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EARSeL Newsletter Editor

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

Editorial Assistant

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

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1 EDITORIAL

I was delighted and honoured when I received in June an invitation from the Chairman of the EARSeL Bureau, Robin Vaughan, to be the new Editor for the EARSeL Newsletter. Ever since my first direct contact with EARSeL in 1995, when I participated in the EARSeL Workshop "Pollution Monitoring and GIS" in Brandys-nad-Labem, Czech Republic, right up until my attendance in June of this year at the 20th EARSeL Symposium in Dresden, Germany, I have been conscious of the important role of EARSeL, both in promoting the use of advanced remote sensing methods for practical applications, and in fostering contact and cooperation between individual experts and agencies throughout Europe. The EARSeL Newsletter has, over the years, mirrored this important role, by keeping all of the members of the large EARSeL "family" regularly informed of the latest scientific, industrial, and political developments in the rapidly changing world of remote sensing and earth observation in Europe. I would like to take this opportunity to acknowledge the excellent work of my predecessor, Lucas Janssen, during his time as Editor of the Newsletter. I will do my best to ensure that the high standards set by Lucas will be continued during my own Editorship.

As this is my first venture as Editor of the EARSeL Newsletter, I shall refrain in this editorial from making weighty pronouncements on topics such as what are the most promising developments in Earth Observation today, or what future directions EARSeL as an association might fruitfully take, or ways to make the Newsletter a more effective instrument, etc. Instead, in the remainder of this editorial I will first briefly introduce myself (since many of you probably do not know me!), and then outline how, as a member of staff of Directorate General – Joint Research Centre of the European Commission, I feel that I can contribute to the Newsletter, by highlighting initiatives and developments taking place at a European level, that are likely to have a significant impact on the European remote sensing community.

I am working at the Space Applications Institute of the European Commissions's Joint Research Centre in Ispra. My current focus is on the use of Earth Observation methods for monitoring urban development and expansion. Since my introduction to remote sensing (and GIS) in 1986, at the start of my postgraduate studies in forestry at University College Dublin, I have witnessed many developments in remote sensing. However, looking back I feel that the current widespread use and acceptance of remote sensing as a practical, cost-effective tool for environmental monitoring, is only partly due to major advances in the various technologies related to remote sensing, but is also a result of the ever-growing environmental crises and disasters that are evident throughout Europe and the world today. As a consequence of these constantly increasing environmental pressures, the number and variety of environmental applications of remote sensing are likely to continue to grow for the foreseeable future.

Within the context of the imminent enlargement of the Europe Union, and in order to guarantee the optimal use of remote sensing for environmental monitoring, several initiatives are being developed at the European level within the framework of a new European Space Strategy. One of the most important of these initiatives – called GMES (Global Monitoring for Environment and Security) – is described in an article in Chapter 3 of this Newsletter. Such initiatives require close collaboration between all of the main actors involved in remote sensing in Europe, including the Member States, the European Commission, the European Space Agency, and other European bodies. One of my goals as Editor of the EARSeL Newsletter will be to monitor and highlight those events and projects taking place throughout Europe, that are aimed at the successful implementation of GMES and similar initiatives.

Finally, I must thank Madeleine Godefroy for the invaluable assistance which she has provided to me in preparing this Newsletter.

The Editor

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2 NEWS FROM THE ASSOCIATION AND ITS MEMBERS

2.1 EARSeL Bureau and Council Meetings in Dresden

The EARSeL Bureau and Council held their regular meetings on the occasion of the annual General Assembly, and also a supplementary "brainstorming" meeting, to which past Chairmen and Bureau members were invited to discuss what future strategy might be adopted in order to adapt to the changing research environment.

Apart from the Bureau members, the national representatives of Belgium, the Czech Republic, Denmark, Finland, Germany, Hungary, Spain, Sweden and Switzerland were present. They were joined by Dr. Sten Folving, who has succeeded Dr. Jacques Mégier as representative of the EC Joint Research Centre, and Prof. Manfred Buchroithner, host and organiser of this year's Annual Meeting.

The Chairman reported that unfortunately the proposals submitted to Brussels had not been accepted for funding, but they would certainly be improved and re-submitted. These were the ERSAIS (European Remote Sensing Advanced Information System) proposal and the ATENEO (Associations Towards a European Network for Earth Observation Education and Training) Project.

