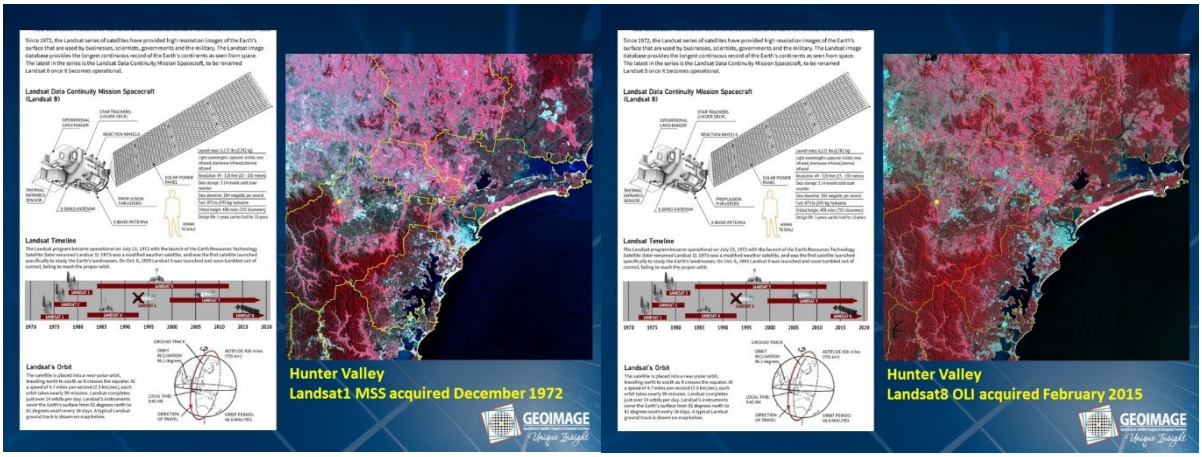
Aspects of Imagery Mapping Using Spaceborne Sensors
RGSQ Map Group Presentation 6 August 2018
Sylvia Michael

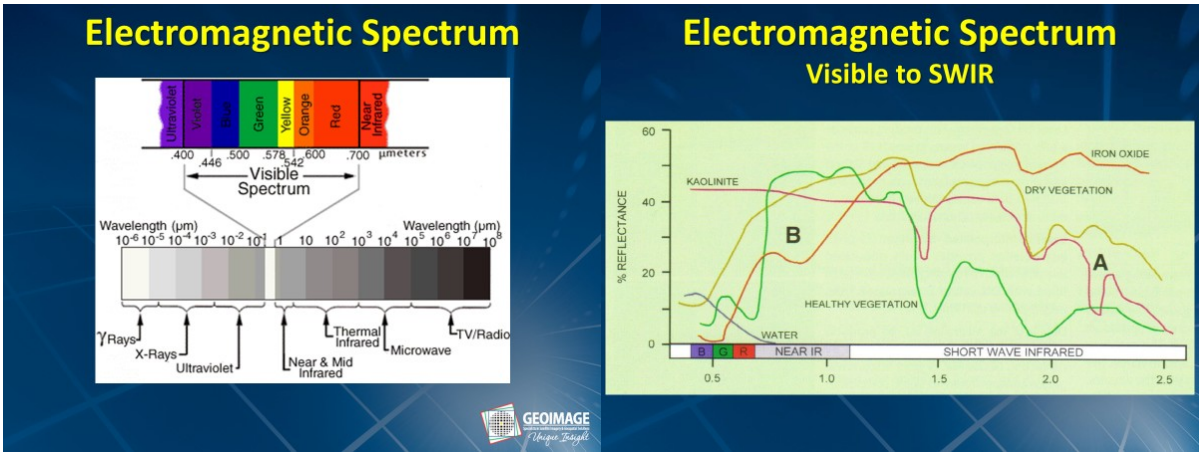
The aim of the presentation was to provide an update to members of the Map Group of the RGSQ on the mapping resources currently available from Earth Observation (EO) sensors, and, in particular optical sensors on space borne platforms.

As an introduction, a brief history and explanation of EO satellites was provided. This introduction included information on the many EO satellites currently operating, EO satellites which operated in the past and have been de-commissioned and the resulting significant library of imagery captured by these satellites.



