floods are natural phenomena that we cannot prevent, we can try and reduce their likelihood and protect ourselves more effectively. I believe that only concerted ac-

tions can improve flood protection all over Europe. We need better co-ordination with the participation of all member states to achieve this goal."

The risk of floods will probably increase during the coming decades. Two trends point to this. Firstly, the magnitude and frequency of floods are likely to increase in the future as a result of climate change, i.e. higher intensity of rainfall as well as rising sea levels. Secondly, the impact of flood events may increase, because more people live in areas at risk of flooding and also more economic assets (business and industry) are located in such areas. Moreover, human activities such as the clearing of forests, the straightening of rivers, the suppression of natural flood plains and poor land planning, have contributed significantly to increasing the risk of floods.

The challenge is to protect society and the environment from the negative effects of floods. Therefore, in the new Communication on Floods, the EC is promoting a concerted EU programme to improve flood protection. Member States will co-operate and co-ordinate to develop and implement flood risk management plans at river basin level and within coastal areas to prevent problems being passed on from one area to another. Flood risk maps will be developed as a tool for planning and communication. The Commission will facilitate co-ordination of information exchange on flood protection and the promotion of best practices as well as ensuring that all relevant EU policies contribute to flood protection. The Member States and the EC together will be responsible for the overall co-ordination of the action programme.

The added value of concerted European action will result in better management of flood risks and hence an improved level of protection. In addition, citizens will be better prepared in case of a flood event and know how to act in order to reduce the damage. The subject of flooding was discussed at the informal Environment Council on 18 July 2004. The Dutch presidency has defined flood protection as one of its priorities.

The official reference for the new Communication on Floods is: European Commission. 2004. Communication on Flood Risk Management - Flood Prevention, Protection and Mitigation. COM (2004) 472 final of 12.07.2004. The full text of the Communication may be found at the EC's internet portal to EU law (website: europa.eu.int/eur-lex/en) under "Documents of public interest" - search by year (i.e. 2004) and number (i.e. 472). The Communication, as well as other information on EU's water policy, can also be found at: www.europa.eu.int/comm/environment/water/.

3.2.4 Space research in next Framework Programme

A recent European Commission (EC) Communication sets its sights on securing Europe's leading role in research and technological development (RTD). Space research is identified as a "key topic" for achieving this. The strategy proposal, published on 16 June 2004, recommends increasing EU funding to around 10 billion a year during the next Framework Programme (FP7), starting in 2007, reducing the number of research themes and focusing future European efforts on key topics, specifically mentioning both space and security. The EC advocates setting up an "agency" to support basic research, as well as encouraging more joint initiatives to get behind industrial policy. The Proposal also endorses further efforts to develop RTD infrastructures and boosting the numbers of skilled researchers and innovation taking place in key sectors.

Outgoing Research Commissioner Philippe Busquin said: "The debate on the future of research in Europe has been launched. Scientific RTD is key to the future of Europe because it generates more than half of economic growth and determines Europe's political weight on the international scene. By backing a more innovative Europe, we are investing in the well being of future generations."

The new RTD strategy document was based on a February 2004 Proposal on the future of EU research. With the latest Proposal, the EC aims to provide a concrete response to the objectives of the Lisbon strategy and to support the European Re-

search Area (ERA). Setting up European "centres of excellence", by increasing co-operation between scientific stakeholders at all levels, is also a priority to exploit fully European added-value. It is important to create what it calls a "critical mass" of material, human and intellectual resources, and better to mobilise public and private research funding. By doubling the budget and concentrating research on fewer priorities in FP7 (than in FP6) the Proposal suggests this might improve the chances of making this happen. It puts forward six major objectives to stimulate European research and the ERA:

- Creating European centres of excellence by means of collaboration between laboratories.
- Launching technological initiatives on an EU scale in promising industrial sectors, by creating joint undertakings.
- Boosting the creativity of basic research by means of competition between individual teams at European level.
- Making Europe more attractive to the best researchers by increasing support for them.
- Developing research infrastructures of European interest based on the example of the trans-European networks.
- Strengthening co-ordination between national research programmes.

In the lead-up to FP7, the EC plans to identify topics on which European research should focus its talents. Two topics of great importance have already been identified: space and security.

In November 2003, the EC adopted the White Paper on European Space Policy. The White Paper recommends the development of a strong, scientific, technological and industrial base for space activities. This will be based on and guided by a "European Space Programme", currently being developed by the EC in collaboration with ESA, and scheduled to be adopted by the EC in spring of 2005. Research will play a key role in the European Space Programme, focusing on:

- Technologies for the exploitation of space, in the areas of satellite radio-navigation (GALILEO), global monitoring for environment and security (GMES) and satellite telecommunications.
- Space transport technology - essential for ensuring independent access to space for Europe.
- Scientific activities in space, including, for example, the use of the International Space Station and space exploration.

Under the new strategy, the Commission also puts forward its plans to streamline and improve the way EU research programmes and funding are implemented and managed. Here, it puts forward the idea of conducting management through partnerships or through "external" actors. The EC also said it wants to improve the way the Framework Programmes work by reviewing and simplifying their financial and administrative provisions, possibly in light of what it has learned from the mid-term evaluation of the new instruments in FP6 and experience gleaned from the first calls for proposals. This article is based on a report on the EU's European Space Policy website (europa.eu.int/comm/space/) on 3 August 2004.

The Commission's new Communication on Science and Technology is entitled: "Science and Technology, the Key to Europe's Future - Guidelines for Future European Union Policy to Support Research", COM (2004) 353 final of 16.6.2004. The full text of the Communication may be found at the EC's internet portal to EU law (website: europa.eu.int/eur-lex/en) under "Documents of public interest" - search by year (i.e. 2004) and number (i.e. 353). Further information on the EU's RTD policy can be found at the DG Research website: europa.eu.int/comm/dgs/research/.

3.3 References to space in new EU constitution

On 18 June 2004 in Brussels, after extensive talks between leaders of the 25 EU Member States, a Constitution was agreed for the EU, including specific references to EU space activities. The EU Constitution brings together, for the first time, the many treaties and agreements on which the EU is based. It defines the powers of the Union, stating where it can and cannot act and

where the Member States retain their right of veto. It also defines the role of the EU institutions, providing orientation for the important work of the European Commission (EC), for example in its support of research and technological development (RTD).

Space is inherently extra-territorial, presenting key opportunities to develop and exploit a range of highly beneficial private and public services, including conventional and broad-band communications, environmental monitoring, satellite-based navigation and Earth observation (EO), as well as defence- and security-related services. The fact that space is referred to specifically in the new Constitution reflects the growing recognition among EU leaders that space systems and related technologies can be used to provide beneficial products and services to European citizens, while delivering a powerful competitive edge to European industry in the global market place.

Article I-13 of the EU Constitution ("Areas of Shared Competence") states: "In the areas of RTD and space, the Union shall have competence to carry out actions, in particular to define and implement programmes. However, the exercise of that competence may not result in Member States being prevented from exercising theirs." In the words of former French President Valery Giscard d'Estaing, the allocation of competencies among the EU and Member States makes it clear "who does what in Europe". The definition of space as a shared competence gives the EU the authority to implement space programmes, as long as it does not interfere with Member States' activities.

Section 9 ("Research and Technological Development, and Space"), Article III-150 *(Editor: error in original report - the correct reference is Article III-155. ☺)* of the Draft Treaty states: "To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support RTD and co-ordinate the efforts needed for the exploration and exploitation of space. To contribute to attaining the objectives referred to [above], a European law or framework law shall establish the necessary measures, which may take the form of a European space programme." For members of the space sector, these unprecedented references to space in a European Treaty represent a true milestone, laying the way for a new era for Europe in space.

Guided by the White Paper on European Space Policy of 2003, the EU has already been moving forward rapidly with important space initiatives. The entry into force of the EC and ESA Framework Agreement and the launching of a new "Panel of Experts on Space and Security" are just two recent examples. Speaking at the first meeting of the EU / ESA High-Level Space Policy Group, the Director General of DG Research of the EC, Achilleas Mitsos, said that the new draft European Constitution is "a window of opportunity for joint space activities". This article is based on a report on the EU's Space Policy website (europa.eu.int/comm/space/) on 13 July 2004.

The full text of the new EU Draft Treaty - entitled "Draft Treaty Establishing a Constitution for Europe" (CONV 850/03, of 18 July 2003) - may be downloaded from the website of the European Convention (european-convention.eu.int).

3.4 UN boosts Space & Major Disasters Charter

On 18 June 2004, during a colloquium at UNESCO in Paris, the United Nations (UN) Office for Outer Space Affairs (OOSA), represented by its Director, Mr Sergio Camacho, announced that the UN intends to remain a "co-operating body" supporting the International Charter on Space and Major Disasters. OOSA intends to enhance promotion of the Charter and to act as gateway for UN agencies responding to natural disasters and emergencies. The colloquium is being jointly organised by the French (CNES) and Canadian (CSA) space agencies, with ESA participation, in the framework of the Canada-France 2004 celebrations.

ESA, CNES and CSA became the founding parties to the Charter during the UNI-

SPACE III Conference in July 1999. After five years in operation, the Charter has been activated more than 50 times in all parts of the world, supporting the management of disasters caused by floods, oil spills, earthquakes, volcanic eruptions and fires. To date, the founding parties have been joined as parties to the Charter by the US National Oceanic and Atmospheric Administration (NOAA), the Indian Space Research Organisation (ISRO) and the Argentinean Space Agency (CONAE). The Japanese Aerospace Exploration Agency (JAXA) has applied to become a party.

The Charter is based on voluntary contributions, by all parties, of Earth observation (EO) satellite data. Its main purpose is to supply states or communities whose populations are exposed to risk or have been affected by a natural or technological disaster with data providing a basis for anticipating and managing potential or actual crises. It relies on limited space capabilities offered by the parties but "this is a focused, concrete demonstration of what a more ambitious programme of global environment and security monitoring can deliver to disaster mitigation and crisis management authorities", said José Achache, ESA Director of EO Programmes. This article is based on a report on the ESA website (www.esa.int) on 15 June 2004.

3.5 EU & USA co-operation on Galileo & GPS

On 26 June 2004, at the EU-US summit at Dromoland Castle, Ireland, Europe and the US signed a deal to co-operate on satellite navigation (Sat-Nav). It means that the EU's planned Galileo system will be compatible with the US GPS - ending a trans-Atlantic dispute. The agreement determines how Galileo's frequencies should be structured which, crucially, will allow signals to be jammed in war zones if necessary. The pact was signed by US Secretary of State Colin Powell and Loyola de Palacio, outgoing EU Transport Commissioner *(Editor: the new EU Transport Commissioner is Jacques BARROT).*

The Galileo project will see its first spacecraft deployed in 2007. The final constellation of 30 satellites will more than double those of the US GPS, increasing the accuracy and reliability of navigation and timing signals that can be received across the planet. Europe believes a Sat-Nav system that is independent of but inter-operable with GPS, will drive a multi-billion euro industry in which receivers access many more markets - from consumer mobile devices such as cell phones to safety-critical applications such as guided trains and buses.

But the idea of Galileo had irked the US Department of Defence, which controls the existing US system, because of the potential of Galileo's signals to interfere with those intended for use by the US military. The Pentagon feared the frequency structure being demanded by Brussels in the so-called Upper L Band between 1559 and 1591 MHz could have prevented US commanders from degrading navigation data in the theatre of war to all but their own forces, as is possible at present. The new accord between the EU and US sees Europe shift its frequency choices to a standard known as Binary Offset Carrier 1.1. The change in technical parameters will allow either side effectively to jam the other's signal in a small area, such as a battlefield, without shutting down the entire system. More importantly from the civilian perspective, the agreement allows the systems to be meshed seamlessly, greatly benefiting manufacturers, service providers and consumers.

Better accuracy, especially in built-up areas where the current GPS signal can be patchy, should lead to a bigger demand for positioning systems. Four permanent working groups are being set up to work through all the remaining and future compatibility, trade, development, and security issues.

Europe's own global satellite navigation system will: work alongside the US GPS and Russian Glonass systems; provide real-time positioning down to just a few metres; be guaranteed under all but the most extreme circumstances; be suitable for safety-critical systems - e.g. for running trains, guide cars and landing planes. There are expected to be more than 400

million Sat-Nav users by 2015. European aerospace and electronics firms say it will create more than 100,000 jobs. Rescue services will be able to pinpoint the exact location of a car driver's accident. It will also allow someone to find his way in an unfamiliar city using his mobile phone. This article is from a report on the Science and Nature section of the BBC News website (news.bbc.co.uk) on 26 June 2004.

