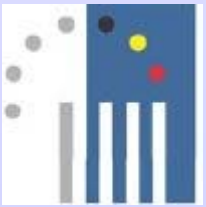
The SEOS Project

Science Education through **E**arth **O**bservation for High **S**chools

Tutorial 1: A World of Images

Caroline Dandois - Martine Stélandre
Belgian Science Policy Office



2nd EARSeL Workshop on Education and Training, Chania, 16-17 June 2009

Table

- Aims of Module 1
- Module structure
- Online tour: module pages, teacher's corner
- Testing in high schools
- Outreach

Aims of Module 1

"A World of Images"*... a first approach to remote sensing*

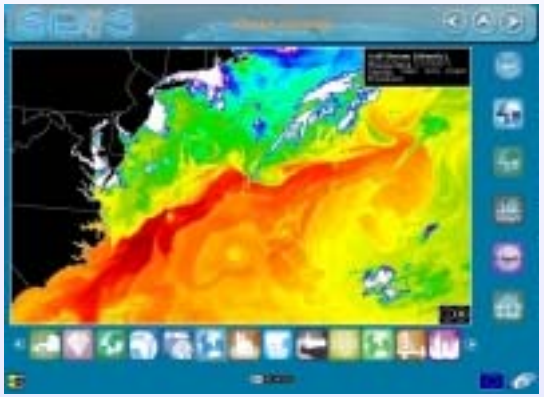
- Make the students **curious** about EO
- Show how **beautiful** is Earth from space

  Raise awareness about how **fragile** it is
- Discover new places in the world
- Explain how satellite images are used to **monitor** and **understand** many processes at work on our planet
- Propose a **variety of images** illustrating remote sensing applications
- Introduce the other SEOS modules
- ... in a **friendly** and **dynamic** tone !

Animation - Mosaic

Module pages

Regular pages



Contents page

Theme pages

Additionnal information pages

Pages linking to the other modules

How can satellites help to study and protect coral reefs ?

Corals are of great importance for animals and human beings living nearby. Study and monitoring of coral reefs would be very difficult without the help of satellites images to :

- Map the sea-floor and localize coral reefs
- Determine the different kinds and forms of reefs
- Retrieve information about reefs communities (corals, fishes, ...) and surrounding areas (seagrasses, sand, rocks, ...)
- Monitor the changes around coral reefs and produce risk maps

Submarine view of Tarawa reefs, Kiribati, Pacific Ocean (April 1994).
Photo: Linda Wade/NOAA's Coral Kingdom Collection.

Discover coral reefs by satellite in Module 3 !

Submarine view of Tarawa reefs, Kiribati, Pacific Ocean (April 1994).
Photo: Linda Wade/NOAA's Coral Kingdom Collection.

Proba image of the Niau atoll, one of nearly 80 coral reef atolls forming the Tuamotu Archipelago in French Polynesia (06/10/05).
Source: SSTL through ESA.

What is an atoll ?

Corals are in danger !

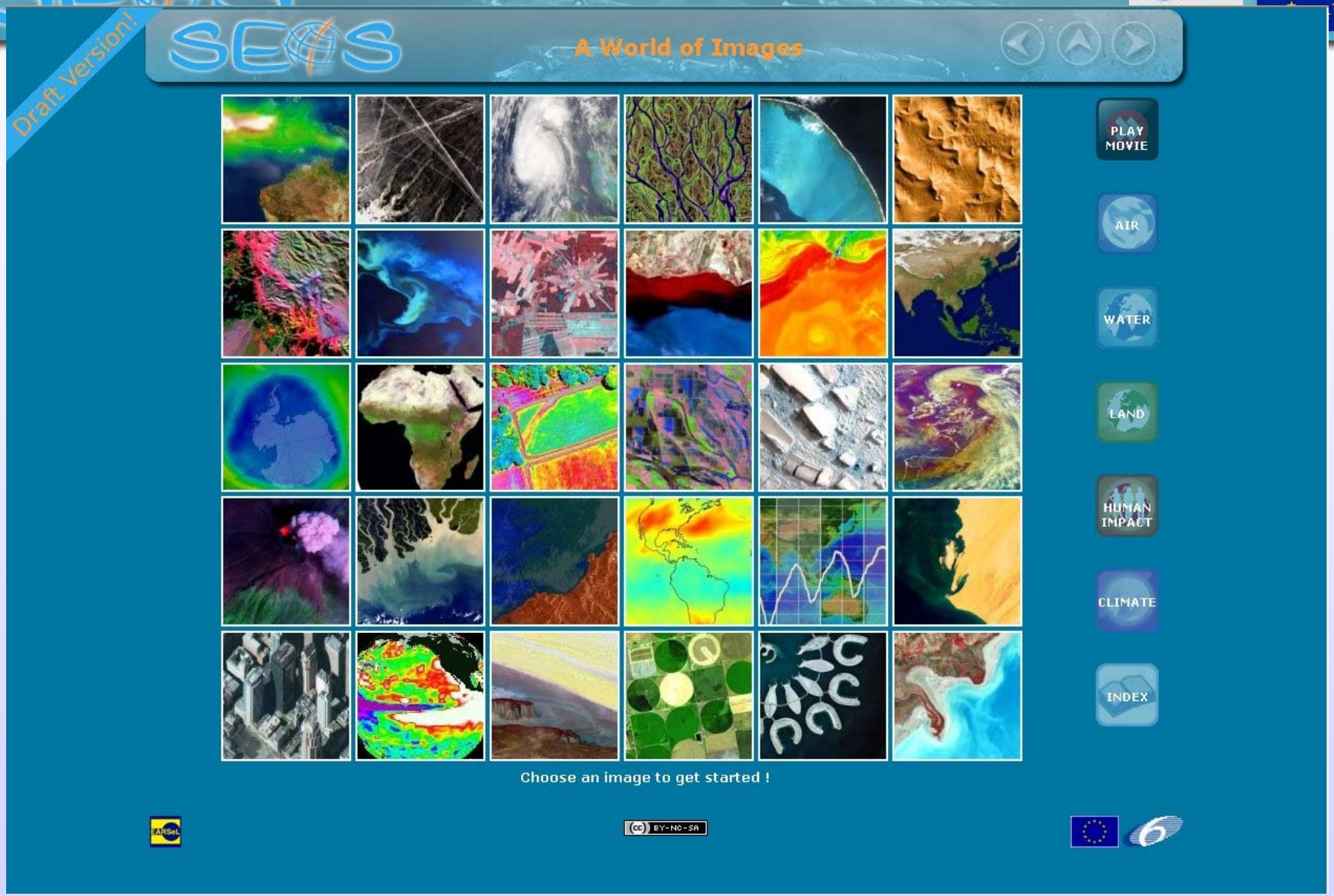
Coral reefs are extremely sensitive. Slight changes in the reef environment may have detrimental effects on the health of entire coral colonies.

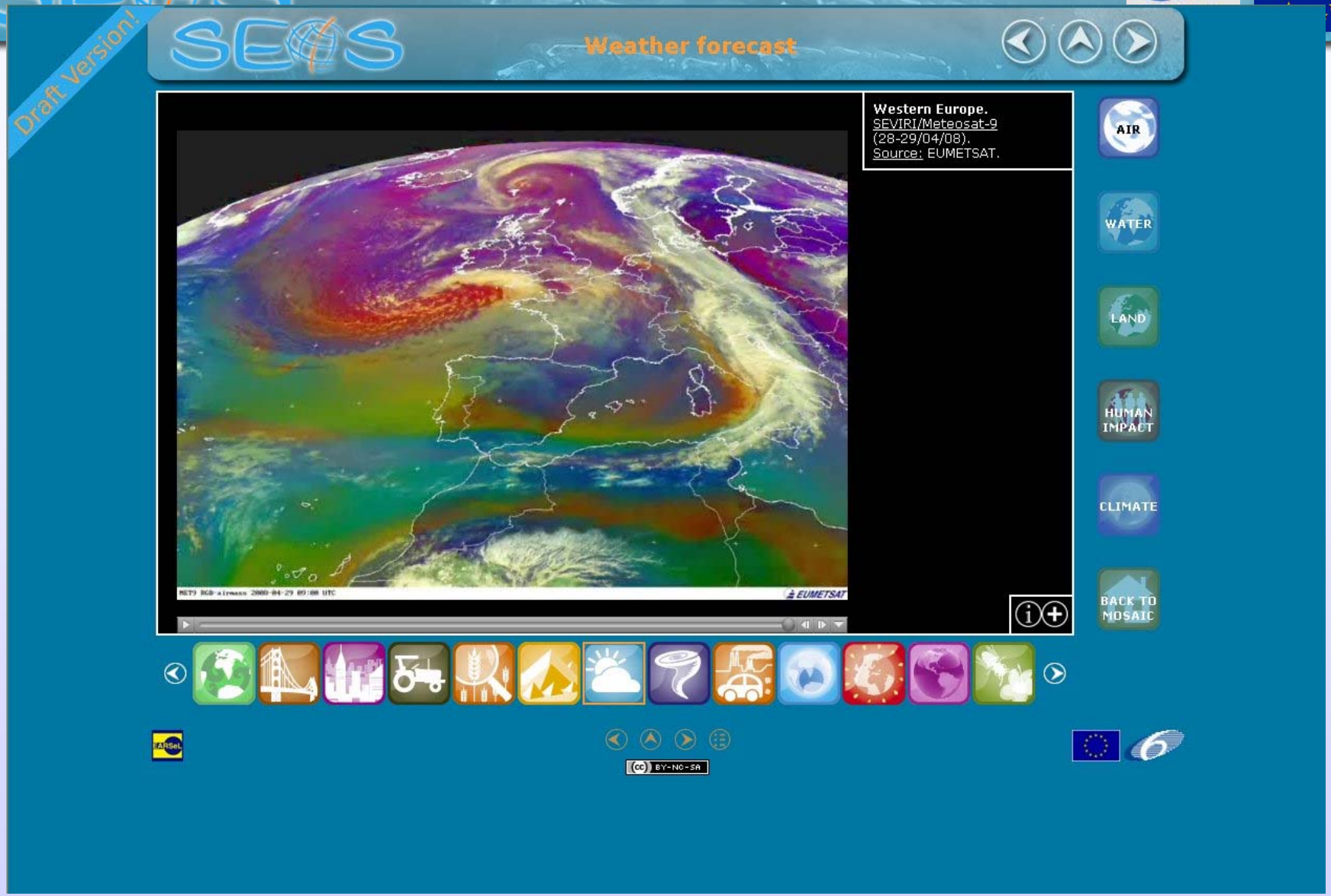
Coral bleaching occurs where the algae is expelled from the coral tissue, progressively losing its colour and eventually dying.

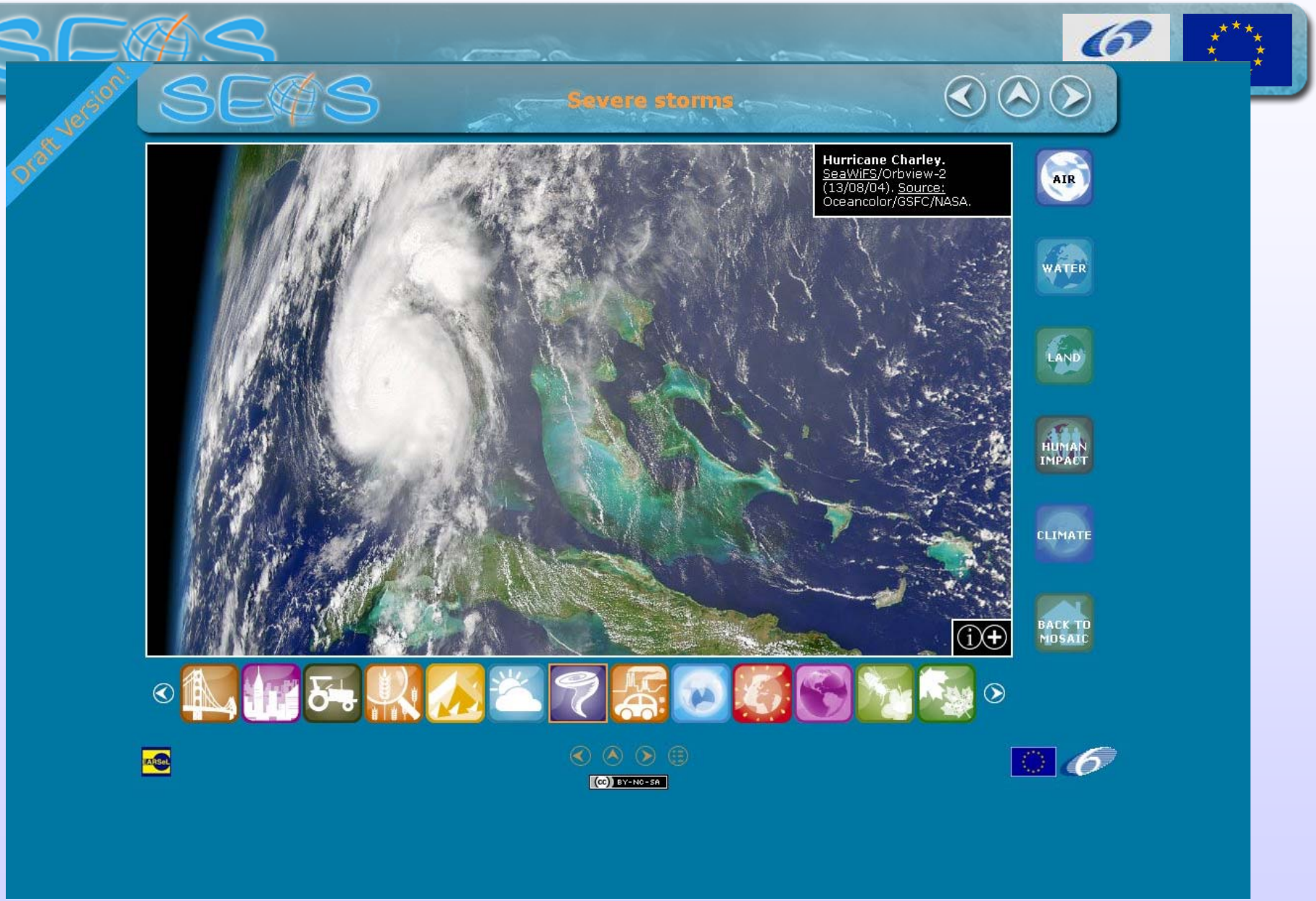
The precise reason for coral bleaching is unknown but the phenomenon is associated with increased water temperatures, low salinity and high sunlight levels.

