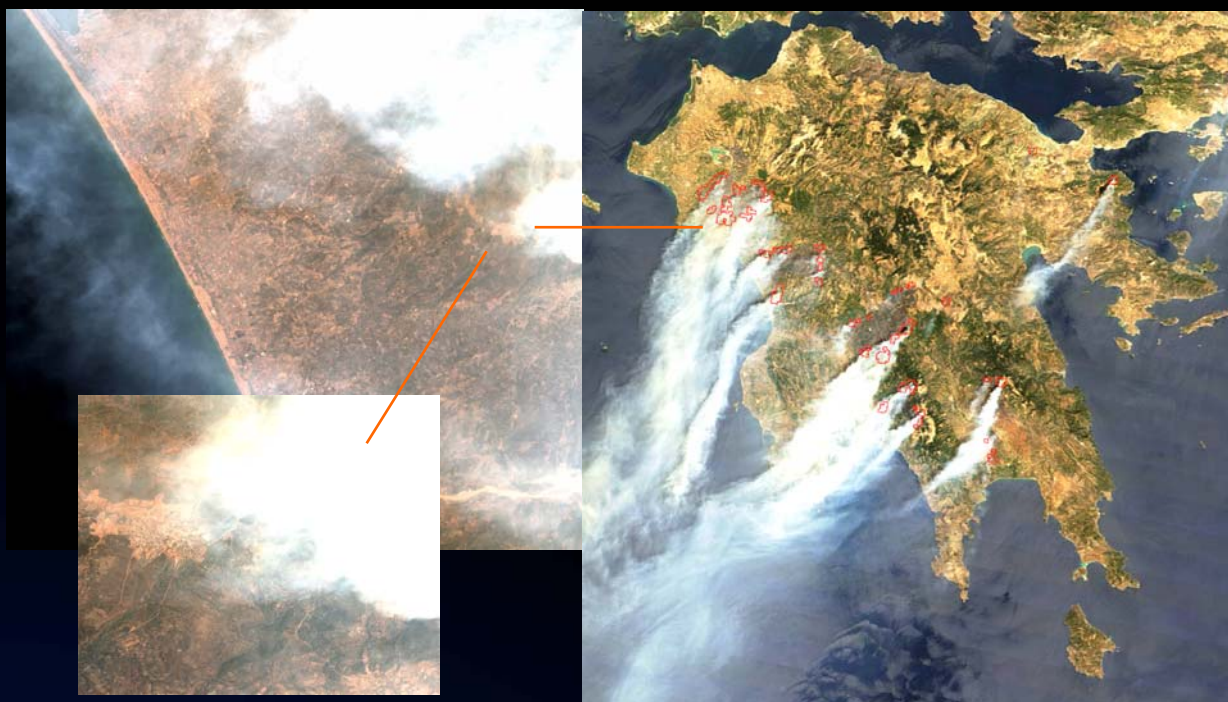


EARSeL



NEWSLETTER

March 2007 & June 2007
No 69 & No 70



European Association of Remote Sensing Laboratories

Front Cover – Forest Fires over the Western Peloponnesus, GR

Forest fires comprise a major issue, especially during the summer period throughout the Mediterranean: Despite the fact that this incident did not occur during the January – June '07 period, the delay in editing and printing of the newsletter made it feasible to incorporate in the last moment

- a. a true colour image of whole Peloponnesus, courtesy of MODIS Rapid Response Project at NASA/GSFC, obtained by the Terra satellite (26.08.07), and
- b. an IKONOS satellite image of forest fire fronts in Western Peloponnesus this August (28.08.07). The image is a kind donation of GEOINFORMATION SA (GR) via INTA SPACETURK.

EARSel Newsletter

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Laboratory/Company with 10 or more members	500€

The Newsletter is a forum for an exchange of news and views among the members of the Association. The opinions expressed in the Newsletter do not necessarily reflect the views of the editor, the EARSel Bureau or the other members of the Association.

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CONTENTS

1. EDITORIAL	5
2. NATIONAL REPORTS FOR 2006	
2.1 Belgium	6
2.2 Croatia	10
2.3 Czech Republic	11
2.4 Finland	13
2.5 France	14
2.6 Italy	19
2.7 Netherlands	21
2.8 Portugal	26
2.9 Sweden	28
3. NEWS FROM MEMBERS AND SPECIAL INTEREST GROUPS	
3.1 Institute of Methodologies for Environmental Analysis (IMAA) is part of the Italian National Research Council (CNR)	30
3.2 New member – Tartu Observatory, Estonia	30
4. NEWS ITEMS	
4.1 EARSel 27 th Symposium and related Workshops	31
4.2 ESA celebrates 50 years of Europe	33
4.3 QuikSCAT Marks Eight Years On-Orbit Watching Planet Earth	33
4.4 Ukraine to Launch Earth Observation Satellite in 2008	34
4.5 Transcontinental Wildfire Emissions Monitored from Space	34
4.6 African water project supported by space	35
4.7 Desertification and Drought Monitoring	36
4.8 GMES Sentinel	36
4.9 Space Council welcomes historic European Space Policy	37
4.10 Satellites shed light on global warming	38
4.11 Satellites play vital role in understanding the carbon cycle	40
4.12 Envisat Symposium 2007	41
5. FUTURE EVENTS	
5.1 b-GIS@Asia	42
5.2 Colloquium on Meteosat Second Generation (MSG)	42
5.3 Postgraduate certificate course “Applications of Earth Observation and GIS in Integrated Water Resources Management”	42
5.4 “Sustainable Solutions, Focus on Africa” Symposium	42

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1. EDITORIAL

General

Let us open this editorial by offering our sincerest apologies for the absence of the EARSeL Newsletter for the past six months. It has been a time of change for the newsletter and the disruption to the publication was, unfortunately, unavoidable. The editing duties have passed on the 27th of June 2007 from Dr. Keith McCloy, who has served the newsletter audience till December 2006, to an editorial collaboration between two Greek EARSeL members: the Department of Environmental Management of the Mediterranean Agronomic Institute of Chania (MAICh) and the newly registered Department of Planning and Regional Development of the University of Thessaly in Volos.

The editorial team would like to thank Keith for his services to EARSeL as newsletter editor and will endeavor to maintain the high standards that the previous editors and the EARSeL Community have set. We consider the EARSeL Newsletter to be the mirror of the European developments in Remote Sensing. It should be interactive and informative, informed and updated by its society and provide the information to all our colleagues across Europe. In this context, we would like to invite and welcome contributions, articles, and news from members and special interest groups.

About this issue

Since there was no publication in March, this issue should be considered as a double issue, covering more than six months of news and progress in the field of Remote Sensing. The size of the information was so vast that it was impossible to include everything in one issue, bearing in mind the limitation of space available. After long consideration we have opted to include the long overdue national reports for 2006, as they should have appeared back in March. We believe that EARSeL members should be aware of the progress and the endeavours of fellow institutes. Even though most institutes involved with Remote Sensing have some organisation at a national level and have established communication and information exchange pathways within the same country, news on the activities undertaken by such institutes find it hard to cross the national

borders. As a European Association, it is very important to convey this news beyond national boundaries, to every member of the Association. These national reports contain an abundance of news, that we are certain the readers will find particularly interesting.

Selected news and events presented in this issue focus primarily on recent items and topics that concern the broad audience. We would like to highlight the report on the 27th EARSeL Symposium and the related workshops that took place in Bolzano, Italy, and the 50 years anniversary of space exploration, celebrated by the European Space Agency in an event in Rome. Other news items include the growing environmental issues of global warming and desertification, as well as the agreement between the EU member states and the ESA, which will bring all ESA space activities and Member State space programmes under a single framework policy.

New members

We are delighted to announce the expansion of the EARSeL family by two members. These are the Institute of Methodologies for Environmental Analysis (IMAA), part of the Italian National Research Council (CNR) and the Tartu Observatory in Tõravere, Estonia, represented by Dr. Rosa Lasaponara and Dr. Andres Kuusk respectively. More information about both members can be found in the "News from Members" section.

Once again, thank you for your patience. We welcome comments, feedback, and suggestions, in order to serve the Association the best way possible.

Sincerely,

The Editorial Team

2. NATIONAL REPORTS FOR 2006

2.1 BELGIUM

CURRENT BELGIAN EO (EARTH OBSERVATION) RESEARCH PROGRAMMES

1. A new programme has started

On 3rd February 2006, the Belgian Council of Ministers approved the new STEREO II research programme "Support to Exploitation and Research on Earth Observation" (25.85 M€, 2006-2013). Spanning an 8 year period, the research programme for earth observation STEREO II is funded by the Belgian federal government and managed by the Federal Science Policy Office.

The objectives of the programme are:

- To consolidate Belgium's EO potential
- To promote innovation
- To create the capacity Belgian organisations need to ensure they are involved as much as possible in international research programmes and European and international EO activities
- To lend support to the Belgian EO infrastructure
- To develop an extensive form of interaction with users

The thematic research priorities are as follows:

- Global monitoring of vegetation and changes in large terrestrial ecosystems
- Environmental management (water, soil, forests, agriculture, coastal areas, urban areas and suburban areas)
- Health and humanitarian aid
- Security and risk management

What's new in STEREO II?

1) The governments of Belgium and Grand Duchy of Luxembourg signed an agreement for cooperation. The Luxembourgian Nation Research Fund (FNR) through the programme INTER (Promotion of International Cooperation) got involved in the STEREO II by investing 500 K€ to co-finance Luxembourgian scientific teams. Therefore, STEREO II is open to teams from the Grand Duchy of Luxembourg which are treated on an equal footing with Belgian teams at that exception that the first call they do not qualify for the coordination of a project.

2) Furthermore, cooperation of Belgian teams with other international scientific partners is made possible. A maximum 20% of the total project budget may be earmarked for international teams. 50% of the resources for this are provided by the programme, while the foreign partner is responsible for securing the 50% co-funding from other sources. The international partner(s) complement(s) the Belgian/ Luxembourgian teams and make(s) a substantial scientific contribution to the project.

3) This is also the first time that international administrations and NGOs headquartered in Belgium/ Luxembourg may take part in projects for developing products and services, provided they contribute min. 25% of the total project budget by way of staff, data, equipment or other.

The first call for proposals was launched on 6 April 2006 for an amount of 9 190 000 EUR (closure on 17 July 2006). This call focused on *five project types* dedicated to basic research with large *thematic projects* and small "satellite" projects such as *spin-off projects* and *innovation projects*, and dedicated to applied research with development of products and services with partnerships with *public administrations* or *private companies*.

From 37 proposals submitted covering all themes and type of projects, 15 proposals were selected for financing after a peer-reviewed selection process. The projects started on 1st January 2007. In total, 75 partners committed in STEREO II of which 21 international partners from Australia, Democratic Republic of Congo (DRC), France, Grand Duchy of Luxembourg, Italy, South Africa, The Netherlands, United Kingdom, CEMUBAC (DRC), JRC (Italy), UNEP (Kenya), UNOPS (DRC).

The next call for proposal was scheduled to be launched in April-May 2007 to start the projects in 2008. The call will also be opened to international partners. To be kept informed about this call, please send an email to the programme administrators (joost.vandenabeele@belspo.be and carine.petit@belspo.be).

2. News from STEREO I

In parallel, the STEREO I programme ended in December 2006. The total budget

dedicated to research on EO has been 11 M€ over a six years period, and in total 43 projects were financed. 65 % of the budget of our programmes has been used to build and consolidate 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 hyperspectral activities, and 1 % to shared-cost actions.

A final evaluation of the programme by external reviewers is planned in 2007 and a general publication on the final results of the programme is in preparation. If you want to get this publication, please send an email to martine.stelandre@belspo.be or yolande.deschepper@belspo.be.

3. Hyperspectral Remote Sensing.

Within the framework of the 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 hyperspectral flight campaigns of 2005, the Belgian Science Policy invited the Belgian and international teams involved to present the results in a workshop in Bruges (10 October 2005). At this occasion, the programme administrators presented the results of the four hyperspectral flight campaigns (2002-2005). The presentations are available on the web <http://telsat.belspo.be/documents/bruhyp2006.html>

The hyperspectral data from the four campaigns are available for a minimal fee (250€) for scientific usage only one year after acquisition: <http://campaigns.vgt.vito.be>.

In 2006, further to the 1st HyperTeach training course (<http://hyperteach.vgt.vito.be>), Belgian Science Policy Office supported the organization of two similar training courses in Jakarta (<http://tisda.org/hyperspectral2006/hyperteach.html>) and in Istanbul (<http://www.avrasya.itu.edu.tr/Kurslar/HyperTeach/Hyper/index.htm>).

These courses were intended to theoretically and practically introduce early-stage researchers and decision-makers to hyperspectral remote sensing. Three parallel sessions of hands-on exercises addressed water, geology and biodiversity specific applications. The courses were a great

success with more than 120 participants in total.

News from the FP6-SSA HYRESSA project (led by VITO, 10 partners) can be found on <http://www.hyressa.net/>. The project aims at improving the coordination of flight campaigns and increasing the use of hyperspectral images in Europe.

RELATED EO ACTIVITIES IN BELGIUM

1. Remote Sensing and Photogrammetry

(Geography, Ghent University, <http://geoweb.rug.ac.be/research/rs.asp>)
In 2006, the Geography Department at the Ghent University and VITO, in collaboration with BPPT (Agency for Assessment and Application of Technology of the Republic of Indonesia), have successfully finished their joint project on 'Monitoring of Coral Reef in View of Sustainable Island Development – Case Study using Hyperspectral Remote Sensing: Fordata, Tanimbar, Indonesia' which has been funded by the Belgian Science Policy Office. With the use of airborne hyperspectral CASI data, comprehensive information on the bathymetric structure of the Pulau Nukaha reef has been obtained as well as a detailed inventory of the dominant bottom types. Further information on the project can be found at: <http://tisda.org/fordate> or by contacting tony.vanderstraete@UGent.be or luc.bertels@VITO.be.

2. Institute for environmental management and land planning (IGEAT, Université Libre de Bruxelles, http://www.ulb.ac.be/igeat/igeat/ulb_igeat/hp_fr.htm)

Multi-resolution temporal study of imperviousness evolution in the Brussels-Capital region: A study was conducted for the Ministry of the Brussels-Capital Region to assess imperviousness evolution from the 1950s up to now in the Brussels-Capital region, with extensions following the limits of the watersheds. The results of the study are images of percent imperviousness at each date considered and statistics aggregating the figures on the level of the different spatial entities of interest.

3. GEMME - Georesources & Mineral Imaging (ArGEnCo, Université de Liège, <http://www.argenco.ulg.ac.be/gemme>)

GeMMe-MICA concluded two important remote sensing programs for geological exploration in the Andes Cordillera of Bolivia and Peru with the help of the Belgian WBRI

and the European ALBAN programmes. GeMMe-MICA lab broadened its expertise by using airborne hyperspectral and ASTER data in the monitoring of acid mine drainage and the identification of vegetation stresses around heavy industrial operations. Test sites in the Meuse valley (Seraing) and in Romania (Rosia Poieni) were more specifically investigated.

Together with specialists in geohazards at ETH Zürich, GeMMe-MICA developed spectral remote sensing tools and quantitative analysis of ASTER DEMs to identify former and potential landslides in the Tien Shan range (Kirghizstan). Last but not least, GeMMe-MICA convened the XIth International Congress for Mathematical Geology in Liege, from 3 to 8 September 2006 with a special focus on "Quantitative Geology from Multiple Sources".

4. Centre for Image Processing (VITO, <http://www.vgt.vito.be> and <http://cvblocal.vgt.vito.be>)

In 2006, the Centre for Image Processing hosted by VITO performed a calibration campaign to put in parallel the three systems of the former "Centre de Traitement d'Images VEGETATION" and finalized a common architecture at three levels: harmonization of the image processing chains with "clusters" of similar CPUs running in parallel, harmonization of archive systems and harmonization of algorithms to implement new rapid processing chains. New CD-ROMs "Vegetation: Special Image Collection" have been produced. To obtain a CD for free, please contact eric.gontier@vito.be or june.cools@vito.be.

5. VITO's UAV (<http://www.pegasus4europe.com/pegasus/index.htm>)

With respect to the Pegasus project a preliminary demonstration fly test was performed on 06/06 in Helchteren (Belgium) using a 40 % scale model equipped with a NADIR looking digital video camera. The main objectives of the test were to prove:

- the feasibility of the launch/landing procedure,
- the permanent control of the system during all the test period,
- the stability of the platform, and
- the correct data transmission as well as the good quality of the images.

Concerning the development of the light weight high resolution digital camera (MEDUSA payload) Vito has successfully

completed the "Phase B" and has already started the "Phase C/D". Finally, Vito has also organized the second international workshop "the Future of Remote Sensing" focusing on innovation in remote sensing. The meeting held in Antwerp on 18 and 19/11/2006 was attended by more than 100 people. During the second day participants had the opportunity to see the full scale Mercator-1 HALE UAV at the Verhaert Premises. The workshop was followed by a one day tutorial dedicated to the Pegasus system.

6. Remote Sensing Applications at Eurosense (<http://www.eurosense.com/>)

2006 was a fruitful year for the Remote Sensing applications at Eurosense. Even more important than its big growth, is the considerable R&D progress achieved in 2006. In fields like "land management", "change detection", "urban green monitoring", "security", "risk management" & "agricultural monitoring", new promising products were developed and existing ones were further fine-tuned to the user needs. The professionalisation of the object-oriented classification approach for HR & VHR satellite imagery, the further integration of SAR data in the basic Remote Sensing processing steps, the application development of aerial digital camera imagery, specific cross-border mapping and detailed product developments for the new agricultural control approach, are some examples of the promising achievements.

