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Education and Training

3rd Workshop on

**Remote Sensing
in Education and Training**

Prague, 31 May - 1 June 2011

Abstract Book

Tuesday, 31 May 2011

8:30 – 10:10	**Education and Training Workshop Session 1**	**PC Room 02**
10:45 – 12:30	**Education and Training Workshop Session 2**	**PC Room 02**
14:00 – 15:30	**Training Course Session 1**	**PC Room 02**
16:00 – 17:00	**Training Course Session 2**	**PC Room 02**

Wednesday, 1 June 2011

8:30 – 10:00	**Training Course Session 3**	**PC Room 01**
10:30 – 12:30	**Training Course Session 4**	**PC Room 01**
13:30 – 14:00	**ESA Keynote**	

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Analysis of ecological changes in a small volcanic lake (Meke), in Turkey via satellite images and pictures

Environmental changes and satellite images

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Keywords: Meke lake (Turkey), environmental changes, satellite images, education

Abstract: Previous studies have been shown the climate changes endanger some volcanic small lakes in the central part of Turkey. Satellite imaginary constitutes an interesting support and alternative to ground surveys in many areas such as drying small lakes that formed after volcanic eruptions. The satellite images, concerning seasonal changes of small lakes can be greatly helpful to provide a rapid assessment in these topographic areas.
Meke is a volcanic lake in the middle of Turkey's only desert area that formed by a volcanic explosion. The lake was formed in a circular shape after collapse which had occurred in the first eras and an eruption caused a chimney to rise in the middle of lake. With various other eruptions seven others were formed with some adjacent cones and islands. The Lake has an eye on the top formed after volcanic eruption previously that this volcanic cone is 25 m deep and salty lake. The lake around the cone is 12 m deep, covering an area of app. 500x800 m2. The volcanic soil on the surface of the volcanic cone (island) is able to suck all rainwater coming down in seconds. Therefore the shape of the lake is preserved for millions of years. It is known that previously this lake and other small salty lakes were in use for salt production for local people. It is located in Karapınar, Konya in Turkey which there is a controlled vegetation and forestation works nearby against erosion in this area. The impacts of global warming, misusage water sources for irrigation could cause drying of the lakes. Unfortunately, in Meke lake due to global warming and the uncontrolled irrigation of farms, the eye of the lake has dried and rest of the lake also is drying. It is well known that lakes are particularly sensitive to changes in climatic parameters. Such as air temperature, precipitation, winds that results with changes in evaporation, water of lake, and entire lake ecosystems. The under such a conditions, some small lakes may disappear entirely. The water covered places of lake mostly muddy and swampy that it's not possible to make any measurement of the water surface. For this any to make a geodetic measurement is impossible. A thought analysis of aerial satellite images and pictures may give satisfactory results in many cases. Satellite images is not always exclusive techniques for detecting environmental changes, but should be used in combination other methods. Remote sensing has a considerable potential for proving accurate, up-to date information for ecological changes like small lake areas. This kind of comprehensive field surveys may answer some questions. The observing and analyzing the Earth by various scale may help better understanding and quantifying some Earth surface properties. Low cost, comprehensive vision of regions may make useful this techniques for cooperative environmental changes in a limited area. In this study, on the basis of satellite image of Meke Lake have been acquired between 2004-2010 and taken pictures in the same period compared for ecological changes. And findings supported field surveys in order estimate the future of lake. Also for educational purpose comparative satellite images of lake could be a good education material to show how local environmental changes due to global warming.

