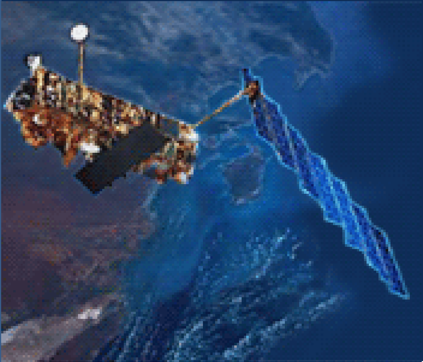


LearnEO ! Learn Earth Observation with ESA

www.learn-eo.org

Valborg Byfield val.byfield@noc.ac.uk, NOC, UK;
Chris Banks, NOC, UK;
Malcolm Dobson, BDL, UK;
Fabio Del Frate, GEO-K, Italy;
Pierre-Philippe Mathieu, ESA/ESRIN, Italy;
Vinca Rosmorduc, CLS, France

The development of remote sensing over the past 20 years has increased our capacity to monitor the environment, understand & forecast its variability, manage natural resources, support humanitarian aid and emergencies management. Remote sensing is no longer a specialist technology, but simply a powerful tool. The interpretation of satellite information is a skill of strategic and economic importance, which should be developed widely and distributed globally.

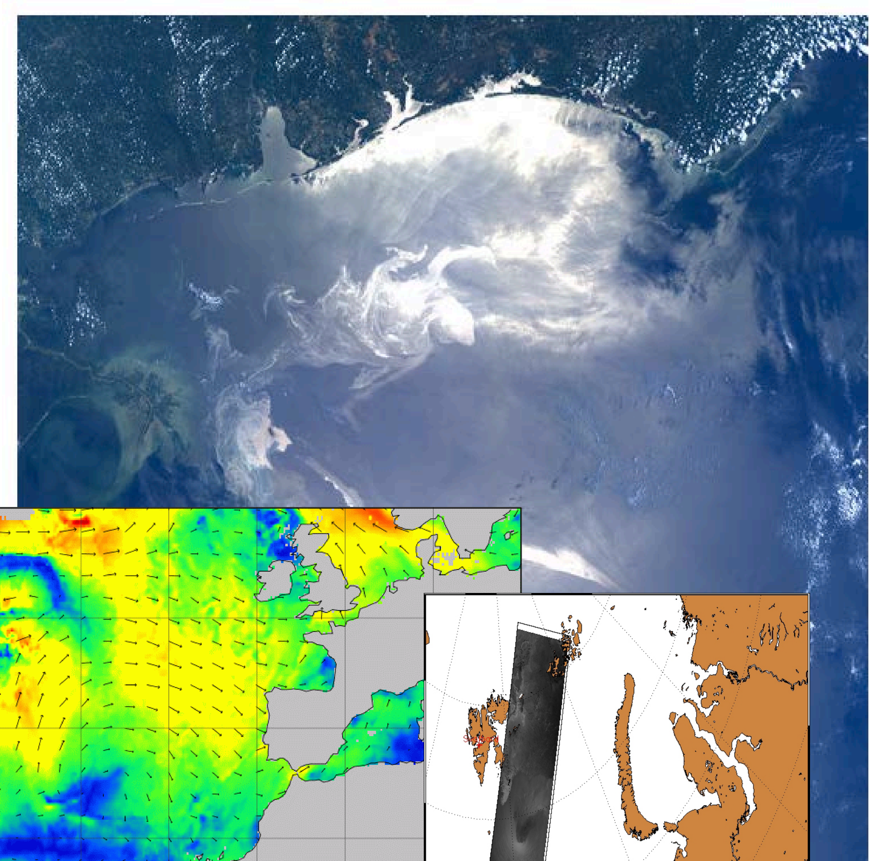
The LearnEO! project supported by ESA aims to “stimulate the understanding and application of ESA EO data sets by implementing and maintaining an educational framework for teachers and students in the 18-25+ age group (upper high school to university level)”