7. 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 (Optical and Radar Federated Earth Observation). The Belgian scientific EO community has been actively involved in 5 thematic working groups (Agriculture, Cartography, Civil security, Coastal zones, Forest). Since January 2006, 6 new methodological research projects (PhD and post-doctorates) have been granted for a total budget of 1.1 M€ working on simulated Pléiades and Cosmo-Skymed data. A first Belgian ORFEO workshop is planned to be organized in October 2007. To get more details about these new projects, visit our website performing the search on the research programme ORFEO at

<http://telsat.belspo.be/projects/projectsearch.asp>.

8. Belgian collaboration with UNESCO

Belgian Science Policy supported two scientific projects in collaboration with the programme "Earth Observation from Space" of UNESCO to edit a new map of Democratic Republic of Congo (SYGIAP project), and to develop an operational chain to monitor the coral reefs in Indonesia (KABAR project). The new national maps of Democratic Republic of Congo (1:2,000,000 and 1:3,000,000) were edited in March 2006 and officially delivered to the authorities of the Democratic Republic of Congo. These maps can be downloaded from http://www.enge.ucl.ac.be/cartes-DC/index_EN.html.

On 21 November 2006, a new cooperation agreement (2007-2011) was signed between Belgian Science Policy Office and the UNESCO World Heritage Centre. Under this agreement the Belgian Science Policy Office will, during a 5-year period, mobilize Belgian scientific expertise in using space technologies to assist State parties to the World Heritage Convention in acquiring the necessary capacity for managing World Heritage sites and in advanced technologies for restoration and rehabilitation techniques for cultural and natural sites. Under this new agreement, new pilot projects are planned focusing on developing a 3D temporal geographical information system for Calakmul in Mexico and working on the cartography of the main Andean route, Qhapaq Nan. A call for proposals was launched (closure on 31 January 2007).

9. PRODEX

Belgium is one of the biggest contributors to the PRODEX Programme, with over 150 projects funded by PRODEX and a contribution of 17.25 M€ in 2006. A complete list of PRODEX funded projects in Belgium is available under <http://www.sci.esa.int/science-e/www/object/index.cfm?fobjectid=33653>.

MEDUSA: The first flight of the Belgian HALE-UAV Mercator-1 is planned for summer 2007 (3 days over Flanders at an altitude of 15 km). During this first flight, an ultra-light payload is foreseen on board: the Medusa miniaturized camera (0.6 kg, PAN+XS, 30 cm spatial resolution). This camera is developed by VITO in cooperation with OIP Sensor Systems through a PRODEX project. Phase B was successfully achieved in September 2006 and the timing of phase C/D is strictly respected.

APEX: The APEX airborne imaging spectrometer is developed by a Swiss-Belgian consortium through a PRODEX project. After one year of negotiations, the CDR was closed in November 2006 and the industrial additional costs were approved by both countries. Phase D started officially and would last over 2007-2008. The first test flights are planned for end 2008 as well as the exploitation phase of 5 years from 2009 to 2013.

ALTIUS: A new PRODEX project was launched on 1st January 2007 to develop, to build and to fully exploit a limb imaging spectrometer on a micro-satellite platform (2007-2017). The goal of the Atmospheric Limb Tracker for Investigation of the Upcoming Stratosphere (ALTIUS) is to fill the dramatic gap expected in the number of atmospheric vertical sounders that will be operating in the next 5 years and to promote the full limb observation method as the future most efficient remote sounding technique to monitor the Earth's upper atmosphere. The Belgian Institute for Space Aeronomy (BIRA-IASB) is responsible for leading and coordinating all project phases from the feasibility studies up to the operational exploitation of the retrieved data.

10. EUMETSAT

Belgium participates still in 4 SAF's: Land, Climate, Ozone and Atmospheric Chemistry, Hydrology.

11. Events organized in Belgium

The 5th EARSel workshop SIG IS workshop on "IMAGING SPECTROSCOPY: innovation in environmental research" (<http://5the.arselsigis.vgt.vito.be>) will take place on 23-25 April 2007, Oud Sint-Jan, Bruges, Belgium.

MULTITEMP-2007 – Fourth Bi-annual International Workshop on the Analysis of Multi-temporal Remote Sensing Images (<http://www.biw.kuleuven.be/multitemp2007/>) will take place from 18 to 20 July 2007, Leuven, Belgium.

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2.2 CROATIA

Remote sensing and GIS activities in Croatia in 2006 were concentrated on the following disciplines: oceanography; forestry and agriculture; hydrology and meteorology; geology-mineral exploration; cartography; and archaeology.

Oceanography

Within the ADRICOSM-extension project, research activities regarding the spatial and the temporal variability of the sea colour were carried out on the basis of the pigment concentration, defined by using the MODIS satellite. The satellite data have been compared to the fluorescence data measured *in-situ*. This project was carried out at the Oceanography Institute in Split, in co-operation with the Institute of Geophysics – University of Zagreb and the Ruđer Bošković Institute of Marine Research. The project involved relevant institutions from Italy, Slovenia, Bosnia and Herzegovina, Albania and Montenegro.

Similar results were furthermore obtained within the ITHACA project, executed by the experts from the Institute of Geophysics – University of Zagreb and the Croatian Hydrography Institute.

Experts from the Oceanography Institute, in co-operation with NATO experts, were involved in the DART project, in the framework of which optic and other oceanographic measuring had been carried out in the Manfredoni Bay. In these research activities, satellite images were used. The reports on the aforesaid projects have been published.

Forestry and agriculture

Several areas in Croatia (Lika, Spačva Basin) had been aerially photographed using the infrared colour technique. These photographs were then used for developing photointerpretation keys in the said areas, which comprise the main tree species (English oak, ash, beech, fir, cypress).

The photointerpretation keys, developed on the basis of infrared images and terrestrial prospects, include the following: tree species, damage evaluation, tree photographs, location sketches, etc. They had been developed in order to enabling the evaluation of the damage suffered by individual (in the aerial photographs).

The processing of the IKONOS images (Pan+ MS) for the area of Spačva Basin is

underway. The results obtained after having interpreted these images are to be compared to the results obtained after having analysed the aerial photographs made by using the infrared colour technique.

The project entitled the *Dynamic Geo-information Survey of the Croatian Forest Ecosystems* is underway. For the purpose of this project, the LANDSAT ETM images were acquired for the whole of the Croatian territory. These images were then used for updating the vegetation covering and the land exploitation method, presented in the previously developed terrestrial data.

Hydrology and meteorology

The international CONEX II project, the follow-up to the CEI-Nowcasting system project, was finalised. The experts from the Croatian Meteorological and Hydrological Service in Zagreb, together with foreign experts from Austria, Hungary, Slovakia and Slovenia, were involved in the project activities. The project objective was to adjust the existing nowcasting methods and products to the data acquired via Meteosat Second Generation – MSG. Moreover, new fog-analysis products were developed as well as the method for recognising the convective clouds was verified and compared to the Rapidly Developing Thunderstorm method. The project resulted in the developing of operational methods for analysing the satellite data and nowcasting, used in the everyday work of the Croatian Meteorological and Hydrological Service in Zagreb.

The work on the EUMeTrain project is underway, involving not only the Croatian experts, but also the experts from Austria, Germany, Finland, the Netherlands and Great Britain. The project topic is creating computer-teaching material, based on the interpretation of the satellite images acquired via meteorological satellites. Within this project, the teaching module entitled “Upotreba vertikalnih presjeka u meteorologiji” (*the Use of Vertical Cuts in Meteorology*) was created.

Geology-mineral exploration

In the framework of the geological research, both aerial photographs and satellite images were used. The aerial photographs were used for the purpose of designing the geological map of the city of Zagreb (The Croatian Geology Institute), whilst the satellite images were used in the context of the oil-related geological research in Croatia

and Syria. The images were particularly useful in: defining sections 2D and 3D of seismological profiles; developing the digital elevation model (DEM); deciphering the vegetation covering; and developing the height profile (INA-Naftaplin).

The firm GEOSAT Ltd. from Zagreb had acquired and digitally processed the Terra-ASTER and the QuickBird satellite images. The processed images were subsequently successfully used for the mineral exploration of the metallic deposits in the territory of Kurdistan (Iraq). These images were of great help in the topographic orientation and the field data entering as well as in the solving of geological and structural relations and the recording of the high mineralisation zones.

Cartography

Aerial photographs were successfully used for designing topographic maps in the scale 1:25 000 (TK-25) for individual parts of Croatia. The photogrammetric aerial photographing of the Croatian northern Adriatic coastal area (Istria and Hrvatsko primorje) was carried out. The orthophoto maps in the scale 1:2000 (DOF 2) were designed for individual parts of the protected coastal area. Furthermore, digital orthophoto maps in the scale 1:5000 were also designed. Within the programme of the cyclic aerial photographing of Croatia, the area of Lika was aerially photographed; in addition, the air-triangulation of the cyclic aerial photographing of the southern part of Croatia was carried out.

Archaeology

Aerial photographs were used in the archaeological explorations carried out on several localities: Krk, Torčec, Gorski Kotar, Crikvenica, etc. Based on these explorations, Bartul Šiljeg M.Sc. defended his doctoral dissertation at the University of Zagreb on 6th February 2006. The dissertation was entitled "Proučavanje kasnoantičke naseljenosti Hrvatskog primorja primjenom metoda daljinskog istraživanja" (*the Study of the Late-ancient-time Population in Hrvatsko primorje by Using the Remote-sensing Methods*).

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2.3 CZECH REPUBLIC

Data collection and products

Long history of aerial photographs and small size of the Czech Republic are probably the main reason why aerial data are very often used by local users. History of aerial photographs started before the II World War and continued after the war organized by the military service having a large archive. After 1989, private companies started to collect aerial data where the most important of them – Geodis is a leading company in photogrammetry, geodetical measurements, 3D modeling of towns (Prague, Brno, Ostrava, etc.), and laserscanning, producing also processed satellite data in the form of orthomaps with 7 m pixel size based on panchromatic data and TM of Landsat 7 data.

Orthophotomaps of the Czech Republic in true colors are available with 50 cm pixel size since 2001 and 20 cm pixel size since 2006 with 3 years updating. The company range of services is possible thanks to human power of the company comprising 300 people in the Czech and Slovak Republics. Their comprehensive activities have been forming the Geodis to be one of the most important company in the world not only by their variability of products, but also by the interface between them and their customers. The customers can follow its whole photograph processing using TerraShare® software already for several years, they can use internet sale etc.

Other photogrammetrical companies are smaller and focused on special tasks. As an example of them, Topol Software can be mentioned with brand new software combining photogrammetrical experience and laser scanning data processing.

A special part of regular evaluation are aerial photographs of brown coal open cast in northern Bohemia with hundreds of hectares made regularly several times per year. Satellite data are used for individual projects – for pervious and impervious areas in Prague to update data for rainfall-runoff models in its quickly developing suburbs, e.g.

The Czech Office for Surveying, Mapping and Cadaster uses orthophotomaps (in the Czech map layout in 1:5000 scale for two main purposes:

- evaluation of blocks of agriculture areas forming parts of private owners demanding donation for agriculture production from European Union (project IACS);

- update of topography of vector data of the Basic database of geographic data (ZABAGED) covering the Czech Republic with 1:10 000 scale map detail. Stereophotogrammetrical evaluation has been updating altimetry using DTM with 1m rms since 2005.

In 2006, a pilot project of aerial photography was performed by the Vexcel UltraCamD digital camera in 1:27 780 and 1:55 560 scales on 2000 km² to verify the possibility to replace analog data by the digital ones.

Research activities

Research activities can be found at universities in Prague, Brno and Ostrava, and at the Academy of Science. The research in Prague (CTU) and Ostrava (TU) is focused on change detection determined from various satellite optical and radar data. Examples of change detection are processed for simplifying methods and exact determination from data for individual cases. These methods are applied for modeling rainfall-runoff from catchment combined with hydrological and hydrogeological models, e.g., for land cover changes caused by highway networks, etc.

Interferometry was implemented for land subsidences in large undermined areas in northern Bohemia at CTU Prague. The main focus of the Workgroup for remote sensing of vegetation processes (the Institute of Systems Biology and Ecology, Academy of Sciences of the Czech Republic, ASCR) of the research is physically based retrieval of biophysical and biochemical parameters of vegetation from hyperspectral remote sensing image data.

Quantitative parameters, representing also bio-indicators of the actual vegetation state, are currently mainly leaf area index (LAI) and total concentration of green photosynthetically active pigments (chlorophyll a+b). The workgroup is (with the Argus Geo System company) operating the airborne hyperspectral sensor AISA Eagle, acquiring image data in visible and near infra red part of the electromagnetic spectra. Using this data of high spatial resolutions, the specialists are capable to estimate spatially the indicated bio-parameters by means of radiative transfer modeling at the

leaf (PROSPECT model) and crown/canopy (DART model) level.

Their current and future development is up-scaling of these approaches to the satellite remote sensing data with coarser spatial resolution. In the framework of co-operation between the Laboratory of Photogrammetry (Faculty of Civil Engineering, CTU in Prague) and the Laboratory of Quantitative Methods of Monuments Research (Faculty of Nuclear Physics and Physical Engineering) and the Institute for Monuments Care new methods of 3D objects documentation based on 3D scanning instruments are used. There are two types of 3D scanners in this time. The first type, well known as a laser scanner, uses laser technology "time of flight". The second type uses triangulation method. The former is used only as a point or profile marker and the path of laser is processed from a digital image to 3D co-ordinates, the latter uses two digital cameras and image projector as a structured light source. Since 2003, Callidus laser scanner has been also using in the Laboratory of Photogrammetry. Next, various devices for 3D object co-ordinates capturing are being developed at present on the CTU in Prague.

The laser scanning technology was used for the Charles Bridge in Prague documentation. The Charles Bridge is a worldwide well-known historical monument being on the World Heritage List (UNESCO) together with the historical center of Prague. During 2002 catastrophic flood its certain parts were damaged. A decision about a gradual reconstruction was taken. The first logical step was to create a complex documentation of the bridge. From the last reconstruction in the seventies of 20th century, the documentation is not complete, some parts have not been found and its quality is not sufficient. The major measurements were made in 2005. The laser-scanning technology was used for determination of the bridge form lines and edges. The "wire 3D model" was created from the laser-scanning data set. Using digital photogrammetry, the detailed 3D model with all individual stones was created. About 2000 images, more than 1000 geodetically measured control points; a boat and special climbing equipment were used. About 70 000 stones were processed in the 3D model in AutoCAD. As the second step, a special database of stones (quality, material, exposition, damage) was created.

Education of remote sensing

Education is prepared by universities in Prague (3), Brno (2), Ostrava (1), Plzeň (1), Ústí nad Labem (1). Their students study remote sensing, photogrammetry, GIS, image processing as a part of more general and wider knowledge range if compared to students in EU, e.g., being students of survey, environmental engineering, forestry, cartography, etc. The more general system of education is a continuation of historical development in the small country in Europe whose university specialist had a small working power market formed by 15 million people in Czechoslovakia without possibility to look for foreign employment.

The National Representative

2.4 FINLAND

General

The national space strategy for 2005-2007 emphasises increasing the utilisation of satellite technology, positioning, and remote sensing in commercial activities. Participation in major European space programmes and strong research groups are considered vital to achieve these goals. Annual public funding of space activities is presently approximately 48 M€. TEKES, Finnish Funding Agency for Technology and Innovation (supporting R&D for commercial and operational activities), and the Academy of Finland (supporting basic research) are the main public funding sources for remote sensing research along with the European Space Agency, European Union and EUMETSAT. Finland's contribution to ESA's remote sensing programmes is about 5 M€ and that to EUMETSAT is 3.7 M€. TEKES and the Canadian Space Agency (CSA) provide in 2005-2007 funding to joint Finnish-Canadian remote sensing projects. The second Call for Proposals will come out soon. The national Remote Sensing Symposium 2006 had about 100 attendees.

Helsinki University of Technology, Laboratory of Space Technology

(TKK/LST; <http://www.space.tkk.fi>)

TKK/LST has developed an airborne L-band (1.4 GHz) aperture synthesis radiometer HUT-2D for remote sensing of land and sea. The radiometer consists of 36 receiver/antenna subsystems, a correlator and a calibration subsystem. The first images

using HUT-2D were acquired over coastal areas near Helsinki. The flight models of the reference radiometer of the ESA SMOS (launch 2007/2008) radiometer, manufactured by Elektrobit Microwave Ltd., have been tested by TKK/LST. The units went through an extensive campaign including characterization, vibration, thermal vacuum cycling and EMC tests. During the project TKK/LST has developed new radiometer measurement and calibration techniques. The reference radiometer is a decisive factor for the performance of SMOS. The testing of the SMOS Calibration Subsystem (CAS) flight model units has been completed, including an exhaustive characterisation campaign as well as standard environmental tests.

In the POL-ICE project the use of a 1-D thermodynamic sea ice model (HIGHTSI) was determined to help understand the behaviour of time-series of RADARSAT C-band HH-polarization backscatter data for the Baltic Sea level ice under varying weather conditions. A simulator for ASIRAS (airborne version of the ESA near-future space-borne CRYOSAT altimeter) sea ice measurements is under development. In the NewSAR project, methods and tools for processing data from the new polarimetric generation of SAR satellites are developed, including polarimetric indices, polarimetric interferometry, and classification methods for land, snow, sea ice and forestry applications.