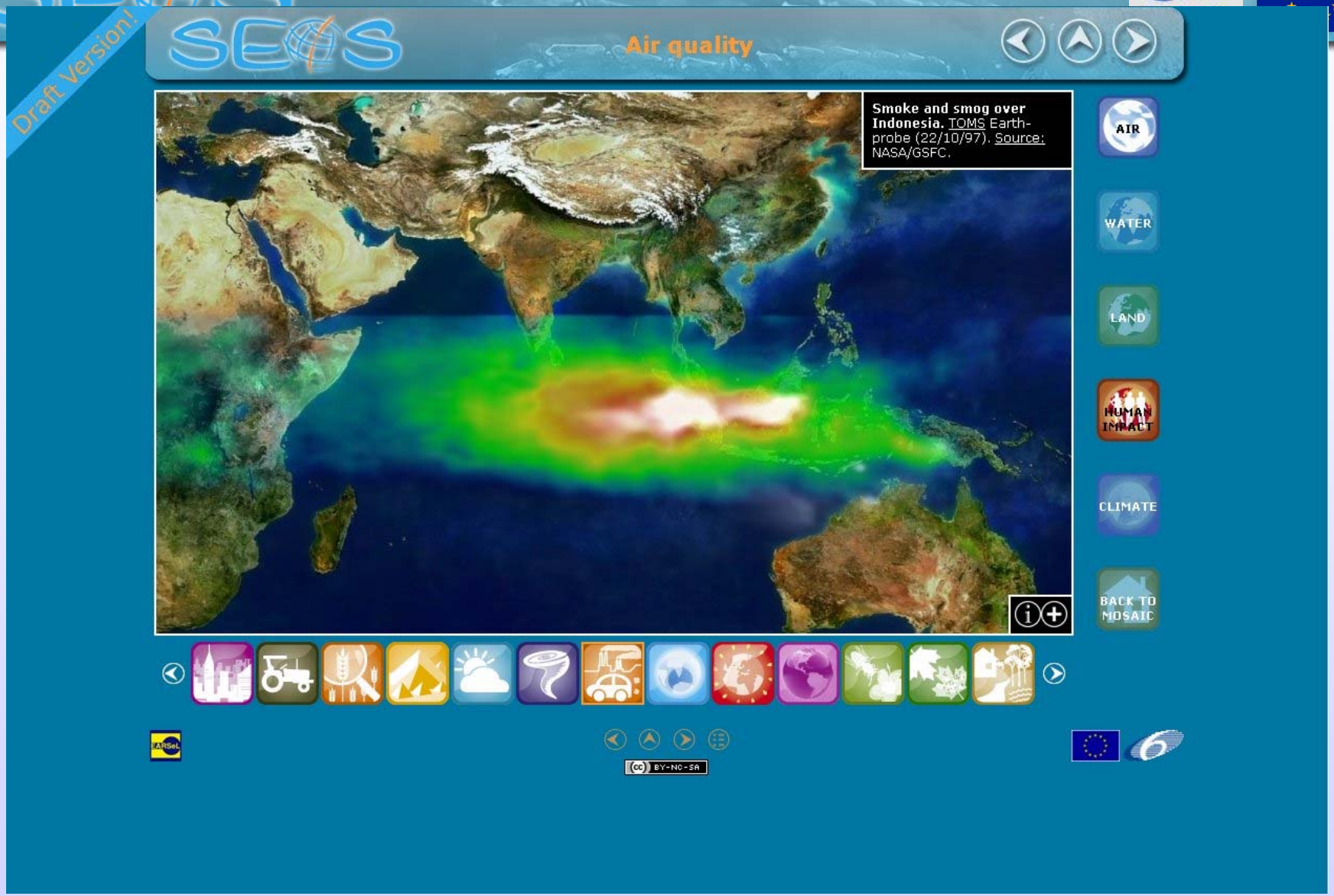
Online tour

- A look at the module pages
- http://modules.seos-project.eu/world-of-images/world-of-images-start-c00-p00.html
- A look at the Teacher's corner


Draft Version!
A World of Images
PLAY MOVIE
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
INDEX
Choose an image to get started !
(cc) BY-NC-SA


Draft Version!
Weather forecast
Western Europe.
SEVIRI/Meteosat-9
(28-29/04/08).
Source: EUMETSAT.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
EUMETSAT
BY-NC-SA


Draft Version!
Severe storms
Hurricane Charley.
SeaWiFS/Orbview-2
(13/08/04). Source:
Oceancolor/GSFC/NASA.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
BY-NC-SA


Draft Version!
Air quality
Smoke and smog over Indonesia. TOMS Earth-probe (22/10/97). Source: NASA/GSFC.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
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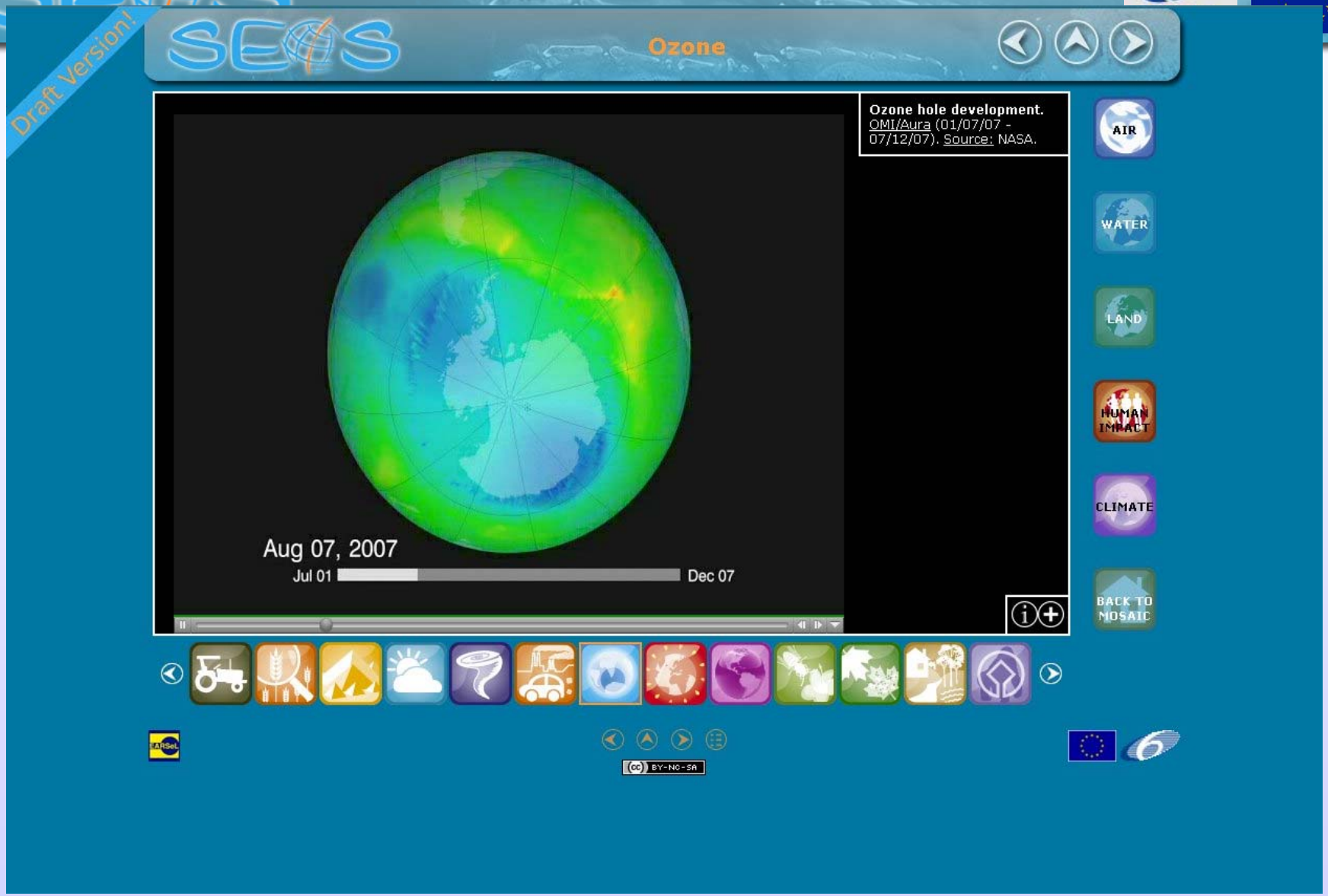
Draft Version!
Ozone
Ozone hole development.
OMI/Aura (01/07/07 - 07/12/07). Source: NASA.
Aug 07, 2007
Jul 01
Dec 07
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
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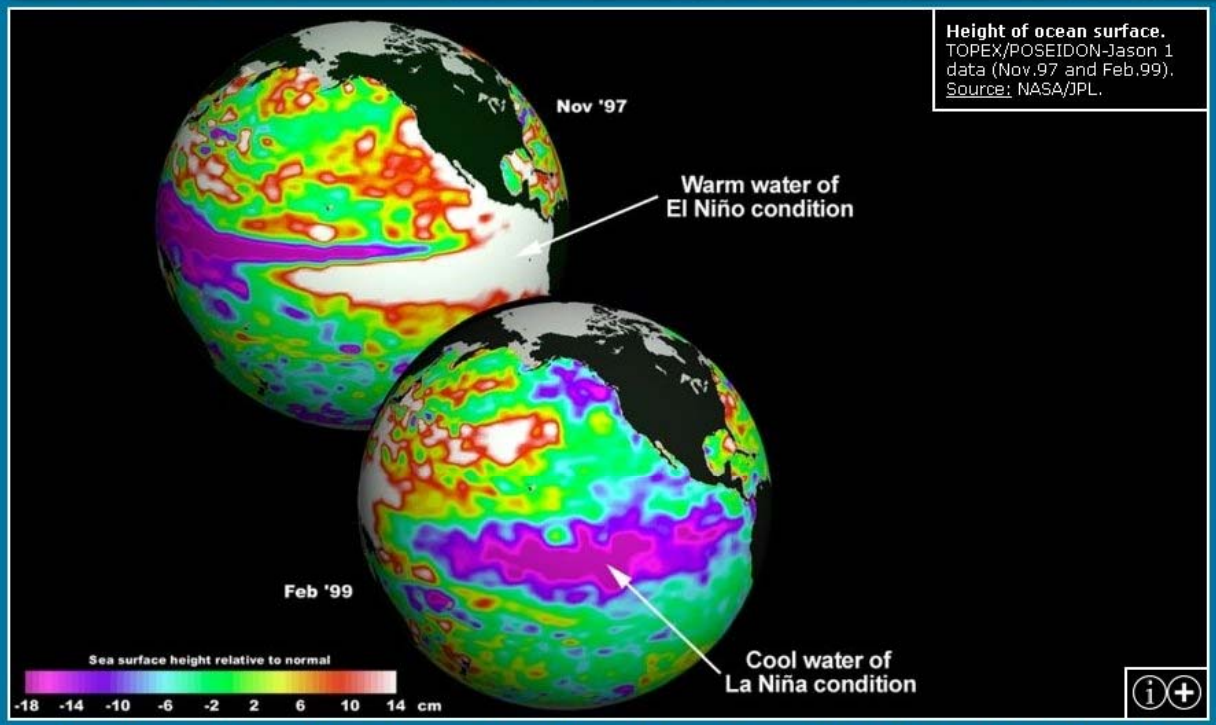
Draft Version!