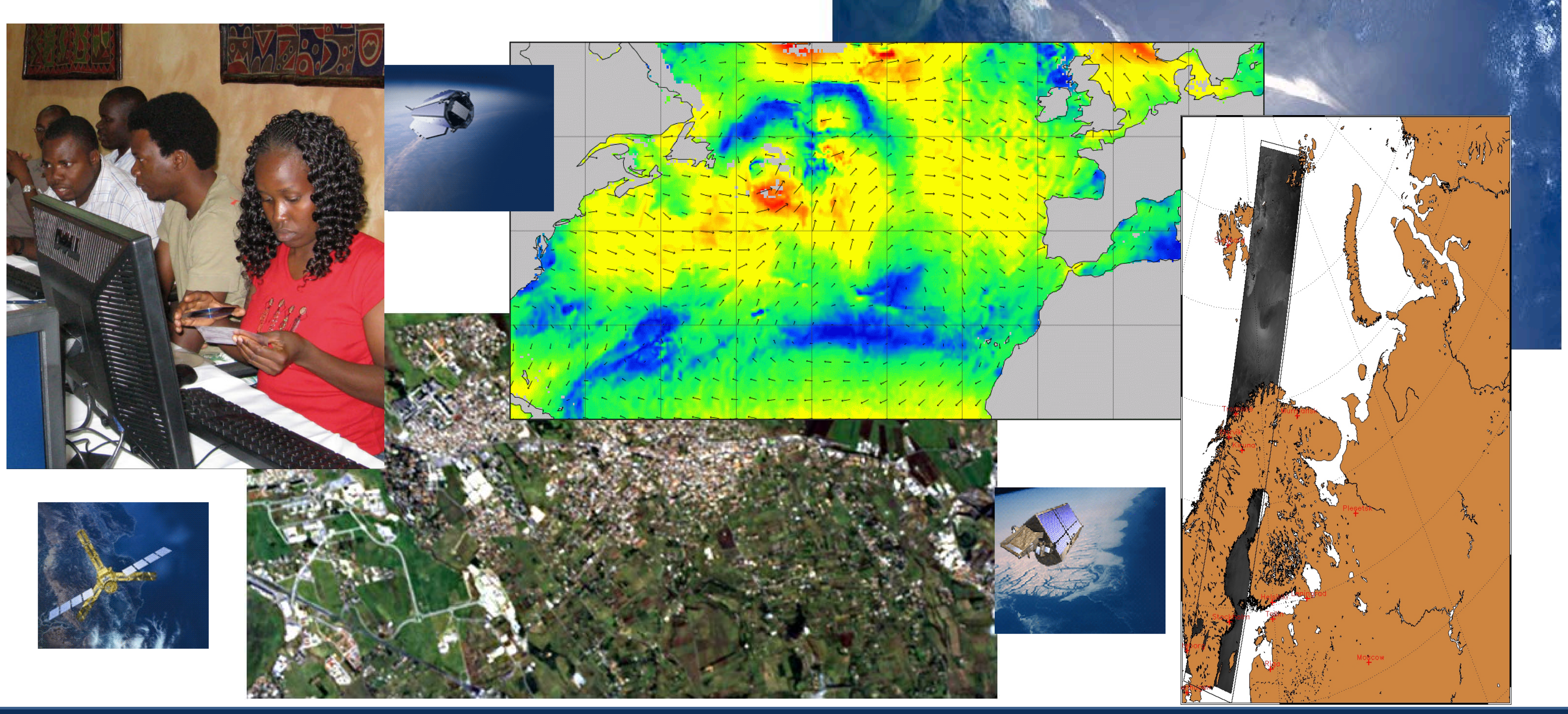
LearnEO!: a user-driven project

Learn EO! has two main aspects.

One is the development of online learning resources, peer-reviewed, concerning all Earth observation techniques, including hands-on lessons (using the Bilko UNESCO software), and a collection of data, available on the web site for educational purposes.

The other is to develop and foster a community of LearnEO! ‘users and producers’; support this community throughout the duration of the project; and develop plans for continuing such support beyond the lifetime of LearnEO!





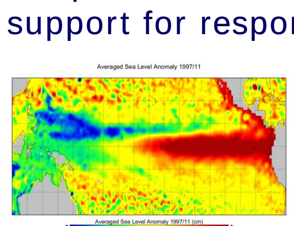
Lessons

1. The Amazon River plume

This plume is clearly visible in satellite data of salinity and ocean colour. The Amazon lesson uses data from SMOS and EnviSat MERIS to explore how water from the Amazon influences the tropical Atlantic.

2. Oil spill detection

Synthetic aperture radar (SAR) is the main sensor for monitoring oil pollution at sea, but for cloud-free areas, optical data is also used. This lesson uses ASAR and MERIS data from the Deepwater Horizon oil spill to show how satellite data is used in oil spill detection and provide support for response.