3.6 Italy's major role in satellite navigation

Europe is implementing its satellite navigation (Sat-Nav) system in a two-step approach. The first step will lead to a European overlay navigation system, called EGNOS (European Geostationary Navigation Overlay Service), using the two existing navigation satellite constellations (GPS and Glonass). This system is already contracted to industry, and test operations start by 2002. The second step (Galileo) is intended to enable Europe to become a major partner in the setting up of a civilian satellite service around 2008. This service will meet worldwide the multi-modal navigation requirements and can operate either autonomously or together with other systems. Aeronautical, maritime and land mobile users will greatly benefit from the service. On 13 July 2004, a master control centre for EGNOS was opened at the air traffic control centre in Ciampino (near Rome, Italy), operated by ENAV, the Italian agency for air navigation services.

When completed later this year, EGNOS - the precursor to Galileo, the full global satellite navigation system under development in Europe - will consist of three geostationary satellites and a network of ground stations (nearly 40). These stations will transmit information on the reliability and accuracy of the positioning signals sent out by the systems currently operating, GPS and GLONASS. EGNOS will allow users in Europe and beyond to determine their position within 2 metres, compared to about 20 metres with GPS. After certification, EGNOS will be used for safety-critical applications such as flying aircraft or navigating ships through narrow channels. There will also be many mass-market applications, such as car navigation or bus and truck fleet management, and professional or specific uses, like assistance to blind pedestrians.

The new master control centre in Ciampino is now ready to be operated, along with four facilities deployed in Italy: two ranging and integrity monitoring stations (in Ciampino, and Catania, Sicily) to pick up GPS signals and deliver them to the control centres for processing, and two "navigation land-earth stations", one in Fucino and the other in Scanzano, Sicily, to send EGNOS-processed signals to the geo-stationary satellites, which then relay them back to users' receivers. Other EGNOS facilities deployed so far include two more master control centres, at the German air traffic control centre in Langen, near Frankfurt, and the Spanish air traffic control centre in Torrejón, near Madrid, plus a network of stations across Europe.

With the EGNOS system, Europe transmits a positioning signal through its own network, and receivers can now track it. The Italian facilities are now reinforcing this first step for Europe in satellite navigation, paving the way for Galileo. EGNOS is a joint project of the European Space Agency, the European Commission, and Eurocontrol, the European Organisation for the Safety of Air Navigation. This article is based on a report on the ESA website (www.esa.int) on 6 July 2004.

4 RS DATA, PRODUCTS & PROJECTS

4.1 Observations

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

Recent launches:

Aura
On 15 July 2004, at 10.03 GMT, NASA's AURA was finally successfully launched by a Delta 2 launcher. On 13 July the launch procedure was aborted about half an hour before launch due to problems with the satellite's solid state recorder. One day later, again the launch had to be halted, this time due to a problem with a battery on the launcher. AURA is the third satellite in NASA's Earth Observing System (EOS) programme. Its primary goal is to take measurements from the Earth's atmosphere, while its predecessors Terra and Aqua were mainly focused on land and sea observations. AURA has four instruments on board to make daily global observations of the atmosphere: High Resolution Dynamics Limb Sounder (HIRDLS), Microwave Limb Sounder (MLS), Troposheric Emission Spectrometer (TES) and Ozone Monitoring Instrument (OMI). The last instrument is build and designed by the Dutch Agency for Aerospace Programmes (NIVR) in collaboration with the Finnish Meteorological Institute (FMI), and is a continuation of the GOME, SCIAMACHY and GOMOS instruments. Data will be made available via the EOS Data Gateway (website: edcimswww.cr.usgs.gov/pub/imswelcome/). More information about AURA is at the website: eos-chem.gsfc.nasa.gov/index.html. *(Editor: See also Section 4.11 below).*

New data sets:

ResourceSat-1
Space Imaging announced that it became exclusive international distributor of imagery from the Indian ResourceSat-1 satellite. ResourceSat-1 acquires multi-spectral data at resolutions ranging from 5.8 to 56 metres with three instruments: LISS-3, LISS-4 and AWiFS. Global data from all instruments at different processing levels can be purchased at www.spaceimaging.com/

SRTM DEM
JPL, NASA, NGA, and USGS have released 3 arc-sec (about 90 metres) DEMs of Australia, New Zealand, and the remaining islands. This marks the completion of the global SRTM digital elevation data set. All data in 1 x 1 degree tiles are available from ftp://edcsgs9.cr.usgs.gov/pub/data/srtm/. The data from North and South America can also be accessed via the USGS Seamless Server (website: seamless.usgs.gov/). The data are preliminary, un-edited, research-quality products. Various documentation files are available, either with the data or at www2.jpl.nasa.gov/srtm/.

Other news:

TRMM
TRMM (Tropical Rainfall Measuring Mission), the highly successful mission to monitor rainfall in the tropic and sub-tropic regions, was launched in 1997, with a planned mission life-time of 1.5 years. In June 2004, NASA said that it would start decommissioning the healthy and fully operational TRMM in July 2004, followed by a controlled re-entry into the Earth's atmosphere in 2005. According to NASA, this would ensure that enough fuel would be left for safe de-orbiting of the satellite. After continuous discussions with officials from the mission partner, the Japanese Aerospace Exploration Agency (JAXA) and NOAA, it was decided to extend the TRMM mission until the end of this year, to cover the 2004 Hurricane season. More information about TRMM is at the website: trmm.gsfc.nasa.gov/ The proposed follow up mission for TRMM is the Global Precipitation Measurement mission. GPM is scheduled for launch in 2008. Website: gpm.gsfc.nasa.gov. *(Editor: See also Section 4.4 below).*

Coming up soon:

Cryosat
The launch of the European radar altimetry mission Cryosat has been postponed from July to November 2004. Its primary objec-

tive is to determine variations in the thickness of the Earth's continental ice sheets and marine ice cover. More information is at: www.esa.int/export/esaLP/cryosat.html. *(Editor: See also Section 4.3 below).*

GOES-N
NOAA's latest geo-stationary satellite GOES-N is scheduled for launch on 1 December 2004. Like its predecessors, it will carry two instruments to provide full disk imagery, primarily focused on weather forecasting. Website: goespoes.gsfc.nasa.gov/

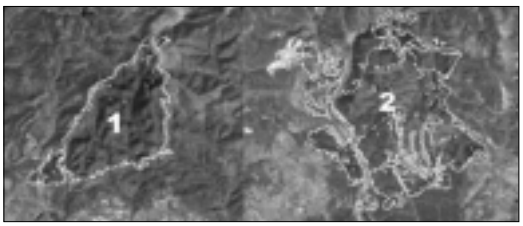
4.2 Tracking Europe's wildfires by satellite

Burning with a core heat approaching 800°C and spreading at up to 100 metres per minute, woodland blazes bring swift, destructive change to landscapes. The resulting devastation can be seen from space. An ESA-backed service to monitor European forest fire damage will help highlight areas most at risk of future outbreaks. The long hot summer of 2003 was a bumper year for forest fires, with over half a million hectares of woodland destroyed across Mediterranean Europe. So far in 2004, fresh fires have occurred across Portugal, Spain and southern France, with thousands of people evacuated from blazes north of Marseilles. According to the European Commission (EC), each hectare of forest lost to fire costs Europe's economy 1,000 to 5,000 Euros.

The distinctive "burn scars" left across the land by forest fires can be identified from space as a specific reddish-brown spectral signature from a false-colour composite of spectral bands from optical sensors in the short wavelength infrared, near infrared and visible channels. A new ESA-backed service based on Earth observation (EO) is making use of this fact, employing satellite imagery from SPOT and Landsat automatically to detect the 2004 burn scars within fire-prone areas of the Entente region of south-west France, within the Puglia and Marche regions of Italy and across the full territory of Spain. Burn scar detection is planned to take place on a seasonal basis, identifying fires covering at least one hectare to a standard resolution of 30 metres, with detailed damage assessment available to a maximum resolution of 2.5 metres using the SPOT 5 satellite.

Partner users include Italy's National Civil Protection Department, Spain's Dirección General para la Biodiversidad (a directorate of the Environment Ministry that supports regional fire-fighting activities with more than 50 aircraft operating from 33 airbases), as well as France's National Department of Civil Protection (DDSC) and Centre d'Essais et de Recherce de l'Entente (CEREN), the test and research centre of the government organisation tasked with combating forest fires, known as the Entente Interdépartementale. Italy's National Civil Protection Department is providing advice on the implementation of the Risk-EOS service, based on previous experience with an ESA Data User Programme (DUP) project called ITALSCAR.

"To cope with fire disasters, the most affected Departments in the south of France have decided to join forces to ensure effective forest fire protection," explained Nicolas Raffalli of CEREN. "Within the Entente region we have an existing fire database called PROMETHEE, which is filled out either by firemen, forestry workers or policemen across the 13 Departments making up the region."



View of burn scars arising from the 2003 fires in the Var region of southern France. Burn scar 1 is from the Fréjus fire, with an estimated surface area of 924 ha in the PROMETHEE database, compared to 891 ha from Landsat. Burn scar 2 comes from the La Motte fire, with 1960 ha in PROMETHEE, compared to 1674 ha from Landsat. Credits: Risk-EOS.

Current methods of recording fire damage vary greatly by country or region. The purpose of this new service - part of a portfolio of EO services called Risk-EOS - is to develop a standardised burn scar mapping methodology for use throughout Europe, and enable more accurate post-fire damage assessment and analysis of vegetation re-

growth and man-made changes within affected areas. Characterising the sites of past fires to a greater level of detail should mean that service users can better forecast where fires are most likely in future, a process known as risk mapping.

Having been validated and geo-referenced, burn scar maps can then be easily merged with other relevant geographical detail. The vast majority of fires are started by the human actions (discarding cigarette butts, deliberate arson, etc.). Checking burn scar occurrences against roads, settlements and off-road tracks is likely to throw up correlation. These can be extrapolated elsewhere to help identify additional areas at risk where preventative measures should be prioritised. Also, overlaying burn scar maps with a chart of forest biomass has the potential to highlight zones where new blazes would burn most fiercely. Once such relatively fixed environmental elements ("static risks") are factored in, other aspects which change across time (e.g. temperature, rainfall and vegetation moisture) can be addressed. These are "dynamic risks". At the end of the risk mapping process, the probability of fire breaking out in a particular place and time can be reliably calculated.

The Risk-EOS burn scar mapping service began in 2003. The intention is to develop further fire-related services by the end of 2007, including daily risk maps combining EO with meteorological and vegetation data. Another planned service will identify "hot spots" during fires, and map fire events twice a day, permitting an overall assessment of its development and the damage being done. A "fires memory atlas" set up at national or regional level will allow the routine sharing of all information related to forest fire events and fire risk.

Managed by Astrium (www.astrium-space.com/corp/), Risk-EOS also incorporates services for flood as well as fire risk management. It forms part of the Services Element of Global Monitoring for Environment and Security (GMES), an initiative supported jointly by ESA and the EC and intended to establish an independent European capability for worldwide environmental monitoring on an operational basis. This article is based on a report on the ESA website (www.esa.int) on 27 July 2004. For more information, visit the Risk-EOS website: www.risk-eos.com.

4.3 Tracking changes in Arctic ice by satellite

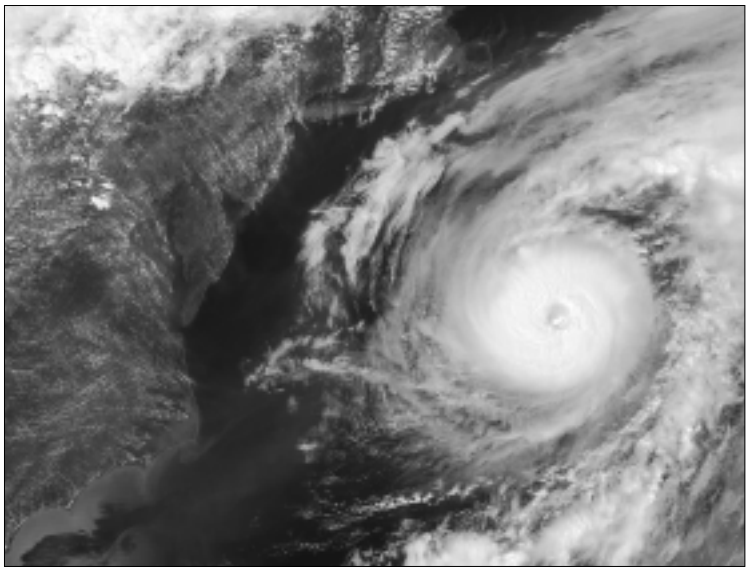
Camping out, for anything up to two months, on vast ice sheets in the Arctic is just one of the challenges scientists faced performing the first of a series of six validation experiments in support of ESA's CryoSat mission. CryoSat will be the first Earth Explorer to be launched as part of ESA's Living Planet Programme. Due for launch at the end of 2004, it will measure changes in the elevation of ice sheets and sea ice with unprecedented accuracy in order to determine whether or not our planet's ice masses are thinning due to global warming.