TKK/LST has developed an operational snow-covered area estimation method based on space-borne C-band wide-swath SAR imagery. The method has been validated and it is in semi-operational use in the national operational watershed simulation and forecasting system. In the EUMETSAT-funded H-SAF project (Satellite Application Facility on Support to Operational Hydrology and Water Management) TKK/LST develops European-wide snow mapping methods for non-mountainous areas, based on space-borne microwave radiometer data augmented with weather station measurements using assimilation techniques.

TKK/LST has used its airborne 36.5 GHz polarimetric radiometer to investigate retrieval of wind speed and direction from polarimetric data over the Gulf of Finland. The effect of incidence angle to the retrieval process has been studied in detail in order to improve retrieval accuracy. A method for simulation of dielectric rough surface scattering has been developed. The method employs a new combination of techniques

to make the computation efficient enabling simulation of large areas of, for example, ocean surface.

Geological Survey of Finland (GTK)
(<http://www.gtk.fi>)

The Remote Sensing group of GTK has in 2006 investigated satellite image data for mineral exploration and carried out close reflectance studies and methodological development for mineral exploration and mining. Remote sensing monitoring using LANDSAT satellite data were studied to find kimberlite related features in northern Finland.

The close VSWIR (400-2500 nm) reflectance studies on bedrock drill cores and crushed rock have proved to be an effective tool. Hydrothermal alteration halo and vectors towards gold mineralization were detected in northeastern Finland. The results were validated in laboratory using automatic Mineral Liberation Analysis techniques. Quantitative assessment of apatite ore minerals using close VSWIR reflectance of mineral powder mixtures resulted in the determination of the main component minerals with an average error of 1.3 %. The reflectance method need well-documented training objects, but once the objects are ready, the method is very quick when compared to any other analysis method.

Results from 366 VSWIR reflectance measurements on drill-core, mineral ore samples have been added to the local mineral spectral library of GTK.

**Helsinki University of Technology,
Institute of Photogrammetry and Remote
Sensing (TKK/IPARS)** (<http://www.foto.hut.fi>)

Basically all activity of the institute is based on images used for both acquiring and managing geoinformation. Research topics include image analysis and pattern recognition, photogrammetric mapping, digital photogrammetry, interpretation and classification methods, automated measuring procedures, and system development for photogrammetric on-line control and 3D digitizing. Focus is on application of laser scanning of rural and urban environment, 3D digitizing using video imagery, the use of projective transformations for analytical photogrammetry, networking of parallel processes for geometrical image analysis, and the use of neural networks in the classification of image information.

Some examples of research include: (a) imaging systems-related research include development of an optical spherical imaging system and studies concerning its photogrammetric applications, and 3D georeferencing of imagery, (b) a 3D virtual reality and documentation system has been developed mainly under archaeological FJHP99 Finnish Jabal Haroun Project, (c) radar-related research has been concentrated on SAR interferometry, to its use in geodetic applications like land movement and up/downlifting, (d) laser-related research has been focused on quality aspects of laser data, its use in forest inventory and change detection with digital images and applications for civil engineering, and (e) data fusion methods have been studied using spaceborne optical and microwave imagery.

The Institute will host together with the Finnish Geodetic Institute the ISPRS Workshop on Laser Scanning 2007 and SilviLaser 2007 on 12-14 September 2007.

**University of Turku, Laboratory of
Computer Cartography (UTU/LCC)**
(<http://utu-lcc.utu.fi>)

The facilities of UTU-LCC have been utilized in 2006 by international projects covering e.g. biogeographical analyses of Western Amazon and studies on the interaction between landscape and nature-human processes in Zanzibar. In Finland, the researchers of the EXTREFLOOD project have developed GI-analysis for flood hazard mapping to re-determine the risks of damages involved in extreme flood events. An Internet service (<http://www.lounaispaikka.fi>), which provides quick access to a variety of Geographic Information concerning south-western Finland, has been further developed by the EU Life Environment project ENVIFACILITATE.

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2.5 FRANCE

Funding and supporting Earth Observation research and technology

CNES, the French Space Agency, develops most of its remote sensing programme in bilateral and multilateral cooperation, as

developed hereunder. A priority is given to programmes developed within the ESA Convention. CNES is a major financial provider of the European Space Agency.

In the 2000's, the CNES financial figures are about the same from one year to another one. CNES grants some 20 to 25% of its budget to sustainable development programmes and to the science sector (which are directly relevant to remote sensing).

The French national budget for Earth Observation is approximately shared between 60% for the defence sector, and 40% for the other sectors. This budget exceeds some 200 M€.

France has reaffirmed its proactive policy and intention to sustain its pivotal role in European space, materialised by an annual contribution of 685 million euros to ESA programmes until 2010. This annual contribution includes some 70 million euros specifically devoted to Earth Observation.

French Scientific Remote Sensing Programme (PNTS)

The **PNTS**¹ programme associates a wide part of the Earth Observation scientific community in operations lasting several years. It aims at developing methodologies designed to prepare the use of satellite data by scientists, promoting the implementation of operational methods, and assessing and assimilating space data in complex models. The 2002-2006 PNTS programme is focussed on two axes: (i) understand the physical phenomena underlying the observed signals and (ii) signal processing including assimilation. It also aims at supporting the development of new instruments and methodologies related to present and future space missions and instruments. The main themes are:

- Developing the use of POLDER/ADEOS, SPOT5, VEGETATION, MERIS/ENVISAT in the solar spectrum domain, altimetry (ERS, ENVISAT, TOPEX-POSEIDON, Jason), scatterometers and SAR (ERS, ENVISAT) in hyper frequency domain,
- Preparing such missions as MSG, ORFEO (PLEIADES HR + COSMOS-SKYMED), AMSU and IASI onboard METOP,
- Preparing international missions and their data scientific exploitation : SMOS and ADM-AEOLUS (wind Doppler Lidar) from ESA, CALIPSO with NASA, ADEOS-2 mission instruments from NASDA, EOS/TERRA,

¹ Programme National pour la Télédétection Spatiale.

AQUA et AURA from NASA and missions from other space agencies,

- Methodological developments for SAR imagery use and radar interferometry, ENVISAT polarimetric SAR, sub-metric X band data analysis, merging SAR and high resolution optical images, in particular object oriented studies – especially in towns.
- Methodological development for 2D submetric resolution use, including pixel, object and scene static and dynamic modelling and multiscale information merging.
- Methodological development for 3D high resolution use: setting up 3D models, especially in towns; monitoring 3D natural moves (ice, landslides, torrential lavas...)
- Space mission definition studies, such as ESA «Earth Explorer" missions, NASA ESSP (Earth System Science Pathfinder) missions de la NASA or CNES microsatellites missions, as well as accompanying studies for existing or planned missions.
- Methodological issues related to processing data from innovative present (CHAMP, GRACE, OERSTED) or future (GOCE, SWARM) gravity and magnetic field measurement missions, within an overarching vision taking into account space borne and in situ measurements.
- Developing the use of the DEMETER mission datasets, in particular their correlation with seismic or volcanic phenomena.
- Developing methodological processing of mono- or multi-sensor and temporal data series to delivering information related land use and land cover evolution in line with the LUCS international programme.

High-resolution optical sector systems and scientific preferential data policy

In this field, France runs both the civilian SPOT and military HELIOS systems:

- The **HELIOS-2A**² satellite has been operational since April 2005. It features sharper imagery, improved viewing field and access time to information, as well as an infrared capability for night imaging. Its ground segment has been enhanced as well.
- The **SPOT**³ constellation currently includes three satellites (2, 4, and 5). End 2006, the related archive includes more than 15 million scenes (including more than 100 million km²

² **HELIOS**, sun-synchronous satellites, are named after the Sun God in Greek mythology, supposed to see everything.

³ Satellite Pour l'Observation de la Terre.

of stereoscopic coverage by the HRS instrument). More than 32.000 scenes were produced by SPOT IMAGE in 2006. The Charter on Space and Major Disasters⁴ was activated 24 times. In November 2006, the highly beneficial and successful SPOT International Users Conference convened 316 participants from 58 countries.

- As a follow-on to SPOT, CNES has associated with Italy to implement the **ORFEO**⁵ programme that eventually will consist of several small compact satellites. This dual-use (military and civilian) programme includes a high resolution optical instrument developed by France (Pléiades-HR), and an X-band radar element (3-12 cm wavelength) developed by Italy (Cosmo-Skymed). The first **Pléiades-HR** satellite should be launched in 2008, the second one in 2010. Pléiades will ensure the continuity and enhancement of wide field observations after SPOT-5, in panchromatic and multispectral bands.

- The **ISIS**⁶ programme (CNES) that grants the European scientific community an easier access to SPOT space imagery through preferential rates is reserved for French users. Since 1 February 2005, European researchers can access the new **OASIS**⁷ programme, which allows the scientific community of 32 countries to use SPOT products for free. In 2006, these two programmes delivered respectively 529 and 290 scenes to researchers.

- Two **VEGETATION** instruments are currently flying onboard SPOT-4 and 5. They offer long-term (beyond 10 years), medium resolution (1.1 km) and wide field (2,200 km) observations, with a typical daily revisit period. VEGETATION is designed for both operational and scientific aims.

- France cooperates with Israel in the **Venus**⁸ research mission, dedicated to Earth Observation (especially vegetation and sustainable development applications). Scheduled to be operational in mid-2009, the Venus micro-satellite will cover every other day more than 50 representative sites of the main terrestrial and coastal ecosystems in 12

spectral bands, in the visible and near infrared regions.

Geodesy and 'Solid Earth'

Five **Doris**⁹ instruments are currently flying. In its latest configuration, Doris enables a 1 cm accuracy positioning and a few yearly mm for the motion of its 55 ground stations. Enhanced Doris instruments are planned to be used in future missions such as Pléiades, Jason-2 and Altika. The Doris tracking network is being modernised using third-generation antennas and improved beacon monumentation.

Developed by France and the USA, the **ARGOS** system has been operational since 1978. This system allows to determine the accurate position of any object equipped with Argos beacons and to collect any information transmitted by them. This unique system is exploited worldwide by CLS, a subsidiary of Cnes and Ifremer¹⁰. The last instrument of the second ARGOS generation was carried on board of the US NOAA-N satellite launched on May 20th, 2006. The first third generation instrument was carried on board of METOP (see hereunder) launched on October 19th, 2006.

Geomagnetism: France has been cooperating with Denmark in the still operational **OERSTED**¹¹ mission and will contribute to ESA's **SWARM** mission, scheduled for launch in 2009.

Gravity: France collaborates with the three main dedicated gravity missions of the decade, i.e.: currently with Germany for **CHAMP**¹² and with the US **GRACE**¹³ mission, and in the future with ESA's **GOCE**¹⁴ mission.

Study of electromagnetic and ionosphere disturbances: Scientific results of CNES DEMETER¹⁵ micro-satellite have been acquired since 2005 and confirm the relevance of the high quality data obtained. These disturbances are believed to be correlated with Earth crust phenomena.

⁴ The French Space Agency is a founder member of this international Charter.

⁵ Optical and Radar Federated Earth Observation.

⁶ Incitation à l'utilisation Scientifique des Images Spot.

⁷ Optimising Access to SPOT Infrastructure for Science.

⁸ Vegetation and Environment Monitoring New Micro-Satellite.

⁹ Doppler and Radio Positioning Integration by Satellite.

¹⁰ French Research Institute for Exploitation of the Sea

¹¹ Named after the Danish physicist.

¹² CHALLENGING Mini-satellite Payload for Geophysical Research and Application.

¹³ Gravity Recovery And Climate Experiment.

¹⁴ Gravity Field and Steady-State Ocean Circulation Explorer.

¹⁵ Detection of Electro-Magnetic Emission Transmitted from Earthquake Regions.

Oceans

- The Franco-American **TOPEX-POSEIDON** system stopped operating in 2005 after a successful 13-year mission. Its successor, the **JASON-1** mini-satellite has enabled to study ocean dynamics and to determine sea level with 1-cm accuracy. The future **JASON-2** satellite, to be launched in 2008, will be a key component of the Ocean Surface Topography Mission (EUMETSAT).

- A new ocean observation programme, the operational ocean altimetry **ALTIKA**¹⁶ mission (2008) will be carried out in cooperation with ISRO (Indian Space Research Organisation). It will allow enhanced observations of ocean surface levels, currents, wave height and wind speed at sea surface.

- Now running for 10 years, the French **MERCATOR** project for operational oceanography (real-time assimilation of global data in complex high resolution models) is part of the French involvement in the **MERSEA**¹⁷ European Integrated Project (a core component of GMES), which in turn contributes to the **GODAE**¹⁸ global experiment.

Meteorology, climate

- Following the successful launch of the EUMETSAT **MSG-2**¹⁹ satellite (2005) developed under the leadership of the French industry in 2005, and the experimental **PUMA**²⁰ exploitation programme, aimed at fostering the use of MSG data for non-meteorological applications, which ended in September 2005, the **AMESD**²¹ programme is now beginning. It is considered as a GMES component to help African countries to better manage their natural resources by providing them with relevant environmental information.

- France took an important part in the development of the **METOP**²² programme, which is the space segment of the EUMETSAT Polar System (EPS)²³. Among

the three polar orbiting satellites to be launched at five-year intervals, the first one was launched on October 19, 2006. So, the polar-orbiting satellites dedicated to operational meteorology are now equally shared between EUMETSAT and NOAA. The most innovative METOP payload is **IASI**²⁴, a new-generation Fourier Transform Michelson interferometer developed by CNES that will provide atmospheric infrared emission spectra of unprecedented accuracy (temperature and humidity profiles accurate to 1°C and 10% respectively, with a vertical resolution of 1 kilometre). It also allows retrieving such trace gases as O₃, CH₄, CO at global scale. It also includes an infrared imaging sensor that allows co-registration with the AVHRR instrument of the payload.

- The Indian Space Research Organisation (ISRO) and CNES are developing together the **MEGHA-TROPIQUES**²⁵ satellite. At first planned to be launched in 2005, its flight has been postponed to 2008-2009. Megha-Tropiques is expected to provide valuable data for climate research, especially regarding the ITCZ²⁶. It carries on three instruments: MADRAS, a microwave imaging sensor to study rainfall and cloud properties, SAPHIR, a 6-channel microwave radiometer to determine water vapour vertical profile and horizontal distribution and SCARAB, a radiometer to measure top of atmosphere radiative flux.

Aerosols, clouds, radiative budget – The A-Train

CNES' **PARASOL**²⁷ micro-satellite carries a **POLDER**²⁸-like wide-field radiometer (figure 1). After a successful in-orbit commissioning, derived products are currently available to users since April 2005. They are distributed by CNES and by the ICARE French centre (see below).

- Managed by NASA in cooperation with France, the **CALIPSO**²⁹ mission was launched on April 28, 2006. CALIPSO will allow answering important questions about the effects of clouds and aerosols (airborne particles) on the Earth climate change.

¹⁶ Altimetry in Ka-band.

¹⁷ Marine EnviRonment and Security for the European Area.

¹⁸ Global Ocean Data Assimilation Experiment.

¹⁹ Meteosat Second Generation.

²⁰ Preparation to the Use of MSG in Africa.

²¹ African Monitoring of the Environment for Sustainable Development.

²² METeorological OPERational Satellite.

²³ The EUMETSAT Polar System consists of the METOP spacecrafts and associated ground segment.

²⁴ Infrared Atmospheric Sounding Interferometer.

²⁵ "Megha" means cloud in Sanskrit and "Tropiques" means tropics in French.

²⁶ Inter-Tropical Convergence Zone.

²⁷ Polarisation and Anisotropy of Reflectances for Atmospheric Sciences coupled with Observations from a Lidar.

²⁸ POLarisation and Directionality of the Earth's Reflectances).

²⁹ Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations.

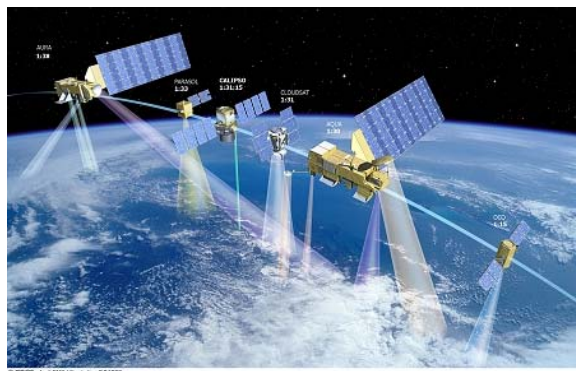


Figure 1. From right to left: The six satellites of the A-Train as listed hereunder © CNES

- **CALIPSO** and **PARASOL** are two components of the series of six satellites that make the so-called **A-Train** (Oco, Aqua, Cloudsat, Calipso, Parasol, Aura), which CALIPSO joined on June, 1st. Developed by the NASA, Cnes and CSA³⁰, the A-Train is a series of satellites crossing the equator at about 13/30. They make a unique observatory of the atmosphere that they sound both horizontally and vertically from about the same location at the same time.

Selection of proposals for assessment studies for the next ESA Earth Explorer Core Missions

In May 2006, ESA informed the national delegations that the ESAC recommended the following studies for pre-phase A studies: BIOMASS, TRAQ, PREMIER, FLEX, A-SCOPE, CoReH20. France is deeply involved in these proposals, and namely in the two first ones.

BIOMASS aims at delineating forests and quantifying forest biomass using a high resolution P-band (alternatively L-band) SAR working in two modes and offering repeat-pass interferometry.

