EARSeL Special Interest Group

Education and Training

1st Workshop on

Earth Observation
From Research to Teaching in Schools and Universities

Istanbul, 5-6 June 2008

Abstract Book

Issue: 14 May 2008

HyperTeach: Theoretical and Practical Training Course in Imaging Spectroscopy

Ils Reusen
ils.reusen@vito.be
VITO

Justin Ahanhanzo

Luc Bertels

Bart Deronde

Yucel Erbay

Max Fernandez

Marina Frederik

Rudy Herman

Els Knaeps

Cédric Lathuy

Koen Meuleman

Sias Mostert

Kevin Ruddick

Hartanto Sanjaya

Sindy Sterckx

Philippe Trefois

Jos Van Orshoven

Joost Vandenabeele

Jan Van Aardt

Adriaan Van Niekerk

Keywords: Imaging Spectroscopy

Abstract: Imaging Spectroscopy (IS) is becoming a major remote sensing technique especially with the advent of next-generation airborne sensors like APEX and ARES in 2008. This field of remote sensing provides relevant input to numerous applications, since an imaging spectrometer samples hundreds of narrow contiguous spectral bands throughout the visible to short wave infrared part of the electromagnetic spectrum. Because of the multidisciplinary character of Imaging Spectroscopy there is a need for training courses that covers upstream (e.g., sensor development) as well as

downstream (e.g., corrections, analysis, interpretation) topics related to the complete chain from acquisition to interpretation of Imaging Spectroscopy data in order to prepare new users.
In the frame of the HyperTeach project, a joint initiative of the Flemish Institute for Technological Research (VITO), the Management Unit of the North Sea Mathematical Models (MUMM), the Royal Museum for Central Africa (AfricaMuseum) and Catholic University of Leuven (K.U.Leuven) funded by the Belgian Science Policy, course material was developed to theoretically and practically introduce early-stage researchers to Imaging Spectroscopy and to prepare them for group shoots with imaging spectrometers. The HyperTeach syllabi (Theory and Hands-on) are conceived in a modular approach. The modules are developed around three thematic applications: biodiversity, water and geology. New modules and thematic applications can be added easily. Basic remote sensing knowledge is required in order to participate in the HyperTeach training courses. During the HyperTeach training courses, there is an equal focus on theory and practical hands-on exercises. After 2-3 days of theoretical introduction, the participants can decide which of the 3 thematic applications (water, biodiversity or geology) they prefer to follow during a 2-3-day parallel session with hands-on exercises (including demo of field spectroradiometers). ENVI software is used for the hands-on computer exercises.
After the 1st HyperTeach training course in Belgium from 26-30 September 2005, the 2nd (a joint organisation of VITO and BPPT) in Jakarta from 13-18 November 2006 and the 3rd (a joint organisation of VITO, AfricaMuseum, NIK and ITU) in Istanbul from 4-8 December 2006, recently the 4th HyperTeach training course HyperTeach@SADC was organised from 19-22 November 2007 at the premises of the University of Stellenbosch, South Africa. The HyperTeach@SADC Training Course was a joint initiative of UNESCO, IOC/UNESCO, VITO, CSIR, SunSpace and the University of Stellenbosch and was implemented in the framework of the FET-REMSENS project funded by the Flanders-UNESCO trust fund. The FET-REMSENS project is developed in the framework of the Global Ocean Observing System in Africa (GOOS-AFRICA) and the UNESCO Crosscutting Project on the Applications of Remote Sensing for Integrated Management of Ecosystems and Water Resources in Africa (ARSIMEWA) and the FET-WATER programme.
We acknowledge the Belgian Science Policy Office, EWI and UNESCO for funding the HyperTeach project and the HyperTeach training courses. We acknowledge ITT Visual Information Solutions for providing the temporary ENVI licenses.

EDUCATION IN REMOTE SENSING AT THE WARSAW UNIVERSITY

Jan R. Olędzki
jroledzk@uw.edu.pl
Warsaw University

Keywords: Warsaw University; Geoinformatics; Remote Sensing; Bachelor's study; Master's study; Doctor's study.