El Niño and la Niña



AIR

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LAND

HUMAN IMPACT

CLIMATE

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Draft Version!
Biodiversity
Lena Delta (Russia).
Landsat 7 (27/07/00).
Source: USGS/EROS and NASA Landsat Project Science Office.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
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EARSeL
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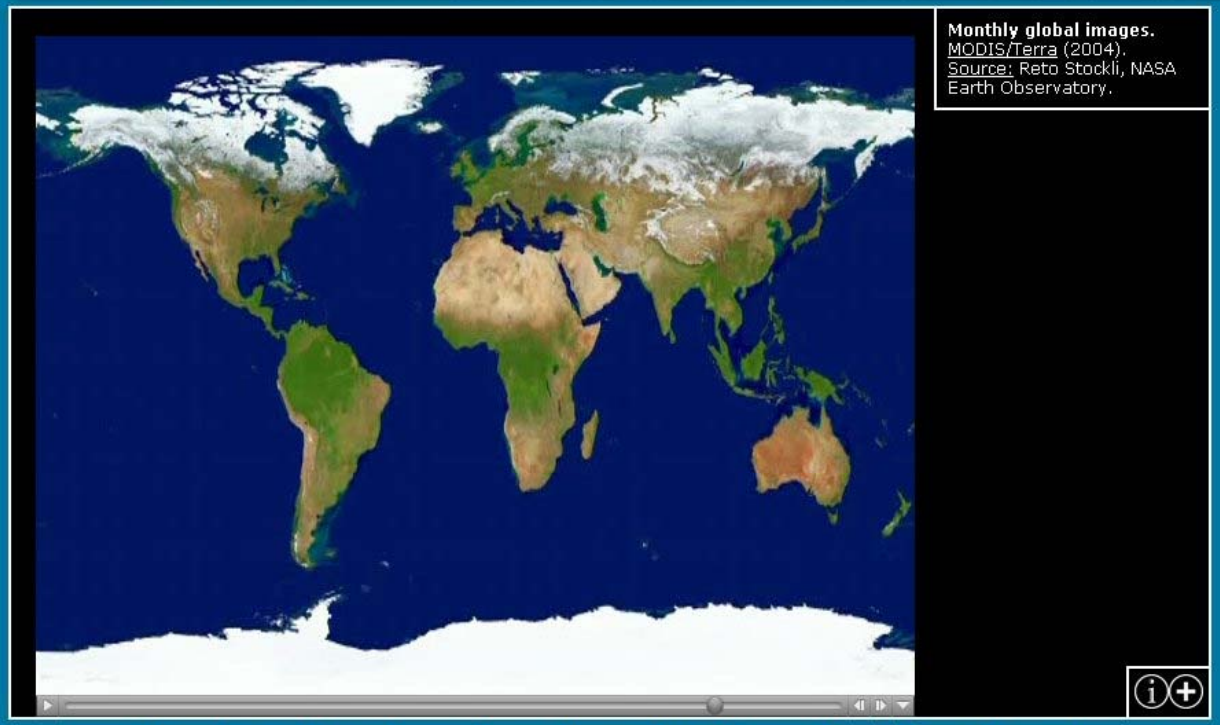
Draft Version!

SEOS

Vegetation status



Monthly global images.
MODIS/Terra (2004).
Source: Reto Stockli, NASA Earth Observatory.

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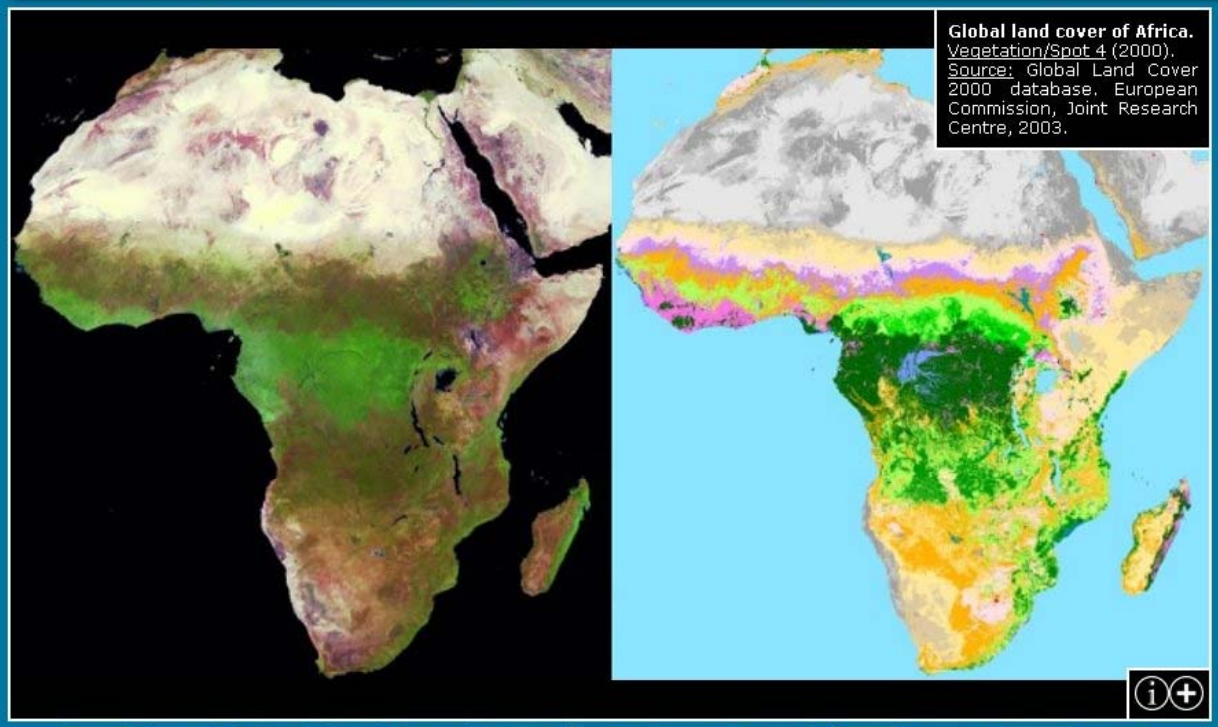
Draft Version!

SEOS

Land cover



Global land cover of Africa. Vegetation/Spot 4 (2000). Source: Global Land Cover 2000 database. European Commission, Joint Research Centre, 2003.

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HUMAN IMPACT

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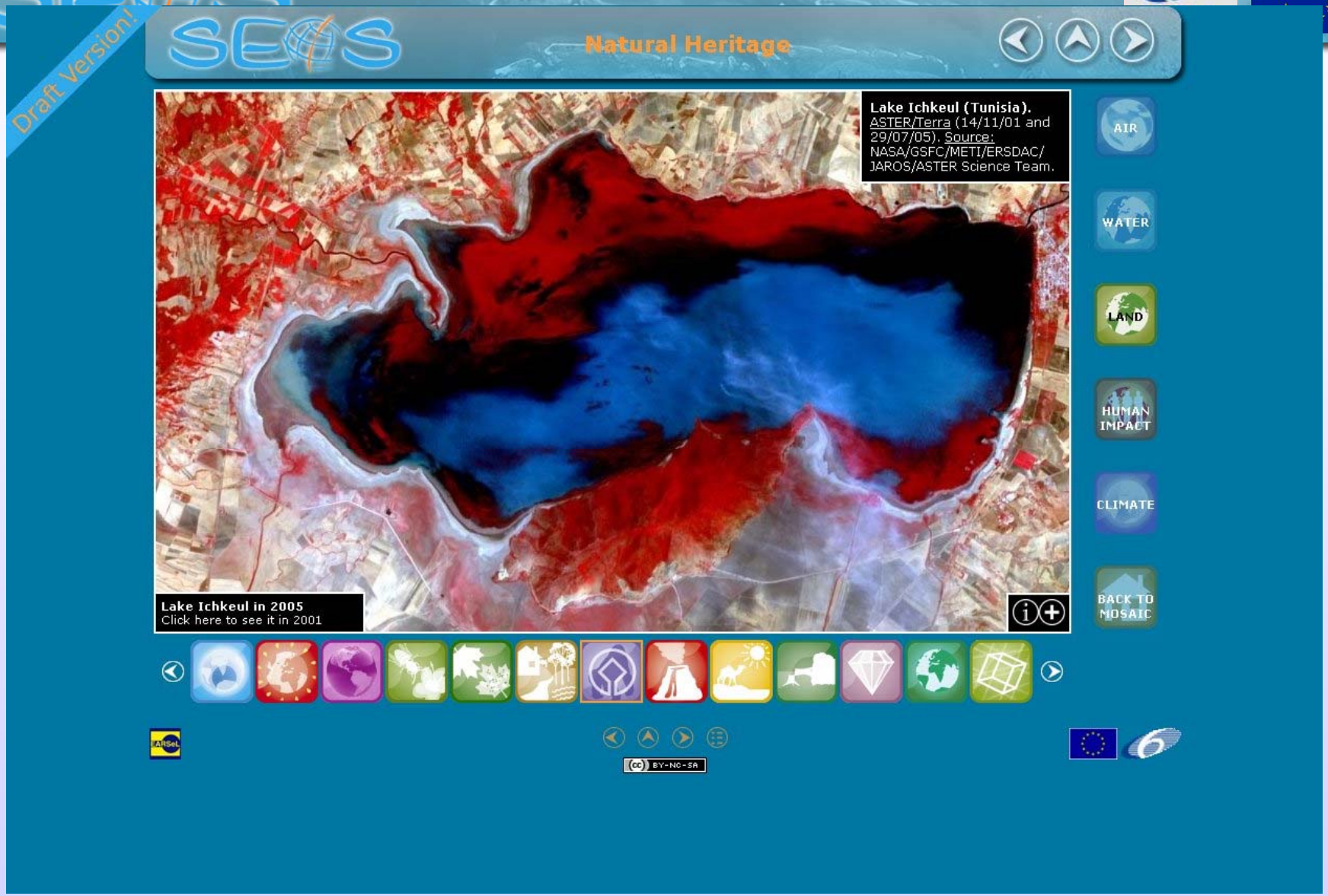
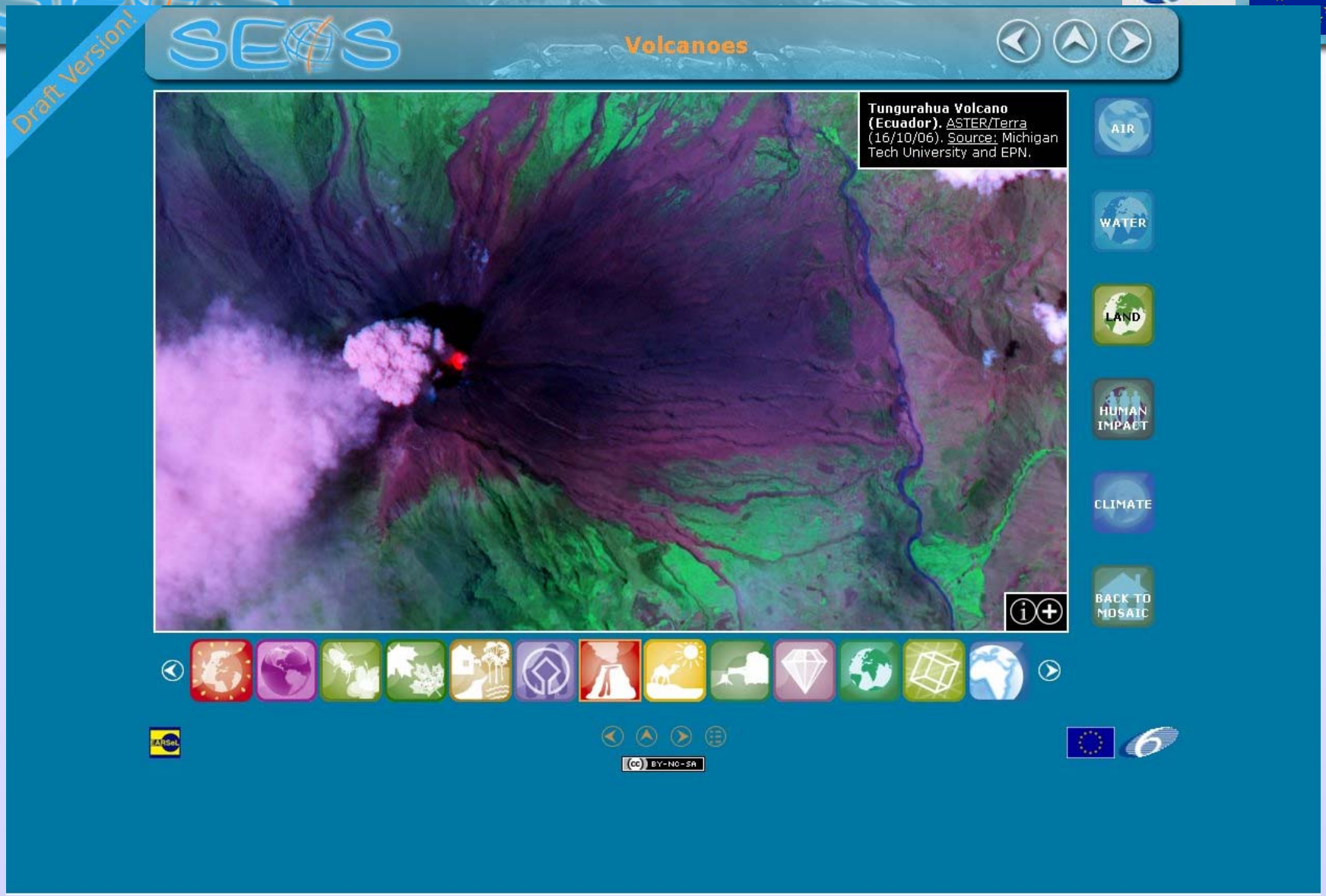

