Capturing Imaginations

Future Directions in EO Education & Training

ESA EO Science 2.0
ESRIN, October 2015

Ravi Kapur

Managing Director, Imperative Space
www.imperativespace.com

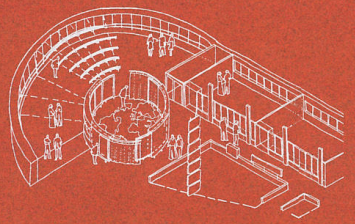
“Learning is the conversion of information into knowledge”

Professor Richard Elmore, Harvard Graduate School

schools for the future

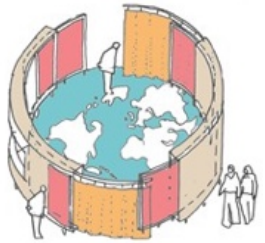
Project Faraday

Exemplar designs for science



department for children, schools and families

project faraday



REDNOCK - PARADAY EXEMPLAR
1:200 @ A3
GOVERN PROPOSAL

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www.our-space.org

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www.youtube.com/user/firstorbit

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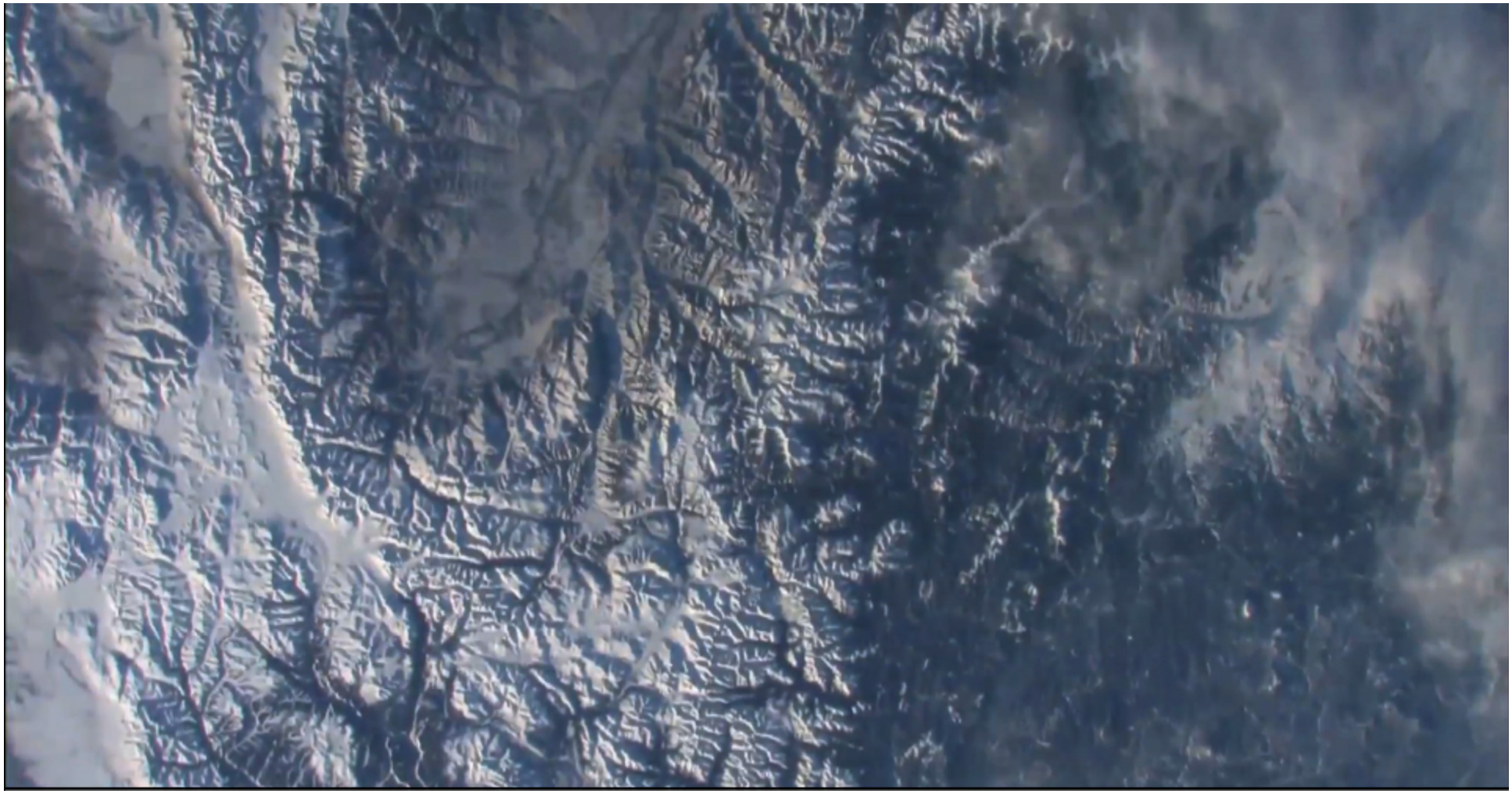

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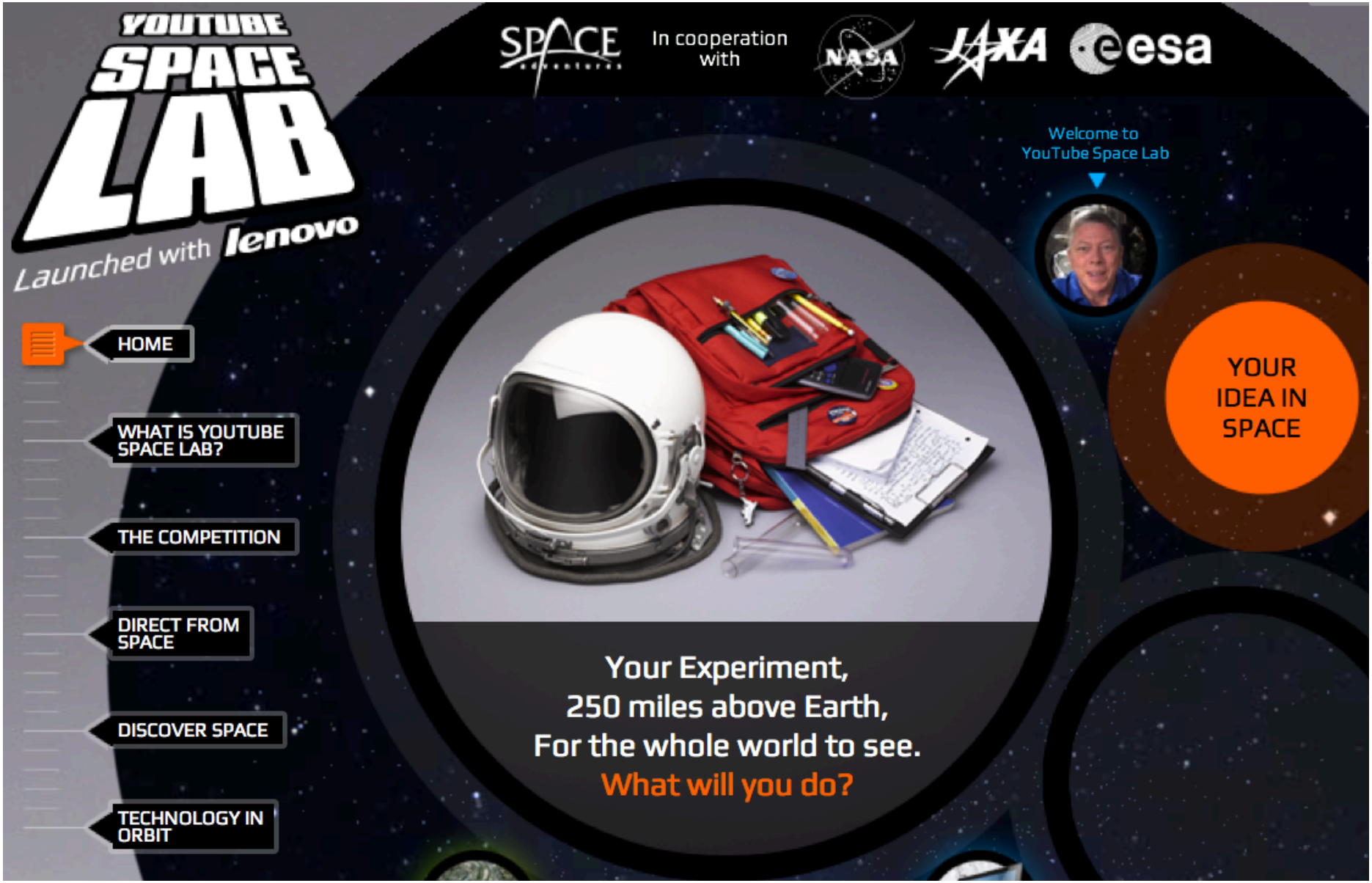

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www.futuremorph.org/my-future-finder/space/day-in-the-life-of/

www.nationalstemcentre.org.uk/elibrary/

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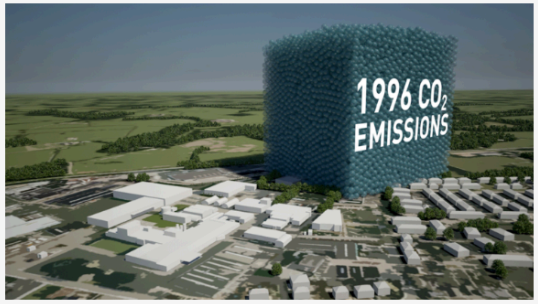
Mars
149,637,908 km

www.spacestudiobanbury.org

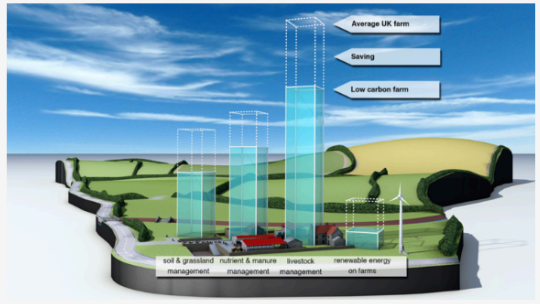


Visualising a 90% carbon reduction

Sep 25, 2014

Animating the world's cars

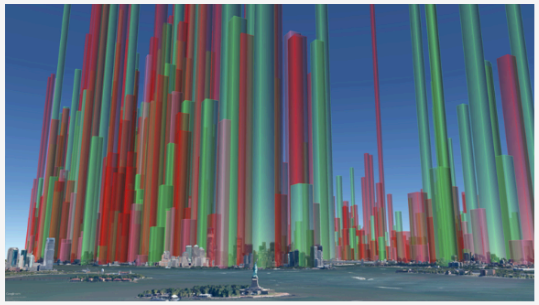
Aug 2, 2014



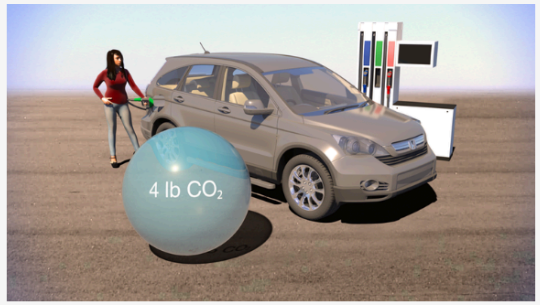
Illustrating low carbon farming

Jul 24, 2014

Carbon Visuals brings radical emissions data to life



Mapping local air pollution in New York



Gasoline from tar sands is different

Jul 1, 2014

www.carbonvisuals.com

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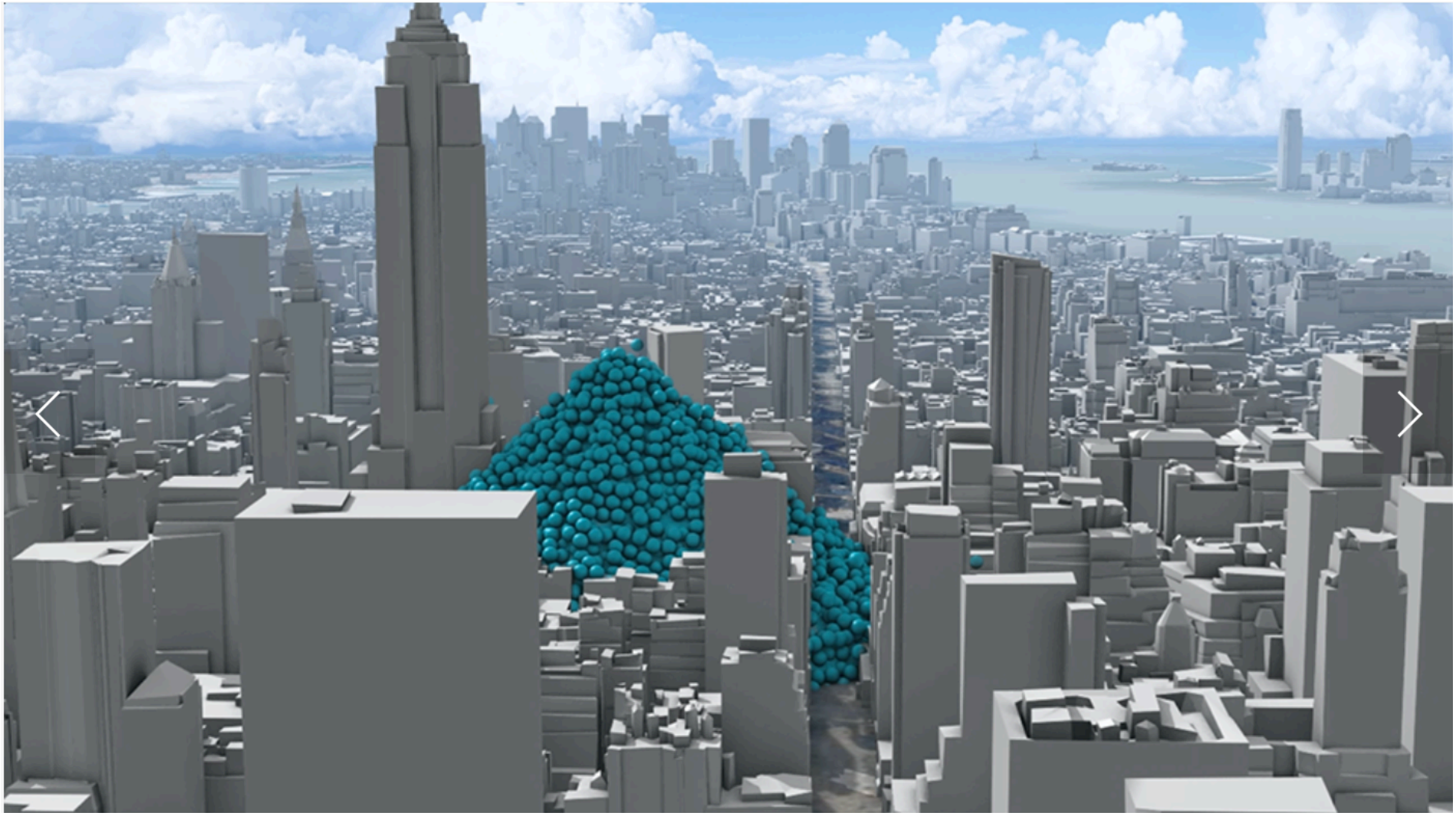

