Imaging the Earth

Satellite Images and how they are used.

An AstroPi resource for primary school teachers.

Introduction

Satellites provide a unique viewpoint, allowing us to monitor our planet and photograph its beauty and power. Satellite images have a wide range of uses, some of which are explored in this series of activities.

This Astro-Pi resource is aimed at teachers of key stage 1 and 2 pupils, and is closely linked to elements of the geography national curriculum which can be taught in new and stimulating ways. Children can explore familiar and unfamiliar world locations from ground level and from space and research for themselves while developing digital literacy and computing skills.

The Astro-Pi board carries both visible-wavelength and near-IR cameras, which can be pointed towards the earth with a similar view to this camera aboard the ISS.

This teacher guide, and the resources that accompany it, can be used in different ways:

1. Following the activities in sequence will cover the curriculum links listed below. This might be done as part of a themed week, or over a series of sessions. This would give a thorough preparation for meeting the challenges and entering the competition, regardless of prior learning.

2. Teachers can pick and choose which activities, resources and links to use and when – they can be used independently of each other. This might enhance the ways in which space topics are currently taught. If teachers have specific challenges in mind that align with their interests and those of the children, learning activities might be selectively chosen.

3. Teachers may wish to present children, in class or as part of an extra-curricular activity, with the challenges only.

   Please note – the challenges are merely suggestions, and schools are completely free to use the AstroPi in any way they see fit to enter the competition.

Curriculum Links

Primary Geography

- use aerial photographs to recognise landmarks and basic human and physical features
- Recognise physical landmarks, both natural and man-made, such as:
    - beach, cliff, coast, forest, hill, mountain, sea, ocean, river, soil, valley, vegetation, season and weather, and
    - town, village, factory, farm, house, port, harbour
- Identify hot and cold places and relate them to the poles and equator
- Land use and distribution of natural resources

Primary Maths

- Use simple coordinate systems for marking locations within images
- Use scales in analysing an image

Primary Computing

- use technology purposefully to create, organise, store, manipulate and retrieve digital content
- recognise common uses of information technology beyond school
- use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content
- select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information

Learning Activities

1. **Where in the World:**

Composing of three short activities (that might form a three-part lesson), this focuses on the 'reading' of satellite images and their comparison to familiar landscape and objects.

Activity A: landmarks

Show the PowerPoint presentation and ask the children to guess what each picture shows on slides 2-4. They each show a recognisable feature (natural and man-made) that have been photographed from space using a satellite – slides 5-7 show the same landmarks from ground level. Some points for discussion:

The scale of each satellite image is very small – the area shown is large but details are hard to see.

Height is difficult to judge – Mt Taranaki, for instance, looks like it might be flat (or even a hole)

The images contain both natural and man-made features. Differences include symmetry, straight lines and shapes that are clearly designed.

B. Reading satellite images

The handout images should be printed as large as possible, with maximum resolution, in colour – this will allow the greatest amount of detail to be seen. They can also be opened on a large screen using image viewing software available on most computers by double-clicking the file.

The children can be encouraged to look very carefully at the images – maybe in silence for 30 seconds, before discussing the image in pairs. Satellite analysts would take great care and time, methodically and consciously scanning the image with their eyes in good light.

They might look for:

- Man-made and natural features,
- Evidence of people or other living things including plants
- Any changes in height
- Indications of the climate
- The location (coastal, mountain region, plain, city etc)
- Anything else they find interesting.

Pairs might then be put into quads to explain what is in their image.

C. Image 'Bingo'

A game of 'bingo' might involve teachers reading the following list if features, with children putting up their hands or marking on a sheet which are found in their picture:

beach, cliff, coast, forest, hill, mountain, sea, ocean, river, soil, valley, plants, clouds, town / village, factory, farm, house, office, port, harbour

These words may also form a vocabulary list or key word display.

Further investigation of places photographed from satellites can make use of Google Earth or Google Earth Pro. These are free, downloadable software applications that can be used for interactively investigating the world using satellite images. This might include investigating the area round school, locating landmarks known to all.