Using remote sensing data for environmental changes in a salty lake in Turkey

Environmental education

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Keywords: Salt Lake (Turkey), Remote sensing, Environmental education, Secondary school

Abstract: Today second large lake of Turkey Salt Lake (Tuz Gölü) is in great danger because of industrial pollution and wrong usage of under and over ground waters. This is threatening the lake itself but also flora and fauna of the area, which will definitely have a negative effect on the local inhabitants around the lake. The primary source of water flow into Tuz Lake is neither rivers nor rainfall, but sewage from the nearby city of Konya and local villages and towns. According to data from the Environment and Forestry Ministry of Turkey, 944 tons of detergent, 90,000 tons of oil and grease, 1,500 tons of organic matter and 276 tons of mercury, lead and other heavy metals make their way into the lake each year. The purpose of using data obtained from Remote sensing for education aims finding a way to integrate remote Sensing in secondary school and to develop teaching and learning material by which this can be realized. However, the development of new material due to new technology has a limited application in schools. The first priority of education should orientate people towards a more ecologically effective way of living. The results obtained from treated and interpreted satellite images showing that the water quality in Salt Lake has been decreased very seriously in previous years. It is a suggestion that the water pollution in the lake be monitored by using current satellite data could be useful for education purpose in secondary schools. Beside several learning methods and sources of information, the analysis of remote sensing data could be a key method for pupils to obtain basic knowledge about environmental issues. For this purpose in this study, the images obtained previously by remote sensing techniques for Salt Lake in Turkey have been used. This may give a good change to pupils to compare environmental changes in this lake that the results obtained from treated and interpreted satellite images may show chancing water quality in the lake due to environmental pollution. This could make pupils more awake changes in their environment and they could act to protect sensible areas by performing their responsibility to conserve and rehabilitate the unique ecosystems of Salt Lake area.

Mobilizing students to monitor local environmental problems with Earth observation data

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Abstract: High school and university students are very open to technology and because they are also enthusiastic internet users they are well aware of satellite data. Increasingly they also have a rather good knowledge about environmental issues and high awareness of associated problems. However, some of the topics seem to be beyond their reach in understanding and providing real actions. Our experience shows that with proper support students can overcome this and become involved in "proper" environmental problem solving.

In Slovenia we are starting the activities that will connect selected student groups with data providers and experts from the remote sensing community. Students will be asked to define projects, related to a specific problem in their local environment. The most promising projects (5-10) will be selected at the national level. Their work plan will be further defined and an external expert will be appointed to each project. The students in multidisciplinary teams will select the appropriate remote sensing and external data, chose and perform the optimal image processing steps, prepare the results and perform the validation. The following themes have already been identified: forest border detection and reforestation, urbanization monitoring, urban spread and change detection, detection of archaeological sites, World War I remains mapping, relief production and morphology analysis, detection, monitoring and mapping of illegal dump areas, natural disasters monitoring, vegetation growth, and drought and storm monitoring.

The most successful student projects will be presented at the special event, organized in the framework of national student competition and a larger international Earth observation event in 2012. This will give the students not only the opportunity to demonstrate their capabilities and understanding of Earth observation but also to meet experts from research institutions and industry.

Linking teaching and research in remote sensing through EBL

an enquiry-based learning consultancy scenario

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Keywords: Enquiry-based learning, consultancy, reflective learning

Abstract: Enquiry-based learning (EBL) is active and student-led. It encourages deeper learning by requiring students to take greater responsibility for the learning process, helping them to become more aware of how they learn as well as what they learn. When the content also draws on real-life studies, it can improve student motivation. However, good real-world scenarios take time to put together, so are seen by some as competing with time for research. This paper stresses the nexus between research and consultancy on the one hand and teaching on the other by using examples from the tutor's own experience to develop realistic EBL scenarios. They were part of a final year undergraduate unit in remote sensing within a Geography degree, and were developed while the author was an EBL Fellow at the Centre for Excellence in Enquiry-Based Learning at Manchester University. The example described here was based on the author's participation in a consultancy workshop for the Scottish government whose purpose was to advise on the use of remote sensing for assessing the rate and extent of erosion in vulnerable organic soils. The scenario given to students was the closely based on the one supplied to the invited panel of academics. Student 'consultancy' teams were required to tender for a pilot project. They worked over four weeks (of two-hour sessions per week) to develop and present their solution, justifying the sampling design and sensors chosen. There was a QA session to obtain further information, where the tutor played the role of the government officer commissioning the advice. The output was an oral presentation, which was formatively assessed. Summative assessment was a reflective log on the learning process. The remote sensing content was assessed in an examination question. The EBL process and skills developed at each stage were explained prior to the exercise and students were asked to reflect in their learning logs on the extent to which their experience mapped onto this. Reflective logs and course evaluations show the very positive response to this mode of learning. Students commented on the way in which it helped to reinforce concepts learned earlier in the course and served as an excellent springboard to revision. Advantages and disadvantages of the approach will be discussed, and related to educational theory on EBL.