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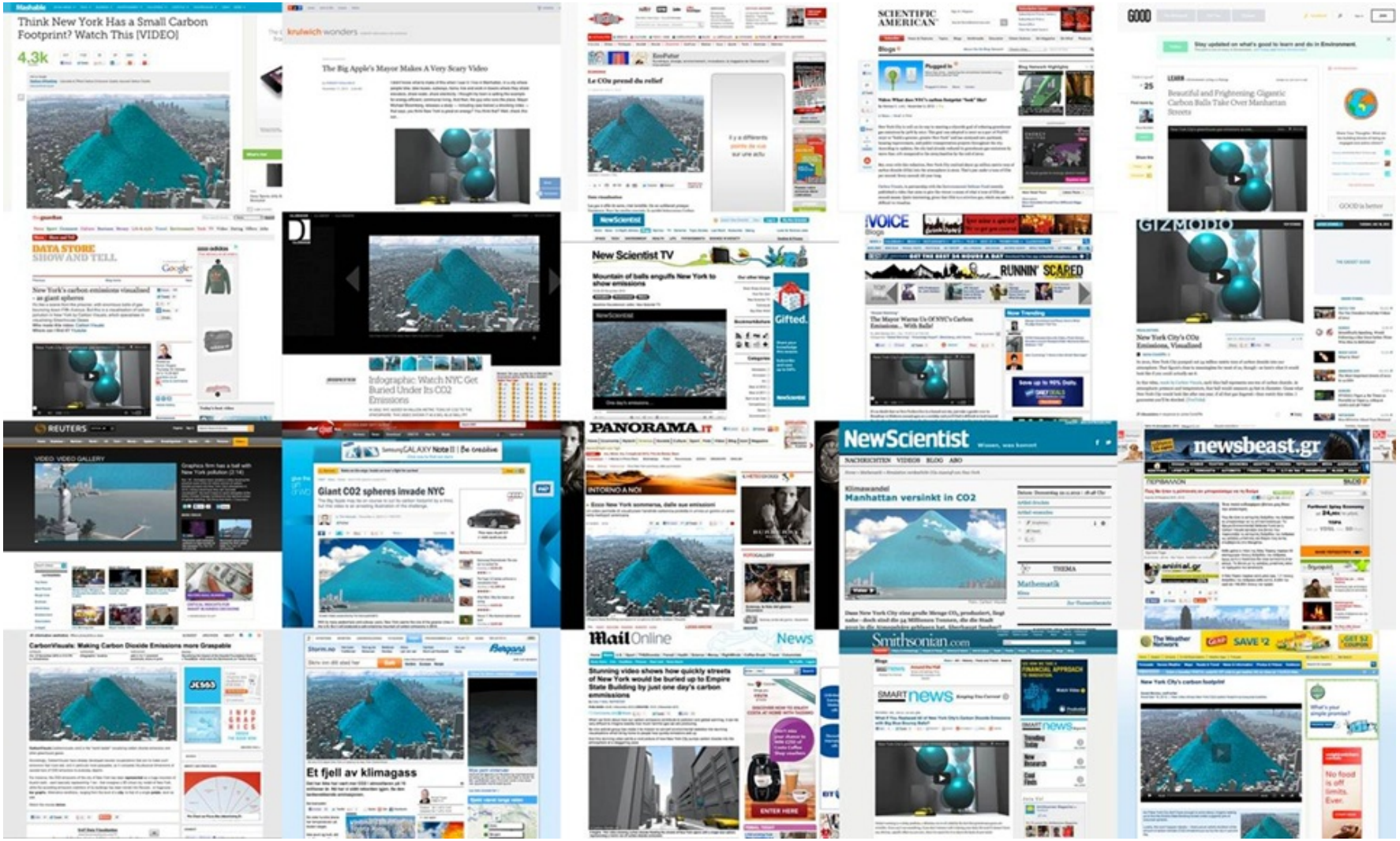

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www.change-ringing.co.uk

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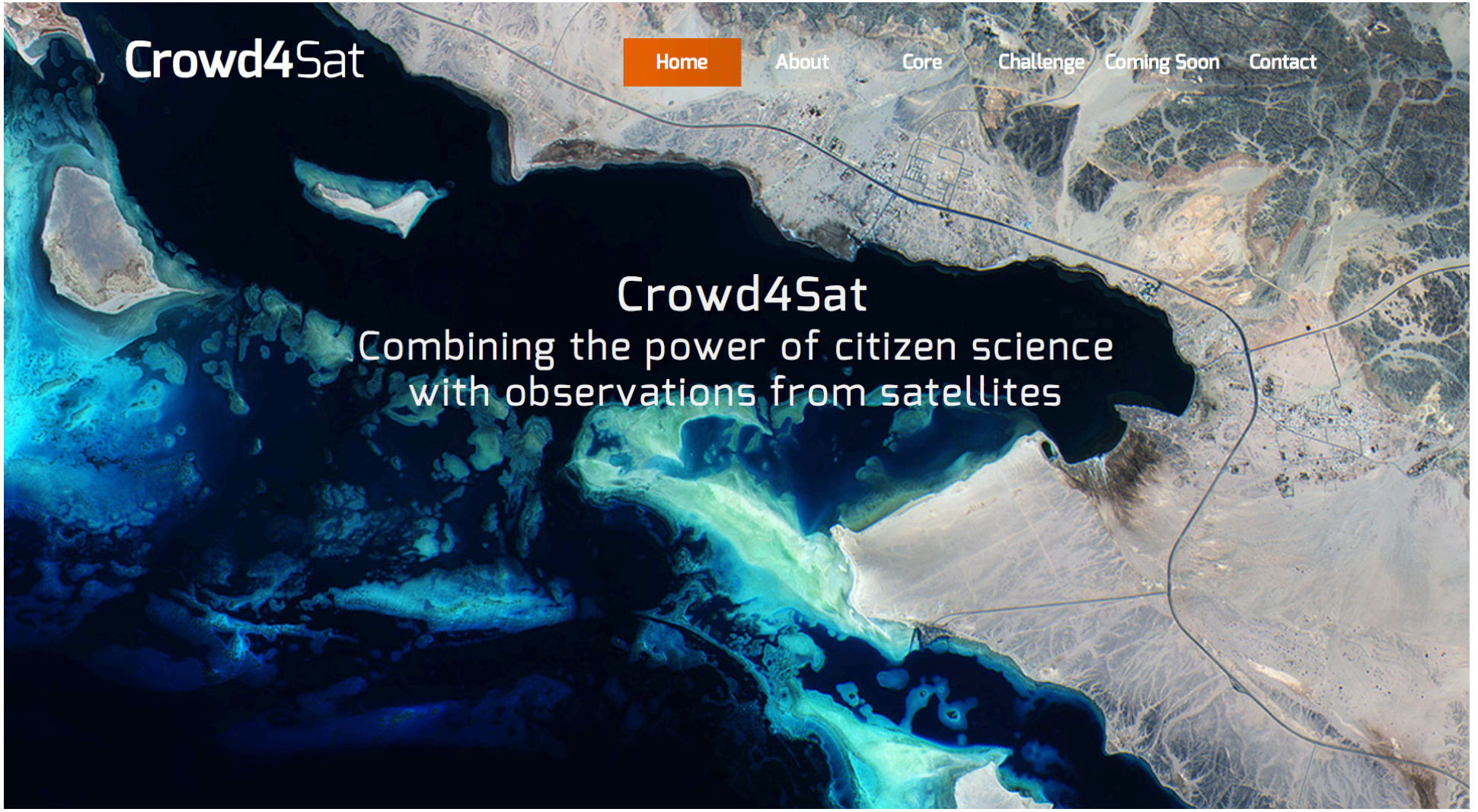
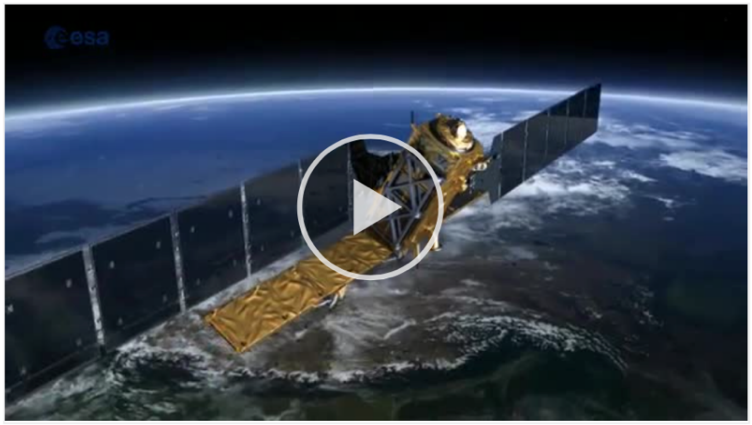


www.crowd4sat.org



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FREE online course

Duration: 5 weeks

3 hours pw

https://www.futurelearn.com/courses/climate-from-space

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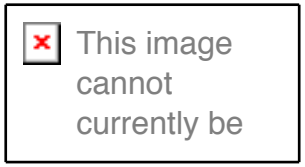
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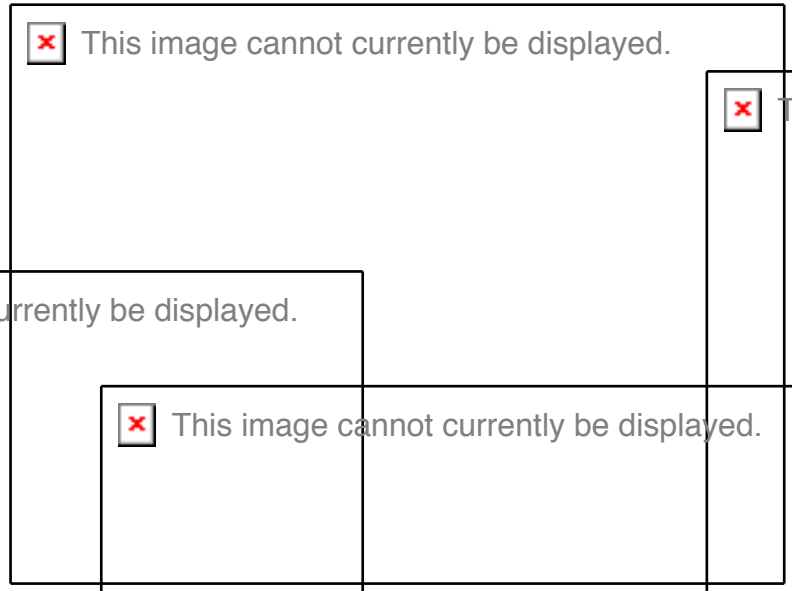
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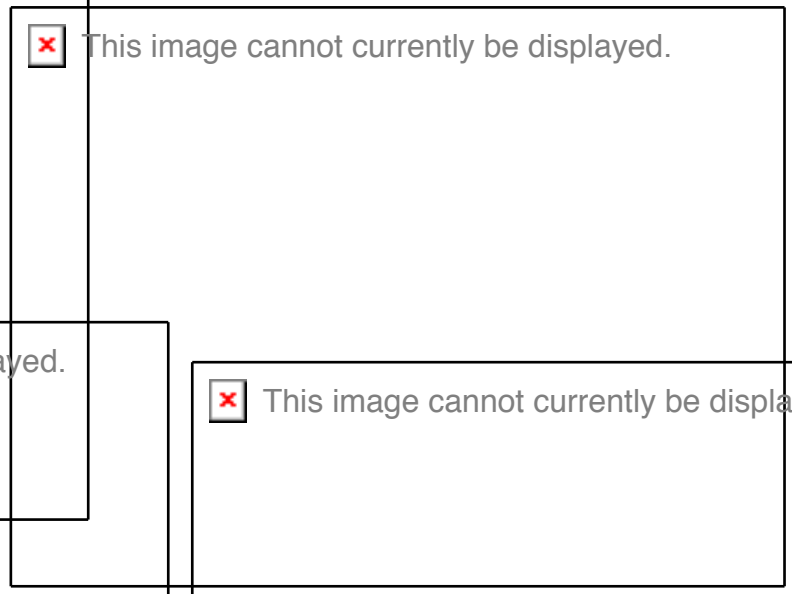
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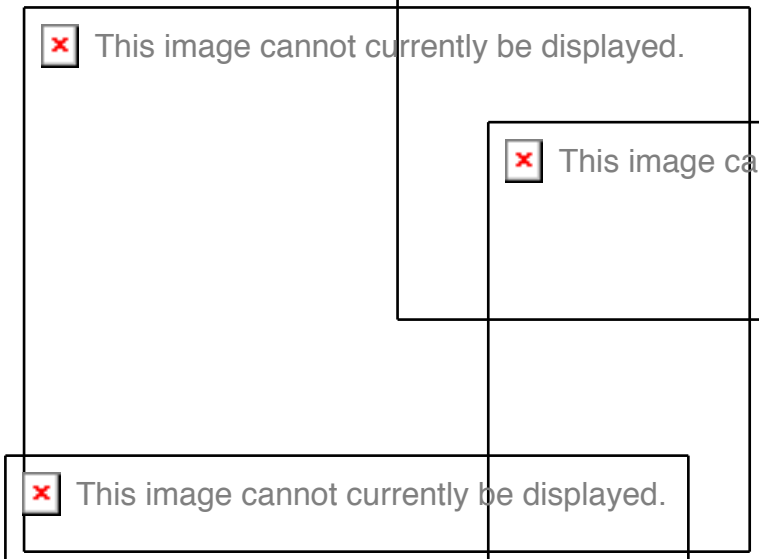
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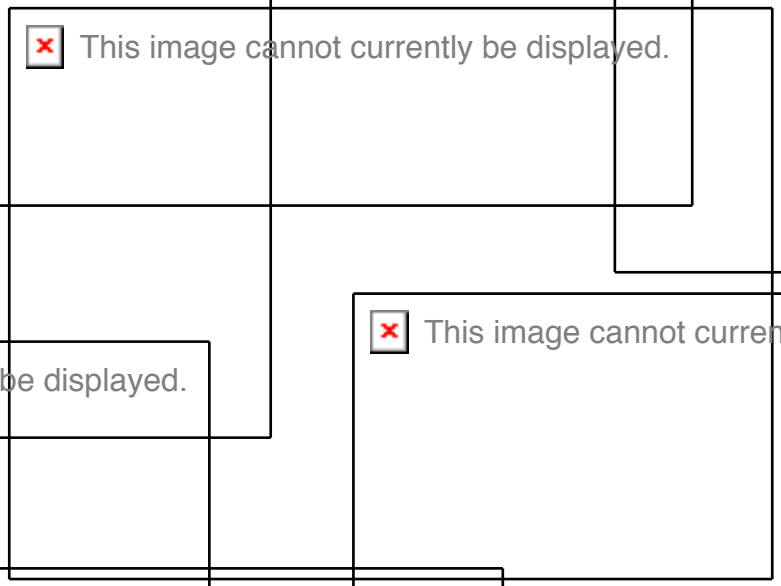
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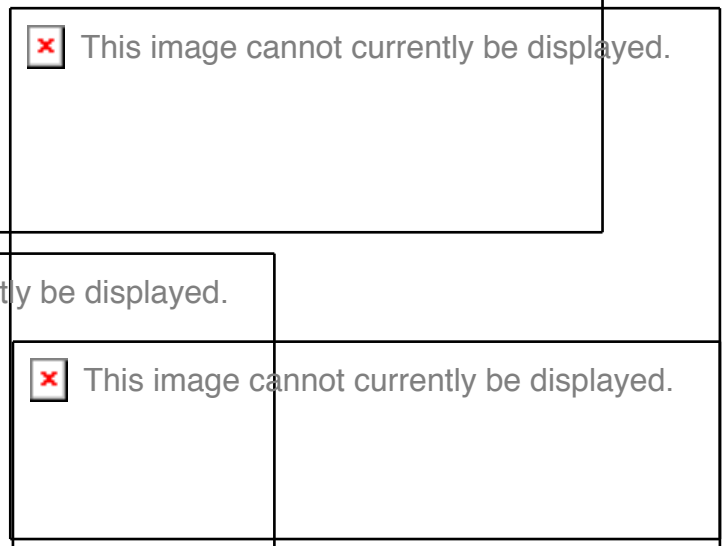
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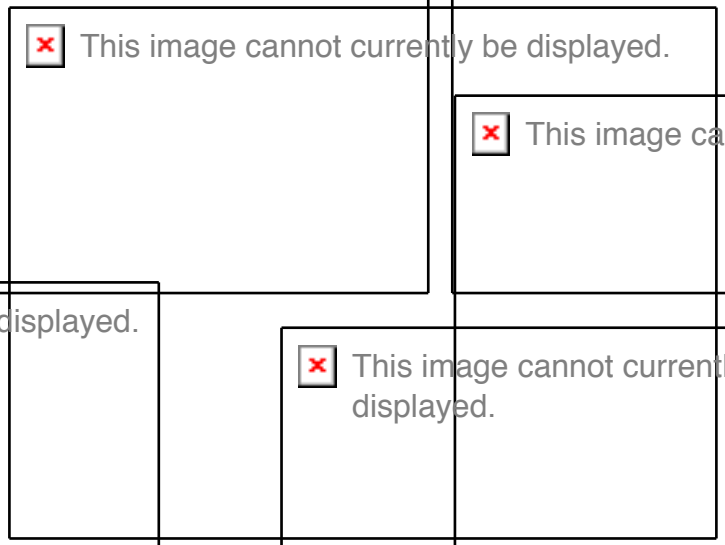
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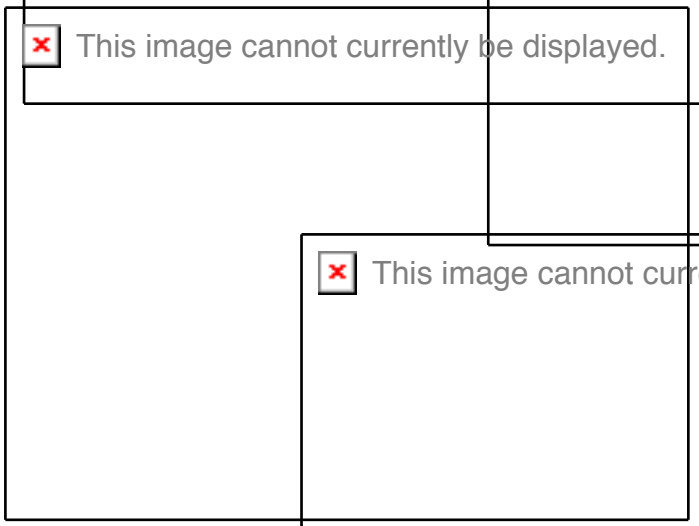

