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1 EDITORIAL

Note from Editor: Apologies to our readers for the lateness, due to unavoidable circumstances, of this issue of the EARSeL Newsletter.

End-of-year message from Prof. Eberhard Parlow, Chairman of the EARSeL Bureau

In this final issue of the year 2003 it is good to take stock of the current situation of European remote sensing as it is conducted by the European Space Agency (ESA) and others.

During recent years Earth observation (EO) from space has become an important technology to tackle environmental problems from local to global scales. Europe has achieved great progress in this field and in some areas is a world player. Things are changing very rapidly, however, and the economic crisis in most European countries has led to a reduction in financial support for space science and EO. This has significantly affected ESA, which has suffered a drastic cut in finance. ESA spent 300 million Euros during 2003 on EO, whereas NASA invested 1.6 billion Euros in the same year. This great discrepancy exists in spite of the fact that Europe has a similar GNP and a slightly higher population. The total US investments in space activities are ten times higher compared to Europe.

ESA's Earth Observation Strategy:
ESA has organised its space strategy along two lines: Earth Explorer and Earth Watch Missions, aimed at improving our understanding of the complex interactions of the Earth system, mainly the climatological and hydrological aspects. Therefore most of the on-going and future missions will provide data on a continental or global scale with very sophisticated sensors but in a medium to coarse spatial resolution. This is a very important issue with negative consequences for all those of the European remote sensing community who are more interested in regional to local research and especially in applications.

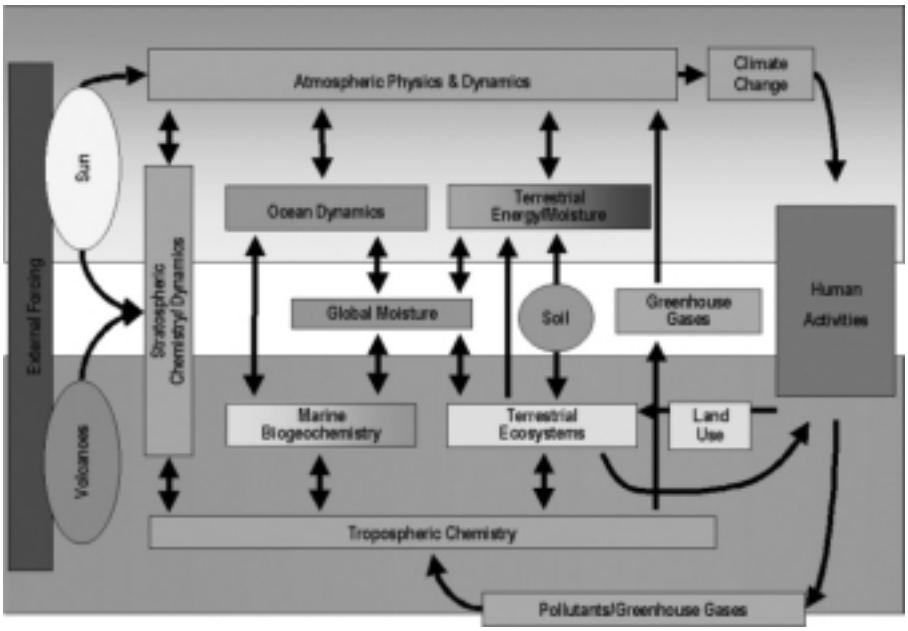
The Earth Explorer Programme includes research and demonstration missions intended to advance our understanding of the Earth's environment and to demonstrate new observing techniques. There are two complementary types of Earth Explorer mission, Core missions and Opportunity missions that have been detailed elsewhere.

The Earth Watch Programme is intended to deliver new EO-based information services that respond directly to Europe's environmental policies. These include GMES (Global Monitoring for Environment and Security) services in co-operation with the European Commission, InfoTerra / Terrasar (aimed at serving institutional and commercial user requirements for geo-information services), and Fuegosat (aimed at providing early warning and monitoring of forest fires).

Driving forces for European Earth Observation:
The Figure below shows the concept of Earth system science with the most important drivers for the Earth´s climate, including the anthroposphere (human activities). A better knowledge of the processes within and especially between the boxes (arrows) is a prerequisite for international and European policy (e.g. the Kyoto-protocol). Without any doubt a better scientific basis for all these processes is very important, but the limited financial possibilities of ESA compared to the US has severe consequences for European remote sensing, and we are in most cases extremely dependent upon US sensors like Landsat or the high resolution systems like IKONOS or Quickbird. This is not necessarily in line with statements of the latest European Space Policy meeting held in Paris in June 2003, when "free access to space information" was formulated.

Europe's EO satellites:
Europe is largely characterised by a patchy and extremely heterogeneous landscape, requiring high to medium resolution sensors which are only to a very limited extent available from ESA (e.g. ERS and ASAR respectively).

Envisat is the largest and most complex European satellite ever built, costing more than 2 billion Euros. Its ten instruments are designed to make major contributions to the global study and monitoring of the Earth



Concept model of Earth system science

and its environment, including global warming, climate change, ozone depletion and ocean and ice surveying. Secondary objectives include more effective monitoring and management of the Earth's resources, and a better understanding of the solid Earth processes. As a total package, Envisat's capabilities exceed those of any previous or planned EO satellite.

The oceans exert a major influence on the Earth's meteorology and climate through their interaction with the atmosphere. Understanding the transfer of moisture and energy between ocean and atmosphere, as well as the transfers of energy by the oceans themselves, are matters of scientific priority. Envisat will contribute to this area by providing information on ocean topography and circulation, winds and waves, ocean waves and internal waves, atmospheric effects on the sea surface, sea-surface temperatures, coastal bathymetry and sediment movements, as well as the biophysical properties of oceans.

The Earth's land surface is a critical component of the Earth system as it carries more than 90% of the biosphere. It is the location of most human activity and it is therefore on land that human impact on the Earth is most visible. Within the biosphere, vegetation is of fundamental importance as it supports the bulk of human and animal life and largely controls the exchanges of water and carbon between the land and the atmosphere. Yet our understanding of the many processes involved is limited. Envisat observations will characterise and measure vegetation parameters, surface water and soil wetness, surface temperature, elevation and topography. These are critical data sets for improving climate models.

Meteosat Second Generation, launched in August 2002 is contributing to a better understanding of atmospheric processes and improved weather forecasting, and is really more than a weather satellite. With a spatial resolution up to 1 km it emulates NOAA-AVHRR. A repetition rate of 15 minutes has never been reached before worldwide and 12 spectral bands will make the data useful for many more applications than "weather forecast only". **SPOT-5** plays a very important role in European high resolution sensors. It offers improved multispectral sensors in three bands and a spatial resolution of 10 metres and a panchromatic image in 2.5 and 5 metres, which meets the needs of many applications (e.g. remote sensing of urban areas). Another very important EO system will be the hyper-spectral sensor **SPECTRA** which was selected as a future

ESA Earth Explorer core mission, and is designed to cover the solar spectrum between 0.4 and 2.35 µm continuously with more than 200 bands, also including the thermal infrared bands at 10.5 - 12.2 µm. With a spatial resolution of 50 metres and a swath of 50 km it observes the Earth from seven different viewing angles to compensate for BRDF problem along satellite track. Its launch is planned in 2008-2010.

Conclusions:
European EO satellites provide a unique opportunity to study the interactions between atmosphere, cryosphere, biosphere and hydrosphere including the human impacts on a global to continental scale. With the presently available and future sensors, Europe is a strong and important player in global change problems. However, this strategy is not necessarily compatible with the requirements of the European remote sensing community which needs multispectral and high resolutions sensors for research and terrestrial applications (forestry, agriculture, urban development and many others). This discrepancy results from a strong European dependency on American or Asian satellite technology. Data of these systems can be easily accessed via Internet, and are available for work within an hour. European satellite data and data providers are far from offering these standards. Easy and fast access is prerequisite for the use of EO data. The success of ASTER or MODIS, to mention just two, is an example for this strategy. Fast access to European satellite data is often a nightmare, and I regularly hear complaints from colleagues all over Europe.

A critical situation has occurred since the failure of LANDSAT 7 on 31st May 2003, as reported in our Newsletters. Many research teams and applications worldwide rely on this unique sensor, with its excellent spatial and spectral resolutions. An important and priceless aspect is its long lasting availability, making changes in the environment detectable. None of the European global change-related satellite sensors will offer this possibility, and relevant European organisations should not complain that most of Europe's EO research teams are NOT using European data!

The only possibility to guarantee free access to all kinds of space-borne information of environmental problems in Europe on regional to local scales, is to improve the financial situation of European EO by the ESA Member States, and also to modify future EO strategy. One important task of EARSeL is to watch developments in EO from an end-users point of view, and to send warnings if future developments and user needs start to diverge. EARSeL is not alone in this discussion, and has started intensive co-operation with ISPRS and IAA (International Academy of Astronautics).

Dear colleagues, I wish you all a very fruitful and successful year 2004. I hope to meet most of you at one of our Workshops or at the Symposium to be held in Dubrovnik, Croatia at the end of May 2004.

Eberhard Parlow
EARSeL Chairman

2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 EARSeL Bureau strategy meeting

In a constantly changing social and economic environment, it is always necessary for associations to regularly review their strategy in order to better meet the needs of their members and sponsoring organisations. The Bureau therefore took advantage of the joint ISPRS-EARSeL workshop on Resolution Mapping from Space in Hanover in early October 2003, where several were present in any case, to take stock of the current situation.

Several of the Special Interest Groups are very active and organise regular high-level meetings, which now produce a selection of reviewed papers on CD-ROM in our e-Proceedings series. These will in time constitute a valuable series of monographs. It was agreed that the editorial board needs to be enlarged and that every effort should be made to produce the CD-ROM as rapidly as possible taking into account the reviewing procedure. Part of our role is also to disseminate research results to a wide audience and it was therefore agreed that papers published should be put on our web pages within a very short time of publication. Developing countries in particular have an urgent need to access the scientific literature and this is one way in which we can help them.

Publication of our annual symposium proceedings in hardback with a CD-ROM proves to be very expensive, together with the cost of postage of a heavy volume to approximately 400 addresses. Bureau and Council are therefore considering whether we should follow the example of many societies and produce these proceedings on CD-ROM only. We need to consult our membership of course, and we welcome your views. Quite often the annual membership fee to EARSeL is taken care of by the libraries of various institutions and it is possible that they still prefer to receive a book rather than a CD-ROM. We need your views on this, and we request you to answer the simple questionnaire included with this issue.

Another item for discussion concerned the EARSeL web pages, which are currently undergoing a review to broaden their scope and make certain sections more easily accessible.

Preparations for the Symposium and Workshop in Dubrovnik were reviewed. The response to the Call for Papers has been good and the Preliminary Programme will be prepared early in 2004. Participants are urged to make their travel arrangements and register as early as possible, since the end of May is just before the beginning of the high season in Dubrovnik and is already a very popular period for hotel bookings.

An important item for discussion concerned the financial situation, since this year it will no doubt be necessary to use some of our savings to cover our expenses, hence the need to generate some more income and to make economies where possible. It was agreed that membership could be made more attractive by making a greater difference between registration fees for members and non-members for future meetings. When considering that the reduced fee applies to all persons coming from a member institute, this can soon offset the annual fee. This latter in fact has now remained at the same level for three years, so that a very small increase next year to take into account inflation, was suggested to Council in January. It was agreed that all expenditures should be kept to a minimum and this will be reflected in next year's budget.

2.2 News from the Special Interest Groups

SIG Data Fusion: This group is organising a session in Dubrovnik, as in 2003 in Ghent.

SIG Developing Countries: This group is actively preparing its next Workshop to be held in Cairo, Egypt, on 26-29 September 2004. The Workshop will be followed by a field trip to Ismailia. A CD-ROM of the Workshop held on 18-20 September 2002 at

the University of Bonn is now available through the EARSeL Secretariat.

SIG Forestry: (See also Section 2.3 below). Prof. Hakan Olsson, convenor of this SIG will organise a session in Dubrovnik. New developments in the field of analysing high resolution data from space, as well as from airborne digital cameras and line scanners, including the multi-view angle aspect, have interesting impacts on forestry applications. This and the need for a continued forum in Europe for discussing airborne laser scanning of forests, prompted the grouping together of these topics, and in September or October 2005 an EARSeL SIG Forestry Workshop on "3-D Remote Sensing in Forestry" will be held in Vienna at the Institute of Surveying, Remote Sensing and Land Information, University of Natural Resources and Applied Life Sciences (Universität für Bodenkultur Wien). For further information, contact the Workshop organiser, Prof. Werner Schneider (werner.schneider@boku.ac.at). Another Workshop supported by EARSeL, on "Laser-Scanners for Forest and Landscape Assessment", is being organised in Freiburg, Germany, on 3-6 October 2004 (see www.natscan.de/conference).

SIG Forest Fires: This group held its 4th Workshop following the Symposium in Ghent. A selection of the papers presented at the Workshop will be published in the "Remote Sensing of the Environment" Journal. There will also be a session on this topic in Dubrovnik.

SIG Geological Applications: This group, in co-operation with the Geological Remote Sensing Group in the UK, is planning a dedicated session in Dubrovnik.

SIG Imaging Spectroscopy: The CD-ROM of the proceedings of the very successful Workshop organised on 13-16 May by DLR in Oberpfaffenhofen, will soon be ready for distribution.

SIG Land Ice and Snow: The CD-ROM of the reviewed proceedings of the Workshop in Berne, Switzerland, on 11-13 March 2002, has now been distributed. Anyone who would like a copy should contact the EARSeL Secretariat. Another meeting is planned in Berne, probably in 2005.

SIG Land Use / Land Cover: The 1st Workshop of this newly-formed group, led by Dr. Matthias Braun of the University of Bonn, is to be held following the Symposium in Dubrovnik. The response to the Call for Papers has been good and the Preliminary Programme will be published shortly.

SIG Remote Sensing of the Coastal Zone: A selection of papers presented at the 1st Workshop of this group, which was held in Ghent, is currently being reviewed, for publication in the EARSeL eProceedings series.

SIG Remote Sensing for Multilateral Environmental Agreements: This group is planning its 1st Workshop, which will be organised as a Tutorial session on 12 July 2004, during the ISPRS Congress to be held in Istanbul. Scientists and decision-makers, as well as service providers generating relevant information, are invited to attend. The aim is to deliver information in order to match the technological and scientific research plans and technology transfer opportunities, with actual needs.

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

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

SIG Remote Sensing of Urban Areas: This group, led by Prof. Carsten Juergens, is organising a session in Dubrovnik.

SIG Multi-Temporal Analysis of Satellite Imagery: The first action of this group, led by Dr. Keith McCloy of the Danish Institute of Agricultural Sciences, will be to hold a session in Dubrovnik.

2.3 EARSeL Workshop: Laser Scanning of Forests

Report on the EARSeL "ScandLaser Workshop on Laser Scanning of Forests", in Umeå, Sweden, 2-4 September 2003.

Håkan Olsson, Chairman of EARSeL SIG Forestry, Remote Sensing Laboratory, Department of Forest Resource Management and Geomatics, Swedish University of Agricultural Sciences, Umeå, Sweden.

Airborne laser scanning is emerging as a very promising technology for remote sensing of forests. Today's laser scanners are operationally used for a multitude of surveying applications, and up to 80,000 3-D positions per second can be measured with an accuracy of a few decimetres. The aim of the Scandinavian Workshop on Laser Scanning of Forest Resources (ScandLaser), which was held in Umeå, Sweden, on 2-4 September 2003, was to bring together researchers in the field of laser scanning of forest resources, to review the state-of-the-art, to compare research and operational results from related activities in different countries, and to create a foundation for further networking. The focus was on airborne, distance measuring, laser techniques. The meeting could probably be considered the first of its kind in Europe, and the third in the world. Similar meetings were held in Australia and Canada in 2002, as reported in the Canadian Journal of Remote Sensing - Special Issue: "Lidar Remote Sensing of Forest Structure and Terrain", 29 (5), October 2003. The ScandLaser workshop was divided into a one-day practical workshop, followed by a two-day scientific workshop. The meeting was attended by about 80 scientists from 16 different countries. Most participants came from Europe, but Japan, China, USA and Canada were also represented.

The practical workshop was primarily aimed at communicating the operational possibilities of laser scanning to staff in the forestry sector that are responsible for such matters, although the workshop was also attended by many researchers. Professor Erik Næsset, from the Norwegian University of Agricultural Sciences, demonstrated his method for stand-wise assessment of key parameters such as mean height and stem volume. This method is based on fitting regression models relating forest parameters on field surveyed plots to laser-derived features such as height percentiles and canopy closure measures. When grid-based estimates of stem volume are summarised on stand level, the accuracy is in the order of 10-15 % of the average stem volume for coniferous stands. The results have been confirmed in different test areas in Norway and Sweden. However, according to the experiences in Norway the accuracy achieved in mixed and broadleaf-dominated stands is not satisfactory. The main reason seems to be the irregular structure of the broadleaf canopy. This conclusion was also supported by experiences in Canada, USA, Sweden and Finland. More research is needed to develop robust methods that can cope with this type of forest.

The experience so far indicates that laser scanning is a more accurate method for assessment of stem volume and stand mean height in boreal coniferous forest, than any other operational remote sensing method. In the practical workshop, Tord Aasland from Prevista AS in Norway told us that, in combination with digital photogrammetry which is used for stand delineation and estimation of species proportions, laser scanning is now marked as an operational method in Norway for stand-wise forest surveys of areas larger then 5,000 ha. The total cost for data capture is higher than using photogrammetric methods alone, but it is argued that this will be offset by the value of the more accurate information gained. The cost for the laser data acquisition part for this stand-wise method is in the order of 3 Euro / ha. In the second half of the practical workshop, experts from Finland and Sweden presented talks on information needs in the forestry sector in their respective countries, and the place for laser scanning.