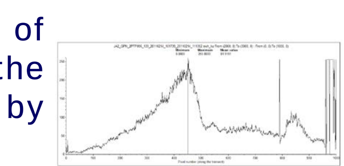


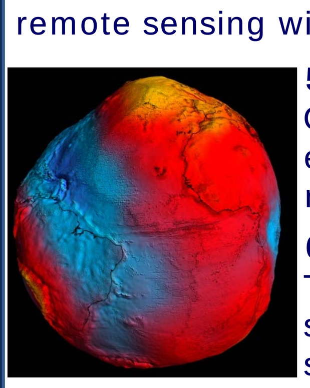
3. El Niño-Southern Oscillation

El Niño involves both the ocean and the atmosphere. It influences ocean temperatures and sea level, and affects weather patterns in many parts of the world through a coupling between winds and movements of ocean water. It can be visualized with many EO sensors, including altimetry, sea surface temperature, and with support from scatterometers.

4. Monitoring Atlantic storms

Several hurricane-force storms cross the North Atlantic Ocean every year. Observation of winds and waves during these storms is a challenge, as they take place in the middle of the ocean, and in extreme conditions. The way Significant wave height can be measured by remote sensing will be shown, as well as wind speeds.





5. Observing Earth gravity: the geoid

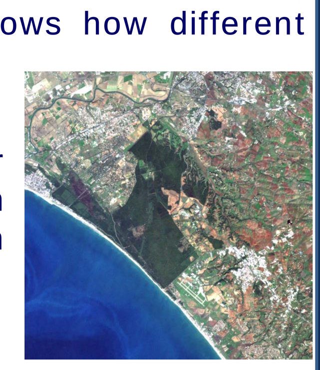
Gravimetry satellites, including GOCE have improved the knowledge of the geoid. The lesson explains what the geoid is, and how it reflects Earth Mantel inhomogeneities and sub-marine reliefs.

6. Monitoring Arctic Sea Ice

The Arctic is strongly affected by global climate change. It is also difficult to measure in situ, so satellite observations become particularly important. The lesson shows how different sensors are used to monitor Arctic impact of global warming.

7. Forest monitoring

This lesson demonstrates the use of multi-temporal spaceborne SAR data to monitor deforestation. In the case of forest fires, SAR data may also be used to monitor vegetation recovery. The lesson explains how the measured backscattering is due to both vegetation and soil moisture effects, and looks at synergies between SAR and optical data.



8. Urban growth monitoring

The archive of radar images is a useful resource for studying change in a variety of situations. This lesson shows how decametric single-polarisation SAR images may be used to montor change in large urban areas.

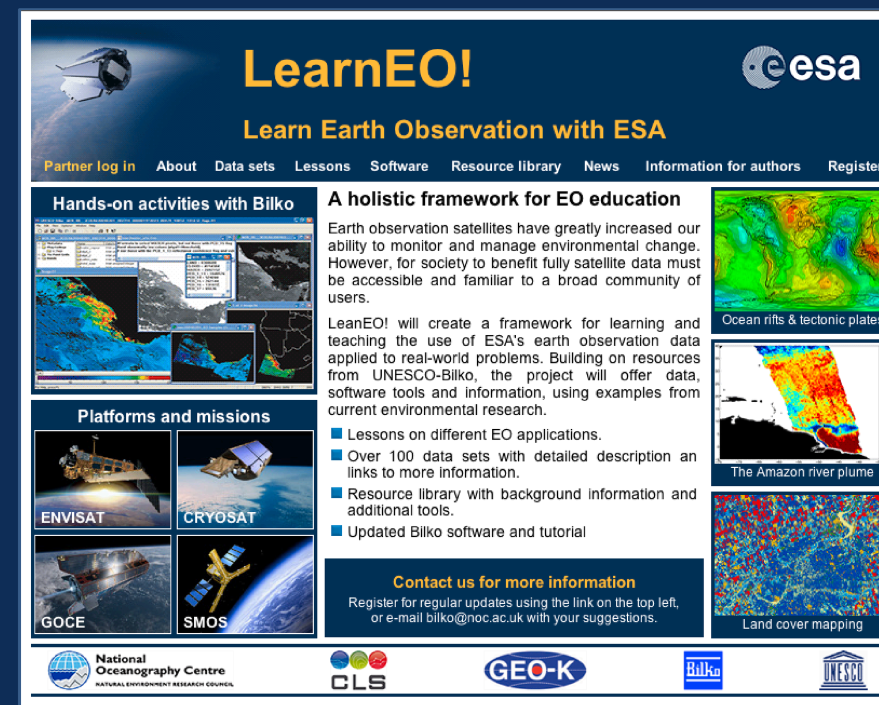
9. Land cover mapping

Hyperspectral and very high spatial resolution data have the potential for detecting subtle difference in ground cover. However, the techniques involved differ from those used for conventional analysis of spectral data.