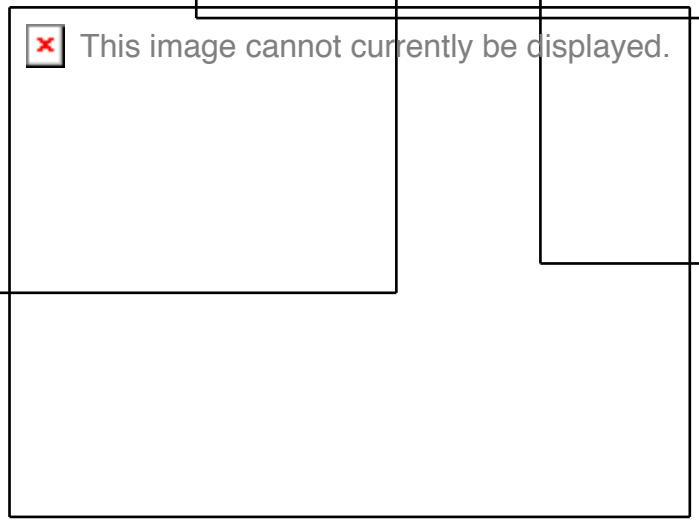
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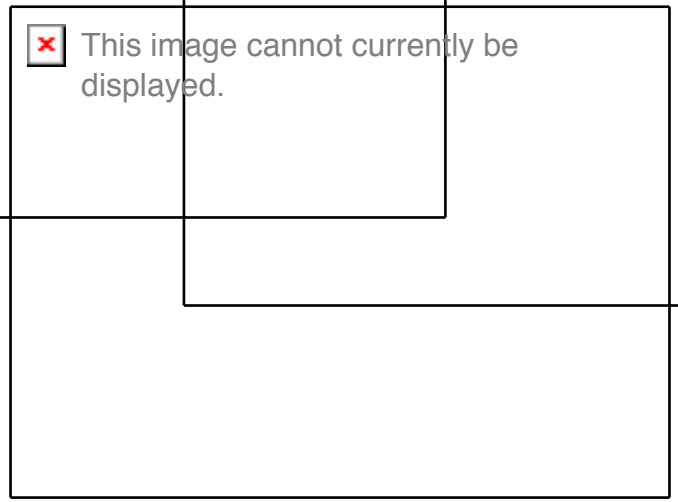
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Barriers

Lack of access to data and information suitable for non-experts

Scientific users with limited EO expertise

Schools and non-technical users in the wider community

Lack of relevant examples and case studies

Fragmentation of European EO education resources and initiatives

Causes of the fragmentation

Overcoming the fragmentation to provide easy access

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Blurring boundaries

Students in higher education

Professional development and knowledge transfer

School-based education

Awareness-raising

ESA Monitoring Climate Change from Space MOOC

Provide basic information about EO data, its uses, types and challenges.

Reduce perceived 'barriers' for non-technical users.

Provide practical examples of usage of EO data.

Demonstrate the benefits of its use in real-world scenarios.

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Types of learner

A new EDS graduate

A career changer

A research scientist needing to work with new data

An environmental consultant

A university lecturer

A school teacher

Policy maker/adviser

Decision maker

High school stduent

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ESA MOOC learner backgrounds

EO and climate scientists

Satellite engineers

Climate diplomats

Policy-makers

Senior decision-makers

School teachers

Students (high school, undergraduate, post-graduate and home-educated)