The validation experiments are crucial to ensuring that the mission runs smoothly and that its aims are achieved. Carrying out experiments in the harsh conditions of the Arctic is always punishing, and this first validation campaign, which has just ended, proved no exception, as scientists had to overcome a number of unique challenges, including the sheer scale of the experiment. It included research scientists from over five different countries and different institutes, all participating in a co-ordinated measurement programme conducted on the ground as well as from aircraft.

The ground experiments were carried out in remote and sometimes inhospitable areas on some of the main ice sheets in the north of Canada, Greenland and Norway. In addition, an aircraft of the Alfred Wegner Institute (AWI) in Germany carried out surveys over each in-situ site, using ESA's ASIRAS (Airborne Synthetic Aperture and Interferometric Radar Altimeter System), to simulate CryoSat measurements, and a laser scanner to support the interpretation of radar measurements. Additional laser measurements were taken from an Air Greenland plane of KMS of Denmark.

Taking the ground measurements posed a particular challenge. Scientists spent anything between two weeks and two months camped on the ice sheets, collecting data that will eventually allow ESA to better charac-

terise the performance of the CryoSat mission and lead to better, more accurate measurements of the changes in ice thickness and mass balance. Ground activities included travelling by skidoo across the vast icy expanses with GPS instruments to measure surface topography, digging snow pits to assess the effects of layering below the surface on the CryoSat signal and so-called "coffee can" measurements to determine ice density and depth.



True-colour image of Hurricane Alex off the US mid-Atlantic coast, as seen by the MODIS instrument on NASA's Aqua satellite, on 4 August 2004. Image courtesy of Jacques Descloitres, MODIS Land Rapid Response Team (website: rapidfire.sci.gsfc.nasa.gov), NASA's Gottard Space Flight Centre (GSFC).

Following the end of the first campaign, the scientists have only a few months to recover, review the data and draw some preliminary conclusions before heading back onto Canada and Greenland's inhospitable ice sheets for the second validation campaign planned for autumn 2004. This article is based on a report on the ESA website (www.esa.int) on 0 June 2004. More information on ESA's CryoSat mission is at the website: ww.esa.int/export/esaLP/cryosat.html.

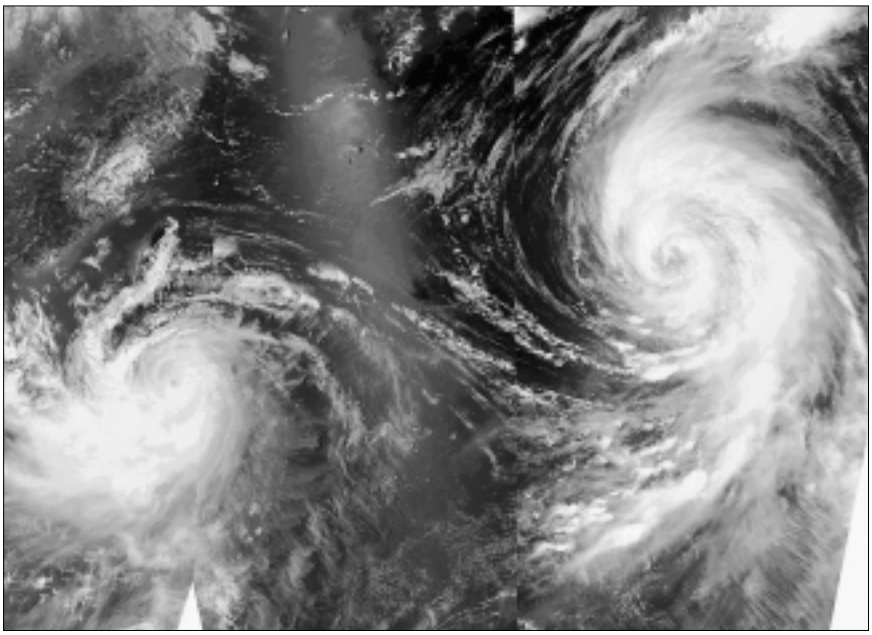
4.4 Tracking hurricanes & typhoons by satellite

During the summer of 2004, several major destructive hurricanes and typhoons occurred throughout the world. Major examples of these were Hurricane Alex, which hit the East Coast of the USA in early August, and the twin typhoons Mindulle and Tingting, which affected the Philippines, the Pacific islands of Guam and Northern Marianas, Taiwan and China, in late June.

(Editor's note: "hurricane" and "typhoon" are regionally specific names for a strong "tropical cyclone" - this is called a hurricane when it is in the North Atlantic Ocean, the North-East Pacific Ocean east of the dateline, or the South Pacific Ocean east of 160 degrees East), and a typhoon when it is in the North-West Pacific Ocean west of the dateline).

The first named storm of the Atlantic hurricane season, Hurricane Alex formed as a tropical depression on 31 July, and developed into a tropical storm on 2 August. It reached hurricane status on 3 August as it neared the North Carolina coast. The development of the storm was tracked by both the MODIS (Moderate Resolution Imaging Spectroradiometer) instrument on NASA's Aqua satellite, and the joint NASA-JAXA (Japan Aerospace Exploration Agency) TRMM (Tropical Rainfall Measuring Mission) satellite. At the time the following true-colour MODIS image of Hurricane Alex was taken, on 4 August 2004, Alex had maximum sustained winds near 150 km per hour and was still on an east-northeast course at 29 km per hour. Alex was forecasted to increase in forward speed over the following 24 hours while flucuating in intensity.

The following MODIS image shows Typhoons Mindulle and Tingting spinning side by side in the Pacific Ocean on 30 June 2004. Mindulle (on the left) left seven dead and two missing (according to news reports) after it scraped across the Philippines on 29 June with winds reaching up to 275 km per hour. When the MODIS on NASA's Terra satellite snapped this image the next day, the maximum wind speed



MODIS image of Typhoons Mindulle (left) and Tingting (right) in the Pacific Ocean on 30 June 2004. Image courtesy Jeff Schmaltz, MODIS Land Rapid Response Team, at NASA GSFC.

had slowed to 200 km per hour. Mindulle appears to be moving towards Taiwan and the eastern coast of China, shown in the upper left corner of this image. On 29-30 June, Typhoon Tingting was dumping heavy rain on Guam and the Northern Marianas. It was reported that the storm had maximum sustained winds of 120 km per hour with gusts up to 147 km per hour.

Still on the above subject, NASA's plan to drop TRMM, a healthy environmental satellite into the ocean in 2005, has provoked an outcry from scientists, and touched off a flurry of last minute discussions between the space agencies of the US and Japan. NASA informed JAXA earlier in 2004 that it intends to decommission the TRMM satellite in the weeks ahead, and steer it into the ocean in 2005. News of the decision leaked to Japan's Kyodo news service in June 2004, and NASA's public affairs division quickly confirmed that TRMM would indeed be coming down in 2005.

But now NASA and JAXA officials say they still are discussing the future of the joint satellite mission and that no final decisions have been made regarding when to end science operations and bring the spacecraft out of orbit. Both sides, however, say they cannot afford to pay the $3-4 million a year it costs to keep the satellite flying. A JAXA official said: "As regards the money, JAXA's overall budget situation is in an extremely bad position and finding that sort of money would be a heavy burden for us". NASA spokeswoman Gretchen Cook-Anderson called continued funding of TRMM operations "unfeasible" in light of the NASA's other Earth science priorities.

TRMM was launched in 1997 on a planned 18-month mission to study rainfall in the Earth's tropical regions. The $650 million spacecraft, designed to last at least three years, is now in its seventh year of operations. NASA built the satellite and has paid the operating costs for the past six and a half years. Japan supplied TRMM's sensitive radar instrument and paid to launch the satellite on a Japanese H-2 rocket. The spacecraft remains healthy with all its major instruments and critical subsystems still in good working order. TRMM team members say the satellite could operate another two years and still have enough fuel left for a controlled de-orbit.

Scientific demand for TRMM data also remains strong, they said, and various weather forecasting agencies around the world are using TRMM data to improve hurricane and typhoon tracking. Operational users of TRMM data include the US National Weather Service, the US Navy's Joint Typhoon Warning Centre and the European Centre for Medium-Range Weather Forecasts.

Ghassem Asrar, NASA's associate administrator for space science, said that the cost of continuing TRMM operations is only one factor, and that it is essential that TRMM's mission ends soon enough to permit a controlled de-orbit of the 3,500 kg satellite. If left to re-enter on its own after exhausting its fuel, the risk to people on the ground, according to NASA, would exceed the US government's probability threshold of 1 in 10,000. NASA concluded in a 2002 risk assessment that TRMM stood a 1 in 5,000 chance of hurting somebody if left to re-enter the atmosphere on its own. Nicholas

Johnson, head of NASA's Orbital Debris Program Office at Johnson Space Centre in Houston, said bringing TRMM down over an uninhabited stretch of ocean would dramatically lower the odds that any piece of the satellite surviving re-entry would hurt somebody.

But the issue of public safety is more complicated than calculating that the odds a piece of TRMM may hit someone. NASA's top safety official said TRMM's contribution to storm tracking should be factored into any de-orbit decision. Bryan O'Connor, NASA's associate administrator for safety and mission assurance, told Asrar that the benefits of extending the TRMM mission to the point where a controlled de-orbit is no longer possible could outweigh the risks of an uncontrolled re-entry. Asrar said NASA wants to get on with development of a proposed TRMM follow-on mission, a constellation of satellites that would measure precipitation on a global scale.

The Global Precipitation Measurement mission would rely heavily on international collaboration. NASA plans to partner Japan to build the constellation's central satellite, with other nations fleshing out the constellation with less sophisticated satellites, with passive radiometers. NASA and JAXA hoped to launch the central satellite in 2008 but now aim at 2010. But TRMM team members said NASA's interest in the new mission should boost TRMM's fortunes, not hasten its demise.

Still, the word around NASA's GSFC is that TRMM's days are numbered. TRMM team members said they expect the order to arrive any day to turn off the satellite's four working instruments and start preparing the craft for an ocean disposal. Those preparations would include repositioning the satellite's solar arrays to increase atmospheric drag, a change that would reduce the amount of onboard power available and end science operations. NASA headquarters officials told the TRMM team 29 June 2004 to continue science operations for now but to scrap a station-keeping operation planned for 1 July 2004. The cancelled manoeuvre was designed to boost TRMM's altitude to keep it within its proper orbit. Once satellites are pegged for a targeted de-orbit, routine orbit boosts typically cease. The satellite's orbit is allowed to naturally degrade for a period before commands are given to fire onboard thrusters and re-enter the atmosphere.

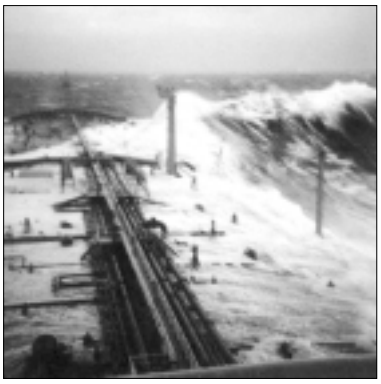
This article has been compiled based on news items on NASA's Earth Observatory website (earthobservatory.nasa.gov), and on a report on the Space.Com website (www.space.com/spacenews) on 28 June 2004.

4.5 Tracking giant ocean waves by satellite

Once dismissed as a nautical myth, freakish ocean waves that rise as tall as ten-storey apartment blocks have been accepted as a leading cause of large ship sinkings. Results from ESA's ERS satellites helped establish the widespread existence of these "rogue" waves, and are now being used to study their origins.