The first keynote speaker at the workshop was Dr Ove Steinvall, head of the department of laser systems, Swedish Defence Research Agency. Dr Steinvall made it possible for Swedish Forest Researchers to test

laser scanning for forest inventory as early as 1991 and has unique insights into future laser technologies. He stressed that the technical development of laser sensors still is very rapid on the military side and that these technologies will most likely also be available for environmental monitoring in the future. A new generation of laser radars that allow for increased measuring density is being developed using Focal Plane Arrays (FPA). For these laser radars, the returned light is not detected by a single detector but by an array of detectors. We can expect future laser sensors to be much more compact and record 3-D data points with a much higher density than today. One conclusion to be made after having heard the talk of Dr Steinvall, is that remote sensing researchers should not only investigate the possibilities with present laser scanning technology, but also carry out more general research in order to be prepared for the capabilities of future operational sensors and contribute with recommendations about system parameters for such sensors.

Other key note speakers were Dr Paul Treitz, Queens University, Canada (substituting for Dr Mike Wulder), and Dr. Randolph Wynne, Virginia Tech, USA, who summarised the development on the application side in their respective countries. Although much research is going on in both the USA and Canada, operational applications of laser scanning in forestry in these countries have been slow to materialise.

The development in laser scanning of forest resources in Norway, Sweden and Finland were summarised in three short presentations. The focus in Norway has been on estimation of stand mean values using regression functions trained with GPS-positioned field plots. This research started in 1995 and has led to the development of a method that since 2002 is marked as operational by a Norwegian mapping company.

In Sweden, the research with scanning lasers has been going on since 1991, when a military system was tested for this purpose. Since 1996, the helicopter-mounted TopEye system has been the workhorse for a series of tests carried out by three research groups in Sweden. Measurements on stand level, plot level, and single tree level have been addressed. On single tree level, one study showed that 71 % of the trees could be detected and that both tree heights and crown diameters of those trees could be measured with an accuracy of 0.6 metres. Furthermore, in a follow-up study, it was shown that pine could be separated from spruce with an accuracy of 95 %, using features from high density laser data only. The first large area (5,000 ha), semi-operational, laser scanning survey of forests in Sweden was ordered by a regional forestry board in 2003, and the data is currently being analysed.

Research in Finland is very active with a large number of groups involved. The focus is mostly on single tree methods. Tree height estimation accuracies of about 0.5 metres using TopoSys laser data were reported. Detection of harvested trees and estimation of forest growth using laser scanning were also demonstrated by Finnish researchers. Two laser datasets with two years between the acquisitions were used for the analysis. Three-dimensional tree height models were calculated for both datasets using raster-based algorithms. Object-oriented algorithms were developed for detection of harvested trees. Out of the 82 field-checked harvested trees, 65 trees could be automatically detected. Problems with detecting harvested trees were encountered mainly for small trees. Forest growth was estimated at tree, plot, and stand level. The precision of the estimated growth was about 5 cm at stand level and about 15 cm at plot level. In a Finnish comparison among a large number of sensors, such as Landsat TM, SPOT Pan and XS, AISA imaging spectrometer and the TopoSys-1 laser scanner, the laser scanner data were superior to the other sensors, both for height estimates and stem volume estimates.

In the remaining part of the workshop, 21 oral presentations were given by speakers from 11 different countries. An additional six studies, mainly about ground-based laser scanning, were presented as posters.

Laser scanning of forests was shown not only to have applications in assessment of

timber resources, but could also be used for obtaining data of relevance for the ecological functions of the landscape. For example Kaori Sato from Japan Wildlife Research Centre, presented a paper about wood mice habitat. Ross Hill from the Centre for Ecology and Hydrology, UK, gave a paper about the study of bird habitat using laser scanner data. One highlight was T. Sweda from Ehime University, Japan, who had analysed a 600 km north-south laser surveyed transect across Canada from two different time points (1997 and 2002), for studying of the impact of climate change on the forest ecosystem. He had also made similar studies in Siberia. Ross Nelson from NASA Goddard Space Flight Centre, USA, demonstrated how a low-cost profiling lidar mounted on a light aircraft could be used for regional scale forest assessment. Also this technique should be of interest for climate impact and carbon estimation research.

There were also several researchers that presented early results from recently started projects. It was apparent that both airborne and ground based laser scanning of vegetation is in a rapidly growing phase, and that much could be expected from coming meetings. One such opportunity to meet in the future will be the conference "Laser-Scanners for Forest and Landscape Assessment - Instruments, Processing Methods and Applications" in Freiburg, Germany, October 3-6, 2004 (www.natscan.de). The organisation of further meetings in a similar format to ScandLaser was also discussed among the workshop participants.

The ScandLaser workshops were jointly organised by the Swedish University of Agricultural Sciences (SLU), the Finnish Geodetic Institute (FGI), the Norwegian University of Agricultural Sciences (NLH), with Håkan Olsson SLU as chair of the organisation committee, Juha Hyyppä FGI as chair for the scientific committee, and Erik Næsset NLH responsible for the practical workshop. The meeting is considered the first meeting sponsored by the new EARSeL SIG Forestry. Furthermore, the meetings were sponsored by IUFRO and the main economical sponsor was the Nordic Forest Research co-operation committee.

The final version of the Proceedings for the ScandLaser Scientific workshop is now available, at a cost of 250 SEK + tax / ca. 30 Euro, from the Department of Forest Resource Management and Geomatics, SLU, Umeå (e-mail: Barbro.Gunnarsson@resgeom.slu.se). The proceedings can also be downloaded free of charge from the ScandLaser web-site (www-earsel-sig-forestry.slu.se/scandlaser), where most of the Powerpoint presentations from the workshop can also be viewed, in a read-only format. The SIG team are also working on putting together a future issue of the Scandinavian Journal of Forest Research, with some articles from ScandLaser.

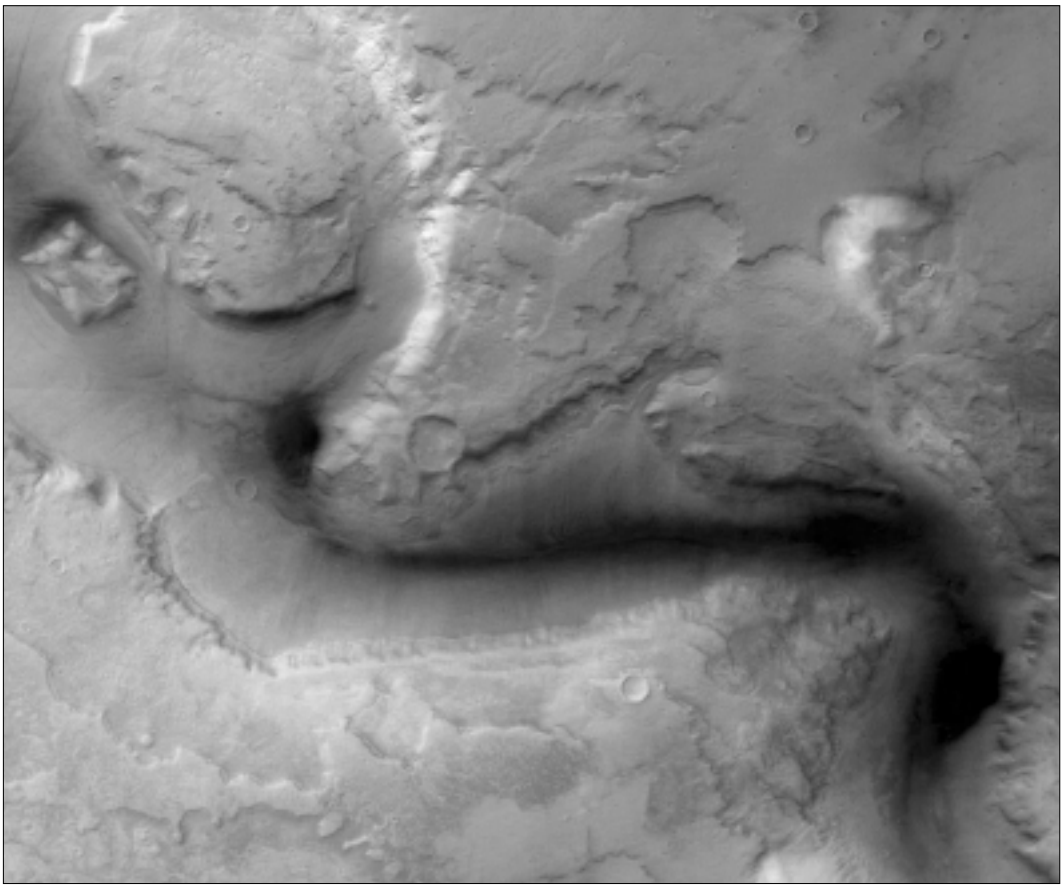
3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 Mars Express: 1st spectacular results

Mars Express, ESA's first mission to Mars, which reached its final orbit on 28 January 2003, has been producing stunning results since its first instrument was switched on, on 5 January. The significance of the first data was emphasised by the scientists at a European press conference today at ESA's Space Operations Centre, Darmstadt, Germany.

"I did not expect to be able to gather together - just one month after the Mars Orbit Insertion of 25 December - so many happy scientists eager to present their first results", said Professor David Southwood, ESA Director of Science. One of the main targets of the Mars Express mission is to discover the presence of water in one of its chemical states. Through the initial map-



This picture was taken by the High Resolution Stereo Camera (HRSC) on-board ESA's Mars Express orbiter, in colour and 3D, on 15 January 2004 from a height of 273 km. The location, east of the Hellas basin, is 100 km across, with a pixel resolution of 12 metres, and shows a channel (Reull Vallis) once formed by flowing water

ping of the South polar cap on 18 January, OMEGA, the combined camera and infrared spectrometer, has already revealed the presence of water ice and carbon dioxide ice. This information was confirmed by the PFS, a new high-resolution spectrometer of unprecedented accuracy. The first PFS data also show that the carbon oxide distribution is different in the northern and southern hemispheres of Mars.

The MaRS instrument, a sophisticated radio transmitter and receiver, emitted a first signal successfully on 21 January that was received on Earth through a 70-metre antenna in Australia after it was reflected and scattered from the surface of Mars. This new measurement technique allows the detection of the chemical composition of the Mars atmosphere, ionosphere and surface. ASPERA, a plasma and energetic neutral atoms analyser, aims to answer the fundamental question of whether the solar wind erosion led to the present lack of water on Mars. The preliminary results show a difference in the characteristics between the impact of the solar wind area and the measurement made in the tail of Mars. Another exciting experiment was run by the SPICAM instrument (an ultraviolet and infrared spectrometer) during the first star occultation ever made at Mars. It has simultaneously measured the distribution of the ozone and water vapour, which has never been done before, revealing that there is more water vapour where there is less ozone.

ESA also presented astonishing pictures produced with the High Resolution Stereo Camera (HRSC). They represent the outcome of 1.87 million km^2 of Martian surface coverage, and about 100 gigabytes of processed data. This camera was also able to make the longest swath (up to 4000 km) and largest area in combination with high resolution ever taken in the exploration of the Solar System. This made it possible to create an impressive picture, 24 by 1.3 metres in size, which was carried through the conference room at the end of the press event by a group of 10-year-old children. Mrs. Edelgard Bulmahn, German Minister for Research and Education, who is also chair of the ESA

Council at Ministerial level, said at the press conference: "Europe can be proud of this mission: Mars Express is an enormous success for the European Space Programme." This article is from a report at ESA's web-site (www.esa.int) on 23 January 2004.

3.1.2 Mars Express: Beagle fails to come to heel

On 26 January 2004 it was reported that the latest attempts to contact the British Mars lander Beagle 2 had drawn a blank, and that the mission team accepted the small probe is now probably lost. Attempts by the Mars Express orbiter to hail Beagle failed. The mission team has now started to look at what might have gone wrong and a board of inquiry will also be set up by ESA. "Let's not grieve," said the project's lead scientist, Professor Colin Pillinger. "Let's look to the future." Professor Pillinger was briefing reporters in London on the latest efforts to track down the "pocket watch" lander. "We haven't found Beagle 2, despite three days of intensive searching," he said. "Under those circumstances, we have to begin to accept that, if Beagle 2 is on the Martian surface, it is not active."

Confirmation that Beagle really is dead will come after one last option has been pursued. This involves sending the lander a command via the US Mars Odyssey orbiter telling it to reboot its computer. If the probe is still intact on the Martian surface and capable of receiving the message, it could just kick-start the Beagle into communicating. But Professor Pillinger told reporters it was a long shot. "It is very much a last resort. We will be asking the American Odyssey spacecraft [team] ...whether they will send an embedded command - a hail to Beagle with a command inside it. "If it gets through, it will tell Beagle to switch off and reload the software. We are now working on the basis that there is a corrupt system and the only way we might resurrect is to send that command. We can also ask Mars Express to send that command. However, they cannot send it probably until the 2 or 3 February," he added.

But the repeated failure to contact Beagle using three orbiters and Earth-based radio telescopes means the chances of getting a signal now look very slim, and the Open University planetary scientist said it was really time to put people "out of their misery". The mission team is now focussing on possible reasons for failure, including the parachute and landing bags not working properly or the probe falling into a crater. A key to this investigation will be getting an image showing Beagle or its landing components on the surface.

ESA's inquiry will take some time to set up. "It takes time to get the experts together to sit on it," said Professor Pillinger. "There's nothing sinister about. If any space mission goes wrong, you have a review - and if ESA didn't call for it, we would." The head of science at ESA, Professor David Southwood, told BBC News Online: "We will be setting up a commission of inquiry to consolidate what we did right and to find out what went wrong." Mars has something of a jinx for spacecraft. There is a long history of investigations of failed Mars missions. We want to make sure we add to the lessons learned."

Professor Pillinger and his colleagues are keen to send "pups" of Beagle to Mars in 2007. They believe the experiments they sent on the probe to look for Martian life were first class and deserve a second chance. But before any space agency would even consider unleashing a pack of such probes on Mars, it would want to be sure the problems that seem to have blighted Beagle have been identified and can be designed out. "We are dedicated to trying to re-fly Beagle 2 in some way, shape or form," said Professor Pillinger. "We will now begin to look at all the aspects of Beagle with a view to deciding what was good and what we would like to change and do differently in the future." This article is from a report at news.bbc.co.uk/2/hi/science/nature/3422113.stm on 26 January 2004.

3.1.3 Envisat completes 10,000 orbits of Earth

At around 7pm CET on 28 January 2004, ESA's Envisat spacecraft completed its ten thousandth orbit of the Earth – travelling a distance of 450 million kilometres since launch, equivalent to taking a trip to Mars.

Envisat orbits our planet every 100 minutes, moving at a velocity of more than 7 kilometres per second. This lorry-sized spacecraft is the most complex environmental satellite ever launched, with ten different instruments mounted on its hull to study Earth's land, oceans and atmosphere.

These instruments were developed and built by scientists and industrial teams from all across Europe. They include the Advanced Synthetic Aperture Radar (ASAR) that sees through clouds and darkness to continuously return radar pictures, and the Medium Resolution Imaging Spectrometer (MERIS) imaging ocean colour and land cover. Envisat's Advanced Along-Track Scanning Radiometer (AATSR) records global ground and sea surface temperature, while the Radar Altimeter-2 (RA-2) measuring surface height to an accuracy of a few centimetres. A trio of atmospheric instruments map trace gases and pollutants.

Envisat completed its latest milestone as it passed over the equator 800 km above the middle of the Indian Ocean. During its ten thousandth orbit, as for any of its 14 daily orbits, Envisat was using all of its ten instruments to gather information about the world below it, and the satellite ground segment generated about ten gigabytes of data products. This article is from a report at ESA's web-site (www.esa.int) on 30 January 2004.

3.1.4 ESA cancels Eddington planet search mission

At a meeting, ESA's Science Programme Committee (SPC) decided that due to money problems it was forced to cancel the Eddington planet-search mission and reduce the BepiColombo mission to Mercury. It is the first time that ESA has cancelled a space mission. Eddington was a state-of-the-art programme designed to observe nearby stars and look for planets circling them. The loss of the BepiColombo lander is also scientifically hard to take. ESA, in conjunction with the Japanese space agency, JAXA, will still put two orbiters around rarely-visited Mercury, but having no lander is seen as a big loss to the project. It was decided that to land on a planet so near the Sun was too difficult in present circumstances.

The origins of the budgetary problems are several sudden demands on ESA finances that occurred after the Ariane 5 rocket's grounding in January. This delayed by a year the launch of the expensive Rosetta comet lander mission. A loan of 100 million Euros was temporarily granted, but it must be paid back out of present resources by the end of 2006. After what ESA called a "long and painful discussion" it decided that only one new mission could be started at this time, namely the Laser Interferometer Space Antenna (LISA) Pathfinder. The mission is the technical precursor to the world's first space-borne gravitational wave astronomical observatory, LISA. The LISA mission itself (to be made in co-operation with the US) is scheduled for launch in 2012.

David Southwood, head of ESA's science programme, is sympathetic to the concerns of Eddington scientists, but said there was little that could be done given the budget problems which, he added, were a result of tighter financial control on space projects these days. He said the loss of this one mission would not stop ESA pursuing its grand quests. This article is from a report at news.bbc.co.uk/2/hi/science/nature/3257137.stm on 10 November 2003.