TRAQ aims at estimating the troposphere composition and air quality. It will also allow studying atmospheric chemical processes. **TRAQ** is based upon a new synergistic sensor concept. The SIFTI instrument is a static Fourier Transform spectrometer allowing a proper vertical sampling of the troposphere.

'Thematic competence networks'

The French programme of 'thematic competence networks' 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 pre-processing irrelevant to their scope of research.

- The **POSTEL**³¹ "Land Surfaces" Thematic centre (biogeophysical geocoded information) is a competence network associating several national research laboratories and a service unit, fulfilling a developing and an operating function. This service unit is planned to supersede the national level by becoming a part of the GMES Land Monitoring Core Service. POSTEL was described in EARSel Newsletter 65, March 2006, pp 49-50.

- The **ETHER** Thematic Competence Network manages and valorises data related to atmospheric chemistry.

- The **ICARE**³² Thematic Competence Network is a partnership dedicated to aerosols, clouds, radiation and the water cycle. Among others, it distributes atmospheric products derived from PARASOL.

Environment and security

From its very beginning, France has been strongly supporting the **GMES**³³ initiative, aimed at designing and establishing by 2008 a European capacity to provide and use operational services for Global Monitoring of Environment and Security. ESA is involved in GMES through the **GSE**³⁴ scheme that is a suite of Earth Observation-based precursor services. Out of the 12 initial GSE projects³⁵, France is engaged in 11 and leading 3 of them.

G rard Begni, Catherine Tin , Delphine Fontannaz Marc Leroy - MEDIAS-France / Marc Bernard - SPOT IMAGE / Michel Avignon, Catherine Proy - CNES

³¹ P le d'Observation des Surfaces Terrestres aux Echelles Larges.

³² Interactions Clouds Aerosols Radiations Etc.

³³ Global Monitoring for Environment and Security.

³⁴ GMES Service Elements.

³⁵ These 12 projects cover the following areas: ground motion hazards, operational ice monitoring, polar monitoring, crop monitoring, urban mapping services, forest monitoring, water management, forest fire and flood management risk information, coastal zone management, ocean surveillance, atmospheric composition, humanitarian aid.

³⁰ Canadian Space Agency.

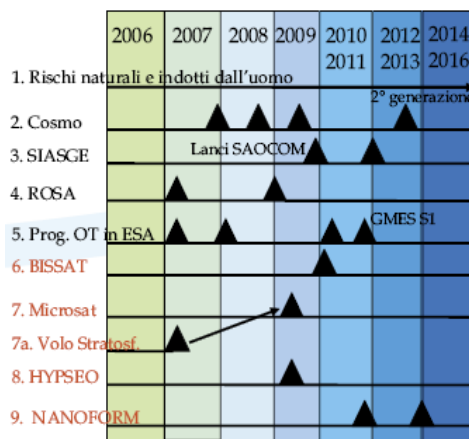
Objective

Earth system knowledge
and improvement of life quality
and security

Main returns

Natural and human induced phenomena
knowledge improvement
Security and life quality enhancement for citizens
National expertise growth
National capabilities success in Europe
Advancement and development of EO data market
Quality Centers development in EO

- Projects and main products**
1. Natural and human induced hazards
 2. COSMO/COSMO 2nd generation (X-band SAR, Ground Segment)
 3. SIASGE (TX/RX with SAOCOM L-band SAR) and processing tool
 4. ROSA (on board of SAC D and OCEANSAT)
 5. EO programs in ESA (CRYOSAT, GOCE, ADM Aeolus, SMOS, GMES), Sentinel 1 SAR C, Earth Watch, DLP, EO Envelope, ENVISAT 1, Meteosat 2nd gen.
 6. BISSAT (bistatic SAR)
 7. MICROSAT (SAGNAC, panchromatic polarized, MEMS)
 8. HYPSEO (hyperspectral camera + MITA enhancement)
 9. NANOFORM



Project plan for EO activities in Italy (ASI, 2006)

2.6 ITALY

The following briefly describes the activities of Earth Observation (EO) and Remote Sensing (RS) developed in Italy during 2006, together with some of the programs which will be continued or begun during the years to come, according to the National Aero-Spatial Plan 2006-2008 developed by the Italian Space Agency (ASI).

The main initiatives in the field of EO are listed below and Figure 1 shows the summary frame of RS activities planned for the future:

- Natural Hazards and human activity induced Hazards
- COSMO-SkyMed
- SIASGE
- ROSA missions
- ESA and International EO programs
- BISSAT mission
- MICROSAT-optical micro-satellite mission
- HYPSEO mission
- NANOFORM mission.

Natural Hazards and human activity induced Hazards

This project aims to develop application products based on Earth Observation data, in order to manage emergency situations, as well as monitoring and control of the environment. These products intend to enhance the comprehension of Earth dynamics, through the definition of a set of models which are reliable and permit an effective mitigation of natural and anthropic phenomena effects.

In the framework of the natural disasters, research and development preliminary studies have been implemented for the following applications: seismic hazard and Volcanic Risk; marine pollution, in the context of DISMAR (Data Integration System for marine Pollution) international project; fires, landslides and floods prevention, in collaboration with the Civil Protection Department.

COSMO-SkyMed

COSMO-SkyMed, a dual-use Earth observation satellite system, being developed by ASI in cooperation with the Italian Ministry of Defence, within the framework of a bilateral Intergovernmental

Agreement between Italy and France, will make use of the most advanced remote sensing technology for the four X-band SAR (Synthetic Aperture Radar) satellites, providing high imaging resolutions that will be processed by a complex and geographically distributed Ground Segment infrastructure, manufactured by Italian industries. The COSMO-SkyMed Earth Observation programme will provide, inter alia, an important contribution to the natural disaster management system, by monitoring, controlling and managing natural disaster risks, among which forest fires, floods, landslides and oil spills.

COSMO-SkyMed System implements specifications compatible with a multi-platform/multi-function/multi-user approach.

The main aims of the mission are the provision of data, products and services related to:

- Natural hazards monitoring, surveying and management applications
- Military and security applications (monitoring, surveying and intelligence)
- Natural resources management and control
- Scientific, dissemination and commercial applications

SIASGE

An important cooperative effort devoted to the management of the natural disasters and emergencies is the bilateral cooperation between Italy and Argentina within the joint programme, named "Italy and Argentina Satellite System for Emergency Management" (SIASGE).

This system's main purpose is to integrate, from an operative point of view, SAOCOM L-band SAR satellites – of Argentinean construction – with COSMO-SkyMed X-band SAR satellites - operated by Italian Space Agency – thus incrementing the application potential of new generation high resolution radar data, especially for emergency management and object recognition over the Earth surface.

ROSA missions

In the field of remote sensing observation, ASI is developing the instrument ROSA, (Radio Occultation for Sounding of Atmosphere), that will provide for important information about space weather, meteorology and climatology. This instrument will be installed on the Indian satellite, Oceansat-2, according to a Memorandum of Understand-

ing, signed by ASI and ISRO, in Fukuoka, in October 2005, and on the Argentinean SAC-D satellite, in cooperation with NASA.

ROSA receiver for Radio Occultation is an instrument capable of measuring humidity, pressure and temperature profiles of the atmosphere, from low quote to 100 km. ROSA is able to measure electronic content profiles of the ionosphere, through occultation technique using GPS and GLONASS (and in the future, Galileo).

ESA and International EO programs

A number of ESA programs dealing with EO has been developed and will see the involvement of Italian institutions in remote sensing. These programs are the natural completion of national initiatives and include:

- The realisation of wide range programs, in coordination and support of EU initiatives, in order to maintain European competencies and competitiveness
- The integration of national industrial systems in the European ambit
- The opportunity to deploy products and expertises developed in Italy

Currently four ESA programs in EO fields are running, which see the participation of Italian Space Agency: ENVISAT satellite operations, EUMETSAT new satellites launch and programs, Earth Observation Envelope Program, Earth Watch Program.

At European level Italy participates in the Global Monitoring for Environment and Security (GMES) programme, identified in the European Strategy for Space approved by the EU and ESA Ministerial Councils in November 2000.

At multilateral level, ASI is member of the Committee On Earth Observation Satellites (CEOS), the Integrated Global Observing Strategy (IGOS) and the Group on Earth Observation (GEO).

BISSAT mission

An Earth Observation mission done in connection with COSMO mission, using bistatic-interferometric techniques to develop environmental analyses products in different fields: marine pollution, landslides civil protection, floods civil protection, burned areas civil protection, environmental security. This mission will therefore provide innovative and original data to the scientific community and institutional users.

MICROSAT-optical micro-satellite mission

MICROSAT mission objectives are to develop and evaluate the performance of new technological products as the microsatellite platform and electro-optical equipment of the payload.

HYPSEO mission

Italy is interested in the development of hyperspectral technologies and gained an important role in the capacity of applicative utilization of satellite data. Particularly in the hyperspectral remote sensing technique, ASI is investing in the national project HyPSEO. At international level, Italy and Canada signed, in June 2005, a Memorandum of Understanding for Cooperation in the field of Earth Observation and, in October 2005, an Implementation Agreement on cooperation in a joint definition phase for a Hyperspectral mission.

HYPSEO is a mission designed to monitor natural resources and atmosphere characteristics by means of an hyperspectral optical sensor, which could also provide a wide range of application fields with ready to use satellite data.

NANOFORM mission

The field of nanosatellites is today one of the most rapidly growing in Remote Sensing. NANOFORM will develop a new architecture for the flight segment of a satellite constellation; this architecture could provide better performances and operative advantages hardly achievable with a big size satellite.

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2.7 NETHERLANDS

The Netherlands had 14 members of EARSel namely (from EARSel website):

1. Department of Geoinformation and ICT (AGI), RWS
2. Synoptics, Integrated Remote Sensing and GIS Applications
3. Netherlands Institute for Sea Research (NIOZ)
4. Royal Netherlands Meteorological Institute (KNMI)
5. ALTERRA
6. National Aerospace Laboratory NLR
7. TNO-Physics & Electronics Laboratory

8. Laboratory of Geo-Information Science and Remote Sensing (Wageningen University)
9. International Institute for Geo-information Science and earth observation (ITC)
10. Department of Physical Geography, Utrecht University
11. ARGOSS
12. P. Geerders Consultancy
13. Terralmaging B.V.
14. Landscape and Environmental Research Group, University of Amsterdam

This is a drop of 4 memberships (from 18 to 14 institutes are EARSel member) since last year. Two institutes have cancelled their membership of EARSel (IVM and EARS) and the original three institutes that reside under the ministry of water and transportation in the Netherlands that were a separate member in 2006 merged into one membership under AGI. The reports submitted by the institutions that responded to a call for reports follow.

AGI (Geo-Information Advisory Service), Rijkswaterstaat (Ministry of Transport and Water). (Stephen Dury).

Representative: Dr. Steve Dury

Water quality monitoring is an essential part of the monitoring programmes of the North Sea countries, including RWS, required by European Directives such as the OSPAR Agreement, and the forthcoming European Marine Strategy. In 2006, AGI was active in developing and implementing a water quality mapping service using remote sensing. The emphasis is on ensuring quality & reliability through robust validation analysis. There is a close cooperation with 'end-users' of the information within Rijkswaterstaat - including RIKZ, RIZA, North Sea Directorate and Directorate IJsselmeer Region. AGI has participated in a number of national and international initiatives, including:

- MarCoast, a European GMES (GSE) project, funded by ESA. This initiative is aimed at establishing a set of operational information services, derived (in part) from EO data. In 2006 this comprised a Harmful Algal Bloom Service, with the Institute for Environmental Studies (IVM) / Water Insight as the Service Provider. AGI is also a key member of the Validation Bureau, ensuring rigorous quality control of the products delivered to end-users, including both RIKZ and North Sea Directorate. In addition a number of complimentary projects were part-funded by the Nether-

lands Agency for Aerospace Programmes (NIVR):

- Towards Remote Sensing Supported Monitoring of the North Sea (TORSMoN) where the objective is to provide recommendations for a cost-effective monitoring strategy for water quality in the North Sea, using a combination of remote sensing and in situ measurements. Collaboration with National Institute for Coastal and Marine Management (RIKZ); Royal Netherlands Institute for Sea Research (NIOZ); Institute for Environmental Studies (IVM); Advisory and Research group on Geo- Observation Systems and Services (ARGOSS)
- Towards an Operational Geo-spatial Infrastructure for satellite enabled Marine Services - collaboration with ARGOSS
- Processing of MODIS data for water quality monitoring in the North Sea - collaboration with ARGOSS, RIKZ, BOSKALIS

During 2006 AGI managed a project 'Monitoring and Evaluation Programme; Effects of the land reclamation and nature compensation, Rotterdam Mainport

Development Project'. A consortium, led by KIWA Water Research, and including Larenstein, carried out a baseline study to establish ecological reference situations in order to measure possible future effects of the land reclamation project. This included interpretation of digital orthophotos using fuzzy classification, and combining the classification results in specified vegetation structure maps.

Royal Netherlands Meteorological Institute (KNMI)

Representative: Hans Roozkrans

Highlight for KNMI, the Royal Netherlands Meteorological Institute, in 2006 was the launch of METOP-A, the first polar orbiting satellite of EUMETSAT. Metop will be an important instrument for the Earth Observation R&D activities at KNMI, both for the purpose of weather as climate.

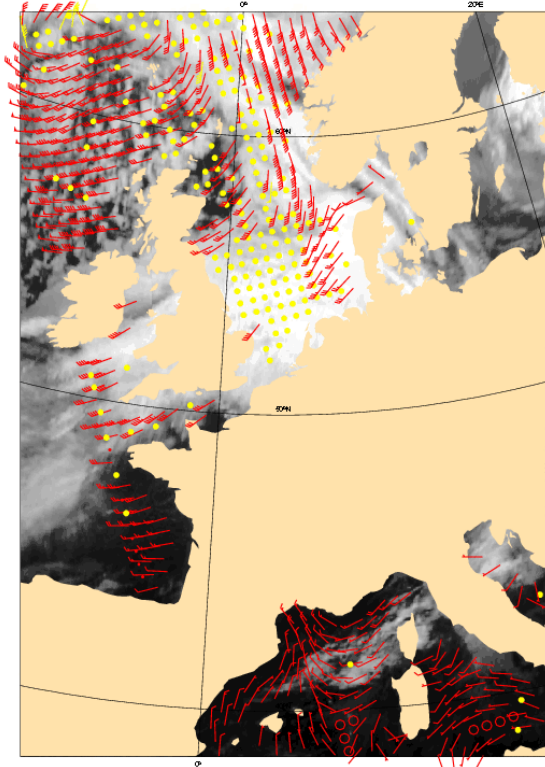
One of the new type sensors on board of Metop is the ASCAT, a radar instrument that is able to measure wind speed and direction at the sea surface. KNMI participates among other European institutes in the Ocean and Sea Ice (OSI) SAF and Numerical Weather Prediction (NWP) SAF projects of EUMETSAT; there it is primarily responsible for the development of improved quality control, ambiguity removal and assimilation algorithms for satellite scatterometer wind observations. In the climate area KNMI participates in two other SAF's: the Climate Monitoring SAF and the Ozone and Atmospheric Chemistry Monitoring SAF. Atmospheric chemistry / air quality monitoring from space is also covered by KNMI by it's strong involvement with the OMI instrument (on board of EOS/Aura). KNMI is PI of this instrument.

For the ESA Core Explorer Atmospheric Dynamics Mission (ADM), KNMI has contributed to the specification of the Doppler wind LIDAR system to be flown (Aeolus) and to simulation studies of the expected impact of the mission. ADM is planned for launch in 2008.

In 2006 KNMI has put a lot of effort in making applicable Meteosat Second Generation (MSG) data and products for the forecasters in the weather service. The potential of MSG for the nowcasting and monitoring of severe weather (storms, fog, snow) has now been fully exploited by the KNMI weather service.

Another important activity in 2006 was the R&D of assimilation of EO data in the KNMI's

QSCAT: 20070111 04:35Z lat lon: 51.09 3.50 IR: 04:30



Wind field measured on 11 December 2007 of a storm passing over the Netherlands. Measurement by the QuickScat scatterometer on board the US Seawinds satellite.

weather prediction model HIRLAM. In a first attempt scatterometer winds and Sea Surface Temperatures (measured by NOAA/AVHRR) are assimilated in HIRLAM.

ALTERRA

Representative: Gerard Nieuwenhuis

The Geo-Information specialization of Alterra works in close collaboration with the Laboratory of Geo-Information Science and Remote Sensing of Wageningen University: the Centre for Geo-information of Wageningen UR. This **collaboration** seeks solutions to spatial problems through education and research. Spatial planning, water management and food production are just a few examples of the social issues that Wageningen UR focuses on. These issues often have a direct relation with the environment. To manage our living environment, collecting and analyzing information about its condition and development is imperative. The Geo-Information specialization supplies such information, on many aspects of the environment, both in the Netherlands and beyond.

Some specific on going remote sensing activities concern:

- Mapping and monitoring land cover and land use in the Netherlands; recently the fifth version of the national land use of the Netherlands (LGN) has been produced. An update of the Corine land cover data base of the Netherlands is foreseen for this year;
- Characterization of vegetation in ecosystem modeling; dealing with this topic CGI participated successfully in several EU projects, such as Biopress, Biohab and Peenhab;
- Energy balance modeling and irrigation performance monitoring; projects were performed in Ukraine and China to map drought based on satellite imagery to improve operational water management
- Data assimilation – coupled numerical modelling of complex water-soil-vegetation-atmosphere systems by assimilation of satellite observations; data assimilation in regional crop growth models an crop yield forecasting has been applied to improve operational systems, such as the MARS-OP project coordinated by the European Joint Research Centre, Ispra, Italy.