Severe weather has sunk more than 200 super-tankers and container ships exceeding 200 metres in length during the last two decades. Rogue waves are believed to be the major cause in many such cases. Mariners who survived similar encounters have had remarkable stories to tell. In February 1995 the cruiser liner Queen Elizabeth II met a 29-metre high rogue wave during a hurricane in the North Atlantic that Captain Ronald Warwick described as "a great wall of water… it looked as if we were going into the White Cliffs of Dover." And during the week between February and March 2001 two hardened tourist cruisers - the Bremen and the Caledonian Star - had their bridge windows smashed by 30-metre rogue waves in the South Atlantic, the former ship left drifting without navigation or propulsion for a period of two hours.

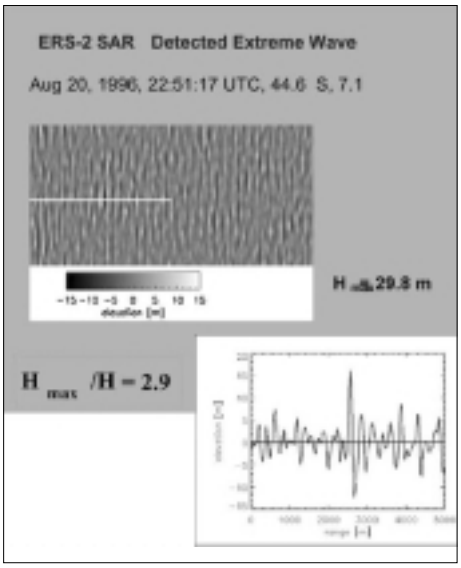
According to Wolfgang Rosenthal, Senior Scientist with the GKSS Forschungszentrum GmbH research centre in Geesthacht (Germany), who has studied rogue waves for years: "The incidents occurred less than a 1,000 km apart from each other. All the electronics were switched off on the Bremen as they drifted parallel to the waves, and until they were turned on again the crew were thinking it could have been their



Rare photo of a rogue wave taken aboard the supertanker Esso Languedoc, during a storm off Durban in South Africa in 1980. The mean wave height at the time was between 5-10 metres. Credits: Philippe Lijour.

last day alive. The same phenomenon could have sunk many less lucky vessels: two large ships sink every week on average, but the cause is never studied to the same detail as an air crash. It simply gets put down to bad weather."

Off-shore platforms have also been struck: on 1 January 1995 the Draupner oil rig in the North Sea was hit by a wave whose height was measured by an on-board laser at 26 metres, with the waves around it reaching 12 metres. Objective radar evidence from this and other platforms - radar data from the North Sea's Goma oil-field recorded 466 rogue wave encounters in 12 years - helped convert previously sceptical scientists, whose statistics showed that such large deviations from the surrounding sea state should occur only once every 10,000 years. The fact that rogue waves actually take place relatively frequently had major safety and economic implications, since current ships and off-shore platforms are built to withstand maximum wave heights of only 15 metres.



Giant wave detected during a global census using 3 weeks of raw ERS-2 SAR imagette data, carried out by the German Aerospace Centre (DLR). This SAR data set was inverted to individual wave heights and investigated for individual wave height and steepness. The wave shown here has a height of 29.8 metres. Credits: DLR.

In December 2000 the EU initiated a scientific project called MaxWave (website: w3g.gkss.de/projects/maxwave) to confirm the widespread occurrence of rogue waves, model how they occur and consider their implications for ship and off-shore structure design criteria. As part of MaxWave, data from ESA's ERS radar satellites were first used to carry out a global rogue wave census. "Without aerial coverage from radar sensors we had no chance of finding anything," added Rosenthal, who headed the three-year MaxWave project. "All we had to go on was radar data collected from oil platforms. So we were interested in using ERS from the start."

ESA's twin spacecraft ERS-1 and 2 - launched in July 1991 and April 1995 respectively - both have a Synthetic Aperture Radar (SAR) as their main instrument. The SAR works in several modes. Over the ocean it works in wave mode, acquiring 10 x 5 km "imagettes" of the sea surface every 200 km. These small imagettes are then mathematically transformed into averaged-out breakdowns of wave energy and direction, called ocean-wave spectra. ESA makes these spectra publicly available. They are useful for weather centres to improve the accuracy of their sea forecast models.

Rosenthal said: "The raw imagettes are not made available, but with their resolution of 10 metres we believed they contained a wealth of useful information by themselves. Ocean wave spectra provide mean sea-state data, but imagettes depict the individual wave heights including the extremes we were interested in. ESA provided us with three weeks of data - around 30,000 separate imagettes - selected around the time that the Bremen and Caledonian Star were struck. The images were processed and automatically searched for extreme waves at the German Aerospace Centre (DLR)." Despite the relatively brief length of time the data covered, the MaxWave team identified more than ten individual giant waves around the globe above 25 metres in height.

Rosenthal added: "Having proved they existed, in higher numbers than anyone expected, the next step is to analyse if they can be forecasted. MaxWave formally ended at the end of 2003, although two lines of work are carrying on: one to improve ship design by learning how ships are sunk, and the other to examine more satellite data with a view to analysing if forecasting is possible."

A new research project called WaveAtlas will use two years of ERS imagettes to create a worldwide atlas of rogue wave events and carry out statistical analyses. The Principal Investigator is Susanne Lehner, Associate Professor in the Division of Applied

Marine Physics at the University of Miami, who also worked with Rosental on MaxWave while at DLR.

According to Lehner, "Looking through the imagettes ends up feeling like flying, because you can follow the sea-state along the track of the satellite. Other features like ice floes, oil slicks and ships are also visible on them, and so there's interest in using them for additional fields of study. Only radar satellites can provide the truly global data sampling needed for statistical analysis of the oceans, because they can see through clouds and darkness, unlike their optical counterparts. In stormy weather, radar images are thus the only relevant information available."

So far some patterns have already been found. Rogue waves are often associated with sites where ordinary waves encounter ocean currents and eddies. The strength of the current concentrates the wave energy, forming larger waves. Lehner compares it to an optical lens, concentrating energy in a small area. This is especially true in the case of the notoriously dangerous Agulhas current off the east coast of South Africa, but rogue wave associations are also found with other currents such as the Gulf Stream in the North Atlantic, interacting with waves coming down from the Labrador Sea.

However the data show rogue waves also occur well away from currents, often occurring in the vicinity of weather fronts and lows. Sustained winds from long-lived storms exceeding 12 hours may enlarge waves moving at an optimum speed in sync with the wind - too quickly and they would move ahead of the storm and dissipate, too slowly and they would fall behind. "We know some of the reasons for the rogue waves, but we do not know them all," Rosenthal concluded. The WaveAtlas project is scheduled to continue until the first quarter of 2005. This article is from a report on the ESA website (www.esa.int) on 21 July 2004.

4.6 Tracking leatherback turtles by satellite

The site where Europe's spacecraft are launched into orbit, the Atlantic shoreline of French Guyana, is also the starting point for another hardly less remarkable journey: the epic migration of the critically endangered leatherback turtle. Scientists have been using tracking sensors to follow the long treks of individual leatherbacks, then overlaying their routes with sea-state data, including near real-time maps of ocean currents gathered by satellites, including ESA's ERS-2 and Envisat. They are working to uncover connections between the apparently meandering routes followed by turtles and the local ocean conditions, and so develop strategies to minimise the unintended but deadly threat posed to leatherbacks by deep-sea fishing.

These giant reptiles - which reach 2.1 metres in length and weigh 365 kg - briefly come ashore to lay their eggs on beaches across French Guyana and neighbouring Suriname, the turtles' last remaining major nesting sites in the Atlantic Ocean. Around nine weeks later the hatchlings emerge en masse and head into the sea, returning when they reach maturity and lay eggs themselves. However the return is by no means certain. While in open water the turtles have been known to dive as deep as 1,230 metres in search of food, most of the time they do not venture deeper than 250 metres, leaving them vulnerable to the hooks of long-line fishermen. Hundreds of thousands of such hooks are used daily across the Atlantic. Ongoing "by-catching" of leatherbacks by fishermen has left the 100-million-year-old species on the brink of extinction in the Pacific and Indian oceans. In the Atlantic their numbers are higher - partly due to a ban on long-line US fishermen operating in the Ocean's northern section - but the turtles are still being lost at an unsustainable rate.

A paper was recently published in Nature summarising the work done so far in tracking leatherbacks through the Atlantic, submitted by a team of researchers from France's National Centre for Scientific Research (CNRS) in Strasbourg, neighbouring Louis Pasteur University, the French Guyana Regional Department of the Environment, and the company Collecte Localisation Satellites (CLS) in Ramonville, specialising in satellite-based systems for location-finding, data collection and Earth Observation.

Pacific leatherbacks follow narrow migration corridors. Researchers hoped that if their Atlantic counterparts acted in the same way then fishing could be restricted across these zones. Starting in 1999 individual turtles were tracked using the CLS-run Argos system, based on radio-emitting tags whose position can be tracked worldwide to a maximum accuracy of 150 metres. Six US NOAA spacecraft currently carry Argos receivers, with ESA's MetOp series due to join the system following their initial satellite launch in 2005. The turtles' tracks were then overlaid with maps of sea-level anomalies obtained by merging data with the radar altimeter aboard ESA's ERS-2 with another on the NASA-CNES satellite TOPEX-Poseidon.

ERS-2, like its successor Envisat, is part of the select group of satellites equipped with a Radar Altimeter (RA) instrument. By firing thousands of radar pulses off the surface of the sea every second extremely precise ocean height measurement is made possible. Height anomalies detected by this type of sensor are often indicators of the presence of ocean currents and eddies: warm currents can stand up to a metre above colder waters. By merging multiple radar altimeter results together, the result is a more frequent and higher resolution measurement of sea-level anomalies than any one spacecraft could achieve. For example, now that ERS-2's global mission is over, results from Envisat's RA-2 instrument are being combined with similar data from the joint French-US Jason spacecraft and the US Navy's GFO.

According to Philippe Gaspar, co-author of the Nature paper and Head of the Satellite Oceanography Division of CLS, "The altimetry data has been very useful to our work because we have been able to check the turtles' trajectory against ocean currents. What we have found is that their relationship with currents alters considerably over the course of their journeys." Unlike their Pacific relations, the Atlantic leatherbacks do not follow narrow migration corridors but disperse widely - to begin with, the leatherbacks carry out long nearly straight migrations either to the north or to the Equator, swimming across currents as they encounter them. One made it to within 500 km of West Africa before turning back, another came close to Nova Scotia. "Then having either made it to the Gulf Stream area or to the equatorial belt, the turtles tend to slow down and follow the frontal areas associated with local ocean current systems, which are generally rich in marine life."

Unfortunately fishing fleets target these frontal systems for exactly the same reason, so these turtles are placing themselves in danger. This finding means limited closures of Atlantic fishing areas is unlikely to have much impact in turtle by-catch reduction, and other solutions will have to be considered, such as turtle-friendly fishing gear and hooks recently developed by NOAA and endorsed by the World Wildlife Fund.

Meanwhile leatherback tracking continues on an on-going basis. Gaspar added: "We are now looking at estimating the swimming speed of turtles during their trips by obtaining their total velocity from the Argos receivers, then subtracting the current velocity made available to us by altimetry. This has never been done before and should provide us with useful information on the energy they expend throughout their migration."

French schools have been given the chance to take part as part of an educational oceanographic scheme called Argonautica, with classes participating in the Argo-luth project, analysing turtle movements against outputs from MERCATOR, a model that presently covers the North and Equatorial Atlantic Ocean and assimilates radar altimeter data on an operational basis. This article is from a report on the ESA website (www.esa.int) on 3 August 2004.

Editor: The reference for the Nature paper on Leatherback Turtles is: Ferraroli S., J.-Y. Georges, P. Gaspar, and Y. Le Maho. 2004. Where leatherback turtles meet fisheries. Nature 429: 521-522. Brief Communications. The full text of the paper is available at the website of CNRS (Centre National de la Recherche Scientifique) in Guiana (www.guyane.cnrs.fr), under the report entitled "14 juin 2004: La tortue Luth - une scientifique qui s'ignore encore." Supplementary information is available at: www.nature.com/nature/journal/v429/n6991/suppinfo/429521a.html.

4.7 Tracking mountain gorillas by satellite

Conservation workers have had their first look at satellite-derived map products that show a remote volcanic habitat of endangered African mountain gorillas in unprecedented detail. Production versions of these prototype products will help protect the less than 700 gorillas remaining alive.

