EARSeL Newsletter

ISSN 0257-0521

Bulletin of the
European Association of Remote Sensing Laboratories
Http://www.earsel.org
March 2005 - Number 61

EARSeL Newsletter Editor

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

Editorial Assistant

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

Published by:	EARSeL Secretariat
Desk Top Publishing by:	GITC bv, Lemmer, The Netherlands
Printing by:	Giethoorn Ten Brink, Meppel, The Netherlands
Nr of copies printed:	500

Subscription rates 2005

Members receive the Newsletter as part of the annual membership fee. For non-members rates are as follows:

(4 issues) within Europe	77€
including airmail postage outside Europe	84€
personal subscription from EARSeL member laboratories' staff	31€

EARSeL membership fees 2005

Individual observer	290€
Laboratory/company member or observer having up to 10 researchers	330€
Laboratory/company member or observer having 11 or more researchers	500€
Laboratory from Eastern Europe (for first two years membership)	145€

CONTENTS

1. EDITORIAL 3

2. NEWS FROM THE ASSOCIATION & ITS MEMBERS 4
2.1 Obituary: Eugenio Zilioli (1950-2004) 4
2.2 2005 EARSeL Symposium in Portugal: update 4
2.3 EARSeL Bureau & Council meetings 4
2.4 Integrated Coastal Zone Management in DCs 6
2.5 New EARSeL Member: DPG, Utrecht University 6
2.6 News from R&D Centre ScanEx, Moscow 7
2.7 Pegasus: permanent monitoring from the air 8
2.8 Reports from National Representatives 9
2.8.1 RS activities in 2004: Austria 9
2.8.2 RS activities in 2004: Belgium 10
2.8.3 RS activities in 2004: Croatia 13
2.8.4 RS activities in 2004: France 14
2.8.5 RS activities in 2004: Germany 18
2.8.6 RS activities in 2004: Italy 19
2.8.7 RS activities in 2004: The Netherlands 22
2.8.8 RS activities in 2004: Spain 25
2.8.9 RS activities in 2004: Sweden 27

3. NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS 30
3.1 News from ESA 30
3.1.1 GMES at the Earth & Space Week 30
3.1.2 3rd EO Summit agrees 10-year GEOSS plan 32
3.2 News from the EC 33
3.2.1 JRC's response to the tsunami disaster 33
3.2.2 JRC's environmental observatory for Africa 34
3.2.3 New European Research Council imminent 35
3.3 EEA highlights EU's changing landscape 36

4. RS DATA, PRODUCTS & PROJECTS 37
4.1 An image compression & analysis framework 37
4.2 Satellites show devastation by tsunami 41
4.3 Huge Antarctic icebergs on collision course 42
4.4 Completion of SRTM-based global DEM 43

5. REVIEWS, PUBLICATIONS & REPORTS 44
5.1 Symposium: Space Services & Maritime Users 44
5.2 Book Review: Elementi di Geomatica 45

6. FORTHCOMING MEETINGS & COURSES 47
6.1 Calendar of forthcoming meetings 47

EARSeL Bureau

CHAIRMAN
Prof. Dr. Eberhard Parlow
MCR Laboratory, Department of Geography
University of Basel, Klingelbergstr. 27
CH-4056 Basel, Switzerland
Tel: +41 61 2670701, Fax: +41 61 2670689
Email: eberhard.parlow@unibas.ch

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

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

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

EAST-WEST RELATIONS
Dr. Tomas Benes
CAGI - Czech Association for Geoinformation
Novotneho
lavka 5, 11668 Praha 1, Czech Republic
Tel / Fax: +420-221-082374
Email: tajemnik@cagi.cz

Representatives of the Sponsoring Organisations

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

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

1 EDITORIAL

It is a sign of the times that we live in, that every new issue of the Newsletter brings with it reports on applications of remote sensing (RS) to yet another major natural disaster. This time the disaster in question is, of course, the catastrophic tsunami (or tsunamis?) which engulfed the coastal regions of several countries in South Asia and East Africa (notably Burma, India, Indonesia, Malaysia, Maldives, Somalia, Sri Lanka, Thailand), following the huge earthquake of 26 December 2004. Subsequent international aid efforts were in many cases supported by near-real-time satellite imagery, provided through the Charter on Space and Major Disasters, for the assessment of the damage. In the immediate aftermath of the disaster, the Joint Research Centre (JRC) of the European Commission (EC), for example, set up a web-site (www.jrc.cec.eu.int/tsunami) with an extensive database of information on the affected regions, including detailed satellite-based maps and analysis results.

The impact of the tsunami, and the role of RS satellites in relief efforts, also featured prominently at two recent major international events on Earth observation (EO) and space, which were held in Brussels. On 12-20 February 2005, an Earth and Space Week was organised jointly by the EC and ESA, and comprised a variety of cultural, recreational and educational activities, a major public exhibition, and high-level policy-related events, showing how EO and Space improve quality of life on our planet. The programme included one day of high-level presentations on the EU's GMES (Global Monitoring for Environment and Security) initiative.

The 3rd EO Summit also took place in Brussels, on 16 February 2005. At the Summit, the 61 countries member countries of the Group on Earth Observations (http://earthobservations.org) agreed to a ten-year implementation plan for a Global Earth Observation System of Systems (GEOSS). This is envisioned as a large national and international cooperative effort to bring together existing and new hardware and software, making it all compatible in order to supply data and information at no cost. Nearly 40 international organisations also support the emerging global network. Europe's contribution to GEOSS will be the GMES initiative.

This Newsletter, being the first issue of the year, includes news from the meeting of the EARSeL Bureau and Council, and a selection of reports from national representatives, on their countries' main activities in RS during 2004. Other highlights include an update on plans for an independent European Research Council to fund scientific research and development in the EU, a technical paper on a methodology for image segmentation and compression developed by the University of Cassino in Italy, and a report on the recent completion by NASA of a global digital elevation model, based on data from the Space Shuttle Endeavour's Radar Topography Mission (SRTM) in February 2000.

Incidentally, the return to flight of the Space Shuttle – the first since the tragic loss of Columbia and its crew two years ago – is scheduled for between 15 May and 3 June 2005. The success of this mission is important, as the Shuttle is needed to transport new modules to continue construction of the International Space Station (ISS). Next year (2006) will see the launch of a European-built supply ship for the ISS – the Automated Transfer Vehicle (ATV). The first ATV (called Jules Verne) is currently at ESA's research and technology centre (ESTEC), in Noordwijk, the Netherlands, before being shipped to French Guiana for launch on an Ariane 5 launcher.

The Editor

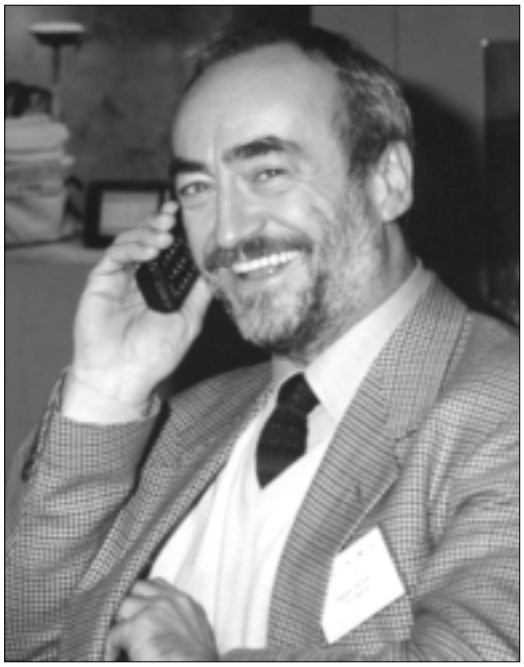
2 NEWS FROM THE ASSOCIATION & ITS MEMBERS

2.1 Obituary: Eugenio Zilioli (1950-2004)

It is with great sadness that we report the recent premature passing of Eugenio Zilioli, on 9th November 2004, after a short and incurable illness.

Dr. Zilioli, who was the EARSeL representative of Italy's CNR (National Research Council) – IREA (Institute for Electromagnetic Sensing of the Environment), was active since the first steps of EARSeL in the mid-1970s. As a geologist, he promoted the activities of the Working Group on "Observation of Volcanic Areas in Europe". Senior scientist and supervisor at CNR-IREA Milano, during his thirty years activity he promoted and co-ordinated many projects both within national (CNR, Italian Space Agency, Ministry of Environment) and international programmes (NASA, ESA, EC).

Dr. Zilioli explored the different fields of RS environmental applications, including volcanic surveillance, hydro-geology in sub-saharan Africa, structural and geo-thermal geology in Central America, and coastal and inland waters. Author of over 150 scientific and technical publications, he chaired for several years the Remote Sensing Conferences on land and geological applications organized by the Europto Series – the joint EOS (European Optical Society) / SPIE (Society of Photo-Optical Instrumentation Engineers) venture aimed at the European optical and opto-electronics community. He also co-ordinated the EC (FP4-RTD) project SALMON (Satellite Remote Sensing for Lake Monitoring). Part of his activity was dedicated to divulgate RS in primary and secondary schools, as a strength assertor of the use of RS for an original perspective of Observation of the Earth.



Eugenio Zilioli (1950-2004).

Whoever met Eugenio Zilioli, even for a short period, could appreciate not only his professional and scientific skills, but also his deep humanity and his enthusiasm for people and life.

2.2 2005 EARSeL Symposium in Portugal: update

The theme chosen for the 25th EARSeL Annual Symposium, to be held on 6-11 June 2005 at the University of Porto, Portugal, is "Global Developments in Environmental Earth Observation from Space". The Symposium will be followed by two EARSeL SIG Workshops: 2nd Workshop on Remote Sensing of the Coastal Zone, on 9-10 June 2005; 1st Workshop on 3D Remote Sensing, on 10-11 June 2005.

The proceedings of the 24th annual symposium, held in Dubrovnki, Croati, from 25-27 May 2004, have now been published in book form, together with a CD-ROM containing all papers and full colour illustrations. They have been mailed to all participants and paid-up member laboratories. Anyone else interested in obtaining a copy should contact the EARSeL Secretariat (earsel@meteo.fr).

2.3 EARSeL Bureau & Council meetings

The regular Bureau and Council meetings were held on 13-14 January 2005 at the Eu-

ropean Space Agency in Paris. Apart from the Bureau members, the countries represented by national delegates included Austria, Belgium Czech Republic, Croatia, Denmark and Iceland, Finland, France, Germany, Hungary, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland, and the UK.

Dr. Klaus Komp represented the German Society for Photogrammetry and Remote Sensing, and Dr. Stuart Marsh represented the UK's Remote Sensing and Photogrammetry Society, as the newly-elected Chairman. The national representatives made short presentations of the outstanding activities in RS in their country during 2004. (Several of these are published in Section 2.3 below).

Mr. Jean-Pierre Massué, who has been the EARSeL contact for many years within the Council of Europe, as Executive Secretary of the EUR-OPA (European Open Partial Agreement) Major Hazards Agreement, was also present, and outlined a planned proposal, in the framework of an Announcement of Opportunity to be issued shortly by the EC on Education and Training within GMES. This has three stages: (a) inventory of existing training programmes and services in Europe; (b) analysis of the general needs for various categories of audience: professionals, politicians, and the public; (c) definition of a training programme to meet the training needs of these categories, leading to the organisation of specialist seminars. Mr. Massué will liaise with the EARSeL Secretary General, to ascertain what rôle EARSeL can play in formulating this proposal.

The Agenda also included an overview of upcoming events of the Special Interest Groups: Land Ice and Snow (February / Bern); Imaging Spectroscopy (April / Warsaw), RS of the Coastal Zone and 3-D RS (after the June Symposium in Porto), and Forest Fires (June / Zaragoza). Other events at which EARSeL is represented include the Earth and Space Week (February / Brussels), RS of Urban Areas (March / Tempe, Arizona), and the IAF Small Satellite Symposium (April / Berlin).

The Council meeting was also attended by Mrs. Gesine Boettcher, who will take over the tasks of the EARSeL Secretariat as from July 2005, when the present Secretary retires. She told Council Members that she had worked at the Institute for Photogrammetry and Geoinformation in Hannover since 1979, and had assisted Prof. Konecny throughout the time when he held high positions in ISPRS, as Congress Director (Hamburg 1980), later as Secretary General and then President. She is presently the secretary to the Institute and will work part-time for EARSeL. Practical and legal aspects are currently being finalised.

An important item on the Agenda was the financial situation, since the incomes and expenditures account for 2004 showed a negative balance. Measures had been taken to make economies, but salary, taxes and publications are the most important costs, and measures to reduce these where possible were agreed. It is hoped to achieve a balanced budget in the coming year or at the latest in 2006. In order better to balance the budget an increase in membership fees from 300 to 330 was agreed, justified by the continuous efforts to improve services to members by providing more useful and up-to-date information on the EARSeL web-site and in the organisation of high quality meetings, where members benefit from a substantial reduction in registration fees.

It is also necessary to recruit new members to compensate those that are lost through the amalgamation of laboratories and certain resignations and exclusions for non-payment of membership fees. An idea was launched that it should be possible for individual persons to join EARSeL. It often happens that persons attending EARSeL events would like their laboratories / institutes to join the Association but for one reason or another, their administrations are not willing to finalise their application. In this case it was considered that it should be possible for individuals to become members at a reduced membership fee. They would benefit from reduced fees to attend EARSeL meetings and receive publications. An alternative would be to have three categories of membership instead of the present two: one category where there are 1-2 persons in a unit, another for 3-10, and the final category for units of more than 10 researchers. It was decided to

leave the decision until the Council meeting in Porto, to allow for discussion among the members.

Concerning publications, Dr. Reuter, responsible for publications within the Bureau, reported that the 2004 issues of the eProceedings are online, and the 2005 issues are in the pipeline.

Regarding the Newsletter, it was decided to maintain this as a magazine in paper form for as long as financially possible, since it seems that most members appreciate this. It might, nevertheless, prove necessary to make this an online bulletin.

Another item was the renewal of the EARSeL Bureau. To conform to the Statutes, it is necessary for the Council to elect a new Chairman and Treasurer in Porto in June. Several nominations were proposed as Honorary President and Vice-President, to oversee the voting procedure.

2.4 Integrated Coastal Zone Management in DCs

P. Geerders Consultancy (pgcons@wxs.nl)

As a long-standing member of EARSeL and drawing from my experience as a consultant in several countries in South America and the Caribbean, mainly related to applications in the field of marine and coastal science and management in that part of the world, I should like to propose a possible role for EARSeL.

There is an urgent need for updated information as a basis for integrated coastal zone management in developing countries. Remote Sensing can play an important role to provide such information in the form of operational, dedicated data and information products, tuned to the various applications in this context. This type of service can only be achieved through an integration of remote sensing data with data from other sources (in situ instruments, models) in an adequate environment (GIS), which allows not only for static analysis but especially provides capabilities of forecast and simulation.

Although in many developing countries, already some awareness is present on the «blessings» of remote sensing, very little has been achieved with respect to operational application at national scales. Many of the currently available products and services derived from remote sensing, are set up and managed by countries from outside the region, especially by the countries operating earth-observing satellites. This creates a certain dependency as well as uncertainty as to the quality and continuity. This situation needs to be transformed into a relation of mutual trust and balanced cooperation by transfer of knowledge and technology, thus creating independent capability in the countries.

EARSeL can play a valuable role in the process of transferring knowledge and awareness on the potential of remote sensing technology and applications for developing countries. This can be done in various ways: through the development and distribution of dedicated promotional and educational material, by facilitating expert and trainee visits, and by increasing the EARSeL presence in the developing world through participation in regional events (congresses, symposia). These contacts could lead to joint projects of the EARSeL laboratories in Europe and counterparts in the developing world, which could include an element of technology transfer. The major objective in these projects should be to create and improve independent capacity on Remote Sensing in the developing countries, aimed at providing updated, complete and reliable information for science and management.

2.5 New EARSeL Member: DPG, Utrecht University

Report by Steven M. de Jong (S.deJong@geog.uu.nl), Utrecht University, the Netherlands

One of the new members of EARSeL is the Department of Physical Geography (DPG), Faculty of Geosciences of Utrecht University (www.geo.uu.nl) in The Netherlands.

This faculty is one of the largest Geo-Institutes in the world (425 staff and 1800 stu-

dents), with the Departments of Physical Geography, Human Geography, Cartography, Environmental Sciences, Geology and Geo-Chemistry residing together. The faculty's Department of Physical Geography, with a staff of 30, has a long-term research record on modern methods and techniques in Geography, comprising spatial-dynamic modeling, GIS, and geo-statistics. Examples of our products are the "PCRaster Environmental Modelling Language" (pcraster.geog.uu.nl), the "Multivariable Geostatistical Modelling Package: GSTAT" (www.gstat.org) and the physically-based run-off and soil erosion model LISEM (www.geog.uu.nl/lisem).

The faculty's RS group is part of DPG, and is headed by Steven M. de Jong. The group offers courses in basic RS and hyper-spectral RS, at the BSc and MSc level, with a focus on geographical applications. Furthermore, we have a 4-year PhD programme of RS and Geo-Computation in Geography. Research activities of the RS group focus on applications of hyper-spectral RS, image analysis algorithms including the spatial domain, and object-based image analysis.

Over the years DPG has been involved in a wide range of European experiments with hyper-spectral instruments. It started in 1989 with EISAC'89, the European Imaging Spectrometry Airborne Campaign (MAC-Europe) in 1991, followed by the airborne experiments with DAIS7915, ROSIS and HyMAP from 1997 to now. DPG contributed to these experiments by collecting field data, analysing the imagery and assessing the suitability of these new instruments for quantitative mapping of soil and vegetation variables. The object-based image analysis aims at improving the quantitative survey of vegetation variables by using image objects and image segments in stead of using per-pixel spectral image analysis methods. The object-based studies are managed and supervised by Elisabeth Addink.

Two examples of current PhD studies at DPG are given below.

- "Modelling Mediterranean Ecological Processes using High Resolution Hyper-Spectral Remote Sensing Images" by Raymond Sluiter. The focus of his research is the effect of agricultural land abandonment and re-establishment of natural vegetation. Emphasis is on the Peyne experimental area in southern France. Aerial photos dating back to 1943, Landsat TM, ASTER airborne hyper-spectral images are used to quantitatively map vegetation dynamics.
- "Integrated Modelling of Top Soil Moisture using Earth Observation" by Hans van der Kwast. In this study the spatial and temporal distribution of top soil moisture in the semi-arid region of Al Sehoul in Marocco is quantitatively modelled using the Surface Energy Balance Simulation model SEBS and optical and thermal ASTER images.

In both studies the field component of collecting data for model input and for model calibration and validation is important. More information about our Physical Geography group is available at: www.geo.uu.nl.

2.6 News from R&D Centre ScanEx, Moscow

Ms. Olga Gershenzon, SCANEX, Moscow

In November 2004, Antrix Corporation Limited (Antrix), India and R&D Centre ScanEx (ScanEx), Russia, signed the agreement for an upgrade to UniScan™ ground station, manufactured by ScanEx, which enables acquisition of images from Indian Resourcesat-1 satellite. Under this Agreement ScanEx is licensed to incorporate Antrix's proprietary software into ScanEx's satellite ground station UniScan™ and market the station exclusively in Russia and CIS (Commonwealth of Independent States). However, customers who need real-time downlink have to sign an agreement with ScanEx, Antrix and Space Imaging, LLC (who have rights for licensing downlinks for Resourcesat-1 worldwide outside India.)

Under the agreement Antrix and ScanEx agreed to offer joint technical solutions for acquisition of Resourcesat-1 data for customers outside Russia and CIS. The

joint solution consists of UniScan™ hardware for receiving and demodulating Resourcesat-1 signals with bit-sync output and Antrix's proprietary interface for reception of Resourcesat-1 data. Antrix has the right to market the joint solution worldwide, outside Russia and CIS countries.