Application of Remote Sensing and GIS to teaching about past permafrost features

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Abstract: Thermal-contraction cracks are one of the most widespread and convincing features, which are diagnostic of permafrost. Thermal contraction leads to the development of not only vertically fissures but also horizontal polygons, which can be relatively easily distinguished on the ground surface in both contemporary and past environments. The main objectives of this research were: (1) to create the catalogue of the past permafrost features in the West Poland based on remote sensing images and GIS; (2) utilizing this catalogue as a database for both teaching and research purposes. For the study, the special methodology of taking aerial photographs was developed. Photographs were taken during different seasons in order to discover which vegetation and humidity settings are the best for wedge-polygon recognition. The photographs were taken from different altitudes, from 200m to 400m above ground level (a.g.l.). Hasselblad and RMK Zeiss 15/24 (using visible part of spectra) cameras were used to taken the photographs. Near-vertical photographs were rectified and resultant photographs are scaled 1:500 to 1:2,000. Aerial images were analysed with the use of GIS software. Patterns of wedges were recognised and digitized using TNTmips and ArcInfo software. The next step was to create a database containing information about slope and exposition (from Digital Elevation Models: DEMs), as well as from data about geological substratum. The final step of GIS analysis was to study the spatial relationship between different types of structures and terrain attributes. Large numbers of aerial photographs were taken and analysed. Several types of regular features were identified: 1) Type A: regular polygons with four to eight edges. They are varied in dimension from several to a dozen metres. In some of the structures smaller polygons were identified inside the larger one. Thus, they can be interpreted as different generations (older and more recent) of cracks. 2) Type B: irregularpolygons with irregular edges. They are usually founded on slopes. The elongated edges depend on terrain gradient; the shortest ones are perpendicular. 3) Type C: other structures, not polygon shaped. These belong to different types of structures. They are usually elongated. Sometimes their shape relates to the curvature of slopes. The catalogue of past permafrost features is used during classes in Geomorphology and Physical Geography. It has also established a base for further research on past periglacial environment in West Poland.

Methods and opportunities for using satellite image classification in school lessons

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Keywords: Remote sensing, classification, digital learning module

Abstract: Map generation is an important topic in geography classes in secondary school education. This also includes the question of how to derive thematic maps based on satellite imagery and, hence, presents a good opportunity to introduce satellite image classification to school education. Relying on mere visual interpretation would only scratch the surface of the possibilities offered by digital image data. The heterogeneous pattern of grayscale and color values presented in satellite images constrains a purely visual quantitative and qualitative analysis. Not until the digital information contained in these patterns is generalized can the content be profoundly interpreted. Deriving thematic information through classification is therefore one of the main applications in digital image processing. If the general topic of remote sensing is to be transferred into school education, the integration of such methods is of utmost importance; but pupils will need simple analysis tools allowing them to derive land cover maps from satellite imagery. This contribution presents ways of integrating the topic of "classification" into geography lessons. It is focused on methods reducing the procedure's complexity to an adequate level for the use in class. For this purpose, different classification tools have been created offering alternative ways for approaching the topic of "image classification".