Campaigners

Media professionals

Science communicators

Retired individuals and casual learners

Example Learner Profiles

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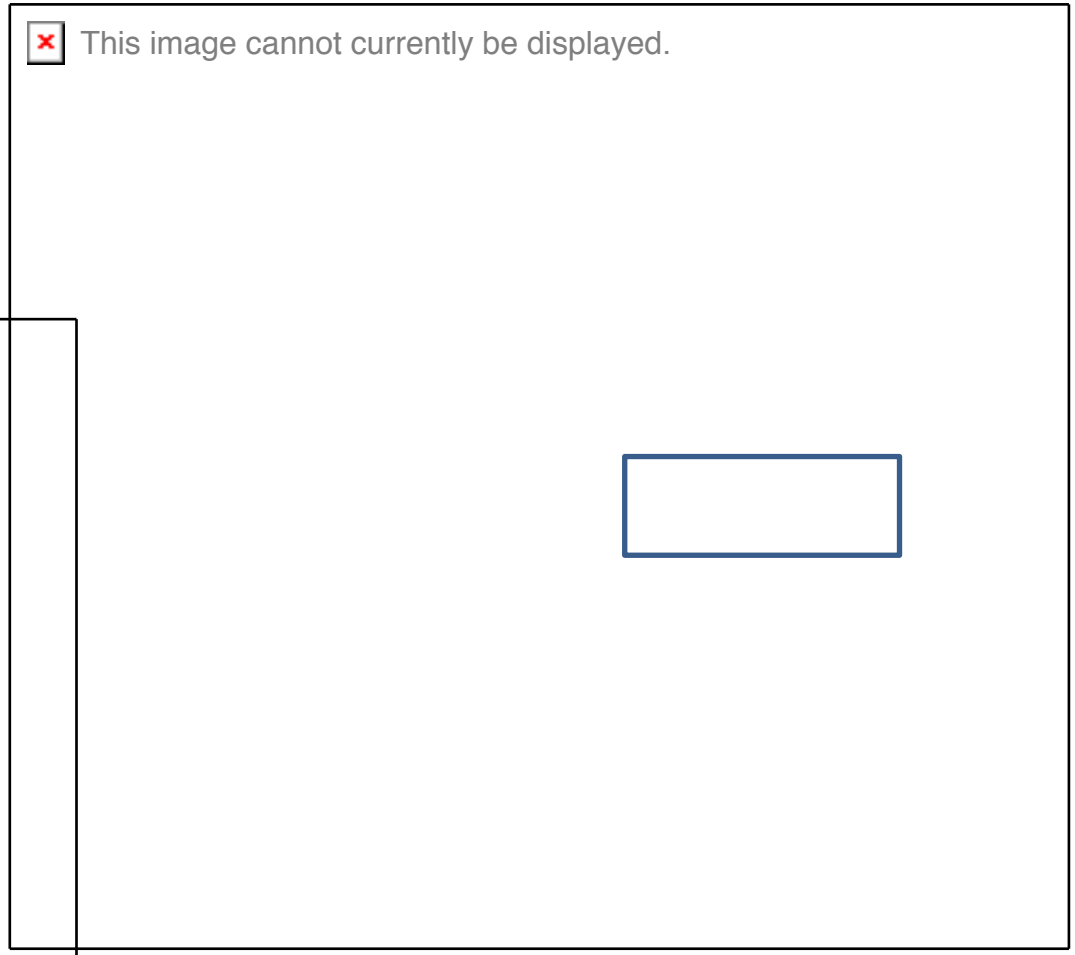
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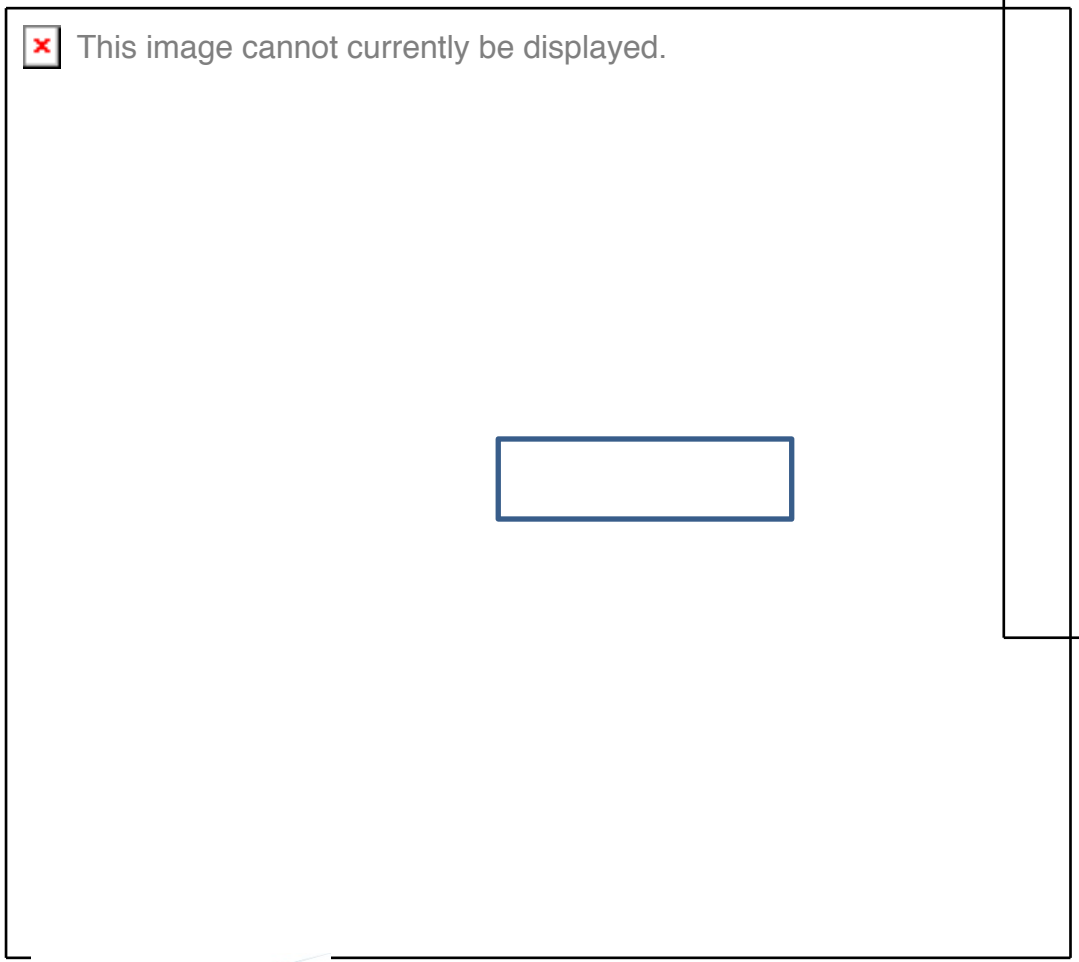
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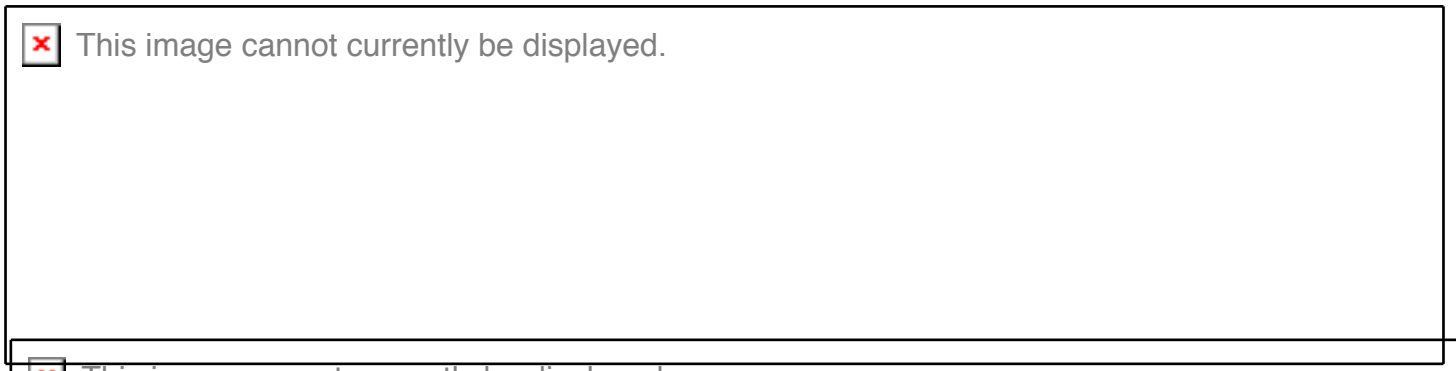
Example Learner Comments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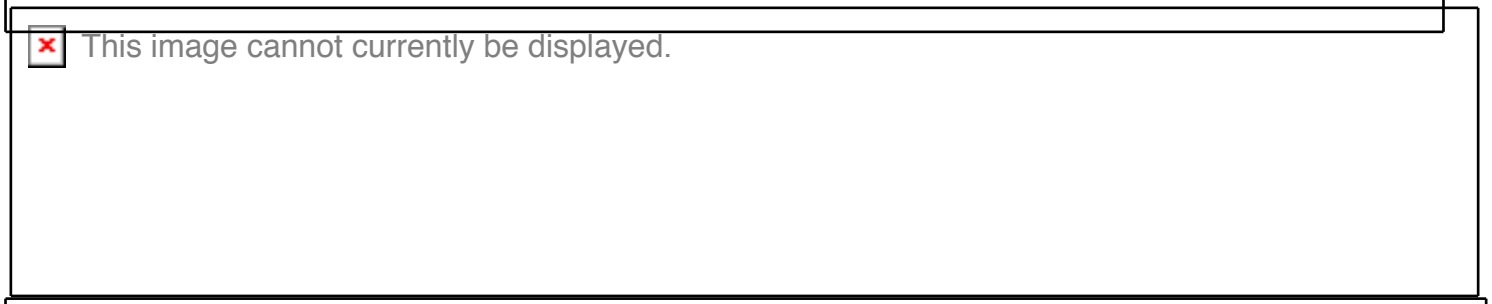
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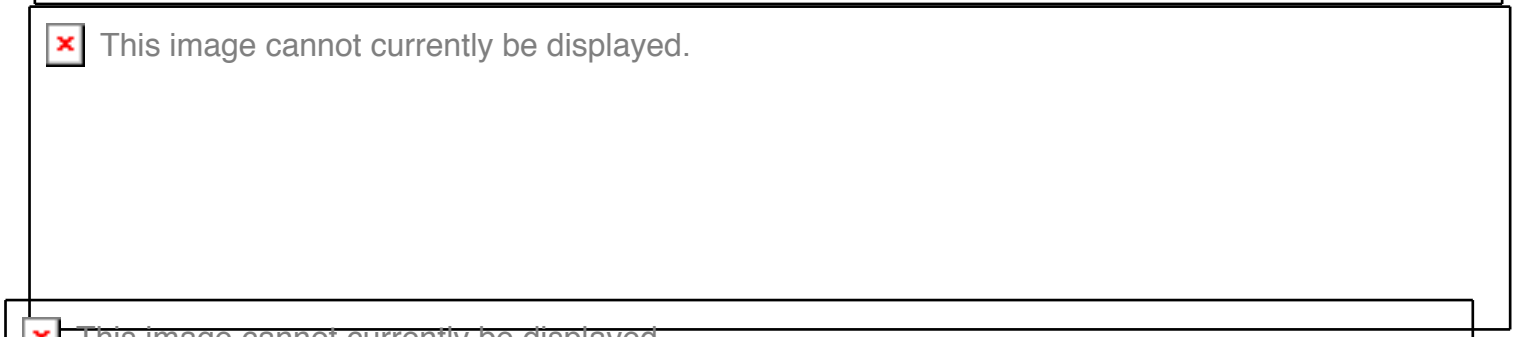
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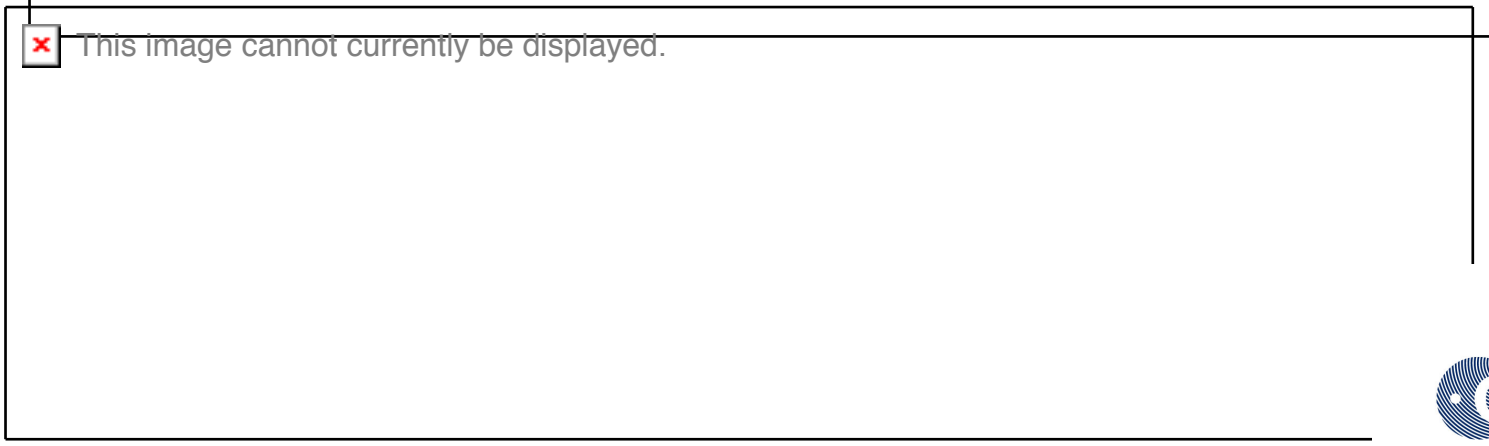
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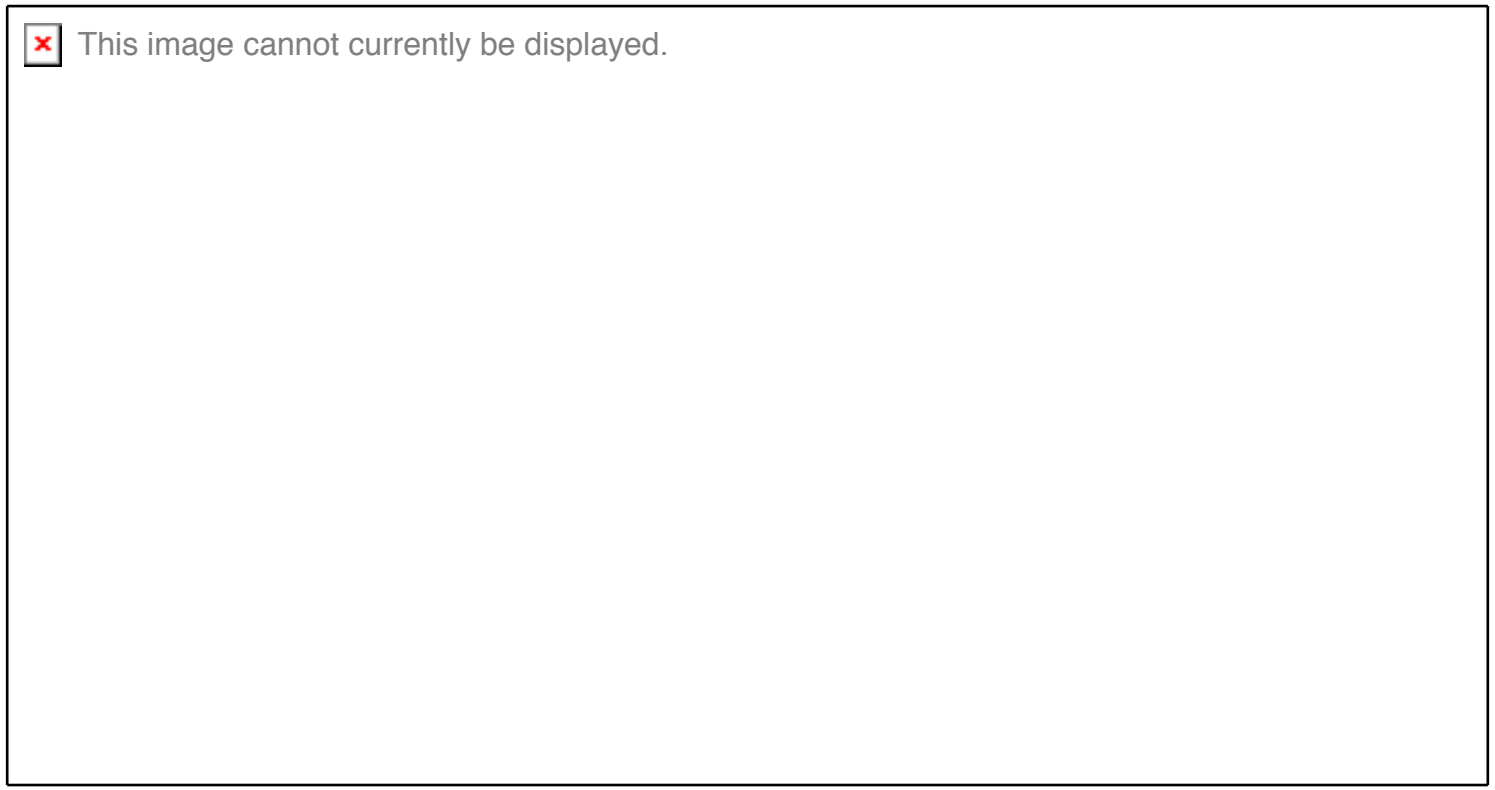
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Satellite Tracking App