For additional information:

<http://www.alterra.wur.nl/UK/research/Specialisation+Geo-Information/>

Laboratory of Geo-Information Science and Remote Sensing (Wageningen University)

Representative: Dr. Jan Clevers

The laboratory of Geo-Information Science and Remote Sensing forms together with the department of Geo-Information of Alterra the Centre for Geo-Information (www.geo-informatie.nl). The Centre focuses on education and fundamental and applied research within the domain of Geo-Information. Research processes within the Laboratory of Geo-Information Science and Remote Sensing are grouped and organized in thematic specialisation groups. These groups are composed of members of the Laboratory of Geo-Information Science and Remote Sensing and Alterra - Geo-Information. Thematically they are subdivided into the following categories:

- Ecosystems and landscape
- IT technology
- Remote sensing
- IQ-Spatial data
- Spatial models
- Visualisation, design and usability

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 remote sensing. 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 remote sensing using physical based approaches in the user community. During 2006 significant contributions to the ISPRS Commission VII mid-term symposium 'From Pixels to Processes' at the ITC in Enschede (The Netherlands) were made.

International Institute for Geo-information Science and earth observation (ITC)

Representative: Prof. Freek van der Meer

During the last five years ITC has concentrated on setting up joint education educational programmes at technician, PM and MSc level in partnership with local universities and institutes in various regions in the world. These are instruments to contribute to building organisational capacity in less developed countries focusing on

issues of relevance (droughts in Sub Saharan Africa, tsunamis in SE Asia, floods in China etc.) to the region and embedded in local infrastructures.

The joint education partnerships are no isolated bilateral agreements between ITC and one partner, but they are part of a larger network in which ITC participates: the GI-Net. GI-Net stands for "Geo-Information Network for Education and Training". The main aim of the network is to promote the use of spatial information and earth observation through capacity building and institutional development. The network is active in research and development, as well as in education, training and advisory services. More details can be found at <http://www.gi-net.org/>.

The joint education programmes are the natural result of the longstanding collaboration that ITC has in many parts of the world. For example in 2006, we celebrated the 40th anniversary of a joint programme of co-operation between the International Institute for Geo-Information Science and Earth Observation (ITC) and the Indian Institute for Remote Sensing (IIRS), formerly known as the Indian Photo Interpretation Institute (IPI), in Dehra Dun, India.

On 4th April 2005, the United Nations University (UNU) and ITC entered into an agreement, appointing ITC as an Associated Institution of the UNU. The UNU-ITC agreement has an initial duration of five years and is directed at developing and carrying out a Joint Programme on capacity building in Disaster Management and in Land Administration, and the dissemination of knowledge on these and directly related issues.

In response to this ITC has prepared the following two programmes:

- UNU-ITC programme on Capacity Building for Disaster Geo-Information Management (DGIM)
- United Nations University School for Land Administration Studies

See also: <http://www.itc.nl/unu/>.

ITC also plays an active role in the Global Earth Observation System of Systems (GEOSS) initiative. In January 2006 a first visit to the GEO Secretariat in Geneva took place. The GEO Plenary establishes committees and working groups to address different aspects of GEOSS implementation, and to date has set up five: (i) the Architecture and Data Committee, (ii) the

Capacity Building Committee, (iii) the Science and Technology Committee, (iv) the User Interface Committee, and (v) the Working Group on Tsunami Activities.

The first meeting of the Capacity Building Committee was held in March this year in Paris and was followed by a workshop in May at the premises of the Brazilian space agency INPE in São José dos Campos. The main objectives of these workshops were to raise awareness among GEO members and participating organisations of existing Earth observation capacity building initiatives, identify best practices worthy of replication, and embark on an analysis of opportunities for project integration and new joint initiatives to close gaps.

In 2006 the following PhD's graduated through ITC's research programme:

- Dr. Rob L.G. Lemmens Netherlands 2006 138 90-6164-250-7 Semantic interoperability of distributed geo-services
- Dr. Marco Huisman Netherlands 2006 137 90-6164-246-9 Assessment of rock mass decay in artificial slopes.
- Dr. Pravesh Debba South Africa 2006 136 90-8504-462-6 Sampling scheme optimisation from hyperspectral data
- Dr. Arta Dilo Albania 2006 135 90-8504-461-8 Representation of and reasoning with vagueness in spatial information: a system for handling vague objects
- Dr. Chudamani Joshi Nepal 2006 133 90-8504-470-7 Mapping and modelling the distribution of invasive shrub species in Nepal and their impact on the native flora
- Dr. Daniël Vlag, van de Netherlands 2006 132 90-8504-384-0 Modeling and visualizing dynamic landscape objects and their qualities
- Dr. Harald M.A. Werff, van der Netherlands 2006 131 90-6164-238-8 Knowledge-based remote sensing of complex objects: recognition of spectral and spatial patterns resulting from natural hydrocarbon seepages
- Dr. Alok Porwal India 2006 130 90-6164-240-X Mineral potential mapping with mathematical geological models
- Dr. Chaichoke Vaiphasa Thailand 2006 129 90-8504-353-0 Remote sensing techniques for mangrove mapping

From 8-11 May 2006, ITC hosted the ISPRS Mid-term Symposium for commission VII on "Remote Sensing: From Pixels to Processes". The meeting attracted a total of 509 delegates.

See also:

<http://www.itc.nl/isprsc7/symposium2006/organization.aspx>

Department of Physical Geography, Utrecht University

Representative: Prof. Steven de Jong

PhD thesis:

In 2006 we had 3 remote sensing related PhD defences:

1. The first thesis investigated the usefulness of remote sensing techniques and advanced contextual image analysis methods for the detection of hydrocarbon seeps. This project was a joint collaboration between Utrecht University and ITC in Enschede. Candidate and thesis title: Mr Harald vander Werff, Knowledge-based Remote Sensing of Complex Objects: Recognition of Spectral and Spatial Patterns Resulting from Natural Hydrocarbon Seepages. 10 March 2006. ITC, Enschede.
2. The second thesis investigated the integrated use of crop growth models with remote sensing images acquired at various levels of scales. Optical as well as radar images were used to feed and calibrate crop growth models. This project was a joint collaboration between Utrecht University and Wageningen University and Research Centre. The defence took place at Wageningen. Candidate and thesis title: Mr. Raymond Jongschaap, Integrating Crop Growth Simulation and Remote Sensing to Improve Resource Use Efficiency in Farming Systems. 12 May 2006.
3. The third thesis investigated the type and frequency of mass movements in British Columbia and how climate change will have an impact on the frequency of mass movements in Canada. The use of remote sensing was only a minor issue in this thesis and was used to map out the larger slides and mudflows. This project was a joint collaboration between Utrecht and the British Columbia Forest Service in Canada. Candidate and thesis title: Mr. Marten Geerstema, Hydrogeomorphic Hazards in Northern British Columbia, Canada. 27 April 2006.

New PhD students in the field of remote sensing:

In 2006 we contracted a new PhD student Mr Wiebe Nijland MSc on a joint project between Utrecht University and ITC. Nijland will study the effects of anticipated climate

change in the Mediterranean region on the productivity and species composition of natural vegetation in particular the mixed Mediterranean oak forests. The study region is the experimental site of Peyne located near Montpellier in France. Hyperspectral imagery and time series of optical remote sensing will be used to feed the forest productivity models.

Remote sensing projects:

Three important projects were continued in 2006:

1. Object-oriented image analysis for spatial ecological modelling. A project funded by the Netherlands Research organisation and carried out by Ms Dr Addink. The project investigates the possibilities of quantitative mapping of structural forest parameters such as leaf Area Index, aboveground biomass, chlorophyll content and moisture contents of Mediterranean forests.

2. Object-oriented extraction of beach morphology from video images. A project funded by the Ministry of Transport in The Netherlands and the PhD study of Ms Quartel MSc. Object based image analysis techniques are applied to timeseries of video images of the Dutch coast near Nordwijk. The dynamics of the intertidal morphology (bars, troughs and rips) of the Dutch coast are investigated.

3. The *Mutatis Mutandis* project: single detection, multiple users – change detection using high spatial-resolution imagery in Dutch urban areas. This project is funded by the Ministry of Economic affairs in The Netherlands. The project investigates the limitations and possibilities of change detection of small objects (trees, individual houses, dormer windows) using high resolution remote sensing (QuickBird, IKONOS, airborne images).

P. Geerders Consultancy

Representative: Paul Geerders

The activities of PGC in 2006 focused on consultancy and training related to applications of remote sensing in support of operational integrated marine-coastal management. Several training events were held, partly funded by local governments, partly by the NATO RTA fund. World-wide there is a growing interest in marine-coastal management in view of the direct impacts of climate change.

Special attention was given to training in the use of airborne photography with (relatively simple) digital cameras as a

methodology for rapid monitoring and cost-effective updating of maps. In view of the common lack of updated cartography and the high-cost of more traditional methods (photogrammetric flights) this methodology has proven to be very successful and is now being implemented in various countries, mostly by local authorities (municipalities). The information thus acquired is used to support research, planning and decision-making. An important additional advantage of this methodology is the independence of external (foreign) sources of vital information, such as satellite images. The material freely available on the Web is usually too much outdated to be useful or is not well documented to allow for quantitative analysis and interpretation. PCG has directed its activities mostly to users and clients in South America and the Caribbean (especially Colombia, Cuba), although activities were also held in Rumania and Turkey.

Although remote sensing from air and space provides excellent and unique information, operational planning and decision-making require that this information is complemented by data from in-situ observations and from models. The latter is especially required in order to make forecasts or carry out simulations. In the consultancies therefore much emphasis is given to the need for in-situ monitoring and to the development of appropriate (numerical) models. A new generation of GIS systems will be required to provide the necessary flexibility for integrated and dynamic analysis and assessment. EARSel could play a valuable role in promoting the integrated European remote sensing knowledge, experience and technologies outside Europe, especially in South America and the Caribbean area. There is a great interest in operational applications for planning and decision-making related to marine-coastal issues, and cooperation with Europe is generally preferred to cooperation with the USA.

Landscape and Environmental Research Group, University of Amsterdam

Representative: Dr. Harry Seijmonsbergen

The chair of Computational Biogeography and Physical Geography (CBPG <http://www.science.uva.nl/ibed-cbpg/>) is a new research group of the Institute of Biodiversity and Ecosystem Dynamics (<http://www.science.uva.nl/ibed/home.cfm>) (IBED) of the University of Amsterdam. One of the research challenges is to link

theoretical models of complex geoecosystems with field observations and remote sensing. In 2006 research was started aiming at integrated landscape classification and improved natural hazard assessment in western Austria using high resolution laser altimetry data (LiDAR). First result is a semi-automated method to identify geomorphological landscape objects using object-oriented image classification and DEM derivatives (van Asselen and Seijmonsbergen 2006). Consult also the following link to the website <http://home.medewerker.uva.nl/a.c.seijmonsbergen/page3.html>.

The NL Bird Avoidance Model (BAM) was implemented for use by the experts of the Royal Netherlands Air Force. Air surveillance radars and field observation were used to predict the density of birds in the air above the Netherlands by modeling the relationship between migration and spatial distribution of birds, and environmental conditions such as weather and landscape properties derived from remote sensing information (<http://ecogrid.sara.nl/bambas/>).

In our 2006 reopened GIS/RS facility new remote sensing education techniques have been developed and are offered as 'coached self tuition' modules in the GIS-Studio at the bachelor's and master's level.

References:

S. van Asselen, A.C. Seijmonsbergen (2006). Expert-driven semi-automated geomorphological mapping for a mountainous area using a laser DTM. *Geomorphology* 78, 309-320.

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2.8 PORTUGAL

There are currently 4 active members of EARSel: Laboratório Nacional de Engenharia Civil (LNEC), University of Porto (CICGE/FCUP), Portuguese Geographic Institute (IGP) and Instituto de Meteorologia (IM). The individual reports of Remote Sensing activities in 2006 are listed below.

LNEC – Laboratório Nacional de Engenharia Civil

LNEC has a Programmed Research Plan (PIP 2005-2008) entitled "Remote Sensing

and Digital Image Processing Applied to Civil Engineering”, with the objective of operational use of very high resolution satellite imagery for the production of photo-maps for local authorities. In 2006 urban evolution studies with IKONOS and QuickBird images were developed. Some methodological studies on analysis of spatially distributed random multidimensional phenomena, such as positional errors, to evaluate the positional quality of numeric image maps derived from satellite images, were developed. A number of publications and presentations were made within this project. For more information please contact the LNEC representative at EARSel, Eng. Ana Fonseca (anafonseca@lnec.pt).

FCUP (CICGE / University of Porto)

Centro de Investigação em Ciências Geo-Espaciais (CICGE) is a research Centre of the Faculty of Sciences, University of Porto (FCUP). The main Earth Observation activities of CICGE / FCUP are research and teaching, both undergraduate and postgraduate courses, in Remote Sensing, Photogrammetry, Image Processing, GIS, GPS, Geodesy and other topics in the fields of geomatics. It is worth pointing out that FCUP is responsible for the first MSc course in Remote Sensing in Portugal, a 2-year course that started in 2000 and that is now on its 4th edition. FCUP has currently 8 PhD students in the field of Remote Sensing or related Geomatics areas.

In 2006 CICGE/FCUP was involved in several research projects, both individually and through partnerships with other national and international organisations. The most significant are listed below.

MOCTIM. The main objective of this project is to integrate LIDAR and stereo IKONOS data to develop 3D city models.

POCUS – Study of the Portuguese Oceanic Coastal Zone using Remote Sensing Data. The objectives of this project are twofold: to study the oceanic processes governing the Portuguese coastal zone using Remote Sensing Data and to exploit the synergetic use of ENVISAT data, with particular emphasis to satellite altimetry, for coastal studies.

OCEAN EYE – OCEANic managEment sYstem for the Environment, funded by ESA in the scope of the Call for Proposals under the ESA-Portugal Task Force, Ref^o AO/1-4669/05/NL/HE. The main objectives of this project is to elaborate a feasibility study

regarding the development of a multi-purpose oceanic observation, monitoring and surveillance system over the Portuguese EEZ, using among others, remote sensing techniques. The FCUP contribution focus on the development of an Altimetry Service, to provide several altimetry derived oceanic products (along-track and gridded) at various delivery levels (from fast delivery to offline products).

For more information about the CICGE/FCUP activities in Earth Observation please contact the EARSel representative, Dr. André Marçal (andre.marcal@fc.up.pt)

Portuguese Geographic Institute (IGP – Instituto Geográfico Português)

This document constitutes a summary of the main activities developed by the Portuguese Geographic Institute (IGP) along the year 2006, in the field of Remote Sensing. These activities were carried out by the Remote Sensing Unit (RSU) of IGP, a research & development department, which develops its activity in the framework of the mission and functions of the Institute. The major part of the Unit's activity is focused on digital image processing methods for thematic information extraction from satellite data (with very high, moderate and low spatial resolution), mostly applied in view of land cover and land use characterisation. In 2006 RSU has been involved in several R&D and cartographic production projects, both individually and through partnerships with other national and international organisations. The main projects are briefly summarised below.

AGRO130. The project AGRO130 has the following main goals: to demonstrate the use of satellite images for automatic mapping of clear cuts and new forest plantations at local and regional scales; to demonstrate the usefulness of monitoring clear cuts and new plantations on information gathering (e.g. forest inventory, map updating) and decision making (e.g. planning and controlling environmental legislation compliance); to use Internet as an interactive tool between information producers and users.

CARFOR This project started in October 2004 and was concluded in October 2006. It addressed the study of the potential of IKONOS images for forest mapping at large-scale, using automated information extraction methods. The project was executed in the framework of a protocol between the Portuguese Geographic Institute, the Association of Paper Industries

(CELPA) and the company MECI LANDEO. The main objectives of this project are: to develop integrated methodologies to explore new ENVISAT optical and radar sensors for land cover characterisation at different scales; to illustrate through demonstration case studies the usefulness of earth observation data as a source of environmental monitoring products.

COSMIC. This project is related with multi-scale land cover cartography. Its main objective is the development of methodologies for the production of different types of cartography (with distinct technical specifications), using satellite data and semi-automated methods.

COS'2005. This project refers to the production of a land cover cartography for Continental Portugal. In 2006 a consultative committee constituted by several entities was created, within the framework of the nomenclature definition for this cartography.

CORINE Land Cover 2006 Portugal. RSU is the National Reference Centre for Land Cover of the European Environment Agency. In this framework the Unit has participated in the definition of the products and production methodologies for CORINE Land Cover 2006.

The Portuguese Geographic Institute, through its Remote Sensing Unit, together with the Institute for Statistics and Information Management (New University of Lisbon), organised the international symposium entitled Accuracy 2006 (<http://2006.spatial-accuracy.org/>). This event was the 7th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences and took place in Lisbon, from the 5th to the 7th July 2006. The symposium had a total of 146 registrations, distributed amongst 26 countries, covering practically all continents. There was a

high participation of students. In 2006 the RSU also organised the workshop "Forest Cover Characterisation with Satellite Images" (<http://www.igeo.pt/gdr/workshop/>). This event took place on the 31st of October, in Lisbon. The main objective was the presentation of results of the Unit's recent projects related with the use of satellite data for forest cover monitoring in Continental Portugal.