GEONETCAB - GEO Network for capacity building

Project of the GEO capacity building

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Keywords: Capacity Building, GEO, GEOSS

Abstract: GEO Network for Capacity Building (GEONETCAB) is a project focuses on the GEO capacity building activities and framework funded by FP7. The purpose of the GEONETCAB is to create the conditions for the improvement and increase of the GEO capacity building with special emphasis on developing countries, new EU member states and climate monitoring and will serve the bigger goal of improved effectiveness and efficiency of GEO capacity building for application in the GEO societal benefit areas. Presentation will describe the project goals, activities and results relating to the Earth Observation training activities and educational support.

Localized Language Learning

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Keywords: Localized Language Learning, remote sensing, geomatics, Web Map Client, OpenLayers, e-learning, education

Abstract: Making use of sound which is 'localized' and involved in visual representations of reality is a new possibility to produce highly interesting educational material for the polysensory acquisition of space-related knowledge. The capabilities of some open source web map client applications allow users to imbed the freely accessible remotely sensed data obtained from free of charge web services into web browser applications via their Application Programming Interface (API). As an example, Google imagery is one of those interesting sources for different educational applications. The visual base provided by Google can be furthermore extended with OpenLayers, an open source JavaScript library, which allows users to link the acoustic dimension with visual spatial representations. To show the interdisciplinary potential of audio-visual products of geomatics in the real and virtual language classroom, a research project named Localized Language Learning (LLL) has been started in the Geomatics/Remote Sensing Group at the Ruhr-University Bochum (RUB), Germany. Apart from a selection of 3D-modelling and multimedia cartographic applications for the study of the Irish, Estonian and English language, an e-learning web mapping application has been created. This application picks up the idea of combining pictoral information with spoken text in order to make cognitive acquisition easier for learners. So, students are invited to study linguistic features like grammar, pronunciation and vocabulary while simultaneously exploring the Earth from space on different scales.

Modernization of ecological education - important step at the present

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Abstract: At present, because of sudden transformation in nature and society, the problem of society development demands to consider new ideas and approaches and work out effective methods of management, which promote minimum load on natural ecosystem while at the same time observing all standards of protection and rational usage of different types of natural resources and the ecosystem in whole. Changes in biosphere are the result of human activities which effect all its elements-water and aerial swimming- pools, the earth, flora and fauna. This has brought to global warming, water and air pollution, planet desertification, pollution of World Ocean, and destruction of ozone layer, which are all well- known to every person. That is why the modern conception of use of nature must base on principles of harmonious interaction between humans and nature. Mountainous ecosystems of Central Asia because of inaccessibility, isolation, and severe ecological environment conditions and life condition of population, demand special approaches to solving the problem of environment protection. As it is known, high mountainous ecosystems were evolutionary formulated in the hardest environmental conditions, and are thus very peculiar in nature. That is why by insufficient scientifically –well grounded interference they may easily and irreversibly be destroyed, and will be very hard to restore. It's proven that the level of environmental awareness plays the biggest role in solving the problems of the environment protection. People start getting the knowledge of ecology from pre-school institutions, then at secondary school and higher education institutions. Therefore, the level of environmental awareness of people considerably depends on how appropriately the curriculum for ecology-related subjects is designed. Unfortunately, in the mountainous regions of Central Asia training on ecology related subjects in higher education institutions and secondary schools is still conducted in accordance with the general concept of ecological education (a slightly changed version) worked out in Soviet Union. To teach the above-mentioned subjects teachers use books published in Moscow, or in other European and American cities, which give general information about the ecological situation in the world. However, according to our analysis these principles most of the time do not conform to the regional specifics of the nature of Central Asian mountainous regions. They sometimes are not only unable to answer to vulnerable ecological problems, which exist in mountainous regions of Central Asia, but also have an opposite effect. At present the intensive and uneven growth of population and, accordingly, the growth of urbanization, development of industry, transportation, industrialization of agriculture, increase in military actions in different parts of the world and nuclear testing have resulted in many questions of environmental protection to obtain strictly regional character, the right solution of which is possible only by appropriate regional approach. Taking indo consideration all these changes in nature and society and the imperfection of the existing curriculum, we believe that the more realistic way of dealing with the situation is the elaboration of a regional program for ecology-related subjects considering the specific peculiarities of concrete regions of the world. This year, under my supervision, together with leading ecologists of Kyrgyzstan and Tajikistan, we have started to work on the project 'Elaboration of curriculum, programs and writing books for the discipline 'Regional Ecology' (for Central Asian regions) for higher education institutions of Central Asia'. After the project accomplishment we intend to address this problem in a narrower regional scale is.est.we will work on elaborating curriculum for ecology-related subjects in higher education institutions in Tajikistan. We believe that this approach to the solution of the regional environmental problems is the most realistic way of coming out of the situation. We are convinced that our experience will have a positive impact on the other regions of the world. In the present time, in the connection with transformation sharp at the natural and at the society, the problem of development society demand to examine the