In contrast to other distributors of RS data in Russia, R&D Centre ScanEx enables access to images transmitted from satellites directly to end users' PCs. This allows, under a separate downlink agreement, to receive real-time data and to decrease their cost in comparison with centralized approach of RS data distribution.

Resourcesat-1, the latest satellite in the IRS series (IRS-P6) was successfully launched on 17 October 2003. Resourcesat-1 is the most advanced of the present IRS satellites. It carries a new LISS-4 scanner providing imagery with spatial resolution of 5.8 m both in mono and multispectral modes with advanced radiometric quality, and Advanced WiFS (AWiFS) scanner giving a unique opportunity to receive 10 bit imagery with 56 m ground resolution in 740 km swath once in 5 days. Also Resourcesat-1 carries a LISS-3 scanner similar to that of IRS-1C/1D satellites (4 spectral channels, 23 m spatial resolution in 140 km swath) with improved resolution in SWIR channel.

The IRS Project first started in Russia in November 2001 after signing licensing agreements with Antrix Corporation and Space Imaging, and successful certification by representatives of ISRO (www.isro.org) and Antrix of UniScan™ ground station in Moscow for receiving IRS-1C/1D data. IRS imagery is of good quality, and flexible pricing policy makes it attractive for users within Russia and CIS counties. During 3 years of the IRS Project in Russia, a huge up-to-date data archive was accumulated, covering almost the whole territory of Russia.

Operational UniScan™ ground stations can be upgraded for IRS-P6 data acquisition. (At present there are 16 UniScan™ stations operational within Russia and CIS, but not all of them receive IRS data). We at ScanEx consider that Russian clients will also be very interested in AWiFS imagery, which allows a repetitive coverage of same area of interest every 5 days with spatial resolution of 56 m within a wide swath width of 740 km, and is ideal for the vast territory of Russian Federation.

About R&D Centre ScanEx (www.scanex.ru): Research & Development Centre ScanEx is a private Russian company that provides fully integrated solutions for satellite RS applications. E-mail: info@scanex.ru. About Antrix Corporation Limited (www.antrix.org): Antrix Corporation Limited is the premier space marketing company of India, offering state-of-the-art products and services developed by ISRO across global markets. E-mail: antrix@bgl.vsnl.net

2.7 Pegasus: permanent monitoring from the air

Recently, the Flemish Government has funded the high-altitude long endurance unmanned aerial vehicle project (HALE UAV) called Pegasus (www.pegasus4europe.com). The aircraft, a scale model of which was shown at the Earth and Space Expo in Brussels, on 12-20 February 2005 (europa.eu.int/comm/space/esw/expo/article_1513_en.htm), will fly over Europe at stratospheric altitudes of about 20 km, for up to 8 months continuously, providing high resolution imagery (20 cm ground pixel size) for coastal and country wide mapping or crop monitoring. Thanks to its agility, it will also be able to virtually hover over an area, in case of natural disasters or industrial accidents, providing decision-makers with real-time updates of the situation. When combined with medium or low resolution satellite data, a global monitoring system will emerge with unprecedented capability. The first test flights are expected to take place in the summer of 2005.

Vito endorses the overall objective of space-based RS to improve life on planet Earth, as was promoted at the Earth and Space Week. Based on its experience in the development of tools to improve the use of imagery from space-borne satellite sensors for Earth observation (EO), Vito recently broadened the scope of its activities with the Pegasus project.

Data from Pegasus are the ideal complement to widely used satellite data, and will likely improve their use. Pegasus can, for example, provide permanent observation of a problem area (e.g. forest fire, drought, flooding, industrial calamity, volcanic eruption) detected by satellite, by going into "hovering" mode above the target site, allowing for geo--stationary observation. Pegasus could significantly contribute to the GMES (www.gmes.info) and INSPIRE (www.ec-gis.org/inspire) projects of the EC.

In the field of EO, Vito focuses on: running the processing and archiving facility for data from the VEGETATION instrument aboard the SPOT4 and SPOT5 satellite platforms; getting the above-mentioned Pegasus system up and running within a strict time frame; developing new applications making use of a new hyper-spectral sensor for airborne observation; playing an important role in GMES, with a specific focus on food security; participating in the MARS (Monitoring Agriculture with Remote Sensing) project of the EC, aimed at providing accurate forecasts of crop growth; participating in Geosuccess (Global Earth Observation in Support of Climate Change and Environmental Security Studies); participating in the INSPIRE project of the EC, aimed at harmonising information from space to the benefit of government, industry and commerce. For more information, see: www.vito.be/english/environment/tap.htm and www.pegasus4europe.com.

2.8 Reports from National Representatives

2.8.1 RS activities in 2004: Austria

Dr. Erwin Mondre, Austrian Space Agency (ASA), Vienna

The national programme for space research and development (ASAP - Austrian Space Application Programme), approved and financed by the Ministry for Transport, Innovation and Technology and coordinated and monitored by ASA, supports several RS projects for different applications and use of satellite data. One of these projects aims to develop and prove a concept for the verification of parameters as required by the Kyoto Protocol, and is carried out by a value-adding company (GeoVille / www.geoville.com) in cooperation with research and university institutes. This project is now in its second phase, verifying the implementation at four different test sites with the involvement of the users responsible at national and regional level for reporting the actual situation, as agreed under Kyoto.

A project sponsored by the Ministry for Transport, Innovation and Technology to support the GMES initiative of the EC and ESA, which was finalised in 2004, dealt with the application of satellite RS data from different sensors combined with GIS information to monitor and improve the security on Alpine transport routes (highways and railroad lines). This project was carried out by the value-adding companies Geospace and ENVEO, in cooperation with the scientific institute Joanneum Research.

Final reports of three ENVISAT studies supported by ASA have been issued. The results were also presented at the 2004 ENVISAT Symposium, in Salzburg on 6-10 September 2004, and at the 4th International Symposium on Retrieval of Bio- and Geophysical Parameters from SAR Data for Land Applications SAR workshop, in Innsbruck on 16-19 November 2004.

The project performed at the University of Technology in Vienna shows the potential of ENVISAT ScanSAR data for soil moisture retrieval over semi-arid regions on a test site in north-western Spain. Further research efforts will be carried out over Africa to monitor the soil moisture dynamics in support of water resources management within the framework of the ESA TIGER project.

Scientists at the University of Innsbruck studied the ice / climate interactions on the Larsen Ice Shelf and in Dronning Maud Land, Antarctica, using as the main data source the images taken by ASAR of ENVISAT. A further project was devoted to environmental research in the Eastern Alps using ASAR and MERIS data with the main aim to develop and test methods for hydrological modelling in alpine catch-

ments basins and in monitoring the water quality of lakes.

Several international events related to RS from space were hosted and supported by Austria and through the active involvement of Austrian scientists in 2004:

- The major event was the ENVISAT and ERS Symposium from 6-10 September 2004 in Salzburg, organised by ESA. This was the fifth conference after Cannes, Hamburg, Florence and Gothenburg where scientists could exchange their results and achievements on the very successful European remote sensing missions. 960 registered participants from 53 countries could follow 374 oral presentations and 290 posters. Special sessions dealt with different topics like climate change, air pollution, polar areas, oceanography and tectonics as well as on GMES and Meteosat Second Generation. An exhibition with demonstration of user tools and improved data access was organised at the conference site.
- A UN / Austria / ESA Symposium on space applications for sustainable development to support the plan of Implementation of the World Summit on Sustainable Development: "Water for the World: Space Solutions for Water Management", was held on 13-16 September 2004 in Graz.
- A 2nd International Workshop on Occultations for Probing Atmosphere and Climate, organised by the University of Graz was held on 13-17 September 2004. *(Editor's note: "Occulation" = the hiding of a heavenly body from sight by the intervention of some other of the heavenly bodies; applied especially to eclipses of stars and planets by the moon, and to the eclipses of satellites of planets by their primaries)*.
- A UN / ESA / Austria / Switzerland Workshop on Remote Sensing in the Service of Sustainable Development in Mountain Areas, was held on 15-19 November 2004 in Kathmandu, Nepal at the International Centre for Integrated Mountain Development (ICIMOD).
- A 4th International Symposium on Retrieval of Bio- and Geophysical Parameters from SAR Data for Land Applications was organised by ENVEO in cooperation with ESA from 16-19 November 2004 at the Congress Centre, Innsbruck.

In my function as the Austrian Council delegate to EARSeL, I have to inform you of a decision by the Austrian Parliament on a science and technology reform in 2004 which included also the establishment of the Austrian Research Promotion Agency, a new central organisation for fostering science and technology activities in Austria. ASA and three other national science and technology institutions have been integrated into this new organisation. They will continue to fulfil all their functions, activities and services on a national level and vis-à-vis ESA, EUMETSAT, EC and other aerospace-related agencies.

I am confident that the new Austrian Research Promotion Agency will further strengthen the Austrian aerospace cluster. ASA is to be formally dissolved in early 2005. The new contact address is: FFG, Forschungsförderungsgesellschaft (Research Promotion Agency), Aeronautics and Space, Canovagasse 7, A-1010 Vienna. Telephone: +43-5-77553011.

2.8.2 RS activities in 2004: Belgium

Dr. Carine Petit (peti@belspo.be; web-site: telsat.belspo.be), Belgian Space Policy Office, Brussels

Status of EO research programmes

Generalities:
At the end of 2004, the programmes have reached beyond their mid-course. In total, 27 projects have been financed. 65% of the budget of our programmes has been dedicated to the building and consolidation of the scientific expertise, 28% to the technological transfer and the development of products and operational services to the benefit of the public and private sectors, 6% to support the development of new hyper-spectral activities, and 1 % to shared-cost actions.

More details about the projects (promoters, laboratories, objectives, etc.) are available on our web-site: telsat.belspo.be/projects/project.asp. We invite you to perform the search by "Research programme", choosing STEREO or VGT.

Market development:
In 2004, we started two new projects to de-

velop products and operational services. The ORMES project aims at developing, automating and implementing in a dredging company a robust and user-friendly method to produce 2D suspended matter maps on the basis of ground measurement, hyper-spectral airborne images and satellites images. The CLIMFISH project addresses climate change impact on a sustainable use of Lake Tanganyika fisheries. CLIMFISH was accepted as a Principal Investigator project of the TIGER initiative of ESA.

Hyperspectral Remote Sensing:
Within the framework of commitments to the development of the ESA imaging spectrometer APEX (Airborne Prism EXperiment), our programmes support hyperspectral activities in order to familiarize the scientists with this new type of data. Following the earlier hyper-spectral flight campaigns of 2002 and 2003, the Belgian Science Policy Office invited the Belgian and foreign teams involved to present the results in a workshop in Bruges (8 October 2004). The workshop was a great success with about 120 participants. The presentations are available on the web page: telsat.belspo.be/documents/bruhyp2004.html.

In 2004, a third hyper-spectral flight campaign with a HYMAP sensor was organized in collaboration with VITO (B) and DLR (Germany). The call for proposals was opened to foreign teams. They were not financed, but they received the data-cubes. Nine projects were selected. Due to bad weather conditions, the test sites were surveyed during three periods (May, June and July 2004) over the Benelux, Germany and UK. A third workshop will be held on 7 October 2005.

Since January 2005, a fourth call for small projects has been open until mid-March. The flight campaign will be organized with INTA (SP), having a AHS160 sensor on board. This year, we encourage again our teams to develop partnerships either with Belgian public departments or with foreign scientific institutes. The foreign partners cannot be financed by the Belgian Science Policy, but they can dispose of the data cubes. Data acquisition abroad is possible if logistics and budget permit. Details about this call can be directed to the programme administrators (peti@belspo.be; vdab@belspo.be). The results of the analysis of the data-cubes will be presented in an international workshop organized in the autumn 2006.

In 2004, the STEREO programme and the Support Plan for Sustainable Development of the Belgian Science Policy shared the financing of an Information and Communication Technologies (ICT)-based course in Earth Observation with emphasis on Imaging Spectroscopy, including hands-on applications. The course was given by the VITO (Vlaamse instelling voor technologisch onderzoek), the Spatial Applications Division Leuven Group (SADL) of the Catholic University of Leuven (KUL), the Management Unit of the North Sea Mathematical Models (MUMM) and the Royal Museum for Central Africa (RMCA) at KUL. This year, the Belgian Science Policy Office will fund the "HyperTeach" training course in Imaging Spectroscopy to be held on 26-30 September 2005 at the premises of VITO, KUL and RMCA, and instructed by teachers from MUMM, RMCA and VITO (hyperteach.vgt.vito.be). The course will be open to an international public.

EODESK educational projects:
A first objective of 2004 was the realization of a poster in the framework of the EU enlargement in May 2004 on the basis of an annual synthesis of VEGETATION images "The European Union, a novel perspective", and the development of an associated web-site available in three languages (Dutch, English, French) (telsat.belspo.be/beo/en/europe-index.htm). The purpose was to illustrate, through the use of satellite images the diversity within unity of the territory of the new EU of 25 member states.

A second project was the publication of demonstration sheets (Dutch, French) on the usefulness of RS within the school scientific disciplines: "Earth observation within the classroom". Developed at the request of teachers, this project aims at providing the teachers and the students with a ready-to-use tool demonstrating for each selected disciplines (geography, physics, chemistry, biology) the usefulness of RS with the help

of either exercises or examples of applications. The sheets are available at telsat.belspo.be/beo/fr/profs/index.htm.

In 2005, a complete coverage of Belgium with Landsat 7 images will be made available on the EOEdu web-site (telsat.belspo.be/beo/flash_menu.htm). Teachers and the public at large will be able to download Landsat 7 ETM+ images of 500 x 500 pixels (7.5 x 7.5 km), for any part of Belgium. Four bands (blue, green, red, infrared), as well as true and false colour composites, will be available.

Related EO activities of the SPACE Department

Centre for Image Processing (CVB):
Within the framework of bilateral agreements with France, the Space department of the Belgian Science Policy financed at VITO (Belgium, Mol) the "Centre de Traitements d'images VEGETATION" (CTiV) from 1998 to 2003. Since 2004, CTiV has started a new phase by integrating the preparation of the exploitation of the APEX airborne hyper-spectral sensor of ESA. The new Centre for Image Processing (CVB) (2004-2010) is funded by the Belgian Science Policy. CVB continues to provide the processing, archiving and distribution of SPOT VEGETATION images on a free basis to the scientific community (www.vgt.vito.be/). From 2006, CVB will provide similar services for APEX data-cubes. In March 2004, the second conference of the VEGETATION users was held in Antwerp (Belgium). The conference was a success with about 150 participants.

News from Belgian participation in ESA programmes:
PROBA-1 was developed within the GSTP programme of ESA. Since 2004, ESA Earth Observation has carried on and financed exploitation of PROBA-1. The operational capacity of the Belgian Redu station to get PROBA-1 data was increased thanks to installation of a new reception station in Kiruna.

News from Belgian participation in DUP:
The Belgian Institute for Space Aeronomy (BISA) contributes to the DUP project TEMIS (Tropospheric emission monitoring internet service). The project BeGO (gorilla habitat monitoring) started in 2003 with the participation of the Keyobs company, the Royal Museum for Central Africa (RMCA) and the Catholic University of Louvain (UCL). Since 2002, two projects have been on-going: HUMAN project (humanitarian disaster mapping for Médecins sans frontières (MSF), dup.esrin.esa.it/projects/summaryp39.asp), and SLAM project (landslide monitoring by radar observations with the company Spacebel, dup.esrin.esa.it/projects/summaryp52.asp). VITO, GIM and TRASYS are involved in the GLOBCARBON project aiming at providing global land products for carbon model assimilation (dup.esrin.esa.it/projects/summaryp43.asp). The COAST-CHART project sub-contracts with the Belgian Eurosense company. Since 2004, the Catholic University of Louvain (UCL, Prof. P.Defourny) has been involved in the GLOBCOVER project.

Belgian participation in GMES:
Several Belgian RS laboratories and private companies are involved in GMES Service Elements of ESA. The project GMFS (Global Monitoring for Food Security) is led by VITO with, among others, 3 Belgian partners (TRASYS, GIM, AVIA-GIS). The company GIM takes part in the COASTWATCH (coastal monitoring) project (led by EADS, France). The Belgian Keyobs company participates in the RESPOND GSE. The GUS (urban services) project conducted by INDRA (Spain) includes Eurosense.

Belgium is also active in FP6: MERSEA (marine monitoring) with MUMM (led by IFREMER (F)), GEOLAND (geophysical land products) with VITO and UCL (Prof. E. Lambin) (led by ASTRIUM and INFOTERRA, Germany), GMOSS (security) with the Royal Military Academy (RMA) (led by JRC (EU)), HAWKEYE (security) with the Keyobs company, VGT4AFRICA (distribution of VEGETATION derived products and training of the user community in Africa) with VITO.

Belgian participation in EUMETSAT:
Through its EUMETSAT and ESA contributions, Belgium continued to support the development of MSG-2, 3 and 4, and of METOP-1, 2, 3. The operation / exploitation by EUMETSAT of Meteosat-5, 6, 7 and

of MSG-1 were also paid from our EUMETSAT contributions, as well as the development of JASON-2. The Belgian participation (KMI-IRM) to the SAF-Land, SAF-Climate and SAF-Ozone was funded by the PRODEX programme of ESA. This programme also continued to fund the Belgian participation by KMI-IRM to the ground segment (data processing) of the GERB instrument on board of MSG-1. First steps towards the set-up of a SAF-Hydrology started. KMI-IRM and VITO are potential Belgian partners.

Belgian participation in ORFEO:
Belgium committed 28.2 M (2004-2009) to support the French Earth Observation programme "Pléiades" and the accompanying French-Italian preparatory programme ORFEO. The Belgian scientific EO community has been actively involved in thematic working groups (Agriculture, Cartography, Civil security, Coastal zones, Forest). In 2005, calls for proposals will be launched to grant more methodological research using simulated Pléiades and Cosmo-Skymed data.

Belgian collaboration with UNESCO:
Belgian Science Policy supports three scientific projects in collaboration with the programme "Earth Observation from Space" of UNESCO: to edit a new map of Democratic Republic of Congo (SYGIAP); to develop an operational chain to monitor the coral reefs in Indonesia (TANIMBAR); to prospect and reconstruct the archaeological site of the Turkish Sagalassos city (SAGALASSOS).

VITO's UAV:
In 2004, VITO (Flemish Institute for Technological Research, in Mol, Belgium) received formal support from the Flemish Government for the acquisition of a High Altitude Long Endurance Unmanned Aerial Vehicle (HALE UAV) for the Pegasus project. A European call for proposals was launched at the end of 2004. In parallel, the definition of the instruments to be carried (e.g. a multi-spectral camera) and the related data processing chain was started. In this context, high-resolution data using airborne cameras have been acquired for the validation of the algorithms currently under evaluation. Finally, numerous contacts were taken with potential end-users and possible industrial and / or scientific partners, especially in the context of disaster and crisis management; VITO has also extended the Pegasus-group to more than ten people. First calibration as well as first flight tests will occur in 2005. (Editor: See also Section 2.5).

2.8.3 RS activities in 2004: Croatia

Prof. Dr. Marinko Oluic (geo-sat@zg.htnet.hr), GEO-SAT, Zagreb

Croatia's RS and GIS activities in 2004 consisted of active participation of Croatian scientists / experts in international scientific symposia, and congresses and project-related work.

The overall activity is first and foremost reflected through the preparation and organisation of 24th EARSeL symposium, held in 2004 in Dubrovnik under the title "New Strategies for European Remote Sensing", followed by an international workshop entitled "Land Use and Land Cover" was also held. Croatian scientists presented 14 papers within these two conferences.

Croatian experts also took an active part in a number of other international conferences, e.g. in 20th ISPRS congress (International Society for Photogrammetry and Remote Sensing), held in 2004 in Istanbul under the theme of "Geo-Imagery Bridging Continents".

Our scientists participated actively in the CIESM congress held in 2004 in Barcelona. Furthermore, a number of our experts took part in the EUMETSAT conference held in 2004 in Prague, Czech Republic. In the symposium held in Trogir, Croatia, "Geographical Information Systems in Research and Practice", Croatian experts presented several papers.