The EARSeL Chairman is invited to attend the meetings of the Earth Science Advisory Committee of ESA and he reported on their work and the choice of Core Missions that had recently been made under the Earth Explorer Programme.

As far as the Special Interest Groups are concerned, it was decided that when these wish to organise workshops independently of the annual meeting, a simple Memorandum of Understanding should be signed between the hosting institute and EARSeL, whereby each party has equal rights and responsibilities in the organisation of the meeting.

The Council agreed that the SIG Forest Fires should organise a workshop immediately following the annual symposium to be held at Marne-la-Vallée (Paris) next May, and that the annual meeting 2002 should be held in Prague.

The organisation of the RISK 2000 meeting had not received the necessary financial support from the sponsoring organisations that had been approached and the Steering Committee decided that it would be better to postpone this until such support could be secured. However, in order to recognise the contributions made by many authors that had submitted papers, these authors would be invited to present their work in special sessions at the 2001 annual meeting.

The Treasurer in his report was pleased to announce that the European Space Agency had agreed to grant EARSeL an annual subsidy this year on a similar level as last year. Since for various reasons the number of member laboratories was in decline, this subsidy is very necessary for us to continue to function.

The main point stressed in the Strategy meeting was that EARSeL needs to make a "public relations" effort to become more visible with the RS community. The Association should be represented by one at least of its Bureau members at most of the large international meetings and articles describing the activities and achievements of the Association could be submitted to certain journals and magazines having a wide circulation. An effort should be made to involve more commercial and industrial companies in EARSeL activities. It was suggested that sessions at the annual symposium should be more structured and a Student Award revived in order to encourage the submission of high quality papers and posters. EARSeL now has a domain (http://www.earsel.org) making it more visible on the Web. It is most important that the Web pages, including those of the SIGs, should be kept up-to-date. Co-operation with other organisations, such as the Technical Commissions of ISPRS, the OEEPE, etc. should be strengthened.

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2.2 EARSeL General Assembly 2000

The full report of the General Assembly will be published in the Annual Activity Report. We should like here to report on a highlight of the meeting, which was the granting of an Honorary Membership to our ex-Chairman, Professor Sergio Vetrella, for the outstanding services he rendered to our Association when he served first as Secretary General from 1987-1989 and then for two terms as Chairman from 1989-1993. A summary of Professor Vetrella's scientific and teaching activities makes impressive reading. He is a member of numerous advisory committees not only in Italy but also within ESA, the EC, NASA, NASDA, the IAF and the IAA (International Astronautical Academy). Apart from his teaching commitments at two universities in Naples, and his chairmanship of the CO.RI.S.T.A. Consortium there, his main responsibility at present is as President of the Centro Italiano di Ricerca Aeronautica (CIRA), the Italian Centre for Aerospace Research, directly responsible to the Italian Ministry of Technological Research. We were extremely happy to welcome Professor Vetrella to Dresden and wish him continuing success in his many endeavours.

(From left to right) : M. Godefroy, R. Vaughan, S. Vetrella, G. Konecny

2.3 EARSeL Symposium 2000

Dr. Gerhard Bax, Karlstad University, Sweden

The 20th annual symposium of our Association was hosted this year by the Technical University of Dresden in Germany and, in particular, by the Institute for Geosciences and Cartography, headed by Prof. Dr. Manfred Buchroithner. The theme chosen was "A Decade of Trans-European Cooperation". This was particularly appropriate since the same Manfred Buchroithner – while operative in his home country – also organised the 11th symposium which was held in Graz, Austria. At that time, in 1991, it became possible to welcome freely participants from countries belonging to the former eastern block, several of which bordered Austria.

As a first time participant I am unfortunately unable to perform a comparison of the meetings, as our newly established laboratory joined EARSeL first in 1999. Nevertheless, I was impressed by the extremely friendly atmosphere in this obviously "seamless" remote sensing community of Europe. Remote sensing covers topics of truly international concern.

This millennium year is more than usually packed with very large international meetings and congresses, beginning with the ISPRS Congress in July, so that participation was perhaps not as was anticipated. Nevertheless, including the workshops organised by two of our Special Interest Groups, some 150 participants came to Dresden from 26 countries, including six eastern European countries, and from countries farther afield such as Algeria, Canada, Israel, Turkey and the United States.

