

EDUSPACE, THE EUROPEAN EARTH OBSERVATION WEBSITE FOR SECONDARY SCHOOLS

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Commission VI, Working Group VI/1

KEY WORDS: Website, education, secondary school, Earth observation, multidisciplinary, image processing, remote sensing, GIS

ABSTRACT:

A new website for secondary schools is designed to provide students and teachers of Europe with a new learning and teaching tool. It offers an entry point to space imagery and Earth observation applications both for science and day-to-day use. It encourages teachers to use Earth observation data in their curriculum by providing ready-made projects. The website is rich in didactical material focusing on remote sensing satellite data both locally (with high-resolution images) and globally (with low-resolution images) to encourage students to study features and events in space and time. EDUSPACE combines teaching and learning material with background material and worksheets to put the student in centre of the learning process. An image processing tool, LEOWorks, is being made available for data analysis and image interpretation to both students and experienced teachers. The website address is: www.esa.int/education/eduspace.

1. INTRODUCTION

ESA and its National and Industrial Partners have developed this website under the umbrella of EURISY. It aims to provide students and teachers of Europe with a new learning and teaching tool that offers an entry point to space image data and in particular a wide-spread visibility of Earth Observation applications for both science and day-to-day use. It aims to inspire teachers to incorporate Earth Observation in their curricula and it provides for in-service training. It encourages teachers to use Earth Observation data by providing ready-made projects and worksheets. It aims to stimulate the curiosity of students with attractive spaceborne images, along with additional resources and tools, amongst which is educational image processing software. The site also includes means to facilitate collaborative work with other schools, especially within the geographical region.

Unlike many educational sites for schools, it is the intention of the Educational Office of the European Space Agency with EDUSPACE to provide a complete view of Earth observation applications to schools, covering most of the application subjects well-known to scientists and operational entities.

2. A SITE FOR BEGINNERS AND EXPERTS

Early in the development of EDUSPACE it was recognised that for introducing Earth observation the material had to cover different levels of complexity. Novices had to be encouraged with an easy and pleasant-to-follow approach; at the same time, expert teachers should be offered interesting material to work with. Therefore special attention was given to include a solid basis of techniques linked to Earth observation from satellites.



Figure 1. The EDUSPACE entry page

The proposed approach is richly illustrated and leads to a more complete overview of the different aspects about how electromagnetic energy is used to sense the Earth. Several databases are available; among them is a series of viewgraphs, ready to download both in a light form, and as a PowerPoint presentation, often including small animations. A teacher can use this material for the different classical subjects, such as Geography, Science and Environmental sciences, Physics, Chemistry, Computer Science, and even in Arts. Project ideas and relevant material presented in the website can be used for the preparation and the delivery of just one or of a series of lessons. It can be used as the basis for a full-scale project in the class. It is also suggested to have Earth observation to become part of the school programme, as a recurring theme within the yearly curricula, whereas the tasks to be addressed by the students is to be adapted to the grade i.e. increasing every year in their complexity. As an example, a first-year activity could concentrate on building up the necessary knowledge of space-related matters, culminating in well-prepared and delivered PowerPoint presentations. The second year could address data collection of an area of interest (e.g. the school town) and aspects of archiving, analysing and statistical evaluation. The third year could deal in applying satellite data, in digital image processing and in the construction of a Geographical

Information System (GIS), using the tools available in EDUSPACE.

3. ACCESS TO EDUSPACE

All material in EDUSPACE is free of charge. Although the website has no access restrictions and thus can be freely used by anyone, the download of most satellite data as well as of the image processing software is only possible after registration. The industrial partners who have kindly provided data and many types of support require this. For the same reason the cost of the software license to produce the freeware image processing software, LEOWorks, could be drastically reduced. For access to these restricted zones, a user has to register and the registration has to be accepted by the EDUSPACE Operations Team to ensure that the requester is a public entity (school, university, educational or research institution). The next step for the user is to register the class (or any specific user within the educational entity) and propose a personal login and password, which eventually will be validated by the Webmaster. After having accepted also this class-registration all the areas of the website are accessible.

The material of the website can be used in many different ways and will hopefully satisfy the requirements of students and teachers. A curious student can browse through the themes while a teacher can instruct students to study certain sections, then perform relevant exercises and deliver the result at the end of the lesson. A teacher can also use the material to prepare lessons or to propose a project to students who can work in teams over a period of time presenting their work to their classmates in the end.

As the data and software are large files, downloading should be done outside of the lesson, and the data should be put on the school's server or distributed to the students' PC prior to the lesson.

The website also functions as a portal to other educational sites and links in specific areas might help to find further background information. Moreover the site is also a communication vehicle, to get in touch with the EDUSPACE helpdesk for specific questions or to post such questions to the forum. The access to the addresses of the registered schools is facilitated through different ways for browsing the relevant database.

4. CONTENTS AND STRUCTURE OF THE WEBSITE

EDUSPACE consists of a tree structure with the following main branches:

- **Europe From Space**, with sub-themes such as Cities, Landscapes, Alps and Weather
- **Global Change**, with sub-themes including Atmosphere, Land and Ocean
- **Disaster Monitoring**, dealing with tropical cyclones, floods, earthquakes, volcanoes and oil pollution
- **Remote Sensing Principles** with a two-level introduction to the techniques
- **Image Processing Tools** containing software and tutorials
- **School Network** managing the addresses of the registered schools and a Discussion Forum
- **News, Helpdesk and Links**



Figure 2. The city of Copenhagen. One of the many images provided to students to work with.

Each sub-theme has further deeper layers including, resources, background information, project-ideas and fully developed case studies.