Left: Information on and imagery from the first EO satellite (Landsat1). Landsat1 was the first satellite that delivered imagery to the wider community.
Right: The latest EO satellite in the Landsat constellation (Landsat8)

In addition, this section of the presentation provided the foundation to understanding of the electromagnetic (EM) spectrum. Different EO sensors collect imagery in different wavelengths and wavelength ranges of the EM spectrum and we can utilise these differences to show features on the Earth which may or may not be visible to the human eye i.e. outside of the visible region of the EM spectrum.



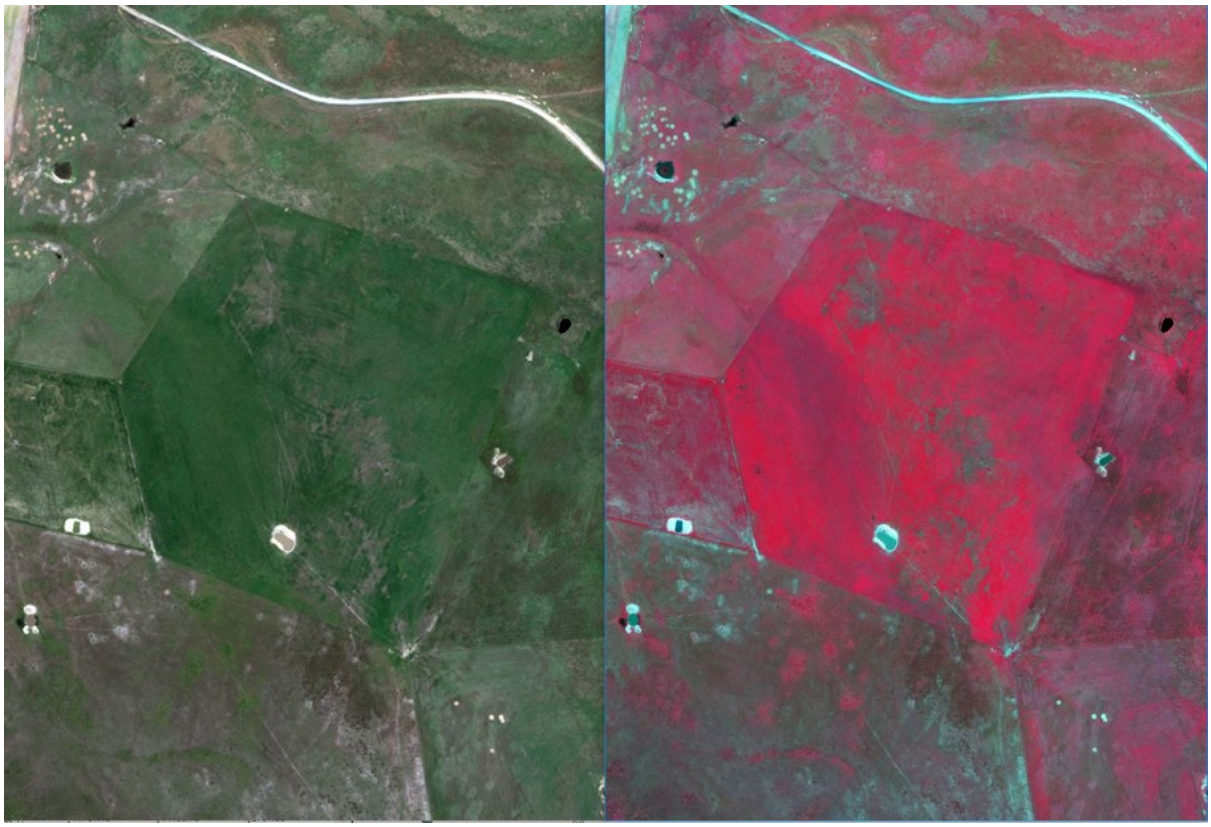
Left: The electromagnetic spectrum showing the main wavelength regions collected by optical EO satellites i.e. Visible, Near Infrared and Short-wave Infrared (or Mid-Infrared) and Thermal Infrared
Right: Spectral curves of a few notable ground features, showing their responses to different wavelengths of the EM spectrum

Most of the remainder of the presentation was dedicated to a description of and examples showing the characteristics of EO satellite imagery including:

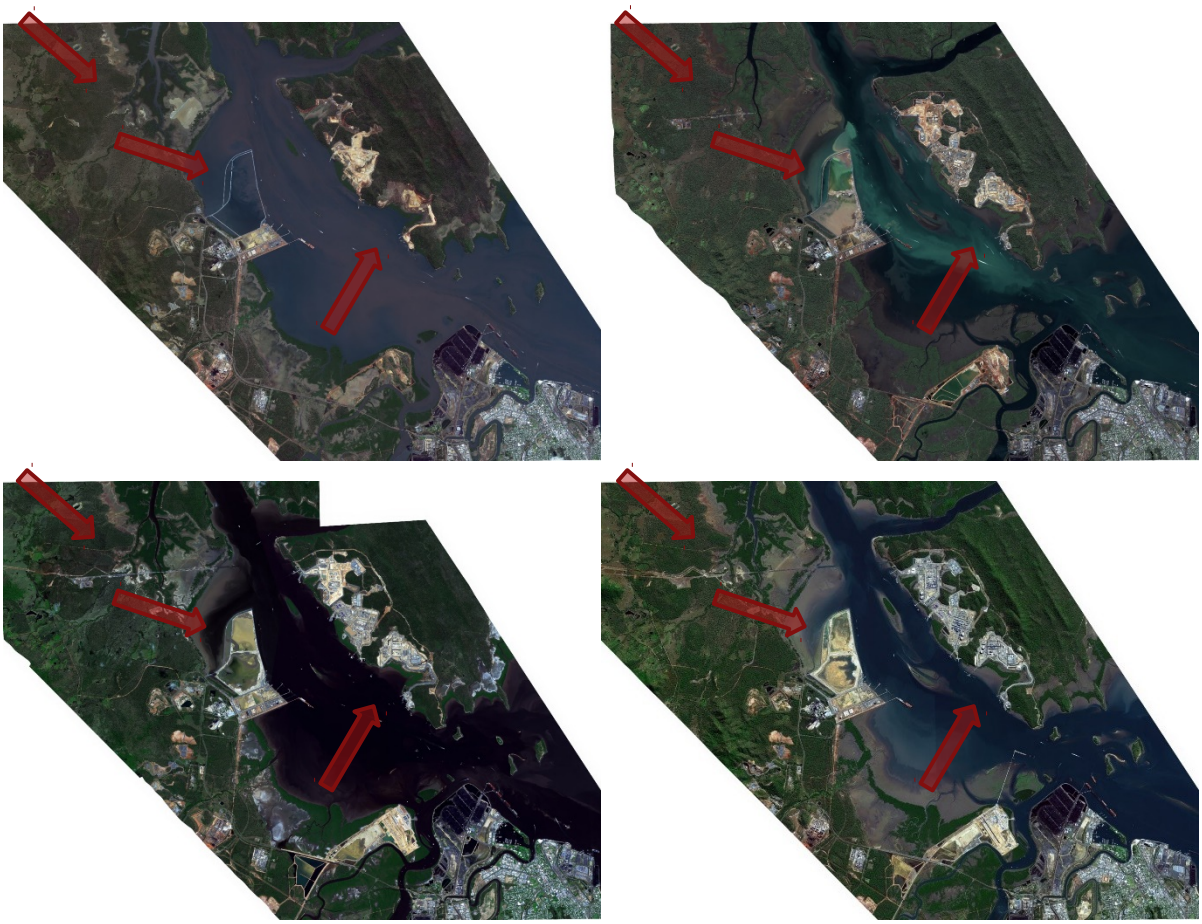
- Spatial resolution
- Spectral resolution
- Temporal resolution, and
- Areal coverage

Example of Spatial Resolution (1)
2km by 2km area in Malawi
Left: 5m resolution Natural Colour using the Visible Bands © RapidEye
Right: 1.2m resolution Natural Colour using the Visible Bands © DigitalGlobe