3.1.5 ESA & the EU: start of a new partnership

On 12 November 2003 it was reported that Negotiations on a framework agreement for structured co-operation between ESA and the European Community had been concluded, and that the ESA Council had adopted the agreement, which had already been endorsed by the EU Council on 20 October. The origins of the agreement date from November 2001, when the ministers in charge of space activities gave ESA clear directions on the Agency's evolution and policy. The ESA-EC agreement marks a milestone in their relationship: it gives recognition to both parties, emphasising that they have specific complementary and mutually reinforcing strengths, and commits them to working together while avoiding unnecessary duplication of effort.

The framework agreement has two main aims. The first is the coherent and progres-

sive development of an overall European Space Policy, which will specifically seek to link demand for services and applications using space systems in support of EU policies with the supply through ESA of space systems and infrastructures necessary to meet that demand. The second aim of the agreement is to establish a common basis and appropriate practical arrangements for efficient and mutually beneficial co-operation between ESA and the EU, fully respecting the institutional and operational frameworks of each.

This agreement will facilitate the setting up of new joint projects and provide a stable framework for ESA-EU co-operation, and that will benefit the European citizens, said ESA Director General Jean-Jacques Dordain. The agreement also opens up new possibilities for co-operation, such as EU participation in ESA optional programmes, or ESA management of EU space-related activities. The framework agreement will be judged mainly according to its success in helping to generate valuable new programmes and activities responding to the demand of citizens expressed through the EC, Dordain added.

On 11 November 2003 the European Commission had adopted its White Paper on space, drafted with the support of ESA. It presents an action plan for implementing an enlarged European space policy, including proposals for joint ESA-EU space programmes that will take the framework agreement as their basis. The framework agreement was officially signed on 25 November 2003 in Brussels, by (for the European Community) Ms. Letizia Moratti, Italian Minister for Education, Universities and Research, and Mr. Philippe Busquin, Commissaire chargé de la Recherche, and (for the European Space Agency) Mr. Jean-Jacques Dordain, Director General ESA. This article is from a report at www.esa.int.

3.1.6 Review of 2003 Envisat Int'l Summer School

The First Envisat Data Assimilation Summer School was held at the end of August 2003 at ESRIN, ESA's Space Research Institute just outside Rome. Sponsored by ESA and the World Climate Research Programme, the two-week summer school was attended by 57 young scientists from 17 countries. The idea for the summer school arose from discussions between ESA staff and Alan O'Neill of the Data Assimilation Research Centre, University of Reading, UK. Its aim is to help train a new generation of scientists in the broad range of skills needed to exploit the exciting new data now being received from satellites, particularly ESA's ENVISAT, launched in February 2002. The summer school was especially timely because it was held just after routine processing of Envisat data became fully operational. Of the ten instruments on board Envisat, three (MIPAS, SCHIAMACHY and GOMOS) are now producing valuable information about the structure and evolution of the Earth's atmosphere, including the distribution of temperature with height and latitude, and the distributions of important trace gases in the atmosphere such as ozone.

A priority of the school was to show how the powerful technique of data assimilation could be used to maximise the value of these new data products. Data assimilation is a key technique to synthesise the complementary information coming from these instruments and to produce a consistent accurate three-dimensional picture of the evolution of the atmosphere. Such a picture is needed to understand how the complex meteorological and chemical processes in the atmosphere work and interact. This will enable more reliable computer models to be built to forecast how natural causes or the effects of human-induced pollution will change the atmosphere in the future.

All the lecturers at the summer school are leading experts in their fields, which include the design of satellite instruments, data analysis, atmospheric modelling and data assimilation. A key feature of the course was the reinforcement of the material presented during the morning lectures by practical, computer-based exercises in the afternoon. One practical involved analysing the current state of the ozone hole using data from instruments on board ESA's ERS-2 and Envisat satellites. Students found that the ozone hole was already well developed in late August 2003,

and that ozone forecasts made using data assimilation techniques predicted that further deepening of the ozone hole would occur. Students agreed that the school was very beneficial, not least because it gave them the opportunity to learn from each other and to make valuable contacts with other researchers at a crucial stage of their careers.

Lecturers and students expressed the hope that the school will not be a 'one-off' but the first of many. Says Claus Zehner of ESA's Earth Observation research and development section, "Envisat can supply us with a wealth of information that has not previously been available. Inviting young scientists to attend a summer school to teach them about the new data and how to use them is an important way to ensure further exploitation of this unique mission." More information is at the web-site envisat.esa.int/envschool.

3.2 News from the EC

3.2.1 Final GMES Forum draws huge attendance

The last of four scheduled fora on the European Commission's (EC) Global Monitoring for the Environment and Security (GMES) initiative took place in Baveno, Italy on 26-28 November 2003. Organisers say they had planned for around 200 participants. Instead, 300 turned up. Discussions were based largely on the Draft Final Report of the Initial Period of the GMES Action Plan (2002-2003). The unexpected crowd in Baveno added to the sense of excitement and expectation that accompanies the end of the GMES Initial Period. According to ESA Earth Observation (EO) Director José Achache, "The EC and ESA have put a lot of work into the Draft Final Report and I think we all agree that the time for paperwork is at an end. We need to move now into the GMES implementation phase, to deliver on the high expectations we have created." European Research Commissioner Philippe Busquin said "GMES is one of the EC's flagship initiatives, aimed at enhancing Europe's technological capacity in the service of EU policy objectives. The kind of advanced environmental monitoring framework that GMES represents has clearly become a top political priority."

At the European level, a number of policy initiatives have already shown convergence on improving access to environmental data. On the global stage, the 2001 Gothenburg Summit on Sustainable Development, the 2002 Johannesburg World Summit on Sustainable Development and recent meetings of the G8 ministers have all noted the need for the international community to monitor the environment and to improve our understanding of environmental processes. The co-ordination of global observing strategies received further impetus in July 2003 at the Earth Observation summit in Washington. GMES is, in simple terms, Europe's concerted attempt to produce better policy-relevant information. This means bringing data and information providers together with users, to allow them to better understand each other and to agree on how to make useful information available to the people who need it most.

In his opening remarks in Baveno, Stefano Caldoro, Under Secretary of the Italian Ministry of Education, University and Research (MUIR), said, "The challenges spelled out in the White Paper on European Space Policy include maximising the use of space data in support of sustainable development and environmental protection, as well as using space technologies in support of European security and defence. These very demanding tasks will have to be implemented within a military and civil 'multi-use' space framework." While GMES does include a strong space component, with satellite-based remote sensing providing an important part of today's environmental data, ground-based, air-based and ocean-based in situ monitoring systems are also included in the overall GMES concept. Importantly, a significant amount of effort under GMES is being made in the areas of coordination and integration of existing capacities.

The current Draft Final Report makes a number of concrete recommendations for moving GMES forward. Among them are: begin implementation of GMES priority services; establish an appropriate organisational and institutional framework for the

initiative; develop a strategy regarding data policies; implement a European spatial data infrastructure; develop the required space and in situ observation networks; organise and fund relevant research and development activities; establish a strategy for effective international co-operation; ensure adequate levels of overall funding for the success of GMES.

While most of the speakers in Baveno expressed high appreciation for the work done in preparing the Draft Final Report, there were also many suggestions for further refinement and improvement. However, more than one participant pointed out the need for immediate action.

The European Commission's Head of Unit for Aeronautics and Space, Herbert von Bose said, "We can go on debating for a very long time indeed all of the things that we could add to the report, all of the changes we could make before we have the 'perfect' final version, but I would like to point something else out. Space activities and GMES in particular, are now very high on the political agenda. We have the new White Paper on European Space Policy, recently presented by Mr Busquin, and we also have the new Growth Initiative, in which GMES is cited as a project for immediate initiation. What this means is that GMES is now being watched by highly placed decision-makers, and what we all must realise is that there is a window open for us right now. But we also know that these windows open and close. If we wait too long, if we insist on discussing and debating the details for more weeks and months, we may find that the policy-makers have moved on when we finally come to them. This is a good basic document which we can already use to convince the people who need convincing."

"The point is to get GMES off the ground now," added Achache. "We can start by working on an initial number of services that we can put in place quickly, using existing monitoring technologies and infrastructure. Once people can see that it works and that it is a valuable programme, we will have secured political support and we can continue to work on perfecting and expanding services and infrastructure." A similar concern for action was expressed by the Chairman of the GMES steering Committee Drafting Group Colin Hicks. In an interesting presentation, he described things that would cause GMES to go wrong. Among these, he said, "GMES will fail," if: some parties use it to further their own interests at the expense of others; it is driven from the supply side and not by users; it becomes a Europe-only system without international partners; we wait for agreement on everything before doing anything.

Representing an important potential international partner, retired US Navy Vice Admiral Conrad Lautenbacher, currently Under Secretary of Commerce for Oceans and Atmosphere and Co-Chair of the Group on Earth Observations (GEO) presented his views on GMES. "It is nice to be here with such a talented group of EO leaders," he said. "I have a great amount of respect for the work you're doing, creating a global strategy in an area of importance to people of all nations. GMES is clearly a critical part of what we in the GEO are trying to do on a global level." The GEO was launched at the Earth Observation Summit in Washington in July 2003. It is currently developing on a ten-year plan to set up a comprehensive EO system or systems. The fact that the second GEO plenary meeting was scheduled to take place in the same venue in Baveno immediately following the GMES Forum was seen as a clear statement about the importance of GMES on the global stage. The next Earth Observation Summit is scheduled to take place in Europe in late 2004.

In his closing remarks, Umberto Giovine, one of the Italian representatives on the GMES Steering Committee, said, "This 4th forum is the final step in the GMES Initial Period. The Steering Committee will introduce the Implementation Period in 2004. We begin this next phase with a much more promising outlook than we might have expected just a short time ago. The EU Council has just approved a Framework Agreement between the European Community and ESA, under which ESA becomes, in the words of José Achache, 'the Space Agency of the European Union'. Meanwhile, the Commission has adopted the Space White Paper, which it calls 'an

ambitious action plan'. Italy remains ready to contribute to the important tasks of GMES as we move into the Implementation Period. To our Irish colleagues, the next to take up the Presidency, we offer our full support and we say good luck, buona fortuna!" This article is from a report on 03 December 2003 at the web-site europa.eu.int/comm/space/articles/news/news83_en.html. More information on GMES is at the web-site www.gmes.info.

3.2.2 JRC's GLC 2000: world vegetation from space

A unique global land cover database for the year 2000 (GLC2000), created from satellite data, is at last ready for use. This map fills an important knowledge gap concerning the distribution of vegetation and land cover on our planet. It was completed by a world-wide partnership of over 30 research organisations, co-ordinated by the European Commission's Joint Research Centre (JRC). GLC2000 results were presented at the 26-29 November GMES (Global Monitoring for the Environment and Security) meeting and subsequent GEO (Global Earth Observation) conference, in Baveno (Italy). GLC2000 will allow for better monitoring of the environment. This will, in turn, help forecast and prevent natural and man-made disasters, and study ecosystems, bio-diversity, climate change and weather forecasting.

"By working together, scientists from around the world have given us a unique and accurate picture of the state of our planet's surface as we enter the 3rd Millennium," says European Research Commissioner Philippe Busquin. "Thanks to this comprehensive mapping, we can better monitor the effects of climate change and human activity on nature. We have a valuable snapshot of the Earth's "skin" that will allow us to better forecast possible disasters and help prevent them. Global land cover monitoring is one of the key needs to be met by the EC and ESA joint initiative on Global Monitoring for the Environment and Security (GMES)".

Mapping our entire planet's surface began to get easier in the 1970s with the advent of Earth Observation (EO) polar orbiting satellites. Images from space were used to map different parts of the world, but it took until the 1990s to gather, process and analyse the first complete global data set. The resulting land cover map, based on satellite observations collected between 1992 and 1993, has been widely used for climate modelling, resource management and ecosystem studies. Yet since 1993 our planet's land cover has changed, and in some cases these changes have been quite considerable. For example, almost 6,000,000 hectares of humid tropical forest have disappeared each year since 1993. At the same time, newer and better sensors have been launched into space, and experts have learned more about ways of analysing the data they provide to create land cover maps. The GLC2000 project is part of this process of scientific and technical advance.

In 1999, a JRC-co-ordinated partnership launched the preparation of a new database to take stock of the state of the world's land cover at the turn of the Millennium: the "Global Land Cover 2000" project (GLC2000). The project involved daily observations of the planet's land surface between 1 November and 31 December 2000 with the "VEGETATION" sensor on the SPOT-4 satellite. The VEGETATION programme partners (Centre National d'Etudes Spatiales, France; Swedish National Space Board; Italian Space Agency; Belgian Office of Science and Technology; the EC) provided the SPOT-4 data to the GLC2000 project partnership. The partnership is made up of major users of land cover information and experts in land cover mapping from different parts of the world, including a number of countries in tropical regions. Local experts mapped each region in the way that best described the local land cover. Partners used a system developed by the UN's Food and Agriculture Organisation (FAO) and UN Environment Programme (UNEP) to classify land cover so that the detailed regional maps could be processed and presented in a consistent way. The JRC analysed regional maps and used them to create the GLC2000 database. This new map presents 22 detailed land cover types, ranging from the boreal forests of the

Northern hemisphere, agricultural land, cities and deserts to tropical forests, wetlands and permanent snow-fields.

FAO and UNEP welcomed the GLC2000 products. They are co-sponsoring publication and distribution of the final maps with the EC. FAO will use them, and will provide them to its Member States for work on climate, biodiversity and the sustainable management of natural resources. The Millennium Ecosystem Assessment, launched by UN Secretary General Kofi Annan in 2001 to provide assessments to the UN's Environmental Conventions, is using GLC2000 as its Land Cover reference to support work on assessing impact of ecosystem change on human health and poverty, bio-diversity, and environmental quality. France's national meteorological service, Météo-France, is integrating the GLC2000 data into its eco-climate database as a fundamental part of their weather forecasting models and global climate modelling in collaboration with the European Centre for Medium-Range Weather Forecasts. This article is from a report on the JRC web-site (www.jrc.it) on 26 November 2003. For further information please visit www.gvm.jrc.it/glc2000/defaultGLC2000.htm.

3.2.3 JRC reinforces EC's humanitarian response

As a key element of European Commission crisis management during the ongoing conflict in Iraq, the JRC supplied up-to-date situation maps and imagery derived from the media and the JRC archive of recent pre-conflict very high resolution Ikonos satellite imagery (www.infoterra-global.com/ikonos.htm) to the External Relations DG (europa.eu.int/comm/dgs/external_relations/index_en.htm) crisis room. The restricted JRC Digital Map Archive (dma.jrc.cec.eu.int/) service for Iraq was updated every day and acted as a central platform for humanitarian and crisis data and information, with the aim of reinforcing humanitarian response and post-war reconstruction activities. More information is at the following web-sites: ipsc.jrc.cec.eu.int/and dma.jrc.it/.

3.3 Highly constructive 2nd GEO plenary meeting

The Group on Earth Observations (GEO), set up at the Washington Earth Observation Summit, held its second plenary meeting in Baveno Italy on 28-29 November 2003. Members reviewed the first draft of the GEO Framework Document, to be presented at the next ministerial meeting in Tokyo in 2004. The meeting followed directly on the heels of the final Global Monitoring for Environment and Security (GMES) Forum, also held in Baveno.

"This day marks a critical juncture," said EC Research Director General and GEO Co-Chair Achilleas Mitsos. "It is a great pleasure to see many of you coming here directly from the GMES Forum. GMES is a key element of our European Space Policy, cited specifically in the recent Space White Paper and in the Competitiveness Council's new Growth Initiative. This is a critical moment because GMES is now moving into its implementation phase, and we expect it to form a major contribution to the global Earth Observation (EO) movement and the work that we are doing in the GEO."

Producing better information on the environment has become a top political priority, both in Europe and around the world. The 2001 Gothenburg Summit on Sustainable Development, the 2002 Johannesburg World Summit on Sustainable Development and recent meetings of the G8 ministers have all noted the need for the international community to monitor the environment and to improve its understanding of environmental processes. The GEO was set up on 1 August 2003, following the EO summit in Washington, to establish wide-scale co-ordination of global observing strategies. It now has 38 members and 24 participant international organisations and its primary goal is to develop a 10-year plan for the implementation of a comprehensive, co-ordinated and sustained world EO system or systems. The draft Framework Document, under discussion at this meeting, is the first step in that direction. GMES is Europe's advanced environment and security monitoring initiative, to bring data and informa-

tion providers together with users, allow them to better understand each other, and agree on how to make useful information available to those who need it.

While environmental monitoring includes a strong space component, with satellite-based remote sensing providing an important part of today's environmental data, ground-, air- and ocean-based in situ monitoring systems are also included under the global environmental monitoring umbrella. A significant effort under both GEO and GMES aims at co-ordinating and integrating existing global monitoring capacities and resources in all these areas.

Akio Yuki, Japan's Deputy Minister of Education, Culture, Sports, Science and Technology, and one of four GEO Co-Chairs, welcomed new GEO members Belgium, Cyprus, Portugal and Greece: "The GEO has accomplished a great deal in a very short period of time. The draft Framework we are considering today is a very important document. We must be sure that it conveys a strong and clear message when we get to Tokyo. The benefits of global EO systems are known to all of us here, but we must be able to convince the politicians and the decision-makers." GEO Co-Chair Rob Adam, South Africa's Director General of the Department of Science and Technology, said, "As the Co-Chair representing developing countries, I am eager to see more African countries being included in this process. After all, it is the developing countries that have the most to gain from the setting up of coherent global EO systems. The lack of such makes it terribly difficult to adequately deal with the developing world's economic, environmental and humanitarian challenges. By bringing people together like this, the GEO can also be a force for international co-operation and multi-lateralism."