For more information about these projects and other IGP activities in Earth Observation please visit the new webpage (<http://www.igeo.pt/gdr/en/home.html>).

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2.9 SWEDEN

EARSel member labs

Sweden has five academic research groups that are members in EARSel. Three of these groups are active in general land cover remote sensing, in Sweden and abroad. These three groups are also doing a substantial amount of teaching in remote sensing and GIS in their respective universities. The largest group is located at the University of Stockholm, Department of Physical Geography and Quaternary Geology (Prof. Bengt Lunden, Prof. Johan Kleman, Prof. Margareta Ihse); the other groups are the Royal Institute of Technology, Department of Planning and Environment (Prof. Yifang Ban); and at the University of Uppsala, Department of Earth Sciences (Dr. Gerhard Bax).

The other two groups (Chalmers and SLU) are more specialised. The remote sensing group at the Department of Radio and Space Science, Chalmers University of Technology (Prof. Lars Ulander, Dr. Leif Eriksson) specialises in radar remote sensing of forests and sea ice. During 2006 this group worked a great deal with calibration of ALOS PALSAR data, using corner reflectors. It was found that data from ALOS PALSAR are of high quality. Together with SLU an experiment about detection of stormfelled trees has also been carried out. Trees in four stands were felled and left to simulate storm damages. SAR data over these stands were acquired at L-band (ALOS-PALSAR), as well as with two airborne systems developed by the Swedish Defense Research Agency (FOI): LORA (P-band) and CARABAS (VHF-band). This experiment will make it possible to evaluate the possibilities and determine limitations for detection of storm damaged forest at different frequencies. The remote sensing group at the Swedish University of Agricultural Sciences (SLU) in Umeå (Prof. Håkan Olsson) specializes in the remote sensing of forests. The tasks of this group also include a substantial amount of operational mapping and monitoring, such as using SPOT for nation-wide forest monitoring and digital aerial photos for interpretation of Natura 2000 areas. Another current topic is the use of small (1 kg, 1 m wide) UAVs with digital cameras for forest inventory and other

similar applications. During 2006, researchers at SLU implemented auto pilot and image orthorectification capabilities as well as formed a spin-off company (www.smartplanes.se).

The earlier research efforts about laser scanning of forests at SLU and FOI as well at the Norwegian University of Life Sciences are now being commercialised by forest inventory companies. Some of the large forest inventory companies in Sweden did during 2006 evaluate the area-based method marketed by the company Prevista from Norway. The excellent results obtained will most likely lead to a commercial break through for laser scanning of forest resources in Sweden. In addition, another Swedish-Norwegian forest inventory company, FORAN, has started to market single tree detection with high density laser scanning as a commercial product for forest inventory.

Government agencies

In 2006, the *Swedish National Land Survey* successfully carried out the first year of the new national Aerial Imagery Program, covering one third of the country on a yearly basis. The introduction of images acquired with digital cameras is expected to meet an increased and broadened use of image data. A new system for digital storage and access has been developed. Starting from 2007, the migration to the use of digital cameras only will be complete and in addition, all photo production will be digital. During 2006, the Land Survey also carried out laser scanning tests for production of a new DEM. Positive results were achieved with laser scanning from high flying altitudes. During 2007, further pilot tests, verification and specifications for DEM production will be made.

Metria Miljöanalys is a service-providing unit within the National Land Survey. The focus is on the operational use of remote sensing and GIS techniques for

environmental and forestry applications, as well as security-related applications. During 2006 Metria conducted several remote sensing/GIS projects under contracts with Swedish users such as the Swedish Environmental Protection Agency, the Armed Forces, and forestry organisations. Metria Miljöanalys is also involved in several projects relevant to GMES such as the EU FP6 projects Geoland, and Preview as well as the GSE projects Respond, Forest Monitoring, Land, and RISK-EOS. During 2006 Metria has been involved as a forestry expert in the ESA Sentinel 2 mission definition study, and in the ESA EoVox study aiming at strengthening the voice of the European & Canadian earth observation industry.

The Swedish National Space Board (SNSB) is the central government agency for space and remote sensing in Sweden. In addition to work within ESA and other international organisations, SNSB also runs a remote sensing program to stimulate remote sensing on a national level, with a budget in the order of 2 Million Euro/year. About half of the funds are used for a research program. The other half is directed to a user program, which aims to stimulate development by, or together with, end users; these projects normally require co-funding. The user program was established in 2000 and was evaluated by an international panel in 2006. The panel regarded the user program as successful and recommended continuation. Among the recommendations made by the panel were to stimulate an expansion of the commercial sector, to pay further attention to increased data availability, and to stimulate increased international cooperation.

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3. NEWS FROM MEMBERS AND SPECIAL INTEREST GROUPS

3.1 INSTITUTE OF METHODOLOGIES FOR ENVIRONMENTAL ANALYSIS (IMAA) IS PART OF THE ITALIAN NATIONAL RESEARCH COUNCIL (CNR)

The Institute of Methodologies for Environmental Analysis (IMAA) is part of the Italian National Research Council (CNR), a public organization of great relevance in the field of scientific and technological research. The scientific activity of IMAA is focused on the study of environmental problems, covering a wide spectrum of research topics: Earth Observations by using both remote sensing and in-situ techniques to characterise atmosphere, hydrosphere, lithosphere and biosphere and their interactions, to develop meteo-climatic applications and risk prediction, prevention and mitigation; Chemical-physical characterisation of soil and subsoil; Development of advanced techniques (in-situ and remote sensing) for environmental monitoring and integration of chemical-physical, biological and geological methodologies; Integrated methodologies for Environmental Planning. These activities are supported by several laboratories (Lidar, radiometry and interferometry, airborne and satellite remote sensing, chemical-physical, biophysical and biological monitoring, geophysics, environmental planning and modelling, environmental geochemistry and mineralogy, biochemistry) and instrumental facilities (i.e. Atmospheric Radiation Measurement Site; NOAA/HRPT and Meteosat/MSG receiving and archiving facility; Mobile Dial System, Mobile System for radiometric and interferometric measurements, Mobile system for near-surface tomography; SEM and X-ray diffractometer, Hydrogeosite: large full scale box).

In particular, the research activities of GIS and EO Laboratories for archaeology are mainly devoted to the setting up of innovative methods for remote sensed multi- and hyper-spectral high resolution data analysis for the identification of archaeological features. Joint research activities are performed by Geophysical and EO

Laboratories for archaeological investigations.

3.2 NEW MEMBER - TARTU OBSERVATORY

Tartu Observatory
Department of Atmospheric Physics, 61602
Tõravere, Estonia
<http://www.aai.ee/>

The research areas are - remote sensing of atmosphere - remote sensing of vegetation

Research activities are focused on radiative transfer in vegetation canopies and in the atmosphere, and its applications in physically-based algorithms for remote sensing. The continuous measurements of spectral atmospheric transparency and of variable atmospheric constituents by means of an AERONET sunphotometer are set up. Atmospheric ozone layer and aerosols, and their effect on the solar UV-radiation at the ground surface are studied. The variability of time series of Estonian climatic parameters and radiation climate in particular are studied. The non-stationary time series of the global climate are characterized from the point-of-view of their persistence/anti-persistence.

Studies show that not only the reliability of future climate scenarios but also that of the last century trends is not high enough. Forest reflectance models under development at Tartu Observatory are mainly targeted at predicting the optical signatures of northern temperate, sub-boreal and boreal forest types; however, considering their physically-based nature, the models may be applied to other highly clumped canopies. In addition to canopy reflectance modeling, methods for atmospheric correction in satellite remote sensing are being tested and developed by the group. Also, studies of coastal and inland water bodies using optical remote sensing were started at Tartu Observatory a few years ago. Special radiometric instrumentation is designed for the study of radiation conditions in vegetation canopies and for supporting satellite-borne instruments via ground truth measurements. Satellite remote sensing is used for monitoring forest cutting and land use change.

4. NEWS ITEMS

4.1 27TH EARSEL SYMPOSIUM AND RELATED WORKSHOPS - GEOINFORMATION IN EUROPE

Italy has welcomed the return of the EARSeL Symposium after an absence of 19 years. The 8th EARSeL Symposium May 17th – 20th, 1988, was the first to be held in Italy, in Capri. The beautiful beaches and coastal environment of Capri stand in contrast to the stark beauty of the Alpine mountains of the Bolzano area where we hosted the 27th Symposium. In 1988, Prof. Roberto Cassinis, of the University of Milan, Italy, was the EARSeL Chairman. Since the Capri event, EARSeL and Remote Sensing have grown and have witnessed diffusion beyond the borders of research into the application of remote sensing, usually through integration of complimentary tools and techniques as well as the development of new instruments and the development of new fields of application.

The title of the 27th EARSeL Symposium, **Geoinformation in Europe** reflects the broadening scope and deeper integration of diverse technologies towards the better management of European resources and recognition of the need to develop ways to foster and strengthen these developments through various European initiatives including Geoinformation, INSPIRE, Galileo, GMES, GEOSS, etc.

In conjunction with the Symposium, four workshops have been proposed:

The Workshop **Tools and Techniques for the Analysis of Time Series Image Data** focused on the emerging area of analysis in remote sensing, dealing with changes over time and the type of information that can be retrieved from land covers and their dynamics from time series image data. The use of time series image data offers real challenges to the researcher as to how to use the data to better understand the problems being investigated and to subsequently develop and test hypotheses concerned with the dynamic processes being studied. There are thus, real challenges in the development of tools and techniques as well as in the calibration of the data in order to provide consistent datasets.

The Workshop on **Remote Sensing of the Coastal Zone, from Inland to Marine**

Waters, continued the series of workshops held in Ghent (2003) and Porto (2005). More than 60% of humans live within 60 km from the coastline and therefore, coastal zones are important environmental and economic resources. As a complex interface between land and oceans, its investigation from space or using airborne sensors has always been a challenge. The event focused on Coastal Zone Research and Coastal Zone Management. It covered all methods of remote sensing and related ground truth measurements with emphasis on methods, technology, applications and results. In this workshop, emphasis was given on the impact of inland waters (rivers, lakes, ground water) to the coastal zones, to the processes induced by freshwater in the marine environment and the dynamics and budgets of substance transport between land and seas. The last day of the Workshop was dedicated to an *excursion on the Garda Lake* in Sirmione, Italy.

GMES (Global Monitoring for Environment and Security) is a theme that was initiated in previous meetings and taken up by both ESA and the EU as the way to promote the application of remote sensing and the associated spatial technologies. Since then GMES has been developed in the 6th FP of the EU as well as by ESA, and it is emerging as a major EU initiative in the use of space data in support of environmental monitoring strategies. GMES and GEOSS also have a relevant role in the 7th European Framework Programme (2007-2013) in the sub-programmes Space (GMES) and Environment and Climate (GEOSS), and in the ESA (GMES Service Element - GSE) initiatives in 2008 onwards, with the operational phase.

The year 2008 will be the starting year of the operational GMES Service Elements. We may be a bit sceptical about this switch to operability, but it is to be considered as planned. This means some kind of switch from research to industry. Needless to say, it must be a research-fed industry.

The workshop addressed a main issue in our professional life and medium-term plans:

What role for European research - and among others remote sensing research - in the GSE?

The Workshop **Geologic Hazards in Mountainous Areas** focused on highland hazards including landslides, earthquakes,

etc., and was a joint activity of the EARSeL special interest group Geological Applications, the Geological Remote Sensing Group of the RSPSoc (Remote Sensing and Photogrammetry Society, UK) and the IGOS (Integrate Global Observing Strategy) working group on geohazards. A fundamental theme of the workshop was Risk Management in which several EARSeL Special Interest Groups (SIGs) could find interoperable interest benefit from participation. The proposed workshop dealt with Geologic Hazards in Mountainous Areas. The last day of the Workshop was dedicated to an **excursion to the Dolomites** with presentations by experts of the area and discussions on Geological Hazards. The Workshop was a follow up of the Warsaw workshop in 2006 which focused on low land hazards.

The Symposium also included a **collaboration with ISPRS Commission VIII**, Remote Sensing Applications and Policies, the Working Group 2: 'Natural Hazards and Human Health'. This special session integrated remotely sensed observation and communication strategies studying vulnerability and hazard for different type of disasters such as forest fire, cyclone, flood, drought, volcanoes, earthquake, land slide, etc.

In parallel at the EARSeL events, other activities were offered to introduce Remote Sensing to the population and students. In fact, the 27th EARSeL international Symposium also offered a spectacular exhibition of images from satellites, titled: "Between light and shadow, beyond the rainbow, the Earth from the Space".

This exhibition (similar images have been recently presented at the Smithsonian National Air and Space Museum, Washington, DC) included 30 images from Space, a perspective which underlines a planet not very well known in its synoptic view. These images are mainly of artistic value and are very fascinating for common people. They carry a clear message on techniques, technologies and possible use. They are very incisive to make people approach the problems about environment and sustainable development, and make them aware of the efforts of institutions for the improvement of the quality of our life.

The Artistic Exhibition was open to everyone, starting from schools which develop in young people, a sensibility for the changes that man is able to impress upon the area he lives in. It is addressed to the experts

of this sector and the companies involved in the technical-scientific dimension of the subject, as well as to the occasional visitor who can enjoy the show offered by viewing the Earth from a distance.

The same exhibition will be presented in Paris, next October, by UNESCO (Mario Hernandez).

A **Didactic interactive Laboratory for Remote Sensing** was organized for students, joining the show of satellite images and the simple introduction to the complexity of the Remote Sensing system.

The didactic laboratory introduced students to Remote Sensing through simple experiments and through the observation of sheets and images properly created and organized.

Two rooms have been equipped to offer to schools very challenging theoretical and practical experiences. The exhibiting path was composed of 10 didactic panels in Italian, English and German, with their hard copy versions distributed to participating teachers free of charge.

Scientific instruments were displayed and useful satellite images were projected for a physical understanding of the emotions spreading from light. Students were guided by expert staff who allowed the exploration, observation and their own involvement. The experiments, directly realized by the students, employed a solar radiometer, a thermo-camera and a photometer. These instruments explain the interaction of the objects with the electromagnetic energy, its emission, absorption and reflection. The use of prisms, multicolour spinning tops, colorimeters and coloured filters allowed the understanding of the visible spectrum, the chromatic dispersion and composition of colours, revealing the mysteries of the rainbow, of mirages and shadows.

Projectors and anaglyphs were used for understanding the photographic and stereoscopic visions which will allow representation of the third dimension.

During demonstrations, professional instruments of ESA (European Space Agency) - EDUSPACE and ASI (Italian Space Agency) were used.

EARSeL was hosted by the EURAC Convention Center, a structure which also includes the **Institute for Applied Remote Sensing of EURAC Research**, formally instituted in September 2006 and which will soon install an antenna to receive images

from the main satellites orbiting for the Observation of the Earth.

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4.2 ESA CELEBRATES 50 YEARS OF EUROPE

As part of Europe-wide festivities to mark the 50th anniversary of the signing of the Treaties of Rome, a special event held in the Italian capital city on Monday night celebrated the contribution of space to a united Europe.

The event 'One night in space: meet the European astronauts', held at University of Rome 'Sapienza' reflected on how space is one of the success stories of European integration.

The event was jointly organised by the European Commission Representation in Italy, the French Embassy in Italy, the University of Rome 'Sapienza', the Italian space agency ASI, and ESA.

Like Europe, space exploration also turns fifty this year – on 4 October 2007 it will be half a century since the Russians launched Sputnik I into Earth orbit – providing a further reason to celebrate.

In the presence of invited dignitaries, including Italian Minister for University and Research Fabio Mussi, an audience of nearly 600 composed of institutional representatives, general public, university students and media was taken on an adventure in space exploration by members of the European Astronaut Corps.

Prof. Renato Guarini, Dean of Sapienza University warmly welcomed the audience, congratulated in particular the astronauts for transforming for one night the amphitheatre in a virtual cosmodrome and recalled the recent celebration of the 80 years of aerospace activities within Sapienza.

Italian Research Minister Fabio Mussi told the audience that he had always had a passion for space, since he was a child, and stressing the importance of space in the daily life of European citizens, he reiterated the commitment of Italy to reinforce investments in space research and its applications.

Former ESA astronaut Claudie Haigneré, the first European woman to visit the ISS in October 2001, said: "With the Rome Treaty

signed in 1957, we became Europeans. With Sputnik and the space conquest, we saw ourselves as Earthlings. These two moments of awakening stay at the heart of our actions today, 50 years later. We can look at the past with pride, but must look at the future with determination."

Daniel Sacotte, ESA's Director of Human Spaceflight, Microgravity and Exploration, introduced the five astronauts who are nationals of five different European countries. "Even though the astronauts retain, with pride, their nationality they all fly under a single European identity and are the strongest ambassadors of a united Europe," he said. "Many more men and women have contributed, as engineers, doctors, scientists, technicians, to the success of human spaceflight missions."

Senior astronauts Michel Tognini and Gerhard Thiele introduced the audience to the European Astronaut Corps and the International Space Station, as well as future plans for exploration. Roberto Vittori, André Kuipers and Christer Fuglesang then presented their own recent space missions, sharing personal anecdotes and showing videos and images.

The common values shared by ESA and the European Union as well as their joint cooperation are essential to the success of Europe, concluded Umberto Guidoni, European Member of Parliament and former ESA astronaut, who became the first European to visit the International Space Station (ISS) during his 12-day Space Shuttle mission in 2001.