Extension: Using known distances to determine the scale of images

The image of Mt. Taranaki in New Zealand, sourced from the Airbus Satellite Image Gallery, shows clearly the Egmont National Park that surrounds the dormant volcano. The park boundary is 9.6 km (6 miles) from the peak of the volcano – can the children use this to determine the distance from the peak to the coast, at its nearest point?

Two methods include:

i. Print the image and use a ruler to determine the scale (cm : km) then measure the distance to the coast.
ii. Use the Ruler tool in Google Earth – click and measure from the apparent peak of the mountain (Answer – the coast is approximately 25km from the peak).

2. Postcards from Space

This activity links together satellite images, maps, ground-level photographs and other information and requires analysis of images as well as research skills.

Children imagine that their friend on the International Space Station has sent them 'postcards from space' – these are images with a caption but no marked location.

There are 11 'postcards from space' that can be handed out to small groups of children. They are then asked to use a set of map links, available on the World City Postcards worksheet, to investigate where their postcard came from. They will need to read the image carefully, looking for features that would be visible on a map and matching them against the symbols used on the website. The orientation of the Google Maps page should align to the image making the task easier, although the scale and size of the map displayed will depend on the computer and monitor used.

Children might then be asked to create a presentation or other information resource about the location of their postcard. This is an opportunity to develop their skills in searching and filtering information:

- Search: Choose appropriate keywords for search and understand the results they obtain. Google Search Education contains some useful tips, and the Kentucky Virtual Library has sharable methods for smarter searches.
- Delve: Develop scanning techniques to quickly assess the usefulness of a website, collecting information and moving on to more relevant pages.
- Source: Check the source – is the author trustworthy? What can be found out from the domain (.com, .org.uk etc) for instance is the organisation seeking to profit from you?
- Validity: Does the information seem plausible? Can it be checked against another source?
- Currency: When was the information written? Is / was the author in a position to provide good-quality information?
- Cite: Children should be taught to credit content authors, and also to use copyright-free, creative-commons and public-domain materials where possible.

The information might be presented as a holiday brochure or advert, and could include:

- Links between the features visible in the satellite image and the map (as well as other maps and geographical information found, for example, in the school library).
- Descriptions of the location – climate, people, distance from UK and how to get there.
- Landmarks and things to do.

3. Disaster Recovery

Using the accompanying presentation, children can be introduced to the role of satellites for disaster relief. Space Agencies around the world share data covering disaster zones under an international agreement – governments, emergency services and other relief agencies then use this data to plan their work – often in places where ground-level information is scarce and access is difficult.

Slide 2 shows the Tongan twin islands of Hunga Tonga-Hunga Ha'apai before the volcanic eruption in January 2015. The next slide shows the two islands joined together after the eruption – the original islands are visible but the sea between them is filled with ash. The islands themselves are also completely covered in ash. This video (on The Independent website) shows footage of the explosion.

Slide 4 shows a satellite view of Moore, Oklahoma, after the tornado that wreaked havoc in May 2013. This CNN page has lots of information, and this page carries more aerial photos taken from helicopters. Children can be given the printed image on which they can draw grid lines that coincide with the residential blocks, and can locate the places mentioned in the news article.

Slides 5 and 6 show part of the Philippine coast before and after Typhoon Haiyan (typhoons are similar to hurricanes, but are in the southern hemisphere and tend to rotate in the opposite direction to hurricanes). Discussion might include identifying what needs to be done and where, and deciding the best way to get people and equipment to where it is needed.

Slide 7 shows smoke from forest fires in Yosemite Park, California in August 2013. This page shows a timelapse of the wild fire– the 6th largest fire in Californian history.

Further uses of satellites in disaster zones include:

providing images of areas of Africa affected by Ebola

mapping the area of Japan hit by a Tsunami in 2011

And other disasters including drought, flood, earthquake, oil slicks – more information can be found here.

Children might discuss the advantages of an 'eye in the sky' during disaster management – for detailed mapping of remote areas, damage assessment, and locating populations, for instance. This preparation may then be used for creative or factual writing on the subject of disaster relief.

Additional links:

This guide from Dynamic Earth explains how to create a small, and a large, fizzing volcano demonstration. Appropriate safety assessments should be made before proceeding!

