



European Association of Remote Sensing Laboratories

Capacity Building in Earth Observation

European Association of Remote Sensing Laboratories

June 2011

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The Mission of EARSeL

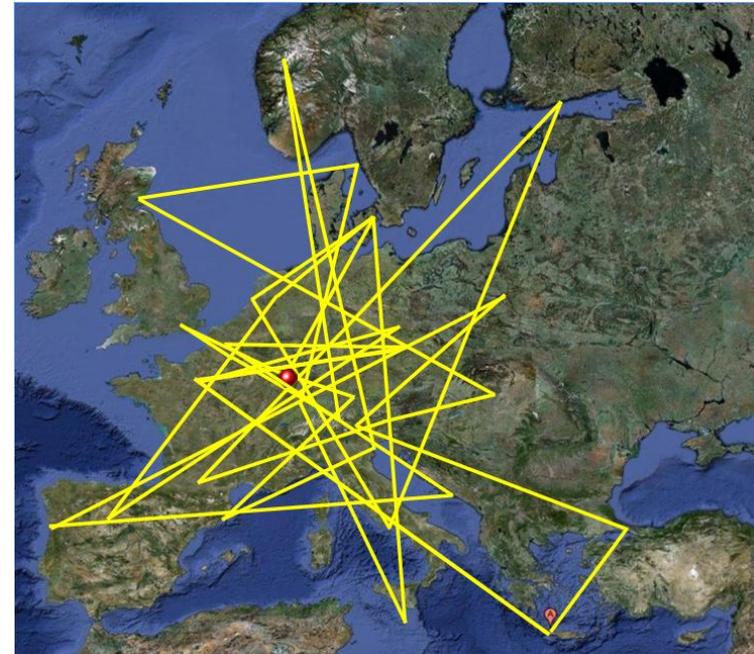
Founded in 1977 at the onset of Earth observation from space, the *European Association of Remote Sensing Laboratories* (EARSeL) is a long-established network of scientific organisations from academia and the commercial world, from all over Europe and beyond. EARSeL members are leading European institutes and companies involved in

- Research on principles of remote sensing, e.g. radiative transfer theory, data and image processing, photogrammetry, and Geographical Information Systems,
- methods and applications as well as teaching of Earth observation in the visible, infrared and microwave spectral range using satellites and aircraft, and
- remote sensing data validation with ground-based measurements on land, in the oceans and atmosphere.



EARSeL's foundation at the Danish Technical University in Lyngby, Denmark, September 1976, read more in [EARSeL's History](#).

EARSeL focuses on fostering a large network of remote sensing specialists and users who meet in symposia and workshops. The annual EARSeL Symposia, covering all fields of remote sensing, bring together about 250 participants.



Venues of annual EARSeL symposia from 1977 to 2011, starting in Strasbourg (red sphere) with the first General Assembly. More specialized workshops on selected topics are organised every two years, on land use and land cover investigations, on forestry, geology, oceanography, land and sea ice, urban remote sensing, to name but a few. Meetings on methods in remote sensing, e.g., imaging spectroscopy, 3D



imagery, radar and observations in the infrared, have become of increasing interest as well.



Pan-cloud layers over the Pacific Ocean,
seen from the International Space Station

Specialist sub-groups have always been an important element of co-operation in EARSeL. This started with six Working Groups on subjects which are nowadays still in focus.

In 1992 the concept of the Special Interest Groups (SIG's) came up and has met increasing interest. They bring together researchers on emerging topics in geosciences and environmental measuring technology, tackling up-to-date challenges in remote sensing. Having started with ten SIG's in 1992, there are now 15 active in year 2011 and they

have become EARSeL's most relevant feature for its members. An overview of their activities is presented on the following pages of this brochure.

Another prominent activity in EARSeL is the publication of scientific results in the field of Earth observation. This covers traditionally the various proceedings of symposia and SIG workshops. *EARSeL Advances in Remote Sensing*, a journal with peer-reviewing procedure, was printed in 1992-97, its issues - still available today on the internet - documented the results of specialist workshops held at that time. A new initiative in 2001 put forward the idea of peer-reviewing with the open-access journal *EARSeL eProceedings*.

More recently, the EARSeL Book Series published by Springer has been brought to life, with original papers and reviews on selected themes of remote sensing. The series comprises four books until 2011, a new issue shall be added each year, initiated and edited by Special Interest Group chairmen.

EARSeL is a scientific international Association registered in France but with member laboratories from all over Europe. It is run by a Council of elected national representatives from each country where there are member laboratories, and an executive Bureau, elected by the Council. The General Assembly, bringing together the representatives from all member laboratories, is held in the framework of the annual symposia and decides on all matters affecting the Association.

Projects

Research projects on the use of remote sensing for research, monitoring and education have become increasingly important activity in EARSeL, with the Association in a co-ordinating function or as a partner. These initiatives strengthen networking among members, and they increase EARSeL's visibility in the remote sensing community and at international funding agencies.

Presently, EARSeL is involved in

- the GMES land monitoring project funded by the EC in FP7
- the forest cover change project funded by Belgian Science Policy



EARSeL's tasks are to provide project results through its members involved, to organise reviews by other experts in the field, and to publish the project results through its journals, in its symposia and in its workshops.

Under the umbrella of EARSeL, an educational project was conducted in 2007-09:

- Science Education through Earth Observation for High Schools, funded by the EC in FP6



In SEOS, 17 internet-based e-learning tutorials have been created by 15 partners in several European languages, for use in science curricula but also suitable for individual and enquiry-based learning. Some tutorials, e.g., on marine pol-

lution and on ocean currents, can be used in training programmes for environmental and governmental agencies.

Publication of SEOS on the internet (ims.seos-project.eu) permits a worldwide access, and allows for continuous updates with most actual information. Additional tutorials from EARSeL member laboratories on new and emerging topics are very much welcome and may be added anytime.

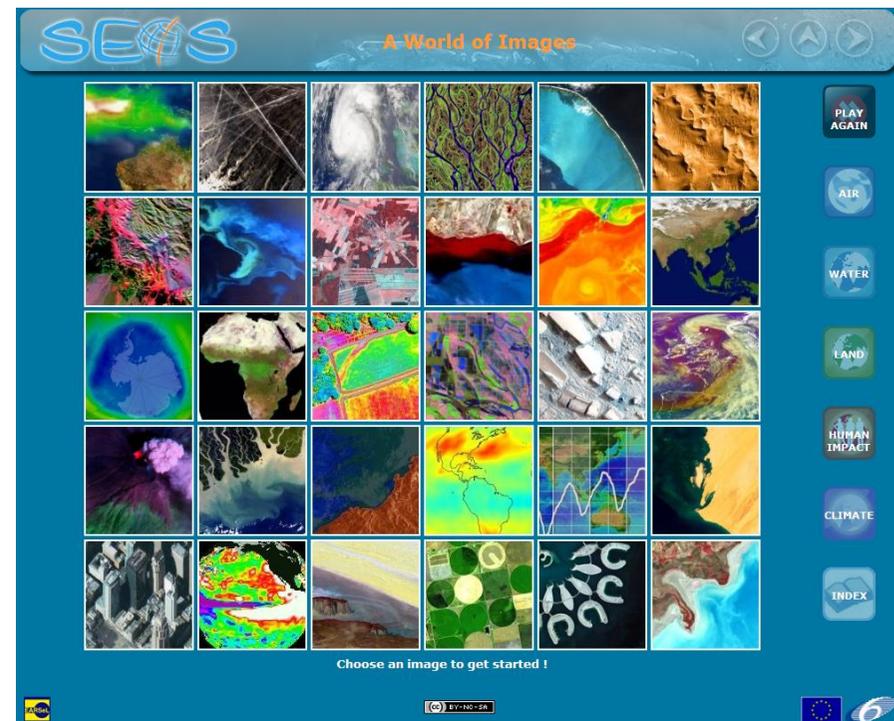


Image mosaic in the tutorial *A World of Images*, depicting the topics covered by the SEOS project

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Member Laboratories

EARSeL has member laboratories in the following countries:

AUSTRIA	BELGIUM	BULGARIA
CROATIA	CZECH REPUBLIC	DENMARK
ESTONIA	FINLAND	FRANCE
GERMANY	GREECE	HUNGARY
ICELAND	ISRAEL	ITALY
LEBANON	THE NETHERLANDS	NORWAY
POLAND	PORTUGAL	ROMANIA
RUSSIA	SERBIA AND MONTENEGRO	SYRIA
SLOVENIA	SPAIN	TURKEY
SWEDEN	SWITZERLAND	
UNITED KINGDOM		

Examples of member laboratories:

➤ German Aerospace Center



➤ IFREMER, France



➤ VITO, Belgium



➤ Rijkswaterstaat, The Netherlands



➤ KTH Royal Institute of Technology, Sweden



➤ European Centre for Medium-Range Weather Forecast (ECMWF), UK



➤ FÖMI Remote Sensing Directorate, Hungary



Partner Organisations

EARSeL cooperates very closely at the working level with:

- the European Space Agency (ESA)
- the United Nations Educational, Scientific and Cultural Organization (UNESCO)
- the European Commission

in programmes for using and dissemination satellite data, and in educational initiatives.

EARSeL is a regional member of ISPRS, the International Society for Photogrammetry and Remote Sensing.

In 2010 an initiative has been launched for a broader cooperation with partner organisations in Africa, Asia, and South and Central America:

- Society of Latin American Experts in Remote Sensing (SELPER)
- Asian Association on Remote Sensing (AARS)
- African Association of Remote Sensing of the Environment (AARSE)

Moreover, EARSeL undertakes joint activities with

- the European Association of Remote Sensing Companies (EARSC)
- Eurisy, an organisation promoting the use of satellite services to the society

EARSeL co-operates closely with many national societies, e.g., with the Remote Sensing and Photogrammetry Society, UK, and with NASA Jet Propulsion Laboratory, Pasadena, U.S.A.



Publications

EARSeL publishes several periodicals and monographs on remote sensing of the Earth:

- **EARSeL Newsletter** is a forum for an exchange of news and views among the members of the Association, a digest of Association activities and a general review of the current remote sensing scene. It is printed quarterly and also available on the internet
- **Proceedings of Symposia and Workshops**, which collect quality-checked manuscripts from EARSeL meetings and are published on CD-ROM and on the internet
- **Springer Book Series on Remote Sensing and Digital Image Processing**, published since 2009, includes four issues on different topics, more issues are in preparation
- **EARSeL eProceedings**, the open-access journal with peer-reviewed publications on all fields of remote sensing.

Become an **EARSeL** Member

Members receive all EARSeL publications free of charge. No page charges are requested from members for publishing the results of their research in EARSeL eProceedings and in the Springer Book Series on Remote Sensing and Digital Image processing.

Moreover, EARSeL members are entitled to

- reduced registration fees at the annual symposia and at specialist workshops
- joining one or more Special Interest Groups
- networking with colleagues around Europe
- participating in research projects initiated by EARSeL.

More information and an application form is available on the EARSeL homepage, <http://www.earsel.org>.



Special Interest Groups

EARSeL members are invited to join one or several of EARSeL's Special Interest Groups (SIGs) which bring together institutes and companies that have similar broad fields of research activity. The Special Interest Groups organise high-level workshops, mostly at regular intervals every two or three years, for an exchange of recent research results.

Networking in SIGs is the initial point for joint activities such as cooperation of member laboratories in research projects and in applications for joint projects.