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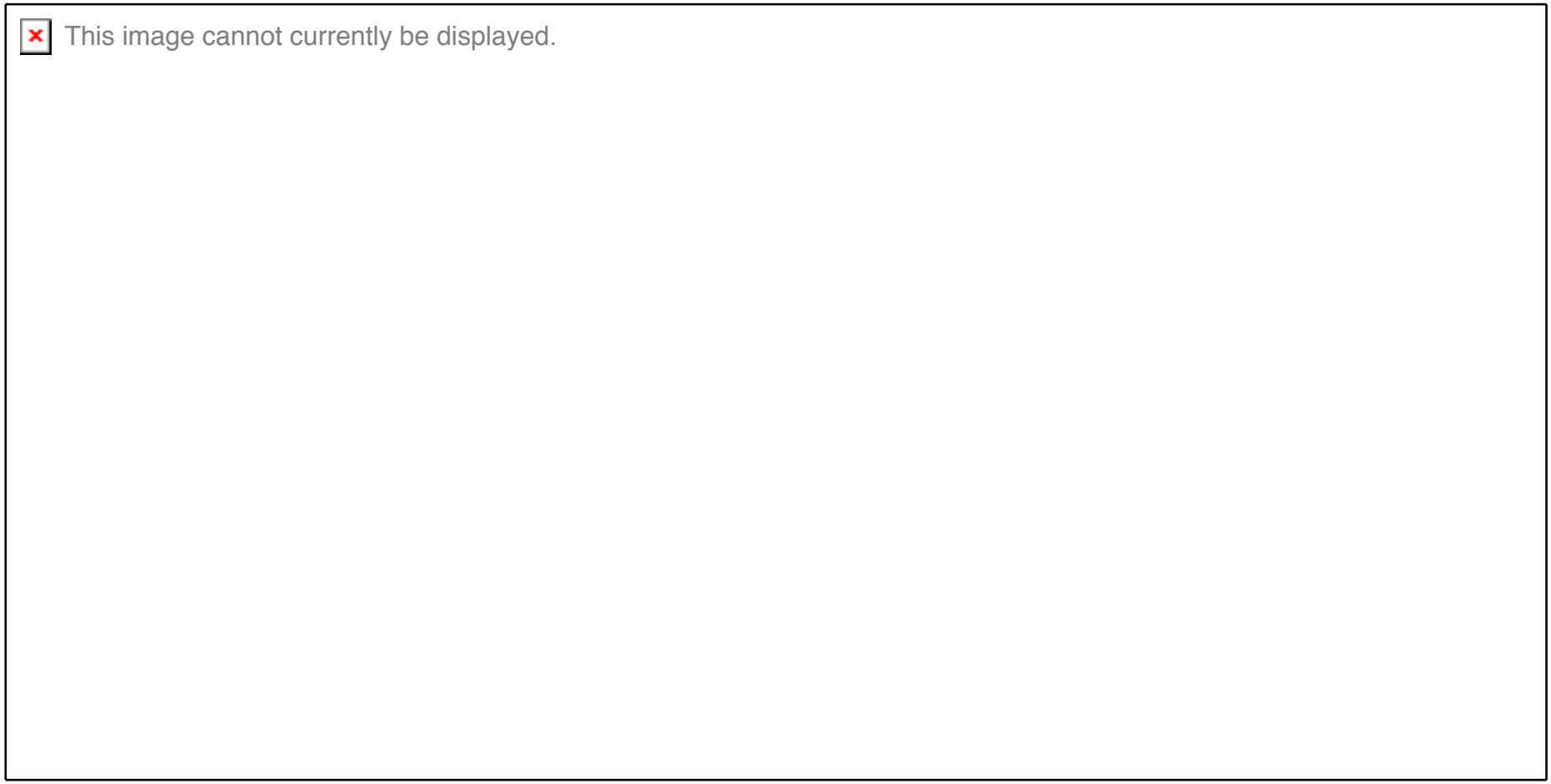
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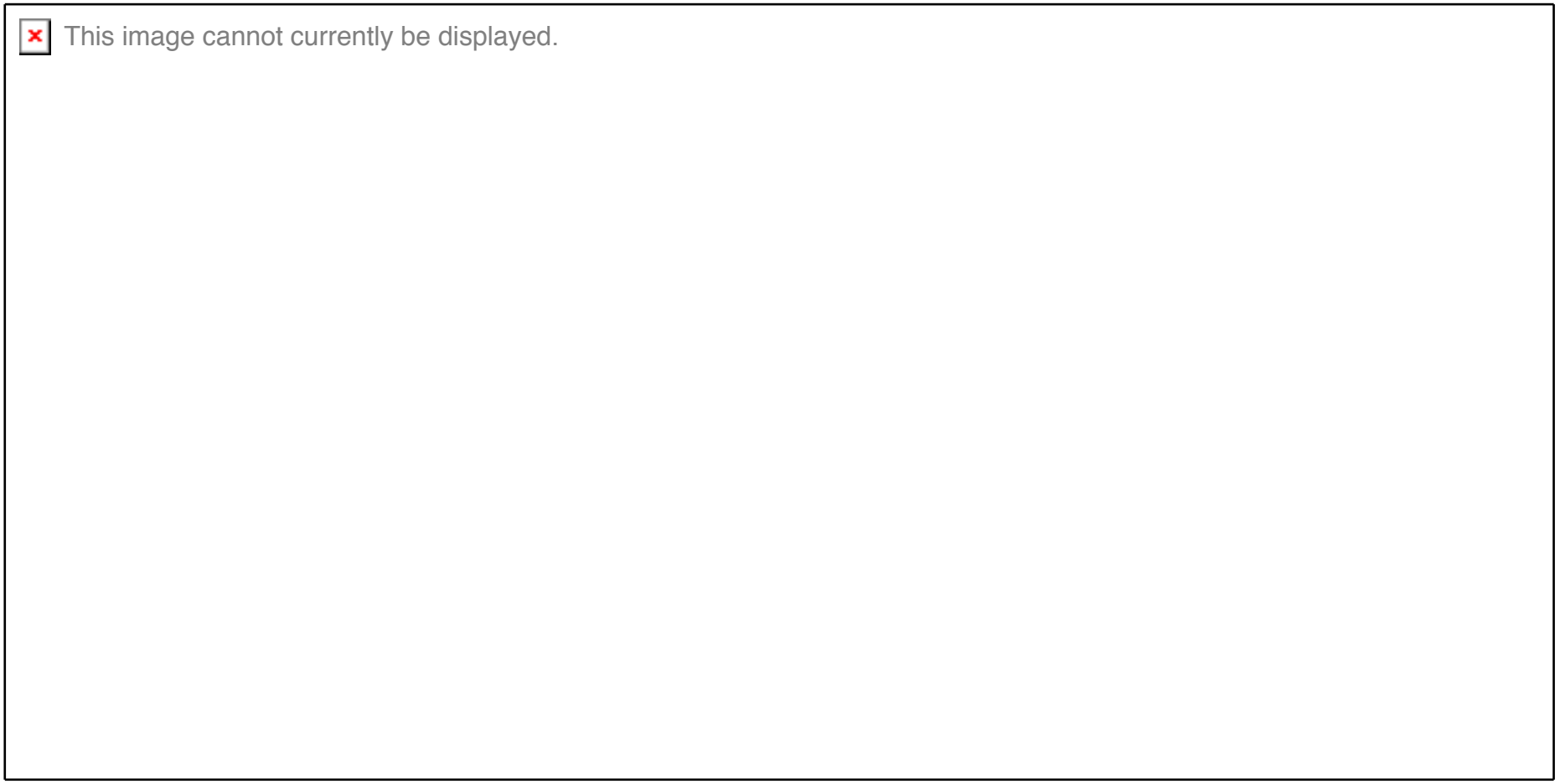
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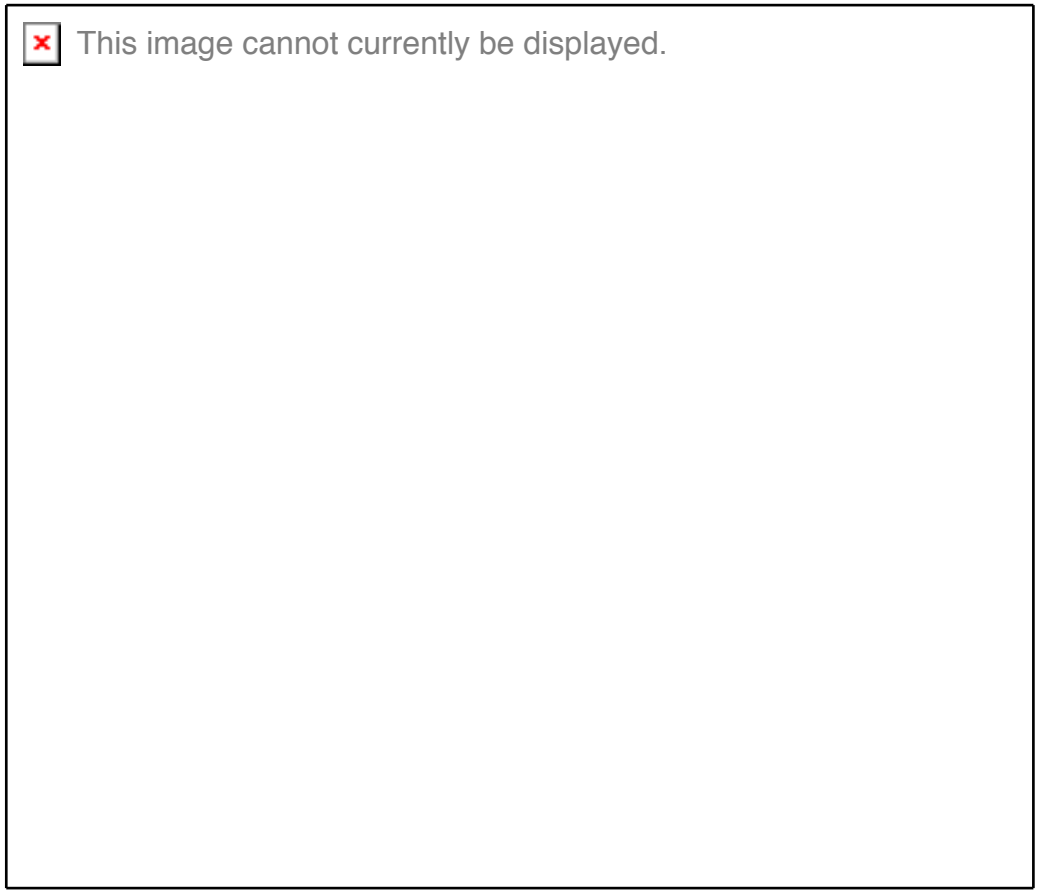
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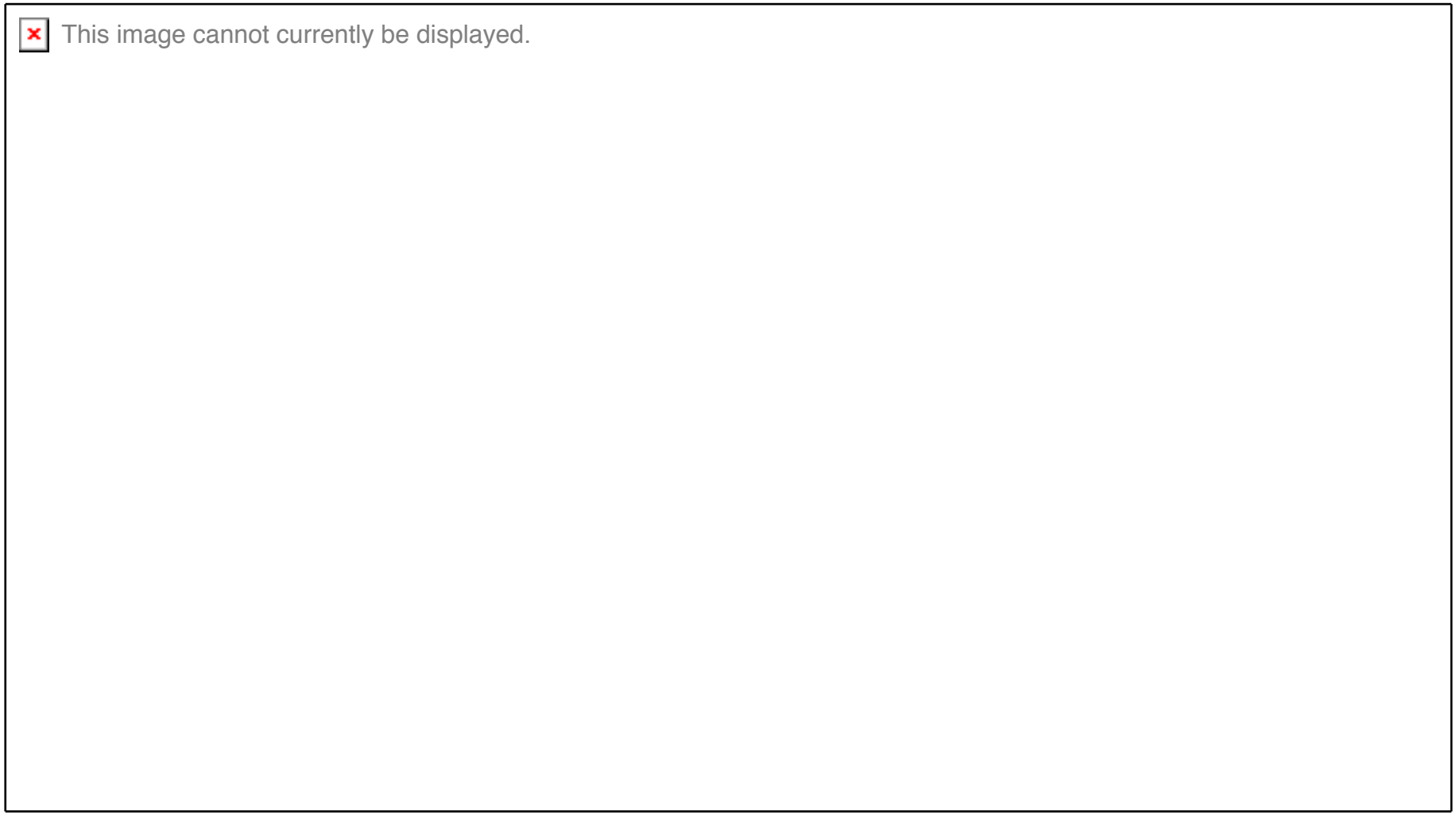
Global usage of Satellite Tracking App in first two weeks of course



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Example learner comments on Satellite Tracking App

Interactive Exercises

Earth Images Lite – used to demonstrate how SAR instruments enable us to observe the ground in detail even when there is substantial cloud cover.

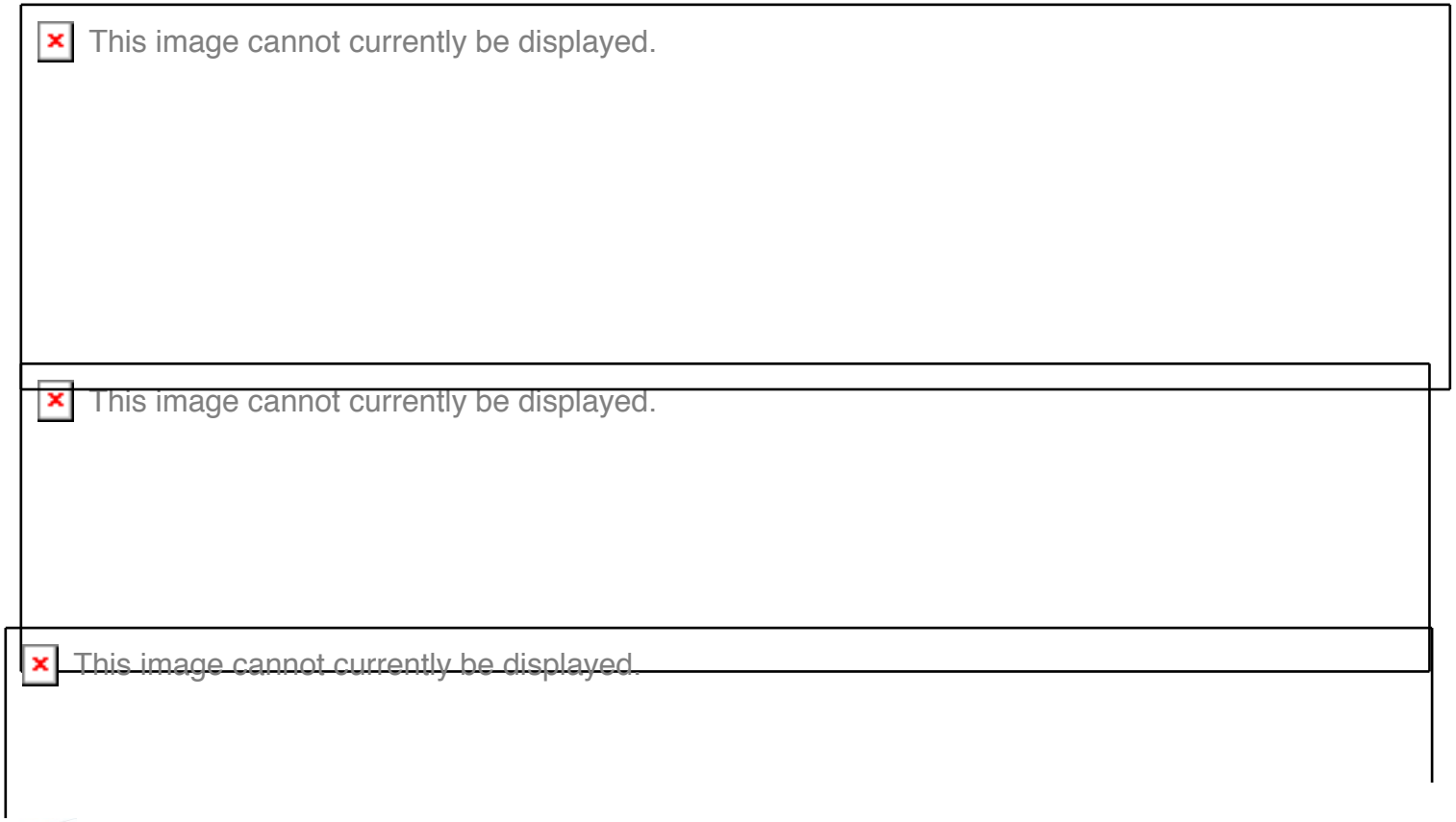
NASA Worldview – used to compare and assess changes in various parameters, including ozone levels, aerosols, fires and sea ice.