Scientific and expert project-related work was performed mostly within the following seven working groups: photography, general interpretation and GIS; geology and geophysics; vegetation, forestry and agriculture; oceanography; hydrometeorology; regional planning and environmental protection; archaeology and historical heritage.

In 2004, research activities carried out under the European SMART (Space and Airborne Mined Area Reduction Tools) and ARC (Airborne Minefield Area Reduction) projects were completed. Cyclic air-photography of 20% of the territory of Croatia was carried out. Furthermore, models for land-registry databases as well as for the official cartography and for the VOGIS (Army Geographical Information System) were designed. Aiming to achieve the best possible environmental protection, especially in the Adriatic coastal area, a total of 1,605 digital ortho-photo maps in the scale 1:5000 were compiled.

A study was made to assess the value of merging Landsat ETM images with air photos for the needs of forestry research (measuring and regulating forest resources). Infrared colour air-photographs were used to assess forest stand volume (fir-forest degeneration). In the course of 2004, the project of designing land-cover maps according to the CORINE 2000 and 1990 standards was finished. Within the scope of forestry research, vegetation maps of Croatian nature parks habitats have been designed using LANDSAT-7 images. Those maps will be used for regional planning and management. For the majority of Adriatic islands, SPOT-5 imagery, used for updating the island status, was acquired. In the field of agricultural activities, the hydro-pedological map of the Adriatic basin (the Croatian Adriatic coast) has been designed, using LANDSAT ETM images. In the framework of the ADRICOSM project, satellite data were used for the surveillance and study of the Adriatic Sea (project leader: Istituto di Scienze dell'Atmosfere e del Clima, Rome, Italy).

In the field of hydro-meteorology, serious work was done on the international project "Elaboration of a system for forecasting direct weather development in Austria, Croatia, Hungary, Slovakia and Slovenia". Work related to the EUMeTrain project on "Interpretation of various interesting meteorological situations from the perspective of satellite meteorology, and keeping manual-form record of individual meteorological phenomena and structures in satellite imagery" is underway.

Several national projects concerning archaeology and historical heritage have been carried out using mostly aerial photography, including: Croatian mediaeval archaeological heritage; Croatian analytical archaeological topography; Antique archaeological sites along the river Sutla in Croatia.

Apart from project-related activities, much work was done for scientific and expert seminars, such as: (a) Faculty of Agronomy, Zagreb: a two-week seminar Application of GIS technology; (b) Institute of Oceanography and Fisheries, Split: working meeting MAMA Project (Mediterranean Network to Assess and Upgrade Monitoring and Forecasting Activity in the Region).

2.8.4 RS activities in 2004: France

Gérard Begni (Director of MEDIAS-France, START/MEDCOM Secretary, Member of the French Scientific Committee on Desertification and of the EARSeL and SFPT Councils.

French RS activities are characterised by huge scientific, industrial and financial investments for the design, implementation and operation of systems in which space plays a major part. These efforts aim at meeting global needs for research and at developing the application field of Earth observation (EO) in many socio-economic sectors likely to benefit. French activities are led as part of an international cooperation inspired by CEOS / IGOS-P initiatives. Cooperation within the framework of the ESA Convention is a priority for France, which takes an active part in the definition of the associated strategy and determines its own so as to complement ESA policy (including programmes carried out with EUMETSAT), national strategies of the other EU countries, and GMES common initiatives.

Regarding more specifically the International Society for Photogrammetry and Remote Sensing (ISPRS), of which EARSeL is a Regional Member, after having been absent for some time from its governing bodies, France took charge of the Second Vice-Presidency of the Council from 2000 to 2004 and has been entrusted with the Presidency of Commission I from 2004 to 2008.

SPOT and its follow-on programme:
The high resolution optical sector corresponds to major investments in France. It includes both the civilian SPOT and military HELIOS systems. Developed in cooperation with Sweden and Belgium, the SPOT constellation currently includes three satellites (2, 4, 5) described in previous reports.

Since its launch in May 2002, SPOT-5 has significantly improved the system performance with two new high spatial resolution and high accuracy positioning products. The two HRG (High Resolution Geometric) instruments enable a 2.5 / 5 m resolution panchromatic mode and a 10 m resolution multi-spectral mode. Imaging swath remains 60x60 km, with a positioning accuracy ranging about 50 m. In addition, a HRS (High Resolution Stereoscopic) instrument allows collecting simultaneously along-track stereo-pairs (in panchromatic mode) with a 10 m resolution (re-sampling at 5 m along-track) in order to develop high precision Digital Terrain Models (DTMs). In this case, the viewing field is 600x120 km, with a positioning accuracy of less than 15 m. The considerable collection capacity of the HRS (more than 125,000 km^2 daily on an average) enables setting up a worldwide DTM database.

Since the launch of SPOT-1 in 1986, the SPOT system has collected an archive exceeding 10 million images covering several times nearly the whole Earth, thus allowing surface analysis and monitoring. The SPOT constellation enables an updating of the image data bank and a quick availability of its data.

The VEGETATION instrument, initially on SPOT-4 (developed in cooperation with the EC, France, Belgium, Sweden and Italy) also flies on SPOT-5. VEGETATION offers long-term (beyond 10 years), medium resolution (1.1 km) and wide field (2,200 km) observations, with a typical daily re-visit period for operational and scientific applications.

Faced with growing international competition, and to meet the ever-increasing demand from users, CNES has associated with Italy to implement the ORFEO (Optical and Radar Federated Earth Observation) programme that eventually will consist of several small compact satellites. This dual-use programme has two main components: a high resolution optical instrument developed by France - Pléiades-HR, 0.7 m panchromatic, 2.8 m multi-spectral / 4 bands (Blue: 0.43-0.55 mm; Green: 0.49-0.61 mm; Red: 0.6-0.72 mm; SWIR: 0.75-0.95 mm), and a 20 km viewing field); an X-band radar element (3-12 cm) developed by Italy (Cosmo-Skymed, 1-100 m resolution depending on the mode).

The first Cosmo-Skymed satellite (4 radar satellites to be launched in 2006, 2007, 2008 and 2009) will be launched in mid-2006; it should be followed by the first Pléiades-HR (2 optical satellites to be launched in 2008 and 2009) satellite in 2008. Pléiades will ensure the continuity of wide-field observations after SPOT-5, in panchromatic and multi-spectral bands. The ORFEO programme will be a major contribution to the European GMES programme, in particular in the sphere of security.

In 1999, CNES decided to start its ISIS (Incitation à l'utilisation Scientifique des Images Spot) programme, which granted the European scientific community an easier access to SPOT space imagery through preferential rates. A new CNES initiative called OASIS (Optimising Access to SPOT Infrastructure for Science) was approved by the EC in July 2003. OASIS aims at widening and consolidating ISIS at a larger European scale in order to cover the needs for research of the EU member states and associated countries, and to satisfy also potential new users. The OASIS programme was instituted during the first quarter of 2004, for an initial 4-year stage. Its implementation for the benefit of European researchers is scheduled by the end of January 2005. It is expected that EARSeL members take full advantage of OASIS. ISIS will then be reserved for French users only.

Solid earth, ocean, atmosphere, coupled systems:
In recent years, a new generation of DORIS positioning instruments has been launched on 3 satellites (SPOT-5, JASON, ENVISAT). This new configuration enables a 1 cm po-

sitioning accuracy and a few yearly mm for the motion of the 54 DORIS ground stations. The French scientific community also plays a significant part in the analysis and interpretation of EO data (optical and radar images) for geo-physical applications (tectonics, volcanology, seismology, landslides…).

In other domains, such as spatial measurements of the Earth magnetic and gravity fields, France cooperates with, respectively, Denmark for OERSTED (launched in February 1999 and still operating), and Germany for CHAMP (initiated in July 2000 and still on-going). The French scientific community is also involved in two ESA projects, taking part in the GOCE payload and data processing, and providing the scalar magnetometers to equip the three satellites of the SWARM mission.

The CRYOSAT mini-satellite, designed to study the cryosphere and developed within the framework of the ESA Earth Explorer programme is being completed and should be ready for launch in 2005.

DEMETER, the first CNES micro-satellite, was successfully launched in June 2004. This mission is dedicated to the study of electromagnetic and ionospheric disturbances and to their relation with earthquakes, volcanic eruptions, tsunamis and human activities. The satellite and its instruments are working properly and the first measurements are currently being analysed.

Following a successful phase B study, the SMOS (Soil Moisture and Ocean Salinity) phase C/D has been formally approved and is scheduled for launch in February 2007. It will be carried out in collaboration with France and Spain (CDTI) within the ESA Earth Observation Envelope Programme (EOEP). This mission had been proposed by French scientists (CESBIO – Y. Kerr) in line with the recommendations of the national seminar on future scientific prospects held in 1998. The payload consists of the MIRAS instrument, a 2-D interferometer operating in L-band and is designed to measure soil moisture and ocean salinity. The SMOS mission will help develop hydrological, climatic and meteorological modelling and forecasts, especially as regards extreme events (droughts, floods), and will improve the management of water resources.

The Franco-American TOPEX-POSEIDON system, launched in 1992, and its successor, the JASON-1 mini-satellite launched at the end of 2001, have enabled to study ocean dynamics and to determine sea level with 1 cm accuracy. The on-going need for accurate altimetric data from non-sun-synchronous orbits has been clearly expressed by ocean data users, especially the Global Ocean Data Assimilation Experiment (GODAE), the Integrated Global Observing Strategy Partnership (IGOS-P) and the European Global Ocean Observing System (EuroGOOS). Consequently, CNES (France), NASA and NOAA (USA), and EUMETSAT have agreed to implement jointly the JASON-2 satellite, scheduled for launch at the end of 2005, with a nominal five-year lifetime. Together with complementary data delivered by ERS and ENVISAT, it will be a key component of the Ocean Surface Topography Mission (OSTM), EUMETSAT's first optional programme.

Regarding applications, France has developed the MERCATOR project for operational oceanography (real-time assimilation of global data in complex high resolution models). Analysis reports and ocean forecasts have been issued since January 2001 (real-time description). Together with OOPC (Ocean Observation Panel for Climate), CNES coordinates its international counterpart, the GODAE project.

The POLDER (POLarisation and Directionality of the Earth's Reflectances) instrument is a wide-field imaging optical radiometer that provides global systematic measurements of the spectral, directional and polarised characteristics of the solar radiation reflected by the Earth/atmosphere system. Its original observing capabilities have opened new perspectives for discriminating the radiation scattered in the atmosphere from that actually reflected by the surface. Two instruments were launched on the ADEOS-I (Advanced Earth Observing Satellite) and ADEOS-II (MIDORI) Japanese satellites, the lifetimes of which

were shorter than expected. Nevertheless, the POLDER instruments provided data that enabled innovative studies and new results on aerosols and clouds (aerosol characterisation, clouds / aerosols interactions, radiative forcing), land surfaces (vegetation, carbon cycle) and ocean colour (primary production, carbon cycle), thus enriching the study of global environment change mechanisms.

Programme of thematic competence networks:
The programme of thematic competence networks ("thematic units") is a major initiative meant to provide scientists with relevant products and information, while saving as much time and manpower as possible regarding data handling and preprocessing irrelevant to their scope of research. Each initiative is led by a cluster of several public entities, some of which are in charge of scientific matters. CNES has been entrusted with space data issues, and is accordingly developing advanced retrieval algorithms, validating outputs and improving the system.

Of specific interest is the POSTEL "Continental Surfaces" thematic unit that meets GMES priorities and key scientific objectives. Its goal is to derive, from wide field satellites, various biophysical parameters related to land surfaces. Use of several space-based systems enabled reasonable eradication of instrumental biases due to the specific viewing modes, while benefiting from the extensive range of observations currently available. POSTEL aims to supply scientific and operational communities with products duly referenced in terms of description and accuracy. Links between existing structures (e.g. EUMETSAT Land-SAF, VITO in Belgium, EC / JRC) and forthcoming GSE elements are taken into due consideration. Decided on in 2002, POSTEL is in its early phase, but already involves several national and international projects approved and funded by now. The most outstanding enterprise is the GEOLAND integrated project of the EC 6th Framework Programme. Jointly led by INFOTERRA GmbH, Germany, and MEDIAS-France, GEOLAND consists of two scales – regional and global, the latter being coordinated by the POSTEL team (CSP, Core Service Bio-geophysical Parameters). It is expected that EARSeL members take full advantage of the POSTEL services – a European initiative.

Encouraging applications – the GMES and PNTS programmes:
From the very beginning (Baveno Manifesto, 1998), France has been strongly supporting the GMES initiative and actively contributed to its definition. GMES Strand 1 is now completed and the related report has been issued. ESA is involved in GMES through the GSE (GMES Service Elements) programme. France is engaged in 10 GSE projects and is leading 3 of them.

At a national scale, the PNTS (French National Programme for RS) aims to develop methodologies to prepare use of RS data by scientists, promoting implementation of operational methods, and assessing and assimilating space data in complex models. The multi-year programme includes many themes: land surfaces, oceans, biosphere, snow and ice, land and water, atmosphere, human and social sciences.

PNTS has backed the following existing space programmes: POLDER, SeaWIFS, SPOT, VEGETATION, MERIS / ENVISAT regarding studies in the solar field, and ERS (altimeter, wind scatterometer, SAR), ENVISAT, TOPEX / Poseidon and JASON in the microwave sphere. It also helped exploit new missions on gravity such as CHAMP or GRACE, and will be involved in the future GOCE project. It has promoted missions now scheduled such as IASI, Lidar WIND, MSG, CALIPSO and SMOS, that resort to new technologies of space measurements. The PNTS also plays an important part in structuring communities on specific themes by organising workshops. Some devoted to higher spatial resolution or LUCC (Land Use and Cover Changes) related issues have already taken place.

In the future, PNTS plans to carry on its actions by supporting the methodological development of future missions (ESA Earth Explorer programme, IASI, CALIPSO, PARASOL, DEMETER…) and by undertaking studies applying new concepts such as higher spatial resolution (namely ORFEO, Pléiades-HR and COSMO-Sky-

Med). PNTS is also maturing methods that use new measurement techniques: the P-band with the RAMSES radar, fluorescence in Fraunhoffer lines, polarimetry in ENVISAT and RADARSAT-2 SARs, bistatic or radar interferometry (GPS, Alos cartwheel), hyper-spectral data (CHRIS), and directionality in the thermal field.

2.8.5 RS activities in 2004: Germany

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

In Germany EARSeL has 23 member laboratories, 8 of which have submitted short progress reports:

The German Aerospace Research Establishment DLR in Oberpfaffenhofen (Prof. Schroeder et al.) makes the most important German contribution in RS. On behalf of the German government it cooperates with ESA in its missions and it maintains bilateral contacts with space agencies and space operators. With ESA it cooperates in the oxygen initiative. It has 50 TB of data in the DIMS archives and has a monthly throughput of 1.2 TB of data. For the Envisat mission it provides operational service for ASAR, MERIS, GOME, SAR, MIPAS, and SCIAMACHY. Further operational service is offered for MSG and Meteosat, for CORONAS-F, Champ, Grace, Marocsat / Tubsat and KOMPSAT-1.

The Indian MOS-IRS mission has finished after 8 years of operation and the first IRS-P6 (Resource Sat) images have been received. It operates an IKONOS ground station and has acquired 1 M km^2 of coverage in 180 acquisitions. The German global SRTM / X-Sar data have been completely processed, and are available on-line. Regarding future missions DLR participates in the design of TerraSAR-X and the Tandem-X studies. Further international co-operations are executed in the GMES programme.

The two laboratories at the University of Bonn (Department of Geography and Centre of RS of Land Surfaces, both under Prof. Menz) conduct a great number of application projects in Africa, Antarctica, and North Rhine-Westphalia. These diverse projects (climate variability in Namibia, vegetation dynamics in East Africa, glacier changes in Antarctica) are either financed by the German Research Foundation DFG or the German Science Ministry BMBF (water management in West-Africa).

The Geographic Institute at the University of Göttingen (Prof. Kappas) monitors land use changes in Sulawesi and glacier tongues in Alaska under DFG support. In October 2004 the "Remote Sensing Days for Environmental Studies" were organized as a conference for 220 participants.

The Institute of Meteorology at the Free University of Berlin (Prof. Eckhardt) receives NOAA 15-17 AVHRR, AMSU, and Meteosat 7 data on an operational basis.

The homogenised reflectivity and vegetation index in 1 km resolution are archived for Central Europe and the Mediterranean, as well as cloud cover since 1989. For Greenland and for Novaja Semlja, the ice-covered area is monitored since 1966. The data are available through the web. Another research project concerns the quantitative precipitation forecast in Germany.

The Department of Geosciences of the Technical University Dresden (Prof. Buchroithner) has completed a 1:100,000 map of the "Nevado Ojos del Saldo" in the Andes using Aster imagery and SRTM data. A new method for stereo viewing by lenticular screens has been developed. Studies in the State of Saxony were made to monitor land use and the vitality of forests and the use of HRSC imagery for DTM's for the prevention of Elbe floods.

The Institute for Photogrammetry and GeoInformation at the University of Hannover (Prof. Heipke) participates in the geometric evaluation of Mars Express images. In cooperation with the University of Zonguldak, Turkey it tests the applicability of space images (Ikonos) for small and medium scale mapping. On the North Sea Coast laser scanning is investigated for DEM creation for coastal needs. The digital German topographic base data set ATKIS needs efficient updating procedures. The Institute investigates how certain features

(roads, vegetation) may be updated in a (semi)-automatic way using new imagery. Special attention is paid to semantic correctness of the data.

The former member, Institute for Photogrammetry and Cartography of the Technical University of Berlin has ceased to exist, after Prof. Albertz retired. Nevertheless he continues his work to produce a topographic image map, Mars 1:200,000, from Mars Express. This is done by a "Planetary Image Mapper" software system.

Of the 16 remaining laboratories, which did not provide a report, information is provided in the following websites:

- Photogrammetry and Remote Sensing, University of Freiburg (www.felis.uni-freiburg.de): bio assess in Europe, forest monitoring in Brazil and Europe
- Forest Yield Sciences, Technical University of Munich (www.wwk.forst.tu-muenchen.de): forest vitality in Bavaria
- Physical Geography, University of Freiburg (www.geographie.uni-freiburg.de/ipg): work in Chad, Southern Africa, Tanzania
- Physics, University of Oldenburg (las.physik.uni-oldenburg.de): projects: fluorescence spectrometry of algae; observation of chemicals in the sea; algorithms for ocean colour; shipboard lidar and spectral photometer development; observation of bio-optical processes in the Indian Ocean and in the Atlantic between the Canary Islands, the Azores and Gibraltar
- Limnological Station, Technical University of Munich (www.limno.biologie.tum.de): (not accessible)
- Geography & Geosciences, University of Trier (www.fent.uni-trier.de:8000): ground water formation and water retention, Mediterranean range lands
- GAF, Munich (www.gaf.de): projects in water resource management in Africa, in Yemen
- Navigation, University of Stuttgart (www.nav.uni-stuttgart.de): laser scanning
- Federal Institute of Cartography and Geodesy BKG, Frankfurt (www.ifag.de): geo-portal development, geodata center, geodetic activities for earth rotation and ITRF monitoring
- Optimare, Wilhelmshaven (www.optimare.de): IR/UV and MV scanning of marine pollution

The remaining institutes (MPI, BGR, Geosciences University of Munich, Geography Humboldt University Berlin) do not have web-sites.

At the Technical University of Oldenburg Prof. Luhmann became the new President of the German Society of Photogrammetry and Remote Sensing and (Ms.) Prof. Glaesser of the University of Halle-Wittenberg the Vice-Chair of the Society. Dr. Carsten Jürgens, who organized successful EARSeL events in Regensburg, has now accepted a chair at the University of Bochum.