The current list of Special Interest Groups includes the following topics:

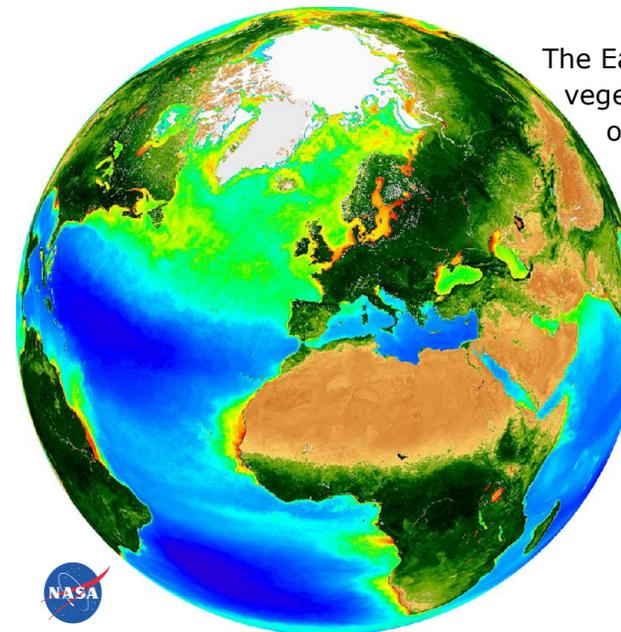
- 3D Remote Sensing
- Cultural and Natural Heritage
- Education and Training
- Forest Fires
- Imaging Spectroscopy
- Land Use / Land Cover
- Temporal Analysis
- Urban Remote Sensing
- Coastal Zones
- Developing Countries
- Forestry
- Geological Applications
- Land Ice and Snow
- Radar Remote Sensing
- Thermal Remote Sensing

More Special Interest Groups may be established depending on requirements of future research.

An overview of activities performed in the Special Interest Groups is given on the following pages.



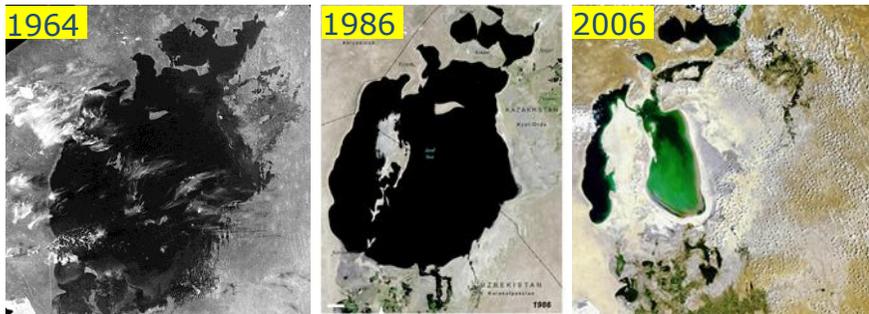
Von Karman vortices in the Canary Island basin



The Earth's biosphere, showing vegetation with green colours on land and in the oceans. Deserts are shown ochre on land and blue in the oceans.

Land Use / Land Cover

Land use and land cover have been one of the first and main products from remote sensing data. Its dynamics are strongly influenced by socio-economic factors and political decisions, generating a need for adequate mapping and monitoring tools. As a consequence, robust and sophisticated analysis methods are required for accurate information extraction and fast and efficient data analyses need to be adapted to the rapid advances in image and sensor technologies as well as data amounts. Furthermore, multi-temporal and multi-sensor approaches are becoming more and more important not only for change detection but also for more detailed classification approaches and information retrieval algorithms.



Land cover change of the Aral lake over the last five decades

The EARSeL Special Interest Group on Land Use and Land Cover (SIG LULC) aims to combine methodological and application-oriented research activities in this thematic field. The workshops form a platform for scientific exchange and discussion on a variety of related topics. The SIGs intention

is to further foster a better integration of science results into operational products and processes. Hence, the SIG welcomes contributions from users, service providers and value adding industry. We also aim at linking with the various European initiatives in the land cover sector as well as on-going core services within the EU Global Monitoring for Environment and Safety (GMES) and ESA ECV programmes.



Cultivation Methods in the region of Almeria, Spain:
Green Houses and Hydroponics altered LU/LC within 30 years

The Special Interest Group *Land Use / Land Cover* is chaired by Matthias Braun from University of Fairbanks, Alaska, USA, and co-chaired by Ioannis Manakos from the Mediterranean Institute of Agronomy (MAICh) in Crete, Greece.

Internet: <http://www.earsel.org/SIG/LULC/>

E-Mail: mabra@gi.alaska.edu
ioannis.manakos@earsel.org

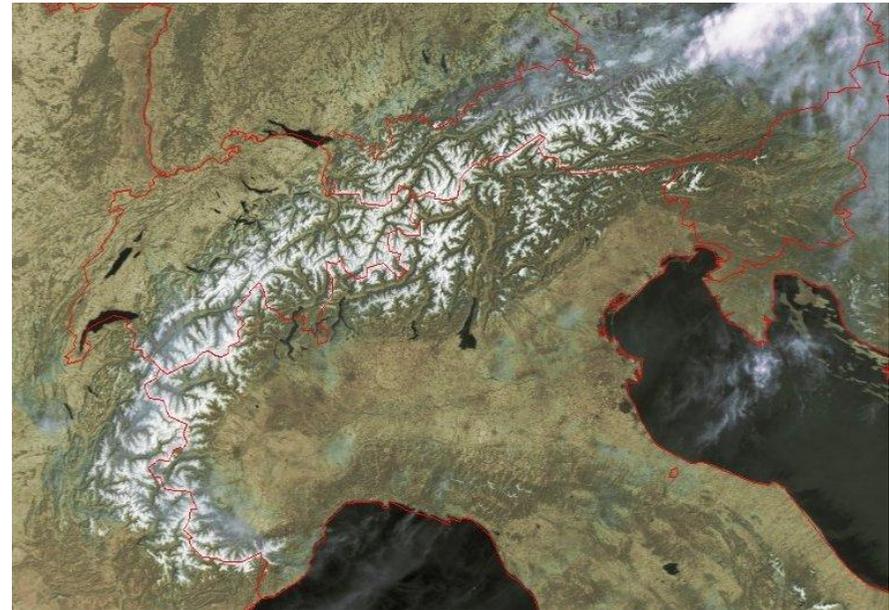
Land Ice and Snow

The dynamics of snow accumulation and ablation in mountainous regions is important to humans and wildlife. The latitude and elevation of snow and glaciers influence water run-off and therefore the water supply for irrigation, tourism, and power generation. Snow is one of the most fascinating materials in nature. A variety of ice crystal shapes are observed which depend on origin, age, density, and temperature. As snow changes its behaviour, its spectral characteristics change as well. These behavioural changes, which are related to the energy and mass transport, essentially affect climate and hydrology. Both the diurnal and annual variability of snow coverage is a driving force of our climate. Some millions of square kilometres of land surface and polar oceans change their albedo during the year.

Hence precise mapping and monitoring of the cryosphere is needed to contribute to questions in hydrology and climate research. Satellite and airborne sensors offer the possibility of detecting snow cover in a spatially comprehensive way over scales from small catchments, to mountain ranges, or even the hemisphere.

Only remote sensing techniques can provide the required data. Therefore, there was a need to bring together scientists working in this field to offer a lively environment for discussion and exchange of new project ideas – the hour of birth of the Special Interest Group *Remote Sensing of Land Ice and Snow*. Since 1992, workshops have been organised every three years with the aim of combining methodologi-

cal and application-oriented research activities in this thematic field.



Snow covered Alps seen by the Metop-AVHRR sensor
(April 7, 2011 at 9:24 UTC)

The Special Interest Group *Remote Sensing of Land Ice and Snow* is chaired by Stefan Wunderle from the University of Bern, Switzerland, and by Thomas Nagler, enveo, Austria.

Internet: <http://www.earsel.org/SIG/Snow-Ice/>

E-Mail: swun@giub.unibe.ch
thomas.nagler@enveo.at

Coastal Zones

About 60% of the world's population lives at a distance of 50 km from the coastline. This segment of the oceans has a considerable economical and environmental importance due to its high productivity. These ecosystems are very sensitive and vulnerable. Many factors threaten their balance: coastal erosion, pollution, eutrophication, unsustainable exploitation of fisheries, urbanization, tourism, sea level rise. For these concerns, nowadays the major goal of the international community is to identify the conditions for a sustainable use of coastal environments so that future generations can continue to enjoy the products that derive from this resource.

Coastal areas have a strong impact on socio-economic activities. But they are affected by environmental risks:

- climate change causing sea level rise and coastal erosion
- degradation of natural habitats and biodiversity changes
- water eutrophication and development of toxic algal blooms
- water pollution due to river discharge, groundwater, sewage, oils and chemical indiscriminate releases or from fish farming and other aquacultures
- the seabed morphology close to coastline, in the context of a possible formation of tsunami waves due to submarine avalanches of sediments or earthquakes.



Beautiful colours of coastal zones, in this example: Holbox Island and the Yalahau Lagoon on the northeast corner of Mexico's Yucatan Peninsula. Blue: coastal water; green: benthic algae; brown: land surface; yellow: limnic water; white: clouds.

Research and monitoring of these phenomena help in the understanding of processes, in order to support a future sustainable development of coastal zones. This implies the necessity to develop and implement new tools and methods such as remote sensing for the management of coastal risks.



Oil leak from a sunken ship in iced water

The SIG is a platform for co-operation and information exchange on

- the physical dynamics of currents, tides, waves and sediment transport
- the flux and transformation of chemical and biological seawater constituents including pollutants
- the relevance of physical conditions for biological and chemical processes
- morphodynamic processes and coastal engineering

- the relevance of these factors for living conditions, tourism, shipping and economy.



Sky and water leaving radiance measurements for suspended matter measurements in surface waters

The SIG *Coastal Zones* is chaired by Antonio Palucci from ENEA, Frascati, Italy, and co-chaired by Rainer Reuter from the Institute of Physics, University of Oldenburg, Germany.

Internet: <http://www.earsel.org/SIG/CZ/>

E-Mail: antonio.palucci@enea.it
rainer.reuter@uni-oldenburg.de

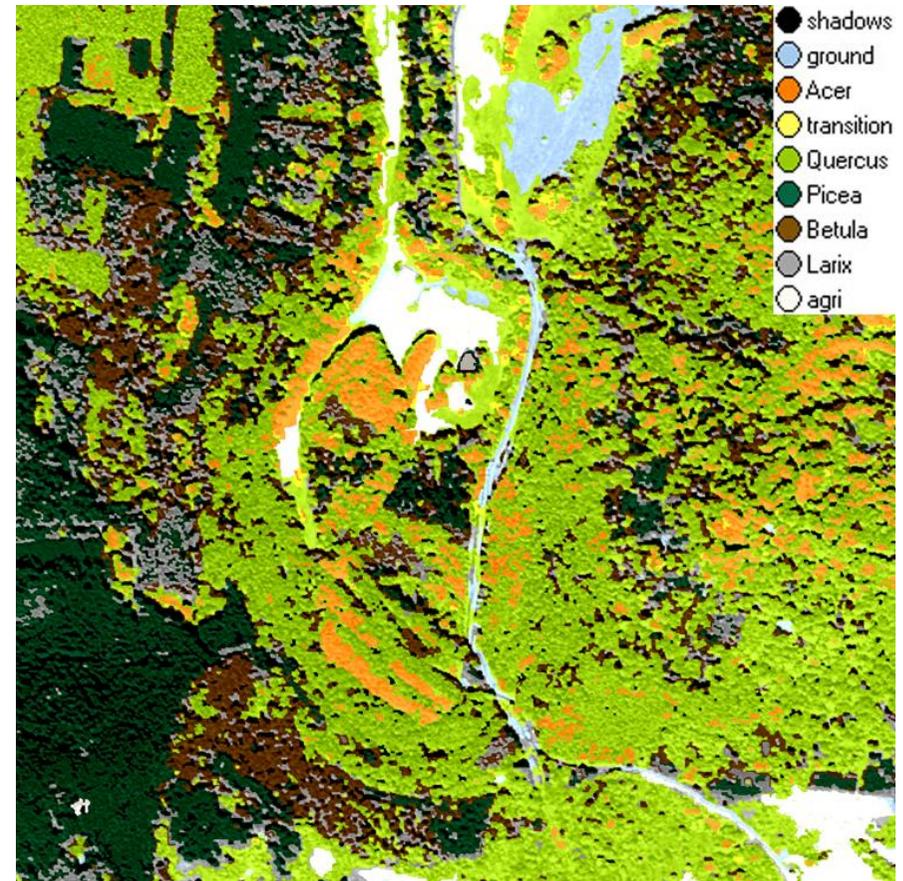
Forestry

More than one third of Europe is covered by forests. Remote sensing can be seen as a very important branch of a big tree called *geomatics*, being a powerful tool for forest resources assessment and monitoring. Consequently, it serves as a unique source of information in the context of topics such as land use/land cover change, climate change, biodiversity and landscape ecology.