USGS Earth Explorer and WRI Global Forest Watch map – used to compare rates of deforestation.

VegScape tool – used to compare vegetation using NDVI (Normalised Difference Vegetation Index) and find correlation with periods of drought.

Earth Images Lite Usage

According to GeoCento, a significant peak in usage on Earth Images Lite could be attributed to the use of the tool in the course, by the end of Week 2 alone.



Headline statistics and feedback

Headline stats

30 original videos, interactive tests and exercises, and 3-5 hours of independent study each week

9000 registrations on its first 'live run'

Participation rate of over 54% and a course completion rate of 22%, above average for large-scale MOOCs on FutureLearn.

Over 80% of participants classified as 'active learners' (ie following through multiple steps of the course)

Around 30% were classified as 'social learners', actively involved in peer-learning and online comments.

Very high levels of retention through to final week of course.

Qualitative feedback

Very high approval ratings for the format, quality and 'layered' nature of the content, and very high levels of 'emotional engagement' and stated intention to continue with further learning in the subject.

Significant numbers of newcomers to the subject expressed a profound new appreciation of Earth science, the evidence for climate change and the detail of the data available through satellite observations.

Others with existing knowledge of the policy and environmental contexts expressed a renewed intention to incorporate EO into their professional work and decision-making, and an interest in deepening their knowledge of the data and applications.

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End of course comments

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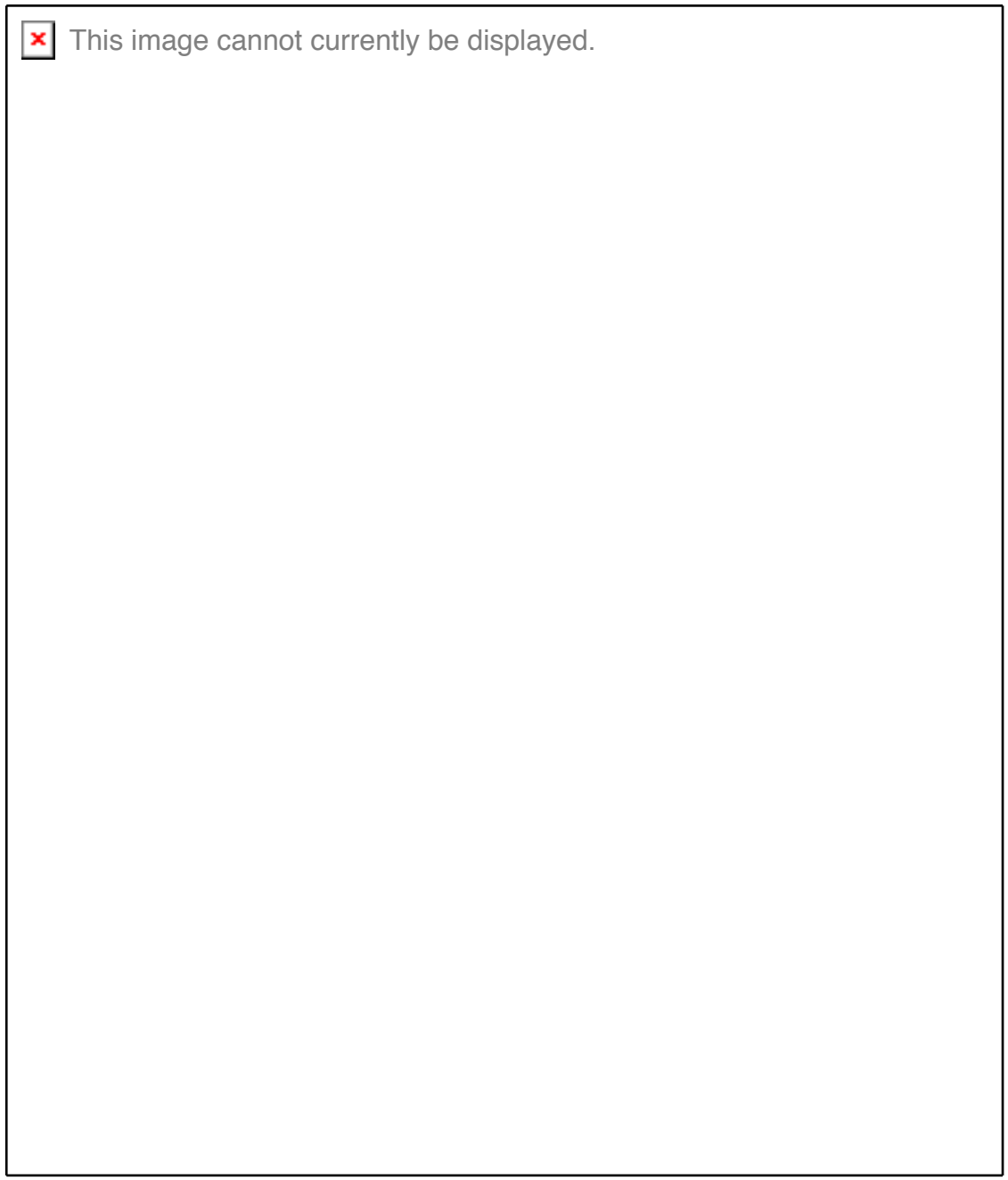
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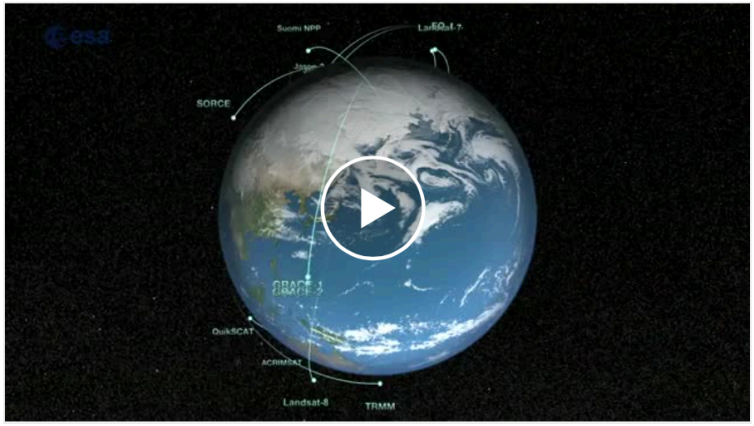


View transcript

Download video: standard or HD

Topic 1a - What is Earth observation?

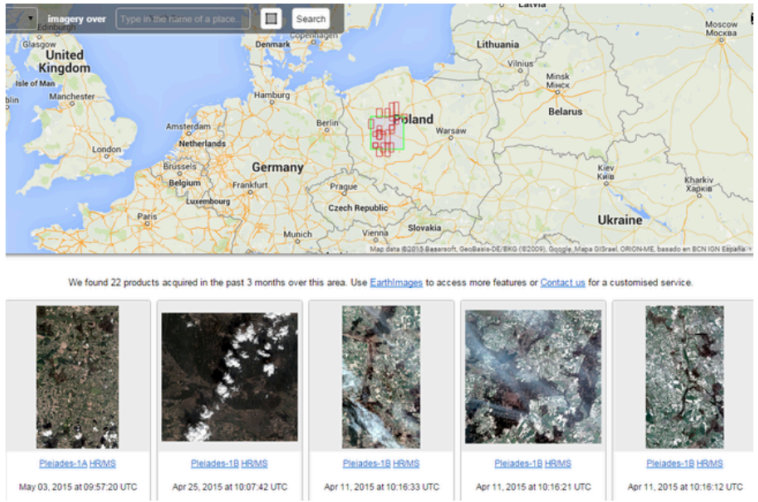
143 comments

Welcome to the first topic of the course. For each new topic you should watch the main video (above), read the explanatory text (below), and you can find links to optional further reading at the external websites in the 'See Also' section at the bottom of the page. You can also find more information about the data, imagery, animations and satellite missions featured in each topic in the step that follows each video.

Earth observation (EO) is a collective term for the gathering of data and information about our planet's physical, chemical and biological systems through the process of 'remote sensing'. Earth observation provides a way of monitoring the status of these systems and checking on their health. In essence, this is done by sensing and recording reflected or emitted

To do | Activity | Replies | Progress

1.25



Week 1 interactive exercise

This week's guided exercise will look at the benefits of radar-based satellite observation, and will enable you to make a simple comparison between optical imagery and SAR (synthetic aperture radar) data in the same location, at roughly the same time.

For this exercise, we will use the **Earth Images Lite** tool from **GeoCento**.

Follow the steps below and then join the discussion to compare results and discuss ideas with other learners. Once you feel confident with the tool, you can explore other locations and data sets of your choice.

You may find it helpful to open the exercise in a separate window.

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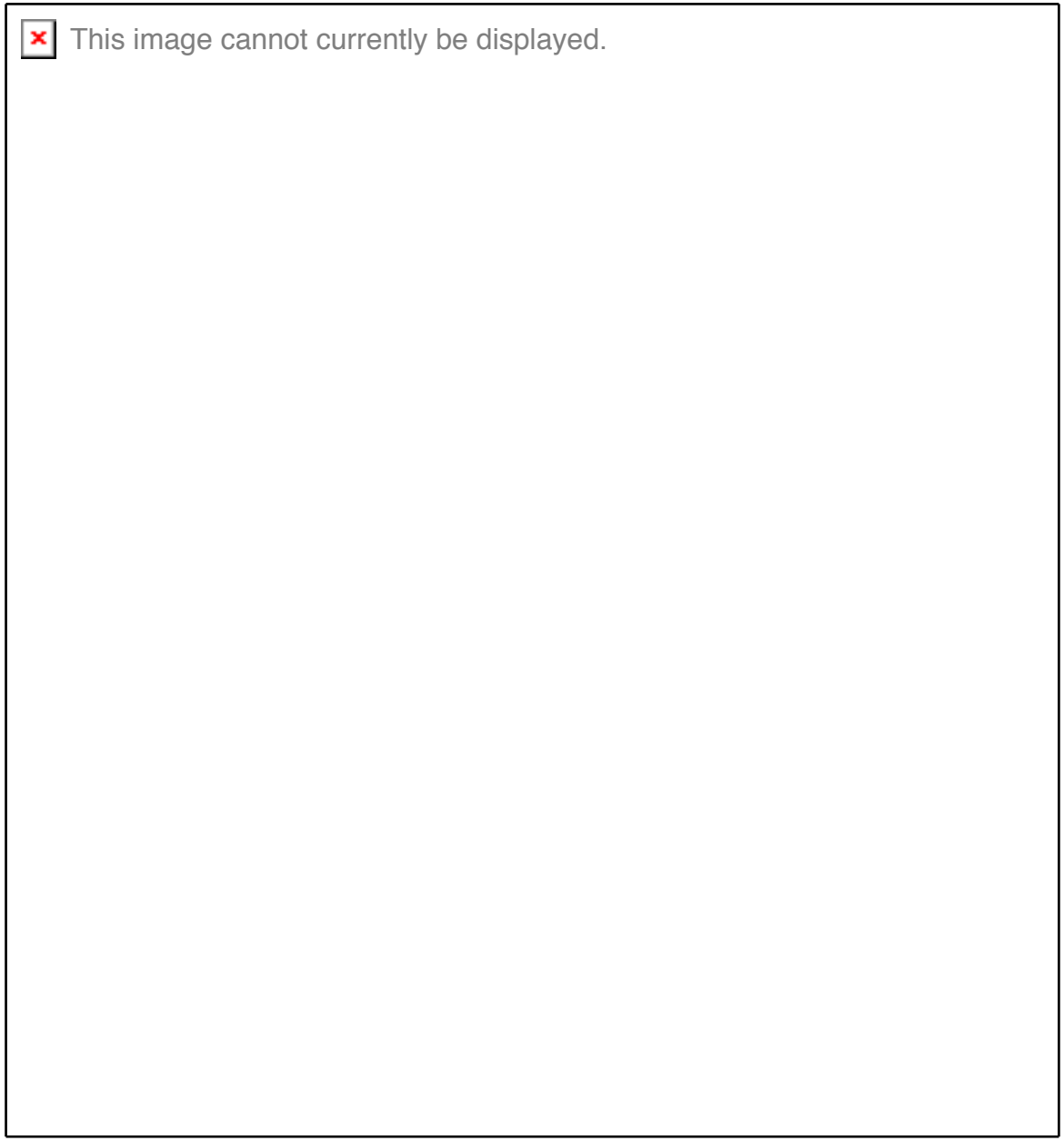
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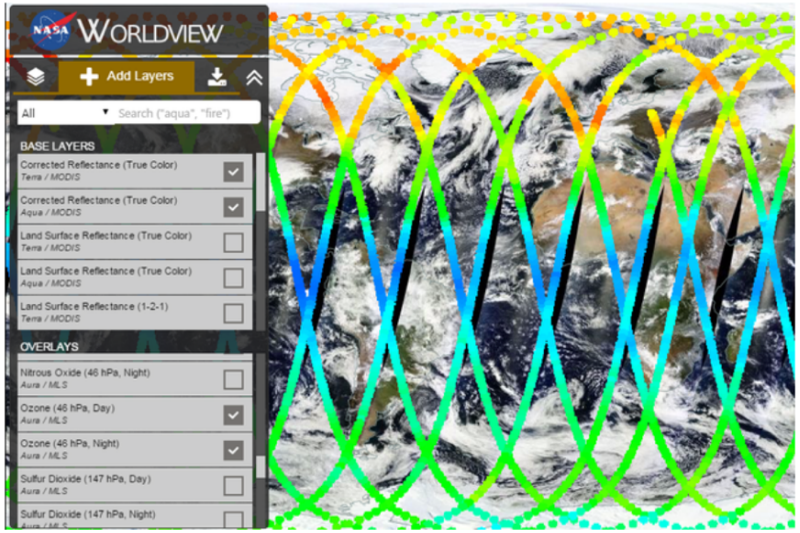