10. Monitoring soil moisture

The SMOS instrument measures microwave radiation emitted from Earth’s surface in the L-band (1.4 Gz), using an interferometric radiometer. This lesson explains the physical principles of soil moisture retrieval from SMOS and demonstrates the processing chain needed to produce soil moisture maps.

Including the wider Education and EO community



Remaining up-to-date with developments in computing, remote sensing technologies and the growing number of applications will always be a challenge for the EO community.

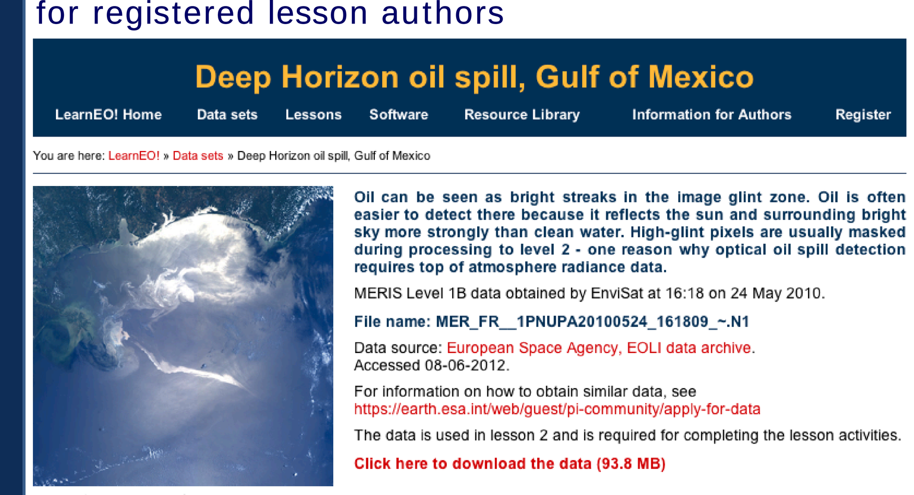
To meet it requires collaboration between remote sensing specialists, environmental scientists and educationalists. LearnEO's ambition is to encourage and support such collaboration by offering a platform for discussion between contributors to the capacity building effort, a contact point for reviewing EO new education material, and a platform for distributing case-study data, tools and lessons to a wider audience. Moreover, an on-line lesson developer's Resource Library will be provided as part of the Web Portal. It will be a repository for processing tools and background information for future authors using the Data Set collection to develop their own lessons.

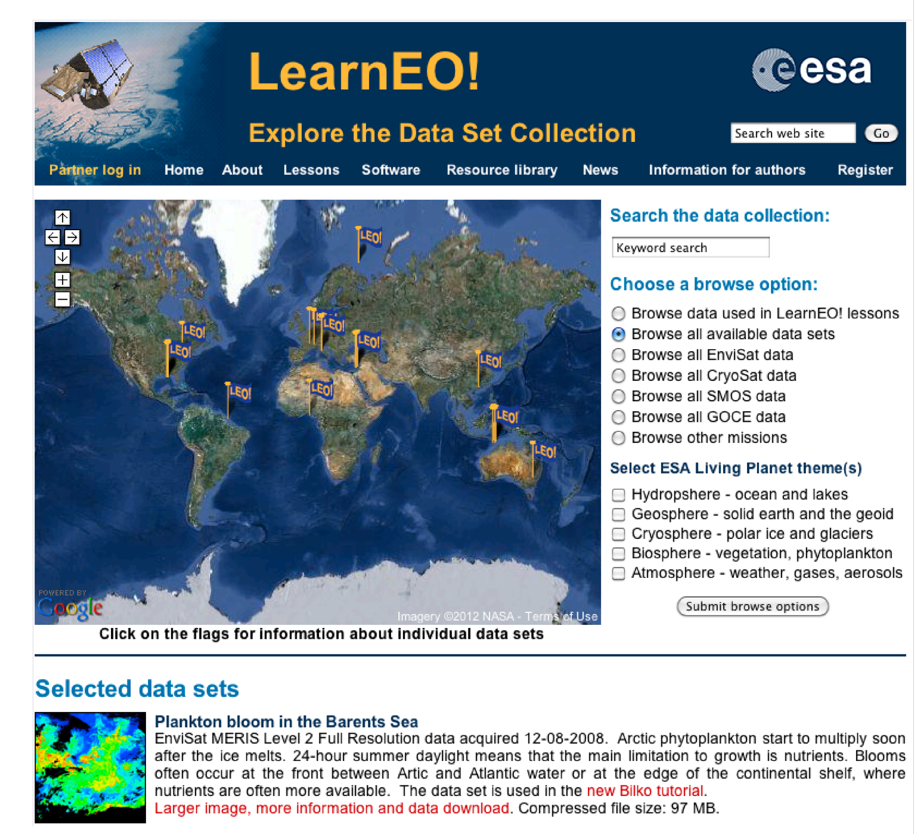
On-line resources

The LearnEO! web portal is designed to support the EO education community by offering easy access to all resources provided in the project.