Presently there are different research platforms on remote sensing in forestry such as: the IUFRO Remote Sensing/GIS (4.02.05 and 4.02.08) World Forestry groups, the ISPRS Forestry Group and the ForestSat or SilviLaser symposium events as well. In this context, the Special Interest Group on Forestry defines its role as a rather application-oriented group. The objectives of the SIG Forestry aim at setting up a common forum for the research community and professionals from the forestry sector, where both the operational techniques as well as developing methodologies can be presented and understood in order to improve forest management and protection practices in Europe.

The SIG Forestry topics include:

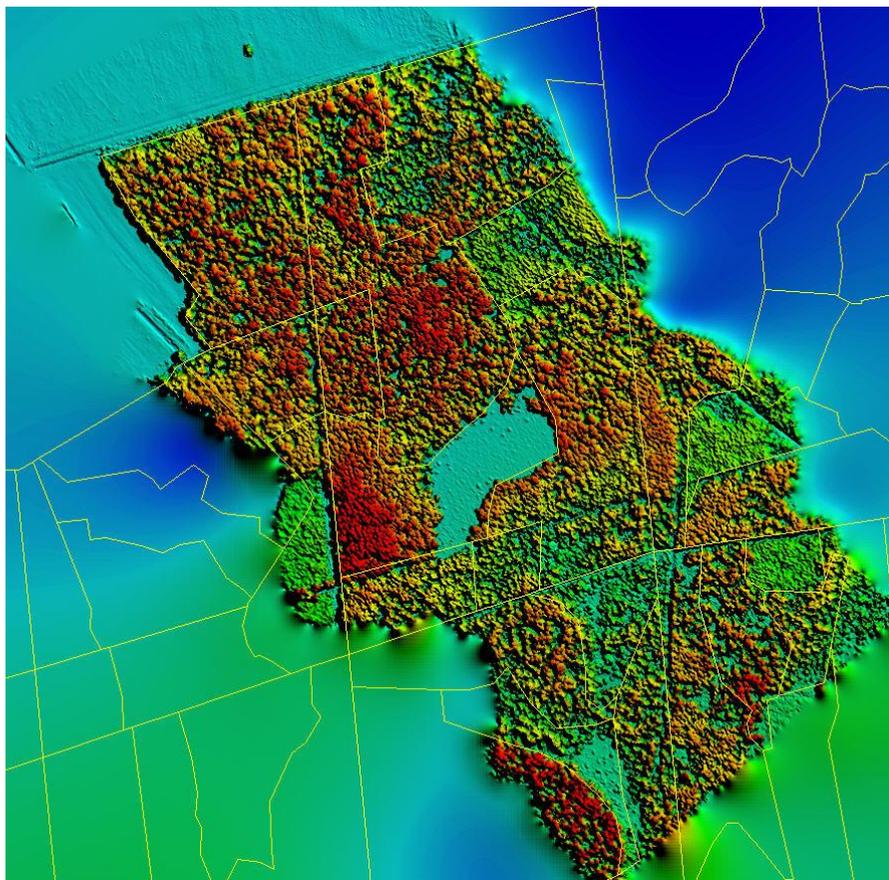
- forest resource mapping, biomass estimation and change detection
- forest inventories, biophysical parameters
- forest damage/degradation related to climate change
- biodiversity, protected forests, mountain forestry, and
- acquisition of reference field data.



Identification of tree species, Czech Republic, from IKONOS data.

The results are periodically presented at SIG workshops, which are often organised in co-operation with the above mentioned IUFRO and ISPRS groups. The SIG Forestry topics are also included within the annual EARSeL Symposia.

Other activities include searching for joint projects with external funding, and arranging freely accessible sensor datasets or ground truth reference data for algorithm testing.



Digital Surface Model based on ALS data and on the Forest Digital Map of Niepolomice Forest, Poland

The Special Interest Group *Forestry* is jointly chaired by Filip Hájek from the Forest Management Institute (FMI), Czech Republic, and Piotr Wezyk from the Lab GIS&RS at the Agricultural University in Krakow, Poland.

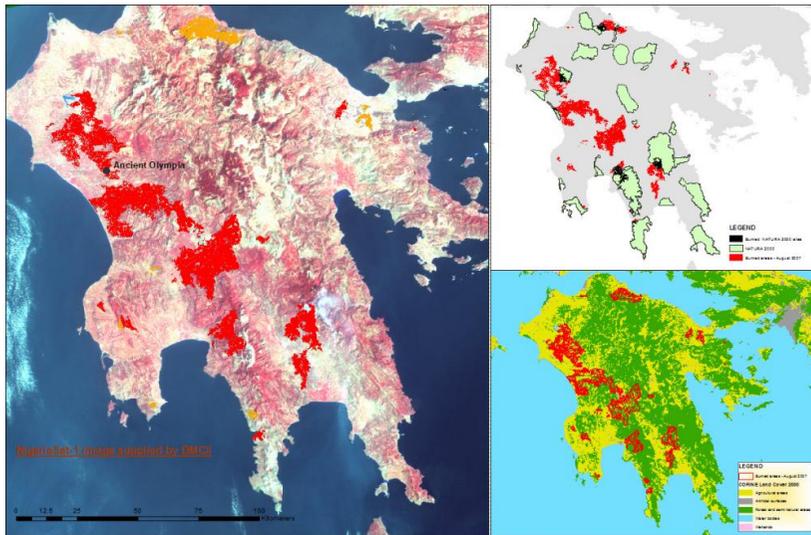
Internet: <http://www.earsel.org/SIG/Forestry/call.php>

E-Mail: hajek.filip@uhul.cz
rlwezyk@cyf-kr.edu.pl



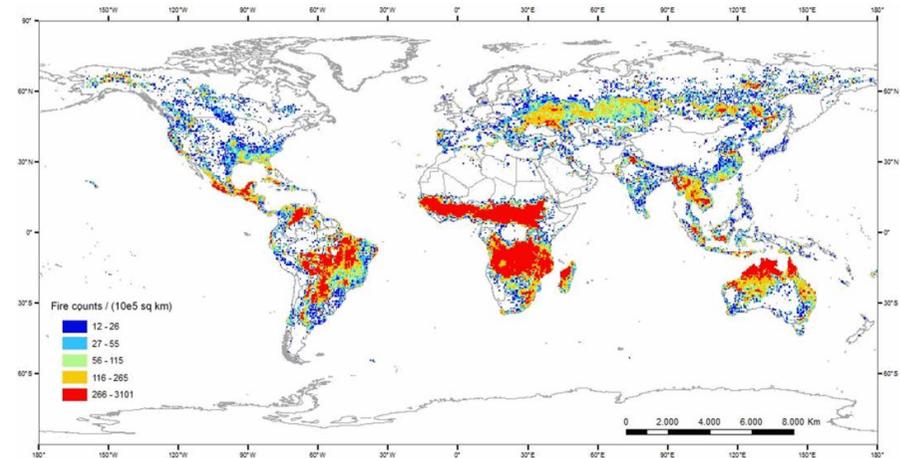
Forest Fires

The Special Interest Group *Forest Fires* (FF-SIG) was created in 1995, following the initiative of several researchers studying fires in Mediterranean Europe. The group fosters interaction among scientists and managers who are interested in using remotely sensed data and techniques to improve the traditional methods of fire risk estimation, active fire monitoring, and the assessment of forest fire effects.



Burned area mapping, Peloponnese, Greece

The SIG has promoted seven workshops and several specialised publications since its foundation, and represents one of the most active groups within EARSeL. The seven workshops organised by the group, so far, were held in Alcalá de Henares (1995), Luso (1998), Paris (2001), Ghent (2003), Zaragoza (2005), Thessaloniki (2007) and Matera (2009).



World fire density (2000-2009)

The workshops resulted, so far, in outstanding progress made in forest fire research. Selected papers presented in the technical meetings were included in a number of special issues of scientific journals related to forest fires and remote sensing such as the *International Journal of Remote Sensing*, the *Remote Sensing of Environment*, the *Journal of Geophysical Research*, and the *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*.

In recent years the FF-SIG workshops host the GOCF-GOLD Fire Implementation Team meetings.

The Special Interest Group *Forest Fires* is chaired by Ioannis Gitas from the Aristotle University of Thessaloniki, Greece.

Internet: <http://earsel-ffsig.web.auth.gr/>

E-Mail: igitas@for.auth.gr

Geology

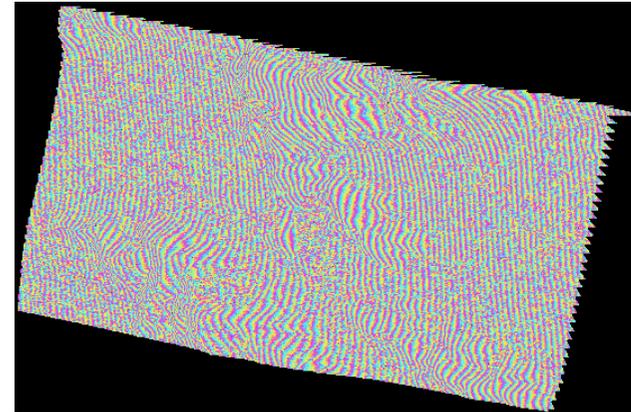
The Special Interest Group *Geological Applications* started its mission in 1999. It is a forum for international discussions amongst Earth scientists. The main objectives of the SIG are to promote geologic remote sensing and Earth observation and to bridge the gap between technology and applications by bringing together experts from universities, institutes and commercial enterprises at scientific meetings.

There is a great number of possibilities of remote sensing in all the sections of geology (lithological and mineral mapping, structural geology, tectonics, hydrogeology, geomorphology, mine monitoring etc).



Remote sensing data facilitates mine monitoring

Earth observation can provide almost real time accurate data for addressing geohazards (landslides monitoring, volcanoes, earthquakes, floods etc).



Radar interferometry is a valuable tool for geological hazards

A main objective of the SIG is as many geoscientists as possible be familiarized with the possible remote sensing applications. By joining the SIG you get access to information, resources, and valuable networking opportunities. You can present your scientific work to a specialized audience, exchange ideas and be informed about the latest developments and applications.

The Special Interest Group *Geological Applications* is chaired by Konstantinos G. Nikolakopoulos from the Institute of Geology and Mineral Exploration in Athens, Greece

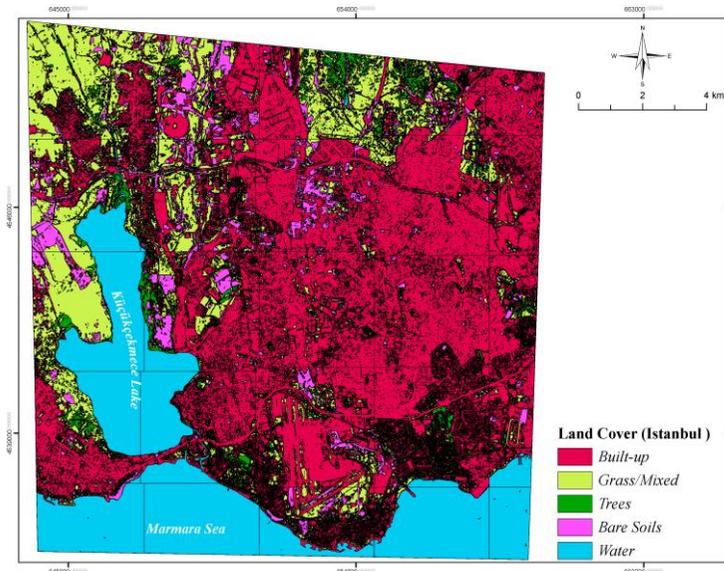
Internet: <http://www.earsel.org/SIG/Geology>

E-Mail: knikolakopoulos@igme.gr

Urban Remote Sensing

Urban environments are characterized by highly dynamic changes in biophysical and socio-economic domains, and management of urban environments involves procedures of mapping and monitoring which require a reliable information base and robust analytical technologies. Remote sensing and geographic information systems (GIS), given their cost-effectiveness and technological soundness, are increasingly being used for developing useful sources of information and for decision making in support of a wide array of urban applications. The Special Interest Group *Urban Remote Sensing* (SIG-URS) focuses on GI applications in urban and suburban environments and invites interested people to join the SIG and share their experiences and knowledge with others.