Abstract: Education in remote sensing at the Warsaw University geographical studies has been conducted by the Department of Geoinformatics and Remote Sensing, Faculty of Geography and Regional Studies since 1964. At present, education in Remote Sensing of Environment is conducted for every student of geography and spatial economy specializations at the Faculty of Geography and Regional Studies, and in Environmental Protection at the Warsaw University Inter-Faculty Programme for Environment Protection.
Education is conducted on three levels.
I – Bachelor's study. Educational programme covers 15 to 30 1-hour lectures and from 15 to 45 1-hour classes, depending on specialization. The programme of the course includes subjects, as follows: Physical bases of remote sensing; Techniques of acquisition of aerial photographs and satellite images; Photographic techniques – panchromatic, infrared black and white, colour film, colour infrared and multispectral; Scanner techniques – in a visible spectrum and in photographic infra-red radiation, thermal images; Microwave and Lidar techniques – radar images; Multispectral and hyperspectral techniques; Basic principles of photogrammetry, measurements of elevations and areas; Introduction to methodology, visual geographical interpretation, aerial and satellite images (for example in geology, geomorphology, soil-science, hydrology, and anthropogeography – agricultural and urban environments and regional planning applications). We educated about 250 students every year.
II – Master's study. Education lasts two years and finishes with the performance of a master's thesis. Students receive master's diploma in geography, in the specialty of geoinformatics – remote sensing. The programme of the course covers subjects, as follows: Preliminary field course - field photointerpretation; Physical bases of remote sensing; Geostatistics; Remote sensing data acquisition methods; Introduction to GIS; Introduction to digital image processing (groups "Erdas" or "Intergraph"); Geographic photointerpretation; Introduction to photogrammetry; Digital stereoscopy - VSD practice course; Introduction to programming; Digital image processing (groups "Erdas" or "Intergraph"); Environmental systems modeling; Introduction to environmental processes modeling; Methods and techniques of field remote sensing; Integrated course on field measurement techniques - remote sensing; Introduction to thematic cartography and map editing; Environment monitoring by remote sensing methods; Monographic lecture - imaging spectroscopy; Master's research fieldworks; Master's research laboratory; Optional lecture; seminar. Total 1085 hours (365 – 1-hour lectures and 720 – 1-hour classes). This gives 120 ECTS. We educated 12 specialists with master's degrees in geoinformatics and remote sensing.
III – Doctor's study in geoinformatics and remote sensing. Education is conducted within the frame of the Faculty of Geography and Regional Studies. It lasts four years and finishes with the performance of a doctor's thesis. A graduate receives an academic degree within the scope of Earth Sciences in geography.

Remote sensing in higher education. Practical aspects from Geomatics and Surveying department at Technological Education Institute(TEI) of Serres, Greece

Konstantinos Papatheodorou
conpap@teiser.gr
Geomatics Surveying Dept., TEI of Serres, Hellas

Konstantinos Perakis
perakis@uth.gr

Alexandros Konstabtinidis
akonsta@teiser.gr
Geomatics Surveying Dept., TEI of Serres, Hellas

Keywords: remote sensing, higher education

Abstract: Remote sensing plays an increasingly important role in the rapidly evolving spatial technology as it can be integrated with different disciplines such as GIS, GPS and photogrammetry in order to provide spatial data in an efficient and economic way. Remote Sensing Education helps with its widespread adoption as it provides an understanding of its concepts and potential applications and providing at the same time opportunities for research and training activities. Remote Sensing education is one of the main disciplines at Geomatics Surveying Department giving students the scientific background needed to support spatial applications and to get involved in postgraduate research in the same scientific field. Teaching is realised both as lectures and as extensive laboratory based exercises and is supported by an e-learning platform. Software used includes both commercial and open source products. Experience gained from the past six years, shows that using open source remote sensing software covers most of the discipline's teaching aspects although it is mostly used in undergraduate research. On the other hand, practice in using commercial products helps students to get involved with Remote Sensing in the professional field. Despite the extensive student training through Laboratory exercises, field work can help improve significantly their understanding of the discipline's concepts and applications.

LEOWorks - a Softwaretool for teaching Earth Observation

Steffen Dransfeld
Steffen.Dransfeld@esa.int

Keywords: Image processing software

Abstract: The "Eduspace" website of the European Space Agency for Secondary schools aims to provide students and teachers of Europe and worldwide with a learning and teaching tool offering an entry point to space image data and in particular to a wide-spread visibility of Earth Observation applications for education and training. Eduspace is primarily aimed at secondary school students, but some material is more advanced and better suited towards first and second year undergraduates. The website encourages teachers to use Earth Observation data in their curriculum by providing ready-made projects. Eduspace is rich in didactical material but especially in remote sensing satellite data both locally in high-resolution and globally. It is a source of ideas about how to introduce space-related matters into the classroom, where also full scale examples are presented. At the heart of most case studies for teachers and students is the software LEOWorks which is an image processing tool made available for data analysis and image interpretation, to be used both for beginners as well as for teacher experts. LEOWorks is invaluable for demonstrating Earth Observation techniques. It began as a simple didactical image processing software, including only the most basic functions for viewing and processing imagery. These functions included band selection, band combination, histogram visualisation and stretching, subsetting, image header analysis, etc. The software has expanded in-line with increasing availability of satellite imagery and algorithms for processing. Now, with the imminent release of version 3, LEOWorks is able to perform many advanced processing operations including image classification, geometric correction, and pan-sharpening. Many image filters are available, and GIS tools enable the displaying and drawing of vectors on images. LEOWorks is currently based on IDL, which would limit the extent of future development. However, the next major release, version 4 in Oct 2010 (but with intermediate releases) will be open source and based on Java. This will allow significant enhancement to the software, as it is foreseen to add a complete radar module to the software as well as an expanded GIS functionality. This presentation will show some practical examples of the LEOWorks software.