new ideas and approaches, the new working and effective methods of economic, promote minimum load on natural ecosystem, in this case observe all standard of protection, and usage in different rational types of natural recourses and the whole ecosystem. Changes in biosphere confider the result of the human activities in the past century, infringe practice all her elements: water aqueous and aerial swimming- pool, land, deaths, vegetable and peace of animal, which bring to: rise temperature of surface land, global water pollution, air and soil, devastation of planet, worlds ocean pollution, permission ozone of layer, today is well- known for every person. That is way modern conception usage by natural must boas on principles of harmonious condition optimism interaction person with nature. Mountains ecosystem of Central Asia of their ability to work, quarantine, severe ecological environment condition and population condition of life, especially demand to approaches decision problem of the environment protection. How its known, that alpine of evolution system grow up at the hardest condition environment, and on their nature, they are self- colorful. That is way by the insufficient scientific –well grounded interference they may easy and irreversible destroy, afterwards citizen restore indigent of hard work. Contend that biggest role to decision problem of the environment protection represent level ecological erudition of population. Ecological erudition of people beginning from childhood under school age, at the secondary school and highest education system. That is way so far as correct plan and program direction teach ecological population. Unfortunately, in territory of mountain region Central Asia to teach ecological discipline in highest education system and secondary school as yet conduct concordant total conception ecological education, working in Soviet Union, to teaching ecological discipline concordant total educationally publication manual at Moscow, or in other Europe or Americans cities, which give all nation of world's ecological situation. This is not treating just at Central Asia countries, but also concern to prevailing countries of world. However, how demonstrate our analysis this principal in majority case not conformity with regional specific natural of central Asia. At this case they don't give answer to vulnerable ecological problem, which exist at mountain regions of central Asia but prove action opposite creation today's whole picture of world, when occur intensive and uneven growth population and together with him growth in process of urbanization, industry development, transport, energy, industrialization, of agriculture, more development of fighting action, at different place of world, trial nuclear weapons and it bring to; that many question environment condition receive specific regional correct decision which possibility just in correct regional approach. Consideration all this changes at the nature and at the society, incomplete educational programs on discipline « Ecology »we consider that the most real way and going out from this situation, appear working in regional program on discipline « Ecology » with especially specific at the concrete region of world. In this year under my guidance with ecology in mountainous Kyrgyzstan and Tajikistan, we began working on plan « working erudite plan: programs and erudite on discipline» Regionally ecology (for Central Asia region) for highest educational system of Central Asia. After this completion we must in more regional scale to decision these problems. » Working educational plan, programs and writing education on discipline « Region ecology for mountains regions of Republic of Tajikistan »We think that this approached to decision regional ecological problem, come the most real going out from this situation we are sure that our appearance give positive impulse and in others region of world.