Urban areas are growing rapidly in all countries of the world. Urban growth and its associated problems are very challenging tasks in which remote sensing imagery could help to obtain-to-date information. During the last few decades and especially during the last few years we have recognized rapid advances in the imaging technology (e.g. high spatial resolution, Lidar, etc.) and in image analysis techniques (e.g. object based classification). According to the growing awareness of urban areas, agglomerations and mega cities, more and more scientists focus on topic related to them. To further support research and information exchange in this area, EARSeL established the Special Interest Group on *Urban Remote Sensing*.

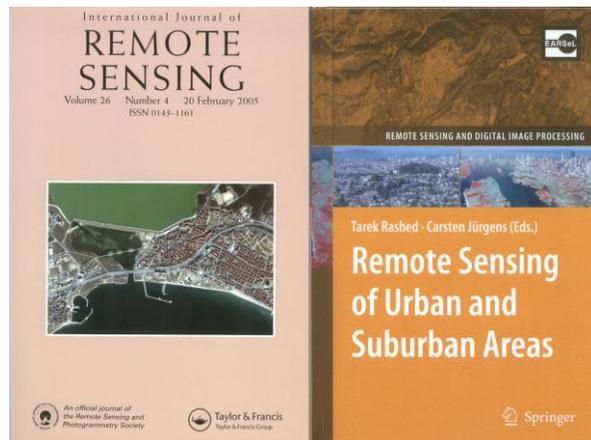


Landcover results for Istanbul, Turkey

Objectives of the Special Interest Group are

- to be a forum for the community interested in the use of remote sensing and GIS for urban areas
- to organize symposia, workshops, tutorials and special conference sessions to disseminate urban remote sensing knowledge,
- to bring together experts working in the field of remote sensing and GIS for urban areas,
- to create a forum for international discussion to better prepare the urban remote sensing and geography communities for new developments in technology and application.

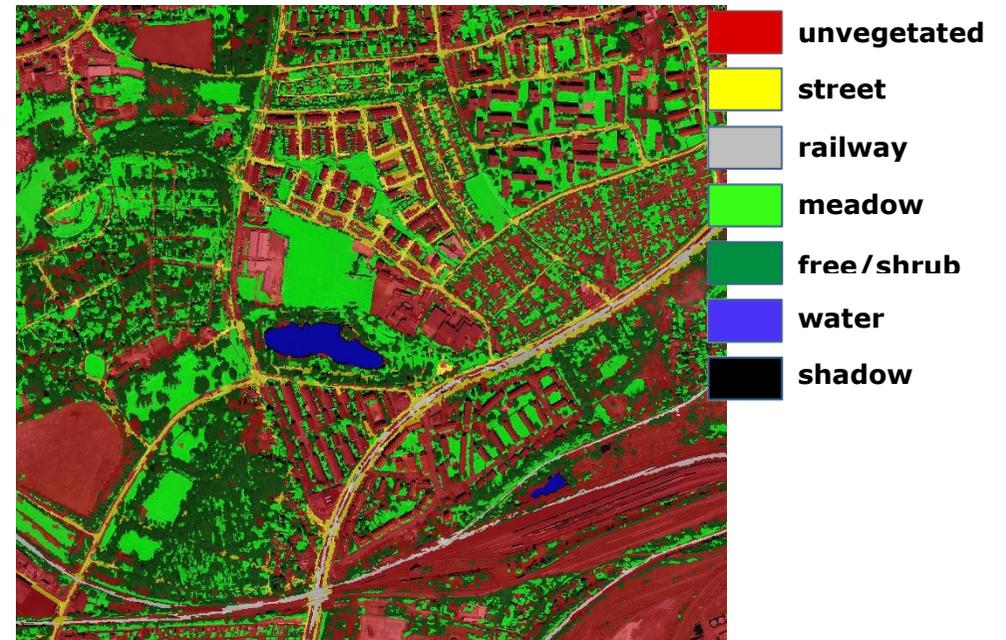
Starting from 2001 the SIG has organised several conferences in Regensburg, Berlin, Bochum and Munich (Germany); Istanbul (Turkey); Paris (France); Tempe (USA); and Shanghai (China). We have also organized special sessions on urban remote sensing in different international conferences, published a book (Editors: Rashed & Jürgens; Chapter: Maktav & Sunar), and edited the special issue *Urban Remote Sensing* of the International Journal of Remote Sensing.



The Special Interest *Group Urban Remote Sensing* is chaired by Carsten Jürgens from the Department of Geography, Ruhr University Bochum, Germany and co-chaired by Derya Maktav from the Department of Geomatics Engineering, Istanbul Technical University, Istanbul, Turkey.

Internet: <http://www.ins.itu.edu.tr/sig-urs>

E-Mail: carsten.juergens@ruhr-uni-bochum.de
maktavd@itu.edu.tr



Urban land cover classification of Bochum, Germany



Developing Countries

EARSel, like other organizations of the remote sensing community, realizes that remote sensing offers global, regional and local observation possibilities which are difficult to attain by other methods. It further realizes that the most potential applications are in areas where data are greatly lacking, which holds particularly in the developing countries. It is therefore that within EARSel a Special Interest Group on *Developing Countries* has been established.

Many workshops held up to now in relation to this SIG concentrated on problems associated with the use of remote sensing in the developing countries. Especially, remote sensing is rapidly becoming accepted in many of such countries as an excellent tool for mapping purposes since up-to-date maps and topographical information are not always available.

Working in developing countries often brings up problems which are different to the ones faced by scientists in more

developed countries working on topics in developed countries. Therefore, a European contact group has been established in order to bring together these scientists in order to exchange experiences and results of research programs more easily.

The SIG aims also to set up contacts with the national development agencies of the EU, in order to highlight the importance of remote sensing for mapping purposes in developing countries and to establish cooperation with the developing agencies.

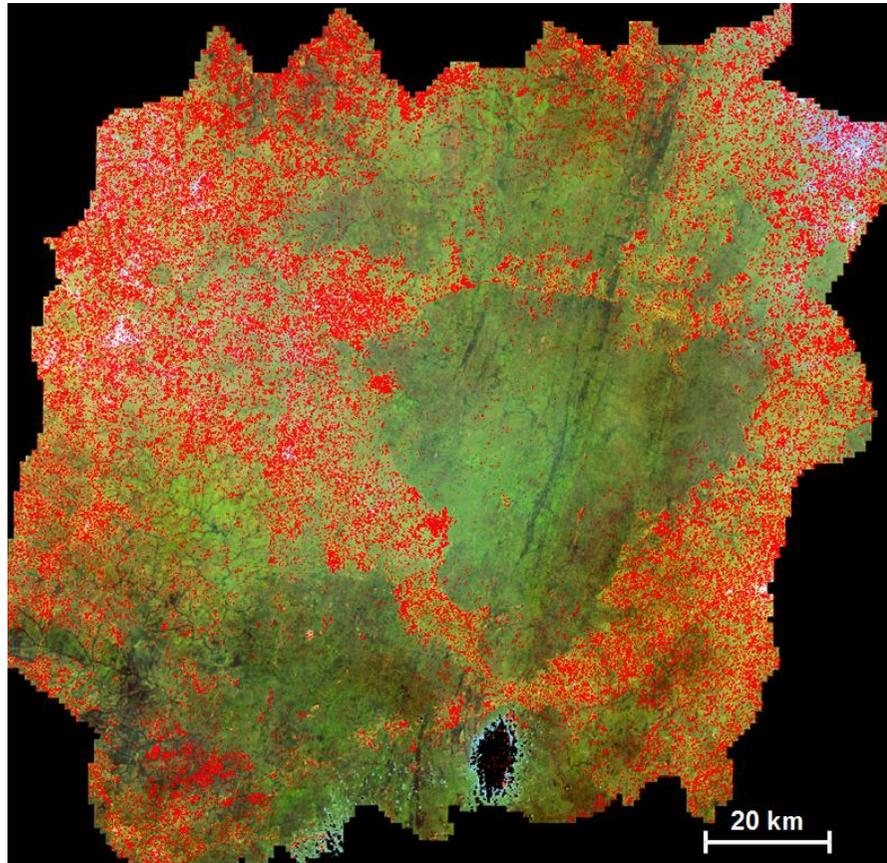


Examples of challenges in developing countries

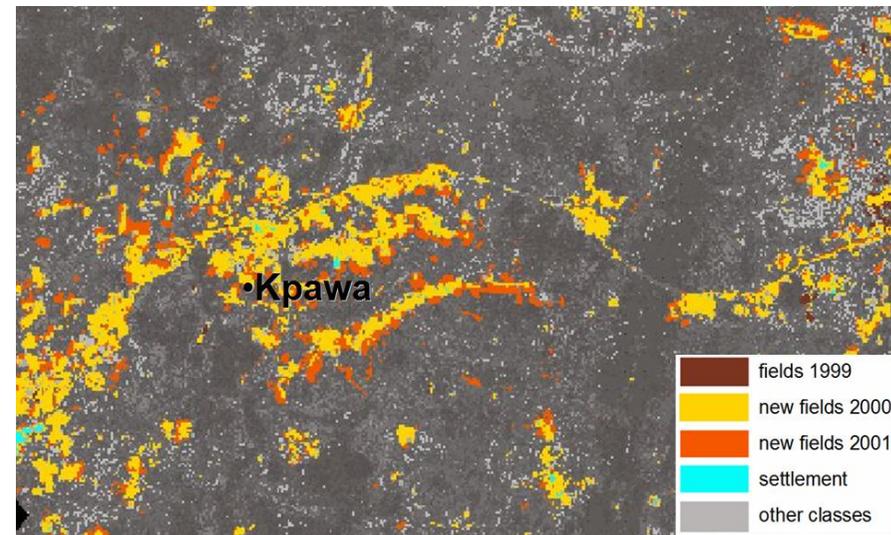


Capacity building in Remote Sensing

The SIG Developing Countries organized workshops in Gent (Belgium) 2000, Bonn (Germany) 2002, Cairo (Egypt) 2005, and Istanbul (Turkey) 2008. It also participated in Joint EARSeL Workshops held in Bochum (Germany) 2008 and Gent (Belgium) 2010.



New fields (red) between 1991 and 2011 in Central Benin



Monitoring of agricultural areas in the Quémé Catchment, Benin

The Special Interest Group *Developing Countries* is chaired by Rudi Goossens from the State University in Gent, Belgium, and co-chaired by Hans-Peter Thamm from the Freie Universität Berlin, Germany.

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Cultural and Natural Heritage

The research, documentation, presentation and management of heritage sites is a complex task. While this task was previously in the hands of archaeologists in the case of cultural heritage sites, or environmentalists in the case of natural heritage sites, today it requires an interdisciplinary approach.

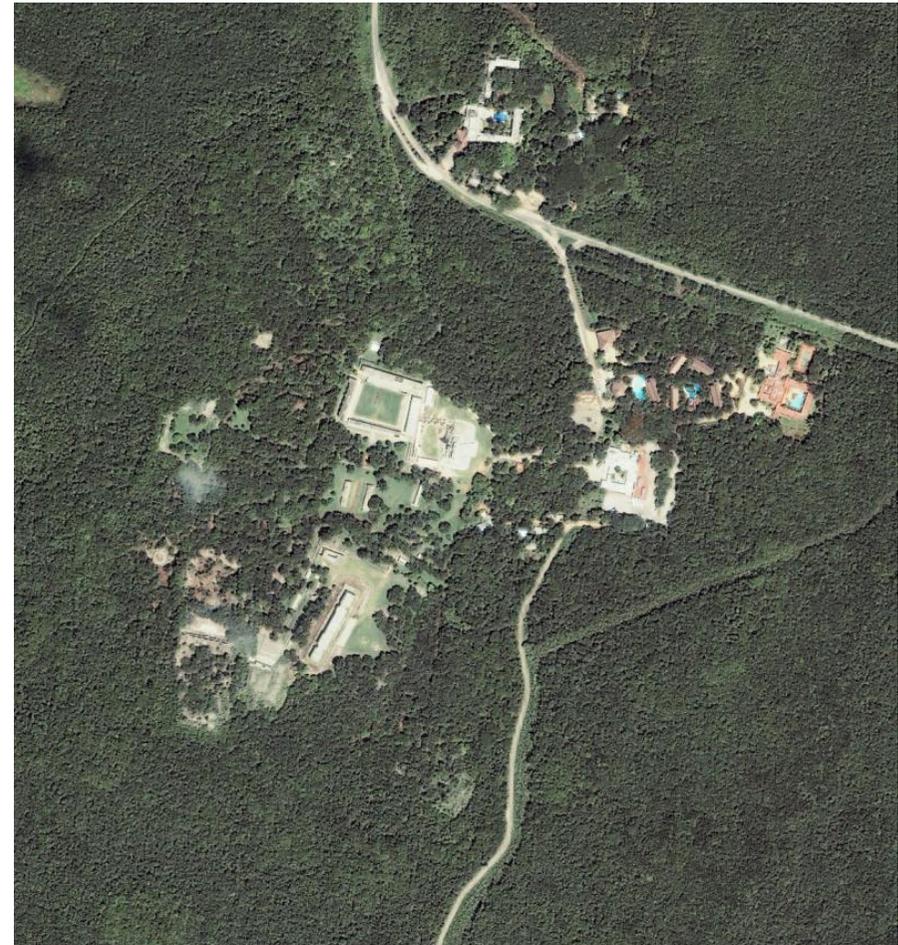
This is precisely the support that remote sensing brings to cultural and natural heritage. Remote Sensing is a technology of obtaining geometrical and semantic information about the Earth and its environment using non-invasive technologies. There is today a large range of satellite sensors available. This data is then combined with airborne and terrestrial sensors. The diversity in terms of sensors and systems subsequently brings the diversity in applications. The cultural heritage domain is obtaining large benefits from the combinations of all these technologies.