The meeting received some support from the German Research Foundation, which enabled some participants from eastern Europe to attend. The Joint Research Centre also supported the meeting with a very good exhibition describing their programmes and CREASO GmbH presented the ENVI suite of software.

Participants were welcomed by the Vice-Rector of the University, Prof. Walter Schmitz, followed by representatives of the

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EARSeL sponsoring agencies. Dr. Josef Aschbacher, Scientific Assistant to the Director of the Joint Research Centre in Ispra, gave an overview of their work, followed by Dr. Livio Marelli from the European Space Agency Headquarters, who spoke on their Application Programmes, and Dr. Michael Rast from ESTEC, who gave a presentation on the Earth Explorer missions. There then followed two keynote addresses, one given by Prof. Charles Elachi, Director of Space and Earth Science Programs at the Jet Propulsion Laboratory in Pasadena, USA. His presentation on "Earth and Planetary Observation with Spaceborne Radar Sensors: American and European Achievements" was very much appreciated by the audience. The second keynote: "Ice in the Earth System: the View from Above", given by Prof. Chris Rapley, former Director of the IGBP Programme and present Director of the British Antarctic Survey, was also a first-class presentation.

M. Buchroithner welcomes delegates to the 20th EARSeL Symposium in Dresden

The symposium included 37 oral and 45 poster presentations in 8 technical sessions. Only two of them, session 4 on Hydrology & Oceanography and session 5 on Ecology and Protected Landscapes, ran parallel. The poster sessions were chaired and authors had the possibility to give short oral introductions to their posters. Unfortunately, this quite unusual possibility was not recognised by all contributing authors. All given presentations were of high scientific level, most of them dealing with applications of remote sensing techniques.

The Annual General Assembly, number 24 as there were 4 assemblies without accompanying symposia in the early days of EARSeL, was chaired by the president of EARSeL, Dr. Robin A. Vaughan from the University of Dundee, UK.

Apart from the technical sessions, probably what participants will remember most were the social events that Manfred had organised with the help of the University conference service. These important points of the agenda were all excellent and enabled participants to establish real contacts and have lively and fruitful discussions. A classical concert was given by the University chamber orchestra, whose 30 musicians performed both modern and classical symphonies with brio and artistry. On Thursday evening participants were taken on a coach tour of the city, with its rich and recently tragic history and its impressive monuments faithfully restored. The symposium dinner was held in the Pulverturm restaurant in the historic centre of Dresden, where a banquet was accompanied by an excellent trio of strings and piano, playing well-known nostalgic cabaret melodies. The participants of both workshops enjoyed together an excellent dinner on the Friday evening at Radisson SAS Gewandhaus Hotel. Both workshops continued on the Saturday, thus rounding off a very full week of meetings.

On each social occasion a vote of thanks was offered to Manfred Buchroithner and his team for their efficient organisation, the music and the delicious buffet meals. Both during the assembly and the symposium special thanks, including standing ovations, were addressed to Madeleine Godefroy from the EARSeL Secretariat in Paris, for her extremely fruitful efforts.

Thanks are also due to the organisers of the workshops, Dr. Rainer Reuter (Lidar) and Dr. Stefan Wunderle (Land Ice and Snow) for their hard work in ensuring a high scientific level of their meetings, which par-

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ticipants hoped would be repeated on a future occasion. Information about the symposium and links to www-sites of the accompanying workshops are available on the Internet under the following URL (http://www.tu-dresden.de/fghgik/aktuell/earsel.htm).
The Proceedings of the Symposium will be published in hardback by Messrs. Balkema later this year and those of the workshops will be published on CD-ROM (with some paper copies for the archives) also later this year.

2.4 News from the Special Interest Groups

2.4.1 SIG Forest Fires

Third International Workshop on Remote Sensing and Forest Fires in 2001 (Paris)

The SIG group on Forest Fires will organise the Third International Workshop on Remote Sensing and Forest Fires on May 17-18, 2001, following the Symposium in Paris. This conference will follow on from two previous workshops held in Thessaloniki (1993) and Alcalá de Henares (1995), and the Seminar organised in Coimbra (1998) by the SIG group. The main topic of the workshop will be the application of new sensors and technologies to fire prevention, detection and mapping. Special emphasis will be devoted to global and regional approaches. Potentials of Vegetation, MODIS, and MERIS will be reviewed, as well as the continued development of techniques to improve processing of AVHRR, ATSR and WiFs data. The integration of human factors in the analysis of risk will also be considered, in order to obtain a more comprehensive view of fire danger estimation.