Older and more able children may be interested in this United Nations game, which simulates the avoidance of different types of natural disaster.

SEEKING INSPIRATION?

The ISS flies over most of the inhabited regions of the earth, passing over the same spot around every 5 days.

Most days its orbit passes through the part of the sky you can see – which means the astronauts can see your part of the world too!

Can you use the camera and other sensors on the Astro-Pi to photograph where you live?

Image: ESA

SEEKING INSPIRATION?

The continents and some countries, especially islands such as the UK, each have very recognisable outlines – imagine a World map.

Can these be photographed using the Astro-Pi?

Maybe you can trigger the camera using the clock, or can it be made to recognise the shapes… if it can be taught what to look for.

Image: ESA

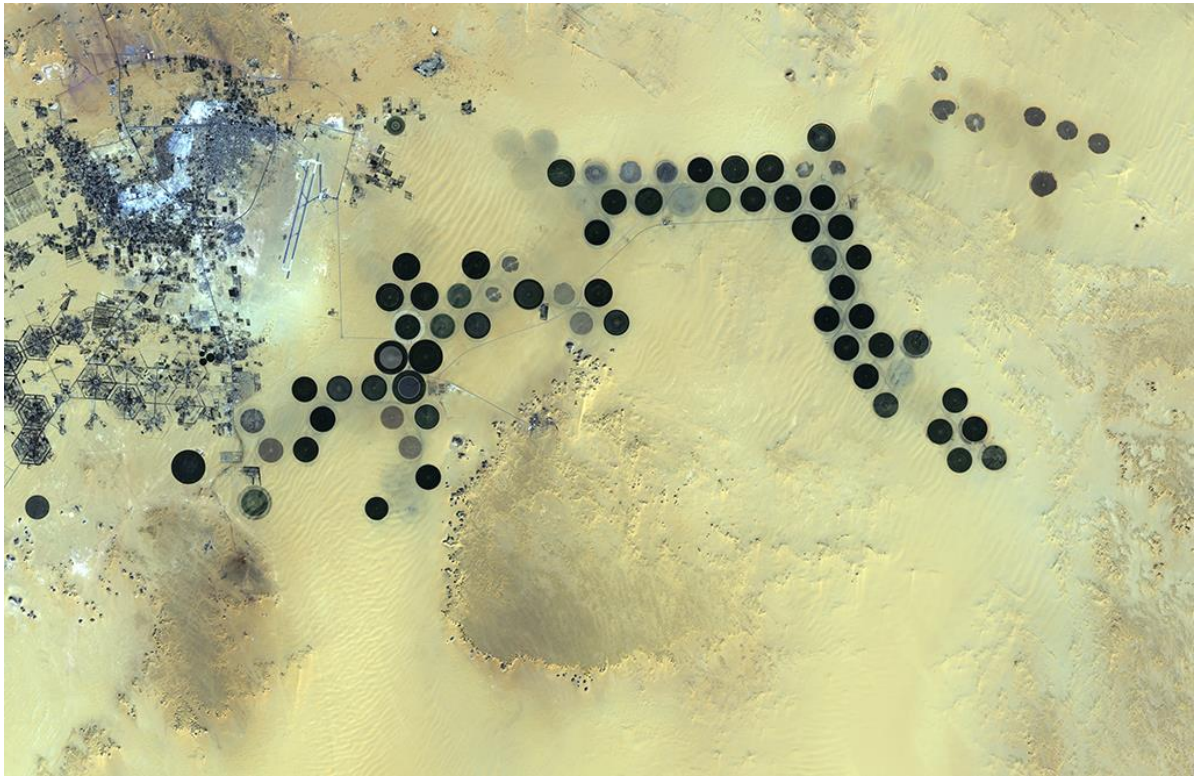
SEEKING INSPIRATION?

The infrared camera on the Astro-Pi is sensitive to the light reflected by healthy plants.

Those monitoring the Earth use such cameras to check on forest cover, crop yields, algae blooms and other greenery.

What could you look for and photograph?

Image: ESA



SEEKING INSPIRATION?