Maryke Gray, regional monitoring officer of the International Gorilla Conservation Programme (IGCP), said: "It's very exciting to get a look at some of the products we're going to be able to take into the field. The area covered is a volcanic massif that is often difficult to access. What maps are available are more than 30 years old and often inaccurate, and we have no maps whatsoever for some territory." Dennis Babasa, ecological monitoring co-ordinator for Uganda's Institute of Tropical Forest Conservation, added: "These are maps we have wanted to create previously, but we simply haven't had the tools. Remote sensing is providing useful assets for our work."

Mountain gorillas are found in highland forests along the borders between Rwanda, Uganda and the Democratic Republic of Congo. These regions make up a set of five national parks. Three are UNESCO World Heritage Sites (WHSs), and the other two have been nominated for the same status. However regional political conflicts have led to an influx of refugees into the areas around the parks. Clearing forest for agriculture or fuel, and illegal poaching for food, has impacted the parks and reduced the living space left for the gorillas. Protecting the parks is difficult because they have long boundaries that run across extremely inaccessible and hardly mapped territory. An ESA-run project called Build Environment for Gorilla (BEGo) has been using Earth Observation resources to chart the region in order to help conservation bodies working in and around the parks.

On 10-11 June 2004 representatives from BEGo partners including UNESCO, IGCP, the Wildlife Fund Eastern Africa Programme Office (WWF-EAPO), the Institute Congolese of Nature Conservation (ICCN) and Uganda's Institute of Tropical Forest Conservation (ITFC) met at ESA's European Space Research Institute (ESRIN) in Frascati near Rome to review initial mapping products. These comprise a 1:50,000 scale base map, land cover map and DEM of the area around Volcanoes National Park in Rwanda. The base map was provided in a paper version during the two-day review. In addition base and land cover maps were overlaid on the DEM to create a three-dimensional representation of the landscape. To help familiarise themselves with the products the BEGo partners experienced a simulated fly-over of the area using ESRIN's Virtual Reality Theatre.

The EARSeL Editor, enjoying a moment of quiet reflection...

The session marked the conclusion of BEGo's first phase. Mario Hernandez of UNESCO said: "The project has up to now produced prototypes. So this meeting was to check these prototypes in order to decide on the go-no-go. What is exciting is that now we are going further, basically entering into a production mode in order to elaborate all maps for all the selected regions of the BEGo project. The testing of the prototypes was therefore successful!" Gray added: "What we're doing here is using our knowledge to identify small classification errors

and other problems. The work is 95% done, with more to do on the other 5%. The new products will obviously be useful when it comes to co-ordinating patrols and associated activities. We now have one map extending across the three countries, while previously we had to use different national maps with different scales."

Marc Languy of WWF-EAPO stressed the extent of the territory covered: "The map extends well beyond park boundaries, reflecting the fact that the parks cannot be thought of as isolated islands but as part of the larger landscape, addressing the development needs of local settlements to provide alternatives to the short-term eating up of park grounds. The map can help a lot with this, for example by enabling the planning of eco-tourism that can benefit local people."

The next phase involves the expansion of coverage to the rest of the mountain gorilla habitat: Kahuzi-Biega National Park WHS and Virunga National Park WHS in the Democratic Republic of Congo, and Bwindi National Park WHS and Mgahinga National Park in Uganda plus the provision of associated maps showing land cover change from 1990 onward. Hernandez said: "Population pressure remains high on park boundaries: land cover change products will help us identify areas under threat. Further along there is the obvious possibility of extending the techniques of BEGo to other WHSs in danger - there are three in the Democratic Republic of Congo alone that are going to be mapped in a similar way."

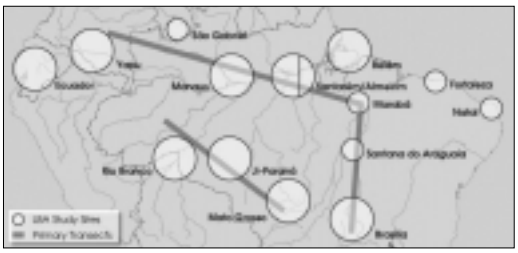
In 2003 ESA and UNESCO formally agreed an initiative for the use of space technologies to support the World Heritage Convention. Other space agencies have joined this initiative. The Belgian Federal Science Policy Office, for example, intends to use space technologies to map all WHSs within the Democratic Republic of Congo, with data and expertise would be fully shared between this project and BEGo. BEGo is a service demonstration project taking place as part of ESA's Data User Element, with Netherlands-based Synoptics as prime contractor. The website for the BEGo project is: www.gorillamap.org. This article is based on a report on the ESA website (www.esa.int) on 29 June 2004.

4.8 Tracking changes in the Amazon by satellite

The 3rd International Scientific Conference of the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) was held on 27-29 July 2004, at the Academia de Tênis Resort in Brasília, Brazil. The purpose of this open meeting was to communicate LBA science to other scientists, decision makers, and the public. The conference drew approximately 600 participants from North and South America and Europe, including over 350 students. 185 scientific talks were given and 418 research posters were also presented. Special guests included Marina Silva, Brazil's Minister of the Environment, and Eduardo Campos, Brazil's Minister of Science and Technology, among many other esteemed representatives of governmental and scientific organisations.

NASA plays a key role in the LBA, the world's largest environmental science experiment. The aim of the conference was to discuss key findings on how the world's largest rainforest impacts the ecological health of Amazonia and the world. Never before has so much information about the Amazon been assembled for presentation at once. LBA is partly funded by NASA. Also, scores of projects that feed the Amazon experiment depend heavily on NASA's vast expertise in satellite information, computer modelling, and providing infrastructure for large-scale field campaigns. The overall experiment concentrates on how the Amazon forest and land use changes within the region affect the atmosphere, and regional and global climate. In turn, LBA also studies how climate changes influence the biological, chemical and physical functioning of the forest itself.

NASA satellites provide data for studying land use changes and their impacts on climate. Scientists hope to learn more about the Amazon forest's role in sequestering carbon from the atmosphere. Atmospheric CO2 traps heat and adds to global warming. Plant life absorbs CO2 from the air during photosynthesis and stores it in

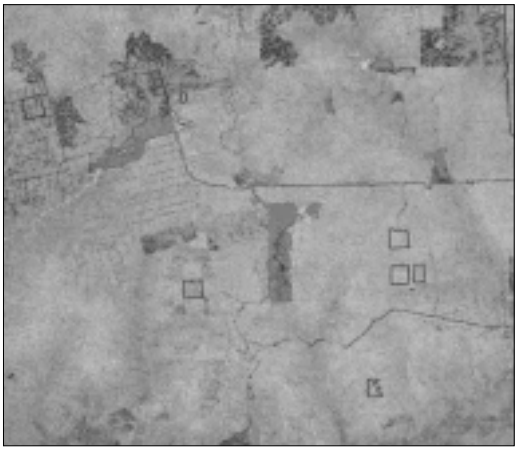


LBA study sites span the Amazon from the headwaters in the Andes, along the river and its tributaries in the Amazon Basin, to the River's mouth in coastal Brazil. Credit: Map courtesy LBA science team, adapted by Robert Simmon.

stems, leaves and roots. In order to understand regional and global carbon balances, researchers must quantify how much carbon is taken up by the rainforest as well as how much is released back to the atmosphere when forests are cleared or burned.

In the Amazon, deforestation, selective logging, fires and forest re-growth all play major roles in the carbon balance. In the Brazilian Amazon region alone, annual clear-cutting and burning of forests cover about 20,000 square km (about the area of New Jersey). NASA data products from various instruments on the Landsat series of satellites have documented the history of deforestation in the Amazon since the 1970s. LBA researchers have found ways to measure both logging area and logging damage using Landsat and experimental new sensors on NASA's EO-1 satellite.

Ecosystem models and NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on the Terra and Aqua satellites have helped scientists understand how the exchange of carbon between the forest and atmosphere differs over the course of the year. Also, LBA studies have found forest uptake of CO2 is not enough to keep pace with carbon that is returned to the atmosphere when forests are cut. Burning practices to clear fields for farming often result in fires spreading to adjacent forests. These large fires create air pollution and can contribute to respiratory problems in people. Thick smoke has forced airports to close, and has caused highway accidents. Satellite retrievals of concentrations of airborne particles from NASA's MODIS instrument have been used by Brazil's Centre for Weather Prediction and Climate Studies to create models that can predict fire risk and smoke transport in near-real time. Satellite data also help scientists study how particles from fires impact climate and weather. These particles, known as aerosols, can both heat and cool the air, depending on size, shape and colour.



Processed Landsat satellite image showing human land uses in an area near Paragominas, Para, Brazil, highlighting logging (blue) and pasture (bright red). Credit: NASA, processed by Greg Asner et al. (in press, 2004).

Scheduled to end in 2006, LBA is considered an international scientific success, with 61 projects completed and 59 in progress. The efforts include more than 1,000 researchers from institutions in Brazil, the US, eight European countries and several other countries of the Amazon Basin (Venezuela, Peru, Bolivia, Colombia and Ecuador). LBA is financed by Brazilian funding agencies, NASA and the EU. This article is based on reports on NASA's Earth Observatory website (earthobservatory.nasa.gov) on 27 July 2004, and on the LBA Conference website (www.lbaconferencia.org/).

4.9 Tracking soil moisture by satellite

On 11 June 2004 a significant milestone in the development of ESA's Soil Moisture and Ocean Salinity (SMOS) mission was reached, when the contract to build the payload was signed between ESA and EADS (European Aeronautic Defence and Space Company) - CASA from Spain. The contract, worth 62 million euros, was signed at the premises of CDTI (Centre for Development of Industrial Technology) in Madrid, Spain. EADS-CASA now heads an industrial consortium of more than 20 companies from all over Europe, and is committed to construct the innovative MIRAS (Microwave Imaging Radiometer using Aperture Synthesis) instrument at the core of SMOS.

Scheduled for launch in early 2007, SMOS is the second Earth Explorer Opportunity

mission to be implemented as part of ESA's Living Planet Programme. The main aim of the mission is to further the development of climatological, meteorological and hydrological models by observing soil moisture over the Earth's landmasses, and sea-surface salinity over the oceans, for a period of at least 3 years. At the signing ceremony, Prof. José Achache, ESA's Director of Earth Observation Programmes, said: "SMOS will provide a major advancement in our ability to model and understand the global hydrological cycle."

The moisture in soil and the salt in the oceans are intrinsically linked to the Earth's water cycle and climate. Currently, in-situ measurements for soil moisture are sparse, but if we are to better understand the water cycle so that the forecasting of climate, weather and extreme events such as floods can be improved, more data are urgently required. The same is true for data on ocean salinity - only a small fraction of the ocean is sampled on any regular basis. However, salinity is an important factor driving the currents in the ocean and in turn ocean circulation plays a crucial role moderating the climate. Therefore, comprehensive data on ocean salinity would greatly improve our knowledge of the conditions that influence global ocean circulation and thus climate.

Not only will this mission further our understanding of the Earth system, but it will also demonstrate a new measuring technique by adopting a completely different approach in the field of remote sensing. SMOS will carry the first-ever polar-orbiting satellite-borne 2-D interferometric radiometer. From an altitude of 763 km, the novel MIRAS instrument has been designed to capture images of microwave radiation emitted from the surface of the Earth at L-band (1.4 GHz).

MIRAS is made up of a central structure and three deployable arms. There are 69 antenna elements, so-called LICEF receivers, which are equally distributed over the central structure and three arms. Each LICEF is an antenna-receiver integrated unit that measures the radiation emitted from the Earth at L-band. The measuring principle takes advantage of the fact that moisture and salinity influence the emissivity of soil and sea-water, respectively. From the information gathered, scientists will be able to derive maps of soil moisture and ocean salinity on a global scale. Now that the contract has been signed to go ahead and build the payload the SMOS mission has taken a significant and exciting step forward in its development. SMOS is executed in close cooperation with the French Space Agency CNES and the Spanish Agency CDTI. This article is from a report on the ESA website (www.esa.int) on 17 June 2004.