Papers can be presented on all topics previously addressed. In order to leave as much time as possible for in-depth discussion of the themes raised, all contributions will be presented as posters. Authors will have the opportunity to give a brief oral presentation of their work before detailed explanations of their posters during the following poster session. Oral presentations will be restricted to three keynote lectures. A summary of three pages of each poster will be printed. Those works selected by the scientific committee will be submitted to an internationally recognised journal. Abstracts of paper proposals should be sent to the scientific organiser no later than 30th October 2000.

Details concerning the scientific content may be obtained from the SIG convenor:

Dr. Emilio Chuvieco, Department of Geography, University of Alcalá, Colegios 2 - 28801 Alcalá de Henares (Spain). (telephone: +34-91-885-4429, fax: +34-91-8854439, e-mail: emilio.chuvieco@uah.es, web: http://www.geogra.alcal.es/EARSeL/EARSeL.htm).

2.4.2 SIG Imaging Spectroscopy

Report on the Second EARSeL Workshop on Imaging Spectroscopy (Enschede)

Introduction
The second EARSeL Workshop on Imaging Spectroscopy was held on 11-13 July 2000 at the International Institute for Aerospace Surveys and Earth Sciences (ITC) in Enschede, the Netherlands, as a follow-up to that held in autumn 1998 at Remote Sensing Laboratories of the Technical University of Zurich (ETHZ). The first Workshop had been organised by the EARSeL special interest group (SIG) on Imaging Spectroscopy attracting around 150 specialists mainly from Europe and overseas (5 continents). At the first Workshop 71 papers were presented on the complete spectrum of issues in airborne imaging spectrometry with an outlook to future spaceborne missions. The second Workshop was organised by EARSeL's SIGs on Imaging Spectroscopy (chaired by Andreas Mueller, DLR) and Geological Applications (chaired by Freek van der Meer, ITC). ITC acted as host organisation, and the meeting was organised in collaboration with DLR, RSL and ESA. The workshop had 92 participants from 23 countries, many outside of Europe. In total, 26 oral papers and 32 posters were presented in 8 thematic sessions. Seven key-notes were given on the various topics by renowned international experts in the field. During the closing ses-

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sion, a resolution was adopted, to be sent to ESA on behalf of the imaging spectroscopy community. The program was closely linked to the 19th ISPRS Congress in Amsterdam on 16-23 July 2000. Before the ISPRS Congress, on-site workshops and tutorials were organised on 14-15 July 2000.

Theme and justification

The turn of the millennium marks the onset of a new era for imaging spectroscopy as the first measurements from spaceborn instruments become available to the science community. For example, ESA is preparing the ENVISAT mission carrying MERIS and the CHRIS Proba mission, NASA has ASTER and MODIS launched on the Terra platform and is preparing hyperspectral missions under the New Millennium Program, the Australian' ARIES should be operational at the beginning of the next century, while DLR is developing a spaceborne mission. These missions open a new era for space-related remote sensing, making high-spectral resolution imagery readily available worldwide. Hence the motto of the meeting: "From air to space". The synergy between field-based, airborne and spaceborne spectroscopy was at the heart of the meeting. Furthermore, the possibilities of sensor integration, which is now feasible with these multi-sensor mission, were explored.

The scientific programme

The scientific committee drafted the programme during a meeting in May. The committee consisted of Andrew Skidmore (workshop chairman), Freek van der Meer (workshop chairman, Michael Schaepman, Daniel Schlaepfer, Klaus Itten, Andreas Mueller, Franz Lanzl, Allan Nielsen, Mike Rast, Steven de Jong, Ingrid Janssen and Robin Vaughan. The scientific committee was assisted by the local organising committee consisting of Andrew Skidmore, Freek van der Meer, Madeleine Godefroy, Karin Schmidt, Wim Bakker, Daniela Semeraro, Bert Riekerk, Edith Howard and Hendrik Prins. The scientific programme was divided into eight thematic sessions, each preceded by a keynote lecture and followed by oral presentations. Much room was given to poster presentations, and the presenters highlighted their poster contribution in a two-minute oral presentation at the end of each morning's session. This set-up turned out to be a success, and the poster session were rated amongst the best of the meeting. The key-note addresses included (in alphabetical order): Mike Abrams (NASA-JPL); Frederique Baret (INRA Avignon); Paul Curran (University of Southampton); Andreas Mueller (DLR); Mike Rast (ESA); Michael Schaepman (RSL); Freek van der Meer (ITC/TUD), Andrew Skidmore (ITC), Steven de Jong (WUR/UU), and Jan Clevers (WUR).