In Germany we have concerns that the overall RS policy formulated by government and the major globalized industrial partners dictate what can be done in RS. The laboratories try to survive within this framework drawing on national and European research funds. The German Society for Photogrammetry, Remote Sensing and Geo-Information confirms that RS as a tool is welcomed as a contributor in a much wider framework of GIS and its applications for sustainable development. This is a call for joint efforts to foster our disciplines to integrate RS into the tasks.

2.8.6 RS activities in 2004: Italy

Dr. Mario A. Gomarasca, Italian Remote Sensing Association (www.asita.it/ait)

The conflict between the necessity to reduce government expenditure and the need for more competitive and active research initiatives is strong in Italy. Some European and other countries in the world have understood that for competitiveness and economic growth, it is required to increase the percentage of internal resources devoted to research and, in our case, specifically to Space research.

The freezing of employment at University level and within institutions such as the National Research Council of Italy (CNR), ENEA, and others, has reduced significantly the opportunities to have continuity and

has discouraged young people to choose careers in research. Nevertheless, the Italian scientific community, despite limited resources, is still extremely active.

ASI - Italian Space Agency (www.asi.it):
The most relevant element of the ASI Earth observation (EO) activities is the COSMO-SkyMed national Programme, in terms of resources allocated and national strategy. COSMO-SkyMed is an end-to-end EO system that foresees the launch of four satellites equipped with a SAR X-band payload. The system, that should be usable by both by civilian and military users, is carried out in close cooperation with CNES, which is developing an observation system in the optical band, named Pleiades. The launch of the first COSMO-SkyMed satellites is scheduled in 2005.

Besides CNES, in 2004, ASI has strongly collaborated with CONAE (Argentina Space Agency) that is studying the design of two satellites with L-band SAR payload (SAOCOM). ASI and CONAE have considered together both the potential integrated use of the two systems (COSMO-SkyMEd and SAOCOM) both the combined use of X-band and L-band SAR data for developing EO applications. This project is named SIASGE.

All the activities previously mentioned are carried out taking into consideration the Italian participation to the ESA EO ongoing and future programme such as ENVISAT, the Living Planet Programme and the GMES services in the frame of the activities of the new worldwide program GEO.

Associations:
- The Federation of the Scientific Societies for Geographic and Environmental Information (ASITA): The ASITA federation is based, since 1997, on the collaboration of four Scientific Associations concerning different aspects of Geomatics:
- SIFET - Società Italiana di Topografia e Fotogrammetria, representing Italy in ISPRS (International Society for Photogrammetry and Remote Sensing)
- AIC - Associazione Italiana di Cartografia representing Italy in ICA (International Cartography Association)
- AIT - Italian Remote Sensing Association, since1996 Associate Member of ISPRS
- AM / FM / GIS (Automated Mapping / Facilities Management / Geographic Information System) Italia, representing Italy in EUROGI (European Umbrella for Geographical Information)

The 8th National Conference was held in Rome, on 14-17 December 2004. About 1,200 registered at the Conference, 400 papers were published in the Proceedings, and more than 60 exhibitors presented their technical solutions in the field of Geographic Information. The various activities promoted by ASITA are reported on the web-site: www.asita.it.

The Italian Remote Sensing Association (AIT):
AIT, which is a member of ASITA, EARSeL and ISPRS, has about 450 Members. In this period AIT published and presented at the ASITA Conference the Volume "Elementi Di Geomatica", Author Mario A. Gomarasca, the first book entirely in Italian that includes Elements of Geodesy and Cartography, Photogrammetry, Remote Sensing, Informatics, GIS and WebGIS, Digital Image Processing, INSPIRE, GMES, etc. Web site: www.asita.it/ait. (See also Section 5.x of this Newsletter).

Laboratories:
CNR-IREA, Institute for the Electromagnetic Detection of the Environment, Milan, Italy (www.irea.cnr.it):

The Institute has lost the friend and scientific guide Eugenio Zilioli who passed away on 9 November 2004. Eugenio was an active supporter of EARSeL since 1997, when he attended the first General Assembly of EARSeL in Strasbourg, on 22-23 March 1977, when 50 laboratories from throughout Europe joined the original six founding member laboratories. On this occasion Dr. Zilioli made a presentation of "Remote Sensing Applications in Volcanic Areas of Southern Italy" and a Working Group was set up on "Observation of Volcanic Areas in Europe", led by Dr. Lechi.

Eugenio led till the end the optical RS group working on water quality of CNR-IREA in Milan on two main items. The research project is in collaboration with the

ERSG of CSIRO-Land and Water (Canberra, Australia), entitled EO for adaptive management of inland and coastal waters, co-funded by CNR and CSIRO and by Regione Lombardia.

The aim of the project is to use a physically-based model for estimating water quality (mainly phyto-plankton and suspended sediments) using EO data and bio-optical modelling. The study area is Lake Garda which, since 1996, has been the target for research activities of several national (ASI-Ninfa closed in April 2004) and international (ESA-Melinos, closed at the end of 2003, and EC-FP4-Salmon and FP5-Hysens) projects, coordinated by CNR-IREA. The second activity was a finalised project for algal blooms detection, integrating EO-related methods and traditional techniques. The study was carried out over Albano and Nemi lakes (volcanic lakes near Rome) in collaboration with Istituto Superiore di Sanità. A semi-empirical model was developed for mapping chlorophyll-a concentrations using satellite (Landsat and Ikonos) and airborne (MIVIS) data. To this aim four field surveys for radiometric and limnologic characterisation of lake waters were carried out from June-October 2004.

CNR-IREA Milano is involved in the GeoLand project. GeoLand is an Integrated Project (FP-6) carried out in the context of GMES, a joint initiative of the EC and ESA, GeoLand is focused on the monitoring of land cover and vegetation utilising EO resources and integrating them with existing models. CNR-IREA Milano is a research partner of the "Observatory Land Cover and Forest Change", one of three GeoLand global observatories, with the specific task of assessing the environmental status of Africa. The Institute also has a strong interest and activities concerning Education and Training.

National Research Council of Italy IIA, Rome:
The Institute manages the Hyper-Spectral Airborne MIVIS (Multispectral Infrared / Visible Imaging Spectrometer) sensor over the Italian territory in cooperation with CGR (Compagnia Generale Ripreseaeree, Parma, Italy). Relevant environmental issues were studied by means of MIVIS data. MIVIS and instruments calibration is still a main focus at IIA jointly with IREA. Website: www.iia-cnr.it

IAO – Natural Nesources, Florence:
The Istituto Agronomico per l'Oltremare has developed several bi-lateral development cooperation projects and contracts with international agencies. The most important concern with the Africover project and FAO / UNEP Global Land Cover Network initiative; the IAO will host a topic centre for land cover mapping methodological development (based upon the FAO / UNEP Land Cover Classification System). The main training activities continue with the Professional Master on "Geomatics and natural resources evaluation". During 2004, the 24rd Edition was completed with field work carried out in Tunisia and Edition 25 started with participants from several developing countries. Web-site: www.iao.florence.it/focus/geoinfo

Laboratory of Communications and Images, Dip. Elettronica e Telecomuicazioni, University of Florence:
Research activities in RS were carried out in conjunction with the Multimedia Integration and Communication Centre (MICC) of the University of Florence and the Department of Information Engineering (DII) of the University of Siena on the following main topics (for more details, e-mail: cappellini@det.unifi.it):

- Multi-temporal SAR image analysis (Project of Relevant National Interest (PRIN) funded by the Ministry of Education and Research (MIUR) on "Processing and Analysis of Multi-temporal Remote Sensing Images for Environmental Monitoring").
- Image fusion (contract of Italian Space Agency (ASI) on development of an "Advanced Hyperspectral Camera" with acquisition also in a panchromatic band).
- Hyperspectral image analysis (contract of Galileo Avionica S.p.A. on interpretation of high-resolution hyperspectral data from an airborne hyperspectral camera).

IBIMET-CNR Florence:
Research activities have been funded by ASI and Tuscany Regional Government for assessing the potential of RS techniques in

modelling the carbon balance of Mediterranean forests. The approach employed exploits the capability of sensors with various spatial and temporal resolutions (NOAA-AVHRR, Spot-VGT, Terra-MODIS, etc.) to provide information on forest Gross Primary Productivity (GPP) through the well known relationship between NDVI and FAPAR. GPP is then partitioned into different components using a model of ecosystem processes (FOREST-BGC) fed by conventional data.

Other collaborations are in progress with the Joint Research Centre, Ispra, regarding the use of RS data for monitoring agricultural production. In particular, both crop surfaces and yields are used within methodologies integrating low- and high-spatial resolution satellite data and ancillary information.

RS in the Gulf of Manfredonia / ISSIA-CNR-Bari, ISMAR-CNR-LESINA:
Within the workpackage WP1133 of FIRB-Project, ISSIA-CNR-Bari has created an archive of sea data regarding environmental parameters (chlorophyll-a, temperature) in the Gulf of Manfredonia, starting from measurements of the sensors SeaWiFS and MODIS. For giving access to the archive and the processing software (SeaDAS of NASA) to a community of oceanographers are used the techniques of the Grid Computing. The satellite data, already used and calibrated in the PITAGEM project (of MIUR Cluster 10: Ambiente Marino), coordinated by CNR-ISMAR-Lesina, were supplied from the Goddard Distributed Active Archive Center (DAAC) of NASA. To obtain the SeaWiFS [chl-a] images at the maximum resolution, it has been necessary to process the SeaWiFS L1 images at ISSIA-CNR-Bari using the software SeaDAS (SeaWiFS Data Analysis System). Instead MODIS chlorophyll and sea temperature images are directly downloaded at full resolution.

Other institutions:
- CNR - Istituto di Fisica Applicata "Nello Carrara" (IFAC): www.ifac.cnr.it
- CNR - Istituto di Metodologie per l'Analisi Ambientale (IMAA): www.imaa-cnr.it
- IPRS Image Processing and Pattern Recognition for Remote Sensing Laboratory, University of Genoa: spt.dibe.unige.it/IPRS

2.8.7 RS activities in 2004: The Netherlands

Prof. Dr. Freek van der Meer, International Institute for Geoinformation Science and EO - ITC, Enschede

Market position of EO in the Netherlands:
Space-oriented research governing RS in the Netherlands is concentrated in the disciplines of astrophysics, microgravity research and Earth observation (EO). Dutch researchers in the field of EO are involved in several of ESA's Earth Explorer Missions (core type). The GOCE and ADM missions have been selected, and the Netherlands is also involved in pre-phase A studies for ACE, EarthCARE and SPECTRA. The SRON institute is leader in the SCIAMACHY instrument to be part of ENVISAT as well as in its successor: GOME-2.

The present position of the Netherlands in EO is characterized by strong cohesion between research groups and industry and a link between fundamental research and application-oriented research, leading to a noticeable leading position in operational use of EO. Many private companies and smaller consulting firms such as Geodan, Argoss, Wageningen Radar surveys, demonstrate this, as well as the operational use of EO in governmental institutes such as the Survey Department of RWS. In the technology side of the space sector, TNO Space, Fokker space, and the Dutch Space Agency NLR play an important role with fundamental research centres at the Delft University of Technology.

Professional society – GIN:
On 23 October 2003 the NSEOG together with several other professional organizations in the field of geoinformation science formed a new society named "Geoinformation Netherlands" (GIN). GIN has some 3,500 members and covers a wide range of professional fields in the arena of geo-information science at academic but also at a polytechnic and practitioners level. Of the

six sections, two deal with remote sensing aspects namely the section on EO chaired by Prof. Vosselman of ITC and the section on Geodesy chaired by Jan Witte of Grontmij.

During 2004 the following one-day workshops / symposia were organized by the EO Section: terrestrial laser-scanning (23 September 2004); the chain approach in EO - (23 June 2004); photogrammetry for documentation and visualization of architecture (8 January 2004); gravity missions (16 December 2004). In 2005, the following topics will be addressed: Hyperspectral RS, results and status of ENVISAT, digital cameras, hydrography. In addition, GIN organizes each year a one-day GIN symposium and a three-day GIN conference and exhibition (former Geodesia congress). GIN also has an email newsletter and a bulletin (Geo-Info) and (of course) a website: www.geo-info.nl.

EO research funding:
The National Science Foundation provides support for EO research as well as operational services. The priority areas for support include research themes where the Netherlands has gained a strong international position: atmospheric chemistry, radiation budgets, atmosphere dynamics; physical oceanography, coastal and inland waters and cryosphere research; land processes including energy balances; solid earth research and space geodesy. Main areas of application include: operational meteorology and oceanography; water and coastal management; land use and agriculture; climate and environmental monitoring; security and disaster management.

For the period 2002-2005 a budget of 12.48 M is available. The proposed projects are linked to EU and worldwide initiatives such as GMES, the Integrated Global Observing Strategy (IGOS) and the research programmes International Geosphere Biosphere Programme (IGBP) in the World Climate Research Programme (WCRP) and ESA Data User Programme (DUP) and 6th and 7th framework programmes of the EU.

Netherlands activities in ISPRS:
It is worth noting that the Netherlands (formally GIN section on EO) has been awarded the ISPRS Technical Commission VII on thematic processing, modelling and analysis of RS data, chaired by Professor John van Genderen of ITC.

Netherlands EARSeL members' activities in 2004:

Royal Netherlands Meteorological Institute KNMI (Hans Roozekrans):
KNMI has spent many efforts on the launch of EOS/AURA in July 2004 with the OMI instrument (for which KNMI is PI) on board. This instrument is partly developed by Dutch space and TNO and will focus on ozone monitoring. Web-site: www.planet.nl/planet/show/id=74127/contentid=527901/sc=ed3e96. In addition, KMNI has extensively worked on operational use of Meteosat Second Generation (MSG) satellite data. An example of a newly developed product on the basis of MSG data is the detection and monitoring of fog.

TNO Physics and Electronics laboratory (TNO-FEL) (Peter Hoogeboom):
In the field of RS various activities took place at TNO in The Hague and in the university chair for Radar Earth Observation at TU Delft (TUD), which is sponsored by TNO. TNO FEL and TUD focused in 2004 on the following activities:

- Miniature Synthetic Aperture Radar for unmanned and small aircraft, called miniSAR, is being developed for both military and civil applications, combining low costs with high resolution.
- At TU-Delft two SAR projects are ongoing, one for an extremely small FM-CW SAR and another project for the realization of a small P-band SAR for forest monitoring.
- The SHIRA oil spill and wave monitoring radar system is now being offered on a commercial basis through the company called Seadarq.
- The development of algorithms for ship detection and monitoring as part of a 6th framework EU project (Declims). The final goal is to achieve a coastal monitoring system that integrates information from satellite SAR, shore radars and AIS (Automatic Information System; a ship-based transponder system).
- In cooperation with the GBP (Geomatics

Business Park) in Marknesse, services for the reception, processing, information extraction and dissemination are being developed and organised through several projects, among them the North Sea monitoring project, linked to the previous topic.
- Development of methods for the detection and monitoring of coastlines, based on SAR imagery.
- A feasibility study on the detection of landmines is ongoing in cooperation with ARL (Army Research Lab in the USA).
- An EU project, Presense (Pipeline Remote Sensing for Safety and the Environment), on the detection of gas and oil pipelines, has been completed (www.presense.net).

International Institute for Geoinformation Science and earth observation ITC (Freek van der Meer):
During 2004, ITC has invested in partnerships in education and capacity building with several universities and institutes around the world, aiming at some 20 joint educational programmes executed in partnerships in the year 2010. In 2004 the GI-NET: Geo-information Network for Education and Training was established to address the increasing demand for flexibility in academic degree programmes, and to respond to the need for more demand-driven and tailor-made training, ITC has adopted a policy that is internally known as "decentralisation". As part of this policy, educational programmes will be developed and implemented jointly with partner institutions abroad.

P. Geerders Consultancy (P. Geerders):
Paul Geerders is a consultant in several countries in South America and the Caribbean, mainly related to applications in the field of marine and coastal science and management in that part of the world. He has provided a three-page policy document on RS for integrated coastal zone management in developing countries with some thoughts on a possible role for EARSeL. An extract from this can be read elsewhere in this issue.

University Utrecht, Department of Physical Geography (DPG) (Steven de Jong):
One of the new members of EARSeL is the Department of Physical Geography (DPG), Faculty of Geosciences of Utrecht University in The Netherlands. This faculty is one of the largest Geo-Institutes in the world (staff of 425 and 1800 students). DPG with a staff of 30 is developing modern techniques in Geography comprising spatial-dynamic modelling, GIS and geo-statistics. Examples of products are the "PCRaster Environmental Modelling Language" (pcraster.geog.uu.nl), the "Multivariable Geostatistical Modelling Package: GSTAT" (www.gstat.org) and the physically-based runoff and soil erosion model LISEM (www.geog.uu.nl/lisem).

Royal Netherlands Institute for Sea Research (Royal NIOZ, the Netherlands) (Marcel R. Wernand):
The last 5 years SeaWiFS ocean colour data were used to guide our research vessels all over the world's oceans (depending of research areas) to indicate fronts, chlorophyll and or diffuse attenuation coefficients. The SeaWiFS data could be obtained in hours through an Internet query and for instance locally from RS calculated chlorophyll concentrations, within 24 hours of overpass, were sent to the NIOZ through email, accordingly filtered by relevance and sent to our research vessels. This service was much appreciated by the scientists on board, but sadly this service stopped in December 2004. However the NASA is still supporting ocean colour data collected by the MODIS sensors.

Concerning ESA data: ocean colour data (ENVISAT-MERIS) for scientific use are hard to get. A proposal has been forwarded to ESA to use level 3 data (geometrically, calibrated and binned data) for scientific purposes. However this is still not a standard product. At the department of Physical oceanography (Marcel Wernand) MERIS ocean colour data will be used to assess long-term ocean colour changes between 1900 and 2000.

During several cruises over the past years satellite altimetry data has been used to detect eddies. Also altimetry (TOPEX / Poseidon, ERS, ENVISAT) was used for global ocean circulation studies. At the department of Physical Oceanography Denis Volkov finished his thesis (18 November 2004) on "Monitoring the variability of Sea level and surface circulation with satellite altimetry".

Laboratory of Geo-Information Science and Remote Sensing, WageningenUniversity and Research Center (Jan Clevers):
The Centre for Geo-Information comprices two chairs: Geo-Information Science with special emphasis on GIS (Prof. dr. ir. A.K. (Arnold) Bregt) and Geo-Information Science with special emphasis on Remote Sensing (Prof. dr. M.E. (Michael) Schaepman), as part of the Department of Environmental Sciences of Wageningen University. The Centre focuses on education, and fundamental and applied research within the domain of Geo-Information.

The fundamental education and research of the Centre is subdivided in four themes: "Geo-Information Infrastructure", "Quality of Geo-Information", "Remote Sensing" and "Visualization and Communication". Likewise the applied subjects are sub-divided in four themes: "Ecosystems and Landscape", "Soil and Landcover", "Spatial Planning" and "Water and Climate".

Besides education and research tasks, the Centre's Geodesk provides support regarding collection, distribution and maintaining Geo-Information within the Wageningen University and Research Centre.

During the last ISPRS conference (July 2004) in Istanbul, Turkey, Prof. Dr. Michael Schaepman (Wageningen University - CGI) has been appointed the new chairman of the working group VII/1 on fundamental physics and modelling in RS. Under the lead of the president of the ISPRS Commission VII, Prof. Dr. John van Genderen from ITC in the Netherlands, Michael Schaepman will jointly with his co-chair Prof. Dr. Shunlin Liang (Univ. of Maryland, USA) and secretary Dr. Mathias Kneubuehler (Univ. of Zurich, Switzerland) strengthen the importance of quantitative RS using physically-based approaches in the user community. Several workshops and conferences jointly with ISPRS, SPIE, and EARSeL are being planned on this matter.