4.3 QUIKSCAT MARKS EIGHT YEARS ON – ORBIT WATCHING PLANET EARTH

The Quick Scatterometer (QuikSCAT) satellite built by Ball Aerospace and Technologies Corp. completed eight years of outstanding on-orbit operations today, performing six years beyond its minimum two-year mission requirement. QuikSCAT continues to return critical wind data to forecast hurricanes and El Nino effects and pinpoint typhoons and other marine storms, as well as help scientists measure the mass of the Antarctic and Greenland ice sheets.

QuikSCAT data has improved the warning time for tropical cyclone development in the Atlantic and Eastern Pacific hurricane basins. Using wind field data from QuikSCAT, researchers are able to detect potential

cyclones in these regions earlier than traditional capabilities allowed. This early detection of storms could allow residents more time to prepare for adverse weather conditions.

"QuikSCAT has clearly demonstrated its reliability to both government and commercial customers, providing quality forecasting data to scientists and meteorologists - the type of data that could easily be extended with a new scatterometer mission," said David L. Taylor, president and CEO of Ball Aerospace.

QuikSCAT is a polar orbiting satellite with an 1800 km wide measurement swath on the earth's surface, circling the earth from a distance of 800 km (500 miles). Generally, this results in 400,000 measurements daily over a given geographic region. The onboard SeaWinds scatterometer has enhanced global climate research by recording sea-surface winds over the oceans on a 25km x 25km spatial scale.

NASA awarded its first Rapid Spacecraft Acquisition fixed-price contract to Ball Aerospace for the QuikSCAT, which was completed in 11 months - an industry record for a spacecraft of its size. The QuikSCAT Ball Commercial Platform (BCP 2000) architecture has since been used for the Ball Aerospace-built QuickBird I and II satellites, the ICESat and CloudSat satellites, and the National Polar-Orbiting Operational Environmental Satellite System Preparatory Project.

Designed to measure ocean winds, SeaWinds has proven useful in many other applications. Earlier this year, it detected the most widespread Antarctic melting ever observed using satellites during the past three decades. In 1999, it detected a mammoth, previously lost iceberg called B10A in the Drake Passage shipping lane. The iceberg is now tracked for the National Ice Center to route supply ships into and out of Antarctica's McMurdo station.

Source: Space Mart web-site on June 20 2007

4.4 UKRAINE TO LAUNCH EARTH OBSERVATION SATELLITE IN 2008

Ukraine is planning to launch a Sich-2 Earth remote sensing satellite into orbit in 2008, the National Space Agency said on its web site. The former Soviet republic has been

conducting space activities since 1993 "for the benefit of the national economy and state security as well as to be able to break into the international space services market."

The development of a "Sich"-based Earth observation system and a crisis-proof space monitoring system is part of The National Space Program of Ukraine for 2007-2011, the agency said.

Ukraine launched its first earth remote sensing satellite, Sich-1, in 1995, and its modernized version, Sich-1M, in 2004. The Sich-2 project is being developed by Ukraine's Yuzhnoye design bureau with an estimated cost of \$20 million.

The spacecraft will be launched on board a Russian-Ukrainian Dnepr carrier rocket from the Baikonur space center in Kazakhstan. The launch services will be provided by Kosmotras, a Russian-Ukrainian joint venture, which converts RS-20 (SS-18 Satan) intercontinental ballistic missiles (ICBM), scrapped by Russia's Strategic Missile Forces, into Dnepr launch vehicles.

The latest Dnepr mission put Germany's TerraSAR-X Earth remote sensing satellite in orbit on June 15.

Source: Space Mart web-site on June 19 2007

4.5 TRANSCONTINENTAL WILDFIRE EMISSIONS MONITORED FROM SPACE

Using data from the SCIAMACHY instrument aboard ESA's environmental satellite Envisat, scientists have determined that the carbon monoxide hovering over Australia during the wildfire season largely originated from South American wildfires some 13 000 kilometres away.

Using SCIAMACHY, Annemieke Gloudemans from SRON Netherlands Institute for Space Research and her colleagues at Utrecht University, the Vrije Universiteit Amsterdam and the Netherlands Meteorological Institute (KNMI) witnessed large quantities of released carbon monoxide (CO) above the southern continents. They also saw increased concentrations of carbon monoxide above Central Australia, a desert region that is not prone to forest fires.

"Initially we assumed that the wildfires in North Australia were responsible for this. Yet when we took a closer look at the transport of carbon monoxide, we had to conclude that the majority originated from fires in South

America. Even one-third of the carbon monoxide enhancements above the fires in North Australia originated from South America," Gloude-mans said.

Knowledge about the global distribution of carbon monoxide is important because it affects air quality and climate.

SCIAMACHY is the first satellite instrument that can measure the global distribution of carbon monoxide with nearly equal sensitivity from the uppermost layer of the atmosphere down to the Earth surface where the carbon monoxide sources are located.

"SCIAMACHY allows us to map the sources of carbon monoxide and see where they are blown to," Gloude-mans added. "We did this for all of the continents in the southern hemisphere - South America, Australia and Southern Africa - for the years 2003 and 2004 and found surprising results.

"It has been known for many years now that carbon monoxide from forest fires can be transported over long distances, but one would expect that the plume would rapidly become more diffuse the longer it travels. So, it was very surprising to find that even over Australian biomass-burning areas still up to 30% of the enhanced carbon monoxide levels from forest fires originate in South America."

Forest fires in South America produced much more carbon monoxide in 2004 than in 2003, Gloude-mans explained. "These levels correlated to the amounts found over Australia for the same periods, confirming that the carbon monoxide levels over Australia are severely influenced by South American forest fires."

Plumes of carbon monoxide signal strong biomass burning. Apart from the carbon monoxide detected by SCIAMACHY, numerous other compounds are emitted that have severe consequences for air quality and climate.

Depending on the aridity, much of Australia is prone to fires between October and March, and the direct consequences for humans and the environment are disastrous. The fire season in South America, often concentrated in Brazil, Argentina, Bolivia and Venezuela, lasts from July to December roughly and contributes up to 50% of the enhanced carbon monoxide levels in the atmosphere over Australia.

Source: Space Mart web-site on May 09 2007

4.6 AFRICAN WATER PROJECT SUPPORTED BY SPACE

Algeria, Libya and Tunisia have kicked off an ambitious water project called GEO-AQUIFER that will use satellite imagery to support the monitoring and sustainable management of their common, trans-boundary groundwater resources, bettering the living conditions of their population.

The groundwater resource, which was built up around 10 000 years ago, is known as the North-Western Sahara Aquifer System (SASS, after its French acronym). The SASS covers an area of over one million square kilometres and is the key water resource in the region. Although it has negligible recharge, it has experienced heavy exploitation, 'ground water mining', in the past thirty years.

Ensuring the sustainability of this valuable, non-renewable resource is vital for the lives of millions who depend on it for drinking water and irrigation. Recognising the overexploitation of this shared resource, these three countries initiated together with the Sahara and Sahel Observatory (OSS) a consultation mechanism at ministerial level. This consultation depends on objective, timely, area-wide and consistent information.

Although the ground water resources are hidden up to more than a kilometre below the surface, the soon-to-be completed ESA project Aquifer has demonstrated that observations from space of the surface of the Earth can provide useful information.

"The ESA (European Space Agency) Aquifer project has demonstrated to us and the countries several tools that space technology can provide. We are starting the GEO-AQUIFER project because we think this technology can help us to get information quickly on issues that have an exponential evolution," the OSS Executive Secretary Youba Sokona said during the launch event on Thursday.

The Aquifer project was developed under ESA's Data User Element (DUE) programme and takes place as part of the TIGER Initiative, aimed at applying EO data to develop a technical, human and institutional capacity to bridge Africa's water information gap using satellite data. Since Aquifer's initiation in 2004, more than 200 African organisations have become involved in different TIGER projects around the continent.

GEO-AQUIFER provides continuity with the ESA Aquifer project. Its principal aim is to provide information to decision makers and thus to strengthen the integrated water management practice. GEO-AQUIFER will use products and services based on satellite data, such as land-use and land-cover maps, change maps, surface water extent and dynamics, digital terrain models, and derive information on water consumption for irrigation.

Capitalising on the encouraging results of the Aquifer project, GEO-AQUIFER will be an extension and expansion towards increased geographic coverage and user specific fine-tuning of products and services.

The GEO-AQUIFER project is co-funded by OSS and the African Water Facility (AWF), which is managed by the African Development Bank (AfDB). OSS, is the executive agency for GEO-AQUIFER, key partners are the national water ministries. ESA is involved as member of the steering committee.

Speaking at the launch event, Yvan Kedaj of the AWF commended the efforts of the African agencies involved. "I really appreciate the appropriation by the countries of the tools and methodologies demonstrated by the ESA TIGER Aquifer project. Countries asked us through the OSS initially as coordinating and executing agency, and now as secretariat of the consultation mechanism, for continuation of national capacity building on the tools and methodologies developed through Aquifer.

"GEO-AQUIFER is co-funded by the AWF as the next step in EO data utilisation in SASS water resources knowledge improvement, in order to quickly give to the consultation mechanism relevant information at SASS level for decision making."

GEO-AQUIFER has a lifetime of 18 months, with final results being planned for late 2008.

Source: ESA web-site on June 08 2007

4.7 DESERTIFICATION AND DROUGHT MONITORING

Today, over 250 million people are directly affected by desertification and over 4 billion hectares of land are at stake - the UN estimates that each year desertification and drought cause an estimated \$ 42 billion in lost agricultural production. The EUMETSAT (European Organisation for the Exploitation

of Meteorological Satellites) Satellite Application Facility on Land Surface Analysis (Land SAF) led by the Portuguese National Meteorological Service might become the right tool to monitor desertification and drought threatened areas, providing an important source of information to combat environmental degradation vital for activities such as agriculture, forestry and terrestrial transport safety management.

The Land SAF uses operational data from EUMETSAT's geostationary satellites to increase the usage of data over land, land-atmosphere interactions and biospheric applications. This information is needed for applications such as modeling and simulation of weather and climate, forecast and analysis of natural hazards and the monitoring of ecological and hydrological systems. Numerical Weather Prediction (NWP) models and research on climate change will largely benefit from Land SAF products which offer state-of-the-art land surface schemes.

The Land SAF is currently involved in GEOLAND, an initiative related the Global Monitoring for Environment and Security (GMES) under the Sixth Framework Program. The program aims to develop and integrate a range of geo-information services and products focusing on land cover and vegetation monitoring with the purpose of helping authorities to fulfill their environmental monitoring and manage their natural resources more effectively.

For more information:

http://www.eumetsat.int/Home/Main/Media/Press_Releases/029969

Source: GMES web-site on June 22 2007

4.8 GMES SENTINEL

An agreement on the first Earth observation satellite for Europe's Global Monitoring for Environment and Security (GMES) program was found between ESA and Thales Alenia Space. At the International Paris Air Show Le Bourget, a contract worth €229 million has been signed for the design and development of Sentinel-1.

The ESA Sentinels, composed of five satellites, constitute the first series of operational satellites responding to the Earth Observation (EO) needs of the GMES program, a joint initiative of the European Commission and ESA. Sentinel-1 is expected to be launched in 2011, including applications such as marine - vessel detection, oil spill mapping and wind

products – and sea ice mapping. Sentinel-2 and 3 satellites, scheduled for launch in 2012, will support land and ocean monitoring, while Sentinel-4 and 5 will be dedicated to meteorology and climatology through atmospheric chemistry.

For more information:

http://www.esa.int/esaCP/SEMBRT7OY2F_index_0.html

Source: GMES web-site on June 18 2007

4.9 SPACE COUNCIL WELCOMES HISTORIC EUROPEAN SPACE POLICY

On 22 May 2007, EU Ministers responsible for internal market, industry and research, together with Ministers in charge of space activities in the Member States of the European Space Agency (ESA), signalled their clear support for a joint and comprehensive European Space Policy that will benefit all citizens and keep European industry strong and competitive.

The meeting of the European Space Council saw the unanimous endorsement by Ministers of a resolution welcoming and supporting the new policy in this strategic and high value-added economic sector.

The new European Space Policy brings all EU and ESA space activities and all Member State space programmes under a single, coherent framework policy. Ultimately, say its supporters, this will eliminate repetition, improve strategic coordination and ensure that Europe's investment in space is as efficient as possible. "We are extremely pleased at the overwhelmingly enthusiastic response to this new European Space Policy", said Commission Vice-President Günter Verheugen. "Today we have reaffirmed Europe's position as a global space power. Europe possesses some splendid technological and scientific capacities as measured against anyone in the world."

Vice-President Verheugen responsible for Enterprise and Industry Policy is working to secure economic and societal benefits for European citizens. "Today Europe has a leading role in space sciences, research and exploration," he said, "but this is also about the day-to-day lives of our citizens. European industry and institutions are investing in a wide range of applications that will mean real services for citizens and a strong competitive economy for Europe." ESA Director General Jean-Jacques Dordain said, "We have taken a real step forward.

Taken together, EU and ESA Member States include 29 countries, now all are unified and committed to a common comprehensive policy. This policy incorporates all the dimensions of Europe and all the dimensions of space." He stressed that Europe has been actively involved in "breakthrough" space activities for 40 years. Space affects many sectors from education to science applications and security. "This new strategy brings a new European dimension to space and a space dimension to Europe", he added.

Reinforcing co-operative framework

The Space Council's adoption of the European Space Policy is a major milestone in an ongoing process bringing European space stakeholders closer together. As space policy has increasingly gained an EU dimension, the goal for the EU and ESA has been a more efficient working relationship. Underpinning the new European Space Policy is the EC-ESA Framework Agreement. Signed in 2004, it provides a basis for coordination arrangements between intergovernmental and Community actions.

Ensuring efficient policy making and programme management is now seen as essential for government bodies and for the sector's investors and users. The new European Space Policy sets out orientations for better coordinating of civil space programmes between ESA, the EU and their respective Member States.

Clear priorities

Specifically, the Communication cites ongoing support for further development and exploitation of European flagship space initiatives such as GALILEO and GMES (Global Monitoring for the Environment and Security), and satellite communication applications. Support for technological and scientific advancement will focus on identified critical technology domains, including continued European involvement in the International Space Station (ISS).

The new European Space Policy makes specific reference to defence and security applications, aiming to support increasing synergies between military and civil space programmes and, in particular, supporting the interoperability of these systems to ensure investments are maximised.

Europe, it says, will also continue to seek autonomous access to space. Today, Europe remains at least partly dependant on the

USA and Russia for non-human payloads and completely dependant when it comes to human space missions. Nevertheless, relations with non-European partners will remain a key priority, to include new players such as India and China. The new space policy will provide for a specific coordination mechanism for such international cooperation

New mandate

Following this historic Space Council meeting, Verheugen and Dordain held a press conference with Maria Van der Hoeven, Chair of ESA's Ministerial Council, and Peter Hintze, Germany's Federal Government Coordinator for Aerospace Policy and representing the German EU Presidency. "After 50 years of Europe, we are now unified in outer space," said Van der Hoeven. "We have come to a consensus among all our Member States that will mean more value for public money and European independence in an important sector".

Hintze said, "Europe has long stood among the pioneers of space travel and exploration. Today we have achieved a landmark that will cut down on paperwork and bureaucracy and deliver practical advantages in areas such as environmental protection, agriculture and security for European citizens."

With the official endorsement of the Space Council, the European Space Policy now has, for the first time, the explicit support of all EU and ESA Member States, putting space issues in the top rank of the European agenda.

Verheugen says he is now looking towards even greater accomplishments for Europe in space. "I do not believe the era of great discoveries in space is behind us," he said. "The best is yet to come."

Source: European Commission web-site on June 20 2007

4.10 SATELLITES SHED LIGHT ON GLOBAL WARMING

As climate change continues to make headlines across the world, participants at the 2007 Envisat Symposium this week are hearing how Earth observation satellites allow scientists to better understand the parameters involved in global warming and how this is impacting the planet.

The cryosphere is both influenced by and has a major influence on climate. Because any increase in the melt rate of ice sheets and glaciers has the potential to greatly increase sea level, researchers are looking to the cryosphere to get a better idea of the likely scale of the impact of climate change. In addition, the melting of sea-ice will increase the amount of solar radiation that will be absorbed by ice-free polar oceans rather than reflected by ice-covered oceans, increasing the ocean temperature.

Average temperatures in the Antarctic Peninsula have risen over the last 50 years by half a degree Celsius a decade and are having an impact on the ice shelves and glaciers. Innsbruck University's Professor Helmut Rott has been observing the accelerated retreat and break-up of the Larsen Ice Shelf on the Antarctic Peninsula in the face of this warming through radar images acquired by ESA's (European Space Agency) ERS and Envisat satellites.

The retreat has been accelerating since 1992 and has culminated in two collapse events: Larsen-A in January 1995 and Larsen-B in March 2002. Envisat captured the disintegration of the 200-metre-thick Larsen-B Ice Shelf, which researchers estimate had been stable since the last ice age 12 000 years ago.

"This retreat was triggered by climate warming, which caused prolonged summer melt seasons and the formation of extended melt water streams and ponds on the ice shelf surfaces," Rott said.

The sections of Larsen-A, which disintegrated almost completely in January 1995, and Larsen-B that broke away were 200 to 350 metres thick. According to Rott, only 1403 square kilometres of Larsen-B remain and will soon break away completely.

After the collapse event in 2002, the outlet glaciers from the Antarctic Peninsula that previously nourished the ice shelf retreated many kilometres above the previous grounding line. Altogether about 250 square kilometres of grounded ice have been lost at the outlet glaciers of former Larsen-A and Larsen-B ice shelves.