Experiences of Capacity Building Activities with GMES and GEOSS

Jan-Peter Mund
jan-peter.mund@dlr.de
German Aerospace Center DLR

Olaf Kranz
olaf.kranz@dlr.de
German Aerospace Center DLR

Tobias Schneiderhan
tobis.schneiderhan@dlr.de
German Aerospace Center DLR

Stefan Voigt
stefan.voigt@dlr.de
German Aserospace Center

Keywords: Capacity building, Simulation test, Crisis response team, Earth Observation technologies

Abstract: Continuous development in Remote Sensing and Earth Observation (EO) technologies with new sensors and innovative applications requires a constant training and enhancement of professional capacities of EO users in all sectors. Consequently DLR-DFD has started a professional capacity development program including customised trainings and tailor made courses for EO application users. Experiences were already made already with the introduction of advanced geospatial technologies to expert teams in the crisis response domain. The unique context of every crisis has an impact on the extent in which EO information, such as data from space-based sensors, and high volume data processing tools, will be used by special groups of crisis expert teams deploying these technologies. This paper will present results, major experiences as well as opportunities and constraints of EO application activities and hands on trainings of remote sensing data application for crisis response expert teams within the GMES program focusing on the usability of information stemming from earth observations and other spatial data. Various spatial data methodologies such as rapid mapping, specific feature extraction image automatic interpretation, GIS modelling for decision support systems were tested during implementation and specific training events. As a special task in GMES, the GMOSS activities address a wider and more heterogeneous community covering academic research, industry, the military, and stakeholders from the EC and end users from the emergency response domain. By integrating remote sensing data analysis, social science and the analysis of key threads and risks, GMOSS contributes to the EU awareness of the "S" in GMES. The GMOSS work program jointly focuses on four test cases, related to conflict regions relevant for Europeans security such as Iraq, Iran, Kashmir and Zimbabwe.
Within the GMOSS-GNEX training agenda the exploitation of advanced geospatial technologies by expert teams was studied while responding to a specific crisis or emergency scenario. On the basis of an emergency management exercise methodology, simulations were prepared and executed with several teams sited at different European locations and composed of experts from various organizations. The teams were tasked to provide rapid mapping products based on satellite imagery and other geospatial data within a given amount of time. These two near real-time simulation exercises (GNEX) have been performed in 2006 and 2007 in order to evaluate the efficiency of collaboration and the effectiveness of tools and strategies in a realistic emergency scenario. The GMOSS network has been tasked to provide detailed decision support information on typical crisis management questions like quarantine control, situation and damage assessment, evacuation routes

and rescue places, capability of transportation and response facilities as well as analysis and probable development of the ongoing crisis situation. Both, end users and various Directorate General of the European Commission (DG RELAX, DG ENTERPISE, DG ENVIRONMENT) have been actively integrated in these exercises. Within three and a half days the participants were provided with information and maps to almost all requests and presented them to representatives of the EC and DG RELEX in Brussels. The experiences drawn of GNEX training exercises have shown that beyond the simple physical existence of functioning modern technologies there are crucial prerequisites for a successful application of EO technologies in crisis situation. Predominantly, a set of 'soft' factors is essential for a successful operation such as acceptance of technology, level of training, clear and accurate communication, agreements on standards and value of resulting products. The knowledge of these didactical and socio-technical processes is essential in order to develop and train expert teams, to be capable to use sophisticated technologies effectively under the wide range of crisis situations with its characteristic conditions and demands. Unlike the more research and experience oriented GMOSS/GNEX training project, another capacity building example focus on testing and demonstrating potential for collaboration of the European Commission and EU Member State within crisis response activities. In synergy with GMES-Land/Sea Integrated Monitoring for European Security (LIMES) services a joint technical testing and collaboration activity is suggested for June 2008. It is intended to combine the EC Assessment Mission Course (AMC), to be held in Cyprus in June 2008, with a test and demonstration activity for developments in the domain of rapid satellite analysis, communication and navigation of the LIMES team. The actors involved are the DG-ENV/MIC, organisers (THW/JUH/Cyprus Civil Defence), trainers and trainees of the MIC/AMC and the GMES/LIMES consortium. The activity will be finalised by a professional demonstration and presentation event e.g. at the DG ENV / MIC in Brussels. As another special GMES initiative RESPOND provides training and capacity building activities to a wider range of user like decision makers, desk officers and field staff of humanitarian relief organisations. With regards to the limited technical level of the participants specialised RESPOND facilitation trainings focus more on transferring basic knowledge about the EO- services and products from the application provider side to the end users. This group of participants require general overview presentations of satellite mapping or remote Sensing and Geographic Information Systems (GIS) courses on an introductory level.