After the opening remarks, GEO members rolled up their sleeves and got to work. Helen Wood, Executive Director of the GEO Secretariat, presented the draft Framework Document: "This is a document which will show the way to the creation of the ten-year Implementation Plan. It is meant only to give you a rough idea of where we might go. You all must now consider it and give us your guidance for its elaboration, adaptation or redirection." Her presentation was followed by a round of comments and suggestions from the GEO members. The spirit of open exchange was evident throughout the two-day meeting, with participants needing little encouragement to voice their ideas and opinions. The delegations from Australia, Brazil, France, Italy, Japan and Russia were particularly active.

Also on the agenda were progress reports from the various GEO subgroups, addressing: architecture; capacity building; data utilisation; international co-operation; user requirements and out-reach. Participants also heard a presentation on the International Global Observing Strategy Partnership (IGOS-P), whose aim is to provide a comprehensive international framework for co-ordinating resources and harmonising long-term EO strategies.

With two days of lively and constructive discussion taken on board, the GEO now plans to continue the drafting of the Framework Document. The next meeting of the GEO plenary is expected to take place in South Africa in February 2004. This article is from a report on the EU Space web-site (europa.eu.int/comm/space) on 05 December 2003. More information is at the GEO web-site (earthobservations.org)

3.4 Head of EuroSDR / OEEPE steps down

Dear Colleagues from EuroSDR / OEEPE - related European and Global GI organisations,

This is to inform you that I have resigned as Secretary-General of EuroSDR / OEEPE in October 2003, after more than 11 years of term of office. I did that with mixed feelings: regrets to leave an organisation that has been a great part of my life for more than a decade and regrets not to closely participate to the challenges of the coming years; but on the other hand pleasure to leave EuroSDR as a very active and sustainable organisation with a fresh image – a new name, a new and strong Secretariat, a future oriented Research Plan and a modern publication system.

I am particularly happy to have passed on the EuroSDR Secretary-General duties to my friend Kevin Mooney; Kevin is a very capable, committed and motivated person, not only as a manager of the organisation but also as a scientist. The new structure of the EuroSDR Secretariat, with Kevin as voluntary Secretary-General and Helen Murray as full time Assistant Secretary-General should permit EuroSDR to further develop and to be more visible on the European geo-information scene. I therefore thank you for relating, as from now and if needed, with the new EuroSDR Secretariat at the following address: Mr. Kevin Mooney EuroSDR Secretary-General, Department of Geomatics, Dublin Institute of Technology, Bolton Street, Dublin 1, Ireland. Telephone: 353-1-4023730. Fax: 353-1-4023999. E-mail: kevin.mooney@dit.ie. The EuroSDR Assistant Secretary-General, Ms. Helen Murray, can be contacted at the same address (telephone: +353-1-4023734; e-mail: helen.murray@dit.ie).

Chris Paresi, ITC, Enschede, The Netherlands (paresi@itc.nl).

4 RS DATA, PRODUCTS & PROJECTS

4.1 Observations

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

What was launched?

DMC
On 27 September 2003 Surrey Satellite Technology LTD successfully launched three more spacecraft in the international Disaster Monitoring Constellation (DMC). The three satellites BILSAT, NigeriaSat-1 and UK-DMC where launched by a Kosmos 3M launch vehicle from Plesetsk Cosmodrome in northern Russia. BILSAT is a Turkish technology mission with three sensors; a pan-chromatic 12-metre resolution instrument, a 24-metre multi-spectral sensor and a 9-band hyper-spectral imager. NigeriaSat-1 and UK-DMC are micro-satellites of the standard DMC design with a 3-band 32-metre multi-spectral sensor. The bands are similar to Landsat 7 bands 2, 3 and 4. See web-site: www.sstl.co.uk.

RESOURCESAT-1
On 10 October 2003 the Indian Space Research Organisation (ISRO) successfully launched IRS-P6, also called RESOURCESAT-1 into an 817 km sun-synchronous orbit. The satellite has three multi-spectral imaging instruments on-board; (1) Linear Imaging Self Scanner-4 (LISS-4); (2) Linear Imaging Self Scanner-3 (LISS-3); (3) Advanced Wide Field Sensor (AWiFS). This launch marks the seventh successful launch by the Indian PSLV-C5 launch vehicle. The first images from AWiFS and LISS-3 were published by the ISRO on 10 November 2003. See web-site: www.isro.org.

DMSP-16
On 19 October 2003 a Titan II placed an American weather satellite into an 830 sun-synchronous orbit. Although DMSP-16 (Defence Meteorological Satellite Programme) collects meteorological and oceanographic data for the US Department of Defence, some data will be publicly available via NOAA. See web-site: dmsp.ngdc.noaa.gov/dmsp.html

CBERS-2
Two days later, the second China Brazil Earth Resource Satellite (CBERS-2) was launched successfully. A Chinese Long March 4B launcher placed the satellite into a 778 km sun-synchronous orbit. CBERS-2 has three imaging instruments on board that are equal to the instruments on board its predecessor, CBERS-1. Two more satellites in the same programme are scheduled for launch in 2008 and 2010. Data from the two-year mission will be available at the Brazilian Space Research Institute (www.dgi.inpe.br/html/eng/english.htm). See web-site: www.cbers.inpe.br/en/index_en.htm.

Problems, problems, problems (continued)….

LANDSAT
On 22 October 2003 after several attempts to get the Scan Line Corrector (SLC) on board LANDSAT 7 back on line, the USGS released the first set of SLC-Off products. There will be no more attempts to fix the problems with the instrument. The SLC-Off data has missing data at the edges of the images, but the centre part should be usable and of normal quality. The costs of the data will be equal to the price before the anomaly. Detailed information is at the web-site landsat7.usgs.gov/slc_off.html. (See also Section 4.5 of this Newsletter).

ICESAT
The ICESAT mission main goal is to provide continuous elevation data of the polar ice sheets, but on 29 March 2003, just 36 days after the satellite was launched, LASER 1 failed. Although NASA gave no official cause, different sources revealed that the problem occurred because components made of gold and indium came in contact with each other, causing a reaction resulting in the failure of the instrument. Although LASER 2 and 3 have the same design flaw, LASER 2 was turned on, on 6 October 2003 and seems to work normally. Data from the mission are available at edcimswww.cr.usgs.gov/pub/imswelcome. Official information can be found at icesat.gsfc.nasa.gov.

ADEOS-II / Midori-II
On 25 October 2003 the Japan Aerospace Exploration Agency (JAXA) announce that the Advanced Earth Observation Satellite II, also called Midori-II stopped sending data to the Earth Observation Centre. JAXA found out that the satellite switched to a stand-by mode with all observation instruments turned off. Although JAXA continues to send commands to the satellite to restore its operations, it seems that ADEOS-II should be considered lost. JAXA formed a team to investigate the cause of the anomaly. ADEOS-II was launched on 14 December 2002. Its predecessor, ADEOS-I, launched in November 1996, also failed 8 months later due to a solar panel failure. Japan continues its Earth Observation programme with the Advanced Land Observation Satellite (ALOS), scheduled for launch in 2004. See web-site: www.jaxa.jp/missions/projects/sat/eos/adeos/index_e.html.

What else was in the news?

JAXA
JAXA was already mentioned in relation to the failure of ADEOS-II. On 1 October 2003 the Institute of Space and Astronautical Sciences (ISAS), the National Aerospace Laboratory (NAL), and the National Space Development Agency (NASDA) merged into one independent agency called JAXA (Japan Aerospace Exploration Agency). See web-site: www.jaxa.jp.

SRTM
NASA / NIMA released another part of the global digital elevation data set based on the radar data acquired by Shuttle mission STS-99. Recently the 90-metre DEM of Europe and Asia was made available via ftp://edcftp.cr.usgs.gov/pub/data/srtm/. According to schedule the DEM of Africa will be released in early 2004.

Coming up soon:

ROCSAT-2
ROCSAT-2, originally scheduled for launch on 25 November 2003 from Vandenberg Air Force Base, California, by an Orbital Sciences Taurus XL rocket, for the Republic of China's National Space Programme Office, was postponed until January 14 2004, and then further delayed until 26 February 2004, to fix an electrical issue with the launch vehicle. Next to a 2-metre pan and 8-metre multi-spectral scanner, the Taiwanese ROCSAT-2 will have a new instrument to obtain images of upper atmospheric lightning. This will mark the Taurus vehicle's return to flight following a failure in September 2001. See web-site: www.nspo.gov.tw/e50/home/index.html.

Aura
After Terra and Aqua, NASA's Aura is the third mission in a series of major Earth observing satellites to study the environment and climate change. The satellite's four instruments will obtain measurements of the atmosphere to study the Earth's climate. Aura is schedule for launch in March 2004. See web-site: eos-chem.gsfc.nasa.gov.

4.2 Mars Exploration Rover: Opportunity beckons

On 31 January 2004 NASA's Mars Exploration Rover Opportunity drove down a reinforced fabric ramp at the front of its lander platform and onto the soil of Mars' Meridiani Planum. Also, new science results from the rover indicate that the site does indeed have a type of mineral, crystalline hematite, which was the principal reason the site was selected for exploration. Controllers at NASA's Jet Propulsion Laboratory received confirmation of the successful drive via a relay from the Mars Odyssey orbiter and Earth reception by the Deep Space Network. Cheers erupted a minute later when Opportunity sent a picture looking back at the now-empty lander and showing wheel tracks in the Martian soil. For the first time in history, two mobile robots are exploring the surface of another planet at the same time. Opportunity's twin, Spirit, started making wheel tracks, halfway around Mars, on 15 January.

The flight team needed only 7 days since Opportunity's landing to get the rover off its lander, compared with 12 days for Spirit earlier in the month. "We're getting practice at it," said JPL's Joel Krajewski, activity lead for the procedure. Also, the configuration of the deflated airbags and lander presented no trouble for Opportunity, while some of the extra time needed for Spirit was due to airbags at the front of the lander presenting a potential obstacle. Looking at a photo from Opportunity showing wheel tracks between the empty lander and the rear of the rover about one metre or three feet away, JPL's Kevin Burke, lead mechanical engineer for getting the rover off the lander, said "We're glad to be seeing soil behind our rover."

JPL's Chris Salvo, flight director, reported that Opportunity will be preparing over the next couple days to reach out with it robotic arm for a close inspection of the soil. Gray granules covering most of the crater floor surrounding Opportunity contain hematite, said Dr. Phil Christensen, lead scientist for both rovers' miniature thermal emission spectrometers, which are infrared-sensing instruments used for identifying rock types from a distance. Crystalline hematite is of special interest because, on Earth, it usually forms under wet environmental conditions. The main task for both Mars Exploration Rovers in coming weeks and months is to read clues in the rocks and soil to learn about past environmental conditions at their landing sites, particularly about whether the areas were ever watery and possibly suitable for sustaining life. The concentration of hematite appears strongest in a layer of dark material above a light-covered outcrop in the wall of the crater where Opportunity sits, Christensen said. "As we get out of the bowl we're in, I think we'll get onto a surface that is rich in hematite," he said. This article is based on reports on the web-site marsrovers.jpl.nasa.gov/newsroom/pressreleases.

4.3 Mars Exploration Rover: Spirit raised

Opportunity's twin Mars Exploration Rover, Spirit, landed on Mars on 3 January 2004, after a seven-month journey. Its task is to spend the next three months exploring rocks and soil for clues about whether the past environment in Gusev Crater was ever watery and suitable to sustain life. On 21 January ground controllers sent commands to Spirit, as usual, and received a simple signal acknowledging that the rover heard them, but they did not receive expected scientific and engineering data during scheduled communication passes during the rest of that Martian day. However, on 1 February 2003, it was reported that Spirit was healthy again, the result of recovery work by mission engineers since the robot developed its computer-memory and communications problems 10 days previously. "We have confirmed that Spirit is booting up normally. Tomorrow we'll be doing some preventive maintenance," Dr. Mark Adler, mission manager at NASA's Jet Propulsion Laboratory, Pasadena, California.

Part of the cure has been deleting thousands of files from the Spirit rover's flash memory – a type of rewritable electronic memory that retains information even when power is off. Many of the deleted files were left over from the seven-month flight from Florida to Mars. On-board soft-

ware was having difficulty managing the flash memory, triggering Spirit's computer to reset itself about once an hour. Two days after the problem arose, engineers began using a temporary work-around of sending commands every day to put Spirit into an operations mode that avoided use of flash memory. Now, however, the computer is stable even when operating in normal mode, using the flash memory. "To be safe, we want to reformat the flash and start again with a clean slate," Adler said. The planned reformatting would erase everything stored in the flash file system and install a clean version of the flight software. Spirit was then told to transmit priority data remaining in the flash memory. The information includes data from atmospheric observations made on 16 January in coordination with downward-looking observations by ESA's Mars Express orbiter. Spirit was also due to make new observations co-ordinated with another Mars Express over-flight, and to run a check of the rover's miniature thermal emission spectrometer.

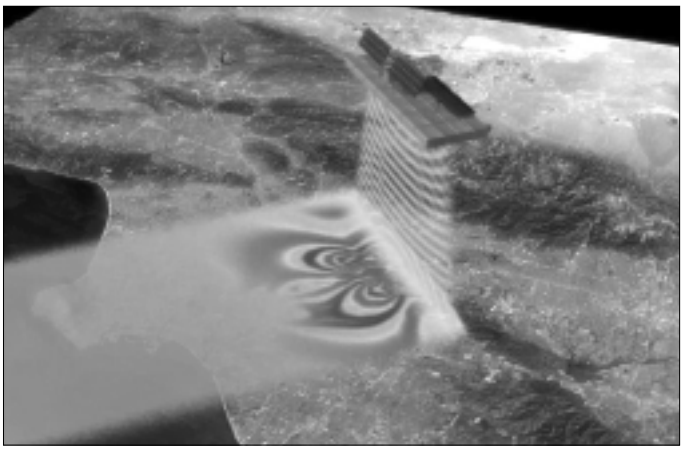
After being restored, Spirit was due to resume examination of a rock nicknamed Adirondack and possibly to move on to a lighter-coloured rock. Each Martian day or "sol" lasts about 40 minutes longer than an Earth day. Spirit and Opportunity began their 30th and 10th sols on Mars, respectively, on Monday 2 February. The two rovers are halfway around Mars from each other. The main task for both Spirit and Opportunity in coming weeks and months is to find geological clues about past environmental conditions at their landing sites, particularly about whether the areas were ever watery and possibly suitable for sustaining life. This article is based on reports on the web-site marsrovers.jpl.nasa.gov/newsroom/pressreleases.

4.4 Progress in space-based earthquake research

Ten years after Los Angeles was shaken by the devastating, magnitude 6.7 Northridge earthquake on 17 January 1994 scientists at NASA and other institutions say maturing space-based technologies, new ground-based techniques and more complex computer models are rapidly advancing our understanding of earthquakes and earthquake processes. Dr. Andrea Donnellan, a geophysicist at NASA's Jet Propulsion Laboratory, Pasadena, California, says the past decade has seen substantial progress in space-based earthquake research. "We've confirmed through space observation the Earth's surface is constantly moving, periodically resulting in earthquakes, and we can measure both the seismically quiet motions before and after earthquakes, as well as the earthquakes themselves. These technologies are allowing us to pursue lines of data and research we didn't know existed only a few years ago."

Two months before the Northridge earthquake, Donnellan and university colleagues published a paper in the journal Nature on ground deformation north of Los Angeles' San Fernando Valley. Six years of Global Positioning System (GPS) data showed the area's faults were active and building up strain, and indicated the size and style of a potential earthquake there. Following the earthquake, the data made it possible to rapidly determine where the fault ruptured and to measure how the earthquake had deformed Earth's surface.

Space-based instruments can image Earth movements to within fractions of an inch, measuring the slow build-up of deformation along faults, and mapping ground deformation after an earthquake. Two primary tools are the space-based GPS navigation system and Interferometric Synthetic Aperture Radar (InSAR). The latter compares satellite radar images of Earth taken at different times to detect ground movement. InSAR complements surface measurements because it lets us look at whole regions in a spatial context. An InSAR mission is also a key component of EarthScope, a jointly led initiative by the National Science Foundation, NASA and the US Geological Survey. EarthScope studies the North American continent's structure and evolution, and the physical processes that control earthquakes and volcanic eruptions, according to Dr. James Whitcomb, section head for Special Projects, Earth Sciences Division, National Science Foundation, Arlington, Virginia.



Still image from Zareh Gorjian animation depicting an artist's concept for a dedicated Interferometric Synthetic Aperture Radar (InSAR) mission

Precise Earth surface-movement data measure strain and provide a first approximation of where earthquakes are likely to occur, notes Dr. Brad Hager, a Massachusetts Institute of Technology professor and co-author of the 1993 Nature paper. "In California, patterns of ground deformation are complicated by the complex interactions between fault systems. Interpreting this data requires computer models that can estimate how much deformation has accumulated and identify regions where strain should be released, but hasn't been." University of California, Davis, researcher Dr. John Rundle says the complexity of earthquakes requires we study them as part of the full Earth system. "Most natural events result from interrelated Earth processes over various lengths and times. These processes have variables that can't be readily observed, so understanding them requires computers."