The remoteness, darkness and cloudiness of Earth's Polar Regions make them difficult to study. An instrument known as the Advanced Synthetic Aperture Radar (ASAR) allows Envisat to produce high-quality images of ice sheets because it is able to pierce through clouds and darkness.

In addition to mapping ice boundaries, Rott used repeat-pass ASAR image data to map the flow velocities of glaciers. All the glaciers, where the buttressing ice had disappeared, have accelerated significantly. The retreat of grounded ice and the accelerated ice export due to increased velocity result in strongly negative mass balance of the glaciers.

"The velocity of the glaciers increased up to eight-fold compared to the speed when the ice shelf buttressed the glaciers," Rott said. "The total estimated mass loss of glaciers above the disintegrated ice shelf sections since 2002 has been equivalent to about 2 percent of total sea level rise, which, although not a significant percentage, demonstrates the vulnerability of ice shelves to climatic warming and the importance of ice shelves for the stability of glaciers upstream."

"The disintegration processes observed at Larsen Ice Shelf are very relevant for estimating the future response to climatic warming of the much larger ice masses of West Antarctica, which contain freshwater equivalent to several metres of sea-level rise," Rott added.

Satellites have been extremely beneficial to scientists in understanding oceanic planetary waves, which are internal waves that have major effects on large-scale ocean circulation and thus on climate. These very long waves travel slowly across the oceanic basins influencing the major oceanic currents and are believed to play a role in the complex 'planetary clock' that triggers one of the major climatic anomalies – El Niño.

"These waves are an important means of ocean adjustment to forcing. In a sense they 'set the rhythm' for some aspects of the interactions between oceans and climate. Faster waves in a warmer ocean, as an effect of climate change, may result in complex repercussions on the climate system, many of which could turn out to accelerate the change," Dr Paolo Cipollini of the National Oceanography Centre in the UK said.

Cipollini illustrated the role satellite instruments have played in understanding these elusive waves. He pointed out that although they were theorised to have existed as far back as the 1930s, it was not until the advent of the satellite-borne radar altimeter that oceanographers were able to offer proof of their existence by mapping the sea surface height and seeing them move by following the measurements of the surface.

Radar altimeters work by sending thousands of separate radar pulses down to Earth per second then recording how long their echoes take to bounce back to the satellite platform. The sensor times its pulses' journey down to under a nanosecond to calculate the distance to the planet below to a maximum accuracy of two centimetres. ESA has had radar altimeters in orbit since July 1991, when ERS-1 was launched, which was followed by ERS-2 in 1995 and Envisat in 2002 and will continue to launch radar altimeters with CryoSat planned for 2009 and Sentinel-3 planned for 2012.

According to Cipollini, these waves have been recently observed to alter the colour of the sea, therefore they are believed to have some effect on phytoplankton – the tiny chlorophyll-pigmented algal cells that populate the oceans in huge numbers and play a leading role in the global carbon cycle and the primary production of nutrients.

Current research is investigating these relationships by exploiting the powerful union of multiple views of the ocean made possible by different instruments like those in the Envisat suite, such as the Radar altimeter, Along Track Scanning Radiometer (ATSR) and Medium Resolution Imaging Spectrometer (MERIS). Envisat carries 10 instruments aboard and generates data on Earth's land, oceans, ice and atmosphere.

By comparing and contrasting information on ocean colour, surface temperature and sea level, scientists are exploring the many subtle ways in which these near-invisible waves are capable of affecting phytoplankton, as they may be providing them with an input of nutrient-rich water from the deep ocean as well as moving them around. These findings are then compared with the effect of waves in models, helping to make the models more realistic, which means better predictions for the future.

Cipollini cited a recent modelling study by Canadian researchers that shows planetary wave speed is expected to increase considerably during this century as a side effect of climate change induced warming of the oceans, which may have a number of far-reaching effects on ocean dynamics.

"It is no surprise, then, that scientists are eager to better understand these phenomena - and satellites provide both the indispensable validation of the theoretical hypotheses and the stimulus for new ideas," Cipollini said.

Sea surface temperature (SST) is one of the most stable of several geographical

variables which, when determined globally, helps diagnose the state of the Earth's climate system. Professor David Llewellyn-Jones, Head of Earth Observation Science at the University of Leicester, UK, outlined the importance of SST data at the symposium.

Tracking SST over a long period is arguably the most reliable way researchers know of measuring the precise rate at which global temperatures are increasing and improves the accuracy of our climate change models and weather forecasts.

"There is now evidence there is a distinctive upward trend in global sea surface temperatures, and this we can now see from measurements made from Envisat," Professor Llewellyn-Jones said.

Working like thermometers in the sky, a number of different satellite instruments measure SST on an ongoing basis, such as the AATSR aboard ESA's Envisat.

The AATSR instrument aboard Envisat and its predecessors, ATSR-1 and ATSR-2 on the ERS-1 and -2 satellites, has been providing researchers with a precise quantitative indication of the changes and variability associated with the climate system over the past 16 years.

"Thanks to a new archive of uniformly processed data from 1991 to the present day, which is due to be launched later this year, it will soon be possible to provide a definitive statement of the rate at which global temperatures have been changing and how the variability of our climate has been changing," Llewellyn-Jones said.

"The ATSR instrument produces data of unrivalled accuracy on account of its unique dual view of the Earth's surface, whereby each part of the surface is viewed twice, through two different atmospheric paths," Llewellyn-Jones added. "This not only enables scientists to correct for the effects of dust and haze, which degrade measurements of surface temperature from space, but also enables scientists to derive new measurements of the actual dust and haze, which are needed by climate scientists."

Source: ESA web-site on April 17 2007

4.11 SATELLITES PLAY VITAL ROLE IN UNDERSTANDING THE CARBON CYCLE

The global carbon cycle plays a vital role in climate change and is of intense importance

to policy makers, but significant knowledge gaps remain in our understanding of it. Several scientists at the Envisat Symposium this week have highlighted research projects using ESA (European Space Agency) satellites to understand better this complex process.

The total number of carbon atoms on Earth is fixed – they are exchanged between the ocean, atmosphere, land and biosphere. The fact that human activities are pumping extra carbon dioxide into the atmosphere, by fossil fuel burning and deforestation, is well known. Because of this, atmospheric carbon dioxide concentrations are higher today than they have been over the last half-million years or so. Scientists are now using satellite instruments to locate sinks and sources of CO₂ in the ocean and land.

Across land and sea, our world's plant life uses the process called photosynthesis to convert incoming sunlight into chemical energy. Plants accumulate carbon dioxide during photosynthesis and store it in their tissues, making them carbon sinks.

Dr Nadine Gobron of the European Commission's Joint Research Centre (EC-JRC) in Ispra, Italy, is combining daily multispectral observations from Envisat's Medium Resolution Imaging Spectrometer (MERIS) instrument with a sophisticated processing algorithm to reveal global photosynthesis activity on land.

The fraction of incoming solar radiation useful for photosynthesis that is actually absorbed by vegetation – a value known as the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) – is recognised as an essential climate variable by international organisations including the Global Climate Observing System (GCOS). FAPAR is regularly used in diagnostic and predictive models to compute the primary productivity of the vegetation canopies.

The operational FAPAR MERIS product is derived with the JRC-FAPAR algorithm, which has been designed to exploit the daily MERIS spectral measurements in the blue, red and near-infrared bands with no prior knowledge on the land cover.

This methodology involves a physically-based approach which can be adopted for generating this biophysical product from various optical medium resolution sensors. The algorithm used allows scientists to derive the equivalent biophysical product from other optical satellite sensors, even retired ones, to ensure the availability of a long-time series of global FAPAR, which is

essential to assess environmental trends, guide policy making and support sustainable development activities.

"Demonstration products at the global scale are now available and are ready to be used in state-of-the-art carbon data assimilation systems (CCDAS) for better understanding the role of the biosphere in the global carbon cycle," Gobron said.

Phytoplankton, microscopic marine plants that drift on or near the surface of the sea, absorb atmospheric carbon dioxide through photosynthesis just as their terrestrial 'cousins' do. While individually microscopic, phytoplankton chlorophyll collectively tints the surrounding ocean waters, providing a means of detecting these tiny organisms from space with dedicated ocean colour sensors, such as MERIS.

Dr Michael Buchwitz from the Institute of Environmental Physics (IUP) at the University of Bremen in Germany presented global carbon dioxide measurements based on observations from Envisat's SCIAMACHY instrument from 2003 to 2005.

The SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) instrument is the first space sensor capable of measuring the most important greenhouse gases with high sensitivity down to the Earth's surface because it observes the spectrum of sunlight shining through the atmosphere in 'nadir' looking operations on a global scale.

Buchwitz explained that he and his colleagues first measure the absolute carbon dioxide (CO₂) column in number of CO₂ molecules per area above the Earth's surface. Then, they measure the oxygen (O₂) column that can be easily converted into an 'air column'.

"There are, however, tiny differences and this is the CO₂ source/sink information we are interested in," Buchwitz said. "To see this we compute the CO₂/O₂ ratio which can be converted into a column averaged CO₂ mixing ratio."

Dr Paul Monks from the University of Leicester is using SCIAMACHY data to measure how much CO₂ is being taken up by plants. Using 20,000 individual measurements a month, he is monitoring CO₂ drawn down over Siberia, North America and Northern Europe.

According to Monks, this view from space is providing the first evidence of the Earth 'breathing' by allowing scientists to witness the biology drawing down CO₂ during the

growing season and then releasing some of it back.

"The exciting new area breaking from this sort of data is that we begin to be able to look at the tropics, which are the 'lungs' of the atmospheric system," Monks said. "Using this data, we are going to be able to assess how efficient the tropics are at modulating carbon as well as how that is changing with time as climate change effects the tropical biosystem."

By comparing the satellite data to aircraft data and to remote sensing sites on the surface, Monks learned the method he and his colleagues are using is approaching a precision of around 1%, giving them confidence in what they see from space.

By better understanding all of the parameters involved in the carbon cycle, scientists can better predict climate change as well as better monitor international treaties aimed at reducing greenhouse gas emissions, such as the Kyoto Protocol which addresses the reduction of six greenhouse gases including carbon dioxide.

Source: ESA web-site on April 25 2007

4.12 ENVISAT SYMPOSIUM 2007

Throughout the week 23-27 April, scientists at the Envisat Symposium have been presenting the latest results of ESA (European Space Agency) Earth observation satellites and in particular its flagship, Envisat.

Following in the footsteps of ESA's former missions ERS-1 and ERS-2, launched in the 1990s, Envisat's sophisticated optical and radar instruments have produced in five years a large amount of data. Its observations of the Earth's land, atmosphere, oceans and ice caps have provided scientists with a greater understanding of the workings of our planet and the reasons behind climate change.

Apart from mapping and monitoring atmospheric pollution, Envisat is also taking the temperature of oceans and other signs of global warming like the melting of the ice caps in Greenland and Antarctica.

Instruments on board Envisat such as ASAR (Advanced Synthetic Aperture Radar) and MERIS (Medium Resolution Imaging Spectrometer) are also providing vital information on the biological activity of the planet's vegetation.

Gathering data in near-real time Envisat can provide the timely and precise information needed to track the path of a hurricane, locate the hot spots of a forest fire,

assess the damage extent of an earthquake and even predict where the next one may strike.

Source: ESA web-site on April 27 2007

5. FUTURE EVENTS

5.1 B-GIS@ASIA

B-GIS@Asia is a conference on GIS set for 17th — 19th December 2007 at Technopark, Trivandrum, India. It is about discovering how GIS empowers organizations as well as demonstrating the role of GIS in organizational business with the intention of urging entrepreneurs, and/or organizations, to invest in GIS for profit and/or operational performance. Towards this end, b-GIS@Asia provides a platform for GIS professionals, academicians, private enterprises, government, and NGOs to come together and orchestrate their combined strengths to expose the myths and misconceptions behind the technology and bring GIS closer to people by focusing on areas of organizational business that are key to organizational functioning. For further details please visit:

<http://www.tagsasia.org/bgisasia>

5.2 COLLOQUIUM ON METEOSAT SECOND GENERATION (MSG)

Colloquium on Meteosat Second Generation (MSG): a new tool for environmental monitoring to be held in Dijon, France, September 13-14, 2007. Further info can be found at:

<http://msg.univ-paris1.fr/colloque2007>

5.3 POSTGRADUATE CERTIFICATE COURSE “APPLICATIONS OF EARTH OBSERVATION AND GIS IN INTEGRATED WATER RESOURCES MANAGEMENT”

7 January – 25 April 2008 (16 weeks), Nairobi, Kenya

The postgraduate course *Applications of Earth Observation and GIS in Integrated Water Resources Management* will provide professionals in the field of Integrated Water Resources Management (IWRM) with practical tools and methods which are in-line

with the recent advances in research and development and are directly applicable. Correct data, knowledge of hydrology, and proper modelling are the main requirements for the development of realistic integrated water management plans. The availability of modern data acquisition and analysis tools has greatly increased over the last few years while the inherent cost has dramatically reduced. Organizations such as basin authorities dealing with IWRM could benefit from these data acquisition and analyses developments.

Funding opportunities

Matching fellowships and co-financing possibilities under the ITC School for Disaster Geo-information Management are available for 2008.

For more information

http://www.itc.nl/itc_worldwide/kenya_brochure.pdf

For on-line registration

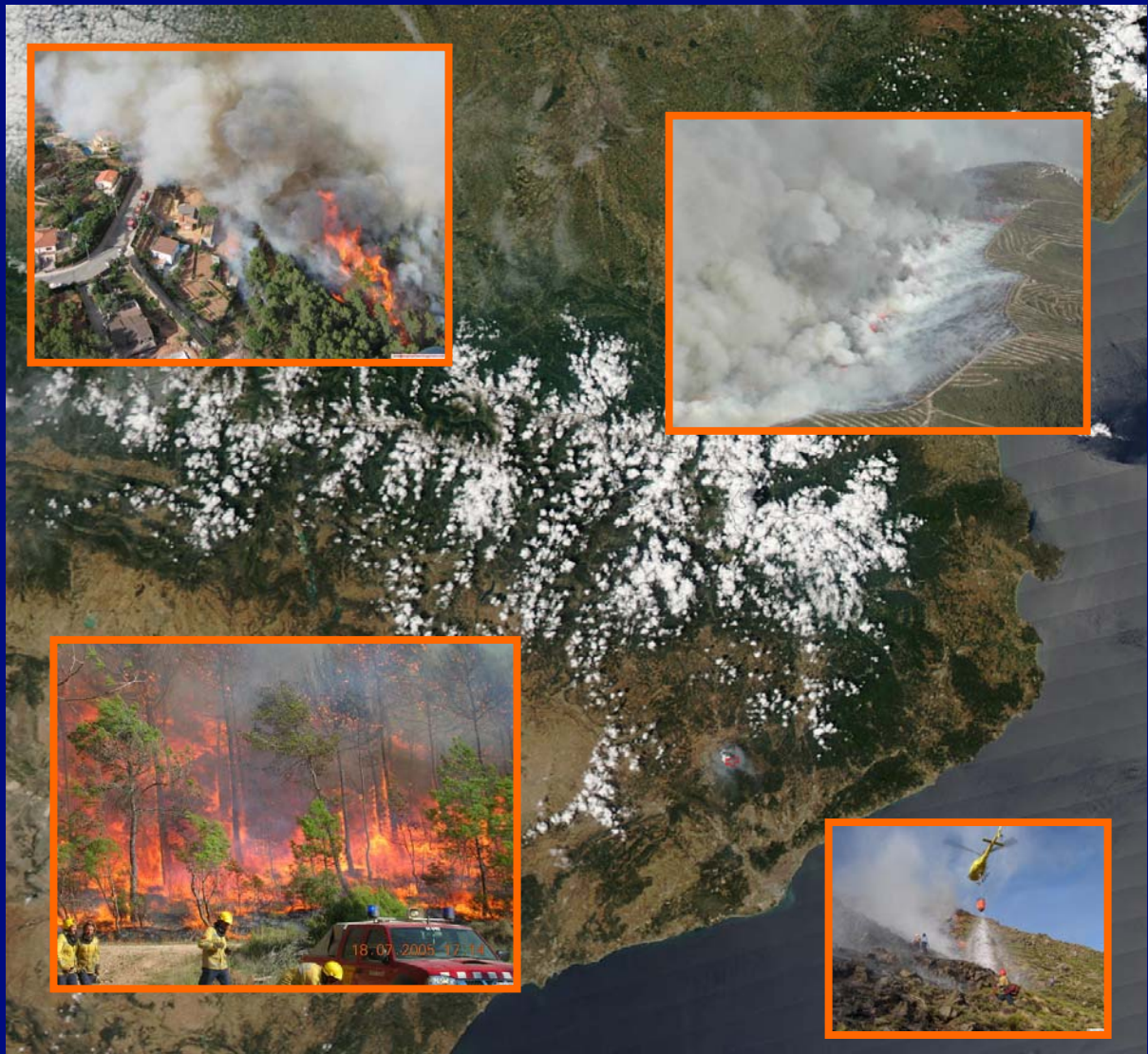
<http://www.itc.nl/education/register/regform.aspx>

5.4 “SUSTAINABLE SOLUTIONS, FOCUS ON AFRICA” SYMPOSIUM

On November 1st and 2nd 2007 Delft University of Technology will organise a symposium on a similar subject called “Sustainable Solutions, Focus on Africa”. For details and more information see <http://www.lustrum.tudelft.nl/symposium>

Back Cover – Fires in Catalonia

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