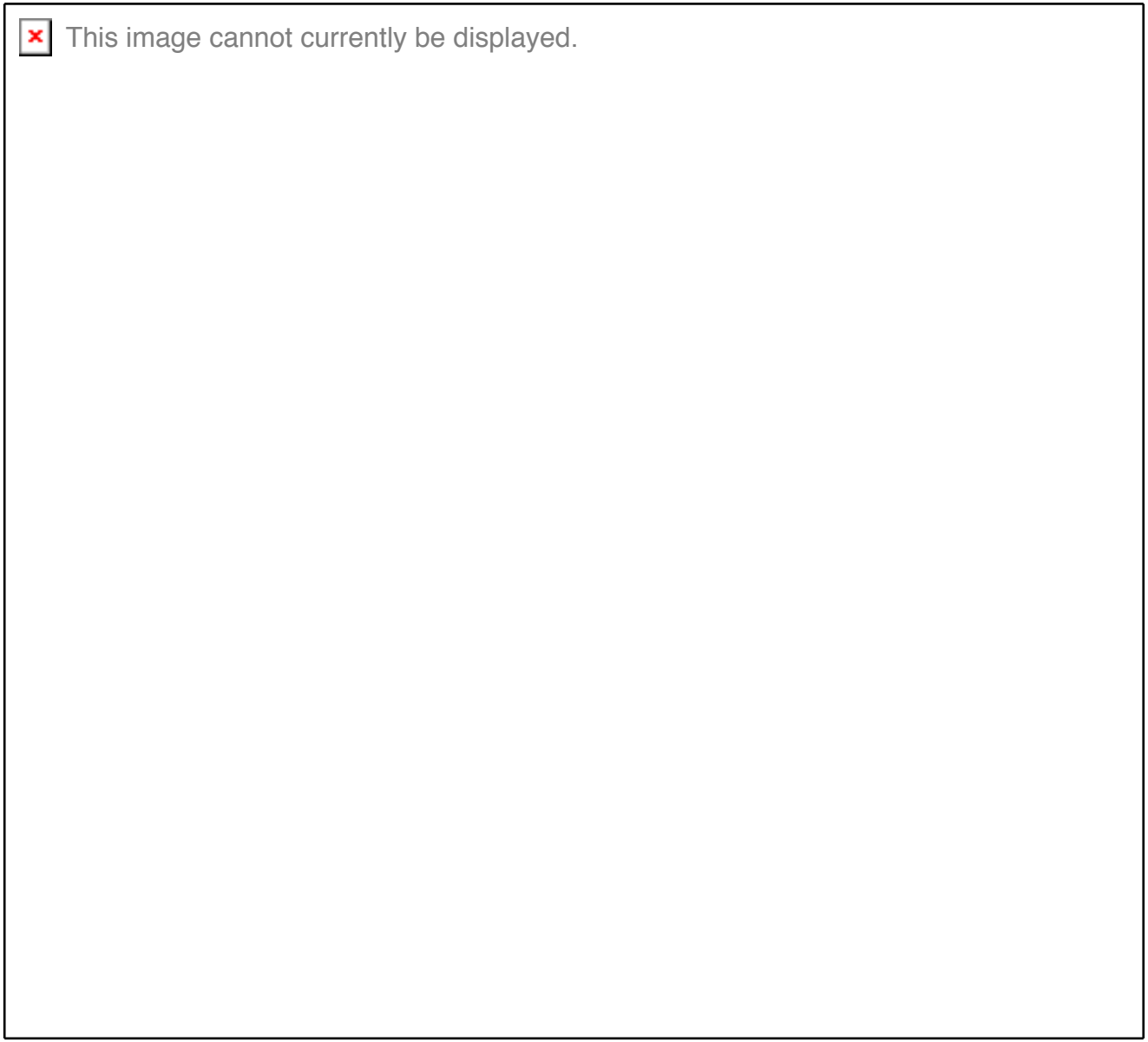
Week 2 interactive exercise

This week's guided exercise will use EO data to compare seasonal changes in the atmosphere and on land.

For this exercise, we will use the **World View** tool from NASA, and **VegScape** explorer from USDA.

Follow the steps below and then join the discussion to compare results and discuss ideas with other learners. Once you feel confident with the tool, you can explore other locations and data sets of your choice.

You may find it helpful to open the exercise in a separate window.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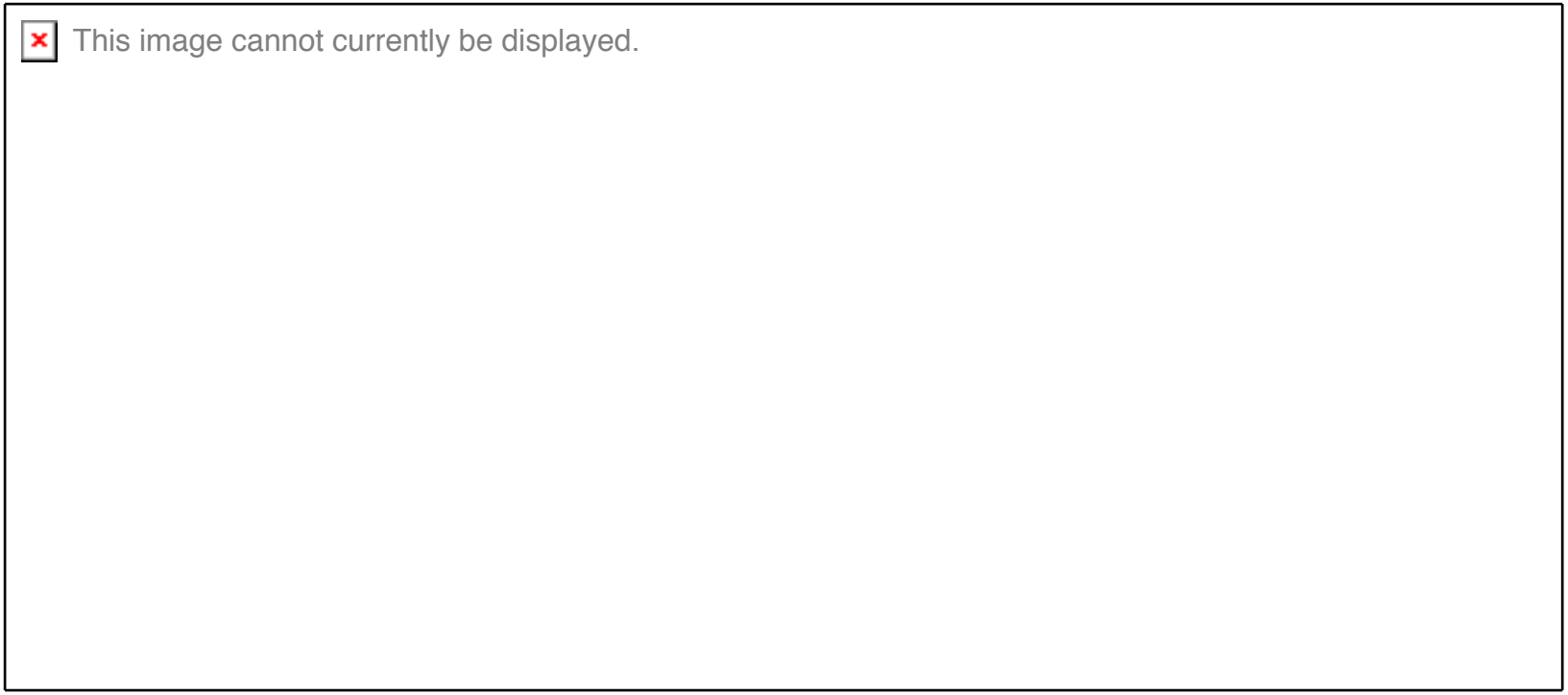
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Exercise 1

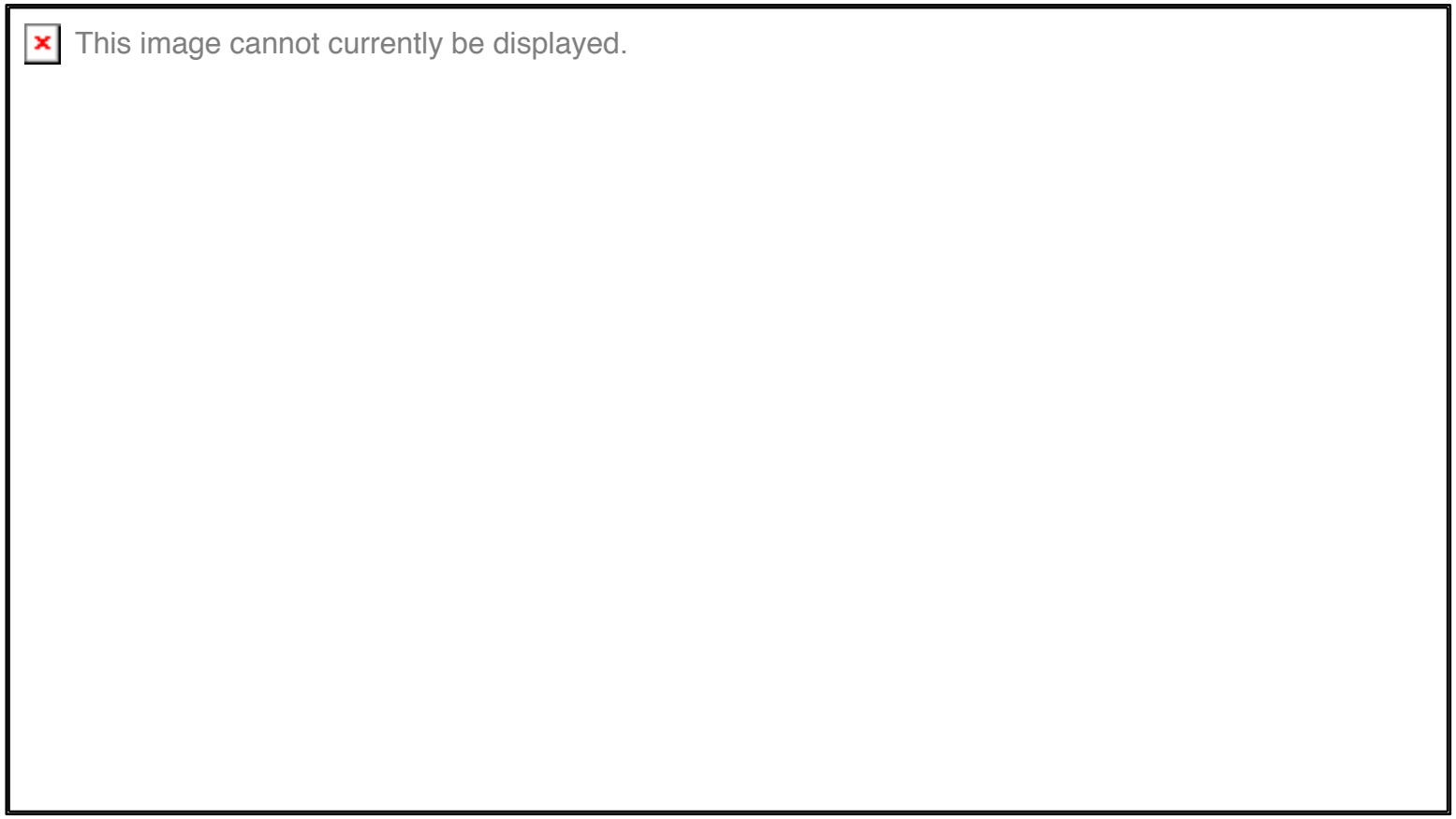
This first exercise will compare changes in ozone levels in the atmosphere over different seasons.

1. Go to the World View tool. (When you first visit World View you will be offered a tour of its features. You can take this tour if you wish to, but it is not necessary for this exercise).
2. On the left hand side of the screen, click on the 'Add Layers' plus symbol. Make sure that under 'Base Layers', only the **'Corrected Reflectance (True Colour)** ***Terra/MODIS***' later is selected.
3. Below the 'Base Layers' menu you will see an 'Overlays' menu. Scroll down until you find the layer called **'Ozone (46 hPa, Day)** ***Aura/MLS*** and select it (this is about two thirds of the way down the menu). By clicking on the 'Active Layers' symbol in the top left hand corner of the menu you can see the layers that have now been added.
4. On the time slider at the bottom of the screen, select January 1st 2015. You should now be able to see the data displayed for this date. Red areas indicate higher ozone levels whilst blue areas indicate lower ozone levels.
5. Take a snapshot of a region of this data set using the camera symbol in the top right-hand corner. Click on the camera icon and an area selection tool will appear on the map. Adjust the area and change the resolution in the drop down menu to '5 km' to keep the file size (shown under 'Raw Size') down to a manageable level. Click Download. The image will appear in a new tab. (You can then save this image to your desktop or pictures folder).
6. Now move the time slider to 1st October 2014, you should now see the data displayed for this date. Take another snapshot of the same region as you selected for the previous snapshot, and compare the two ozone images. Make an assessment of whether ozone levels have increased or decreased in different regions of the atmosphere.
7. Describe (in the discussion area below) the changes you have found.

Exercise 2

This exercise will compare vegetation using NDVI (Normalised Difference Vegetation Index).