GMES SERVICE ELEMENT FOREST MONITORING

TRAINING FOR END-USER ORGANISATIONS

Gernot Ramminger
gernot.ramminger@forest-ds.de
FELIS, University of Freiburg, Germany

Barbara Koch
barbara.koch@felis.uni-freiburg.de
FELIS. University of Freiburg, Germany

Keywords: EO-based services, remote sensing, forest, GMES, GSE-FM

Abstract: The paper will present the modality of user training in GSE-FM. The Global Monitoring for Environment and Security (GMES) is a joint initiative of the European Space Agency (ESA) and the European Union (EU). GSE Forest Monitoring (GSE-FM) as one of ten GMES Service Elements (GSE´s) is one part of the ESA Earthwatch Programme and contributes to GMES by delivering policy-relevant, EO based operational information services. Intensive end-user training has become essential in recent years due to the change from traditional monitoring methods towards new and improved technologies, and the use of increasingly complex monitoring instruments. The objectives of training activities are to ensure that GSE-FM services are strongly user-driven and to establish a basis for achieving a high awareness of existing EO-based services. The training will support the development of a user internal infrastructure to exploit available products and services. Discussions concerning the results and costs of these services, together with their implementation, also play an important role within the training sessions. Actual training is based on experiences from stage 1 (2003 to 2005) and the first two phases of stage 2 (2006 to 2008) of GSE-FM. The training strategy is based normally on a regional (national/sub-national/local scale) and direct (service provider/user) approach with some service lines, which are expandable to a global level (Pan-European scale). Training is offered to politicians (more based on promotion activities) and management staff of existing and new users from thematic and/or technical departments. The general objectives of the whole training in the context of GSE-FM, an overview of all planned training activities in the current year, possible content and manner of the training are captured and updated annually in the so-called training plan. Individual training sessions are planned and carried out for their users by the service providers themselves. In some cases, cooperating universities are also involved in the training. As an underlying instrument the lecture, which contains oral presentation, discussion and training material is one of the popular training methods for GSE-FM. Field trips, practical software training and E-Learning modules complete the training offer. A very important part of the training is the Training Review as part of every training session. The review gives the user the opportunity to evaluate the training and the product, but also to mention new requirements for additional products and future training content. Furthermore training provides the opportunity to discuss possible service improvements and enlargements directly with the users. The training identifies new and evolving user needs and builds the capacity of individual users to adopt the appropriate elements of the service portfolio. This will support end-users in their efforts to make better use of EO-based services in order to provide and improve forest information and forest monitoring systems.

Remote Sensing in Schools

From an empirical study and a theoretical concept to first applications

Isabelle Kollar
kollar@ph-heidelberg.de
University of Education Heidelberg

Alexander Siegmund
siegmund@ph-heidelberg.de
University of Education Heidelberg

Alexandra Wolf
wolf@ph-heidelberg.de
University of Education Heidelberg

Keywords: remote sensing, international comparative study, space related competences, interactive learning management system

Abstract: Satellite images and aerial photographs as modern geographical method can be found more frequent in atlases, textbooks, television and internet. Nevertheless, the use of it is hardly spread in lessons as well as in the curriculum in many countries. But the imparting and use of modern geographical methods at school is of an increasing importance because satellite images have a didactic potential and can contribute to foster-ing important geographical competences, like 'space related action competences' and the 'subjective evalua-tion faculty'. Satellite images offer through demonstrative and immediate images of the earth surface large primary space information. With it they enhance project-orientated and hands-on learning because satellite images can be directly compared with reality and interdisciplinary interpreted. Therefore the research pro-jects in progress follow the aim to systematically and holistically implement satellite images in school through the following procedures: 1. An international empirical study based on online questionnaires about the extent and kind of use of satellite images and aerial photographs in (Geography) lessons. 2. Development of a theoretical based concept for a didactical overall remote sensing interactive and multimedia learning environment with the goal of a self led and context-engaged application of satellite images and aerial photographs. 3. First application of the theoretical based concept for Middle Schools and within the context of the European project „Science Education through Earth Observation for High Schools" (SEOS) in a web based learning management system. The international online questionnaire aims to analyse the different concepts of teachers and pupils about the extent and kind of satellite images that are used in school and the technical competence or the fore-knowledge of the pupils. The study shows that there are significant differences in various answers and inter-esting approaches to be followed, e.g. the gap between interest and motivation of satellite images in school. Based on these results a didactical theoretical remote sensing-overall concept is being developed how satel-lite images can be reasonable and purposeful initiated in school commenced with Middle School pupils and ending with High School graduates. One of the first applications of the didactical theoretical remote sensing-overall concept is realised within a web based remote sensing learning management system implemented within the EU-founded project "Sci-ence Education through Earth Observation for High Schools" (SEOS). Within this project the Department of Geography at the University of Heidelberg is developing two modules, one about the basic methodology of remote sensing and one module about using satellite images monitoring land use changes. The last module should be analysed in the context of promoting 'subjective evaluation faculty' of the pupils in the field of envi-ronmental changes and if satellite images can better contribute to that evaluation competence than 'normal' methods and medias.
Through the development and evaluation of an overall didactical remote sensing concept and

derivated learning elements for different age levels, such as the SEOS modules, the didactical potential of satellite images should be put in value and sustainable supported in school.