As well as photographing the outside through the Cupola window, the Astro-Pi can shoot inside the ISS.

What, and who, might it see there?

Can you think of ways to combine the camera with other sensors and outputs to interact with astronauts or its surroundings?

Image: ESA

SEEKING INSPIRATION?

The ISS receives visitors every now and again.

Supplies are sent in the Automated Transfer Vehicle (ATV) and crew swaps happen quite regularly using the Soyuz launcher.

Could you use the Astro-Pi camera to record these events, as if you were there yourself?

Image: ESA

SEEKING INSPIRATION?

Clouds and weather formations are easily visible from the ISS, and weather satellites play an important part in predicting the weather.

Can you capture images of the weather, and match them to your observations here on Earth?

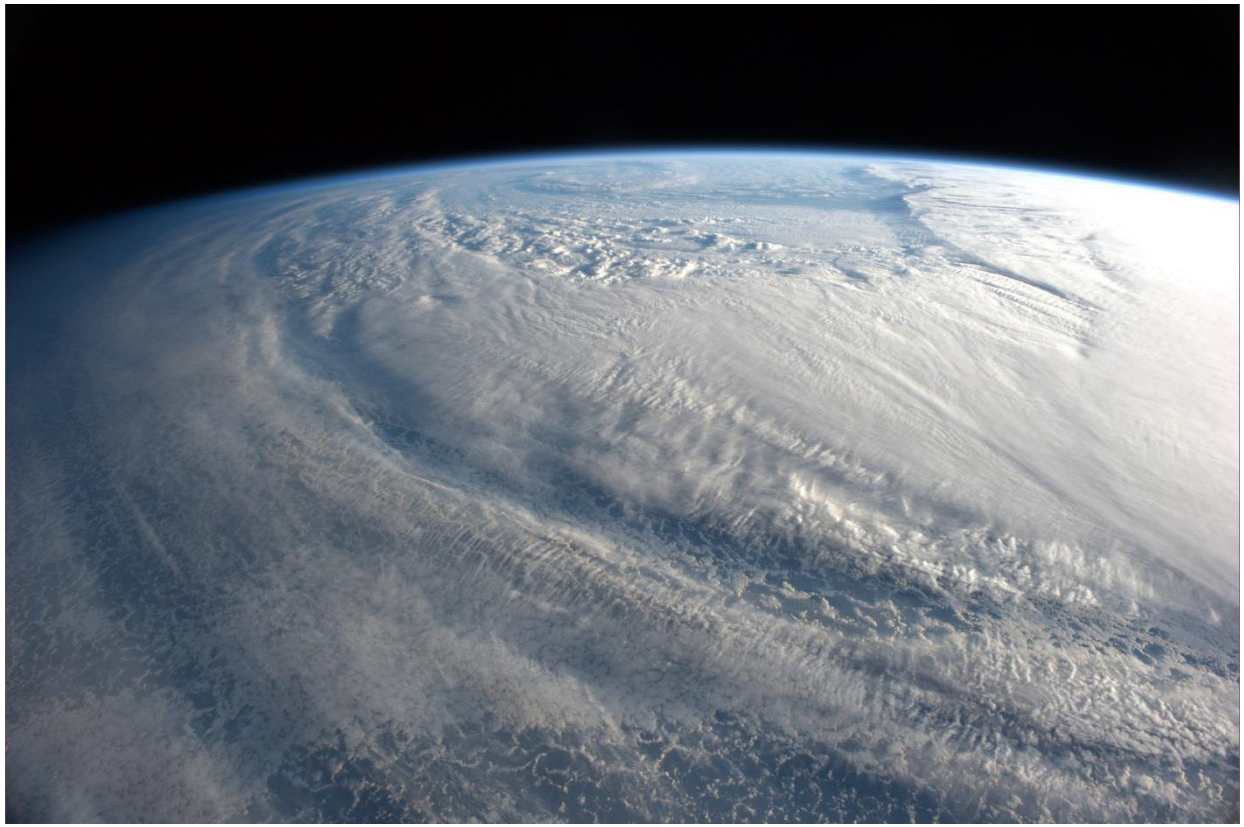


Image: ESA