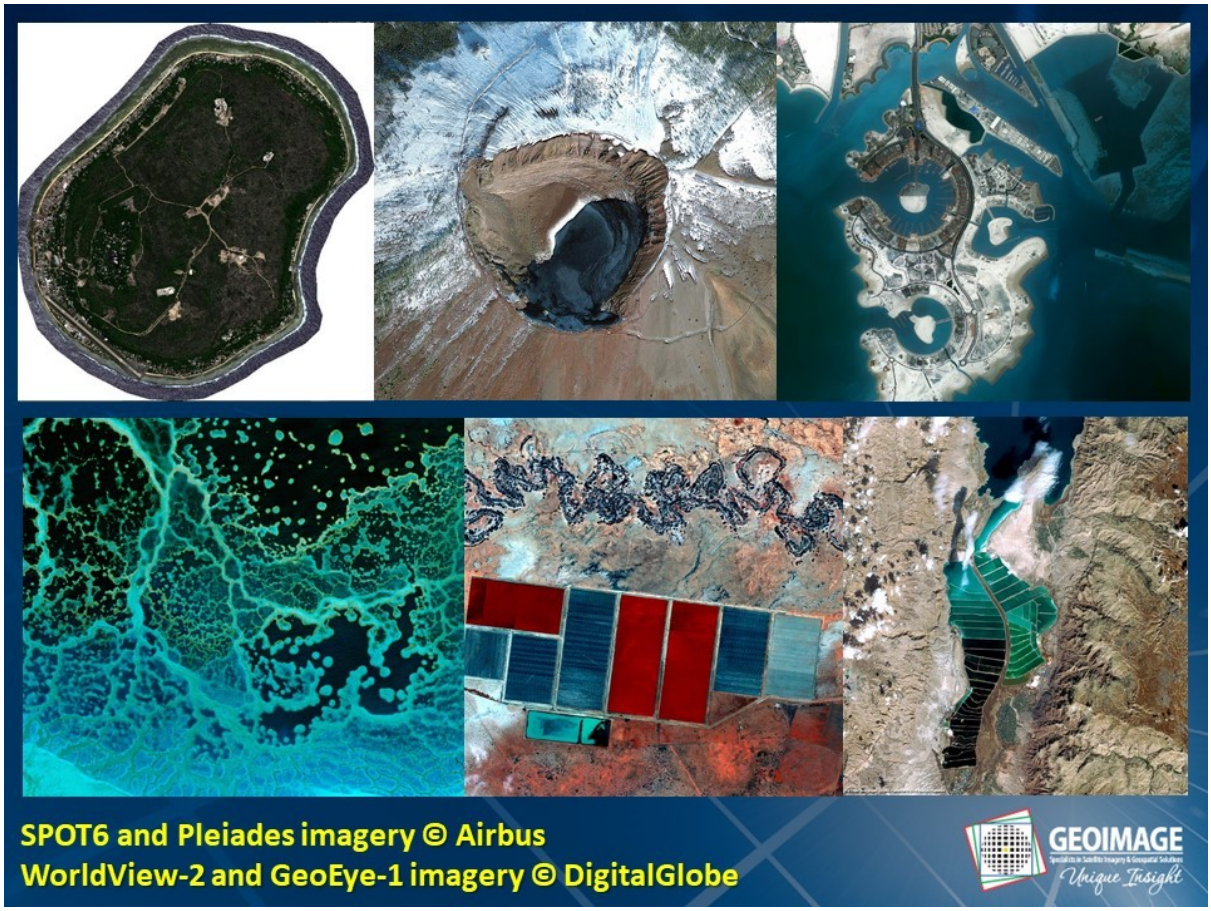
Example of Spatial Resolution (2)
250m by 250m area in Malawi
Left: 1.2m resolution Natural Colour using the Visible Bands © DigitalGlobe
Right: 30cm resolution Natural Colour using the Visible Bands © DigitalGlobe (most detailed resolution available from EO satellite imagery)



Example of Spectral Resolution
Left: Natural Colour using the Visible Bands © DigitalGlobe
Right: False Colour (“red-for-veg” colour scheme) using the Visible Green, Visible Red and Near Infrared Bands © DigitalGlobe

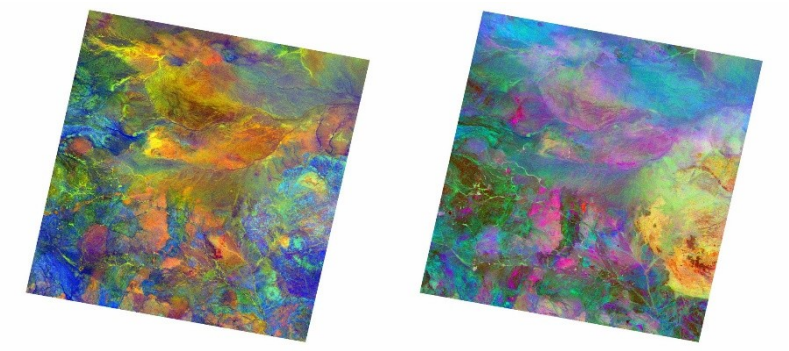


Example of Temporal Resolution over the mainland near Gladstone and Curtis Island
Top left, top right, bottom left, bottom right: Natural colour acquired 2011, 2012, 2013 and 2014 © DigitalGlobe
Red arrows highlight some of the areas exhibiting change