Inspiring Images

Ways to integrate Remote Sensing in Secondary Education

Kerstin Voß
k.voss@geographie.uni-bonn.de

Roland Goetzke
r.goetzke@geographie.uni-bonn.de

Henryk Hodam
h.hodam@geographie.uni-bonn.de

Keywords: remote sensing, secondary education, cross-linked thinking , interactive and multimedia training applications

Abstract: In spite of the discussion of many years about the use of satellite images as additional teaching material, remote sensing is almost irrelevant in secondary education. Furthermore, if satellite images are used, this is primarily the case in geography classes. Because of the targets and specifications of the curricula teachers have only small time slots for the integration of new topics in their classes. In case remote sensing data is used in geography classes, many teachers tend to use it as additional material in order to answer certain geographical questions. This approach can advance skills in terms of the handling of certain media and methods as well as students' visual skills and spatial orientation. However the basic scientific principles that are necessary for a fundamental understanding of remote sensing data cannot be conveyed under those conditions. Those subjects better fit in physics or maths classes.
In this study we present the potential of integrating remote sensing in secondary education. The sustainable integration of remote sensing concentrates on regular classes. Therefore free space in the curricula is detected in lessons and material prepared in a way that usual topics are taught with the aid of satellite imagery. Furthermore integration includes physical and mathematical basic principles and the analysis and interpretation of the remote sensing data. Therefore cross-linked thinking is one of the guiding principles. Consequently the subject matter will be discussed in different classes. The basic principles of remote sensing are treated in the natural science classes like maths, physics or computer science, while in the more applied sciences like geography or biology satellite data is analyzed to answer a research question. We believe that with basic knowledge about the principles of remote sensing this technology can expand into secondary education and thereby going beyond the traditional use of satellite images as a medium for visualization purposes only. Consequently both aspects, the physical and mathematical basics and application-oriented questions, will be considered.
Additionally to the presentation of the theoretical concept examples from different classes (Geography, Maths and Physics) will be presented, which are based on interactive and multimedia training applications. Additionally the study shows advantages in computer-based learning resulting in students' directed and responsible handling of new media in classes, by not only using the computer as a source of information and entertainment but as a tool for solving complex problems.

What can my GIS - software do for me? What should it be able to do?

Josef D. Gspurning
josef.gspurning@uni-graz.at

Keywords: GIS, Higher Education

Abstract: Although the number of teachers which plead for an at least episodic use of Geographic Information Systems at middle and higher schools has increased continuously throughout the last years, due to the wide spectrum of different approaches the framework conditions for a more intensive usage of geo-technological software are still not elaborated clear enough. Particularly in German speaking countries the problems of the amount of the toolbox - functionalities which a "ready-for-school" GIS - package should provide and the methods of implementation are still discussed controversially. This contribution tries to answer the question which tools in which intensity are needed from the toolboxes of a standard commercial GIS to enrich the traditional GW (Geography and Economics) - lessons appropriately. To simulate nearly real life scenarios the contents used as central topics within this study coincide with the content of the most recent editions of the GW textbooks Austrian students use at school. Therefore the results presented in this paper can be seen as indicators for the need and importance of certain tools from the GIS – repertoire.

Cosmas, the space reporter

An interactiving teaching environment for collecting and understanding space imagery

Therese G.O. ONGENA
Therese.ongena@Ugent.be

Philippe DE MAEYER
Philippe.demaeyer@Ugent.be

Beata DE VLIEGHER
Beata.devliegher@Ugent.be

Joris VERBEKEN
Joris.verbeken@Hogent.be

Wouter VANNEUVILLE

Ruben MADDENS
Ruben.Maddens@ugent.be

Keywords: Education, interactive tool, space imagery, remote sensing, resolution, scale

Abstract: Cosmas, the space reporter is an interactive tool for understandingn space imagery and related problems such as resolution and scale.
With different questions and tasks, students can find their own way through 5 different modules. Those different modules are developed so that students are able to learn more about space imagery, spatial and spectral resolution and scale.
Cosmas, a space reporter is helping to find their way through those different modules and at the end, students can be 'Star reporters'