The EARSeL Special Interest Group on *Applications of Remote Sensing for Cultural and Natural Heritage* brings together experts working on the wide range of disciplines mentioned in the previous paragraph.

Through the organization of international workshops this Special Interest Group of EARSeL facilitates the exchange of technologies, lessons learnt and projects in the area of remote sensing as applied to natural and cultural heritage.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) and its dedicated programme *Open Initiative on the use of Space Technologies to support*

World Heritage is a strong partner of EARSeL for this particular SIG.



Uxmal, Mexico archaeological site seen by GeoEye satellite.
© GeoEye, all rights reserved; <http://www.geoeye.com>



Uxmal, Mexico archaeological site

As an example, the topics coordinated by this SIG are:

- Aerial archaeology
- Remotely sensed data processing, analysis and interpretation
- Development of statistical methods to perform advanced analyses of aerial imagery (from panchromatic to hyperspectral data) and VHR satellite data for the detection of buried archaeological remains
- Integration of space/airborne and ground active and passive techniques for archaeological prospection

- Multiscale, multidata and multispectral approach for the archaeological prospection (aerial imagery, satellite data, geophysical analyses)
- Subsurface reconstruction based on GPR, magnetic and electrical tomography
- Inverse Problems related to Subsurface Sensing
- Integration of remote sensing studies and ground truth
- Remote sensing and GIS for archaeological landscape and paleoenvironmental studies
- Virtual reality, 3D visualisation, open source and Web-GIS.

As indicated in the beginning, remote sensing for cultural and natural heritage is interdisciplinary and therefore this Special Interest Group or EARSeL works closely with the other EARSeL Special Interest Groups.

The Special Interest Group *Cultural and Natural Heritage* is chaired by Rosa Lasaponara from IMAA-CNR and Nicola Masini from IBAM-CNR, Tito Scalo, Italy, and by Mario Hernandez from United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris, France.

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m.hernandez@unesco.org

Temporal Analysis of Image Data

Many years ago EARSeL began the process of establishing a Special Interest Group on time series analysis of remotely sensed data. This action was stimulated by the open and mostly free access to satellite data archives providing the opportunity to study, for example, environmental changes over a period of more than 30 years which is the minimum time needed to study impacts of climate change.

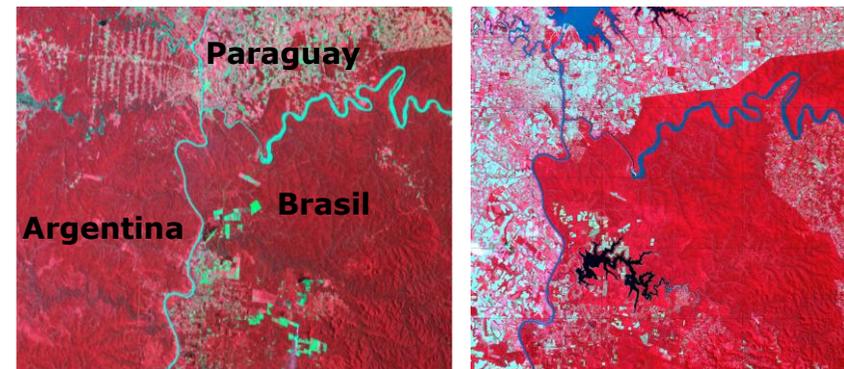
It is no surprise that timeseries analysis of satellite data is a growing field of interest in various scientific disciplines and the use of "old" data experiences a kind of renaissance. Furthermore there is intensive use of new sensors providing data with global coverage in a very short time-scale and enabling in-depth analysis of environmental processes and anthropogenic impacts.

The following topics are an interesting start of this new SIG:

- overview of existing data archives, e.g., Landsat, NOAA-AVHRR, MODIS, ERS 1 and 2, InSAR, etc.
- methodological requirements on multitemporal data calibration and correction, and on geometric accuracy of old satellite data
- existing tools for time series analysis in commercial software packages
- development of improved/sophisticated algorithms for change detection
- vegetation dynamics and ecological processes

- high resolution time series from Thermal Infrared cameras - the link to boundary layer meteorology and process studies.

It is obvious that the activities of this Special Interest Group are closely related to many other EarSeL SIGs. Therefore a close co-operation is foreseen. The development of sophisticated algorithms is an especially important task.

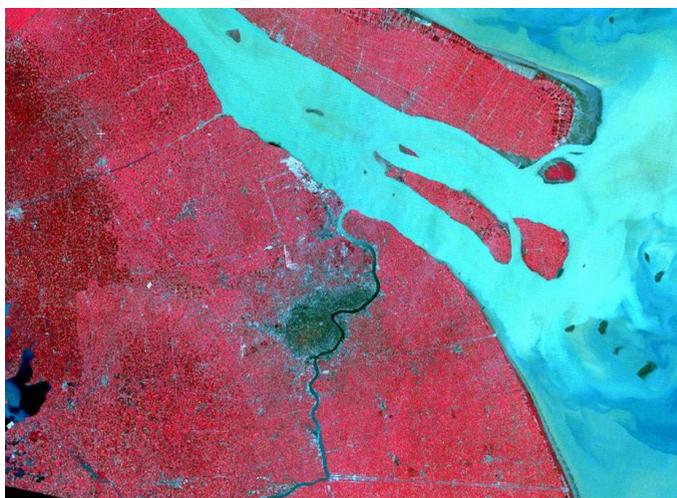


Land use change at UNESCO World Heritage Site Iguazu National Park between 1973 and 2011 (Landsat); vegetation is shown in red, deforested areas in light red and blue colour.

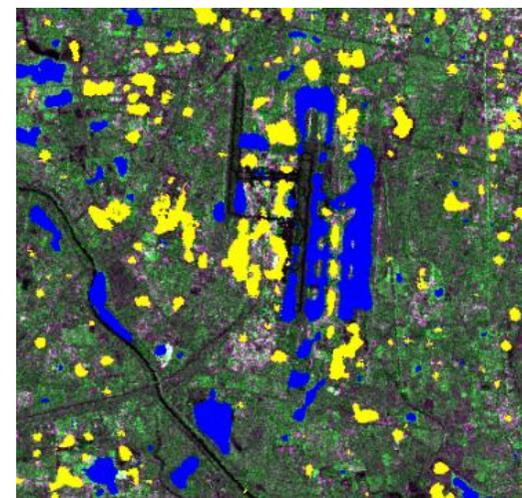
The Special Interest Group *Temporal Analysis of Image Data* is chaired by Eberhard Parlow from University Basel, Switzerland, and co-chaired by Yifang Ban from the Royal Institute of Technology in Stockholm, Sweden.

Internet: <http://www.earsel.org/SIG/timeseries/>

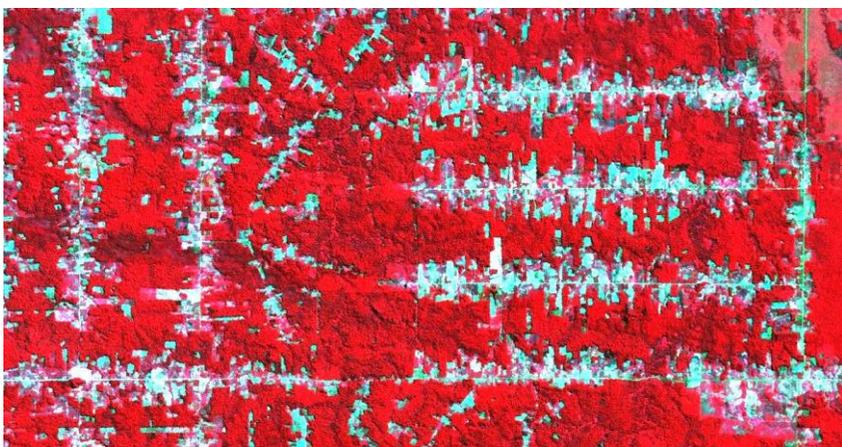
E-Mail: eberhard.parlow@unibas.ch
yifang@kth.se



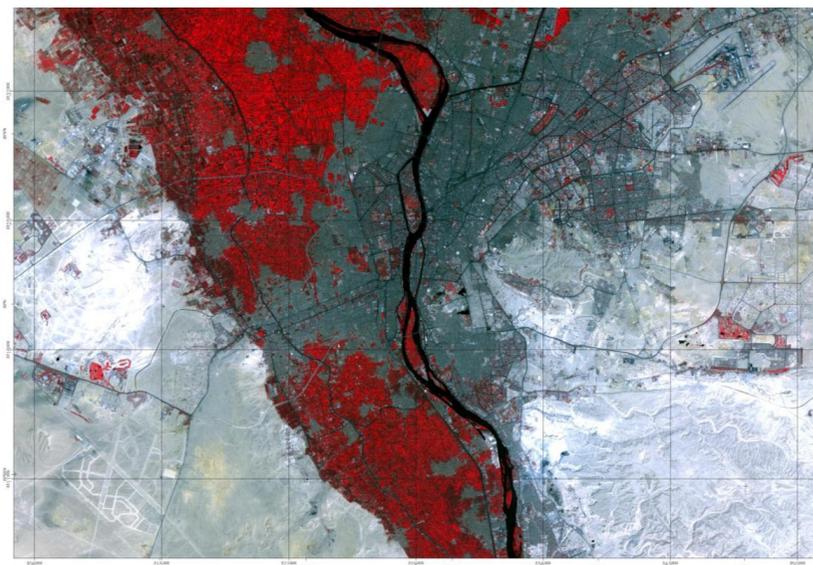
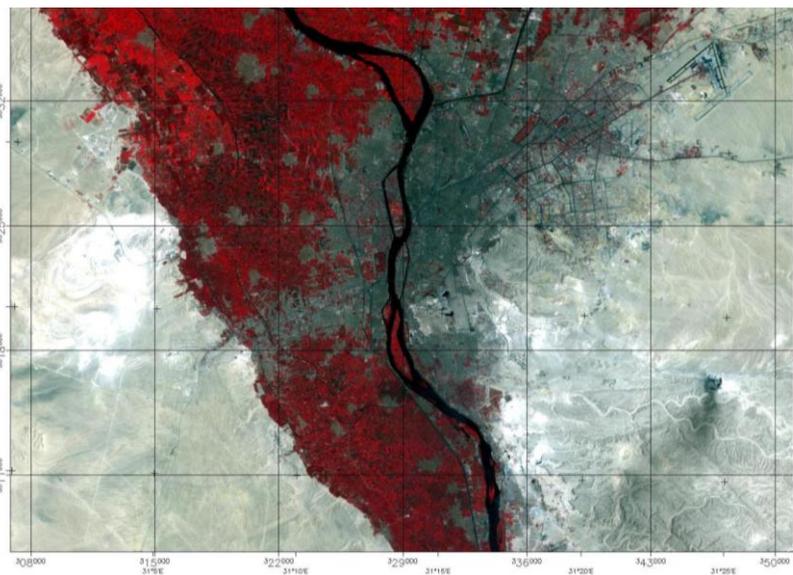
Multitemporal false-colour images of Shanghai, China, 1979 (left; Landsat) and 2010 (right; HJ-1B images)



Multitemporal SAR data of Beijing, China, 1998 (left; ERS-2 SAR), 2008 (centre; ENVISAT ASAR), and change detection (right; yellow: backscatter increase, blue: backscatter decrease)



Tropical rain forest in Rondonia, Brasil, 1986 (left) and 1999 (right; Landsat); vegetation is shown in red, deforestation in blue colour.