This includes:

- Easy access to data sets and description through keyword search, geographical location or selective browse tool,
- Overview of lessons, with links to more information and lesson downloads
- Software descriptions, with links to downloads and tutorial for image processing and display
- Searchable Resource Library with background information and extra tools
- Author area offering advice, support and a forum for registered lesson authors

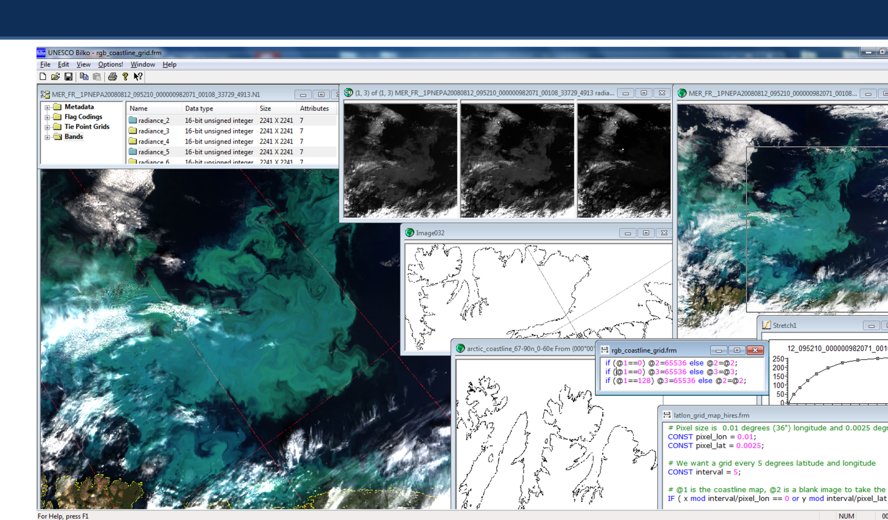


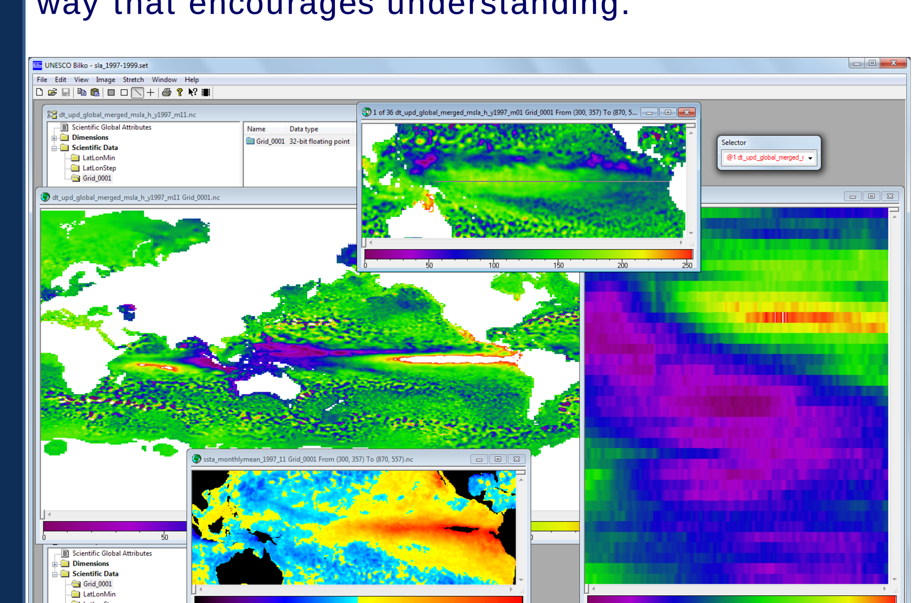


Bilko

LearnEO! builds on training resources developed over 25 years in UNESCO's Bilko project, and extends these to include new application areas and data types.

Bilko was conceived as free educational software for use on low-cost computers. Its core user community is still found in academic education. The software is suitable for teaching common image processing, display and analysis techniques, in a way that encourages understanding.





Bilko supports most of the data types and analysis activities used in LearnEO! In some advanced lessons, more expert software tools may be needed; if so, the LearnEO! website explains how to obtain these.