Remote sensing group, Institute for Environmental Studies IVM, Free university Amsterdam (Marieke Eleveld):
The RS group of IVM focuses on the RS of water quality parameters (hydro-optics). The following products are becoming available: information about chlorophyll-a (CHL) in the North Sea through our European project on REgional VAlidation of MERIS chlorophyll Products in North Sea coastal waters (REVAMP); information about CHL and cyanobacteria in Lake IJssel (IJsselmeer) from our projects on SPatial mapping of the Algal Concentrations in Lake IJssel (IJsselmeer) and Cyano (a joint project with NIOO-CL), respectively. Results from both REVAMP and SPAC are being compiled in atlases. In addition IVM is working on a total suspended matter (TSM) service built upon our SeaWiFs processing line and on a portal for water quality information products from operational RS (WATeRS). More information is at: www.vu.nl/ivm.

2.8.8 RS activities in 2004: Spain

RS activities have undergone an extraordinary increase in Spain during 2004, especially with the organisation of academic, informative and post-graduate courses that make RS widely known.

The Space Studies Institute of Cataluñia must be mentioned first, with the organisation of the 6th Master of Remote Sensing and Geographic Information Systems, of 450 hours, orientated at post-graduates. Also aimed at post-graduates are the 6th Edition of the University Professional Specialisation Course "Industrial and Environmental Applications of Remote Sensing" and the course "Remote Sensing: treatments, applications and data-bases", both of them organised by Prof. Vicente Caselles at the University of Valencia and at the University of Murcia respectively. During his stay in the Neural Networks Group of the University of Extramadura, directed by Prof. Pablo Martinez Cobo, Dr. Robert O. Green, from the NASA-JPL, gave a Specialisation Course on Hyperspectral Sensors in which special attention was paid to the use of these techniques in the monitoring and detection of forest fires. This topic has been followed with great interest by the regional authorities in charge of this problem. Another post-graduate course was the one organised by the Regional Development Institute (IDR), of the University of Castilla-La Mancha en-

titled "Specialist in Remote Sensing and Geographic Information Systems".

There has also been a great number of other more general courses oriented at students and professionals who wish to recycle their knowledge by learning about RS. In the University of Castilla la Mancha, Prof. Elena Gonzalez presents a basic module on RS within the "Cartography and Photointerpretation Course", and at the University of Malaga Prof. Eusebio Garcia gives an introductory course in RS. Dr. Carlos Perez, from the University of Salamanca, has led both a "Basic Course of Theory and Practice Introduction to Remote Sensing" which had to be repeated because of the high interest it raised and a workshop on "Remote Sensing: Treatment of ASTER images". Two books have been published as a result of these two courses: "Remote Sensing: notions and applications", ISBN: 84-607-7624-7 and "Remote Sensing Workshop: treatment of ASTER images" ISBN: 84-609-1536-0, which includes a multimedia CD.

Finally, the group GTD from the Polytechnic University of Madrid, UPM, composed of Drs. Agueda Arquero, Consuelo Gonzalo and Estibaliz Martinez has used the net for the spreading of two courses:

The first one, open to all university alumni is "Processing and Analysis of digital images in Remote-Sensing" (www.gate.upm.es/formacion_reglada/ curso2004-2005/informacion/vidprim.htm), included in the AGWS (Agora Groupware Web Server): agws.dit.upm..es/projects/cyberaula

The second one is an on-line course of continuous training called: "Remote Sensing in the Management of Natural Resources", in the Site Universia: cursos.universia.net/app/es/index.asp, whose activity has spread to South America. Prof. Consuelo Gonzalo has given another two post-graduate courses in Chile: "Artificial Neural Nets: application to the processing, analysis and interpretation of satellite imagery" in the Agriculture Engineering College of the University of Concepcion, and "Introduction to Remote Sensing", given by the Science Department of the Engineering, Science and Management College of the University of la Frontera, Temuco.

With respect to the spreading of RS, we can mention the workshop "MODIS Data and Imagery: How to get and use them", organised by the Remote Sensing Laboratory of the University of Valladolid, LATUV, on the 24-25 June, with the presence of Prof. Chris Justice, from the University of Maryland, USA, Dr. Evangelina Oriol, from the ESA, Dr. Olga Gershenzon, from the R&D Center "ScanEx", Russia, and Mr. Robert Wolfe, from NASA-MODIS, as guest lecturers. Their presentations can be obtained at: www.latuv.uva.es/workshop/index.html. In this workshop, the LATUV facilities for the reception of the MODIS-AQUA and TERRA and MSG satellites were presented. The 11th National Congress on Quantitative Data, S.I.G. and Remote Sensing was held from the 20-23 September in Murcia. Its proceedings can be obtained at www.um.es/congresoMCSIGT/postcongreso.html. Finally, on 25-26 March a meeting about "Remote sensing and Forest Inventory" was held in Lerida.

The spreading task also comprises the publishing of books. Apart from the three already mentioned, Prof. Emilio Chuvieco has edited the book "Wildland Fire Danger Estimation and Mapping. The Role of Remote Sensing Data, World Scientific Publishing, 264 pp. 2003. ISBN 981-238-569-X. He has also co-ordinated an issue of Remote Sensing of Environment on forest fires (Vol. 94, 2004). The FUNGE of the Polytechnic University of Madrid has edited the book "Remote Sensing. An approximation from the surface to the satellite", by Agueda Arquero, Consuelo Gonzalo and Estibaliz Martinez. ISBN: 84-96244-12-1. "Recent Research Developments in Thermal Remote Sensing", directed by Prof. Vicente Caselles, has also been published by the Publishing Company Research Signpost of Kerala, India. The authors are: M. Arbelo, M.M. Artiago, A.Calle, I.L Casanova, V. Caselles, C. Coll, R. Evans, K. Kilpatric, R. Niclos, G. Podest3, A. Romo, E. Rubio, R.Rivas, I.M. Sanchez, J.Sanz, E.Valor.

In order to make RS available to farmers, the LATUV has put into operation the website www.agrosat.info, in which the state of crops and forests in all Spanish regions, provinces and municipalities can be found.

This information is generated every ten days and it also includes information on the accumulated rainfall. It must be pointed out that farmer associations and regional authorities are showing an increasing interest in RS. It is already common that regional Governments finance projects where RS is used. As an example, "The feasibility study of an agro-environmental program in the basin of the Guadiamar" has been financed by the Regional Government of Andalucia, whose IP is Dr. Ma. Jose Prados.

Concerning research, mention should be made of "The Soil Moisture and Ocean Salinity (SMOS) Mission, of the Living Planet Programme of ESA ", where a great number of Spanish researchers are participating and whose Data Processing Ground Segment (DPGS) is located in Villafranca, Spain. It includes the Payload Data Processing Centre (PDPD), the X-band Acquisition Station (XBAS), and the SMOS User Service that is split between Villafranca and ESA-ESRIN (Italy). The Payload Prime Contractor is the Spanish firm EADS CASA.

On the other hand, the National Commission of Science and Technology, CICYT, has financed a large number of national projects on RS and several groups have participated in European projects. The IDL participates in the HARMONIRIB, DEMETER, BACCHUS and MORE projects concerning water management in irrigated lands and the study and management of vineyards. The LATUV is participating in the DRAGON programme, promoted by ESA and the Chinese Ministry of Science and Technology for the study of forest fires in China. It is also participating in the NOD, CDMC and DEMOBIRD projects, which are also related to forest fires and are financed by ESA and it has just finished its participation in the FORMA project, financed by the UE for the establishment of a fire monitoring system through satellites in Morocco.

The RS Group of the UPM is developing a Cooperation Project with Latin-America on the "Design of spectral indexes for the quality estimation of surface aquiferous". Drs. Agustin Lobo, of ICTJA-CSIC from Barcelona and Philippe Maisongrande from CESBIO / Toulouse are the PIs of the project "Water limitation of Primary production in the Inter-Pyrenean region: an approach based on RS and simple models" and Dr. Emilio Chuvieco is the Coordinator of the Latin-American Net of Forest Fires, which is currently making a map of the burned areas on the continent.

As a result of the research task, a large number of PhDs have been presented in 2004. We can mention "Remote Sensing and SIG in the Assistance of the Post-fire Forest Performance", by I. Reyes Ruiz Gallardo, led by Dr. Santiago Castañio and Dr. Arturo Valdes from the IDR. "The anisotropy of the BRDF in the estimation of the biophysical parameters of the vegetation cover through Remote Sensing / Retrieval of vegetation parameters from BRDG data" by Fernando Camacho-de Coca, led by Dr. J. Melia and Dr. M.A. Gilabert, from the University of Valencia. Both of these PhDs have the European Doctorate grade. "Detection of anomalies in the development of corn in a Mediterranean irrigated land from their spectral behaviour", by Makram Anane, directed by Dr. Ma. Auxiliadora Casterad Seral and "The salt marshes of Southern Monegros: facies, water regime and current state", by Carmen Castañieda del Alamo, directed by Dr. Juan Herrero Isern. Both directors belong to the Soil and Irrigation Unit of the Agricultural Technology and Research Centre of Aragon, Government of Aragon.

Lastly, it should be mentioned, that the first step has been taken towards the creation of a National Centre of RS promoted by the Spanish Association of RS and its President Dr. Vicente Caselles.

2.8.9 RS activities in 2004: Sweden

Dr. Håkan Olsson, SLU, Umeå (e-mail Hakan.Olsson@resgeom.slu.se)

A number of GIS and RS organisations in Sweden can now be reached through the new web portal Geoforum (www.geoforum.se), including the Swedish Cartographic Association, the RS section of which is also the national section of ISPRS. Most information at Geoforum is in Swedish. Most Swedish RS research is funded by the Swedish National Space

Board (www.snsb.se), which funds both a research programme and a programme for user-driven implementation projects. In 2004 the space board also acquired a national coverage of SPOT scenes that were used for the projects they support.

Swedish National Land Survey:
During 2004, the National Land Survey concluded the Swedish CORINE Land Cover (CLC) project. In addition to the European CLC dataset, this database also includes a more refined national product with 1-5 hectares minimum mapping units.

During 2004, the Metria division of the National Land Survey of Sweden has acquired a Z/I DMC digital air photo camera. Metria is thereby one of the first organisations in Europe that will set up an entirely digital production line for air photography and mapping. Also tests with laser scanning for the creation of a new national digital elevation model are on-going. This project is planned to result in recommended methods during the year 2005.

Metria Miljöanalys is a section in Metria which focuses on satellite RS. In 2004 it conducted several RS / GIS projects under contracts with Swedish users, such as the Swedish Environmental Protection Agency, the Swedish Board of Agriculture, the National Board of Forestry, the Swedish National Rail Administration, the Swedish National Road Administration, and different forestry companies. Currently Metria Miljöanalys has also been participating in four GMES Service Element projects.

Metria also has the responsibility for the Water Observatory in the EU 6FP GMES integrated project (IP) Geoland. Additionally, Metria is a partner in the PREVIEW IP-project within the same programme. Metria is also a partner in ASTRO+, which is a project within the EU Preparatory Action for the enhancement of the European industrial potential in the field of Security Research (PASR).

Remote sensing laboratory, Swedish University of Agricultural Sciences (SLU), Umeå:
A nationwide database, with forest parameters for all of Sweden has been finalised. This raster database is computed by use of the Finnish "kNN-method" using more than 30 Landsat ETM+ scenes which are trained with more than 50,000 national forest inventory plots. The "kNN Sweden" database is used by forest authorities, environmental protection authorities, forest companies and researchers. During the year 2004, a method for improving the sample plot based forest statistics through post stratification with a segmented version of the kNN database has been developed. Methods have also been developed for using the NFI plots for reduction of within-scene haze differences, and for reflectance calibration of Landsat ETM+ data.

Together with the regional board of forestry in Gävleborg-Dalarna, the first large area (5000 ha) laser scanning for forest resource assessment was carried out. The results show an RMSE of 14 % for stem volume estimates at stand level. This good result is also consistent with many other stand-wise laser scanning results in Scandinavia. Thus, laser scanning appears to be one of the most promising RS methods, also for forest resource assessments. During 2004, a special issue of the Scandinavian Journal of forest research about laser scanning of forest resources was also published.

Methods for analysing RS data on single tree level, both using dense laser scanning data, and optical data such as for example Z/I DMC are also developed. In one such study together with the National Defence research agency (FOI), tree canopies were segmented using laser scanner data and spruce / pine and deciduous forest were then discriminated with 90% accuracy using only colour information from Z/I DMC imagery.

Centre for image analysis, SLU and Uppsala University, Uppsala, Sweden:
Together with the Swedish Environmental Protection Agency, habitats along the entire Swedish coast have been classified using Landsat-7 imagery. The results were presented at a conference in Fremantle, Australia. Cooperation with Italian groups continued in ROSALMA, monitoring of chlorophyll and macrophytes from satellites, and

NYMPHA, experimentation on a RS integrated system for lake water monitoring.

Forest inventory from airborne sensors has been an active research field since 1994. At present Mats Erikson has worked on segmentation methods for tree crowns, and species identification based on this segmentation reaching 95% species identification on the stand level. He finished his PhD thesis in November.

Department of Physical Geography and Quaternary Geology, Stockholm University:
Together with the county boards in northern Sweden, a mapping of vegetation change in the Swedish mountains during the last 10 years has been carried out. RS is also used for coastal zone studies in East Africa and in Sweden. ASAR radar data is used for studies of glaciers. MERIS data are used for water quality studies in the Baltic Sea.

Department of Earth Sciences, Uppsala University:
RS is utilised for mapping and environmental monitoring, with special emphasis on geological studies. Target areas have been the Eurasian Arctic, Central Africa (Uganda,), and the Higher Himalayas. New projects has recently also been started in Tanzania, Sri Lanka and mainland China. Projects where RS is used for land cover mapping, water resources assessment, etc, are also ongoing in Mozambique, Swaziland, South Africa and Sri Lanka.

In cooperation with other departments at Uppsala University, Earth Sciences were involved in RS applications in the fields of Archeology, Environmental Impact Assessment and Limnology. The project "A Satellite Water Quality Monitoring System for Lakes Vänern and Vättern, Sweden" was recently finalized and the results can be accessed through www.geoinformatik.geo.uu.se/lake_satellite/.

Department of Physical Geography and Ecosystems Analysis, GeoBiosphere Science Centre, Lund University:
The department carries out research concerning RS of vegetation processes and land cover / land use in relation to environmental change, particularly effects on the carbon cycle. During 2004 methods for estimating leaf area index and photosynthetically absorbed active radiation were tested in Swedish forest ecosystems. The research involves analysis of optical field measurements and satellite sensor data from optical instruments. Furthermore, work was carried out on development of methods for analysing time-series of satellite sensor data. These methods are used for analysing dynamic changes of land vegetation over very large areas. Work was carried out on environmental change in the Sahel region of Africa using a variety of RS data from high resolution (1-10 m) to low resolution (250-1000 m). Integration of RS data with ecological models at different spatial scales was also carried out.

Department of Radio and Space Science, Chalmers University of Technology, Gothenburg:
During 2004, the radar RS group at Chalmers completed a study of land applications for a possible P-band SAR satellite utilising the recent frequency allocation around 435 MHz. The study "Applications of Low-Frequency SAR" (www.rss.chalmers.se/rsg/Research/Projects/ALFS/) investigated the usefulness of SAR data for forest biomass and soil moisture retrieval – accounting for the performance limitations due primarily to ionospheric distortion. Work is continuing in this field, with Chalmers participating in a major flight campaign (LORAM 2004) to collect relevant data over the Remningstorp forest test-site in southern Sweden. The SAR data collection was performed as part of a bilateral cooperation using the airborne SAR systems LORA and CARABAS run by the Swedish Defence Research Agency (FOI) and RAMSES operated by ONERA.

Additional activities are the continued development of algorithms for retrieving forest stem volume at stand level, and for individual trees, using data from the CARABAS VHF-band SAR. During 2005, work will also include preparation for calibration and validation activities for PALSAR on ALOS (planned for launch in September 2005), and preliminary studies on the usefulness of PALSAR data for forestry monitoring within JAXA's Kyoto and Carbon Initiative.

3 NEWS FROM ESA, THE EC, & INTERNATIONAL ORGANISATIONS

3.1 News from ESA

3.1.1 GMES at the Earth & Space Week

Keeping watch on the world from orbit is helping to make it a safer place to live, heard European journalists visiting the Earth and Space Week in Brussels. Experts recounted how Europe's GMES (Global Monitoring for Environment and Security) initiative is already delivering operational information services and it is set for further expansion.

On 15 February 2005, a day-long series of press briefings at the Earth and Space Expo focused on the joint EC and ESA initiative GMES, intended to provide an independent European capability for global environmental monitoring by combining all available ground and space data sources. The briefings came on the eve of the anticipated agreement to implement a Global Earth Observation System of Systems (GEOSS) at the Third Earth Observation Summit, on 16 February 2005. With initial services already in operation, GMES will be the European contribution to GEOSS. The date also marked the historic day that the Kyoto Protocol to combat global warming finally came into effect, demonstrating that international cooperation for environmental protection is an idea whose time has come.

"Our environmental policies and legislation are based first and foremost on our knowledge of the state of the environment, what are the risks to it, what are the environmental trends," said Timo Makela, a Director in the EC Directorate-General for Environment. "What we know is that we do not know enough at the moment, and satellites and space can bring something additional to our existing monitoring." Makela explained that GMES services are already serving a wide range of users on an operational basis. Satellite images are being used to detect illegal dumping of oil waste from ships around EU waters, so that the ships responsible can be identified. Meanwhile tiny millimetre-scale ground movements in Italian and Swiss territory are being detected using space-based radar techniques to create risk maps for landslides.

Humanitarian aid workers plan their activities with up-to-date satellite maps of their operational areas capable of highlighting flooded roads or earthquake-hit buildings – or even, as the briefing heard later, counting the number of individual tents in a crowded refugee camp to assess local needs.

GMES is less about suddenly constructing grand new monitoring systems than making better use of those already existing. There are around 50 Earth Observation (EO) satellites currently in orbit around Earth, along with numerous ground-based observation systems – think of weather stations, tidal gauges or sea buoys - which gather a rich bounty of information on the ocean, atmosphere and land surfaces. Blending all these Earth and space-based data together – along with numerical models to enable forecasting – can provide a richer and more accurate picture of our planet, providing information services robust enough to be used operationally, and in support of European decision makers.

For examples of how EO is currently used in a practical way, Jacqueline McGlade, Executive Director of the European Environment Agency, explained how views from space enable monitoring of changes in European land cover. "We can see that the landscape of Europe has a high ecological potential," McGlade said. "There remains a lot of green landscape, but corridors between them are shrinking – impacting biodiversity – and a large area the size of a major city has been covered up by urban sprawl in a decade, so that if this rate stayed unchanged for forty years there would be little European open space left. These are the sort of changes that are almost imperceptible if you live down on the ground, but we can detect these shifts from orbit."

Jean François-Minster, President and Director General of the French oceanograph-

ic body IFREMER turned to the ocean, revealing how satellite readings of sea surface temperature and height are blended with inputs from buoys and floats and a mathematical model of the ocean to create robust forecasting system known as Mercator.

With memories of the tragic Indian Ocean tsunami still fresh, disaster mitigation and response loomed large in discussions. Udo Gärtner, President of the German Meteorological Services Deutscher Wetterdienst pointed out that weather retains the power to do great harm to life and property – European floods in May 2002 did 20 billion worth of damage, while the 2003 heat wave killed an estimated 20,000 – but accurate forecasting can minimise disaster provided information gets out to those who need it in time.

Satellites have clearly proved their worth in the field of disaster response: the International Charter on Space and Major Disasters makes satellite data available to civil protection authorities responding to emergency situations. First signed in 2000, it is activated on average once every two weeks, with recent activations including the Tsunami aftermath. Delilah Al Khudhairy, of the Institute for the Protection and Security of the Citizen, of the EC's Joint Research Centre (JRC) in Italy, used the tsunami disaster as a case study of what EO could do across a variety of timescales, from hours to weeks. When initial news of the disaster came through in late December, the JRC began by combining publicly available regional elevation models, sourced from Space Shuttle radar data, with US satellite-based maps of global population density in order to estimate the area affected and the potential casualties. "In the next few days it became possible to acquire coarse and medium resolution imagery from ESA and the US" Al Khudhairy stated. "This could be used in turn to plan optimal acquisitions of very high resolution imagery which is most useful for the early response of relief organisations, and now for the ongoing process of sustainable reconstruction." She added that GMES service consortium "Respond" is supplying value-added services and maps based on satellite data to relief organisations in the field.