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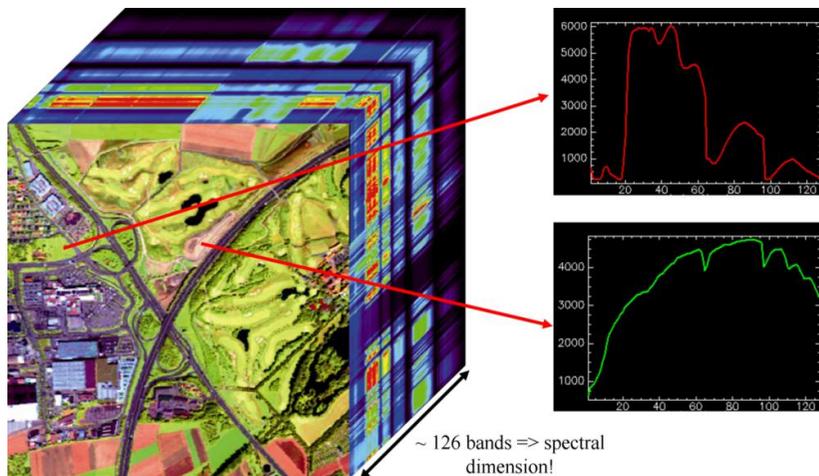
Urban sprawl of megacity Cairo, Egypt, 1984 (left; Landsat) and 2004 (right; Aster), false-colour infrared composite images



European Association of Remote Sensing Laboratories

Imaging Spectroscopy

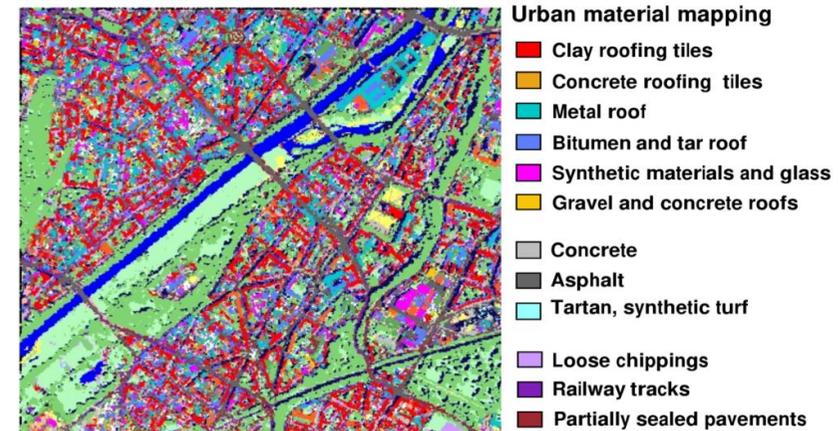
Imaging Spectroscopy is concerned with the measurement, analysis, and interpretation of spectra acquired from a given scene or object at various altitudes of airborne or satellite imaging spectrometers. Hyperspectral sensors produce hundreds of images, corresponding to contiguous channels of different wavelengths for the same region on the Earth surface, enabling the construction of an almost continuous reflectance spectrum for every pixel in the scene. Spectra can range from the visible, near- and mid-infrared to the thermal infrared.



Hyperspectral data cube of Barrax (Spain)
acquired with the imaging spectrometer HyMap©

Such wealth of spectral information has opened groundbreaking perspectives in many applications, including environmental and urban monitoring and assessment, target detection for military and homeland defence/security purposes, and risk prevention and response. The latter includes

tracking wildfires, detecting biological threats, and monitoring oil spills and other types of chemical contamination.



Urban material mapping

The SIG Imaging Spectroscopy (SIG-IS) promotes quantitative approaches in Earth observation and presents an integrated view on sensors, calibration, data evaluation and applications. Workshops are organised every two years with the objectives to introduce air- and spaceborne hyperspectral imaging techniques; to familiarise scientists with technological advantages in hyperspectral remote sensing; to qualify research groups for hyperspectral data processing; and to strengthen the communities ability to apply hyperspectral data to research projects.

The Special Interest Group *Imaging Spectroscopy* is chaired by Andreas Müller from DLR Oberpfaffenhofen, Germany.

Internet: <http://www.opairs.aero/SIG-IS.htm>

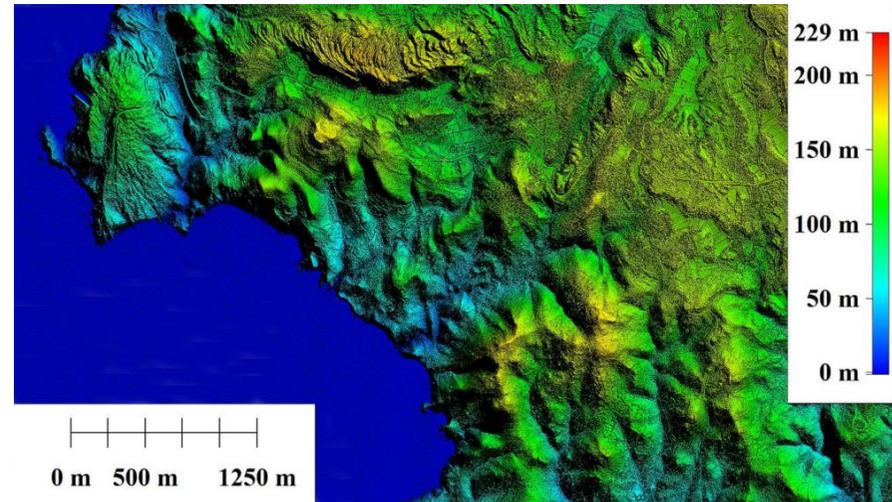
E-Mail: andreas.mueller@dlr.de

3D Remote Sensing

The three-dimensional shape of the Earth has become of major importance for several remote sensing applications in the last year, thanks to the continuously increased ground resolution of optical and radar sensors. Topics like the geometrical correction of the remote sensed imagery through models for image orientation and geo-referencing and the discrete 3-D representation of the surface of the Earth through Digital Surface, Elevation and Terrain Models (DSM – DEM - DTM) based on remotely sensed imagery are of primary importance.

The mentioned topics are strictly interrelated, since the generation of DSMs requires stereo or multiple image orientation together with matching strategies, whereas the image correction for orthoimagery production requires the DSM's. Moreover, the generation of DEM's and DTM's from DSMs requires filtering strategies to eliminate vegetation and man-made objects (buildings, bridges, ...) in order to recover the shape of the bare terrain itself.

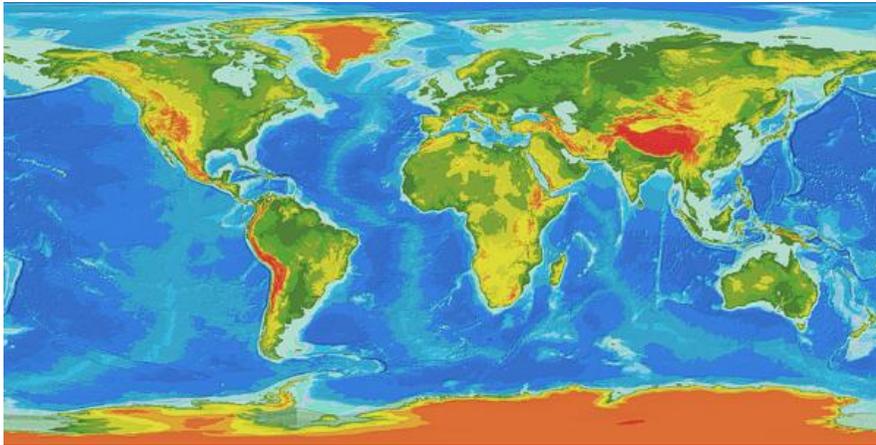
The discrete 3-D representation of the surface of the Earth is a basis for a large and increasing variety of applications in Engineering, Earth and Environmental Science, Safety and Security (terrain analysis, flood prediction, coastal mapping, erosion control, determination of subsidence, noise and gas propagation, telecommunications planning, ...), so that methodologies and techniques related to the different steps of DSMs, DEMs and DTMs generation and quality control are in the centre of the SIG 3D Remote Sensing.



Digital Surface Model of Sardinia, Italy, derived with Lidar data

The SIG strongly encourages both the cooperation with other international associations involved in similar topics such as ISPRS, ASPRS, IEEE-GRSS, IAG. It also supports the networking and technology transfer among academia and professionals, government entities and industry which are involved in remote sensing research and applications at European level and beyond.

In this respect, the SIG organizes oral and poster sessions within each EARSeL Symposium on an annual regular basis; further, the SIG promotes specialist Workshops, approximately every two years, possibly in the framework of a Joint Workshop of EARSeL Special Interest Groups.



Global Digital Surface Model with 4 km resolution, derived from NASA's Shuttle Radar Topography Mission data

Overall, general topics of the SIG 3D Remote Sensing are as following:

- models for orientation/geo-referencing of single and multiple optical and radar images
- matching strategies for stereo and multiple imagery
- generation of Digital Surface Models (DSM's) (the visible surface) based on space and aerial images, laser scanning, interferometric and radargrammetric Synthetic Aperture Radar (cooperation with the EARSeL SIG Radar Remote Sensing), with particular care to complex morphology areas (urban, mountain)

- generation of 3D-city models (cooperation with the EARSeL SIG Urban Remote Sensing)
- DSM and DEM comparison, cross-validation and quality assessment, with special attention for global DEM's (as the new ASTER DEM)
- applications of DSM's, DEM's or other height information in engineering, land and environmental planning, management and protection
- determination of changes of the Earth surface
- 3D spatial databases.

We are glad to encourage you to submit new ideas for future research which could be of interest for the SIG.

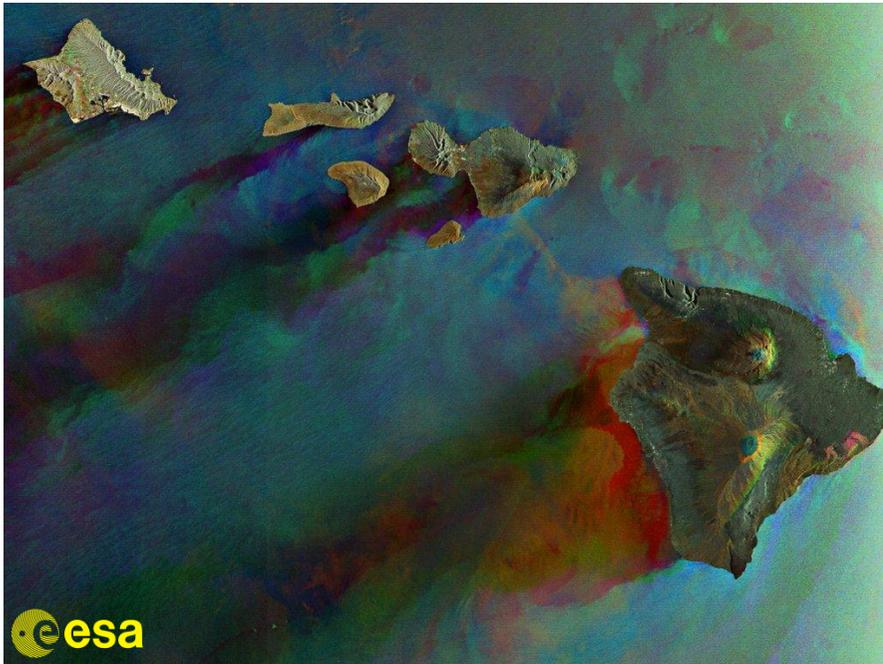
The Special Interest Group *3D Remote Sensing* is chaired by Mattia Crespi from Università di Roma *La Sapienza*, Italy, and by Karsten Jacobsen from the Leibniz Universität Hannover, Germany.