4.10 Tracking urban heat islands by satellite

Some people think cities and nature don't mix, but a new NASA-funded study finds that concrete jungles create warmer conditions that cause plants to stay green longer each year, compared to their rural environs. Urban areas with high concentrations of buildings, roads and other artificial surfaces retain heat, creating "urban heat islands". Satellite data reveal that urban heat islands increase surface temperatures compared to rural surroundings. Using data from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on NASA's Terra satellite, Boston University researchers discovered that city climates have a noticeable influence on plant growing seasons up to 10 km away from a city's edges. Growing seasons in 70 cities in eastern North America were about 15 days longer in urban areas compared to rural areas outside of a city's influence.

According to Xiaoyang Zhang, the study's lead author and a researcher at Boston University, "If you live in a rural area and drive regularly into the city, and if you pay attention to vegetation, you will see a difference in the growing seasons in early spring and late autumn. The study appeared in a recent issue of the American Geophysical Union's Geophysical Research Letters journal. Zhang added that urban heat islands provide a very good model to assess the effects of global warming on plant growing seasons and ecosystems. As temperatures warm due to climate change, growing seasons will likely change as well. Zhang and colleagues found that for every 1°C that temperatures rose on average during the

early spring-time, vegetation bloomed 3 days earlier.

Spring-time land surface temperatures in eastern North American cities were on average 2.3°C warmer than surrounding rural areas, according to the study. In late autumn to winter, the city temperatures were 1.5°C higher than the surroundings. These higher urban temperatures caused plants to start greening-up on average seven days earlier in spring. Similarly, in urban heat islands, the growing season lasted 8 days longer in autumn than in rural areas.

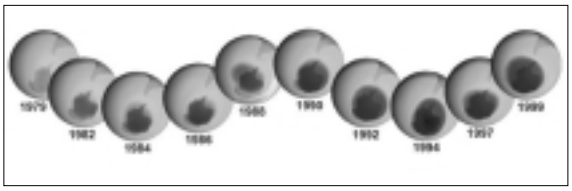
The researchers used MODIS surface reflectance data to measure seasonal changes in plant growth for the entire year of 2001. By accounting for angles of views from the satellite, varying sunlight, land surface temperatures, cloud cover, and the presence of snow, the scientists were able to detect daily variations in the green colour of plants. The researchers classified urban areas using MODIS data from October 2000 to October 2001, as well as Defence Meteorological Satellite Programme's (DMSP) night-time light imagery and population density data. Only eastern North American cities with urban areas larger than 10 square km were included in the study.

The researchers found that the effect urban heat islands have on plants' growing seasons is exponentially weaker the further away from the city one travels. Significant effects were seen up to 10 km from city lines. In other words, the impact of urban climates on ecosystems extended out 2.4 times the size of a city itself. Zhang said: "Warming from global climate change will definitely impact ecosystems. Thus, urban areas provide us with some measures of how changes in temperature might affect vegetation". This article is from a report on NASA's GSFC (Gottard Space Flight Centre) website (www.gsfc.nasa.gov) on 29 July 004.

4.11 Tracking global air quality by satellite

On 15 July 2004, Aura, a mission dedicated to the health of the Earth's atmosphere, was successfully launched from Vandenberg Air Force Base, California, aboard a Boeing Delta II rocket. Aura, which was inserted into a 705 km orbit, is NASA's latest Earth Observing satellite, and will help us understand and protect the air we breathe. NASA Associate Administrator for Earth Science, Dr. Ghassem Asrar, said: "This moment marks a tremendous achievement for the NASA family and our international partners. We look forward to the Aura satellite offering us historic insight into the tough issues of global air quality, ozone recovery and climate change. This mission advances NASA's exploration of Earth and will also better our understanding of our neighbours in the planetary system. Aura joins its siblings, Terra, Aqua and ten more research satellites developed and launched by NASA during the past decade, to study our home planet".

Aura will help answer three key scientific questions: Is the Earth's protective ozone layer recovering? What are the processes controlling air quality? How is the Earth's climate changing? NASA expected early scientific data from Aura within 30-90 days. Aura also will help scientists understand how the composition of the atmosphere affects and responds to Earth's changing climate. The results from this mission will help scientists better understand the processes that connect local and global air quality.



TOMS (Total Ozone Mapping Spectrometer) images, showing the growth of the ozone hole over 20 years.

Each of Aura's four instruments is designed to survey different aspects of Earth's atmosphere. Aura will survey the atmosphere from the troposphere, where mankind lives, through the stratosphere, where the ozone layer resides and protects life on Earth. With the launch of Aura, the first series of NASA's Earth Observing System satellites is complete. The other satellites are Terra, which monitors land, and Aqua, which observes Earth's water cycle. More information is at the website:

www.nasa.gov/aura. This article is from a report on the NASA website (www.nasa.gov) on 15 July 2004.

4.12 Tracking high altitude flashes by satellite

Fresh data on sprites, jets and elves - strange flashes of coloured light in the Earth's upper atmosphere - are being returned to Earth by a new satellite. The Taiwanese ROCSAT-2 satellite, a European-designed satellite which was developed for the NSPO (National Space Programme Office) by EADS-Astrium, was successfully launched on 20 May 2004, and is studying the high-altitude phenomena. They are believed to be discharges of electricity from above thunderstorms, part of a global electrical circuit. Rocsat-2's first goal is to make a map of the distribution of the flashes and how often they occur, say scientists.

For years, reports of red streamers, blue jets and strange diffuse glows seen in the upper reaches of the atmosphere were not taken seriously. But in the past decade videos taken from high-altitude aircraft and the space shuttle have convinced scientists that they are real. The phenomena are difficult to study as they occur 50-100 km above the Earth's surface, too high for most aircraft and too low for satellites.

ROCSAT-2 scientific payload includes the ISUAL (Imager of Sprites and Upper Atmospheric Lightning) set of instruments. The scientific goals of ISUAL are to investigate lightning-induced, luminous atmospheric phenomena, polar aurora and upper atmospheric air-glow. This scientific co-operation includes the design and construction of a scientific instrument package, its integration on the ROCSAT-2 satellite, its placement into orbit, and its in-orbit operation for five years.

First ROCSAT-2 black and white image: Taichung (Taiwan), 4 June 2004 (c) NSPO.

ROCSAT-2's very specific geo-synchronous orbit enables it to acquire any scene in its coverage area each day. In addition, due to its sun-synchronous orbit, each accessible scene can be systematically observed from the same angle under the same lighting conditions. The satellite's agility enables very rapid pointing (up to +/- 45°) both along track (forward- and backward-looking) and across-track (side-looking). ROCSAT-2 provides black-and-white images with 2 metres resolution, colour images with 8 metres resolution (4 spectral bands: near infrared, red, green and blue), and each scene covers 24 x 24 km. The characteristics of ROCSAT-2 images combined with its unique revisit capabilities make it a valuable tool for agriculture, defence and risk management but also for cartography, town and country planning, forest management, etc.

NSPO has chosen Spot Image to be the exclusive worldwide distributor of ROCSAT-2 products and services, except for Taiwan and the continental China. The first ROCSAT-2 image was acquired on 4 June 2004, only two weeks after its launch. Images are due on the market in September 2004.

This article was compiled from various reports, on the Science and Nature section of the BBC News website (news.bbc.co.uk) on 24 July 2004, the Spot Image website (www.spotimage.fr) on 1 July 2004, and the ISUAL website (sprite.phys.ncku.edu.tw/En/Eindex.html).

4.13 Tracking illegal drugs trade by satellite

High-resolution IKONOS satellite imagery is being used by the United Nations Office on Drugs and Crime (UNODC), as part of its fight against the illegal heroin and co-

caine trade, to detect and inventory the cultivation of illicit crops (poppy and coca plants), in the Middle East, Asia and South American countries, including Afghanistan, Laos, Myanmar and Bolivia. One of the most recent studies, the Afghanistan Opium Survey 2003, published in October 2003, is the first Afghanistan survey completed in conjunction with the new government in Kabul. The survey indicates that in 2003, Afghanistan again produced 75% of the world's illicit opium. The UNODC most recently used IKONOS imagery in its Bolivia Coca Cultivation Survey 2003, published in June 2004.

For the UN's Afghanistan survey, IKONOS snapped 43 high-resolution pre-harvest and post-harvest colour images during the 2003 survey time-frame. More than 89,000 hectares were imaged as IKONOS orbited from north to south at 27,000 km per hour over the Middle East. Approximately 70 high-resolution images were collected for the UNODC's Myanmar survey to monitor opium poppy cultivation. The images were collected during a short time window between December 2003 and January 2004.

According to the UN, the objectives of the UNODC's Illicit Crop Monitoring Programme are to establish methodologies for data collection and analysis, to increase governments' capacity to monitor illicit crops and to assist the international community in monitoring the extent and evolution of illicit crops in the context of the elimination strategy adopted by the Member States at the General Assembly Special Session on Drugs in June 1998.

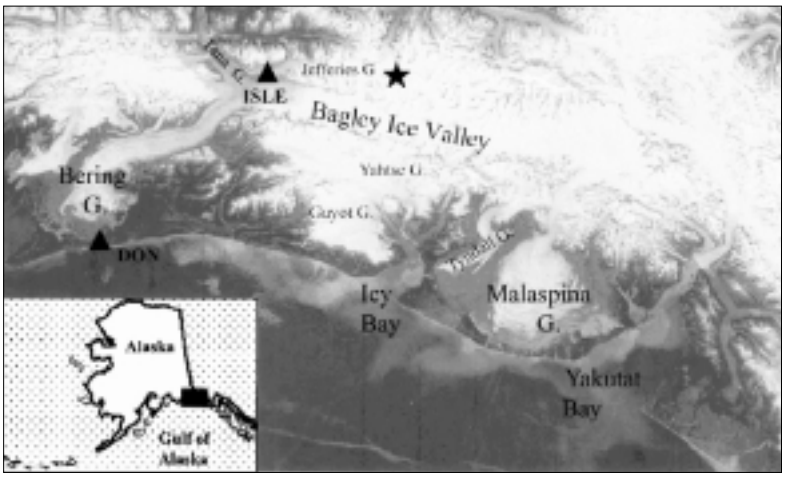
Thibault le Pichon, UNODC manager, Illicit Crop Monitoring Programme, said, "The introduction of civilian high-resolution imagery in the monitoring of illicit narcotics in recent years has enabled UNODC and concerned nations considerably to improve the effectiveness and safety of surveys conducted in difficult and / or dangerous areas." Robert Dalal, CEO of Space Imaging (owners of IKONOS), said, "A key advantage of IKONOS is its capability to task and download imagery from regional grounds stations around the world. Our Regional Affiliates have the digital landing rights for high-quality imagery. IKONOS provided frequent revisit rates and product consistency which helped the UN do their analysis of illicit crop production with high efficiency and lower risk". This article is from a report on Space Imaging's website (www.spaceimaging.com) on 13 July 2004.

4.14 Satellites assess glacier - earthquake link

In a new study, NASA and United States Geological Survey (USGS) scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes. The study examined the likelihood of increased earthquake activity in southern Alaska as a result of rapidly melting glaciers. As glaciers melt they lighten the load on the Earth's crust. Tectonic plates, that are mobile pieces of the Earth's crust, can then move more freely. The study is published in the July 2004 issue of the Journal of Global and Planetary Change.

Jeanne Sauber of NASA's Goddard Space Flight Centre, and Bruce Molnia, a research geologist at USGS, used NASA satellite and global positioning system (GPS) receivers, as well as computer models, to study movements of Earth's plates and shrinking glaciers in the area. Sauber said, "Historically, when big ice masses started to retreat, the number of earthquakes increased. More than 10,000 years ago, at the end of the great ice age, big earthquakes occurred in Scandinavia as the large glaciers began to melt. In Canada, many more moderate earthquakes occurred as ice sheets melted there". Southern Alaskan glaciers are very sensitive to climate change, Sauber added. Many glaciers have shrunk or disappeared over the last 100 years. The trend, which appears to be accelerating, seems to be caused by higher temperatures and changes in precipitation.

In southern Alaska, a tectonic plate under the Pacific Ocean is pushing into the coast, creating very steep mountains. The high mountains and heavy precipitation are critical for glacier formation. The colliding plates create a great deal of pressure that eventually is relieved by earthquakes. The weight of a large glacier on top of these active earthquake areas can help keep things stable. But,



Moderate Resolution Imaging Spectroradiometer (MODIS) true-colour image from NASA's Aqua satellite, of the southern Alaska coastal region, on August 2003. The solid star shows the location of the 1979 St. Elias epicentre.

as the glaciers melt and their load on the plate lessens, there is a greater likelihood of an earthquake to relieve the large strain underneath. Even though shrinking glaciers make it easier for earthquakes to occur, the forcing together of tectonic plates is the main reason behind major earthquakes.