With ESA's starting portfolio of 12 GMES services up and running – known as the GMES Services Element (GSE) – the next step in the joint initiative is to further grow existing services into self-sustainability while gathering user requirements for further ones. Along with this comes evolving and integrating the GMES ground segment and – with uncertainty over long-term data continuity a barrier to user acceptance – developing a series of dedicated spacecraft known as Sentinels. Five Sentinels are currently planned: the first one radar-based, the second hyperspectral, the third dedicated to ocean monitoring and the final two for atmospheric monitoring from geostationary and low Earth orbit respectively. These missions will be classed as 'operational' as opposed to scientific, comparable in status to weather satellites such as Europe's Meteosat series.

During a panel on GMES and business, Paul Kamon, Chairman of the European Association of Remote Sensing Companies (EARSC) made the point that ensuring data continuity was vital for maintaining the independence and competitive status of European EO.

Nigel Press, Chief Executive Officer of Nigel Press Associates stressed the importance of small to medium enterprises (SMEs) in making GMES work. He explained that the current non-military EO sector was dominated by SMEs that had developed niche services for customers willing to pay – Dutch firm ARGOSS uses satellite data for tide and sea state forecasting to sailors and offshore industry, for instance, while his own firm provides radar-based natural oil seep detection for oil prospecting firms.

A working lunch saw the spotlight shift from GMES to GEOSS. It was hosted by co-chairs of the Group on Earth Observation (GEO) charged with creating the ten-year plan to implement GEOSS, due to be accepted by the Third Earth Observation Summit on the following day. The theme of the lunch was 'Imagine if…' we lived in a world where GEOSS was already a reality. National Oceanic and Atmospheric Administration (NOAA) Administrator, Vice Admiral Conrad C. Lautenbacher

rose to the challenge ably, comparing the likely impact of GEOSS to turning the Hubble Space Telescope back from imaging the furthest corners of the universe to look back at the Earth and cover it completely.

"We would be able to mitigate all sorts of catastrophes with a comprehensive EO system," Lautenbacher said. "Undergoing a drought we may be able to forecast whether it was going to last one year or five years, which would make a big difference." Fellow GEO co-chair Rob Adam, Director-General of the South African Department of Science and Technology, added that developing nations stood to benefit from GEOSS in a number of ways. Its existence would first highlight identify and then progressively shrink severe data gaps associated with these countries. This article is from a report on the ESA web-site (www.esa.int) on 16 February 2005. See also Section 3.1.2 below.

3.1.2 3rd EO Summit agrees 10-year GEOSS plan

On 16 February 2005, around 60 nations and more than 40 international organisations joined ESA and host, the European Community, at the Third Earth Observation (EO) Summit. History was made at the Palais d'Egmont in Brussels as assembled delegates formally agreed a ten-year plan to implement a Global Earth Observation System of Systems (GEOSS). The plan summarises the steps needed to put a GEOSS in place. GEOSS will build on existing EO systems by coordinating efforts, addressing data gaps and supporting inter-operability and information sharing. It aims to increase responsiveness to user needs and improve information delivery to users.

The creation of a single, comprehensive and sustained system for EO should help countries to identify and address global environmental and economic challenges, including climate change and natural disasters – the agreement coming on the same day that the Kyoto Protocol entered into force, and just under two months after the Indian Ocean tsunami disaster.

Delivering the opening address, EC Environment Commissioner, Stavros Dimas, said that a combination of different EO systems is needed to study the kind of complex phenomena found within the Earth system: "Good policy needs good science – we need to understand the environment in order to protect it. It is very fitting that we are today, on the date of entry into force of the Kyoto Protocol, launching a system that will greatly enhance our understanding of the environment and will hopefully help us to do what we can to improve it."

Kusmayanto Kadiman, Indonesian State Minister for Research and Technology, described his 220-million person nation as "both threatened and blessed by nature", with the vast archipelago rich in resources but also subject to a variety of hazards including earthquakes and volcanoes, forest fires, hurricanes and floods, as well as the recent tsunami that struck Sumatra and Banda Aceh on 26 December 2004. Kadiman said he was overwhelmed by the response of the world community, including near-real time satellite imagery provided through the Charter on Space and Major Disasters, which enabled the government swiftly to grasp the full scope of the tragedy. He said: "The effectiveness of EO has been demonstrated", adding that Indonesia is setting up a Regional Centre for Disaster Mitigation, planned as part of a global network of such centres. "Early-warning systems are required to guard against future disasters, so GEOSS could not be more timely."

US Commerce Secretary Carlos Gutierrez reminded the Summit that it had been just 19 months since the 1st EO Summit in Washington DC. A lot of work had been done to reach this stage, but the benefits would be worth it: "Hurricane prediction has already saved the lives of many people, keeping our citizens out of harm's way. A third of the US economy is weather or climate-related – a figure of 3 trillion dollars. Just imagine with GEOSS, farmers being able to predict their crop yields, or identifying the areas most sensitive to forest fires, having weather forecasts with an accuracy of months instead of days, and zeroing in on our climate with complete accuracy."

GEO Co-Chair Rob Adam, DG of the South African Department of Science and Technology, welcomed the GEOSS implementation plan, stating that its emphasis on capacity-building will particularly help sustain and extend the observational capacities of developing countries.

Colonel Benjamin Ndala, Secretary-General of the International Commission of the Congo-Oubangi-Sangha Basin (CICOS) gave an example of how capacity-building works in practice. Starting in 1996, a project called PUMA ensured that 53 African national meteorology services could use the enhanced data and services of the new Meteosat Second Generation (MSG) family of European weather satellites. Supported by 11 million from the EC, as well as bilateral contributions from Belgium, France and UK, PUMA has set up 59 receiving stations across Africa – one for each participating country and six regional centres – and 350 technicians will have been trained by September 2005. He added that the PUMA Task Team is now working on a follow-up project, called African Monitoring of the Environment for Sustainable Development (AMESD), that extends beyond meteorology to cover EO capacity-building, with the intention of providing support for African policy makers. AMESD will serve as the African link to GEOSS.

Stephen Briggs of ESA's Earth Observation Science and Applications Department gave details of a programme called TIGER which is focused on applying EO to Africa, with a particular focus on water management issues – some 95 research proposals have been received across the continent. Satellite radar images are being used to calculate rates of water extraction from underground aquifers, for example, based on millimetre-scale measurements of ground motion.

Alan Belward of the EC's Joint Research Centre (JRC) stated that the JRC's Africa Observatory project aims to supply EO data to African users. He had a graphic example of EO in practice: he compared a 1963 declassified military satellite image of Lake Chad to a view from 2000, showing that it is now a tenth the size it was forty years ago. Shortages of water and other resources are increasing drivers of regional conflicts. Developing countries are disproportionately threatened by climate change, he said. But EO can enable wise stewardship of resources such as water, forestry and national parks – valuable in themselves as tourist attractions, but threatened by illegal logging and poaching. "The environment and poverty reduction fit hand in glove. Natural resources equal income in developing countries. Poor management of natural resources now can limit their value for future generations - decreasing biodiversity limits the value of ecosystem services."

Mosibudi Mangena, South Africa's Minister of Science and Technology said he was pleased to have GEOSS established, and that the developing world was well represented: "We will be able to generate data, and get data on a worldwide basis, to use in our own countries against poverty and the other issues affecting humanity. For developed countries the GEOSS challenge is to coordinate many existing systems, while we in many cases still have to create our own EO systems. We welcome GEOSS and hope it will bring future generations a better health than our own." This article is from a report on the ESA web-site (www.esa.int) on 17 February 2005.

3.2 News from the EC

3.2.1 JRC's response to the tsunami disaster

Since the earthquake of 26 December 2004 in the Indian Ocean, and the subsequent devastating tsunami, the EC has worked closely with international and European organisations (i.e. UN Agencies; ESA national agencies such as the German Space Agency / DLR; RESPOND-GMES; SPOT-Image; EURIMAGE; NASA satellite data providers and space companies) to use satellite image analysis to measure the immediate extent and impact of the disaster. These regional, national and in-country analyses have been used to support international aid efforts. Extensive use has been made of satellite imagery, notably in the context of the activation of the International Chart on Space and Major Disasters. The immediate response by the EC's Joint Research Centre (JRC) has consisted of:

- Analysis of regional maps depicting tsunami flooded zones, affected population and natural resources: A preliminary estimate of the inundation zone was produced by calculating the area of less than 10m and 20m elevation contour lines within 5km of the coastline for the entire region. This information was cross-checked with global population density data to estimate the likely population affected. Regional land cover maps were used to estimate impact on natural resources.
- Analysis of country maps depicting affected population and infra-structure: DG JRC acquired information and data through open sources to produce thematic country-scale maps depicting affected population, infra-structure and natural resources. Additional geo-political and other relevant information is now being integrated while similar maps for other affected zones will either be created or integrated from other sources.
- Analysis of in-country maps depicting damage analysis / assessments for specific Tsunami affected zones: Together with various agencies and pictures as detailed as 1 metre or less, it has been possible to prepare damage analysis / assessments for disaster affected zones.

Follow up action work is continuing on damage and situation analysis / assessments over the region. A comprehensive tsunami information system is being maintained by DG JRC to assist EU operations. An assessment of the strengths and weaknesses of European and international mapping and satellite-based efforts to be deployed in such situations will also be made. Further information is at the websites www.jrc.cec.eu.int/tsunami and unosat.web.cern.ch/unosat

3.2.2 JRC's environmental observatory for Africa

On 16 February 2005, the EC's Joint Research Centre (JRC) announced the creation of an Observatory for Environment and Sustainable Development for Africa. In close cooperation with the EC's other DGs for External Relations, Development, and the EuropAid and Co-operation Office, the JRC is contributing to EU initiatives in Africa by developing a dedicated Environmental Information System based on satellite and computer-mapping technologies. This provides information on food needs, helps the EC Humanitarian Office provide aid in the aftermath of natural disasters and other emergencies, and helps long-term development through sustainable management of natural resources.

Africa faces some of the world's greatest development challenges. More than 200 million people are under-nourished, thousands of displaced persons are housed in refugee camps and the quality of essential resources such as water, cropland and forests is under threat. As the world's largest donor of development aid, the EU is a leader in the fight to eradicate poverty and improve social development.

Over the last decade, research at the JRC has used satellite imagery, maps, statistics and computer models to address diverse environmental monitoring issues. This work has seen strong links established with UN Agencies, with counterparts throughout the developing world, as well as space agencies and other data providers. The JRC is using this experience to create an Environmental Information System for Africa that brings together established JRC projects to help the DGs charged with policy development and implementation in the identification of priorities for EU intervention, and in the strategic orientation of European aid to Africa and other developing countries.

Income in many regions of Africa relies on natural resources – and armed-conflicts are increasingly driven by resource availability. Careful resource management will ensure economic value for present and future generations and help avoid conflict. The JRC gathers and processes information on forests, biodiversity, land-use, land degradation and water to produce environmental information such as land-resource maps for the whole of Africa, location and timing of water resource replenishment and exhaustion, and the detection of forest logging activities. GISs exploiting this information have been installed in EU Delegations and already help in the better

management of some of West and Central Africa's national parks.

Africa has a high proportion of the world's refugees. The EC Humanitarian Office provides aid to the dispossessed, helping to save lives and to provide emergency relief to people affected. A significant part of this aid sustains people hosted in refugee camps. Insecurity in the host country or delays in repatriation mean refugees may have to live in camps for years: Lukole camp in Tanzania set up in 1994 to host Rwandese refugees still operates more than a decade later. The JRC uses satellite imagery to count family dwellings in the camps and estimate the number of refugees. This information is then provided to the DGs involved in the disbursement and control of aid and assistance, thus helping to ensure that aid goes where, and when, it is most needed.

The JRC's crop monitoring and forecasting system assesses agricultural productivity in over 30 countries vulnerable to crises and food shortages; the Horn of Africa is particularly important because of recurrent food crisis and the absence of a regional monitoring system. Monthly reports describing current crop condition, yield prospects and the likelihood of food shortages are issued from April to October. During this period, continuous exchange takes place with the EU offices in Africa, African institutions and UN partners. In 2004 the focus was on North-Sudan's Darfur region, and the regions of Mauritania and Mali suffering from desert locust plagues.

Africa has 17% of the world's forest, at least 20% of its grassland and 11% of the wetlands. Changes to these (and they do change: for example much of the grassland burns each year) affect Africa and the global environment, especially our climate. The rural peoples of Africa are some of the most vulnerable to climate change; they have little adaptive capacity and are among the worst affected by droughts, floods and storms; their agriculture, forestry and livestock too are all sensitive to climate. The environmental measurements made by the JRC help determine Africa's role in the global climate system, and highlight how climate change will affect the ecosystem services the poorest rely upon.

The EC and ESA have launched an initiative to establish, by 2008, a European capacity for global monitoring for environment and security (GMES) to support the EU's political goals regarding sustainable development and global governance. GMES will facilitate and foster the operational provision of quality data, information and knowledge, and the JRC will help extend the application of the GMES initiative to Africa. More information on the activities of the EC's JRC is at www.jrc.cec.eu.int

3.2.3 New European Research Council imminent

A European Research Council (ERC) to fund science across the EU is close to being realised. The EC told the annual meeting of the American Association for the Advancement of Science (www.aaas.org), which was held in Washington on 17-20 February 2005, that it also wanted to double annual science funding from five to 13 billion euros. The ERC is conceived as being independent from the EC. It could be set up as early as 2006, if the proposals are accepted by both the European Parliament and the European Council of Ministers.

In Europe, research is funded by individual national agencies as well as the EU's Framework 6 programme (FP6). But FP6 has been criticised widely for being overbureaucratic, skewed towards big, complex collaborations and subject to political pressures. Perceived shortcomings have led to calls for an ERC to support basic research across all disciplines. EC spokesperson Patrick Vittet-Philippe confirmed that the ERC would form part of the submission for Framework Programme 7. "What are not clear are the competiton and control aspects and how the money would be managed," he said.

Campaign groups have warned that unless Europe streamlines its funding process, it risks losing top scientists to other countries, notably the US, where the investment process is seen as being more efficient. The

ERC is envisioned as an independent, quality-driven funding body run by scientists, modelled on the US National Science Foundation and National Institutes for Health. Supporters argue that it would drive up the competitiveness and, by extension, quality of scientific research in Europe.

The R&D expenditure of the US is about 40% of the world total. US industry, government and other sectors spend more on R&D than the entire EU combined. This disparity in research funding is already feeding a brain drain of scientists from Europe to the US, as recently highlighted by the UK's Royal Society. EU member states tried to address the imbalance in the 2000 "Lisbon strategy", which promised an agenda for transforming Europe into "the most competitive and dynamic knowledge-based economy in the world". But a mid-term review in 2004 was highly critical of progress on delivering the strategy, blaming a "lack of determined political action". This article is from a report on the BBC News web-site (news.bbc.co.uk/science/nature) on 18 February 2005.

3.3 EEA highlights EU's changing landscape

The resolution of the 3rd Earth Observation Summit, adopted on 16 February 2005, seeks to develop over the next 10 years a capacity to use Earth observation (EO) for early warning systems, responses to natural disasters, health issues, management of energy resources, climate monitoring, weather forecasting, management of natural ecosystems, agriculture and biodiversity – in other words, an almost overwhelming list of essential information to help society thrive in the 21st century. But at the heart of these extensive efforts are the real needs of citizens.

Over the past 10 years, the European Environment Agency (EEA) has provided information to policy makers, officials and researchers. In 2004, the EEA reached the attention of the general public through the launch of two products:

- European Pollution Emissions Register (web-site: www.eper.cec.eu.int/eper): A tool to examine emissions of pollutants to air and water from nearly 10,000 industrial sites.
- Corine Land Cover 2000 (web-sites: dataservice.eea.eu.int and image2000.jrc.it): The first digital map of the multiple changes that have occurred in Europe's landscapes since 1990.

The immense response to both these products showed that there is an intense interest from the general public in gaining access to information about their local environment.

What the public can see from the Corine data-sets is a series of snapshots of the conflicts arising from the various European policies in agriculture, transport and regional development which are now potentially at odds with the sustainable development of Europe.

Europe has been shaped by centuries of traditional farming practices, resulting in a wealth of different landscapes with high cultural and natural value. Landscape change is a relatively slow process, where small changes often go unnoticed but ultimately where the larger picture changes dramatically. Recent analyses by the EEA show that land is becoming a scarce resource: 800,000 ha of Europe's land cover was converted to artificial surfaces from 1990-2000. Only with careful spatial planning of urban and rural development can Europe avoid compromising its agricultural production, biodiversity, energy security and Kyoto targets and aspirations under the Lisbon agenda.

As urban sprawl continues to spread into the countryside, and transport infrastructure, recreational and rural services take over agricultural and natural areas, the rights and freedoms of individual citizens will increasingly be put at risk. It is therefore essential that information on the environment both in real-time and over accumulated periods of time be freely available – free at the point of delivery to citizens and policy-makers alike.

Under the Aarhus Convention, a new EU Directive (2003/4/EC) on public access to environmental information was adopted

on 14 February 2005, replacing an earlier directive from 1990 (90/313/EEC). The adoption of the 10-year implementation plan for Global Earth Observation System of Systems (GEOSS), on 16 Feburay 2005, must therefore seek to do the same for Europeans at a global level. And in its turn, the EEA will continue to step up the release of useful data and products, free at the point of delivery, for the citizens of its member countries to better understand the future changes in Europe's changing landscape and environment.

The EEA is the leading public body in Europe dedicated to providing sound, independent information on the environment to policy-makers and the public. Operational in Copenhagen since 1994, the EEA is the hub of the European Environment Information and Observation Network (www.eionet.eu.int), a network of around 300 bodies across Europe through which it collects and disseminates environment-related data and information. This article is from a report on the EEA web-site (org.eea.eu.int) on 15 February 2005.

4 RS DATA, PRODUCTS & PROJECTS

4.1 An image compression & analysis framework

An image compression and analysis framework for optical and radar data

C. D'Elia (delia@unicas.it) and G. Cuozzo (g.cuozzo@unicas.it), Università di Cassino – Dipartimento di Automazione, Elettromagnetismo, Ingegneria dell'Informazione, e Matematica Industriale (DAEIMI), via Di Biasio 43, I-03043 Cassino (Frosinone), Italy. Phone: +39-0776-2993748. Fax: +39-0776-2993987. Web-site: www.lit.ing.unicas.it

This report briefly describes the research activities in the field of image compression and analysis that are carried out by the Laboratorio di Informatica e Telecomunicazioni (LIT LAB), at the University of Cassino, Italy.

I. Introduction

Research in the field of image processing is increasingly moving towards the use of algorithms based on data models, mainly due to the availability of computing resources. In this context, different cultural areas of image processing are sharing common theoretical methodologies. Image compression, classification and content extraction, for example, could take advantage of the same image model.

This paper describes a framework, illustrated in Figure 1, for image compression and analysis, in which the image model, embedded in the segmentation block [1], is shared by some processing. This framework addresses the compression [2] of multi-spectral and hyper-spectral images, and their classification. Furthermore by the extraction of the heterogeneity feature [3, 7] it is possible to apply the framework to the classification of focused SAR Data.