Internet: <http://www.earsel.org/SIG/3D/>

E-Mail: mattia.crespi@uniroma1.it
jacobsen@ipi.uni-hannover.de

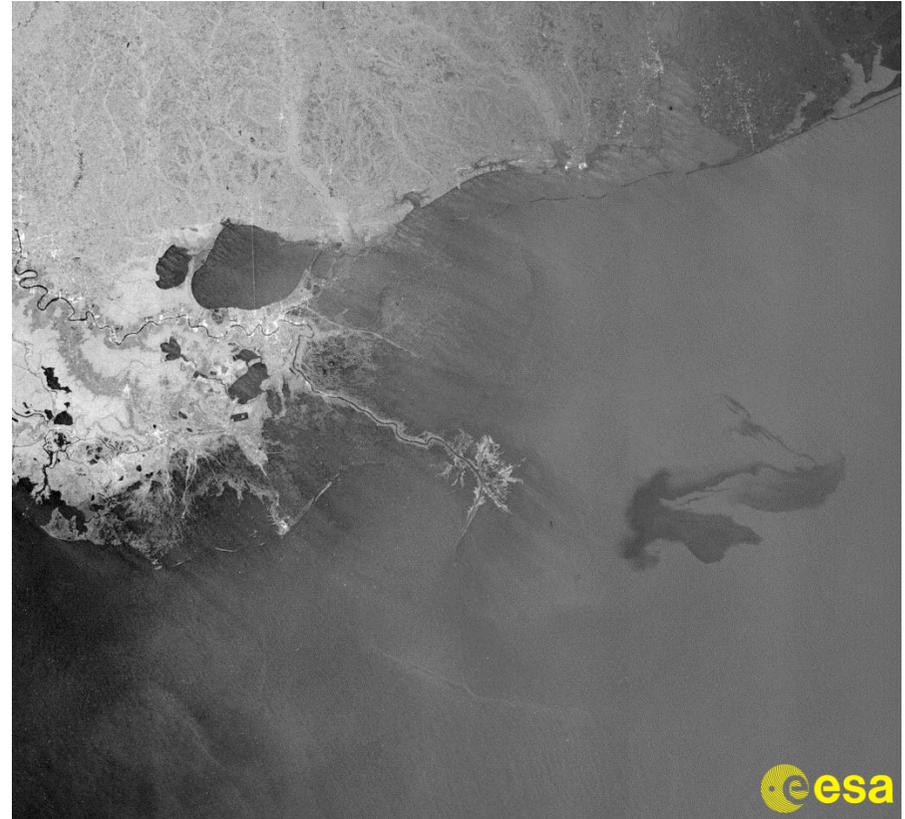
Radar

Nowadays, a substantial part of remote sensing for Earth Observation is performed in the microwave domain of the electromagnetic (EM) spectrum. Radar instruments illuminate the scene with EM wavelengths on the order of centimetres, which permit all-weather, day-and-night operation, ability to work in different modes implying complementing data features and characteristics. Illumination control results in polarimetric capabilities.

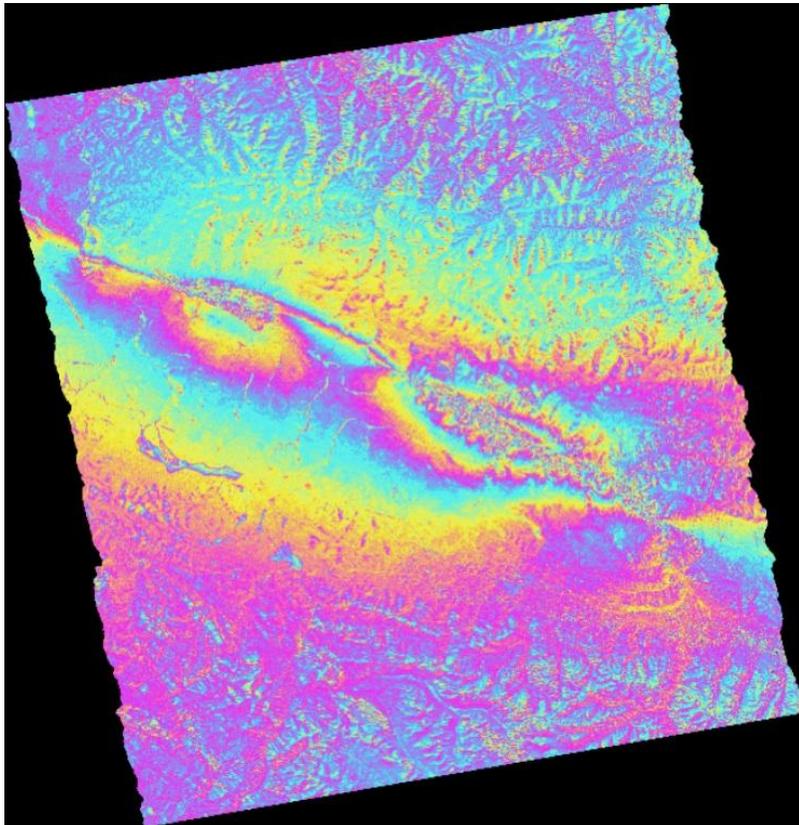


Polarimetric Envisat ASAR image of Hawaii islands, USA

Radar is used for diverse applications such as surveillance, altimetry, scatterometry, and large-scale imaging of the Earth surface. Preserving phase information permits the extraction of coherence and 3D information on the observed targets.



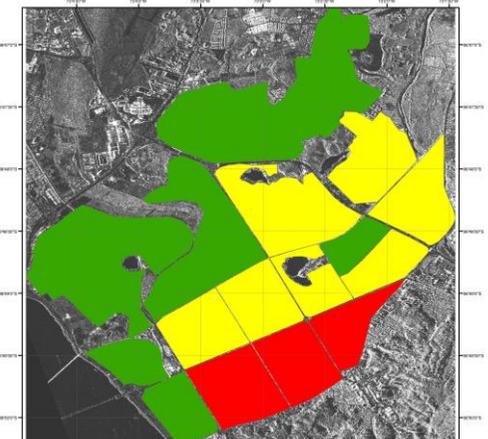
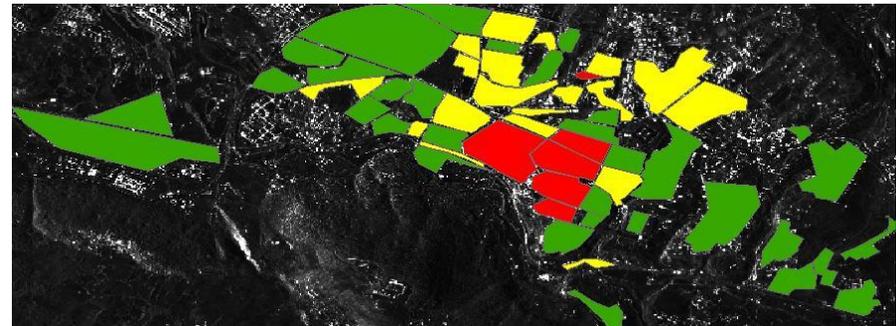
Oil spill off the coast of Louisiana, USA, imaged by Envisat ASAR



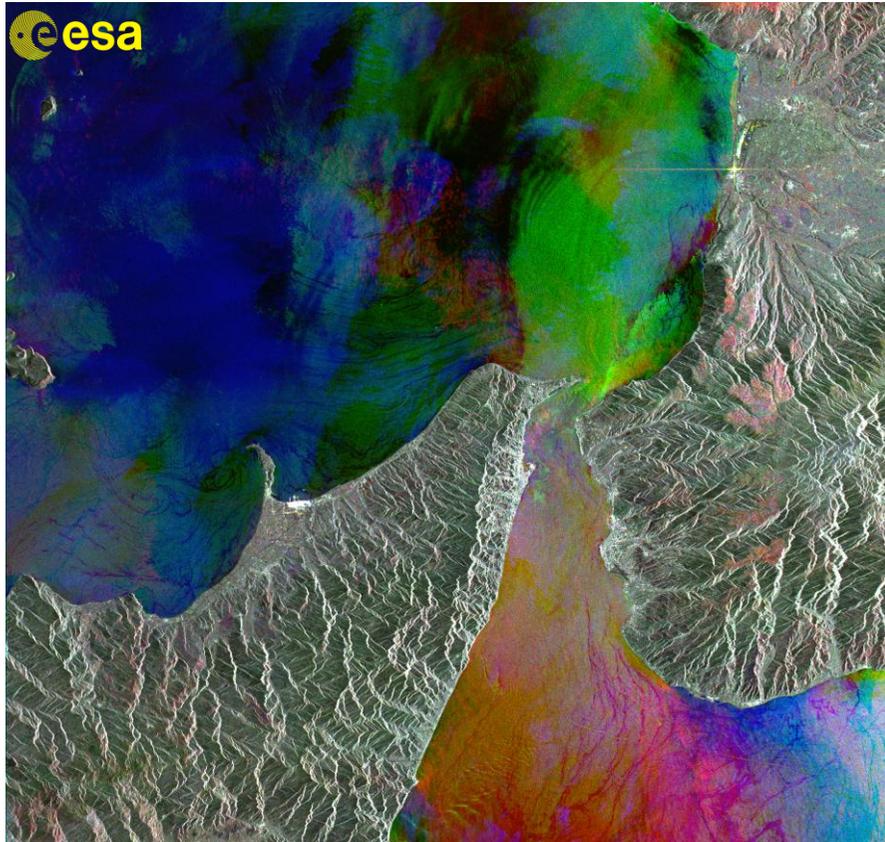
Interferogram of the Yushu earthquake, China; 14 April 2010

Unlike optical imaging, however, understanding the theoretical background of imaging radar can be challenging, particularly when new to the field. The interaction of the incident microwave energy with the landscape to finally form an image entails a degree of complexity far beyond the relatively intuitive concepts usable for optical acquisitions.

The required specialized knowledge has been an important factor hindering large-scale usage of radar remote sensing in various applications.



Case studies on mapping earthquake damage from post-event data only. Top: L'Aquila, Italy, 2009; left: Haiti, 2010; right: Chile, 2010



Multi-temporal ERS SAR image of Messina strait, Italy

Recent years have seen an unprecedented improvement in spaceborne synthetic aperture radar (SAR) systems with the introduction of metre-resolution sensors and satellite constellation. These systems, such as COSMO/SkyMed,

TerraSAR-X and TanDEM-X, are providing a wealth of information on the earth surface which permits continuous, detailed, and multifaceted observation of our environment.

The Special Interest Group *Radar Remote Sensing* specializes in active microwave sensing of the environment. It intends to build on the opportunities open by this challenging but promising field of Earth Observation by facilitating exchanges between research groups, circulating information, encouraging educational initiatives and spreading knowledge among people in the field and disseminating to the community at large.

The Special Interest Group *Radar Remote Sensing* is chaired by Fabio Dell'Acqua from the Department of Electronics, University of Pavia, Italy, and co-chaired by Uwe Soergel from the Institute for Photogrammetry and GeoInformation, Leibniz Universität Hannover, Germany.