The three-day meeting featured the following sessions: Opening session; Radiometric calibration and sensor simulation; European Imaging Spectrometer activities; Geological resource management; Natural resource management; Water and atmosphere modelling and interaction; New analytical approaches; Vegetation modelling; Discussion and closing.

An oral presentation at the Second EARSeL Workshop on Imaging Spectroscopy

On each day, an interactive poster session was planned during which there was ample time for discussion and for short oral poster introductions. A small exhibition was also held, including Analytical Spectral Devices with their field spectrometers, Creaso GMBH demonstrating ENVI and IDL, the Netherlands Remote Sensing Board (BCRS) presenting various remote sensing projects, and an interactive demo of the parametric geocoding software PARGE.

The scientific programme incorporated room for informal get-together's during

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the various coffee and tea breaks and during the discussions over the posters. In addition, participants were invited to the icebreaker reception on Tuesday evening, organised by the Mayor of the City of Enschede, Mr. Jan Mans and the Vice-Councilor, Mr. Marco Swart. Mr. Swart welcomed the delegates to Enschede, and pointed out the use of remote sensing to local communities and cities such as Enschede. On behalf of the Workshop, Freek van der Meer thanked the Vice-Councilor for his hospitality. During the conference dinner, organised in the recreational park of Enschede, Andrew Skidmore thanked delegates for the meeting's success.

The resolution

In the first EARSeL Workshop on Imaging Spectroscopy, a resolution was accepted and sent to ESA. During the second Workshop a resolution was discussed in the closing session. Important issues were raised, including the need for more user support and interaction in imaging spectroscopy, and for operationalisation of techniques and products. The issue of improving collaboration by common test sites in Europe was accepted by vote. It was considered important to define common test sites for various applications, with ample space for individual user groups to work on other selected areas. The data (including remote sensing and ancillary data sets) at the common test sites should be made publicly available through a co-ordinating effort. Finally, the Chairman of SIGIS indicated that several countries have shown interest in organising the Third EARSeL Workshop on Imaging Spectroscopy in 2002. The date will be fixed shortly and timed in March, as efforts are underway to get AVIRIS to Europe! A third Workshop would then serve to prepare for AVIRIS flight campaign planning.

Report prepared by Freek van der Meer (ITC/TUD) and Andrew Skidmore (ITC).

2.5 Remote Sensing by Low-Frequency Radars

During recent years, low-frequency radars, able to operate up to the L-band, have aroused great attention among the international scientific community, due to the increasing number of applications within the field of remote sensing. The scenario has rapidly widened and includes Archaeology, Ecology, Environment, Geology and Geophysics, Glaciology, Oceanography, Planetology, UXO and Mine Detection. Innovative RS systems, along with the design and development of more effective data processing and numerical modelling techniques, inverse problems and tomography, are the priorities of today's scientists.

Within this field of interest, the CO.RI.S.T.A. consortium in Naples has invited EARSeL to organise jointly, in June or September 2001, a conference aiming to underline the importance of the latest technological developments, and also the need for this growing sector to be adequately covered by periodic events. It is hoped that this will be the first in a series of meetings on such radar systems within the world calendar of events. Sessions will be devoted to Spaceborne, Airborne and Ground-Based Low-Frequency Radar Systems, along with Data Processing, Numerical Modelling, Inverse Problems and Tomography.

Other organisations involved in the organisation will be the "Federico II" University and the SUN (Second University of Naples), ALENIA SPAZIO SpA, JPL (Jet Propulsion Laboratory) and the Italian Space Agency.

More details will be published shortly.

2.6 Remote Sensing Activities in Portugal 1999

Dr. Mário Caetano (mario@cnig.pt), Centro Nacional de Informação Geográfica (CNIG)

The remote sensing community in Portugal is linked through the Rede de Observação da Terra (ROT), i.e. Earth Observation Network (http://www.cnig.pt/ROT)). ROT is an information service designed to promote the use of satellite imagery in Portugal, and it is integrated in the National System for Geographical Information (SNIG) network. ROT enables (1) the image users to find a set of information

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about satellite images and their processing, and (2) the image suppliers, R&D institutions and the value added services to disseminate/advertise information about their activities.