Draft Version!
Natural Heritage
Lake Ichkeul (Tunisia). ASTER/Terra (14/11/01 and 29/07/05). Source: NASA/GSFC/METI/ERSDAC/ JAROS/ASTER Science Team.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
Lake Ichkeul in 2005
Click here to see it in 2001
BY-NC-SA


Draft Version!
SEOS
Volcanoes
Tungurahua Volcano (Ecuador). ASTER/Terra (16/10/06). Source: Michigan Tech University and EPN.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
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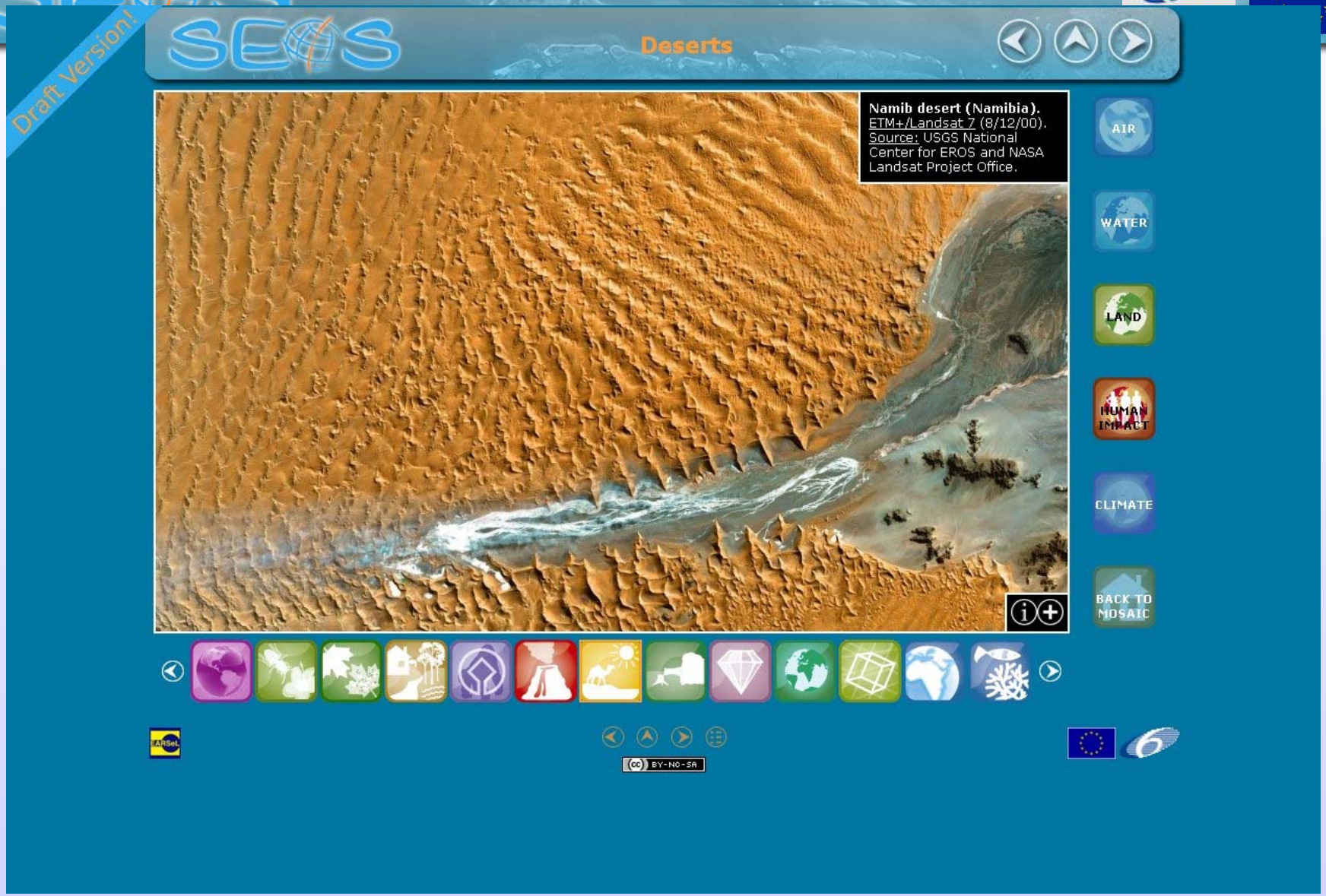
Draft Version!
Deserts
Namib desert (Namibia).
ETM+/Landsat 7 (8/12/00).
Source: USGS National Center for EROS and NASA Landsat Project Office.
AIR
WATER
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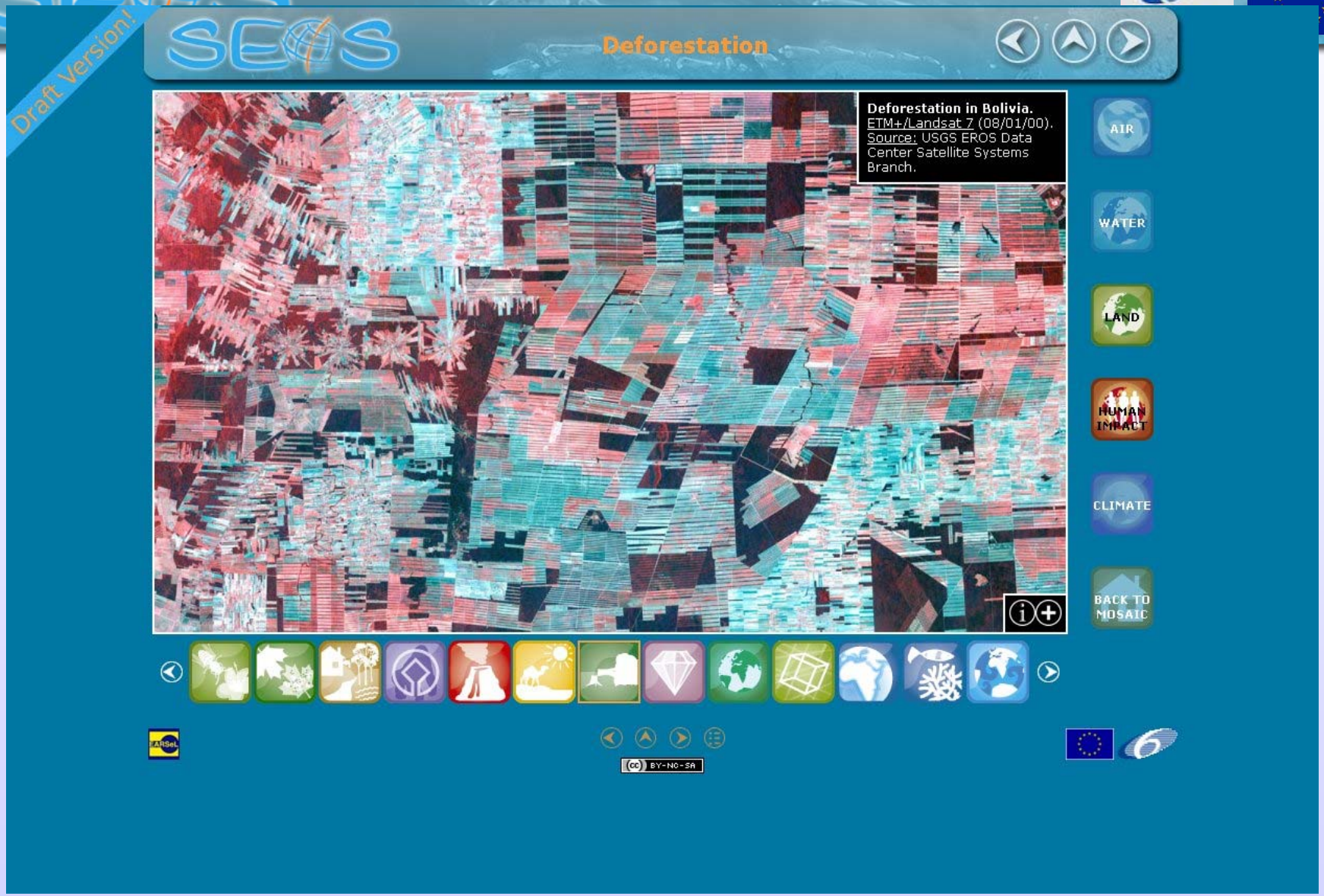
CLIMATE
BACK TO MOSAIC
(cc) BY-NC-SA


Draft Version!
Deforestation
Deforestation in Bolivia.
ETM+/Landsat 7 (08/01/00).
Source: USGS EROS Data Center Satellite Systems Branch.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
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Draft Version!
Geology
Escondida mine (Chile).
ASTER/Terra (23/04/00).
Source: NASA/GSFC/METI/
ERSDAC/JAROS/ASTER
Science Team.
AIR
WATER
LAND
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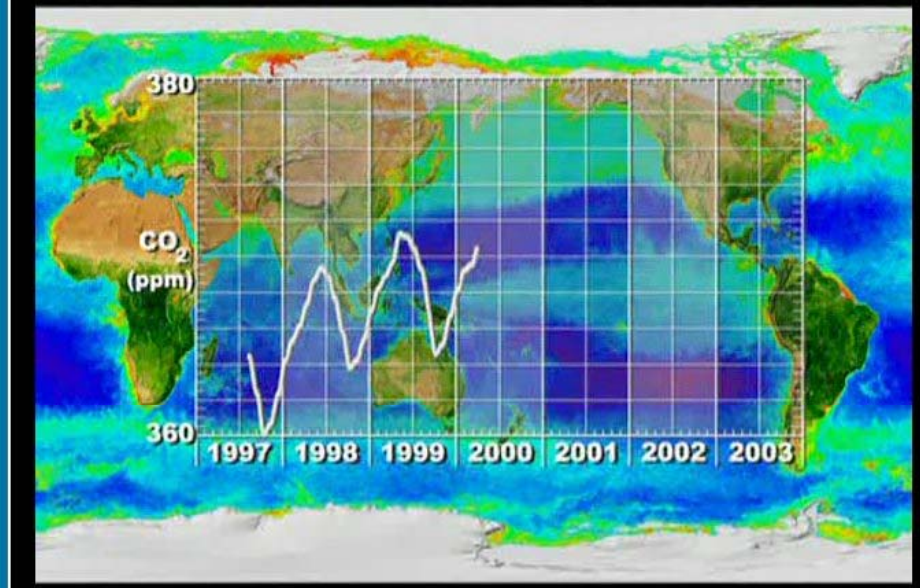
CLIMATE
BACK TO MOSAIC
Escondida mine SWIR image
Click here to see VNIR image
(cc) BY-NC-SA

Draft Version!

The global biosphere



Global biosphere and CO_2.
SEaWiFs and ground data.
Source: GSFC/NASA, SeaWiFS Project, GeoEye.