NASA's QuakeSim project is developing a similar forecasting methodology. Its tools simulate earthquake processes, and manage and model the increasing quantities of data. "We're focusing on observing and understanding earthquakes in space and time, and developing methods that use patterns of small earthquakes to forecast larger ones," Rundle explains. "New simulations of earthquakes on California's active faults are providing considerable insight, showing earthquakes tend to "cluster" in space and time due to their interactions. That is, an earthquake on one fault section can turn on or off earthquake activity on nearby fault sections, depending on the relative orientation of the faults. Simulations have led researchers to conclude that fault system geometry determines earthquake activity patterns."

A NASA / Department of Energy-funded research team reports promising results from an experiment to forecast earthquakes in southern and central California from 2000 to 2010. It uses mathematical methods to forecast likely locations of earthquakes above magnitude 5 by processing data on earthquakes of about magnitude 3 from the past decade.

The high-risk regions identified in the forecast are refined from those already identified by the government as susceptible to large earthquakes. Five earthquakes greater than magnitude 5 have occurred since the research was completed, all in those high-risk regions. Dr. Wayne Thatcher, a senior research geophysicist at the US Geological Survey, Menlo Park, California, says as these technologies are validated they will be transferred to end users. "Such data and models improve understanding of earthquake and volcanic processes, substantially refining seismic hazard maps and resulting in more appropriate, earthquake-resistant construction codes and more targeted retro-fitting strategies." This article is from a report at the web-site www.jpl.nasa.gov/releases/2003/162.cfm, on December 4, 2003.

4.5 Earthquake detection via signals from space

A violent earthquake that cracked highways in Alaska set the sky shaking as well as the land, an ESA-backed study has confirmed, according to a report on 31 October 2003. This fact could help improve earthquake detection techniques in areas lacking seismic networks, including the ocean floor. A team from the Institut de Physique du Globe de Paris and the California Institute of Technology has successfully used the Global Positioning System (GPS) satel-

lite constellation to map disturbances in the ionosphere following last November's magnitude 7.9 earthquake in Denali, Alaska. Their paper has been published in the scientific journal Geophysical Research Letters. The research itself was carried out in support of ESA's Space Weather Applications Pilot Project, aimed at developing operational monitoring systems for space conditions that can influence life here on Earth.

The ionosphere is an atmospheric region filled with charged particles that blankets the Earth between altitudes of about 75-1,000 km. It has a notable ability to interfere with radio waves propagating through it. In the particular case of GPS navigational signals, received on Earth from orbiting satellites, fluctuations in the ionosphere – known as "ionospheric scintillations" – have the potential to cause signal delays, navigation errors or in extreme cases several hours of service lockouts at particular locations.

But while such interference can be an inconvenience for ordinary GPS users, it represents a boon for scientists. By measuring even much smaller-scale shifts in GPS signal propagation time - caused by variations in local electron density as the signal passes through the ionosphere - researchers have at their fingertips a means of mapping ionospheric fluctuations in near real time. The French and US team made use of dense networks of hundreds of fixed GPS receivers in place across California. These networks were originally established to measure small ground movements due to geological activity, but they can also be utilised to plot the ionosphere structure across three dimensions and in fine detail.

When the Denali earthquake occurred on 3 November 2002, the team had a chance to use this technique to investigate another distinctive property of the ionosphere, its ability to work like a natural amplifier of seismic waves moving across the Earth's surface. There are several types of seismic waves moving the ground during an earthquake. The largest, and the one that does most of the movement, is known as a Rayleigh Wave. This type of wave rolls along the ground up and down and side-to-side, in the same way as a wave rolls along the ocean. Previous research has established that shock waves from Rayleigh Waves in turn set up large-scale disturbances in the ionosphere. A one millimetre peak-to-peak displacement at ground level can set up oscillations larger than 100 metres at an altitude of 150 km.

What the team were able to do following the Denali quake was detect a distinctive wave-front moving through the ionosphere. "Using the network allowed us to observe the propagation of the waves," explained co-author Vesna Ducic. "We could also separate the small total electron content signal from the very large total electron content variations related to the daily variation of the ionosphere." The team observed a signal 2-3 times larger than the noise level, arriving 660-670 seconds after the arrival of Rayleigh Waves on the ground. And because around six GPS satellites are visible to every ground receiver they were able to calculate the altitude of maximum perturbation – about 290-300 km up. The signals were weak and only sampled every 30 seconds, with a maximum resolution of 50 km and the overall noise rate high. But the ionospheric signal observed had a clear pattern consistent with models of seismic behaviour. The hope is that the technique can be improved in future, and used to detect earthquakes in areas without seismic detectors, such as the deep ocean or near islands.

"In the framework of Galileo we plan to develop this research," said Ducic. "Galileo will double the number of satellites and therefore will allow much more precise maps of the ionosphere. We can also foresee that Europe will develop a dense network of Galileo / GPS stations that will take part in the monitoring of these phenomena. ESA, together with the French Ministry of Research and CNES have already decided to fund a pre-operational project called SPECTRE – Service and Products for Ionosphere Electronic Content and Tropospheric Refractive index over Europe from GPS – devoted to the high-resolution mapping of the ionosphere. We will be carrying out mapping above Europe as well as California. These investigations will support the French space agency CNES's

DEMETER (Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions) micro-satellite, to be launched in 2004 and devoted to the detection in the ionosphere of seismic, volcanic and man-made signals. These ESA activities will be performed in the framework of the Space Weather Applications Pilot Project."

The Space Weather Applications Pilot Project is an ESA initiative which has already begun to develop a wide range of application-oriented services based around space weather monitoring. The co-funded services under development – of which this project is one – also include forecasting disruption to power and communication systems, and the provision of early warning to spacecraft operators of the hazards presented by increased solar and space weather activities. The hope is that a seismic detection service based on ionospheric measurements may in future supplement existing resources in Europe and elsewhere. www.esa.int/export/esaSA/SEMUPAWLDMD_earth_2.html

4.6 FRINGE: use of radar to see the Earth move

Tiny ground movements that occur too gradually to be seen by the human eye, can nevertheless be detected by ESA satellites looking down to Earth from 800 km away. At the 3rd ESA International FRINGE Workshop, a five-day gathering devoted to Synthetic Aperture Radar interferometry (InSAR) advances from the ERS and Envisat missions, which was held in Frascati, near Rome, Italy, on 1-5 December 2003, researchers explained how they are using this ability to monitor volcanoes and earthquake zones, aid oil and gas prospecting, observe urban subsidence and measure the slow flow of glaciers.

Data from SAR instruments like those flown aboard the ERS spacecraft and Envisat are the basis for InSAR. Two or more radar images of the same ground location are combined in such a way that very precise measurements – down to a scale of a few millimetres – can be made of any ground motion taking place between image acquisitions. Very small movements can potentially be detected across wide areas: tectonic plates grinding past one another, the slow 'breathing' of active volcanoes, the slight sagging of a city street due to groundwater extraction, even the thermal expansion of a building on a sunny day.

More than 230 researchers from all across Europe, plus the United States, Argentina, Korea, Indonesia and China attended the ESA FRINGE Workshop in Frascati. More than 110 papers were presented by Principal Investigators during the Workshop, with dedicated sessions on specialist subjects including tectonics, land motion, volcanoes and ice movement. "Collecting multiple images of the same landscape might at first sound boring, until you realise the extraordinary level of precision with which InSAR shows us how that landscape changes," explained Prof. Fabio Rocca of the Milan Politecnico, who has worked in this field for the last two decades. "The technique really came into its own since ESA launched its first ERS satellite in 1991. The decision was made to archive all ERS data, which was courageous as data storage was so much more expensive then. Now that decision is paying off because all the archive is available for InSAR use."

Radar images record the backscatter of microwave pulses reflected off the Earth's surface, and so measure relative surface roughness – the brighter a given point shows up, the higher its roughness, and backscatter. Smoother surfaces tend to bounce radar pulses away from the spacecraft's field of view. "It is very different from looking at optical wavelengths, and one of the subjects we are discussing at the Workshop is how to work out more accurately what we are seeing," said Rocca. "We are looking with different eyes – think of it as like the eyes of the Terminator! At optical wavelengths the surface of a building reflects light, but at radar wavelengths we pierce through the walls of the building to the steel skeleton beneath – its sharp corners give it high radar reflectivity. Features like vegetation or loose soil can be difficult to image clearly, and can move between acquisitions causing an InSAR image to lose coherence. So for reference we use fixed

and high reflecting points in a landscape like buildings, large rocks or even the poles holding up a tennis-net. We call them permanent scatterers and they function in the same way as trig points for ground-level mappers."

Researcher Paul Lundgren of the California-based Jet Propulsion Laboratory – working with Italy's National Research Centre Institute for Remote Sensing of the Environment (IREA-CNR) in Naples – has mined the ERS data archive to produce more than a hundred interferograms of Mount Etna. Acquired between 1992 and 2001 they reveal terrain shifts as large as 14 cm taking place between measurements. The volcano appears to alternately inflate and deflate depending on the pressure of its underground magma chamber, and a gravity-driven spreading movement has also been observed. By turning the interferograms into an animation, the volcano appears to be breathing.

Lundgren's intention is to better understand the connection of surface deformation to subsequent volcanic activity, and increase our ability to predict volcano behaviour. He plans to make use of Envisat data in future to continue his survey: "With ERS over-flying it every orbit, Etna is a great volcano to study because there are lots of data, and there are lots of relatively new lava flows on its slopes which make for good InSAR coherence. It's not as dangerous as the likes of Vesuvius but while that volcano stays dormant for long periods Etna does a lot, and by measuring its displacement we've learned a lot about the complexity of its underlying structure and what is happening inside."

InSAR has also been used to look beneath a polar ice sheet four kilometres deep and learn more about conditions prevailing in one of the strangest environments on Earth. Lake Vostok in the East Antarctic is a 280 km long freshwater lake that has been buried beneath the ice sheet for at least half a million years. A combination of crushing pressure, geothermal heat and the insulation of the thick ice above it is thought to keep the waters of Lake Vostok liquid. What remains unknown is whether any life exists in this dark, cold, low-energy environment, entirely cut off from the rest of the world. Researchers have decided not to drill into the lake until they can be certain they will not contaminate its pristine waters with top-side bacteria.

Although Lake Vostok is off-limits for now there are indirect ways of seeing beneath the ice. Back in 1993 ERS data was employed to help map the lake's full extent, establishing the ice directly over it was much flatter than that around it. More recently, German researchers have used ERS interferograms to establish that, despite their distance from the surface, the waters of Lake Vostok are stirred by daily tides. During the FRINGE ice session, Anja Poetzch of the Dresden Technical University presented details on how a pair of interferograms acquired during ERS-1 and 2 tandem operations in 1996 demonstrated a maximum vertical displacement of 15 mm above Lake Vostok, corresponding to tidal motion. Results from in-situ GPS observations during the last two Antarctic summers confirm the conclusion.

Future planned radar satellites were discussed on the final day of FRINGE, and high on the list of recommendations from participants was the need to ensure continuity of coverage so ESA's SAR data archive will extend well into the 21st century. Both ERS and Envisat have identical orbits and their radar instruments are based around C-band wavelengths (code letters are an inheritance from radar's early use in World War 2). For a future spacecraft's radar imagery to be back-compatible for InSAR, it would have to follow the same orbit and radar wavelength. The importance of having a follow-on C-band mission to ensure continuity of both wide area SAR and InSAR capability was also a key finding of October's meeting of ten consortia developing services within Global Monitoring for Environment Security (GMES) Service Element programme. GMES is a joint venture between ESA and the EU to use satellite data to gather global environmental and security intelligence.

Radar missions that go beyond C-band were also discussed during FRINGE. A proposed ESA Earth Watch mission called TerraSAR-L is currently in the study phase.

It would employ longer wavelength L-band radar, of greater use over vegetated surfaces. Dr. Richard Bamler of the German Aerospace Centre DLR explained how TerraSAR-L could work in concert with TerraSAR-X, a German mission using the short wavelength X-band wavelength to resolve objects as small as 1 metre to be launched in spring 2006: "Potentially our spacecraft might map the corners of a field while TerraSAR-L identifies its contents. X-band can map the layout of suburban roads, or see details of forests that appear greyed out on longer wavelengths. There is also experimental instrumentation to measure fast velocities on the ground – we will track the speed that cars on a motorway move." The mission is an indication of the growing market for InSAR data, Bamler added: "It is a public-private partnership between Astrium, whose subsidiary Infoterra gets commercial rights to the data, and DLR, taking charge of scientific exploitation. We have a detailed business plan."

The increasing size of the market was a point also emphasised by Rocca: "A distinctive community of InSAR users has developed, and now we are coming back to ESA with our user requirements for further missions. The growing number of end users – including the insurance industry, railways and oil and gas companies – recognise the value of the technique and require its continuity into the future." This article is from a report at the web-site www.esa.int/export/esaCP/Protecting.html, on 12 December 2003.

4.7 Update on Landsat 7 anomaly

An instrument malfunction occurred on board Landsat 7 on 31 May 2003. The problem was caused by failure of the Scan Line Corrector (SLC), which compensates for the forward motion of the satellite. Subsequent efforts to recover the SLC were not successful, and the problem appears to be permanent. The Landsat 7 Enhanced Thematic Mapper Plus (ETM+) is still capable of acquiring useful image data with the SLC turned off, particularly within the central portion of any given scene. Landsat 7 ETM+ will therefore continue to acquire image data in the "SLC-off" mode.

The US Geological Survey (USGS) Earth Resources Observation System (EROS) Data Centre (EDC) released an initial set of Landsat 7 ETM+ SLC-off data products, effective 22 October 2003. This product release includes all image data acquired by Landsat 7 in SLC-off mode from 14 July 2003 to present, excluding a 2-week interval from 3-17 September 2003. The SLC-off data products currently available include Level 0Rp, Level 1R, and Level 1G data, and are distributed as standard Landsat 7 single-scene (WRS-2) and multi-scene products. SLC-off Level 1R and Level 1G products are currently being processed by the Level 1 Product Generation System (LPGS) only. The target release date for future data products (e.g. Level 1G, Level 1P, and Level 1T) processed through the National Land Archive Production System (NLAPS) is 1 March 2004. Initial SLC-off data products can be searched and ordered via the EOS Data Gateway (EDG) only. The target release date for SLC-off product access through other Landsat 7 search and order systems (e.g. Earth Explorer, GloVis) is 1 March 2004.

The centre of an SLC-off data product should be very similar in quality to previous Landsat 7 data. However, the scene edge will contain alternating scan-lines of missing data (Level 1G) or duplicated data (Level 0Rp or L1R). The precise location of the affected scan-lines will vary from scene to scene, and these gaps will not be visible on the browse image preview when ordering SLC-off data. Data prices for initial SLC-off products are the same as for Landsat 7 data collected prior to the SLC anomaly. As required by public law, the USGS must charge for data products according to the cost of fulfilling user requests (COFUR). These costs have not been reduced by this anomaly. In order to enhance the overall usability of SLC-off data, the USGS EDC is implementing a series of improvements to SLC-off products and processing, several of which will result in a fully populated SLC-off image.

Landsat 7 has collected approximately 250 scenes per day for the USGS archive in the

SLC-off mode, since mid-July 2003. As stated above, an SLC-off image will contain alternating bands of missing data along the scene edge, which gradually diminish in width toward the middle of the scene. The middle portion of an SLC-off Level 1G image contains no scan gaps. The radiometric and geometric quality of all of the SLC-off data is the same as previous Landsat 7 image data.

The USGS Landsat Project and NASA Landsat Project Science Office jointly held a Landsat 7 SLC-off product enhancement workshop in Maryland on 28-29 October 2003. The workshop was intended to identify methods to enhance the use of SLC-off data and new potential SLC-off data products. Scientists from the former Landsat 7 Science Team and technical representatives from USGS and NASA participated and generated many improvements the USGS is pursuing for near-term implementation. Release schedules for the suggested near term SLC-off improvements will be announced shortly.

These improvements include: (1) enhancements to the current Landsat 7 browse displayed on the various data ordering web interfaces to help users assess the impact of the SLC-off scan gaps on their area of interest; (2) provide users the option to choose the number of interpolation pixels (current EDC systems use 2) during Level 1G processing; (3) a pixel mask file to be included with all Level 1 data products to assist users in identifying the location of the scan gaps in SLC-off Level 1G products; (4) release of a new Landsat 7 data product that is the result of compositing Landsat 7 SLC-off and SLC-on images, providing users with a complete Landsat 7 image; (5) enhancements to the current interpolation methods used by the operational EDC Level 1 processing systems.

Beyond these initial improvements, the USGS and NASA are also pursing new composite data products that combine two or more SLC-off images to produce a current Landsat 7 scene that may eliminate the scan gaps present in a single SLC-off scene. As the USGS has stated in previous communications, the Landsat 7 SLC-off data are of the same radiometric and geometric quality as those collected prior to the SLC failure. The release of these product improvements will enable users to more effectively utilise the L7 SLC-off data into the future.

On 20 November 2003, the USGS released enhancements to the National Land Archive Processing System (NLAPS). These enhancements include the addition of a work order report file with Landsat 5 GeoTIFF products that contains the radiometric gains and biases used during processing. Additionally, a significant improvement was made to remove striping in Landsat 5 products using the NASA LUT (Look Up Table) processing method. A late January 2004 NLAPS release is expected to provide the initial Landsat 7 SLC-off products.