In 1999, CNIG (Centro Nacional de Informação Geográfica) and FCT (Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa) organised the ROT'99 workshop. This workshop was the first successful attempt to bring together the remote sensing Portuguese community, i.e. data suppliers, researchers and end-users, to discuss the present and future activities related to satellite images.

The remote sensing activities in Portugal during 1999 are presented here in two groups: (1) research activities and (2) operational uses of satellite images.

Examples of the many Portuguese research projects on remote sensing:

- ACTUS100 (Land cover map updating with satellite images (1:100 000)). Co-ordinator: Dr. Mário Caetano (Centro Nacional de Informação Geográfica), (mario@cnig.pt).
- CARTUS-AML (Land use mapping of Metropolitan Area of Lisboa). Co-ordinator: Prof. José Tenedório (Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa), (ja.tenedorio@fcsh.unl.pt).
- Development and test of a methodology for global cartography of burned areas using ERS ATSR-2 satellite images. Co-ordinator: Prof. José M.C. Pereira (Instituto Superior de Agronomia, Universidade Técnica de Lisboa), (jmcpereira@isa.utl.pt).
- Magmatic activities in Madeira islands. Co-ordinator: Prof. Paulo Fonseca (Faculdade de Ciências, Universidade de Lisboa), (mario@cnig.pt).
- MINEO (Assessing and monitoring the environmental impact of mining activities in Europe using advanced Earth Observation techniques). Co-ordinator: Prof. António Sousa (Instituto Superior Técnico, Universidade Técnica de Lisboa), (ajsousa@alfa.ist.utl.pt).
- Radar interferometry for digital terrain modelling. Co-ordinator: Eng. José Rodrigues (Instituto Geográfico do Exército – IGeoE), (telephone: +351-21-8505345).
- SHELT (Seismicity hazard evaluation of the lower Tagus valley). Co-ordinator: Prof. João Cabral (Faculdade de Ciências, Universidade de Lisboa), (jcabral@fc.ul.pt).

Examples of operational uses of satellite images in Portugal:

- Burned area mapping (1:100 000) – produced by Instituto Superior de Agronomia (ISA) for Direcção Geral das Florestas (DGF). Co-ordinator: Prof. José M.C. Pereira, (jmcpereira@isa.utl.pt).
- Irrigated areas mapping with Landsat-5 TM (1:50 000) – produced by CNIG for Instituto da Água (INAG). Co-ordinator: Eng. Cristina Seabra (cas@cnig.pt) and Dr. Mário Caetano, (mario@cnig.pt).
- 1:100 000 Image maps – produced by IPCC (Instituto Portugês de Cartografia e Cadastro). Co-ordinator: Eng. João Cordeiro (jcordeiro@ipcc.pt).
- 1:50 000 Image maps – produced by IGeoE (Instituto Geográfico do Exército). Co-ordinator: Eng. José Rodrigues, (telephone: +351-21-8505345).
- Topographic map updating using satellite imagery (1:250 000) – produced by IGeoE. Contact: Eng. José Rodrigues, (telephone: +351-21-8505345).

2.7 News from Bulgaria: Study on Data Fusion

A new member of EARSeL is the Space Research Institute of the Bulgarian Academy of Sciences. They have sent us the following report of their study :

Data fusion of airborne and satellite data for preliminary preparation and investigation of a training area for the calibration of the Visible Video Spectrometer (VVS-MOSAM):

K.P. Iliev, N. Dimitrov, I Dimitrova, A. Pavlova, K.P. Popov, Space Research Institute, Sofia.

Introduction

MOSAM is a multifunctional optic-electronic system which includes: a High Resolution Panchromatic CCD Camera in the

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visible range; a CCD Video Spectrometer in the visible and near IR range; and a multispectral IR linear scanner. The CCD Video Spectrometer, based on a back illuminated CCD sensor- diffraction grating with spectral interval 4-10 nm, can detected fine spectral structures.

Conventional methods for measuring and assessment of the environment are time consuming and not very suitable for regular monitoring of large areas. Satellite and airborne remote sensing, providing images of adequate global coverage and temporal resolution, offer a potential means for this purpose. Image fusion or the merging of images recorded at different spatial resolutions is applied in various applications of remote sensing. Often the aim is to increase the visual content of an image as the results of merging low spatial, multispectral resolution imagery with high spatial resolution photos.