Integrating BLIF in school

A Web Based Remote Sensing Application for Competence Oriented Education

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Keywords: web based software, modern learning, intuitive usability, technical features, newest didactical achievements, self learning experience, spatial behavior competence

Abstract: One of the basic competences demanded by many curricula is the ability to acquire, to retrieve, to interpret and to reflect on geographical information by using geospatial technologies, such as digital remote sensing data. Moreover, the development of methodological skills plays an important role in students´ learning processes. In order to meet these demands, "BLIF" (Blickpunkt Fernerkundung – Focus on Remote Sensing) provides a web based learning environment in order to establish remote sensing more frequently in schools. The software is designed considering the newest didactical achievements as well as current remote sensing and technical standards. Using BLIF, the students are able to work on problem-solving exercises and to handle with digital remote sensing data individually. Both intuitive usability and the availability of different modes foster the development and the improvement of essential competences and skills. The web based application can be used without limitation on access and does not require any installation. It can be used in various contexts which range from geography to environmental sciences, as well as mathematics and information technologies. These contexts include a wide range of topics of educational relevance. Therefore, a wide range of remote sensing datasets is offered. Additionally, Landsat data can be uploaded individually in order to adapt the context to the user's individual needs. Furthermore, the teachers and students have access to several tutorials and a large selection of representative exercises which will give the students and teachers helpful hints on using the software.
BLIF consists of two different modes. The first mode is guided by an assistant. Here, the students are introduced to menu navigation. Within the assistant mode, there will be three levels: beginners, advanced learners and professional users. Depending on the level, the student will find various processing options. Going through all the levels, the students learn to handle standard program procedures and learn how to process satellite images efficiently. The second mode is open for individual analysis. The technical features of BLIF are based on educational relevance and the most common utilities of remote sensing systems. The software includes basic features, such as importing exporting files and zooming in and out. Moreover, different image improvement methods, georeferencing, several standard indices (e.g. NDVI), the common forms of image classifications and change detection tools are offered. Besides it will be possible to evaluate the classified image and publish it with several standard layout elements, like title, scale and legend. Implementing BLIF in schools led to first practical experience. In this context, changes in motivation and self-concept of students of the lower secondary school level (13-15 years old) will be considered as well aspects of layout, design and usability of the software. Additionally, the workshop is aimed at providing insights in the software application, including a large selection of representative exercises.

Training course on LeoWorks

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Keywords: Image processing software

Abstract: LeoWorks is the ESA educational image processing and GIS software for students and teachers. Its use is demonstrated on examples from ESA's Eduspace website for Earth Observation.

Eduspace and the ESA School Atlas, Part 1

A training course

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Keywords: EduSpace, e-learning tutorials

Abstract: Eduspace, ESA's website for secondary school students, is presented, showing how to use earth observation in teaching and learning of many subjects and themes such as Earth from Space, Environmental Issues and Envisat for Schools. Exercises from Eduspace are demonstrated using LeoWorks 3 and 4. In addition the ESA School Atlas - Geography from Space will be presented for the use in the classroom using the content on the accompanying two DVD's and the Teachers Handbook.

EduSpace and the ESA School Atlas, Part 2

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Keywords: EduSpace, e-learning tutorials

Abstract: Eduspace, ESA's website for secondary school students, is presented, showing how to use earth observation in teaching and learning of many subjects and themes such as Earth from Space, Environmental Issues and Envisat for Schools. Exercises from Eduspace are demonstrated using LeoWorks 3 and 4. In addition the ESA School Atlas - Geography from Space will be presented for the use in the classroom using the content on the accompanying two DVD's and the Teachers Handbook.

BLIF – A remote sensing web application for competence oriented school education

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Keywords: School Education, Remote Sensing

Abstract: The use of the digital learning environment created by the project „Focus on Remote Sensing (Blickpunkt Fernerkundung, BLIF) – A Remote Sensing Web Application for Competence Oriented School Education" is presented. „BLIF" provides a web-based remote sensing software which can be applied in schools. It includes selected, competence-oriented working materials. The contribution comprises a theoretical part where the learning environmentfunctionalities and a selection of learning material are presented. In the practical part the participants have the opportunity to use the software on their own and to deal with the selected material intensively.

SEOS - EARSeL's e-learning tutorials for science education at high schools

A training course

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Keywords: SEOS, science education, e-learning

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). Eleven partners from several European countries, in cooperation with the European Space Agency (ESA) and teachers from European high schools, created e-learning tutorials for science students in high schools across Europe.