Fifty participants from fifteen different countries gathered in Hiroshima, Japan during the week of 12 October 2003, to attend the 32nd Landsat Ground Station Operators Working Group (LGSOWG-32) meeting. The four Japanese organizations (JAXA, RESTEC, HIT and HEEIC) were extremely gracious hosts to the record number of attendees, and provided an excellent venue for both the meeting and after-hour discussions. Topics such as the Landsat 7 SLC anomaly, the Landsat 5 mission status and recent announcements regarding the Landsat Data Continuity Mission (LDCM) made this LGSOWG an important and productive meeting.

Of primary interest to all participants was the status of the Landsat 7 mission and news as to when the USGS would resume operational downlinks to the International Co-operator (IC) network. The USGS provided a series of presentations on the nature of the scan line corrector (SLC) failure and its impacts to the data and ground processing. Tracy Zeiler, the USGS Landsat Project Chief, announced several programmes for re-introducing the ETM+ data to the ICs. Of primary interest were that the USGS would immediately resume downlinks to all ICs at no charge through the end of 2003 and that each IC would be permitted to order up to ten SLC-off data products from the USGS archive to use in evaluating the utility of the impaired products for their local applications. The next LGSOWG meeting for participating ICs

will be held in October 2004 in Chiang Mai, Thailand.

The Landsat Project is the longest-running enterprise for acquiring moderate resolution imagery of the Earth from space. Landsat 1 was launched in 1972; the most recent, Landsat 7, was launched in 1999. The instruments on the Landsat satellites have acquired millions of images, forming a unique resource for applications in agriculture, geology, forestry, regional planning, education, mapping, and global change research. The Landsat Programme is managed by the USGS under authority established by Presidential Decision Directive NSTC-3. This article is based on reports on the web-site landsat7.usgs.gov.

4.8 Eurimage's Pan-European Landsat 5 campaign

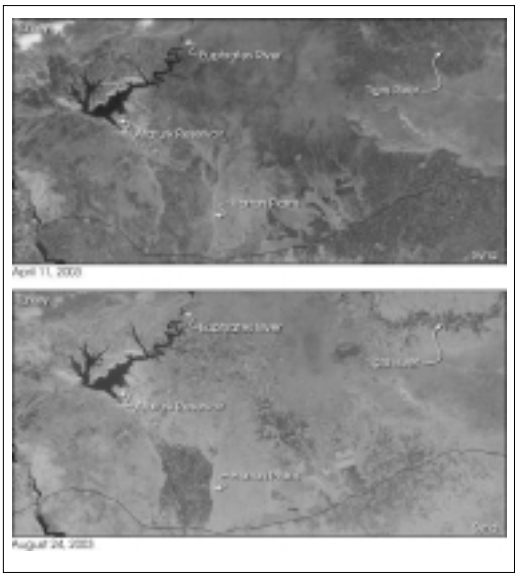
Eurimage wishes to inform its clients that, following the temporary campaign of last summer (from 23 July to 26 October 2003) acquisitions of Landsat 5 TM data over Pan-European areas will start again on an operational basis from January 2004. From that date, after ESA has completed the update of the processing software ("bumpered mode" correction) necessary to generate Landsat 5 products at the station, all Landsat 5 imagery collected over the acquisition cone of the Ground Station will then be acquired and processed at the same facilities, with the same level of service previously available for Landsat 7. More information is at the Eurimage web-site (www.eurimage.com).

4.9 USDA uses EO for global agricultural change

On 20 January 2004 it was reported that NASA's Earth observation (EO) satellite systems are helping the US Department of Agriculture (USDA) Foreign Agricultural Service (FAS) improve the accuracy and timeliness of information they provide about important crops around the world. FAS information is crucial in decisions affecting US agriculture, trade policy, and food aid. NASA and the University of Maryland are providing the FAS with observations and data products from instruments on NASA's Aqua and Terra satellites and from the TOPEX / Poseidon, Jason and Tropical Rainfall Measuring Mission (TRMM) satellites. FAS analysts are using these products to regularly assess global agricultural conditions. "The partnership between NASA and FAS is an example of how we extend the benefits of Earth science missions to meet the needs of our operational partners," said Ed Sheffner of NASA's Earth Science Enterprise.

NASA provides daily, high-quality, observations of the Earth. The timeliness and quality of these science data products are used to support decision-support tools employed by FAS to assess crop productivity over large areas of the world. NASA products allow FAS analysts to distinguish between different crops such as wheat and rice, and permit analysts to measure other features like surface temperature and snow cover. Analysts can gauge the health of agriculture by comparing recent and historic data. NASA satellites collect data twice daily: Terra in the morning and Aqua in the afternoon. Frequent satellite observations are important so analysts can assess how natural disasters such as fires, volcanic eruptions, floods, storms, or even extreme temperatures, affect crops. The information is often crucial to international food aid organisations. Earth Science products quickly demonstrated their utility as they helped analysts identify and monitor new areas of irrigated agriculture in the Middle East. NASA's Rapid Response System processes and delivers observations to FAS usually less than four hours after it is collected. Scientists at the University of Maryland are creating an archive and an interface that enables analysts to compare current and historical conditions.

Altimetry data from the TOPEX / Poseidon and Jason satellites are used to monitor the water level of 100 lakes and reservoirs around the world. Innovative use of these data to measure lake and reservoir water levels operationally has proven valuable. The information allows FAS analysts monitor the duration of droughts, assess how much water is available for irrigated farmland in arid regions and, as a result, how much of a crop the region is able to pro-



The irrigated crops in the Harran Plains flourish while the surrounding countryside dries out. These images compare the wet (top) and dry (lower) seasons. (Images by Jeff Schmaltz, based on data provided by the MODIS Rapid Response Team / website: rapidfire.sci.gsfc.nasa.gov)

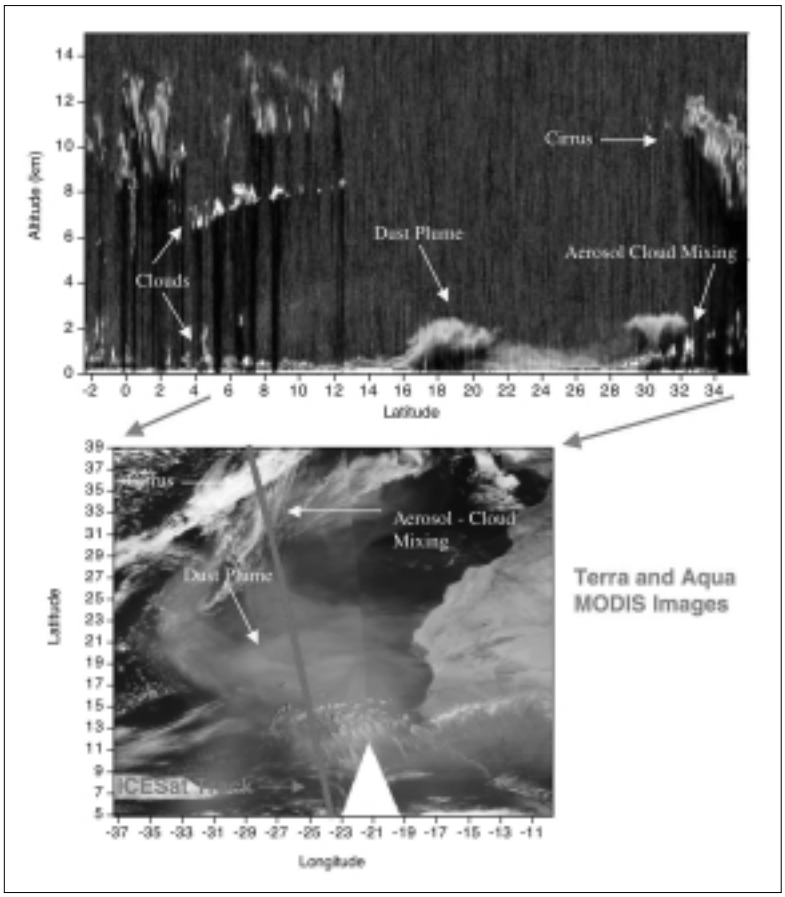
duce. The TRMM satellite provides near real-time observations about precipitation for mid-latitudes. Rainfall has a large impact on both rain-fed and irrigated crops. TRMM data helps analysts gauge planting and growing conditions and predict the size of the harvest with greater reliability. Applications of NASA's Earth Science research enable the use of observations, measurements and models to improve agency partners' decision-making capabilities. FAS has benefited from incorporating products from EO systems into operational procedures. See web-sites: www.gsfc.nasa.gov/topstory/2004/0115agriculture.html; www.pecad.fas.usda.gov/cropexplorer.

4.10 Spectacular 3D images of Earth from Icesat!

NASA's Ice, Cloud and land Elevation Satellite (ICESat) is sending home important scientific data and spectacular 3-D views of Earth's polar ice sheets, clouds, mountains, and forestlands. The data are helping scientists understand how life on Earth is affected by changing climate. The principal objective of the ICESat mission, and its Geoscience Laser Altimeter System (GLAS) instrument, is to measure the surface elevations of the large ice sheets covering Antarctica and Greenland and determine how they are changing. Much of an ice sheet's behaviour and response to changes in climate are apparent in their shape and how that shape changes with time. The laser sends short pulses of green and infrared light to Earth 40 times a second and collects the reflected laser light with a one-metre telescope.

The measurements have provided revolutionary accuracy and detail about the elevation of ice sheets and the elevation structure of land surfaces. ICESat is providing scientists with the most accurate measurements to date of the heights of clouds. It is also providing critical observations of atmospheric particles, called aerosols, over the ice sheets and the rest of the world. These help climate modelers, who reconstruct the past and project future climate. "NASA has developed tremendous capabilities over the last several decades for observing our Earth in two dimensions. With ICESat, we can see the critical third-dimension, that is, the vertical dimension of land, water, and the atmosphere, in new and innovative ways," said Waleed Abdalati, ICESat Programme Scientist, NASA Headquarters, Washington. "The first few months of ICESat data have really been phenomenal. We can see detail in ice and land features that were never visible before from space."

Scientists are using ICESat data to develop Digital Elevation Models (i.e. 3-D high-resolution images) of ice sheets in Greenland and Antarctica. Gathering these data from space will allow scientists, to obtain an unprecedented view of how and where ice sheets are growing and shrinking. This information is critical to understanding how the Earth's changing ice cover affects sea level. Earlier in 2003, ICESat's first topographic profiles across Antarctica revealed details never before seen of features such as the ice streams of the Siple Coast, the Amery Ice Shelf, and mega-dunes in the Antarctic interior. "The amount and coverage of heavy dust and pollution loading in many regions of the Earth that we are seeing in the initial ICESat data are unexpected," said James Spinhirne, principal atmospheric scientist for ICESat at NASA's Goddard Space Flight Centre, Greenbelt, Md. These include the



ICESat directly sees, for the first time from space, the height of all clouds and also aerosol layers from sources like dust storms and forest fires. The top graphic shows the vertical distribution of the laser light reflected from clouds and aerosols along a track over the Atlantic Ocean near the coast of Africa. The lower graphic shows a conventional two-dimensional satellite image taken at almost the same time. Credit: NASA

rivers of dust from the Sahara desert, massive dust storms, and large-scale smoke from burning vegetation. The observations tie smoke, dust and clouds directly to winds and global transport.

ICESat was launched 12 January 2003. It is the latest in a series of NASA Earth observation spacecraft designed to study the environment of our home planet and how it may be changing. NASA's Earth Science Enterprise is dedicated to understanding the Earth as an integrated system and applying Earth System Science to improve prediction of climate, weather and natural hazards using the unique vantage point of space. This article is from a report at www.universetoday.com/am/publish/icesat_view_earth.html. Original NASA News Release: www.gsfc.nasa.gov/topstory/2003/1209icesat.html.

4.11 New global NASA-SRTM topographic data-set

Marco Polo. Alexander the Great. They were some of history's most prolific explorers, each trekking across sweeping stretches of Europe and Asia in their lifetimes. But these greats of world history have nothing on you, thanks to a new topographic data set from NASA and the National Geo-Spatial Intelligence Agency (NGA). You now can explore the vast reaches of most of Europe, Asia and numerous islands in the Indian and Pacific Oceans, from the comfort of home, without breaking a sweat. Gathered in just ten days in February 2000 by NASA's Shuttle Radar Topography Mission (SRTM) the new digital elevation data-set show-cases some of Earth's most diverse, mysterious and extreme topography. Much of it previously had been very poorly mapped due to persistent cloud cover or inaccessible terrain. The new data being released comprise about 40% of the entire mission data-set. The new images are available on the JPL Planetary Photojournal (web-site: photojournal.jpl.nasa.gov).

"People around the world will benefit from the release of the mission's Europe and Asia topographic data sets because they greatly extend our knowledge of this immense region that also is home to most of Earth's citizens," said Dr. John LaBrecque, manager, Solid Earth and Natural Hazards Programme, NASA Headquarters, Washington. "The shape of Earth's surface affects nearly every natural process and human endeavour. Precise, uniform 3-D elevation data are needed for a wide-range of applications from studying earthquakes, volcanism, floods and other natural hazards, to planning development, managing precious water resources, and insuring the safety of aircraft navigation."

According to NGA Technical Executive Roberta Lenczowski, "releasing the Eurasia SRTM data provides geo-spatial data users with a remarkably consistent Earth-elevation surface. This enhances our global knowledge, provides a baseline for any future comparisons, and delivers accuracy and integrity unparalleled in any other global-elevation model of the Earth. The mission's data represents 40% of the data collected during the mission, which covered

roughly 80% of the land-mass of the Earth. The co-operative effort between NASA and the NGA, fusing science objectives with national security requirements, benefits all."

The mission is a co-operative project of NASA, the NGA and the German and Italian space agencies. NASA's Jet Propulsion Laboratory, Pasadena, California, processed the data into research-quality digital elevation data. The NGA is providing additional processing to develop mapping products. The US Geological Survey Earth Resources Observation Systems Data Centre in Sioux Falls, South Dakota, provides final archiving and distribution of the SRTM data products. This article is from a report on 23 January 2004, at www.jpl.nasa.gov/releases /2004/32.cfm. More information is at the web-sites www.jpl.nasa.gov/srtm and www.nasa.gov.

4.12 Launch of 1st Turkish EO satellite

The first Turkish scientific EO satellite, BILSAT, was successfully launched late last year, on 27th September 2003. The surveillance satellite was launched from a military base in Russia and will be used to gather information about the environment, the Anatolia news agency reported. The equipment on the satellite was developed by engineers from the Turkish Institute for Electronic Research and Scientific Technology (BILTEN) who worked alongside colleagues in Britain for two years. Twelve engineers from BILTEN and the Turkish Centre for Scientific Research worked on the 12.6 million Euro project. The 129 kg satellite took up orbit around Earth at an altitude of 686 kilometres. Information gathered by the satellite will be used for agricultural purposes, the management of natural catastrophes and urbanisation issues. Turkey's three previous satellites were built by France's Aerospatiale and launched by the European Ariane rocket. This article is from a report at www.spacedaily.com/2003/030927075109.yyauh6hp.html.

4.13 SMART-1 leaves on long journey to the Moon

SMART-1, Europe's first science spacecraft designed to orbit the Moon, had a flawless launch during the night of 27-28 September 2003. The European Space Agency's SMART-1 was one of three payloads on Ariane Flight 162. The generic Ariane-5 lifted off from the Guyana Space Centre, Europe's spaceport at Kourou, French Guyana. SMART-1, as last of the three satellites, was successfully released into a geo-stationary transfer orbit (654 x 35,885 km, inclined at 7 degrees to the Equator). While the other two satellites are due to manoeuvre towards geo-stationary orbit, the 367 kg SMART-1 will begin a much longer journey to a target ten times more distant than the geo-stationary orbit: the Moon. "Europe can be proud", said ESA Director General Jean-Jacques Dordain, after witnessing the launch from ESA's European Space Operations Centre (ESOC) in Darmstadt, Germany. "We have set course for the Moon again. And this is only the beginning: we are preparing to reach much further".

As the first mission in the new series of Small Missions for Advanced Research in Technology, SMART-1 is mainly designed to demonstrate innovative and key technologies for future deep space science missions. The first technology to be demonstrated on SMART-1 will be Solar Electric Primary Propulsion (SEPP), a highly efficient and lightweight propulsion system that is ideal for long-duration deep space missions in and beyond our solar system. SMART-1's propulsion system consists in a single ion engine fuelled by 82 kg of xenon gas and pure solar energy. This plasma thruster relies on the "Hall effect" to accelerate xenon ions to speed up to 16,000 m/s (or 57 600 km/hr). It is able to deliver 70 mN of thrust with a specific impulse (the ratio between thrust and propellant consumption) 5-10 times better than traditional chemical thrusters and for much longer durations (months or even years, compared to the few minutes' operating times typical of traditional chemical engines).

The ion engine at first fired almost continuously – stopping only when the spacecraft is in the Earth's shadow – to accelerate the probe (at about 0.2 mm/s2) and raise the altitude of its perigee (the lowest point of its orbit) from 654 to 14,000 km. This manoeuvre was due to take about 80 days to complete, in order to place the spacecraft safely

above the radiation belts that surround the Earth. Once at a safe distance from Earth, SMART-1 would fire its thruster for periods of several days to progressively raise its apogee (the maximum altitude of its orbit) to the orbit of the Moon. At 200,000 km from Earth, it would begin receiving significant tugs from the Moon as it passes by. It would then perform three gravity-assist manoeuvres while flying by the Moon in late December 2004, late January and February 2005. Eventually, SMART-1 will be "captured" and enter a near-polar elliptical lunar orbit in March 2005. SMART-1 will then use its thruster to reduce the altitude and eccentricity of this orbit.