AIR
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HUMAN IMPACT
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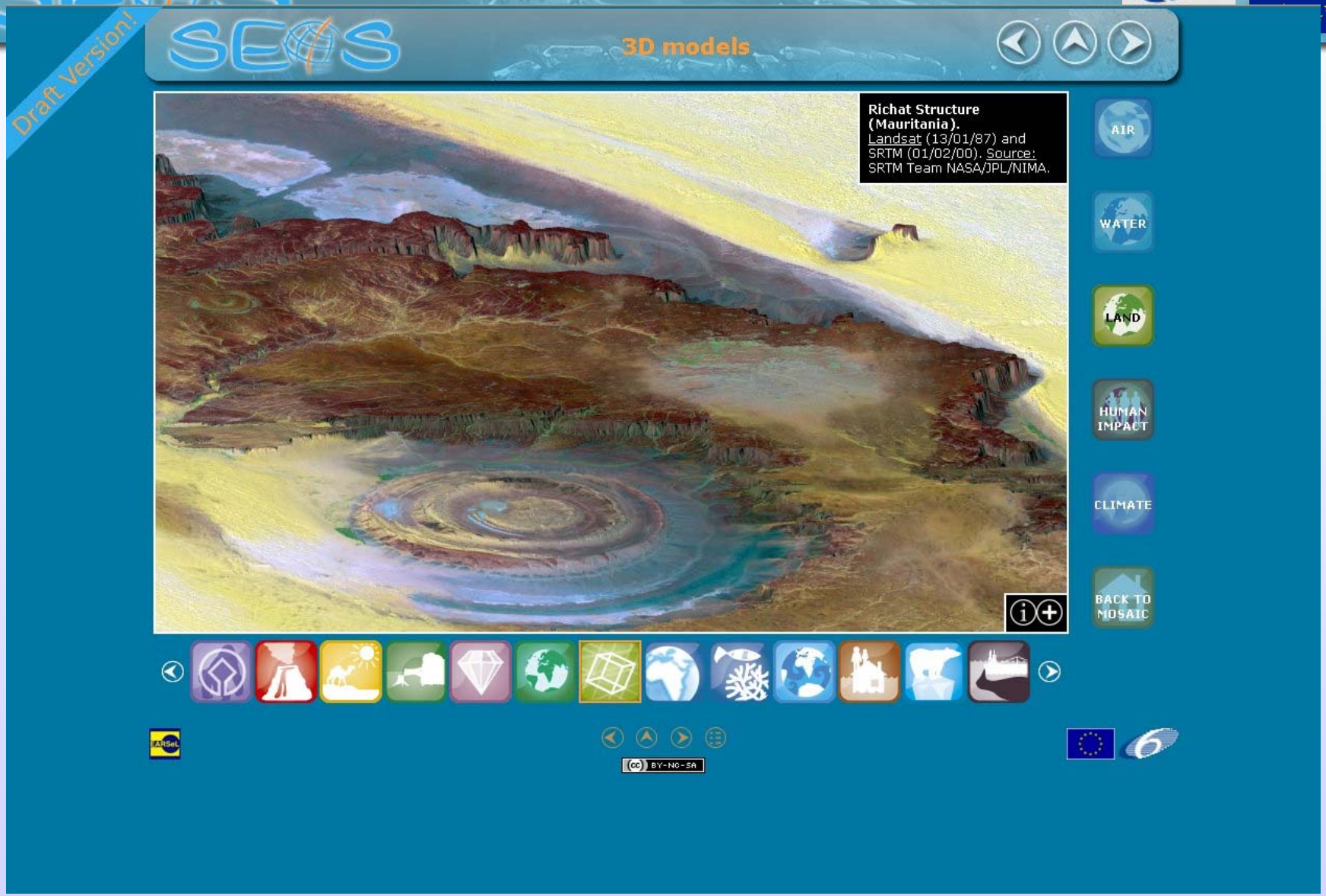
BACK TO MOSAIC


Draft Version!
3D models
Richat Structure (Mauritania).
Landsat (13/01/87) and SRTM (01/02/00). Source: SRTM Team NASA/JPL/NIMA.
AIR
WATER
LAND
HUMAN IMPACT
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Draft Version!
Coastal zones
Bangladesh coastline.
MERIS/Envisat (08/11/03).
Source: ESA.
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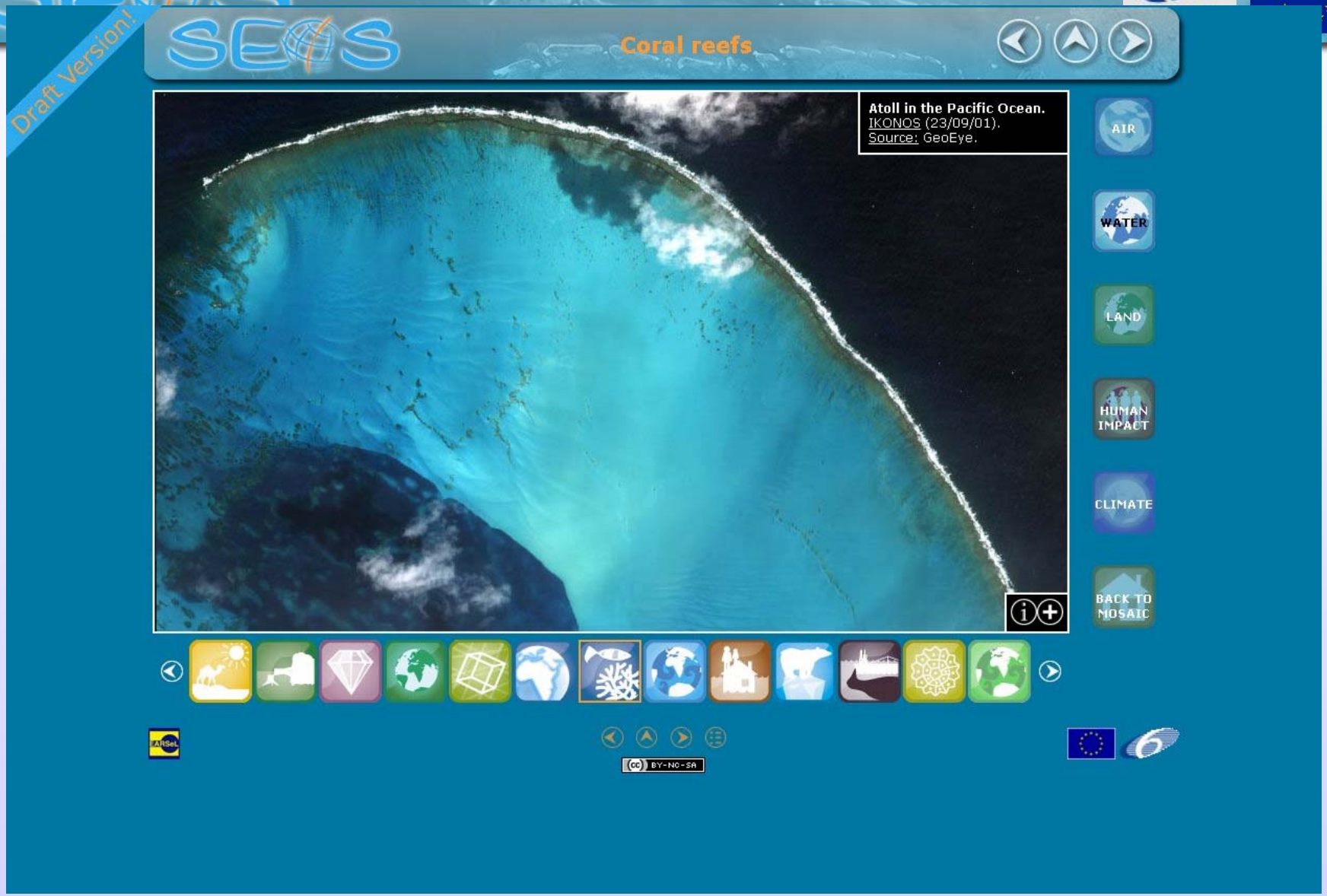
Draft Version!
Coral reefs
Atoll in the Pacific Ocean.
IKONOS (23/09/01).
Source: GeoEye.
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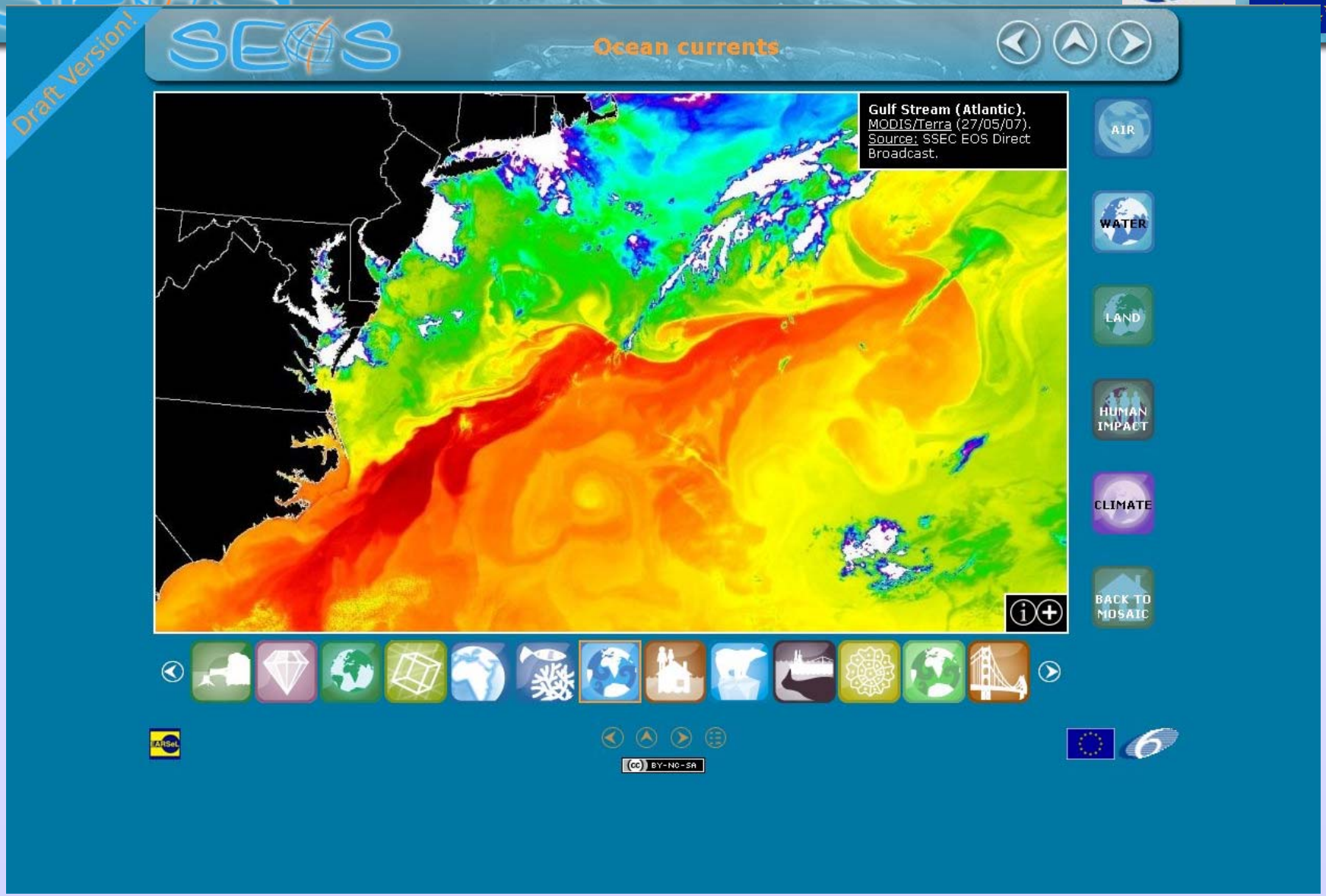
Draft Version!
Ocean currents
Gulf Stream (Atlantic).
MODIS/Terra (27/05/07).
Source: SSEC EOS Direct Broadcast.
AIR
WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
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Draft Version!
Floods
White River (USA).
ASTER/Terra (14/04/06 and 07/04/08). Source: NASA/ GSFC/METI/ERSDAC/JAROS/ ASTER Science Team.
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WATER
LAND
HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
White River in April 2008
Click here to see it in April 2006
EARSeL
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Draft Version!
Ice melting
Wilkins shelf disintegration (Antartica). Formosat-2 (08/03/08). Source: Cheng-Kung University and Taiwan Space Organisation.
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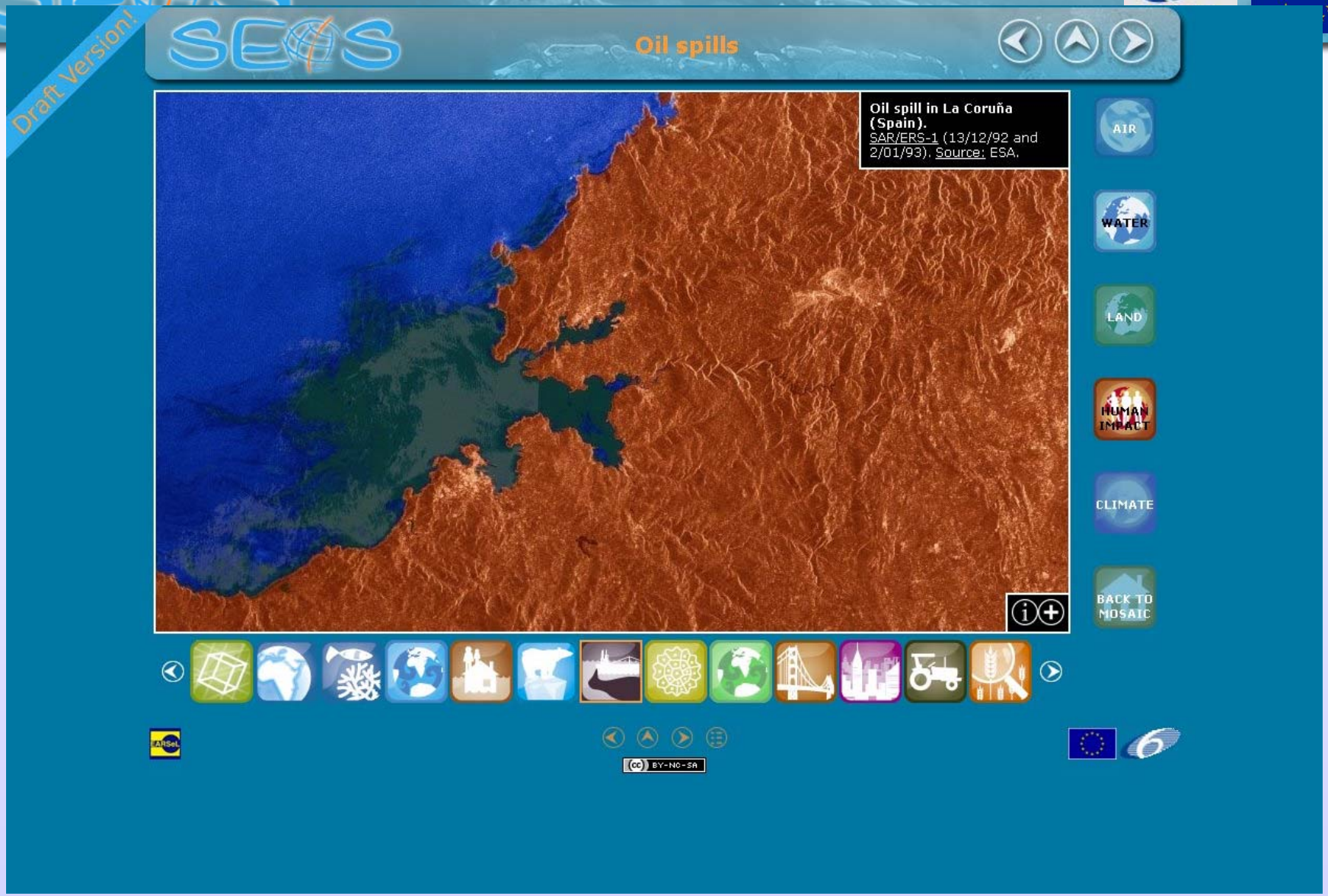
Draft Version!
Oil spills
Oil spill in La Coruña (Spain).
SAR/ERS-1 (13/12/92 and 2/01/93). Source: ESA.
AIR
WATER
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HUMAN IMPACT
CLIMATE
BACK TO MOSAIC
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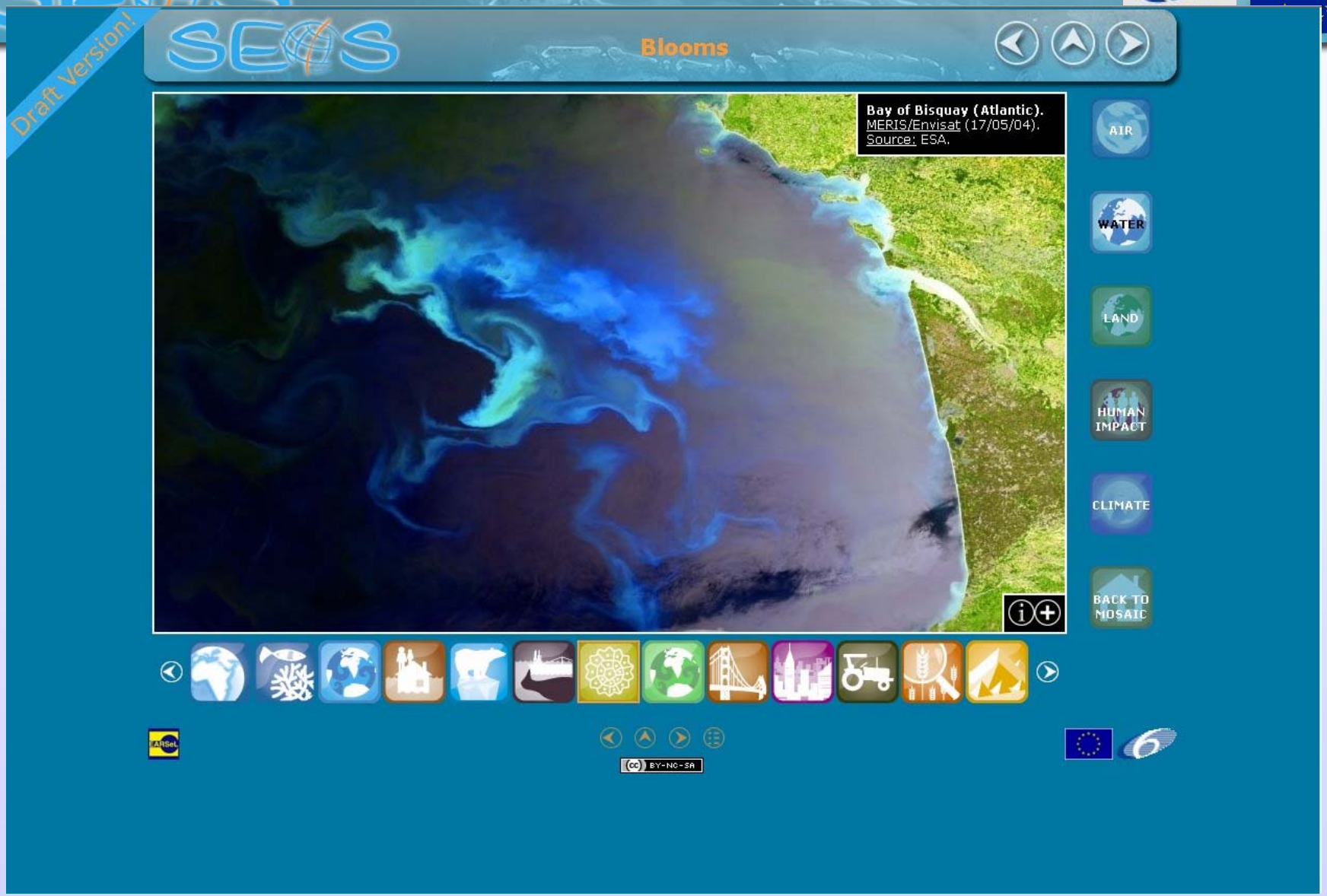
Draft Version!
Blooms
Bay of Bisquay (Atlantic).
MERIS/Envisat (17/05/04).
Source: ESA.
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Coastal upwelling