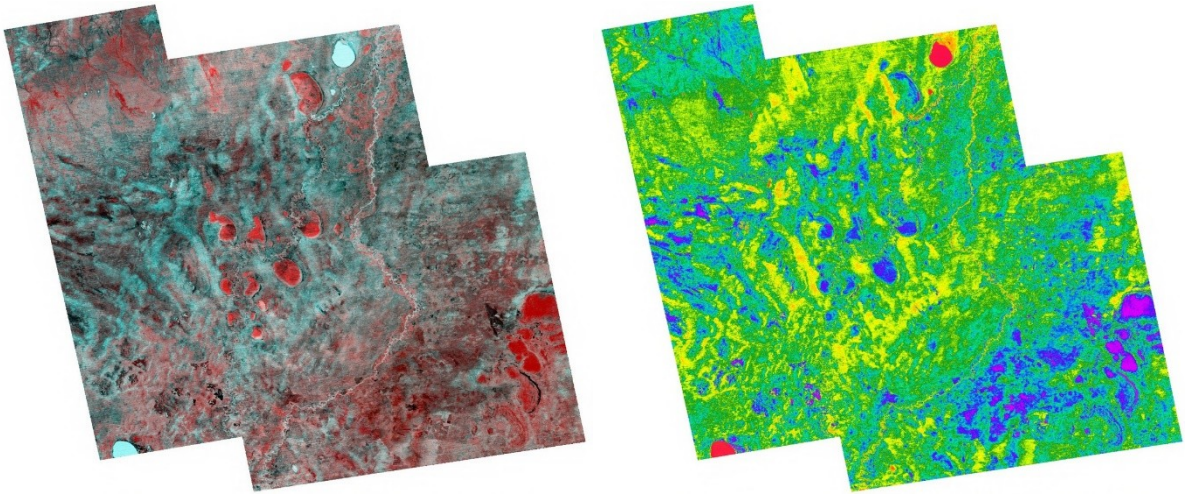


Examples of Areal Coverage - Where we can obtain imagery?
Top row, left to right: Nauru, Mount Vesuvius, Qatar
Bottom row, left to right: A coral atoll in the Pacific Ocean, Riverina, Dead Sea

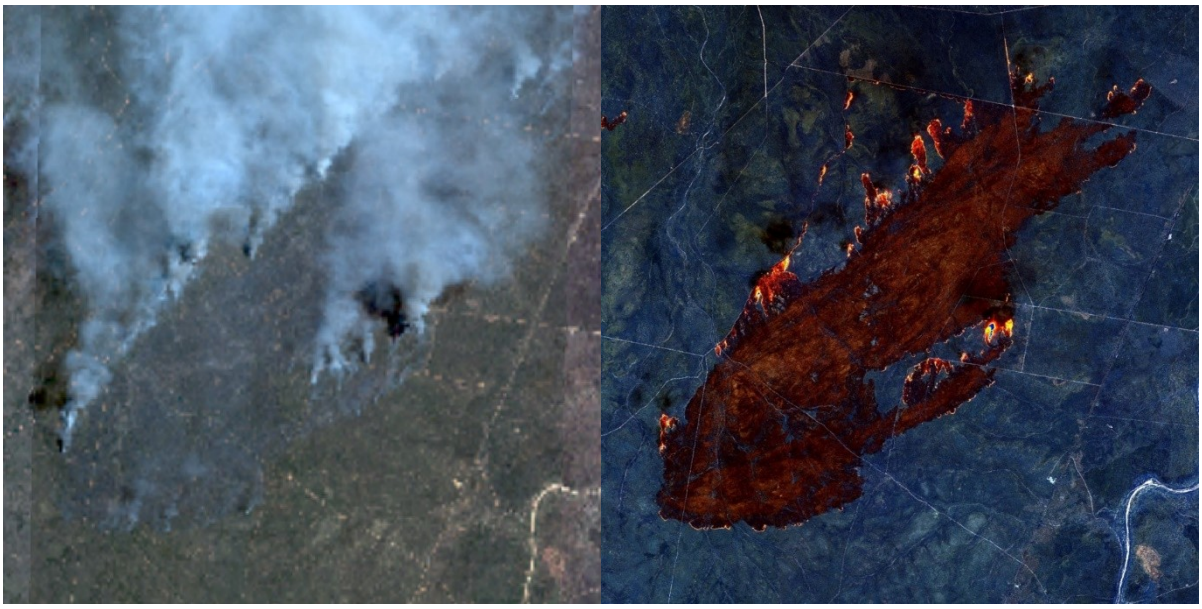
The presentation also included slides showing how different combinations of EM wavelength ranges (or bands) show different features and also how ratios and other mathematical formulae can manipulate these bands to provide even more information that is not immediately visible.