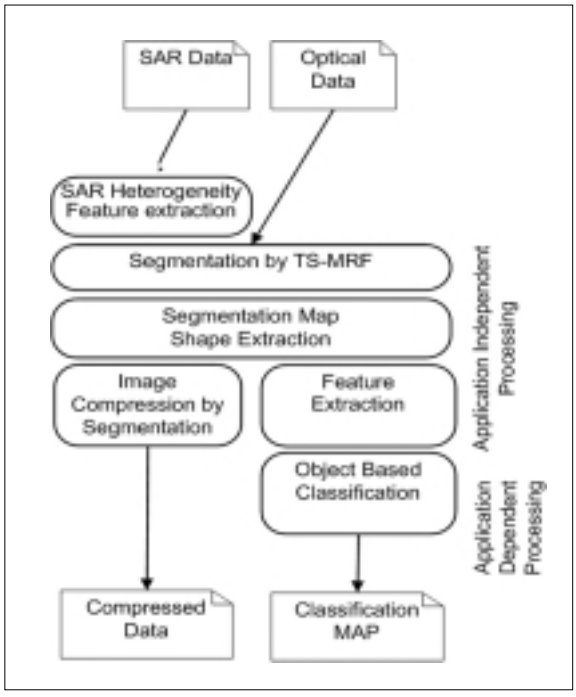


Figure 1: Common framework for image compression and classification.

Figure 1 shows how compression and classification applications can be performed using common processing. Segmentation provides the map of elementary homogeneous areas inside the data, based on a Markov Random Field (MRF) model, while the shape extraction procedure represents it in a vector format, in such a way that it is possible to encode it efficiently, and to extract the features easily.

The data compression takes advantage of the segmentation map because it represents the "common" part of the multi- / hyper-spectral bands, while the classification performed on the elementary regions / objects (called "shapes" hereafter) of the segmentation map can be more powerful and advanced because it has to be computed on thousands of shapes instead of millions of pixels.

The interaction between classification and compression goes further than model sharing. For instance, in some compression applications it is useful to assign to some "target areas" a higher quality than others, as in medical images. In this case compression can take advantage of automatic classification of "target areas". In addition, however, the classification interacts with compression because the compression algorithm acts in such a way that the segmentation map is embedded in the compressed bit-stream. This implies that many classification tasks, in this framework, can be done either from compressed or original data. Furthermore, a classification obtained from compressed data requires only the fast "Feature Extraction" and "Object-Based Classification" blocks, because "Segmentation" and "Shape Extraction" information are already embedded in the compressed bitstream.

The segmentation, feature extraction, classification and compression processes are described below.

II. Image segmentation

Segmentation is achieved by applying a reasonably simple MRF a-priori model, taking into account the spatial dependencies in the image through the conditional probability that a pixel belongs to a given class, given the classes of its neighbours. Using this model, the segmentation becomes a MAP (maximum a-posteriori probability) estimation problem, and estimation of a set of unknown parameters from the data and model. Due to the inherent complexity of this problem, in practical applications one must resort to heuristics that reduce the search complexity, and accept sub-optimal solutions.

In this study, in order to reduce drastically the search complexity and to estimate the MRF parameters for each single class, a tree-structured (TS) MRF model optimisation algorithm [1] was adopted. The TS-MRF segments recursively divide the image into smaller regions using a binary tree structure in which the tree leaves partition the image in a certain number of disjoint regions (i.e. provide the segmented image) at the end of the process.

More precisely, the whole image is associated to the root node "t = 1" of a tree "T", and is segmented in two regions using a binary MRF model. The two new regions, associated with the children of the root ("t = 2" and "t = 3") can be likewise segmented by a newly defined local binary MRF, and growth of the tree continues until a suitable stopping condition is met, or by setting a priori the class number. Indeed, a split gain "Gt" is associated with each leaf "t" and is defined as the likelihood ratio between the two hypotheses of splitting the region in two (according to the realisation "xt" of the local binary MRF) or leaving it unaltered. If the split gain is greater than 1, the region "St" is better described by a two-class rather than a uniform field. When all the leaves have a split gain less than 1 the tree stops growing. In [1], it is shown that the growth of the tree can be based exclusively on local decisions.

The use of binary fields only, together with the localisation of the splitting (i.e. the segmentation of a region does not depend on other regions) leads to a significant reduction of the computational complexity with respect to the case where a flat C-class MRF is used.

III Feature extraction

After the segmentation step, the image is divided into a huge number of homogeneous elementary segments, belonging to the same cluster, that are further subdivided in connected regions ("shapes"), as shown in the segmentation map of Figure 2, where each colour represent a cluster that is composed by different shapes. Each shape is characterised by a set of features related to the geometry (e.g. shape descriptors, smoothness), spectral signature and neighbour regions (contextual features), as follows:

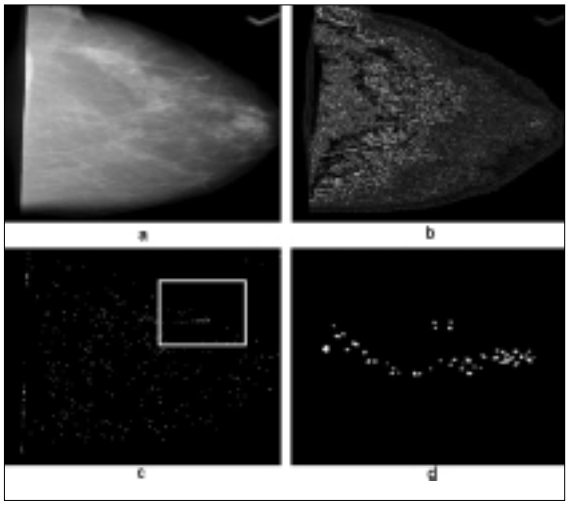


Figure 3: (a) Original radiographic data; (b) segmentation map; (c) map of "small and bright" micro-calcifications; (d) zoomed area of SVM classified calcification.

- Mean cluster radiance value: the value mi of the i-th class to which the region belongs (this feature is provided directly by the segmentation process)
- Mean shape radiance value: the value mri of the i-th shape.
- Compactness: Area / (Perimeter)2
- Elongation: (X Axis) / (Y Axis), where X Axis = maximum width along the horizontal axis, Y Axis = maximum height along the vertical axis.
- Gradient on the original data: minimum, maximum and average value of the gradient strength on the region contour pixels; this feature is strictly related to the single region, but is significant only if the original data sufficiently sharp on the border of the region.
- Gradient on the mean: minimum, maximum and average value of the gradient evaluated as in the previous feature, but in this case the value of the pixels is equal to the mean mi of the class to which the region belongs; in this way we obtain a feature related both to the class and to the region, which is significant even if the border of the region is not sharp.
- Boundary Fourier Transform: Samples of the boundary Fourier transform, useful to discriminate manmade from natural objects.

The "feature extraction" block of Figure 1 stores the whole set of features in a database. At this point the image is represented as a set of shapes, each characterised by its features. In many applications, using this powerful image representation, it is already possible to extract many shapes that are quite different from a target, by a simple threshold on the features, usually spectral or geometrical ones. This is the case in Figure 3, where we are looking for micro-calcifications. Here as usual the segmentation provides thousands of shapes (Figure 3b), but by selecting "small and bright" ones, only a few hundred shapes (Figure 3c) reach the classifier, with an obvious advantages in term of computational speed.

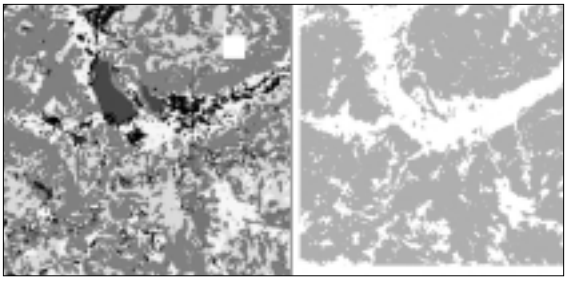


Figure 2: Segmentation map and forest / non-forest classification map.

Moreover in some simple applications (see Figures 2 and 4, for example), it is possible to achieve good result even without any sophisticated classifier. For instance, in the case of detection of melanomas in RGB pictures (Figure 4), using a few training images it is possible to set proper thresholds that are enough to extract melanomas for the whole image database. Even with the forest classification of Figure 2 it is pos-

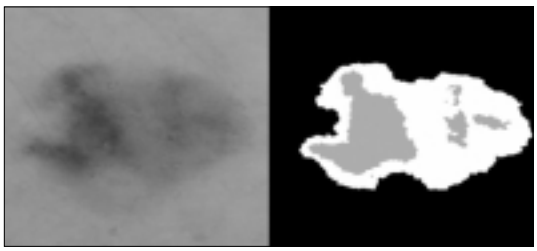


Figure 4: Melanomas – RGB image data and classified target object.

sible to achieve good results in forest / non-forest classification with the selection of simple thresholds. A more complex classifier like Dynamic LVQ (learning vector quantization), of course, could improve the performances and enables the framework to identify more complex land covers, inside forest areas, like coniferous and deciduous broadleaves forests.

In the next Section, the use of different classification techniques suited to the considered applications will be discussed.

IV. Image classification

The application framework of Figure 1 has been tested in different contexts, for example in remote sensing as a land cover classifier, in medical imaging as a computer-aided diagnostic tool, and other cases. The power of the method is that, in order to adapt the framework to the application context, it is sufficient only to design the proper "object-based classification" block. Some of the classification strategies adopted are described below.

(a) SVM Classification for micro-calcification detection:

Support Vector Machines (SVMs) represent one of the best classifiers now available. SVM with respect to Artificial Neural Network presents three distinct peculiarities: the regression estimation is performed using a set of linear functions defined in a high dimensional feature space; the regression estimation is carried out by risk minimisation, where the risk is measured using Vapnik's _-insensitive loss function; the SVM implements the SRM (structural risk minimisation) principle which minimises the risk function consisting of the empirical error and a regularised term. As a consequence, the expected results could be better with respect to other classification systems.

The SVM classification tools have been used in [4] to extract calcification clusters. In this application the "object-based classification" block is made by several sub-blocks. The first sub-block selects the shapes that are "bright" and "small enough" (see Figure 3b and 3c), the second sub-block classifies in a finer way the micro-calcification using the SVM, while the third block recognises the micro-calcifications organised in clusters, as in the zoomed area of Figure 3d.

(b) Dynamic LVQ Classification:

Dynamic LVQ is a method introduced in [5] to solve some problems of classical neural classifier. The peculiarity of this classification method is to select the proper number of neurones per class for a target performance, and above all to have a progressive learning useful in the case that the data is not available all at the same time, like in monitoring applications where data is acquired day after day.

V. Image compression

The image compression algorithm is depicted in detail, with the grey blocks of Figure 5. The basic idea of any compression algorithm is to model the dependencies inside the data to achieve a high compression rate at a desired quality. Here, a KLT (Karhunen Loeve Transform) is used to address spectral dependencies and a DCT (Discrete Cosine Transform) for spatial ones. Unfortunately the images are highly non-stationary and the use of a single KLT on the whole image does not achieve good performances. The segmentation is used here to adapt the KLT to the single cluster (see [2] for details). Using this approach, to reconstruct the image to the receiver, it is necessary to encode without loss the segmentation map. This is the factor that enables the effective performance of the previous classifications, even over the compressed bit-stream.

The image representation obtained after shape extraction enables also an object-based compression useful in the application in which the bit-stream has to be used for further classification. For instance, it is possible to compress in a near-lossless manner the forest areas, to obtain a reliable classification of forest species even on compressed data.

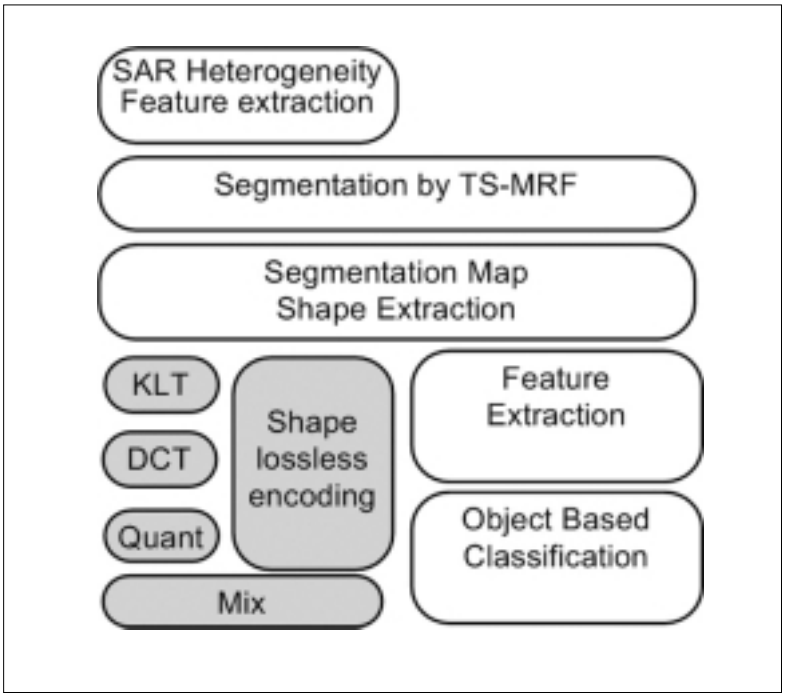


Figure 5: Segmentation-based image compression algorithm.

VI. Acknowledgements

The application presented here has been developed jointly with the following people:

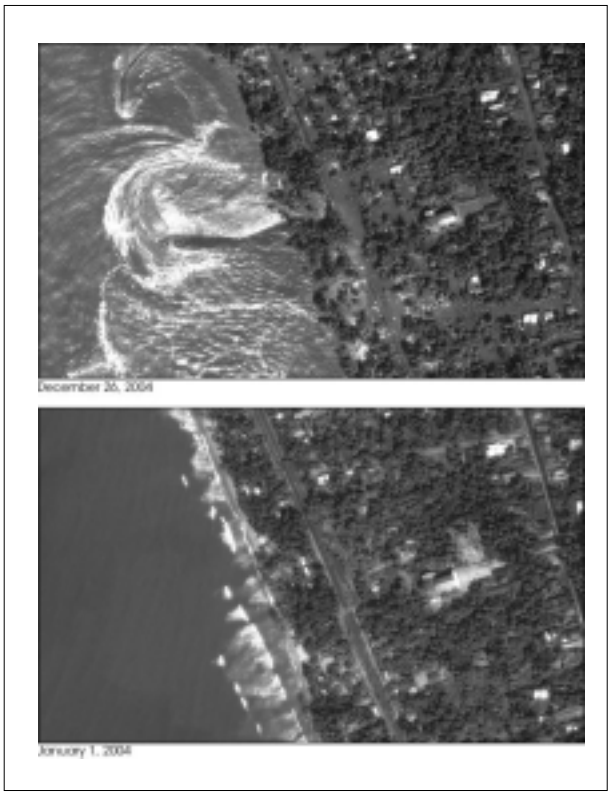
- Giovanni Poggi and Giuseppe Scarpa, University of Naples (reference 1 below).
- Francesco Tortorella, Mario Molinara and Claudio Marrocco, LIT LAB (reference 4 below).
- Claudio De Stefano, LIT LAB, and Angelo Marcelli, University of Salerno, Italy (reference 5 below).
- Virginia Puzzolo, European Commission – Joint Research Centre, Ispra, Italy (reference 6 below).
- Bruno Aiazzi and Stefano Baronti, IFAC-CNR, Firenze, Italy, and Luciano Alparone, University of Florence, and Gilda Schirinzi, LIT LAB (reference 7 below).

VII. References

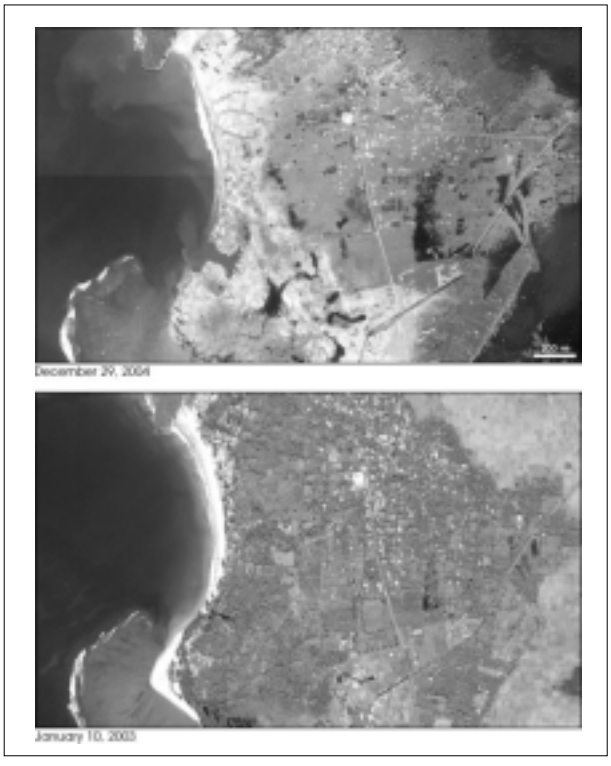
1. C. D'Elia, G. Poggi, G. Scarpa. A Tree-Structured Random Markov Field Model for Bayesian Image Segmentation. IEEE Trans. On Image Process., Vol.12, Nr.10, Oct. 2003.
2. G. Poggi, G. Gelli. Compression of multispectral images by spectral classification and transform coding. IEEE Transactions on Image Processing, Vol. 8, Issue 4, April 1999. Pages: 476 – 489.
3. B. Aiazzi, L. Alparone, S. Baronti. Information-Theoretic Heterogeneity Measurement for SAR Imagery. IEEE Transactions on Geoscience and Remote Sensing, Vol. 43, Issue 3, March 2005. Pages: 619 – 624.
4. C. D'Elia, C. Marrocco, M. Molinara, G. Poggi, G. Scarpa, F. Tortorella. Detection of microcalcification clusters in mammograms through TS MRF segmentation and SVM-based classification. 17th International Conference on Pattern Recognition. Cambridge (UK), August 2004.
5. C. D'Elia, C. De Stefano, A. Marcelli. A Dynamic Approach to Learning Vector Quantization. 17th International Conference on Pattern Recognition. Cambridge (UK), August 2004.
6. G. Cuozzo, C. D'Elia, V. Puzzolo. A Method Based on Tree-Structured Markov Random Field for Forest Area Detection. Proc. IEEE International Geoscience and Remote Sensing Symposium. Anchorage (Alaska), Sept. 2004.
7. B. Aiazzi, L. Alparone, S. Baronti, G. Cuozzo, C. D'Elia, G. Schirinzi. SAR Image Segmentation through Information-Theoretic Heterogeneity Feature and Tree-Structured Markov Random Fields. Proc. IEEE International Geoscience and Remote Sensing Symposium. To be published in July 2005.

4.2 Satellites show devastation by tsunami

On 26 December 2004, tsunamis swept across the Indian ocean, spawned by a magnitude 9.0 earthquake off the coast of Sumatra. Aside from Indonesia, the island nation of Sri Lanka likely suffered the most casualties, with the death toll reported at 21,715 on 29 December. The following image (top half) was captured by DigitalGlobe's Quickbird satellite, and shows the devastation around Kalutara, Sri Lanka, on 26 December 2004, at 10:20 am local time – about an hour after the first in the series of waves hit. A Quickbird image taken on 1 January 2004 (bottom half) shows the normal ocean conditions. Water is flowing out of the inundated area and back into the sea, creating turbulence offshore. Some near-shore streets and yards are covered with muddy water. It is



Tsunami strikes Sri Lanka. (Credit: Images Copyright DigitalGlobe).



Tsunami destroys Lhoknga, Indonesia. (Credit: Ikonos images copyright Centre for Remote Imaging, Sensing and Processing, National University of Singapore and Space Imaging).

possible that the image was acquired in a "trough" between wave crests. Imagery of nearby beaches shows that the edge of the ocean had receded about 150 metres from the shoreline.