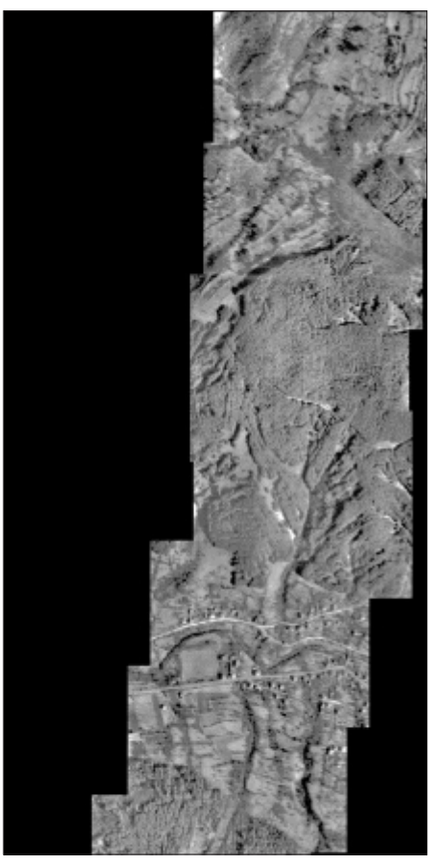

Figure 1: Row mosaic data captured with TC217 CCD camera during the flight experiment

The Earth has a highly complex and variable surface the topographic relief and material composition of which reflect on the fusion results. Image fusion improves interpretability more often in the case of homogeneous data than that of heterogeneous data but in any case it is useful for combining valuable environmental information existing at different levels of spatial resolution so that no loose data are lost for the investigation of the training area.
A Landsat-TM scene was used from August 1995 and air-photos acquired by the multifunctional spectral optic-electronic system installed on an aircraft flown in April 1999.

Analysis and choice of typical area

Many of the world's environmental problems are related to the waste produced by human activities. Environmental pollution results when a pollutant degrades the quality of an environment. For the study two representative regions were selected from the route overflown during the initial flight experiment, namely the Northern part of the Etropole area in the Stara Planina Mountains and the area of the "SODY" – Devnia plant located near to the town of Varna. These study areas are interesting for analysis and investigation due to the significant anthropogenic pressure on the natural environment. In the first region the pollution is caused by mining activities which are very widespread in the mountainous terrain. In the second region the manufacturing processes at the "SODY" – Devnia plant cause extensive organic, inorganic and dust emissions which are accumulating in a huge area, changing the aspects and the structures of the ecosystems, their morphological structures, and provoking a succession of ecological changes.

Using high-resolution airborne data

Small-format aerial photography is a cost-effective alternative to large-format satellite imagery for local area investigation and mapping. High resolution photos contain a detailed record of features on the ground at the time of exposure so that we can precisely delineate and visually assess the state of the investigated sites. The photos are taken with the optical MOSAM system installed on an An 30 airplane from an altitude of 3900 m height at a speed of 420 km/h of the plane, having a 75x50 cm spatial speed of the plane and having a 50x50 cm spatial resolution. The study areas in which we are interested span several air image files. During the visual classification of a photo-mosaic were evaluated several image characteristics (tone, size, shadow, location) in order to identify and deduce the significance of the components. The photos files, covering the training area near Varna, were ordered as mosaic along the flight path (see Figure 1).

One can clearly observe the drainage patterns and the water flow, the structure and the order of the nearest buildings, the roads and fields. Some transformations for the equalisation of the mosaic-colour balance were used for the improvement of the

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visualisation and the colour balance. One can also clearly observe the morphological structures, different types of landuse and forests, and variations in vegetation cover. The mosaic gives quite accurate information on the shape and size of ground features. The high spatial resolution combined with information from the VVS (visible video spectrometer) can improve the quality of environmental monitoring. The spectrometric range between 300-850 nm, which is covered by the operation of the MOSAM system, is essential for the investigation of natural features (vegetation, soil and water) and their changes which are indicators for the anthropogenic influence on the earth surface.