A NEW GEOGRAPHY FROM SPACE

THE ESA SCHOOL ATLAS

Markus M Eisl
Markus.Eisl@geospace.at

Lothar Beckel
geospace@geospace.at

Keywords: school atlas, remote sensing, education, e-learning

Abstract: In cooperation with the European Space Agency, the "Geography from Space", a Satellite Image Atlas for secondary schools has been developed. The atlas bridges the gap between the classroom and space technology and earth observation, adapted to the use from the 5th to the 12th grade. Based on satellite images, it is an ideal supplement to classical school atlases. A wide variety of examples and analyses give an impression of the state and of the development of our globe. Issues that are currently in the focus of interest such as climate change are treated in a wealth of maps. A Teachers' Handbook accompanies the ESA School Atlas with texts and material to support teachers in the use of the Atlas in the classroom. Descriptions of the satellite images and the thematic maps help to optimise the information transfer of the maps, providing the basis for numerous suggestions of questions and exercises to creatively develop geographical knowledge. Two DVD-ROMs contain the pages of the ESA School Atlas, satellite data, image processing software and descriptions. The datasets in form of original data and thematic vector data can be processed and evaluated to derive new maps. Working with the exercises on the DVD-ROMs a step-by-step ap-proach to the methods and potential of satellite remote sensing is possible, furthermore an inter-connection with Eduspace, the e-learning platform of ESA is in work. The paper describes the specific properties of this atlas and provides information on the use and the advantages of this new dimension of education in geography.

EDUSPACE – Experiences with Teacher Education in Austria

Wolfgang Sulzer
wolfgang.sulzer@uni-graz.at
University

Keywords: Teacher education, secondary school, EDUSPACE, Remote Sensing

Abstract: The European Space Agency realized several initiatives to provide remote sensing for general purposes. Among those is EDUSPACE, a multilingual website for Earth observation in secondary schools. In co-operation with partners from all over Europe the European Space Agency ESA coordinates the EDUSPACE website www.eduspace.esa.int. EDUSPACE aims at providing the youth of Europe with a portal to assess the widespread potential of space applications, and at contributing to give access to Earth Observation to a wider public. With several products (printed school atlas, digital school atlas, teacher's handbook, connection to EDUSPACE website and an educational image processing software LEOworks) it is possible to provide teachers and students with a modern and stimulating teaching and learning tool in Geography and related subjects. At the Institute for Geography and Regional Science (University if Graz, Austria) these tools are used for teacher education. The lessons are embedded in the subject "Geographic Technologies". This 3 hours/per week/semester lasting lesson includes the GIS and Remote Sensing techniques and should give an applied introduction into their capabilities for teaching in secondary schools. This presentation gives an overview about the content of teaching and lessons. Applied exercises, which are prepared by the students itself, their problems and the challenges for teaching will be documented and discussed.

Science Education through Earth Observation for High Schools (SEOS) : development of an introductive eLearning tutorial

Module 1. A World of Images

Caroline Dandois Dutordoir
caroline.dandois@belspo.be

Keywords: remote sensing, satellite image, tutorial, education

Abstract: SEOS is an initiative for using remote sensing in science education curricula in high schools funded under the 6th Framework Programme of the European Commission (EC). Based on current research results, 15 internet-based eLearning tutorials are developed by 11 different partners from several European countries in cooperation with the European Space Agency (ESA). The introductive module "A World of Images" is meant to provide an overview of the current usage of remote sensing so as to enthuse students about the capability of this technology for the management and maintenance of Earth resources. In close connection to the other modules, this module was constructed around a set of selected remote sensing applications to demonstrate the usefulness of different image types for different purposes from local to global scales. Each application is presented on a one-screen basis where a central image acts as an "eye-catcher". Text is voluntarily kept concise, however a few links allow additional information to be displayed. The navigation was designed to be intuitive. The module opens with a short animation offering a flyby inside the solar system until reaching Earth. The animation ends on a screen covered with images' quicklooks leading to the different applications. Each quicklook pairs off with a stylised icon illustrating at a glance the issue covered by each remote sensing application. Furthermore, a menu organises the applications into 4 themes (air, water, land and human impact).