1. Go to VegScape. On the left hand side of the screen select the 'Products' tab
2. In the 'Type' drop down menu, select 'NDVI' and set the 'Period' to 'weekly'.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Pierre-Philippe Mathieu and Prof Alan O'Neill in course introduction video

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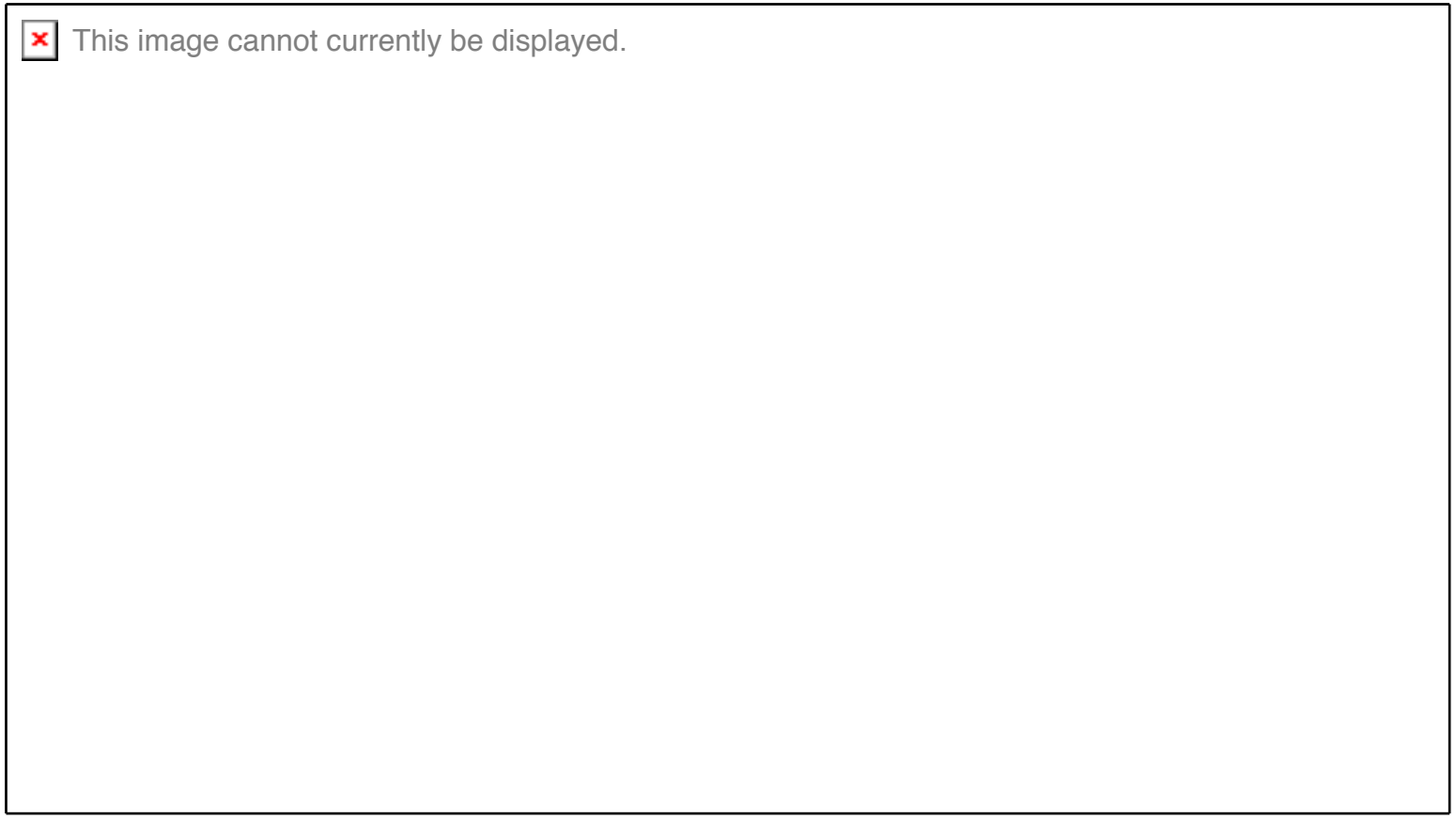
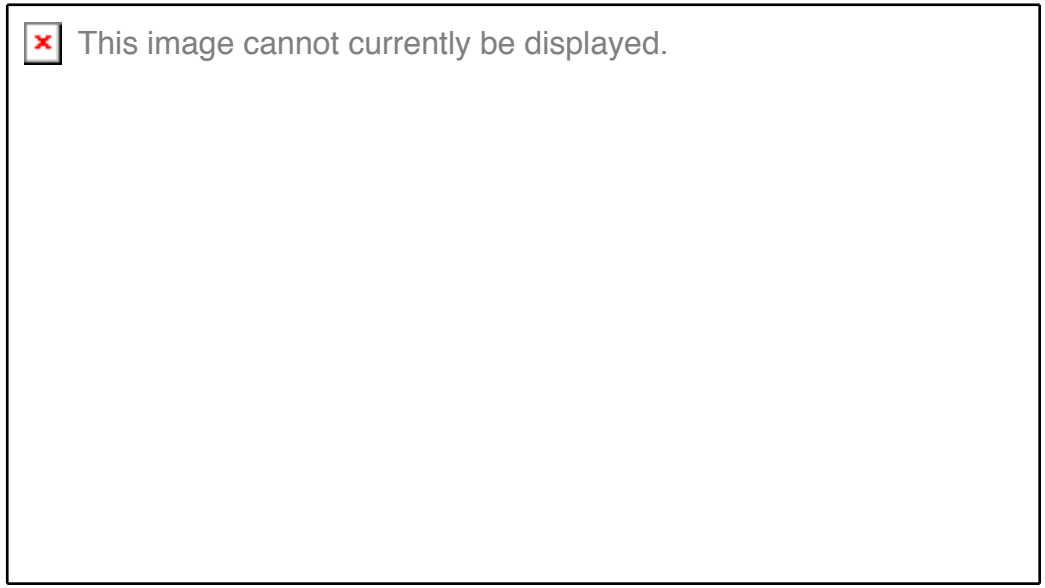
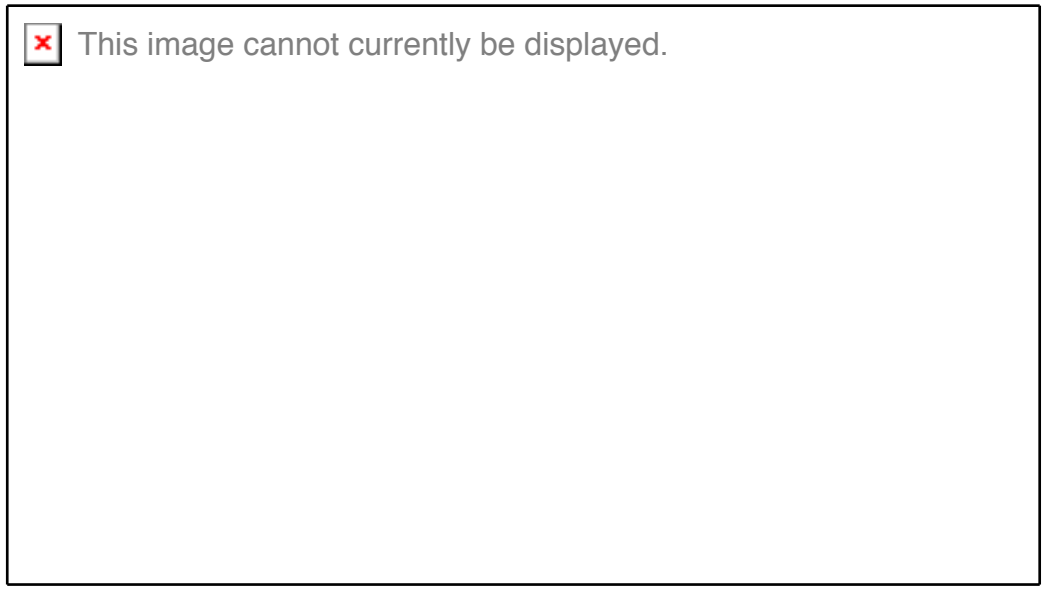
Professor Stephen Briggs
discussing ECVs and related topics

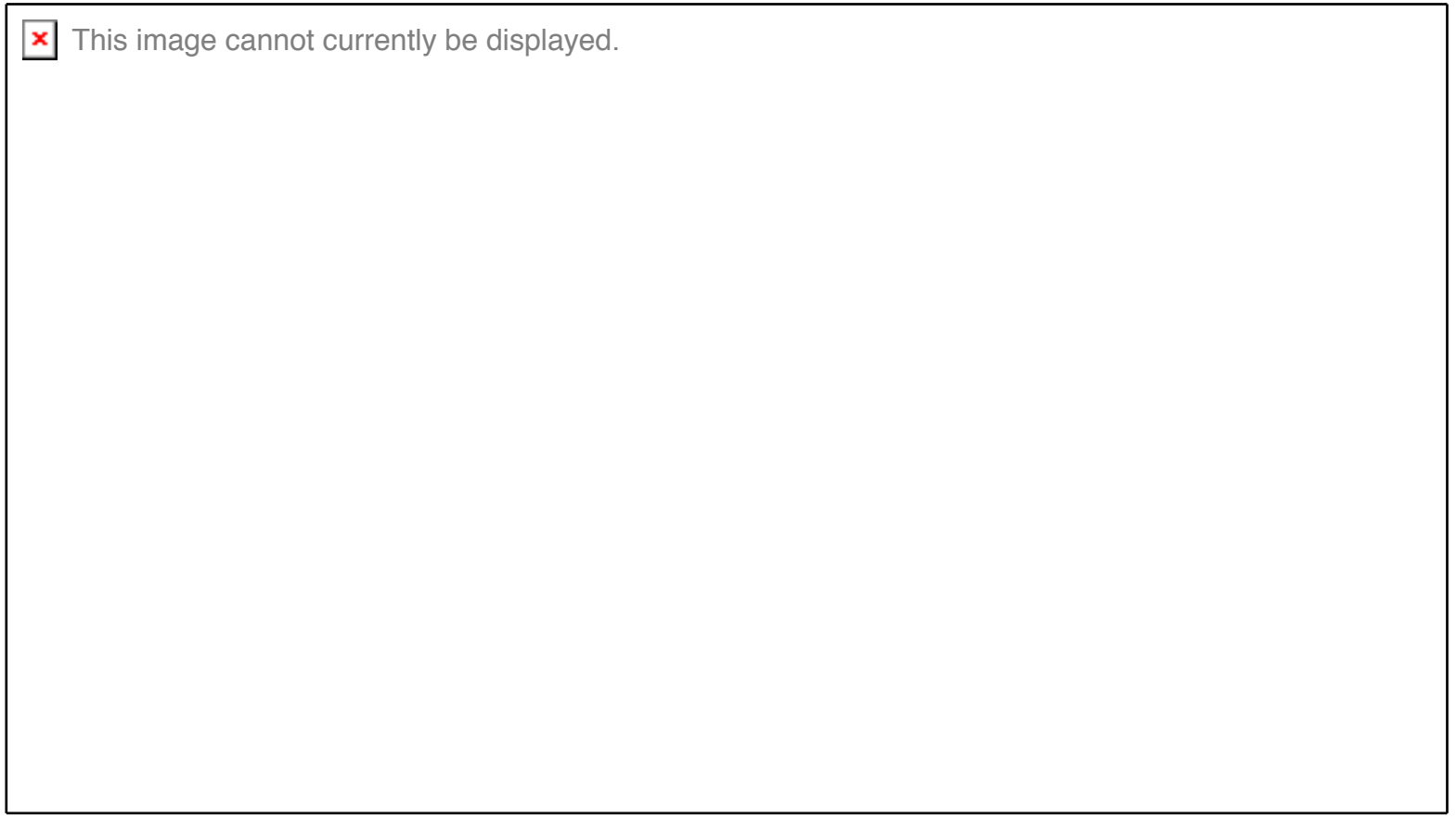


Prof Martin Wooster (KCL) discussing Sentinel 3 and the advantages of satellite observations over aircraft





Dr Angela Benedetti (ECMWF) discussing MACC II, aerosols and related topics



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Dr Helen Snaith and Dr Paolo Cipollini at the National Oceanography Centre, UK

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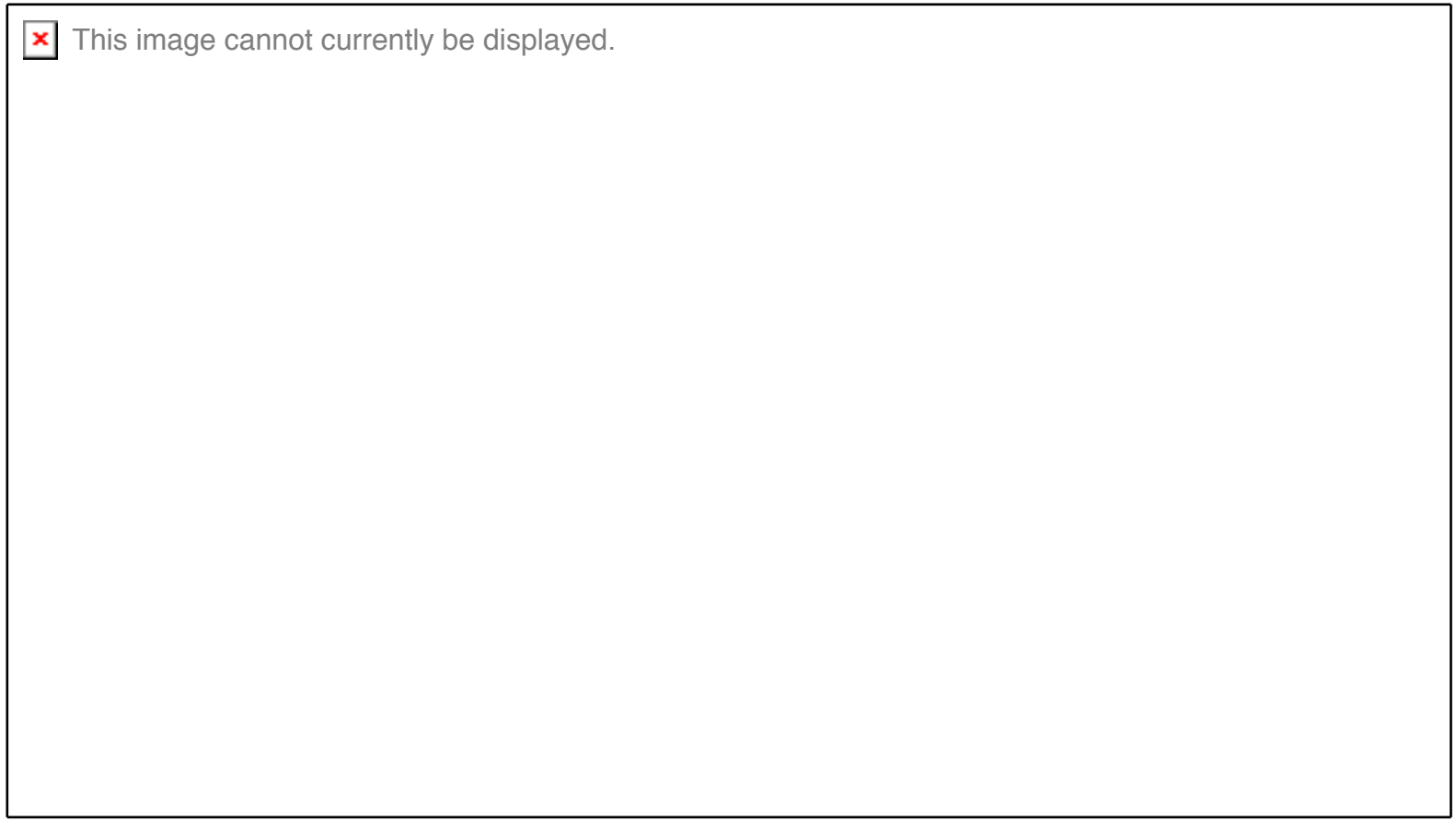
Prof Andrew Shepherd discussing Cryosat and related topics



Dr Mat Disney (UCL) discussing observation of forests and related topics

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Prof Chris Merchant on ocean currents and Prof Chris Lintott on citizen science

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Dr Kirsten Barrett on land observation & related topics and Dr Nathalie Pettorelli on biodiversity

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