On 4 February 2004, SMART-1 spacecraft was in its 207th orbit, in good health and with all functions performing nominally. The spacecraft has been thrusting only before rounding the perigee (lowest point of its orbit) to finely tune the altitude of the apogee (highest point). This is to limit the length of the eclipses due to occur in March 2004. The perigee is now 14,312 km and apogee 59,491 km, with an orbital period of 24 hours and 53 minutes. "In this period the electric propulsion engine's performance has been nominal," said Giuseppe Racca, ESA's SMART-1 Project Manager. The total accumulated thrust so far is more than 1705 hours, using 27.1 kg of xenon gas fuel and providing a velocity increase of about 4390 km per hour. From 30 January 2004, the ion engine will remain switched off for the next three weeks. With a stable and predictable orbit, this period is being used for instrument commissioning. "After driving for four months in the near-Earth radiation belts, fogged with dangerous energetic particles, we have now reached a quieter environment," said Bernard Foing, SMART-1 Project Scientist. "This is the right moment to pause the ion engine, check the instruments on board, and start taking some scenic pictures and smell the fresh magnetosphere." On 18 January 2004, a first test image of the Moon was obtained by the AMIE camera. On 29 January, a series of AMIE images of the first quarter Moon were taken with several filters. "We are still far away from the Moon but these pictures promise very nice results for when we approach closer," said Jean-Luc Josset, Principal Investigator for AMIE.

During this 18-month transfer phase, the solar-electric primary propulsion's performance, and its interactions with the spacecraft and its environment will be closely monitored by the Spacecraft Potential, Electron and Dust Experiment (SPEDE) and the Electric Propulsion Diagnostic Package (EPDP) to detect possible side-effects or interactions with natural electric and magnetic phenomena in nearby space. A promising technology, Solar Electric Primary Propulsion could be applied to numerous interplanetary missions in the Solar System, reducing the size and cost of propulsion systems while increasing manoeuvring flexibility and the mass available for scientific instrumentation.

In April 2005 SMART-1 will begin the second phase of its mission, due to last at least six months and dedicated to the study of the Moon from a near polar orbit. For more than 40 years, the Moon has been visited by automated space probes and by nine manned expeditions, six of which landed on its surface. Nevertheless, much remains to be learnt about our closest neighbour, and SMART-1's payload will conduct observations never performed before in such detail. The Advanced/Moon Micro-Imaging Experiment (AMIE) miniaturised CCD camera will provide high-resolution and high-sensitivity imagery of the surface, even in poorly lit polar areas. The highly compact SIR infrared spectrometer will map lunar materials and look for water and carbon dioxide ice in permanently shadowed craters. The Demonstration Compact Imaging X-ray Spectrometer (D-CIXS) will provide the first global chemical map of the Moon and the X-ray Solar Monitor (XSM) will perform spectrometric observations of the Sun and provide calibration data to D-CIXS to compensate for solar variability. The SPEDE experiment used to monitor Solar Electric Primary Propulsion interactions with the environment will also study how the solar wind affects the Moon.

The overall data from SMART-1 will provide new inputs for studies of the evolution of the Moon, its chemical composition and its geophysical processes, and also for comparative planetology in general. In addition to valuable lunar science, SMART-

The AMIE camera on board ESA's SMART-1 acquired its first image of a crescent moon on 18 January 2004. On 29 January images of the first quarter Moon were taken through several filters. The result is a small, but impressive, image revealing, clockwise from the top: Mare Serenitatis, Mare Tranquillitatis, Mare Fecunditatis and Mare Nectaris, with Mare Crisium also visible near the limb. The result is very encouraging as the spacecraft is still over 300,000 km from the Moon. The camera appears to have survived its journey through the high-radiation environment with no apparent reduction in performance

1's payload will be involved in the mission's technology demonstrations to prepare for future-generation deep space missions. For instance, the AMIE camera will be used to validate the On-Board Autonomous Navigation (OBAN) algorithm, which correlates data from sensors and star trackers to provide navigational data. It will also participate in a laser communication link experiment with ESA's optical ground station at the Teide Observatory in Tenerife, Canary Islands, trying to detect an incoming laser beam from the ground. Using both AMIE and KaTE hardware, the Radio Science Investigation System (RSIS) experiment will demonstrate a new way of gauging the interiors of planets and their moons by detecting the well-known tilting motion of the Moon. This technology can be used later by ESA planetary missions.

SMART-1 was developed for ESA by the Swedish Space Corporation, as prime contractor, with contributions from almost 30 contractors from 11 European countries and the US. Despite its small size, the spacecraft carries 19 kg of science payload consisting of experiments led by Principal Investigators from Finland, Germany, Italy, Switzerland and the United Kingdom. Despite its relatively small budget and short development schedule, SMART-1 holds tremendous potential for future missions and is a clear illustration of Europe's ambitions in the exploration of the solar system, also highlighted by the June 2003 launch of Mars Express, and the launch of Rosetta, due in February 2004, to visit comet Churyumov-Gerasimenko. For more information about SMART-1 and the ESA science programme, visit: www.esa.int/science. This article is based on reports at the ESA web-site (www.esa.int) on 28 September 2003 and 4 February 2004.

4.14 Rosetta set for launch, new comet targeted

Rosetta is scheduled for launch by an Ariane-5 rocket on 26 February 2004 from Kourou, French Guyana. Originally timed to begin about a year ago, Rosetta's journey had to be postponed, as a precaution, following the failure of a different version of Ariane-5 in December 2002. This will be the first mission to orbit and land on a comet, one of the icy bodies that travel throughout the Solar System and develop a characteristic tail when they approach the Sun. This delay meant that the original mission's target, Comet Wirtanen, could no longer be reached. Instead, a new target has been selected, Comet 67P / Churyumov-Gerasimenko, which Rosetta will encounter in 2014 after a 'billiard ball' journey through the Solar System of over ten years. Rosetta's name comes from the famous 'Rosetta Stone', from which Egyptian hieroglyphics were deciphered almost 200 years ago. In a similar way, scientists hope that the Rosetta spacecraft will unlock the mysteries of the Solar System.

Comets are very interesting objects for scientists, since their composition reflects how the Solar System was when it was very young and still "unfinished", more than 4,600 million years ago. Comets have not changed much since then. In orbiting Comet Churyumov-Gerasimenko and landing on it, Rosetta will collect information essential to an understanding of the origin and evolution of our Solar System. It will also help discover whether comets contributed to the beginnings of life on Earth. In fact comets are carriers of complex organic molecules that, delivered to Earth through impacts, perhaps played a

role in the origin of living forms. Furthermore, 'volatile' light elements carried by comets might also have played an important role in forming the Earth's oceans and atmosphere.

"Rosetta is one of the most challenging missions undertaken so far," says Professor David Southwood, ESA Director of Science. "No one has ever attempted such a mission, unique for its scientific implications as well as for its complex and spectacular interplanetary space manoeuvres." Before reaching its target in 2014, Rosetta will circle the Sun four times on wide loops in the inner Solar System. During its long trek, the spacecraft will have to endure some extreme thermal conditions. Once it is close to Comet Churyumov-Gerasimenko, scientists will take it through a delicate braking manoeuvre; the spacecraft will then closely orbit the comet, and gently drop a lander on it. It will be landing on a small, fast-moving "cosmic bullet" about whose "geography" very little is known yet.

Rosetta is a 3-tonne box-type spacecraft about 3 metres high, with two 14-metre solar panels. It consists of an orbiter and a lander, approximately 1 metre across and 80 cm high. It will be attached to the side of the orbiter during the journey to Comet Churyumov-Gerasimenko. Rosetta carries 21 experiments in total, 10 of them on the lander. They will be kept in hibernation during most of its 10-year trek towards the comet.

Why does Rosetta's cruise need to take so long? To reach Comet Churyumov-Gerasimenko, the spacecraft needs to go out into deep space as far out from the Sun as Jupiter. No launcher could possibly get Rosetta there directly. ESA's spacecraft will gather speed from gravitational "kicks" provided by four planetary fly-bys: one of Mars in 2007 and three of Earth in 2005, 2007 and 2009.

The spacecraft will be fully reactivated prior to the comet rendezvous manoeuvre in 2014. Then, Rosetta will orbit the comet – an object only about 4 km in diameter – while it cruises through the inner Solar System at 135,000 km per hour. At the time of the rendezvous – around 675 million km from the Sun – Comet Churyumov-Gerasimenko will hardly show any surface activity. This means that the characteristic "coma" (the comet's "atmosphere") and tail will not be formed yet, because of the distance from the Sun. The tail is in fact made of dust grains and frozen gases from the comet's surface that vaporise because of the Sun's heat. Over a period of six months, Rosetta will extensively map the comet's surface, prior to selecting a landing site. In November 2014, the lander will be ejected from the spacecraft from a height perhaps as low as 1 km. Touchdown will be at walking speed, about 1 metre per second. Immediately after touchdown, the lander will fire a harpoon into the ground to avoid bouncing off the surface back into space, since the comet's extremely weak gravity alone would not hold onto the lander. Operations and scientific observations on the surface will last at least a week, but may continue for many months. Besides taking close-up pictures, the lander will drill into the dark organic crust and sample the primordial ices and gases.

During and after the lander operations, Rosetta will continue orbiting and studying the comet: it will be the first spacecraft to witness at close quarters the changes taking place when a comet approaches the Sun and grows its coma and tail and then travels away from it. The trip will end in December 2015, after 12 years, when the comet has made its closest approach to the Sun and is on its way towards the outer Solar System. All scientific data including those relayed from the lander will be stored on the orbiter for downlink to Earth at the next ground station contact. ESA has installed a new deep-space antenna at New Norcia, near Perth in Western Australia, as the main communications link between the spacecraft and ESOC Mission Control in Darmstadt, Germany. This 35-metre diameter parabolic antenna allows the radio signal to reach distances of more than a million km from Earth. The radio signals, travelling at the speed of light, will take up to 50 minutes to cover the distance between the spacecraft and Earth. This article is based on a report at www.esa.int on 26 January 2004.

4.15 Cassini-Huygens mission to Saturn & Titan

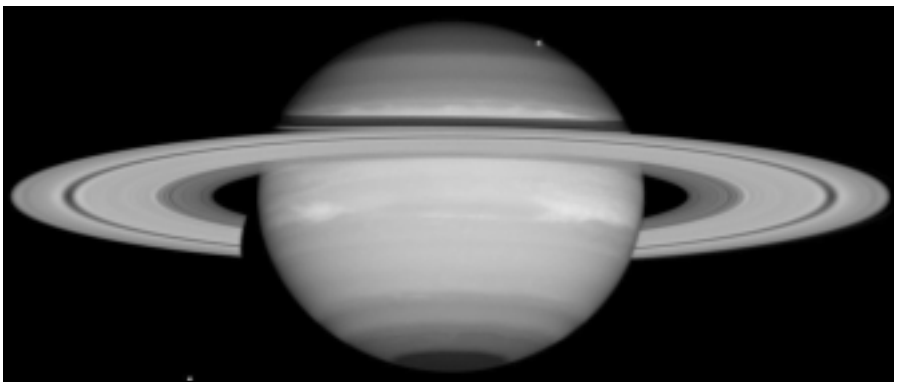
This time next year, ESA's Huygens spaceprobe will be descending through the atmosphere of the giant ringed planet Saturn's largest moon, becoming the first spacecraft to land on a body in the outer Solar System. All the planets orbit the Sun as if on a giant racetrack, travelling in the same direction but in different lanes. Those in the outer lanes have further to travel than those on the inside. So, Earth regularly "laps" the further planets. On New Year's Eve 2003, Earth overtook Saturn, drawing closer than at any time in the next three decades.

Through a small telescope, Saturn is normally visible as a creamy yellow 'star'. You may be able to see the ring system for which the planet is famous, and its largest moon Titan will show up as a tiny dot of light. That tiny dot is the destination for ESA's Huygens probe and may hold vital clues about how life began on Earth. Titan is the only moon with a thick atmosphere in the Solar System. Astronomers think this atmosphere might closely match the one Earth possessed millions of years ago, before life began. Certainly Titan's atmosphere is rich in carbon, the chemical necessary for life on Earth. What is more, this is all stored in "deep freeze", ten times further from the Sun than the Earth.

The big mystery is Titan's surface, which is hidden by a cloud layer. This is why ESA built Huygens, to probe through this layer which is impenetrable by Earth-based observations. In January 2005, Huygens will parachute below the clouds to see what is really going on. Its battery of instruments will return over 1000 images as it floats down and samples the chemistry of this exotic place. The Titan probe was named Huygens in honour of the Dutch astronomer who discovered Titan in 1655. Launched from Kennedy Space Centre on 15 October 1997, Huygens is currently in space, hitching a ride on NASA's Cassini spacecraft.

What sets Saturn apart from the rest of the planets in the solar system are its picturesque rings. Made up by billions of ice and rock particles of all sizes – from small debris to boulders as big as houses – these rings orbit Saturn at varying speeds. There are hundreds of these rings, believed to be pieces of shattered comets, asteroids or moons that broke apart before they reached the planet. The rings are so big that they would fill most of the distance between Earth and the Moon.

Titan is one of the most intriguing and significant bodies in the Solar System. Optical observations cannot see through the photochemical smog that shrouds the world, but infrared and radar radiation can get through, revealing a varied surface beneath the clouds. Ground-based telescopes and the Hubble Space Telescope have produced coarse maps of the surface, showing what could be a continent of rock and ice surrounded by hydrocarbon seas or lakes. Hydrocarbons – methane and ethane – could form oily oceans on the surface, whose waves lap against shorelines of ice stained by hydrocarbon drizzle from the sky. In January 2005 Cassini will drop the Huygens probe on to Titan, which may land with quite a splash.



False-colour image of Saturn, taken with Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS), shows the planet's reflected infrared light, and provides detailed information on the clouds and hazes in Saturn's atmosphere

The Cassini-Huygens spacecraft will reach the Saturnian region in July 2004. The mission is composed of two elements: the Cassini orbiter that will orbit Saturn and its moons for four years, and the Huygens probe that will dive into Titan's murky atmosphere and land on its surface. The sophisticated instruments on these

spacecraft will provide vital data to help understand this mysterious, vast region. Cassini-Huygens is an international collaboration between three space agencies and 17 nations. The Cassini orbiter was built and managed by NASA's Jet Propulsion Laboratory. The Huygens probe was built by ESA. The Italian Space agency provided Cassini's high-gain communication antenna. More than 200 scientists worldwide will study the data collected. More information is at the web-site saturn.jpl.nasa.gov. This article is based on reports on the web-sites www.esa.int (16 January 2004) andnews.bbc.co.uk/2/hi/science/nature (3 October 2003).

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 3rd Int'l Symposium on Digital Earth

3rd International Symposium on "Digital Earth: Information Resources for Global Sustainability" in Brno, Czech Republic on 22-25 September 2003.

Report by Prof. (em.) Gottfried Konecny, University of Hannover

From 22-25 September 2003, the 3rd International Symposium on Digital Earth, with the sub-title Information Resources for Global Sustainability was held in Brno, Czech Republic. The holding of such symposia was initiated in China in 1999, with the first in Beijing, and the 2nd in Fredericton, New Brunswick, Canada, in 2001. The invitation to the 3rd Symposium in Brno in 2003 was made by the newly elected president of the International Cartographic Association ICA, Dr. Milan Konecny of the Technical University of Brno. Dr. Milan Konecny succeeded in arranging a most interesting scientific and technical programme composed of a great number of international participants from academia, government and private industry. In the programme the entire geo-information field, from remote sensing (RS) to photogrammetry to geographic information systems (GIS), and their applications, was covered by international papers with the emphasis on research, development, application, and the concept of international and national implementation programmes.

Except for the opening and the daily keynote papers presented by Ms. Pretha Pulusaini, Vice President of Intergraph, Ms. Hana Ayala, reporting on a National Geographic Society Project in Panama, and Prof. Michael Blackmore of the University of Durham, the participants were free to choose from papers presented in three parallel sessions. Therefore it is difficult to summarise these. Nevertheless a few highlights should be mentioned. Prof. Chen Shupeng of the Chinese Academy of Sciences, who originated Digital Earth impressed the audience together with his scholars (Guo), that China has been able to integrate high technology into national requirements. NSDI was well represented by Alan Stevens from the USA and Borrero from PAIGH. International programmes such as UNEP-GRID (Marek Baranowski, Forseman) as well as European programmes such as Inspire (Annoni) were well represented such as IGN France (Lagrange) or the Czech Republic (Pašek, Kavalič, Hradek, Halonnova). Academic contributions came from the University of California (Zaslavsky), the TU Delft (Slater), the University of Utrecht (Ferjan Ormeling), Ohio State University (Joel Morrison), and the University of Hannover (Gottfried Konecny). International and local industry was well represented in the exhibit (ESRI, Intergraph).

Brno is known as a very interesting historical city. However, the conference was so attractive that very few participants had the opportunity to see it. They rather spent their time at the papers, the exhibits, and in discussions at the Voronez hotel. The meeting was a true international networking event. This continued to be so in the social programme (gala dinner and dance and visit to a wine cellar near Hodonin). But it

also offered to the international participants the impression that the Czech Republic is a future-oriented, dynamic country dealing actively in the progress of modern technology. The credit for this goes to the main organiser, Dr. Milan Konecny, and his team.

5.2 New book: Sea Ice

"Sea Ice: An Introduction to its Physics, Chemistry, Biology and Geology".