- **Resources** consist of databases of satellite images from different sensors, ready for selection and downloading. In some cases the data is not resident but must be retrieved from other sites.
- **Projects** are presented in the form of suggestions to teachers and students. They refer to activities connected with satellite image interpretation. Such activity needs to be supported by adequate terrain information (maps, documents) and further collection of ground truth is stimulated, either through fieldwork or by a bibliographic search. Some projects are considered as exercises that imply the use of tools and data available in the website, others can be further developed requiring teamwork or collaboration with other schools throughout Europe.
- **Case Studies** are collections of material with worksheets for more in-depth studies of a selected area, addressed to Regional Geography, landcover mapping and Meteorology, or to a more complex theme such as Global monitoring. The topic is often of general nature and the Case Study can be seen as a practical application of environmental issues independent of geographical location. Case Studies include rich illustrations, satellite images, texts and links. The material can be used either following traditional working methods in the worksheets or can be downloaded, visualised and studied in a computer environment for which a dedicated PC-based image processing software, called LEOWorks, is provided. Particular emphasis is put on the use of Geographic Information Systems (GIS). Related to this technique the site includes complete integrated data sets for some of the Cases Studies. Background material for the Case Studies is given in a concentrated form to ensure that students understand the underlying problems and methods. Specific external links can be activated to retrieve further information and material

from other sources worldwide. This will help students to collect facts and methods to work in proper areas of interest.

4.1 Example of a Project Idea

One of the many project ideas is named “My Home Town Seen from Space”. Students are requested to work on a project aimed at providing a detailed interpretation of a satellite image of the area where their school is located. Tiles of satellite images are included in the site and are available free of charge. Projects of different size are suggested, either to produce a well-annotated postcard-sized satellite map of the hometown to be mailed/mailed to friends or to a collaborating school, or to start a larger project involving more time and resources. EDUSPACE holds satellite images and descriptions of many cities in Europe with the idea that a school class would produce a much-improved caption as a result of a project. Such reports are greatly welcome and will be put on-line together with the names of the authors!

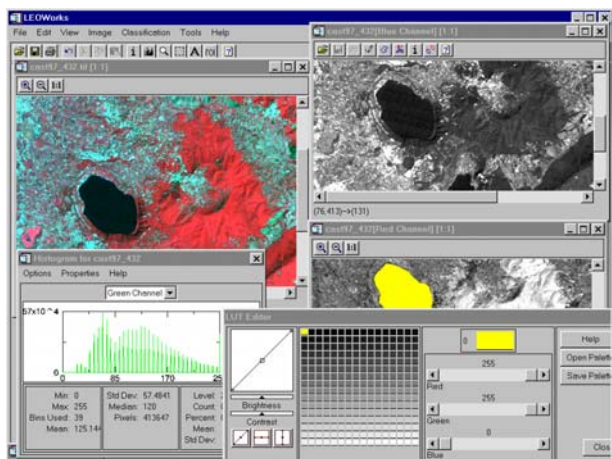


Figure 3. The Image processing software LEOWorks allows novices to make first steps in image data understanding and expert to do a full-scale image analysis

4.2 The Educational Image Processing Tool LEOWorks

This specially generated piece of software introduces teachers and students to the world of digital image processing in an intuitive manner. To use this tool a beginner will find an exhaustive tutorial, which will guide him through the software. It offers nearly all the options of professional software but initially can also be used just to play with digital images in order to explore the different ways to manipulate image data. In progressive steps a student is asked to analyse the image and to alternate the values of a data set for a better interpretation of an image content. A user finds modules allowing grey tone and colour manipulation and can even perform an automatic or supervised classification. There are tools for image annotation (to construct a satellite image map) and to extract image information (thematic information such as the perimeter of a town or the length of a roads), which can be saved as layers of a Geographical Information System. Such layers together with satellite images can then be combined and interrogated in order to derive new findings - and visualise them for a report or a presentation.

LEOWork has been constructed not only to give the students many options to input and edit images, but also to visualise

digital values. Special emphasis is also given to understand and alter the histogram, including many options, some of which are unique. There are a variety of filters implemented and there is also a module to superimpose images of different origin. With respect to well-known commercial software, some processing might not be as fast to perform, but has to be done step by step. This is done to preserve the educational value of how digital images are manipulated. The LEOWorks software is free and any registered user can download the executable file as well as the exhaustive tutorial.

4.3 A Network of Schools

EDUSPACE aims at stimulating the contacts between schools of Europe. After a school and a class have registered the information becomes available to all visitors of the site. Of course, the list of participating schools can be easily browsed and email addresses eventually extracted. It is hoped that such an opportunity might strengthen contacts between schools and provide a possibility to make new contacts. Within certain projects such as the “Interactive METEOSAT”, to be found in the chapter “Weather”, a possible partner will be immediately visible, since the location and name of all schools having submitted a weather observation on a specific day will be included in the relevant METEOSAT image. For the search of partners for other projects, using the Forum might be useful. EDUSPACE also provides for a Helpdesk function where teachers can mail their questions or suggestions, and eventually, also new material they or their classes have produced.

5. OUTLOOK

The EDUSPACE website will be further populated in the near future with more satellite data and more teaching material. The series of animated viewgraphs will be enriched, and more case studies and project ideas will be added. The website data base structure is conceived to hold different languages using the same illustrative material. Although in secondary schools English language skills are widespread, there is still a strong requirement from several countries to provide at least parts of the website in their native language. It is envisaged to have at least a French, German, Italian and Spanish translation. Finally the authors of the website stress their support for the generation of material of the other continents and adding chapters such as Latin America from Space, Africa from Space, and Asia from Space with similar content as in Europe from Space and thus including schools from around the world. The website address is: www.esa.int/education/eduspace
Contact address: eduspace@esa.int