Upwelling along the Sahara. MERIS/Envisat (22/03/02). Source: ESA.

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WATER

LAND

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Draft Version!
Man-made wonders
Durrat Al Bahrain (Bahrain). KOMPSAT-2 (01/04/07). Source: KARI 2007, Spot Image.
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LAND
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BACK TO MOSAIC
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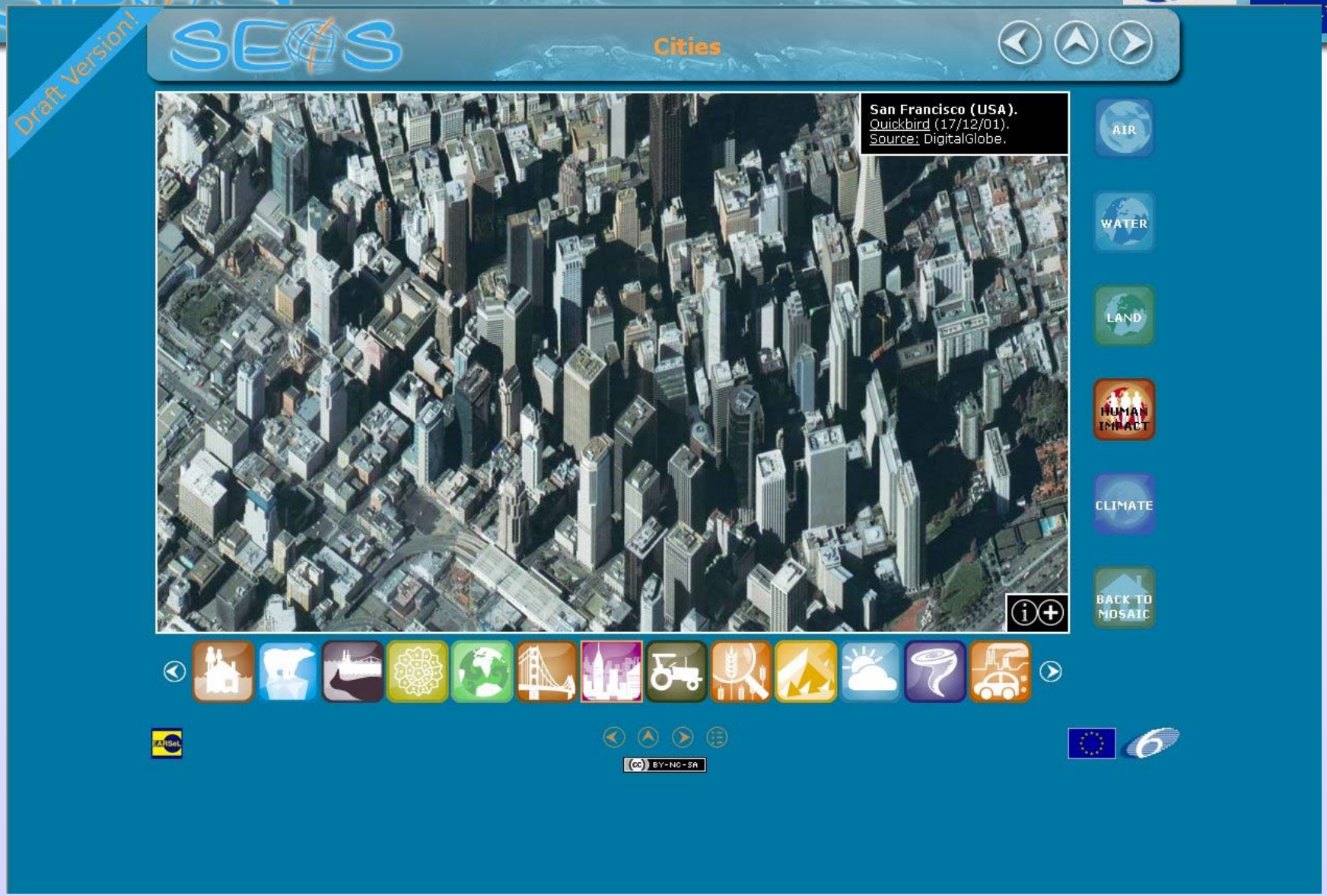
Draft Version!
Cities
San Francisco (USA).
Quickbird (17/12/01).
Source: DigitalGlobe.
AIR
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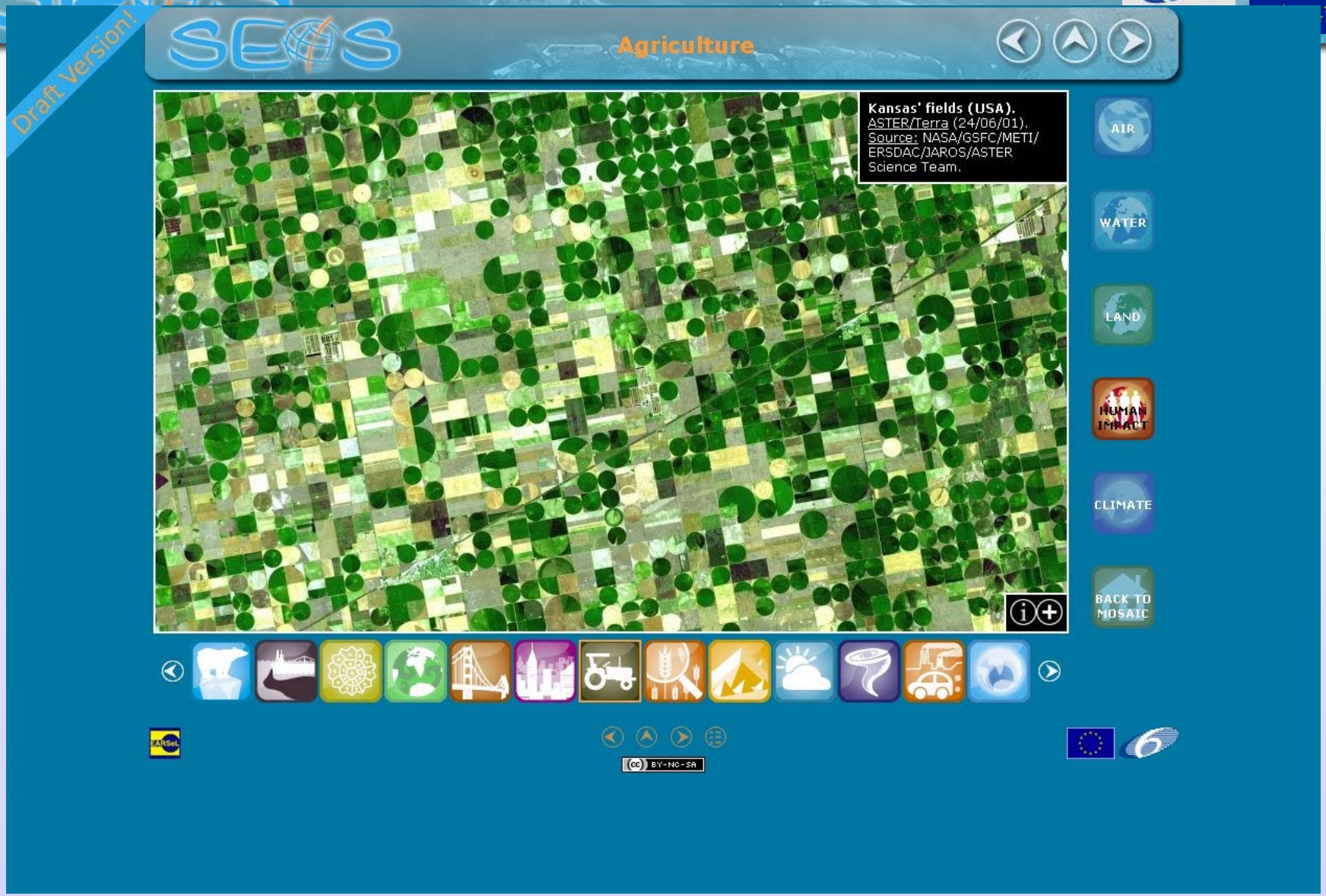
Draft Version!
Agriculture
Kansas' fields (USA).
ASTER/Terra (24/06/01).
Source: NASA/GSFC/METI/
ERSDAC/JAROS/ASTER
Science Team.
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WATER
LAND
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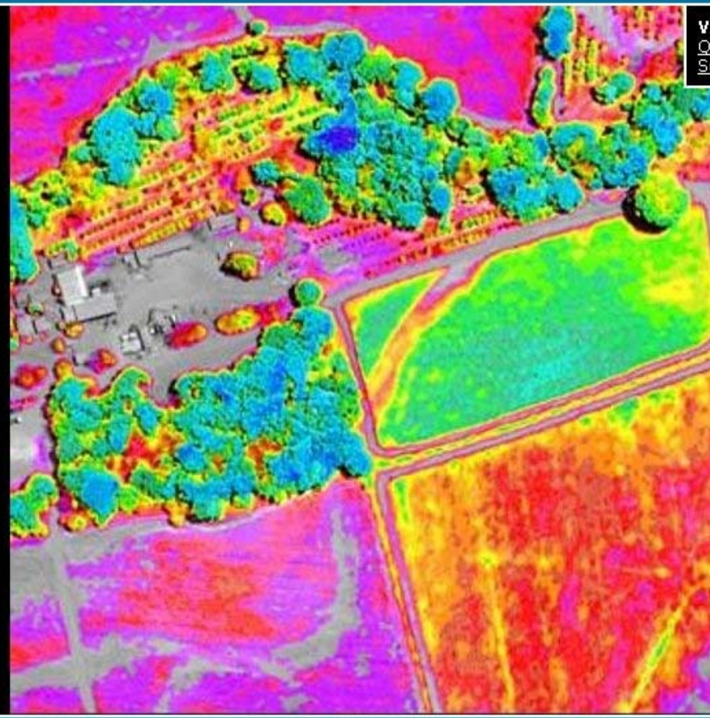
Draft Version!