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E-Mail: fabio.dellacqua@unipv.it
soergel@ipi.uni-hannover.de

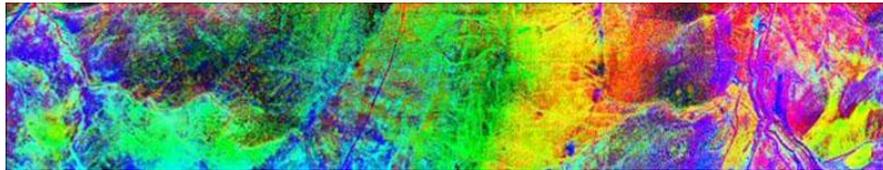
Thermal Remote Sensing

The Special Interest Group Thermal Remote Sensing (SIG-TRS) brings together European thermal remote sensing scientists from different disciplines. Our objectives include

- Encouraging international exchange of knowledge and data common to all thermal research groups independent of application
- Increasing awareness of the thermal remote sensing domain
- Joining forces in the TRS domain, in order to position TRS higher on the agenda for new sensor development in Europe

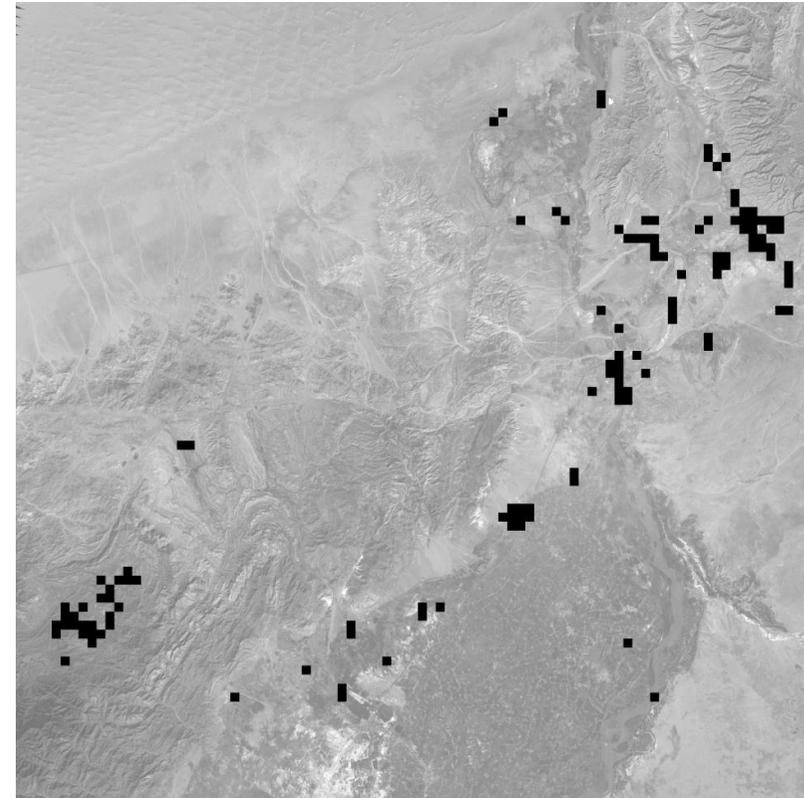
We intend to achieve these objectives by organizing

- Workshops in the framework of EARSeL Symposia
- Topical sessions attached to other EARSeL and/or non-EARSeL events
- Informal demonstrations or training courses



Hyperspectral Thermal Infrared imagery (SEBASS)
for lithologic mapping

SIG-TRS maintains a website and mailing list to distribute interesting information directly to its subscribers. It also maintains a linkedin group page for informal contact amongst group members. For more information visit the website.



Thermal anomaly detection results from MODIS data

The SIG *Thermal Remote Sensing* is chaired by Claudia Künzer from DLR Oberpfaffenhofen, Germany, and by Chris Hecker from University of Twente, The Netherlands.

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hecker@itc.nl

Education and Training

Remote sensing of the earth covers many topics that are significant for all science disciplines in school and university curricula. Satellite imagery and data derived from satellite sensors are available for studies of local or regional phenomena. This covers larger scales, as is typical for remote sensing using satellites, but also the region around schools, and thus allows the appreciation of the dependence between local and global scales. Remotely sensed data are used to explain actual conditions on earth. But they also enable the methods for predicting future developments to be appreciated – e.g. the climate system – with models.



Teaching satellite image processing software ...



... and learning its application at workshops

The Special Interest Group is a platform for information exchange among people interested in the use of methods and results of earth observation

- in the curriculum at all school levels
- in lectures at university on physics, biology, chemistry and earth sciences
- at organisations and authorities involved in environmental monitoring

and the application of remote sensing. The SIG has organised workshops in the framework of the annual symposia for several years with the aim of promoting educational initiatives in earth sciences, but also to motivate EARSeL members to contribute with their research results to this subject as well.

EARSel's SEOS project, described on page 6, and the promotion of its tutorials (<http://lms.seos-project.eu/>) to the public was the starting point of the SIG in 2007. Since then, a number of other projects have been initiated.

Blickpunkt Fernerkundung – BLIF:

Satellite images are required in the classroom in many fields of expertise within the curricular and national education standards in different countries. BLIF (www.blif.de) offers a software solution for the integration of satellite images into modern contemporary geography lessons. Its characteristics are:

- it is web-based and freely accessible educational remote sensing software
- it offers many features including georeferencing, unsupervised/supervised classification, geotagging, etc.
- three wizard guided modes are supported



BLIF User Interface (Assistant-mode: professional level)

Satellite Image Learning Centre – SILC:

The interactive and multimedia-based learning software SILC (www.ph-heidelberg.de/esa) allows students a limited yet introductory access to RS and to promote interest and motivation for scientific research with hands-on applications.



The SILC homepage

The Special Interest Group *Education and Training* is chaired by Rainer Reuter from the University of Oldenburg, Germany, and co-chaired by Alexander Siegmund from the University of Education Heidelberg, Germany, and Mario Hernandez from UNESCO Headquarters in Paris, France.

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Image Credits

Cover page

True-colour Envisat MERIS mosaic of Europe.
Antonios Mouratidis, European Space Agency (ESA).

The Mission of EARSeL

EARSeL's foundation meeting ...
EARSeL's History; Godefroy M, G Østrem & R Vaughan (Eds.),
2008. <http://www.earsel.org/Monographs/EARSeL-History.pdf>.

Venues of annual EARSeL symposia ...
Eberhard Parlow, University of Basel, Switzerland.

Pan-cloud layers over the Pacific Ocean ...
NASA Johnson Space Center, The Gateway to Astronaut
Photography of the Earth, <http://eol.jsc.nasa.gov/>. Mission:
ISS007, Roll: E Frame: 10807: Pan-cloud layers, anvils.

Projects

Image mosaic in the tutorial *A World of Images*, ...
SEOS project, http://lms.seos-project.eu/learning_modules#1.

Special Interest Groups

Von Karman vortices in the Canary Island basin
European Space Agency, Envisat MERIS, 6 June 2010,
http://earth.eo.esa.int/cgi-bin/satimsgsql.pl?show_url=2058.

The Earth's biosphere, ...
NASA Goddard Space Flight Center, SeaWiFS Project, SeaWiFS
Globe Design Tool; <http://oceancolor.gsfc.nasa.gov/SeaWiFS/>.

Land Use / Land Cover

Land cover change of the Aral lake over the last five decades.
Beckel, 2007; UNEP site 09.2009; UNEP site 09.2009; Beckel,
2007; NASA Earth Observatory 08.2009; ESA 08.2009

http://lms.seos-project.eu/learning_modules/landuse/landuse-c03-p03.html.

Cultivation Methods in the Region Almeria, Spain ...
UNEP, 09.2009; http://lms.seos-project.eu/learning_modules/landuse/landuse-c03-p03.html.

Land Ice and Snow

Snow covered Alps seen by Metop-AVHRR sensor ...
Remote Sensing Research Group, Institute of Geography,
University of Bern, Switzerland.

Coastal Zones

Beautiful colours of coastal zones ...
European Space Agency (ESA)
http://www.esa.int/esaEO/SEMOYZ3UFLG_index_0.html.

Oil leak from a sunken ship in iced water
Sergey Babichenko, Laser Diagnostics Instruments AS, Tallinn, Estonia.

Sky and water leaving radiance measurements ...
Rainer Reuter, University of Oldenburg, Germany.

Forestry

Identification of tree species, Czech Republic, ...
Filip Hájek, Forest Management Institute, Czech Republic.

Digital Surface Model based on ALS data ...
Piotr Wezyk, Agricultural University in Krakow, Poland.

Forest Fires

Burned area mapping, Peloponnese, Greece
Laboratory of Forest Management and Remote Sensing,
Aristotle University of Thessaloniki, Greece.



World fire density (2000-2009)
Lucrecia Pettinari, University of Alcalá, Madrid, Spain.

Geology

Remote sensing data facilitates mine monitoring.
Konstantinos G. Nikolakopoulos, Institute of Geology & Mineral Exploration, Greece.

Radar interferometry is a valuable tool for geological hazards.
Konstantinos G. Nikolakopoulos, Institute of Geology & Mineral Exploration, Greece.

Urban Remote Sensing

Urban land cover classification of Bochum, Germany
Ruhr University Bochum, Germany; Carsten Jürgens.

Landcover results for Istanbul, Turkey
Istanbul Technical University, Turkey; Derya Maktav.

Developing Countries

Examples of challenges in developing countries.
Hans-Peter Thamm, Freie Universität Berlin.

Capacity building in Remote Sensing.
Rudi Goossens, State University of Gent, Belgium

New fields (red) between 1991 and 2011 in Central Benin.
Hans-Peter Thamm, Freie Universität Berlin.

Monitoring of agricultural areas in the Quémé Catchment ...
Modified from Thamm H-P, M Judex & G Menz, 2005: Modelling of Land-Use and Land-Cover Change (LUCC) in Western Africa using Remote Sensing. In: Photogrammetrie, Fernerkundung, Geoinformation 3, 191-199

Cultural and Natural Heritage

Uxmal, Mexico archaeological site seen by GeoEye satellite.
GeoEye, 08.08.2002, all rights reserved, <http://www.geoeye.com>.

Uxmal, Mexico archaeological site
Mario Hernandez, United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France.

Temporal Analysis of Image Data

Land use change at UNESCO World Heritage Site Iguazu Nationalpark ...

Eberhard Parlow, University of Basel, Switzerland.

Multitemporal images of Shanghai, China, ...

Left: data from US Geological Survey; right: HJ-1B images, Yifang Ban; data from Chinese Ministry of Science and Technology (MOST)

Multitemporal SAR data of Beijing, China, ...

left and centre: Yifang Ban; data from European Space Agency (ESA); right: Yifang Ban, Royal Institute of Technology, Stockholm, Sweden.

Tropical rain forest in Rondonia/Brasil ...

Eberhard Parlow, University of Basel, Switzerland.

Urban sprawl of megacity Cairo/Egypt ...

Eberhard Parlow, University of Basel, Switzerland.

Imaging Spectroscopy

Hyperspectral data cube of Barrax (Spain) ...

OpAIRS - Optical Airborne Remote Sensing and Calibration Facility, German Aerospace Center (DLR), Oberpfaffenhofen, Germany.

Urban material mapping
Wieke Heldens, Earth Observation Center (EOC), German Aerospace Center (DLR), Oberpfaffenhofen, Germany.

3D Remote Sensing

Digital Surface Model of Sardinia, Italy, ...
Dipartimento di Ingegneria Civile, Edile e Ambientale, Università di Roma "La Sapienza", Italy, from data available at Regione Sardegna, <http://www.sardegnaeoportale.it/>.

Global Digital Surface Model with 4 km resolution, ...
Valerie Paskevich, Woods Hole Science Center, U.S.A.
US Geological Survey,
http://woodshole.er.usgs.gov/openfile/of2005-1001/data/basemaps/srtm30plus/srtm30plus-world_pctshade.htm

Radar

Polarimetric ASAR image of Hawaii islands, USA.
European Space Agency (ESA).

Oil spill off the coast of Louisiana, USA, ...
European Space Agency (ESA).

Interferogram on 14th April 2010 Yushu earthquake, China.
PALSAR data Jaxa/METI; processing: SARMAP SA.

Case studies on mapping earthquake damage ...
COSMO/SkyMed data, ASI; processing:
EUCENTRE/University of Pavia.

Multi-temporal ERS SAR image of Messina strait, Italy.
European Space Agency (ESA), Multimedia Repository.

Thermal Remote Sensing

Hyperspectral Thermal Infrared imagery (SEBASS)
University of Twente, ITC, The Netherlands.

Thermal anomaly detection results from MODIS data
University of Twente, ITC, The Netherlands.

Education and Training

Teaching satellite image processing software ...
Photos taken at the EARSeL Symposium 2005, Porto, Portugal. Rainer Reuter, University of Oldenburg, Germany.

BLIF User Interface ...
University of Education Heidelberg, Germany.

The SILC homepage
University of Education Heidelberg, Germany.

Imprint

Earthrise
NASA Johnson Space Center, The Gateway to Astronaut Photography of the Earth, <http://eol.jsc.nasa.gov/>, Mission AS11, Roll 84, Frame 6552





Earthrise seen over the lunar limb during Apollo 11 mission to the moon in July 1969.

Imprint

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Brochure on the internet:

<http://www.earsel.org/Monographs/Brochure-2011.pdf>
with links to high-resolution images

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