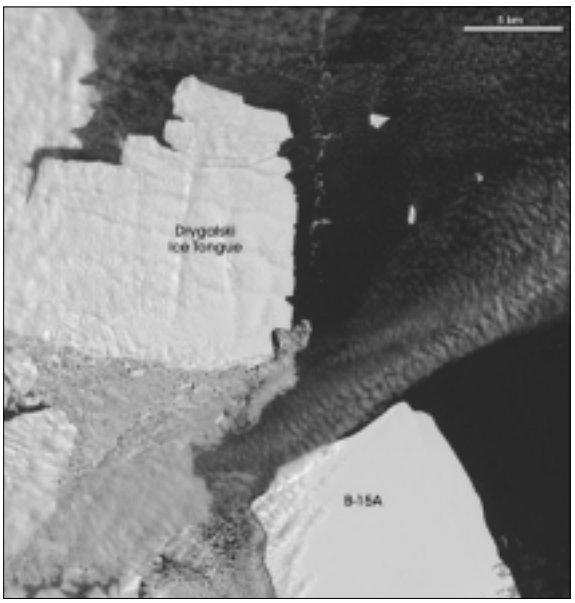
The Indonesian province of Aceh was hit hardest by the earthquake and tsunamis of December 26, 2004. Aceh is located on the northern tip of the island of Sumatra. The largest waves struck the north-western coast of Sumatra. The following two Ikonos satellite images were acquired on 29 December 2004 (top) and 10 January 2003 (bottom). As can be seen, the town of Lhoknga, on the west coast of Sumatra near the capital of Aceh, Banda Aceh, was completely destroyed by the tsunami, with the exception of the mosque (white circular feature) in the city's centre.

This article and images are from a report on the NASA web-site (www.nasa.gov/vision/earth/lookingatearth/indonesia_quake.html) on 10 January 2005.

4.3 Huge Antarctic icebergs on collision course

In early January 2005, it appeared that the B-15A iceberg was on a collision course with the Drygalski Ice Tongue, the floating portion of a glacier flowing off the Scott Coast of Antarctica and into the Ross Sea. Scientists and amateur Earth-observers checked satellite images of the region each day to monitor the northward march of the berg and to witness the impacts. Would it be just a "fender bender", or would the ice tongue shatter under the impact of the oncoming berg?

In mid- to late January, however, the berg's forward progress was arrested. After coming within just a few km of collision, the big berg appears to have run aground in the shallow coastal waters and is no longer headed for Drygalski. The Landsat satellite image below, captured on 23 January 2005, shows just how close the two icy giants came to each other. At upper left is the tip of the Drygalski Ice Tongue, while at bottom is the northern-most portion of the B-15A iceberg. The distance between them was less than 5 km on this day.



Landsat image of B-15A iceberg, acquired on 21 January 2005. NASA image created by Jesse Allen, Earth Observatory, using data provided courtesy of the Landsat Project Science Office (landsat.gsfc.nasa.gov) and the USGS EROS Data Centre (edc.usgs.gov).

The ice tongue and the iceberg have created something of a corral for the seasonal sea ice, which by this point in the season often would have already broken up and drifted away into the Ross Sea. Trapped sea ice is visible in the lower left corner of the scene. The parent iceberg of B-15A calved off the Ross Ice Shelf in 2000, and pieces of the berg have been influencing the circulation patterns in the region for several years.

4.4 Completion of SRTM-based global DEM

Compiled based on more than four years of processing data, NASA and the National Geospatial-Intelligence Agency (NGA) have completed Earth's most extensive global topographic map. The data, extensive enough to fill the US Library of Congress, was gathered during the Space Shuttle Endeavour Radar Topography Mission (SRTM) in February 2000. The digital elevation maps encompass 80% of Earth's land-mass. They reveal for the first time large, detailed swaths of Earth's topography previously obscured by persistent cloudiness. The data will benefit scientists, engineers, government agencies and the public with an ever-growing array of uses.

"This is among the most significant science missions the Shuttle has ever performed, and it's probably the most significant mapping mission of any single type ever," said Dr. Michael Kobrick, mission project scientist of NASA's Jet Propulsion Laboratory, Pasadena, California. The final data release covers Australia and New Zealand in unprecedented uniform detail. It also covers more than 1,000 islands comprising much of Polynesia and Melanesia in the South Pacific, as well as islands in the South Indian and Atlantic oceans. Kobrick said: "Many of these islands have never had their topography mapped. Their low topography makes them vulnerable to tidal effects, storm surges and long-term sea level rise. Knowing exactly where rising waters will go is vital to mitigating the effects of future disasters such as the Indian Ocean tsunami."

SRTM data are being used for applications ranging from land use planning to "virtual" Earth exploration. "Future missions using similar technology could monitor changes in Earth's topography over time, and even map the topography of other planets," said Dr. John LaBrecque, manager of NASA's Solid Earth and Natural Hazards Program, NASA Headquarters, Washington.

The SRTM radar system mapped Earth from 56 degrees south to 60 degrees north of the equator. The resolution of the publicly available data is three arc-seconds (1/1,200th of a degree of latitude and longitude, about 90 metres, at Earth's equator). The mission is a collaboration among NASA, NGA, and the German and Italian space agencies. SRTM's role in space history was honoured with a display of the mission's canister and mast antenna at the Smithsonian Institution's Udvar-Hazy Centre, Chantilly, Virginia.

To view a selection of new images from SRTM's latest data set on the Internet, visit: photojournal.jpl.nasa.gov/targetFamily/Earth. To view a new SRTM fly-around animation on the Internet, visit: www2.jpl.nasa.gov/srtm. To learn more about SRTM on the Internet, visit: www.jpl.nasa.gov/srtm. This article is from a report on NASA's Earth Observatory web-site (earthobservatory.nasa.gov) on 6 January 2005.

5 REVIEWS, PUBLICATIONS & REPORTS

5.1 Symposium: Space Services & Maritime Users

Joint EURISY / IAF Symposium on "New Space Services for Maritime Users: The Impact of Satellite Technology on Maritime Legislation", on 21-23 February 2005, in Paris, France

Dr. Rainer Reuter, University of Oldenburg

On 21-23 February 2005, EURISY and the International Astronautical Association (IAF) held a Symposium on "New Services for Maritime Users: The Impact of Satellite Technology on Maritime Legislation", at UNESCO in Paris. It followed a first conference on the same topic in Vigo (Spain) in June 2003, following the Prestige wreckage in November 2002 and driven by the dramatic oil pollution of the Spanish coast. The Symposium, attended by over 150 scientists and officials, focused on two topics: (1) state-of-the-art of RS for maritime transport security and safety, and resources exploitation; (2) recommendations for the preparation of a legal updating on maritime transport in Europe.

Particular attention was given to the current potential of RS in maritime transport. Much effort has been spent on Automatic Identification Systems (AISs) which make it possible to locate and identify vessels at sea. This is most relevant in coastal zones since, according to US Coast Guard information, 95% of all search-and-rescue operations take place within 20 nautical miles from the coast. Technologies are under development to extend automatic identification to a global scale, with two different approaches: long-range identification and tracking (LRIT) using transponders on ships for data links to shore-based stations via Inmarsat, and a continuous surveillance using satellite sensors with a high ground resolution, such as synthetic aperture radar (SAR) and multi-spectral optical imaging. While SAR is less sensitive to clouds and rain, optical imagery can only be used in clear atmospheric conditions. The information content of optical data enables ships to be identified based on their size and signature and often also their deck cargo. This makes optical sensors interesting candidates for these purposes.

Both on-ship transponders and satellite-borne imaging have specific advantages and drawbacks, which makes it difficult to give one of them a priority. It became clear that the most relevant application would be in the field of search and rescue. This would also necessitate a profound knowledge of environmental parameters. Beyond meteorological data, this includes data on ocean currents, necessary for predicting the trajectories of drifting objects in coastal waters. Networks of shore-based coastal radar systems (CODAR) for mapping currents up to 200 nautical miles from the shore have been set up in the US, and there is a need for these systems in other coastal zones as well.

Surveillance of marine pollution was addressed in several presentations, with the attempt to quantify accidental oil discharges and to predict the drift of oil spills. Again, SAR was considered to be most efficient due to its capability in cloudy conditions and high ground resolution, the PRESTIGE oil spill being a prominent example. It has been stressed however, that the oil spill from the ERIKA wreckage had not been visible in SAR images, presumably due to bad weather and submerged oil. Detection of small oil spills has been considered equally important, with the aim to identify polluters and hence to reduce the amount of controlled oil spillages.

Impressive annual maps on the basis of SAR imagery were prepared by the Joint Research Centre in Ispra, showing oil spills in the Mediterranean, the North Sea and several other coastal areas. The data were compared with reports from airborne surveillance and found to be in good agreement. SAR images, however, display the size of a slick but do not provide any means to derive data on the substance type and quantity present in a spill, and were therefore considered to be in support of aerial surveillance. Much emphasis should be spent on future basic research for im-

proving the information content of satellite data from marine pollution, to make satellites operationally suitable for this purpose. These topics would be relevant in the Global Monitoring for Environment and Security (GMES) initiative of ESA and the EC, and in the Global Earth Observation System of Systems (GEOSS) adopted by the Third Earth Observation Summit (Editor: see Section 3.1.2 of this Newsletter).

The International Charter Space and Major Disasters, initiated in 1999 by ESA and CNES and declared formally operational in November 2000, was appraised to be very efficient for an immediate acquiring and delivering of satellite data to the users in the case of disasters at sea. This included until today the tanker "Limburg" explosion in the Gulf of Aden in November 2002, the PRESTIGE accident in January 2003, and the earthquake and tsunami in southern Asia in December 2004.

In the area of development and implementation of EU legislation on maritime safety, maritime pollution by ships and security on board ships, the establishment of the European Maritime Safety Agency (EMSA) has been considered a very important step towards a further improvement of security and safety of maritime transport.

The participants at the symposium addressed a number of recommendations to decision makers of the EU, its Member States and other relevant international organisations. They cover the need for the establishment of operational services, which incorporate full use of space technologies for maritime safety and security; the further promotion of legislation regarding the use of space technologies for maritime activities by the EC; the creation and the operational long-term continuity of the required satellite observations through appropriate technical and financial proposals through the EC and ESA; and the initiation of European and international activities in the field of capacity-building, awareness creation, technology transfer and training aimed at maritime users both within and outside Europe including less-developed countries.

Internet links: Eurisy Association (www.eurisy.asso.fr); International Astronautical Association (www.iafastro.com); European Maritime Safety Agency (www.emsa.eu.int); International Charter Space and Major Disasters (www.disasterscharter.org).

5.2 Book Review: Elementi di Geomatica

"Elementi di Geomatica", by Mario Gomarasca. Published in Italian by the Associazione Italiana di Telrilevamento (AIT).

Reviewed by Sergio Dequal, Full Professor of Topography and Photogrammetry, Director of the Department of Engineering of the Territory, the Environment and the Geotechnologies (DITAG), Polytechnic University of Turin, Italy

"Geomatics" (from "Geo" - Earth, "Matics" - Information technology) is a neologism *(Editor: "neologism" = newly coined word or expression ☺)* which is more and more used, although still not universally accepted. The term includes all the disciplines of territorial and environmental surveying, and highlights the leading role which geo-spatial Information plays in them.

Geomatics includes topography in its most modern applications (measuring electronic devices, sophisticated techniques of data to analysis and network compensation, satellite positioning systems, laser scanning, etc.), analytical and digital photogrammetry, airborne and satellite remote sensing, numeric cartography, GISs, and decision support systems.

By reason of their affinity in scientific backgrounds and of the goals they set for themselves, these specialized sectors are intimately connected: a rigorous classification which considers them as separated and autonomous would not facilitate an understanding of the many common features among them, whereas the overall problem of surveying can find a solution.

On the other hand, the attempt by a single "know-it-all" author to deal in a single organic book with all the advanced subjects of all these complex and extremely specialized disciplines seems a daunting challenge, almost impossible to meet. Even in

the event that the author did overcome all these objective difficulties, the result would be an encyclopaedic work, composed by many volumes, similar to many, sometimes excellent books already available in Italy and worldwide.

The goal which Mario A. Gomarasca set for himself is, apparently, more unpretentious: to write a general introduction of the different features of surveying, containing the basic concepts of geomatics and its component disciplines in a simple and widely accessible form, describing meanwhile, in a rigorous yet synthetic way, the main instruments and methodologies connected to the numerous techniques today available.

The result is this full-bodied book, intended not for the super-specialists, but for the vast number of technicians and scholars who use Geomatics, or a part of it, in their professional or research daily activity. I am referring in particular to those technicians in charge of natural or anthropogenic territory (engineers, geologists, agronomists, architects, surveyors, town planners, people who work in the natural or architectural heritage preservation, governmental officers, etc.), and to bachelor or master degree students, who increasingly deal with subjects in which Geomatics' disciplines play a key role.

Mario A. Gomarasca is a CNR (Italian National Research Council) researcher who has always worked in RS, but more recently, and for several years, has filled the prestigious and demanding position of President of ASITA (Italian Federation of Scientific Associations for Territorial and Environmental Information). In this capacity, which he carried out with enthusiasm and great efficiency, he had the opportunity to come in contact with all the different features of geomatics from a privileged point of view, as he had to organise and coordinate the National Conferences where each year several hundred scientific works are presented, as a compendium of the intense research activity at the national level in the field of geomatics. As a result, his more specific competence in RS has been extended and enriched with those related with the others disciplines of surveying. In this Volume, therefore, the Author transfers his personal experience, deep in his main field of research but at the same time efficiently connected with the whole world of geomatics.

While it cannot be said that the specialist in a single sector will find new or in-depth elements in the chapter related with his specific discipline, at the same time it is certain that the same specialist will be allowed to get a valuable cross-section of information on the other disciplines in the other chapters.

The reader, whether a university student or a professional or a technician or a scholar, will easily find in the book both the main concepts and the most detailed information on the state-of-the-art, to face with a more broad-minded attitude, complex and multi-disciplinary problems concerned with the survey of the territory and of the environment in all its features.

In my opinion this goal is entirely achieved by this book and its author, Mario Gomarasca. I wish both the best of luck and the great success they deserve. The present edition is in Italian but perhaps, if the structure and organisation of the book are appreciated, it will soon be translated and published in English. It is up to the scientific and professional world to stimulate the author in this direction.

More details from: Mario A. Gomarasca (gomarasca.m@irea.cnr.it), National Research Council of Italy, IREA, Via Bassini 15, 20133 Milano, Italy Web-site: www.asita.it.

Foreword from the author:

This book, the first written in Italian on the subject, introduces several disciplines and techniques concerning "geomatics" (geospatial information). It serves as a stimulating reference book, leaving to the reader the opportunity to find more detailed and in-depth references. Many demonstrations and thorough analyses has been often omitted, giving however precise references for further readings. The wide and selected bibliography at the end of each chapter allows the reader to disentangle himself

through the extensive array of references available in the different fields.

Geomatics being a recent discipline, with not clearly defined borders, and open to many interpretations, I propose here my point of view, as an agronomist specialist in RS with an experience in the field of the environmental applications. This might raise approvals and criticism, beginning, I hope, a constructive scientific and professional debate.

The book does not expect to address the many issues raised by geomatics, but strives instead to offer elements of knowledge and inter-disciplinary starting points to contribute in a constructive way to deal with this complex world.

In many parts of this book I faced the problem of defining terms which subsequently are used several times. There is no doubt that it is a task of ontology (*Editor: "ontology" = the branch of metaphysics concerned with the nature of being* ☺) to try to put in order the large number of definitions and acronyms which are often used in a generalized and generic way. However, ontology being a young discipline in this field, and there not existing a universally accepted ontological dictionary, I found the definitions more widely used and accepted, and I reported them in the text, sometimes mediating between contrasting positions.

The book is oriented towards the people wishing to have an introduction to the Geomatics' disciplines and techniques (geo-spatial information), with particular attention to public administration, professionals, university courses, master and graduate courses, as was the case for my first book.

Mario A. Gomarasca (gomarasca.m@irea.cnr.it)

6 FORTHCOMING MEETINGS & COURSES

25-27 April 2005
Warsaw, Poland

4th EARSeL Workshop on Imaging Spectroscopy: New Quality in Environmental Studies
Web-site: www.wgsr.uw.edu.pl/zts/workshop/index.htm

17-20 May 2005
Hannover, Germany

ISPRS Workshop on High-Resolution Earth Imaging for Geospatial Information
Web-site: www.ipi.uni-hannover.de/ISPRS_workshop_05

NEW
22-26 May 2005
Algiers, Algeria

UN / Algeria / ESA Int'l Seminar on the Use of Space Technology for Disaster Management: Prevention and Management of Natural Disasters
Web-site: www.oosa.unvienna.org/SAP/stdm/stdm_planned.html

26-28 May 2005
Estoril, Portugal

AGILE 2005: 8th AGILE Conference on GIS Science
Organised by AGILE (Association of Geographic Information Laboratories in Europe), & held in conjunction with GIS Planet 2005 (see below).
Web-site: www.agile-online.org

30 May - 2 June 2005
Estoril, Portugal

GIS Planet 2005: 2nd Conference & Exhibition on Geographic Information
Held directly after AGILE 2005 (see above). Web-site: www.gisplanet.org

30 May - 3 June 2005
Borås, Sweden

ForestSat 2005: Operational Tools in Forestry using Remote Sensing Techniques
Programme: Workshop on Satellite RS for Forest Monitoring (30 May - 1 June), followed by Workshop on RS & GIS for Forest Authorities & field excursion (2-3 June). Contact: Prof. Håkan Olsson, Swedish University of Agricultural Sciences. E-mail: Hakan.olsson@resgeom.slu.se. Web-site: www.svo.se/forestsafe

6-11 June 2005 Porto, Portugal	**25th EARSeL Symposium: Global Developments in Environmental Earth Observation from Space** Web-site: www.fc.up.pt/earsel2005
9-10 June 2005 Porto, Portugal	**2nd EARSeL Workshop on Remote Sensing of the Coastal Zone** Web-site: las.physik.uni-oldenburg.de/workshop.html
10-11 June 2005 Porto, Portugal	**1st EARSeL Workshop on 3D Remote Sensing** Web-site: www.ipi.uni-hannover.de/html/aktuelles/workshop.doc
16-18 June 2005 Zaragoza, Spain	**5th EARSeL Int'l Workshop - RS & GIS Applications to Forest Fires Management: Fire Effects Assessment** Web-site: www.geogra.uah.es/earsel/
NEW 11-16 July 2005 La Coruña, Spain	**22nd Int'l Cartographic Conference and 13th General Assembly of the International Cartographic Association Theme for conference: "Mapping approaches into a changing world".** Web-site: www.icc2005.org
23-27 August 2005 Amsterdam, The Netherlands	**45th Congress of the European Regional Science Association (ERSA): Special Session on Modelling Land Use Change** E-mail: ersa2005@feweb.vu.nl Web-site: www.feweb.vu.nl/ersa2005
7-9 Sept 2005 Trier, Germany	**Int'l Conference - RGLDD / Remote Sensing & Geo-Information Processing in the Assessment & Monitoring of Land Degradation & Desertification: State of the Art & Operational Perspectives** Contact: Prof. Dr. Joachim Hill (hillj@uni-trier.de) or Dr. Achim Roeder (roeder@uni-trier.de), Remote Sensing Department Faculty of Geography / Geosciences, University of Trier, Behringstr., 54286 Trier, Germany. Phone / fax: +49-651-2014606 / 2013815.
7-9 Sept 2005 Brno, Czech Republic	**EnviroInfo 2005 / 19th Int'l Conference - Informatics for Environmental Protection: Networking Environmental Information** Organised by: Masaryk University in Brno, Centre of Biostatics & Analyses, Czech Republic. Web-site: www.enviroinfo2005.org
9-13 Oct 2005 Bonn, Germany	**Final Meeting of the Land Use & Land Cover Change project (LUCC)** Web-site: www.geo.ucl.ac.be/LUCC
17-19 Oct 2005 Beijing, China	**9th Int'l Symposium on Physical Measurements & Signatures in RS (ISPMSRS)** Web-site: www.ISPMSRS2005.org
NEW 15-18 Nov 2005 Catania (Sicily), Italy	**9th National Conference of ASITA (Italian Federation of Scientific Associations for Territorial and Environmental Information)** Web-site: www.asita.it