The researchers believe that a 1979 earthquake in southern Alaska, called the St. Elias earthquake, was promoted by wasting glaciers in the area. The earthquake had a magnitude of 7.2 on the Richter scale. Along the fault zone, in the region of the St. Elias earthquake, pressure from the Pacific plate sliding under the continental plate had built up since 1899 when previous earthquakes occurred.

In 1899-1979, many glaciers near the fault zone thinned by hundreds of metres, some completely disappearing. Photos of these glaciers, many taken by Molnia during the last 30 years, were used to identify details within areas of greatest ice loss. Field measurements were also used to determine how much the glacier's ice thickness changed since the late 19th century. The researchers estimated the volume of ice that melted and then calculated how much instability the loss of ice may have caused. They found the loss of ice would have been enough to stimulate the 1979 earthquake.

GPS measurements, made by Sauber and Molnia, and NASA satellites were used to document glacier variability. Data from Landsat-7 and the Shuttle Radar Topography Mission (SRTM) were used to study glacier extent and topography. Currently, NASA's ICESat satellite is being used to measure how the glacier thicknesses are changing. Sauber said, "In future, in areas like Alaska where earthquakes occur and glaciers are changing, their relationship must be considered better to assess earthquake hazard, and our satellite assets are allowing us to do this by tracking the changes in extent and volume of the ice, and movement of the Earth,". This article is from a report on NASA's Gottard Space Flight centre website (www.gsfc.nasa.gov) on 2 August 2004.

Editor: The reference for the glaciers - earthquakes paper is: Sauber, J. M. and B. F. Molnia. 2004. Glacier ice mass fluctuations and fault instability in tectonically active Southern Alaska. Journal of Global and Planetary Change, Volume 42, pages 279-293. The full text of the paper can be freely downloaded from the ScienceDirect website (www.sciencedirect.com).

4.15 NASA supercomputer boosts shuttle programme

US space agency NASA is to get a massive supercomputing boost to help get its shuttle missions back in action, after the 2003 shuttle disaster. Project Columbia, a collaboration with two technology giants, will mean NASA's computing power will be ramped up by 10 times to do complex simulations. It will be one of the world's biggest Linux-based supercomputers. The new supercomputer will help the agency model flight missions, climate research, and aerospace engineering. The system will have 500 terabytes of storage, the equivalent of 800,000 CDs. It will use the might of 10,240 Intel Itanium 2 processors for complex computer simulations.

The supercomputer will help patch holes in NASA's computing power limitations, highlighted after the Columbia disaster which killed seven astronauts. Sean O'Keefe, NASA administrator, said, "This will enable NASA to meet its immediate mission-critical requirements for return to flight, while building a strong foundation for our space exploration vision and future missions".

Richard Dracott, from Intel's enterprise platforms group, said that previously, supercomputers have taken far longer to deploy because of specially-made specifications and processors. Japan's Earth Simulator, for example, which is the fastest supercomputer in the world, took five years to get up and running. The NASA project, which is based at its Ames Research Centre in California, reinforces a move away from that approach. According to Dracott, "This is the epitome of change in supercomputing. It is using an off-the-shelf system and taken that and built a powerful system around 512-processors which are then hooked together to give considerable power."

The increase in computing power for NASA means researchers can do a lot more to help in future mission planning, as part of its Space Exploration Simulator. It will play an integral part in other critical areas of scientific research, like climate change. The shared memory of the Project Columbia supercomputer means a large problem or scenario can be worked on by all the processors simultaneously. Dracott said, "The more computer power you have, you can do two things: you can simulate more events, have that many more what-if scenarios to foresee other circumstances. Taking advantage of gravity modelling would certainly be something that would be done much faster and to a greater degree of accuracy and turn around time."

The increase in computing horse power also allows for more complex analyses of scenarios. With very large scale computing power, weather patterns which are critical for shuttle missions for instance, can be simulated, merged and stored graphically. They can also be modelled over a time period of weeks or months instead of over just a few days. But the system will also be used to model the human impact on climate change and global warming.

The off-the-shelf approach to putting together such massive computing power also opens up the supercomputing market to countries or organisations who could not previously afford to employ build them, according to Dracott. Supercomputing has become critical for many scientific and research communities. They have been used in the human genome project, and the US army has just commissioned a supercomputer from IBM to help in their military research. Increasingly, their use has also been driven by the power industry to simulate nuclear power station safety models.

Usually, supercomputers are built with thousands of two-processor nodes. These are clustered together, but Project Columbia will have 20 nodes. The first one to be deployed was named Kalpana after Kalpana Chawla, an Ames alumna, who was among the seven astronauts to die in the Columbia accident. The rest of the nodes will be in action by the end of the year, said Intel and Silicon Graphics. The system, worth $160 million, will also be made available to other government agencies, and US research facilities. This article is from a report on the Technology section of the BBC News website (news.bbc.co.uk) on 6 August 2004.

4.16 Next shuttle mission in March or April 2005

Nearly 18 months after Columbia's shocking demise, sistership Discovery is in the home stretch of a massive overhaul to once again return the shuttle fleet to flight. Overseen by an ambitious and soft-spoken 34-year-old woman, shuttle Discovery stands still inside a massive hangar, encased by work platforms like the queen bee in a hive. Technicians and engineers, huddled in groups of three or four, crawl over and inside the ship, attaching panels, monitoring test equipment, consulting work sheets. They progress slowly and steadily, one shift of workers passing off to another, with an occasional overnight team called in to complete the odd job as well.

All is on schedule for Discovery to leave the processing hangar shortly after the New Year so it can be outfitted with a new shed-proof external fuel tank and twin solid rocket boosters. The ship is then slated to be rolled out to the launch pad and put into orbit alongside the space station in March or April 2005. It will be NASA's first foray into space on its own passenger-carrying vessel since Columbia and its crew of seven were lost during a landing attempt on 1 February 2003.

Discovery played a similar role in 1988, two-and-a-half-years after the first shuttle accident. Seven astronauts were killed on Challenger as well, and though the technical cause of the ships' demise differed - Challenger was lost because of a defective booster, Columbia because of tank debris piercing the heat shield - investigations traced both accidents to flawed management practices.

NASA is still in the midst of sorting out how to re-invent itself but the equipment fixes are well under way. In addition to a modified tank design, one that hopefully will not shed chunks of insulating foam on the orbiter as it blasts into space, the post-Columbia up-grades include 88 new heat and acceleration sensors placed throughout the inside of the wings. The data will be fed to engineers after launch so they can assess if there were any potentially hazardous impacts on the critical wing heat panels. More cameras will be laced to the shuttle to monitor the launch, and new inspections have been added to every post-flight to-do list.

The panel overseeing NASA's implementation of the Columbia Accident Investigation Board's recommendations said the agency had completed 5 of 15 requirements for flight. NASA may need leeway for some of the other requirements, however. For example, the agency will be unable to develop by March a repair option for a hole in the wing as large as the one that downed Columbia. Rather, NASA is focused on preventing debris impacts in the first place and developing safe-haven options on the space station if a shuttle crew is unable to return home on its launch vehicle.

Workers are painstakingly piecing the shuttle together to deliver a clean ship to space. Vehicle manager Stephanie Stilson, who counted up roughly 100 systems tests that remain to be done, said, "There is a lot of work ahead of us. We've turned the corner though. Our major components are now back on the structure." The shuttle team will be tasked to have not only Discovery ready to launch, but Atlantis as well. That will give managers more options should an in-orbit rescue be necessary.

Once shuttle missions resume, NASA will be consumed with finishing the International Space Station and positioning it for on-going operations without future shuttle servicing calls. Partners last week agreed to continue working toward expanding the station crew size to six astronauts. Details on how additional Russian Soyuz lifeboats would be purchased, as well as what research programmes the crewmembers would be working on, remain pending. This article is from a report on the Science and Nature section of the BBC News website (news.bbc.co.uk) on 26 July 2004.

4.17 UK asks NASA to bring Beagle 3 to MARS

Colin Pillinger, project leader of the ill-fated Beagle 2 mission to Mars, has asked NASA to put a Beagle "pod" on its Mars Science Laboratory probe for 2009. Pillinger says he wants to send a second Beagle instrument package to the Red Planet as soon as possible. The Mars Science Laboratory is designed to pave the way for a future mission that would return rocks to Earth. MSL includes a "smart" rover that would be dropped on to the surface of Mars by a "skycrane". The vehicle would operate for at least one Martian year, doing biology experiments as well as extending the geology work currently being conducted by the Mars Exploration Rovers on the planet today.

Pillinger argued the case for sending a follow-up mission to Mars before the Committee on Space Research (COSPAR) scientific assembly in Paris, on 23 July 2004. "If you're going to bring back a documented sample from Mars, I think you ought to screen it beforehand to make sure that all the effort you've gone to gets the best sample," he said. The Beagle 2 creator was talking at a panel discussion on the future of Mars exploration. He added that, in his opinion, it was also essential to demonstrate whether or not there was life on the Red Planet before manned missions were sent to explore it. "If we do send men there, we will inevitably be taking Earth microbiology to our neighbour in the Solar System and it will never be the same after that," he explained.

Steve Squyres, principal investigator for the Mars rovers' science payload, who was

also on the panel, said he hoped the success of NASA's robotic explorers had ended discussions about the importance of mobility on landers. But Pillinger argued that Beagle had a unique capability lacking in other science payloads - the ability to burrow beneath Mars' soil. "Whenever people argued that Beagle didn't have mobility, I would argue it did. We were going to go down instead of across. I think down is a very important place to go [on Mars]," he said. Pillinger was referring to the "mole", a burrowing instrument designed to obtain a soil sample from beneath the surface.

Pillinger also mused on the factors that might have scuppered his first attempt to land on Mars: "We don't know what went wrong. It could have been something as simple as a tiny resistor in a communications chain. Our best bet is that the gremlins of Mars changed the composition of the atmosphere to the point where it was thinner than we anticipated so we didn't make it to the surface." But he added: "I should remind you that Beagle 2 was named after the ship HMS Beagle that took Charles Darwin around the world. It was the second voyage of HMS Beagle which was the important one, not the first."

ESA is planning its own lander mission, called ExoMars, to look for traces of life on the Red Planet. This might also launch in 2009. This article is based on a report on the Science and Nature section of the BBC News website (news.bbc.co.uk) on 26 July 2004.

4.18 Data Information & Management System (DIMS)

On 17 June 2004 it was announced that DLR (German Aerospace Centre) and the software provider Werum Software and Systems have agreed on international commercialisation of the Data Information and Management System (DIMS) for Earth observation (EO) data, and signed a technology transfer agreement. In the coming years, the partners expect a growing demand for systems designed to manage EO data, due to the ever increasing worldwide use of satellites for the observation of land and water surfaces and the atmosphere, as well as for the supply of information for use in natural disaster containment and humanitarian relief actions.

DLR developed DIMS to integrate a full range of versatile processes, from development to delivery of digital data products, and to optimise the storage of vast amounts of data, ranging into the terabytes. As a systems partner, Werum has been involved in this development from the outset.

Since its first deployment in 1999, DLR and Werum have expanded and evolved DIMS into a multi-mission system currently managing data from over 30 missions and projects. For example, DLR applies DIMS for the creation and distribution of daily ozone maps, the generation of global 3-D elevation models based on data from the Shuttle Radar Topography Mission (SRTM), and the creation of high quality information products for use in such areas as precision farming, coastal preservation and disaster monitoring. The users of such information - part of which is available just a few minutes after satellite recording is completed - access DIMS via a configurable Web interface (www.eoweb.de). Along with the option for electronic ordering, the system also provides automatic / interactive processing and invoicing functions (e-commerce).

Due to its open interfaces and high levels of scalability and configurability, the system is quite flexible and can be easily adapted to individual customer specifications and requests. Prof. Dr. Stefan Dech, Director of the German Remote Sensing Data Centre (DFD) explained: "At an early stage, we had already recognised the need to develop a system that could effectively manage the huge amounts of our data and information. After assessing the latest software technologies with regard to the demands of our data centre, and having documented them according to international standards, we found Werum to be the most competent partner in terms of worldwide marketing for our product". Dr. Hans Windauer, Chairman of the Executive Board of Werum, said: "In an intense, trust-based co-operation with DLR, we have been able continuously to advance DIMS to its current elevated level of technical sophistication. For this reason, we are confident that DIMS will soon find further applications in other international projects, too".