Based on real examples, the tutorials use remote sensing images and data to involve students in different aspects of current environmental research and monitoring. The tutorials demonstrate how information from satellites can be directly relevant to everyday life conditions and emphasise the importance of awareness of the environment. They cover a broad range of topics, from daily weather data to long-term climatic conditions, landcover changes, marine pollution and environmental hazards, ocean currents, coral reefs and coastal water quality, natural and cultural heritage and conservation, time series analysis and modelling, to name but a few. Connections between different topics are made clear, and links make it possible for teachers and students to follow their own route through the lessons according to their own interests. The tutorials use the method of Enquiry-based Learning, which is also supported by worksheets highlighting an interesting scenario in the environment followed by questions or tasks which can be solved when studying the web-based tutorials. Advanced information on a more complex level is available through links to supplementary pages, which is particularly relevant with tutorials that are used in physics and mathematics classes.

The tutorials are the core element of the SEOS Learning Management System, allowing teachers to create their own courses, to distribute already available or new worksheets to the students for homework and to collect the results. Forums are available for teachers, students and other users to exchange information and discuss topics relevant for their study.

The use of SEOS tutorials in the science curricula at high schools is presented in this training course.

The Earth Observation Programme of ESA

Educational tools for schools

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Abstract: Earth Observation (EO) from satellites is a unique tool for the understanding of the Earth's system and its processes, which can be a valid support to school teaching in subjects such as geography and earth science. Moreover, monitoring our planet and its environment, detecting and understanding its variations is more and more important, in a planet threatened by global change and climate change, where the uncontrolled use of natural resources like biomass, carbon and clean water associated to the explosion of demography could make life conditions of future generations hard. The observation of the changing earth from space can provide a valid support to the creation of public awareness and the education of young generations about these issues. The first missions conceived by Earth Observation Programme of the European Space Agency (ESA) were in the area of meteorology, with the successful launch of Meteosat in 1977, followed by a series of meteorological satellites, including Meteosat Second Generation and METOP (all operated by EUMETSAT). Moreover, in 1991, ESA launched its first EO satellite with a synthetic aperture radar payload, ERS-1, followed by ERS-2 (1996) and Envisat (2002), the largest EO satellite ever launched and with a variety of different sensors for the observation of land, ocean, cryosphere and atmosphere, providing a precious information serving the scientific community, as well as an increasingly larger number of operational and commercial users. In parallel, ESA is preparing scientific Earth Observation missions called Earth Explorers, dedicated to the study of scientific challenges identified by the science community. The first three, GOCE (measuring the Earth's gravity field), SMOS (determining soil moisture and ocean salinity) are already in orbit, and CryoSat (observing continental ice sheets and marine ice cover) have been launched already, to be followed by other satellites for a variety of scientific objectives. Other important issues are the observation and fast response in case of natural disasters and all environmental hazards. In this context, GMES (Global Monitoring for Environment and Security), a joint initiative of ESA and the European Union, aims to monitor the state of the environment on land, at sea and in the atmosphere and to deliver policy-relevant EO information that can be used to improve the security of the citizens. Its Space Component comprises five types of new missions called Sentinels, plus so-called Contributing Missions from Member States and other organisations, with their associated Ground Segment infrastructure, developed by ESA. The Sentinel missions include radar and superspectral imaging for land, ocean and atmospheric monitoring. Associated to this challenging programme of Earth Observation, ESA is carrying out a programme of EO Education, in cooperation with other national space agencies and with international bodies, like UNESCO or the Committee on Earth Observation Satellites (CEOS) and its Working Group for Education. In this frame, dedicated tools for schools, such as Eduspace, have been developed with the objective to create awareness about the potential of Earth Observation from space among young generations and to bring 'space' closer to youngsters. A variety of different tools have been developed and a series of training courses at different levels (university, post-doc, scientific or professional-oriented) are provided by ESA and other institutes cooperating with ESA.