SEOS

Precision farming



Vegetation vigour.
Quickbird data.
Source: DigitalGlobe.

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HUMAN IMPACT

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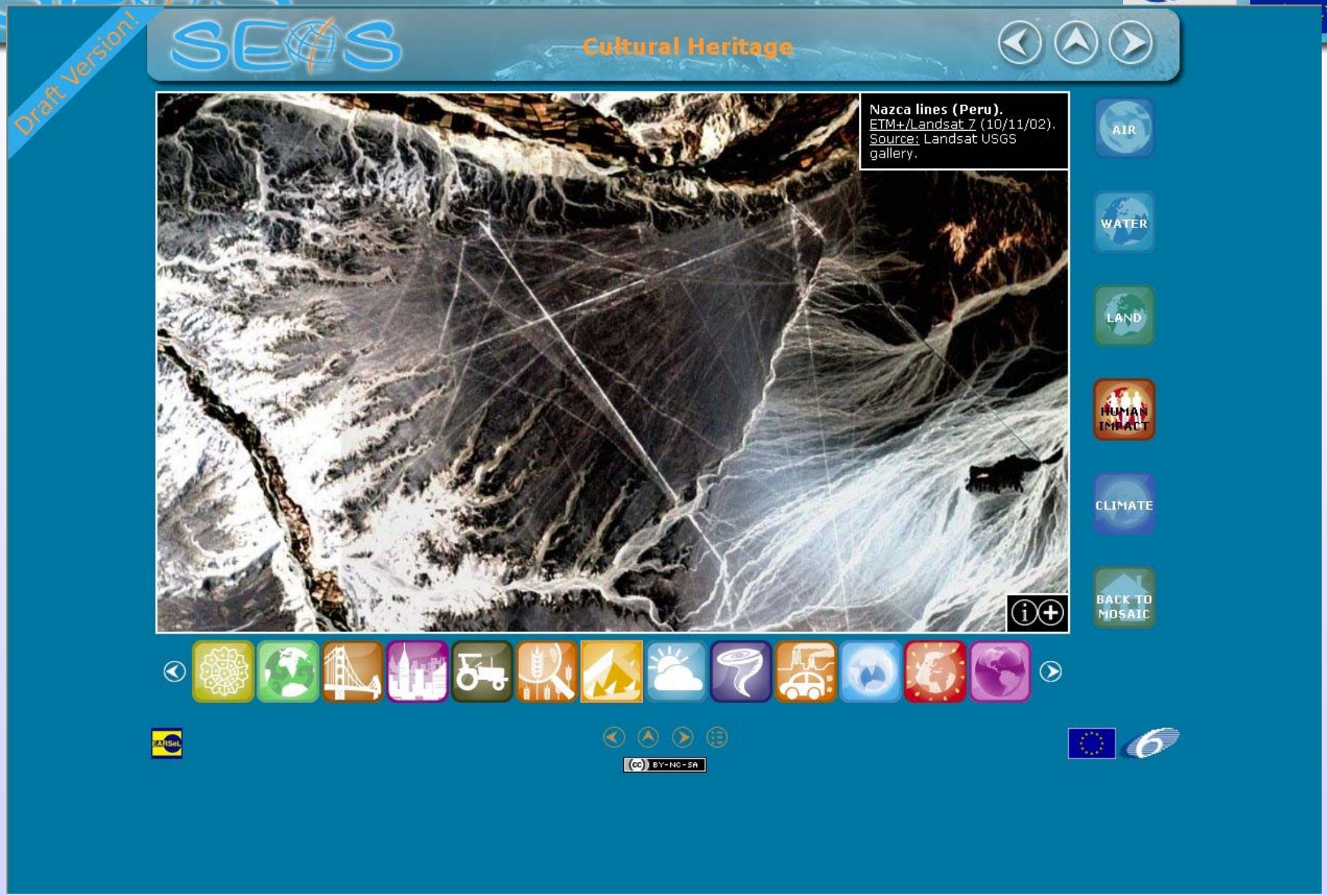
Draft Version!
Cultural Heritage
Nazca lines (Peru).
ETM+/Landsat 7 (10/11/02).
Source: Landsat USGS gallery.
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LAND
HUMAN IMPACT
CLIMATE
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To download/to check out:
- Teacher's instructions.
- Article to be printed or modified for use in class (24 MB .rtf file).

To learn about Earth observation and satellite images

Tutorials, worksheets - Eduspace website

Subjects: Geography, Science.

Overview: The website aims to give to the youth of Europe a portal to space applications and in particular to a wide-spread visibility of Earth Observation as co-ordinated by the European Space Agency (ESA) and its European and National Partners. The website is being developed under the umbrella of EURISY and offers to teachers and students of secondary school in Europe means to bring Earth Observation into the classroom.

Materials: An internet access to the Eduspace website (available in French, Dutch, English, Danish, Spanish, Portuguese, German and Italian).

Source: Eduspace.

Tutorial - EOEdu website

Subjects: Geography, Science.

Overview: An educational website to discover satellite Earth Observation. The website is divided into 6 parts: **Introducing remote sensing** (a tutorial explaining the basis of remote sensing, data acquisition, image processing, radar and GIS), **Applications** (a list of projects and applications based on Earth observation techniques), **Satellites and sensors** (a list of satellites and sensors, with detailled explanation on wheather satellites and interpretation of cloud images), **Teacher's corner** (a list of educative resources and news), **Links** and **Glossary**.

Materials: An internet access to the EOEdu website (available in English, French and Dutch).

Source: EOEdu © Belgian Science Policy. All rights reserved.

Tutorials, worksheets - Outreach material from the Canada Center for Remote Sensing

Subjects: Geography, Science.

Overview: A selection of tutorials about **Fundamentals of remote sensing**, **Digital images** and digital analysis techniques, **Satellite data reception**, **Radar** remote sensing, polarimetry and stereoscopy and an **Image interpretation quiz** .

Materials: An internet access to the website (available in English and French).

Source: Natural Resources Canada/CCRS.

Worksheets - Earth Observation in the classroom

Subjects: Geography, Physics, Chemistry.

Overview: A set of 5 fiches demonstrating the usefulness of remote sensing to be used in the science curricula: **Introduction to remote sensing**, **Calculating cyclones' speed**, **Mapping floods**, **Monitoring photosynthesis** and **Tracking oil spills**.