Ocean colour in the coastal zone

Science Education through Earth Observation for High Schools Module 7

Marieke A. Eleveld
marieke.eleveld@ivm.vu.nl
VU-IVM

Hendrik J van der Woerd
hans.van.der.woerd@ivm.vu.nl
VU-IVM

Christina Klose
christina.klose@uni-oldenburg.de
UOL

Keywords: Light and life; Ecosystems; Health

Abstract: We will present ongoing work on the development of a module on coastal water quality that is being developed within the Science Education through Earth Observation for High Schools (EU-SEOS) project. The aim of this module is to get a profound insight in important functional aspects of the coastal zone by analyzing ocean colour images. Sensors like MERIS (ESA) and MODIS (NASA) on recently launched satellites are especially designed for the observations of coastal waters since they can cope with complex spectral signals. It is now possible to make maps showing the distribution of algal pigments, suspended material (including sediment), coloured dissolved organic mater (CDOM), transparency and solar photo-synthetically active radiation (PAR) available for phytoplankton growth. In this module the students will experience that our European coastal waters are frequently observed from space and that relevant information is available on-line. The module will contribute significantly in understanding the coastal resources: coastal water quality is a complicated issue affected by a large number of parameters including human activities (river-run-off, fisheries) and numerous consumer products are produced in coastal areas. The present module will introduce the European directives on protection of the environment, the need for monitoring coastal waters in order to protect various activities (fishing, tourism, bathing and aquaculture) and the common policy on eutrophication. It focuses on: 1) Light and life: Students will start to understand the role of light in water. A link is made to growth, in particular the available light for algae and water plants to grow or for predators to hunt. The major sources for attenuation (suspended sediment in the near coastal zone and algae in the clearer waters) are presented. Transparency and attenuation will be presented and satellite based maps of these maps will be available. From these maps a link will be made to safety (for the Bathing Water Directive an underwater minimum visibility is required). 2) Ecosystems: Understanding and visualization of the human impact on the coastal eco-systems, in particular eutrophication. The impacts of eutrophication include: increased phytoplankton and macro-algae production and biomass. For the Dutch-German-Danish Wadden Sea and German Bight area the eutrophication and link to river input will be made explicit. 3) Health: Increase the capabilities to monitor the occurrence of harmful algae blooms in coastal waters and the potential risk for the quality of products such as fish and shellfish. Examples will be demonstrate that extensive blooms do occur now regularly in Spring, sometimes with negative effects on shellfish, human health or annoyance (foam on beaches).

Introducing Earth Observation to high school curricula: Agriculture and Natural Resources Management modules

Chariton Kalaitzidis
chariton@maich.gr
Department of Environmental Management, Mediterranean Agronomic Institute of Chania

Ioannis Manakos
manakos@maich.gr
Department of Environmental Management, Mediterranean Agronomic Institute of Chania

Konstantinos Perakis
perakis@uth.gr
2Department of Planning and Regional Development, School of Engineering, University of Thessaly

Keywords: earth observation, secondary education, remote sensing

Abstract: Earth Observation data are becoming more and more widespread, reaching the common public in its everyday life. In the near future, the younger generation will be called upon to use such data, both at a professional and a personal level. Hence, it is imperative that young people become familiar with Earth Observation data and their applications at an early stage.
The SEOS project (Science Education through Earth Observation for High Schools) is a response to this challenge, as it aims to introduce the application of Earth Observation data to high school students, by providing a complete teaching module for selective use of its parts in the classroom, as well as the students on their own.
This study addresses the topics of the use of Earth Observation (EO) in Agriculture and Natural Resource Management. The first topic is addressing EO applications in conjunction with Geographical Information Systems (GIS) on crop identification, monitoring of crop health status and yield estimation, as well as the assessment of field soil quality, and the methods of precision agriculture. The second topic is focusing on EO applications possibilities regarding the monitoring of soil quality, erosion and desertification, the management of forests, water resources and ecosystems in general, as well as urban planning and waste management.
The tutoring methods used to familiarise the pupils with EO applications involve common real-life issues, which stimulate their interest and challenge their critical thinking. Remotely sensed images are utilized for visual representation, extraction of information, and user friendly exercises.

Science Education through Earth Observation for High Schools. Module 7: Marine Pollution

Christina Klose
christina.klose@uni-oldenburg.de
University of Oldenburg, Institute of Physics, Marine Physics

Valborg Byfield
valborg@noc.soton.ac.uk
National Oceanography Centre Southampton

Colette Robertson
ycr@noc.soton.ac.uk
National Oceanography Centre Southampton

Keywords: eLearning, marine pollution, oil spills, harmful algal blooms, marine invasive species

Abstract: About 60 percent (3.6 billion) of the world population lives within 60 kilometres of the coast, and this number is rapidly increasing. The oceans cover about 70
The aim of the eLearning tutorial presented here is to increase awareness among high school students of the damage done by marine pollution, and what may be done by individuals and society to protect valuable marine environments. Through carefully selected examples, students will understand how the state of the oceans may impact their everyday lives, even if they live many hundred kilometres away from the coasts and don't eat fish. The tutorial covers the main sources of marine pollution, the impact of different pollutants, methods to detect pollution, and ways in which pollution may be prevented and environmental damage minimised. There are sections on oil pollution, harmful algal blooms, litter, invasive species, and invisible pollutants such as chemicals, heavy metals, thermal and noise pollution. Throughout the main focus is on the monitoring of different types of marine pollution using a range of remote sensing techniques, each with their own strengths and limitations. Oil spills, for example, can be detected using radar images from satellites, In the case of larger spills, a suite of airborne sensors at microwave, infrared and optical wavelengths may be used to provide information about the position and extent of a spill, its relative thickness and potentially the composition of the oil. Eutrophication arising from anthropogenic input of nutrients such as nitrogen compounds and phosphate may be monitored with ocean colour sensors. Thermal pollution from the input of cooling water from industry and power stations may also be monitored using a range of infrared and microwave satellite sensors. Carefully selected case studies demonstrate how the different sensors are used, individually and in synergy, to provide a thoroughly modern system for monitoring pollution and its impacts on the marine environment.