Using multispectral satellite data

Landsat TM with a ground resolution of 30x30m and seven bands in the visible and infrared parts of the spectrum is useful for preliminary spectral investigations. For the interpretation of satellite data are often used band ratios as indexes to enhance the differences between bands and to reduce the effects of topography. The assessment of the spectral changes is necessary in order to identify the sites with a damaged environment. An anthropogenic impact can be detected by spectral changes of the vegetation cover which is sensitive and easy to determinate. For the test regions were used several ratio combinations between Landsat bands 5, 4, and 3, which show the decrease of of the reflectance sensitivity of plants and crops.

Data fusion

The data fusion process includes several steps: (1) Histogram equalisation transformations of the mosaic for smoothing and improving the colour balance due to the different intensities of individual images. (2) Resampling of the pixel size of the Landsat scene from 30x30m to 5x5m; the scene was smoothed without increase of the spatial resolution of pixels. (3) Landsat and airborne images were georeferenced and overlapped using representative ground control points. For the purpose of fusing images with different spatial resolution use was made of ground control points clearly identifiable on both photomosaic and satellite scene. Cultural features, such as roads, road-intersections, man-made water bodies were suitable as GCPs.

Conclusion

The image fusion improves interpretability mostly in the case of homogeneous data.

Forthcoming EARSeL Events (2000 and After)

13-15 September 2000:	1st EARSeL Workshop on **REMOTE SENSING FOR DEVELOPING COUNTRIES** Venue : "Het Pand" Abbey Conference Centre, Gent, Belgium Organiser and contact: Prof. Rudi Goossens Email: Rudi.Goossens@rug.ac.be
14 - 17 May 2001:	21st EARSeL Symposium : Organised in collaboration with the Société Française de Photogrammetrie et de Télédétection (SFPT). **"Observing our Environment from Space: New Solutions for a New Millennium"** Venue : Ecole National des Sciences Géographiques, Marne-la-Vallée (Paris), France followed by:
18-19 May 2001:	3rd EARSeL Workshop on **Forest Fires Management** organised by the EARSeL SIG, chaired by Dr. Emilio Chuvieco
4-6 June 2002:	22nd EARSeL Symposium: **"Geoinformation for European-wide Integration"** Hosted by UHUL Forest Management Institute and organised by Dr. T. Benes Venue : Prague, Czech Republic

For more details on all these events, please contact the EARSeL Secretariat

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The information obtained received will be more complete if there exists spectral information for the features in the training area. This will make the investigation more accurate and will and open a new way to merge spectral information from different remote sensing systems. The spectral range of the VVS-MOSAM system will help to improve the quality of the results.

Minimising environmental degradation caused by pollution, generated during industrial processes and by extractive industries can be achieved through use of more efficient technologies in combination with an improved environmental monitoring using different sources of remote sensing data. The future challenge will be to create hyperspectral and multispectral imagery fusion and to improve the identification and the quality of observation of anthropogenically vulnerable sites.

The results of this study prove the great flexibility and the potential for a higher accuracy for the combining and the preservation of spectral-spatial information of remotely sensed data and their applications. Imaging spectrometry holds the potential to provide a quantum jump in the quality of spectral data obtained on earth surface features. Research is continuing on how to optimise the analysis of the high volumes of data acquired by the systems.

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3 NEWS FROM ESA, THE EC AND INTERNATIONAL ORGANISATIONS

3.1 European Space Agency

3.1.1 ERS-ENVISAT Symposium

This event "Looking down to Earth in the New Millennium" to be held in Gothenburg, Sweden, from 16-20 October 2000, is expected to be attended by more than 600 participants from worldwide. Chalmers University of Technology, which is hosting the meeting, is familiar to many EARSeL members, since we held our annual symposium there in 1994, very ably organised by Professor Jan Askne. We shall again be present at this important event.

3.2 European Commission

3.2.1 GMES Initiative

The work that is being carried out on the development of Europe's GMES (Global Monitoring for Environment and Security) initiative, was endorsed recently when the French Minister for Research, Mr. Roger Gerard Schwartzenberg, in a speech to the European Parliament's Research Commission on 12th July 2000, identified GMES as a key element of the new European Space Strategy, and a high research priority during the French Presidency of the European Union.

GMES is a joint initiative that aims to provide Europe with an independent capability to support policy in the fields of global environment monitoring, risk management, and natural resources. GMES is being developed by a partnership comprising the following European space organisations: the British National Space Centre (BNSC); the French Space Agency (CNES); the German Aerospace Centre (DLR); the Italian Space Agency (ASI); the Norwegian Space Centre; the Swedish National Space Board; EUMETSAT (European