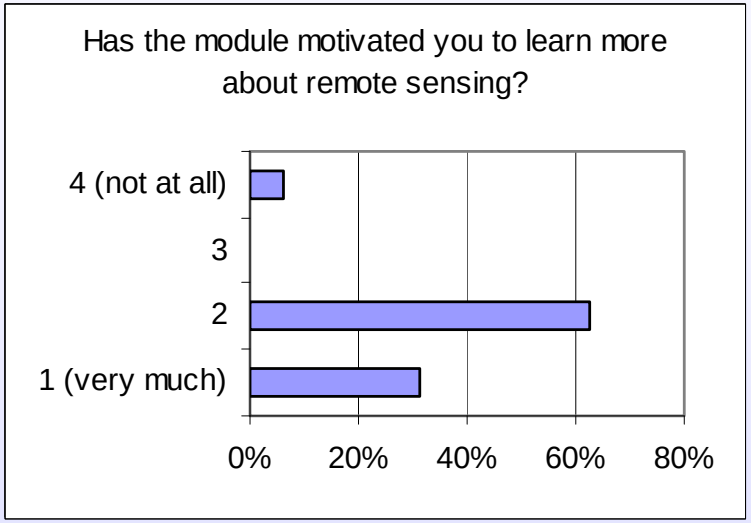
Testing in high schools

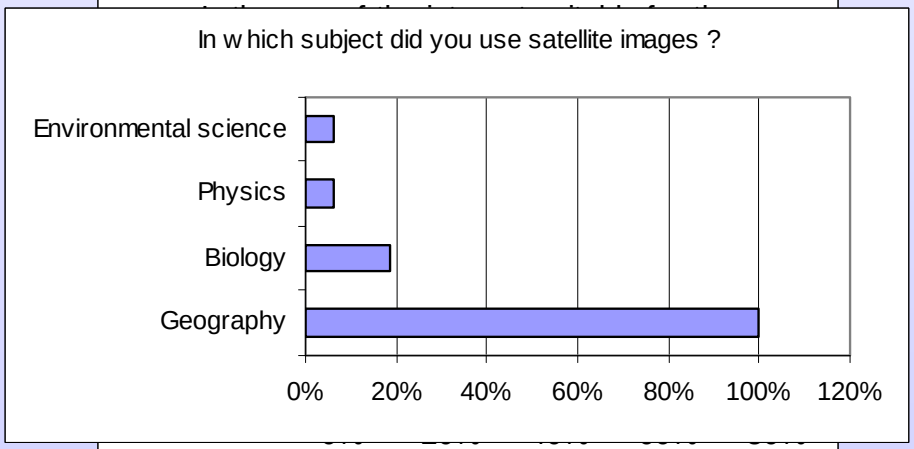
- 3 tests in Belgium and UK
- Pupils visited the module while seaking answers to one of the quizzes
- Pupils gave useful comments to improve the module
- Feed-back:
  - Straightforward navigation
  - Nice layout, nice pictograms
  - Scientific content but easy to understand
  - Images sometimes difficult to interpret but very well explained
  - Interesting topics
  - Beautiful images

➔ Successful first approach of RS and EO

Test UK – Sept. 2008 (16 pupils)

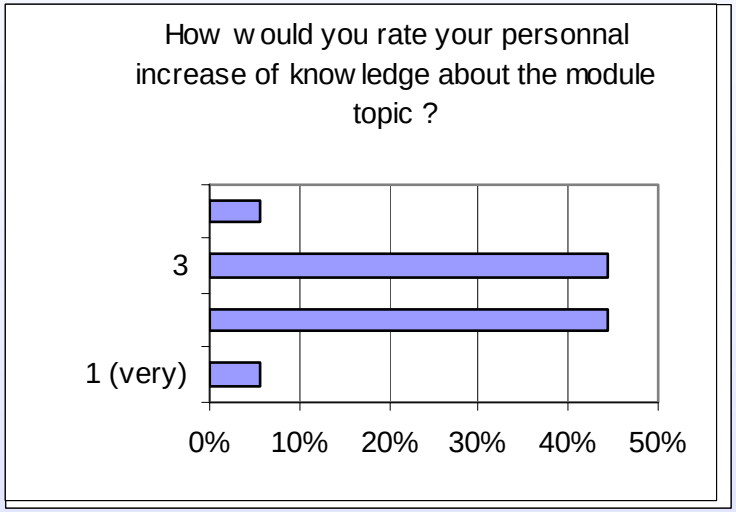
- What did you like ?
  - beautiful images
  - nice symbols, nice structure
  - helpful explanation about each picture
- Improvements ?
  - Quiz too long
  - Colour codes, labels, more information on the image details
- Motivated to learn more ?
  - Yes. *"It makes you look at the world in a different way. A fresh look."*

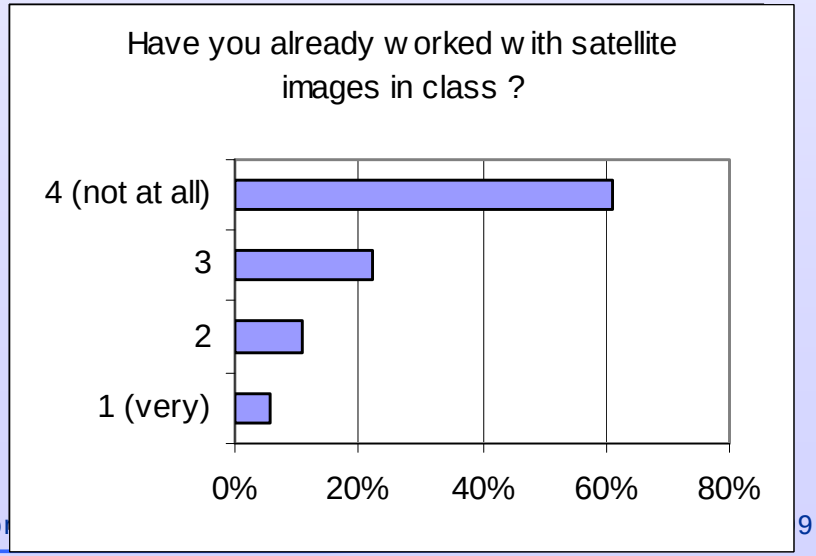




Test Belgium – Oct. 2008 (18 pupils)

- What did you like ?
  - beautiful images + zoom
  - nice symbols
  - the quiz
  - clear explanations
- Improvements ?
  - Another language
  - Global overview would help navigating
- Motivated to learn more ?
  - Not really. *"It's nice to catch new things but I'm not really interested in that topic."*



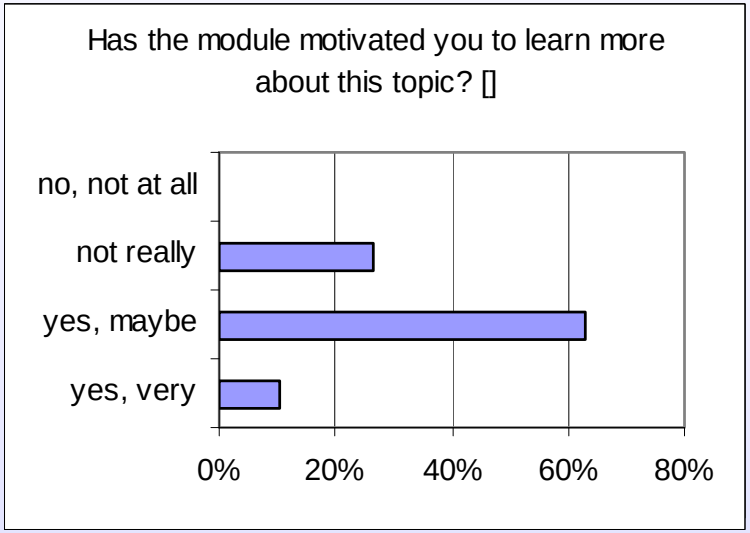


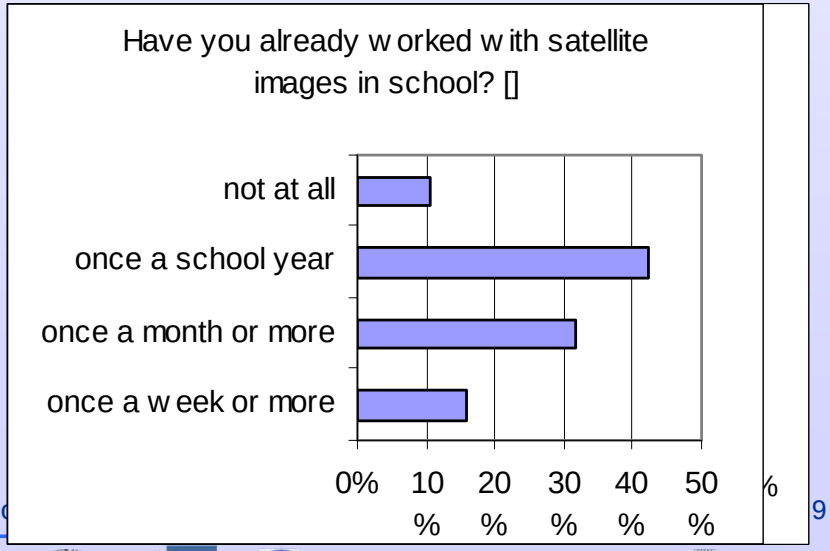
Test Belgium – Jan. 2009 (19 pupils)

- What did you like ?
  - beautiful images
  - pictograms
  - diversity
  - explanation boxes

- Improvements ?
  - Another language
  - Shorter loading time

- Motivated to learn more ?
  - Yes, maybe. "*You learn that remote sensing techniques are used in a lots of researches about current environmental problems and how to map these problems. You are surprised by the diversity.*"



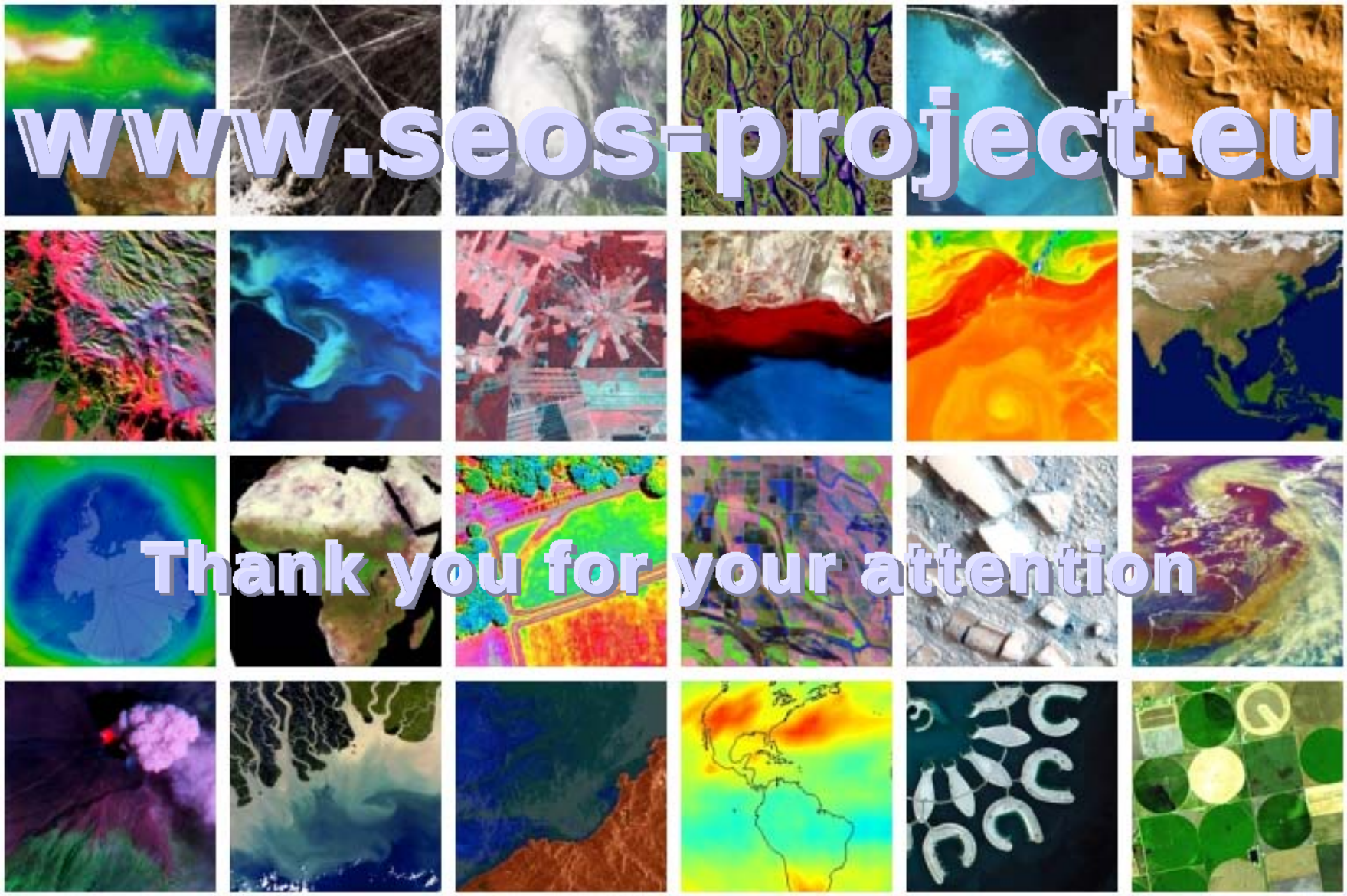


Teachers's comments

- Teacher A about Teacher's Corner:
  - *It is very clearly set out and at the appropriate level, with excellent resources which challenge the usual ideas and therefore shows the benefit of remote sensing.*
- Teacher B:
  - *I loved the intuitive navigation, going from one image to another through nice visual little icons was great. It is visually very nice. It was interesting and topics were worth knowing about.*
- Teacher C:
  - *Very interesting but not really related to the curricula.*

Dissemination - outreach

- Prerequisite: translation
- European level:
  - Presentation in educational or RS conferences
  - European websites
- National level:
  - Teacher trainings
  - Demonstrations in schools or in special events
  - Outreach through associations of geography teachers
  - Articles in teachers' publications and websites
- Online:
  - www.seos-project.eu
  - www.eoedu.be
  - http://www.esa.int/SPECIALS/Education/
  - Education websites:
    www.eschoolnet.org, http://www.scienceinschool.org, ...


www.seos-project.eu
Thank you for your attention