Science Education through Earth Observation for High Schools Module 8: Ocean Currents Measured from Space

Valborg Byfield
valborg@noc.soton.ac.uk
National Oceanography Centre, Southampton

Colette Robertson
ycr@noc.soton.ac.uk
National Oceanography Centre, Southampton

Paolo Cipollini
cipo@noc.soton.ac.uk
National Oceanography Centre, Southampton

Keywords: eLearning, ocean circulation, ocean currents, tides, altimetry

Abstract: Ocean currents influence climate and living conditions for plants and animals, even on land. Like the circulation of air, the global ocean circulation transports energy from the equator towards the poles. Warm surface currents move warm water from the tropics and release heat and moisture into the air at mid to high latitudes. Cold currents move from higher latitudes toward the equator, near the surface and at depth. Water evaporating from warm ocean currents falls on land as rain; hence global vegetation cover is determined by both prevailing winds and the flow of ocean currents. A good knowledge of surface ocean currents is important for reducing the costs of shipping by reducing fuel costs. In the sail-ship era knowing the wind and currents was essential, while today, the round-the-world sailing competitors use surface currents to their benefit. Ocean currents also help to disperse eggs and larvae of many marine life forms, while fronts between different currents are fertile areas, rich in phytoplankton (microscopic marine plants), and important feeding areas for a variety of marine animals. Fishermen the world over know this and take advantage of it, whether they are artisanal fishermen in developing countries, or work from factory ships equipped with the latest satellite technology. The same information is important for environmentalists working to protect endangered species and encourage sustainable development of marine resources.
Ocean currents flow in complex patterns affected by wind, the water's salt and heat content, bottom topography, and the earth's rotation. This module aims at an understanding of the physical principles that drive the global system of surface and deep ocean currents. It shows how our knowledge of ocean circulation may be improved by measuring sea surface topography using satellite altimeters. The module also aims to increase awareness of the role of ocean currents in transporting heat from the equator to the poles, and how cold and warm currents influence our climate by affecting temperature and rainfall in different climate zones.
Ocean currents can be monitored using changes in the sea surface height measured by satellite altimeters. Other remote sensing datasets for example sea surface temperature and chlorophyll concentration, can be used as tracers, following water movement across the oceans.

E-Learning modules on optics in SEOS

Rainer Reuter
rainer.reuter@uni-oldenburg.de
University of Oldenburg

Keywords: SEOS, e-Learning modules, physics curiculum, high school

Abstract: An initiative of using remote sensing in science education curricula at high schools has been launched by EARSeL. The project, entitled Science Education through Earth Observation for High Schools (SEOS) started in August 2007 and will have a duration of two years. It combines the efforts of 11 partners, all members of EARSeL and representing research and cultural organisations, universities and information management corporations. Based on their research results, internet-based tutorials are realised on selected topics in Earth observation. The tutorials cover themes, which are relevant to lessons in geography, biology, physics, engineering and mathematics. A particular focus is on the context of these subjects, in agreement with the interdisciplinary aspects of earth observation, which shall stimulate knowledge in other science disciplines and shall help to solve problems in team work.
Teaching physics in high schools is not always straightforward. The students are confronted with a series of formulas and theories that are often difficult to understand and to relate to every-day life. Therefore, two tutorial address topics of physics curricula where interest of students can be attracted with Earth observation data: 'Understanding Spectra from the Earth' and 'Laser Remote Sensing'. In the first instance both tutorials aim at teaching optics, spectroscopy and elements of electricity and magnetism. This includes themes such as geometrical and wave optics, spectra of light and radiation, electromagnetic waves and photons, vibrations and waves, physics of light sources including lasers, optical instruments for measuring light and radiation intensity and imagery. These themes are presented with examples from the student's daily life. But the focus is given on remote sensing data of the earth surface, the atmosphere and the oceans, to the spectral information included therein and to the methods used to measure spectral images onboard satellites.
Further to these aspects the modules shall emphasize interdisciplinary and integrative approaches in the curricula of schools. Indeed, remote sensing data used in these modules have a unique potential for interdisciplinary education. Beyond optical phenomena which are evident in satellite images, they include information relevant to topics of other science disciplines such as land cover and vegetation, environmental hazards, ocean currents and temperature, atmospheric constituents and weather phenomena, and may others. They also link these topics to actual themes such as climate change. This will help building bridges between physics and the other science disciplines in high school education.