Editors: David N. Thomas, University of Wales, Bangor, and Gerhard S. Dieckmann, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany. (Blackwell Publishing Company, 2003, 402 pages, ISBN 0-632-0585-0, Retail Price: £89.50).

Reviewed by Prof. (em) Preben Gudmandsen, Technical University of Denmark

"Yet another book about sea ice!" This was the reaction by the present reviewer on hearing about the book for first time. But when he then read the sub-title he got interested, because it appeared to include chapters on subjects which he knew very little about: the chemistry and biology related to sea ice, and introductory types of chapters that should be easily accessible to an informed layman, he said confidently to himself. In general, he was not disappointed.

The book is written by a number of knowledgeable specialists authoring various chapters, from microscopic to macroscopic to regional scale: growth, microstructure and properties of sea ice scale (H. Eiken); dynamics versus thermo-dynamics: the sea ice thickness distribution (C. Haas); large-scale characteristics and variability of the global sea ice cover (J.C. Comiso); primary production in sea ice (K.R. Arrigo); microbiology of sea ice (M.P. Lizotte); macro-biology of sea ice (S.B. Schnack-Schiel); sea ice – habitat for polar marine mammals and birds (D.G. Ainley, C. T. Tynan and I. Stirling); biochemistry of sea ice (D.N. Thomas and S. Papadimitriou); particulate flux from sea ice in polar waters (A. Leventer); paleo sea ice distribution – reconstruction and paleo-climate significance (L.K. Armand and A. Leventer).

These chapters are preceded by a foreword by Prof. em. G.E. Fogg (University of Wales, Bangor, UK), who presents a short overview of the history of exploration of the Arctic and the Antarctic (with a number of references to old literature). He goes on by reviewing the chapters to follow. This is also done in the subsequent Chapter 1 entitled "the importance of sea ice" (G.E. Dieckmann and H.H. Hellmer) which inter alia describes how sea ice may be a proxy for extra-terrestrial systems and the use of ice organisms for novel biotechnologies (low-temperature biological features) - very interesting aspects that normally are not considered by sea ice specialists and give prospects that might materialise one day.

The chapter on sea ice physics is a standard version of the subject going into details like a textbook, with good examples of the features discussed, including informative colour plates of various sea ice formations. The chapter on ice thickness describes upward-looking sonar, electromagnetic induction sounding and laser and radar altimeter with special reference to the forthcoming ESA satellite Cryosat. In one respect the chapter is remarkable by its reflections on the accuracy of the measurements and especially its reservations as to the conclusions that may be arrived at from ice thickness changes in the Arctic Ocean that have been reported in the literature during the last five years or so. It is suggested that the observations made may be an effect of the spatial sampling that has been applied rather than "climate change": scepticism that is the mark of a good scientist. The overview of the large-scale variability of the sea ice cover is based on more than 20 years of data from passive microwave radiometers elegantly presented with many colour plates (NASA-supported). The interesting new thing is the considerations as to surface temperature effects, temperature trends and cyclical patterns. They represent new tones in the discussion of the effect of "climate change".

About half of the book is dealing with various subjects in marine biology describing about 20 years of research of the food chain in the Arctic and the Antarctic from primary production to marine mammals

and birds with special reference to sea ice. All biology chapters seem to have been written according to the same model, with a brief introduction to the features dealt with, a description of their habitat and life cycle, and methods applied in studying them. They introduce the reader to a fascinating life that is adapted to the rather hostile environment in the sea ice itself, at its underside and over side, and the food chain from primary production (algae) to birds and mammals. They are well written but to the unprepared reader the wealth of names is distracting so that more than one reading may be needed to fully appreciate the information offered. Most names are in Latin, probably because in most cases they do not have a simple name and still English names may not help a non-English reader.

By the same token, tables of the organisms and animals are included, as well as maps of places investigated. Since the biology most often is carried out on a very localised sampling basis, more general information may be arrived at by modelling, which is described and its limitations clearly expressed. Thoughts as to the influence on the biological activity due to climate change are also presented. An overall impression is that more work has been carried out in the oceans surrounding the Antarctic continent than in the Arctic. In fact very few references are made to the Arctic Ocean. Perhaps this is because there is not very much to report upon – lack of life or lack of investigations or both – or that the authors have been working mainly in the Antarctic oceans.

The chapter on biochemistry is equally informative describing the chemistry that is a result of the freezing of sea ice as well as the modifications that are due to biological activity. The nutrients that are a prerequisite for the biology are dealt with in some detail. The last two chapters are related not only by author but also from the point of view of measurement of particulate flux from sea ice in polar waters. A great deal of this stems from the biology in sea ice and oceanic water and thus reflects the physical conditions of the marine life at a certain time. Sampling of sediments over large areas may therefore be used for studying the sea ice distribution in the past and to reconstruct the climate – the paleoclimate. Methods are described and interesting results are presented from the Antarctic oceans.

The book contains 11 pages of glossary that are very useful for the "informed layman" when reading either of the subjects: the physics and dynamics of sea ice or the biology of sea ice. The present reviewer had good reasons to make reference to it when reading the biology and chemistry chapters and found assistance in most cases. An important feature is the extensive list of references associated with each chapter. In many cases more than 100 references to articles and books are listed. It is noted that they refer to information from scientific literature published up until 2002. The book may be valuable from just that point of view.

Most chapters are written according to the model of the Journal of Geophysical Research, which means that references to literature are stated in the text with author and year in parenthesis. However, considering that the book is an introduction it is rather disturbing to a new reader. For example, in one chapter there were seven references with many names in only twelve lines so that the text had to be read a few times to apprehend the information offered. References by way of numbers would be less disturbing, a method often used in textbooks.

Many of the chapters refer to future activities in the exploration of sea ice and its habitat, which is also very useful. It is therefore surprising that the chapter on application of passive microwave techniques does not refer to the new instrument, the Advanced Microwave Scanning Radiometer, launched recently with the Japanese Advanced Earth Observing Satellite II and with the US Aqua satellite. The data from these instruments will extend the time series by many years. Also, the very fine spatial resolution of the instrument of less than five km has proven very useful. Although another chapter deals with ice thickness measurements it is felt that considering their usefulness for sea dynamics observations, satellite synthetic aperture radars

need more than just a few lines and in particular the application of polarimetric radar signals that open a new way to study sea ice formation, for example. They are complementary to sea ice thickness measurements. These are minor points and the book is highly recommended to Arctic and Antarctic oceans researchers.

5.3 New book: Digital Photogrammetry

Digital Photogrammetry – Theory and Applications

Wilfried Linder. (Springer, Berlin, Heidelberg, New York, 2003, ISBN 3-540-00810-1).

Reviewed by Prof. (em.) Dr. Gottfried Konecny, University of Hannover

In his book of 189 pages with 44 figures and an included CD-ROM, the author presents a treatise on digital photogrammetry to those who had no prior education in photogrammetry. The concept of photogrammetric measurement and restitution is presented in its various stages by examples contained with the CD-ROM software. The book should appeal to geographers and remote sensing (RS) specialists who would like to get familiar with 3D-spatial data extraction from images.

In chapter 1, the introduction, details of aerial photography are presented. Chapter 2 deals with the needed hardware and the software package LISA contained on the CD-ROM. Chapter 3 discusses digital scanning of analogue aerial photos with practical hints. Chapter 4 is devoted to geometric restitution of a stereo model including interior orientation, the use of control, the generation of stereo-models for stereo-observation, the generation of digital elevation models by image matching and the production of an orthophoto. Chapter 5 treats the control extension by aerial triangulation, which is used to minimise the expense for control provision. Aerial triangulation block adjustment by the bundle block adjustment program BLUH (which is included on the CD-ROM for a limited number of images) provides quality control and it permits to geometrically (and radiometrically) create seamless image mosaics. Chapter 6 shows a number of special close range applications for terrestrial cameras: interior orientation without known camera parameters. In chapter 7, detailed instruction is given on how to use the USA-FOTO program for the demonstration of the tasks listed in chapters 4-6. A number of relevant images are included on the CD-ROM. The book and the accompanying CD-ROM constitute an excellent "hands-on" introduction and a practical application of digital photogrammetry. It can be highly recommended to all geo-information specialists, who wish to include photogrammetric aspects into their RS restitution tasks.

5.4 GINIE: GI Network in Europe

The GINIE Book, "GI in the Wider Europe", is now published and available on the GINIE website (www.ec-gis.org/ginie). GINIE (Geographic Information Network in Europe) is a project funded by the Information Society Technologies Programme of the EU, running from 1 November 2001 to 31 January 2004. Its main aim is to support the development of a cohesive GI Strategy at the European level.

The purpose of the GINIE Book is to collect in one single volume the salient findings of the project as a whole and give structure to the lessons learned and the conclusions that need to be drawn. The book is divided into eight chapters: (1) Introduction and overview; (2) SDI developments in Western Europe; (3) SDI in Accession and Pre-Accession countries; (4) SDI in the Mediterranean Basin; (5) International comparison; (6) Key GI players in Europe; (7) Lessons learned; (8) Towards a European GI strategy.

Chapters 1-6 focus on the results of the GINIE workshops and studies. Chapter 7 draws the findings of the previous chapters together and also builds on additional specialist workshops held by GINIE in respect to registries and e-services, and local-to-global infrastructures. The final chapter builds on the lessons learned during the project to put forward a set of proposal that the GINIE consortium feels are crucial for

future development. These come under three main headings – Spatial Data Infrastructure issues; Capacity Building; Research – and provide the basis for discussion, and action with other GI stakeholders in Europe. The large number of co-authors of this final chapter indicates the shared "ownership" of the proposed strategy by all the members of the GINIE Consortium.

6 FORTHCOMING MEETINGS & COURSES

6.1 SPOT VEGETATION Conference in Antwerp

The 2nd International SPOT-VEGETATION Users Conference will be held on 24-26 March 2004, in Antwerp, Belgium. Monitoring the state of our planet and its resources is becoming more and more important with the increasing awareness of environmental issues (Kyoto protocol, GMES initiative, GEO, etc.). To meet the need for information, the VEGETATION mission offers the international remote sensing (RS) and user community a truly global Earth observation (EO) system endowed with high performance standards. The success of the VEGETATION mission since its beginning in 1998 was confirmed with the successful launch of SPOT 5 / VEGETATION 2 in May 2002. VEGETATION products older than three months are available free of charge since October 2001. The VEGETATION mission now, more than ever, provides a viable and vital capacity for operational satellite-based, global and continuous monitoring of Earth for the benefit of a large and diverse user community.

This conference is the second dedicated forum where users of the SPOT 4-5 / VEGETATION 1-2 data have the opportunity to present the results of their research and development efforts as well as their operational applications, and exchange experiences and expectations. It aims to present, through presentations, exhibitions and poster sessions, the broad range of applications and services now developed with VEGETATION sensor products to scientists, commercial and institutional end users. Applications relate to the monitoring of agriculture, forest, range-land, land cover change, the assessment of biosphere productivity as well as the bio-geophysical characterisation of the Earth's terrestrial surfaces. The joint operation of the two VEGETATION instruments makes it possible to develop new types of applications, e.g. snow-cover characterisation as well as oceanographic and atmospheric applications. Besides applications, innovative algorithm developments are presented. The target audience for this conference are current and potential users of VEGETATION products: scientists, commercial and institutional end users, as well as policy makers. To obtain free VEGETATION products, visit the web-site free.vgt. vito.be.

The conference will cover a wide range of topics, including: operations, applications and status of the VEGETATION 1 and 2 mission and other broad field-of-view sensors; validation of VEGETATION products and applications; system performance and data distribution; estimation and validation of bio-geophysical variables; land use / land cover / change detection / GLC 2000; carbon cycle / primary production / yield prediction; operational and (near) real-time VEGETATION applications; multi-sensor opportunities for VEGETATION; marine / snow-ice / atmospheric applications; user requirements, feedback and testimonials; VEGETATION in major international projects and programmes; future of the VEGETATION programme. More information is available at www.vgt.vito.be/vgtapen2004.htm, or from June Cools (june.cools@vito.be), Secretary of the Organising Committee (telephone: +32-14336807; fax: +32-14322795). This announcement was submitted by Els Puttenaers (els.puttenaers @vito.be), Vito Communicatie, Boeretang 200, BE-2400 Mol, Belgium.

6.2 20th ISPRS Congress in Istanbul: update

The Call for Abstracts for the 20th Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS) in Istanbul, Turkey, on 12-23 July 2004, has attracted a record number of submissions (more than 1,770). The Congress will feature a Scientific Programme with more than 50 poster sessions and 100 oral presentation sessions. Over the 12 days of the Congress, these sessions will be organised so that similar topics have minimum overlap and participants have time to visit the exhibition to learn about recent technological developments. Professor Dr. Orhan M. Altan, Congress Director, said, "I want to draw attention to our first-ever Youth Forum on Saturday, 17 July. We place great importance on this event, because it represents the future of our profession. Learning by doing is always most effective, and in this Youth Forum our young colleagues are gaining experience in organising conference sessions as well as in making presentations."

More than 2500 people representing more than 120 countries are expected. Attendees who register by 1 December 2003 will receive the early registration rate of US$390. Additional exhibitors can still be accommodated. More information is available from the web-sites www.isprs2004-istanbul.com and www.isprs.org, or from Ian Dowman, ISPRS Secretary General (e-mail: idowman@ge.ucl.ac.uk).

6.3 Int'l Conference on Landscapes in Bordeaux

The International Conference "From Knowledge of Landscapes to Landscaping Action", will take place on 2-4 December 2004, at Palais des Congrès, in Bordeaux, France, with a landscape study tour on 1 December. The conference, organised by the French Ecology and Sustainable Development Ministry with support of Cemagref, will mark the conclusion of a French national research programme started in 1998, and will focus on a comparison of the programme's results with those of similar studies in other European countries.

The European Landscape Convention signed in Florence in October 2000, is proof of an increasing interest in the issue of landscapes. This interest is, however, more evident in political action than in research. The ideologies driving both politicians and NGOs focus on conceptions of landscape which are within the scope of ecology, national heritage, or a more societal framework. Is this concern emerging at a European scale a sign of a specific European apprehension of landscape? The diversity of motives and concepts underlying action reflects the many concepts of the landscape being developed in the field of research. The aim of this colloquium is to bring together researchers from all over Europe for an update on the concepts and scientific methods implemented. It will also try to provide answers to questions about the effects of public policies on landscapes.

This scientific meeting will be organised along four main themes: (1) Public policies and landscapes; (2) The place of the landscape in environmental policies; (3) The place of the landscape in urban policies; (4) Civil society, participation in decision-making, governance. Papers can deal with any one of the above themes, or propose cross-functional analyses. Case studies and the definition of "good practices" are welcomed. Language: French and English. Full translation will be provided. A more detailed version of the call for papers is available on the conference web-site: landscape.lyon.cemagref.fr

6.4 ENVISAT & ERS Symposium in Salzburg

ESA would like to invite you to participate in the 2004 ENVISAT and ERS Symposium, which will be held in Salzburg, Austria, on 6-10 September 2004, and which follows the previous successful Symposia in Gothenburg (2000), Florence (1997), Hamburg (1993), and Cannes (1992). The main objectives of the ENVISAT and ERS Symposium are: to provide a forum for investigators to present results of on-going research project activities; to review and assess the development of applications and services. The Symposium is open to all interested parties, from

scientists to operational users, and will cover both ENVISAT and ERS missions. We expect presentations of results from the ESA Principal Investigators, in particular those working on the 3rd Announcement of Opportunity for ERS Data (AO3), the ENVISAT CAL/VAL, the ENVISAT AO (AOE) projects and the Category-1 projects. Scientists working in the framework of national investigations and projects are also welcome to contribute. ERS and ENVISAT data Distributing Entities, Value-Adding Companies and Service Providers are strongly encouraged to participate to illustrate their contribution in an active EO market. More information is at www.congrex.nl/04a06.

6.5 Calendar of forthcoming meetings

NEW
24-26 March 2004
Antwerp, Belgium

2nd Int'l SPOT-VEGETATION Users Conference
Web: www.vgt.vito.be/vgtapen2004.htm

NEW
26-30 April 2004
Nice, France

European Geophysical Society: General Assembly
Web: www.copernicus.org/EGS

NEW
3-6 May 2004
Fairbanks, Alaska

Int'l Boreal Forest Research Association (IBFRA): 12th Annual Scientific Conference
Web: www.lter.uaf.edu/ibfra

25-27 May 2004
Dubrovnik, Croatia

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

28-29 May 2004
Dubrovnik, Croatia

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

12-23 July 2004
Istanbul, Turkey

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

18-25 July 2004
Paris France

35th Scientific Assembly of COSPAR (Committee on Space Research) – Scientific Commission A3.1: Biological and Physical Processes on Land
Contact: R. Gupta (gupta_rkg2000@yahoo.co.in), NRSA, Hyderabad, India; N. Gobron (nadine.gobron@jrc.it), JRC, Ispra, Italy. Web: www.copernicus.org/COSPAR/COSPAR.html

NEW
6-10 Sept 2004
Salzburg, Austria

2004 ENVISAT & ERS Symposium
Web: www.congrex.nl/04a06/

NEW
7-10 Sept 2004
Aberdeen,
Scotland, UK

RSPSoc (Remote Sensing & Photogrammetry Society) 2004 – Mapping and Resources Management
Web: www.rspsoc.org/ Contact: rspsoc@rspsoc.org

NEW
2-4 Dec 2004
Bordeaux, France

Int'l Conference: From Knowledge of Landscapes to Landscaping Action
Web: landscape.lyon.cemagref.fr