Details on Werum Software and System and DLR are at the websites: www.dims.werum.com, www.eo.werum.com, www.dlr.de and www.caf.dlr.de/caf/institut/dfd.

For further information, contact Volker Mensing (mensing@werum.com), Werum Software and Systems AG, or Gunter Schreier (gunter.schreier@dlr.de), DLR.

4.19 ERDAS IMAGINE supports Oracle Database 10g

On 16 July 2004, it was announced that Leica Geosystems and Oracle Corporation have partnered to bring to the market, for the first time, imaging tools that address multiple terabytes (approaching petabytes) of remote sensing (RS), photogrammetry and satellite imagery as a single logical dataset in an open, enterprise system. Leica Geosystems' ERDAS IMAGINE now supports Oracle 10g Spatial and GeoRaster, and can access raster data stored and managed in Oracle Database 10g.

Oracle Database 10g is the industry's first database designed for grid computing. It includes the new GeoRaster feature in Oracle 10g Spatial that allows vector data, georeferenced raster imagery and gridded data to be stored, indexed, queried and analysed in the same system. When imagery is stored in GeoRaster, users can find a location on the Earth's surface or in a local coordinate system for each cell in a raster. Additionally, given a location on the Earth, they can find the cell in a raster layer associated with that location. Support for Oracle 10g Spatial and GeoRaster will be a standard feature in all Leica Geosystems image processing products, including future releases of ERDAS IMAGINE and Leica Photogrammetry Suite (LPS).

With the explosive growth in the collection and analysis of RS and satellite imagery, and the dramatic improvements in high-resolution data capture, both companies recognise that multi-petabyte image archives will become increasingly common. Using GeoRaster, Leica Geosystems products will be able to perform operations on single images of up to half a terabyte, in archives spanning petabytes of vector and raster data.

The extension of ERDAS IMAGINE and LPS will allow product users within a large organisation to share imagery across the entire organisation, avoiding the management and maintenance difficulties associated with traditional shared file systems. ERDAS IMAGINE and LPS will both directly access database imagery without the need of special importers. Both products will be able to place data directly into the database and it will be possible to use imagery within the database as easily as imagery in IMG, TIFF or JPG formats.

For more information about Oracle or Leica Geosystems GIS and Mapping, visit their respective websites: www.oracle.com and gis.leica-geosystems.com.

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 New book on thermal remote sensing of Earth

Quattrochi, Dale A. and Jeffrey C. Luvall (Editors). 2004. Thermal Remote Sensing in Land Surface Processes. CRC Press, Boca Raton, London, New York, Washington. ISBN: 0415302242. 440 pages.

Review by Dr. Hans-Peter Thamm (thamm @rsrg.uni-bonn.de), Remote Sensing Research Group, Institute for Geography, Meckenheimer Allee 166, D- 53115 Bonn, Germany.

Thermal infrared (TIR) remote sensing (RS) offers fascinating possibilities for the investigation of land surface processes. Especially with the launch of the NASA Terra suite of satellite RS instruments in 1999, TIR data are poised to become a major source of quantitative and qualitative information on land surface processes, and their characterisation,

analysis and modelling. But there is still a gap between the potential value of TIR RS data and their widespread utilisation, perhaps due to the lack of a comprehensive, technical sound standard textbook.

To encourage more scientists to discover the fascinating possibilities of TIR RS for observing land surface processes, editors Dale Quattrochi and Jeffrey Luvall have collected 11 extended papers giving detailed information on work with TIR RS images for land surface processes.

The editors' aim is to present studies where TIR data have been applied to derive quantitative measurements of the fluxes and redistribution of surface thermal energy balance characteristics, for land surface process understanding and investigation of land-atmosphere interaction. They also wish to promote the wider usage of TIR data in research and modelling for a better understanding of the role of thermal energy balance and surface energy fluxes in driving land processes. A further goal is to elucidate prospects and problems of using TIR data in land processes research, as a major component in Earth system research. And last but not least, the editors wish to illustrate the virtues and importance of TIR data, to facilitate the development of new and improved TIR RS systems in the future. To fulfil these demands the book has the following structure:

- Part I: TIR data for assessment and quantification of surface energy fluxes and soil moisture: estimation of environmental variables using thermal RS; land surface temperature retrieval techniques and application - example of AVHRR; high spatial resolution mapping of surface energy balance components with RS data; estimating spatially distributed surface fluxes in a semi-arid Great Basin desert using Landsat TM thermal data; coupling TIR and visible satellite measurements to infer bio-physical variables at the land surface; rapid soil drying and its implication for RS of soil moisture and the surface energy fluxes; mapping surface energy fluxes with radiometric temperature.

- **Part II: TIR data for assessment of ecosystem health**: TIR measurements as an indicator of plant ecosystem health; energy analysis of ecosystems - establishing a role for thermal RS.

- **Part III: TIR instruments and calibration**: calibration of TIR sensors; MUST - a Medium-Scale Surface Temperature mission dedicated to environment and agriculture.

Despite the fact that, in a book containing contributions of different authors, slight changes in the quality of the individual papers are unavoidable the overall scientific quality is high. In every Chapter the underlying physical processes and methods are described in detail with the necessary formulas, and backed up with many figures. If there are different methods described in literature, these are explained and evaluated, which is a great help for the user. The literature references within the articles are detailed and represent mostly the present status of the science. The figures within the articles are black-and-white, but there is a separate 24 page section with detailed colour figures.

A big advantage is that the volume is designed as much as possible as a "how-to-do" book. The interested user can find a lot of valuable information to utilise TIR RS data for his own work. A big plus in this regard is that the use of TIR data in different spatial and temporal scales is described.

With this book the authors fill a significant void in the RS literature. Perhaps the selection of the presented projects could be discussed, but overall it is a very important book for everyone who want to work with thermal RS data for investigating and modelling land surface processes.

5.2 Airborne hyperspectral RS paper wins award

On 15 June 2004 it was announced that the scientific paper entitled "Extraction, Modelling and Use of Linear Features for Restitution of Airborne Hyperspectral Imagery", by Changno Lee and James S. Bethel, had won the U.V. Helava Award, one of the most prestigious ISPRS (International Society for Photogrammetry and Remote Sensing) recognitions. A 5-member jury of profes-

sionals, with expertise covering the main topics within the scope of the ISPRS Journal, evaluated 114 papers published in 2000-2003. Each year during the 4-year evaluation period, the Best Paper was selected and announced in the ISPRS Journal, ISPRS Highlights and on the ISPRS and Elsevier websites. The paper by Lee and Bethel was chosen from the four Best Papers, as the U.V. Helava Award winner, which was presented during the 20th ISPRS Congress in Istanbul, Turkey, by ISPRS President John Trinder and sponsor representatives (see below).

The winning paper discusses semi-automated line extraction, and incorporation into the orientation process for linear array CCD (charged coupled device) sensors. This is a very relevant topic, considering the current development of digital aerial cameras and existing problems in the orientation of linear CCDs. The authors used up-to-date techniques for trajectory modelling, line feature extraction and integration into the geometric sensor model, providing convincing and thorough experimental tests and a transparent analysis of the results. Their research provided an excellent balance between theory and practice. The paper's high practical significance was increased by the use of GPS / INS (Global Positioning System / Internal Navigation System), and reduction of the needed control line features.

The award consists of a monetary grant of 10,000 Swiss francs, certificates and a silver plaque. It is sponsored by Leica Geosystems GIS and Mapping LLC *(Editor: Limited Liability Company ☺)* and Elsevier B.V. Co-sponsors of the award are the Institute of Photogrammetry and Remote Sensing (Prof. Henrik Haggrén) of the Helsinki University of Technology.

The U.V. Helava Award was established in 1998, and first presented in 2000. Its purpose is to encourage and stimulate submission of high quality scientific papers by individual authors or groups to the ISPRS Journal, to promote and advertise the ISPRS Journal, and to honour the outstanding contributions of Finnish scientist Dr. Uuno (Uki) Vilho Helava (1923-1994), a leading photogrammetrist and developer of analytical and digital systems *(Editor: and inventor of the analytical plotter)*. The award is presented to authors of the best paper (in English) and published exclusively in the ISPRS Journal, during the 4-year period from January of a Congress year to December of the year prior to the next Congress. Recipients can receive the Award only once.

Editor: The reference for the paper by Lee and Bethel is: Lee, C. and J. S. Bethel. 2004. Extraction, modelling, and use of linear features for restitution of airborne hyperspectral imagery. ISPRS Journal of Photogrammetry and Remote Sensing, Volume 58, Issues 5-6, July 2004, pp 289-300. The paper can be freely downloaded from the ScienceDirect website (www.sciencedirect.com).

6 FORTHCOMING MEETINGS & COURSES

6.1 Calendar of forthcoming meetings

3-6 Oct 2004
Freiburg, Germany

International Conference: Laser-Scanners for Forest & Landscape Assessment - Instruments, Processing Methods & Applications
Website: www.natscan.de

NEW
7-8 Oct 2004
Göttingen, Germany

GGRS 2004: 1st Göttingen GIS & Remote Sensing Days
Organised by: Institute of Geography, Georg-August-University, Göttingen, Germany.
Website: www.ggrs.uni-goettingen.de

27-29 Oct 2004
Chioggia (near Venice), Italy

24th Urban Data Management Symposium
Organised by Urban Data Management Society (UDMS). Website: www.udms.net

28-30 Oct 2004 Amsterdam, the Netherlands	**International Workshop: Integrated Assessment of the Land System - the Future of Land Use** Website: www.lucc.nl
2-4 Dec 2004 Bordeaux, France	**International Conference: From Knowledge of Landscapes to Landscaping Action** Website: landscape.lyon.cemagref.fr
23-26 January 2005 New Orleans, USA	**1st International Conference on Environmental Science & Technology (IC EST '05)** Website: www.AASci.org/conference
NEW 21-23 Feb 2005 Bern, Switzerland	**4th EARSeL Workshop on Land Ice and Snow: Remote Sensing of Snow and Glaciers - Important Water Resources of the Future** Contact: Dr. Stefan Wunderle (swun@giub.unibe.ch), University of Bern, Switzerland. Website: dude.uibk.ac.at/lissig.
14-16 March 2005 Tempe, Arizona, USA	**Joint Symposia: Remote Sensing and Data Fusion over Urban Areas (URBAN 2005) & Remote Sensing of Urban Areas (URS 2005)** Website: www.urban-remote-sensing.org
NEW 25-27 April 2005 Warsaw, Poland	**4th EARSeL Workshop on Imaging Spectroscopy: New Quality in Environmental Studies** Website: www.wgsr.uw.edu.pl/zts/workshop/index.htm
NEW 30 May - 3 June 2005 Borås, Sweden	**ForestSat 2005: Operational Tools in Forestry using Remote Sensing Techniques** Programme: Workshop on Satellite RS for Forest Monitoring (30 May - 1 June), followed by Workshop on RS and GIS for Forest Authorities and field excursion (2-3 June). Contact: Prof. Håkan Olsson, Swedish University of Agricultural Sciences. E-mail: Hakan.olsson@resgeom.slu.se. Website: www.svo.se/forestsafe
6-11 June 2005 Porto, Portugal	**25th EARSeL Symposium: Global Developments in Environmental Earth Observation from Space** Website: www.fc.up.pt/earsel2005
9-10 June 2005 Porto, Portugal	**2nd EARSeL Workshop on Remote Sensing of the Coastal Zone** Website: las.physik.uni-oldenburg.de/workshop.html
10-11 June 2005 Porto, Portugal	**1st EARSeL Workshop on 3D Remote Sensing** Website: www.ipi.uni-hannover.de/html/aktuelles/workshop.doc
NEW 16-18 June 2005 Zaragoza, Spain	**5th EARSeL International Workshop on RS and GIS Applications to Forest Fires Management: Fire Effects Assessment** Organised by: Dr. Emilio Chuvieco (Emilio.chuvieco@uah.es), Department of Geography, University of Zaragoza, Spain. Website: www.geogra.uah.es/earsel/
NEW 13-15 Feb 2006 Vienna, Austria	**Workshop on 3-D Remote Sensing in Forestry** Contact: Prof. Werner Schneider (Werner.Schneider@boku.ac.at), EARSeL SIG Forestry