Geological mapping using ASTER imagery over an area in Mongolia
ASTER has been collecting imagery since 1999 in the visible, near infrared, short-wave infrared (SWIR) and thermal infrared (TIR) wavelengths, providing a large range of colour composites and ratio combinations from one sensor.
Top row, left to right: False colour, simulated true colour, decorrelation stretch of SWIR bands 765
Bottom row, left to right: Iron ratios, combination of ratios showing mineral assemblages possibly related to ore mineralization

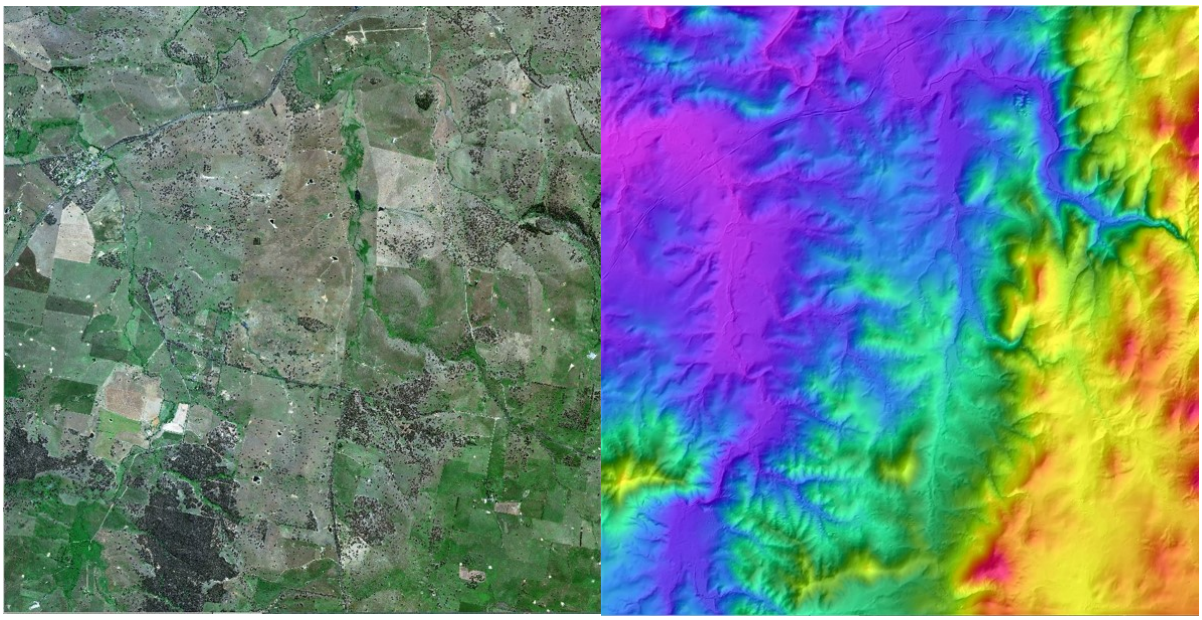


Geological mapping using an ASTER imagery mosaic collected at night over an area in New South Wales
Left: Colour composite of emissivity (energy release or retained) derived from the TIR
Right: Temperature derived from the emissivity imagery



Imagery over the Adelaide Hills fire in March 2015
Left: Natural colour, ground and fire front obscured by smoke © DigitalGlobe
Right: Colour composite of three SWIR bands “seeing” through the smoke to show burnt areas and fire fronts © DigitalGlobe

In addition, the presentation provided examples of topographical models (Digital Elevation Models) derived from imagery collected by EO satellites and an emerging access, delivery and processing platform that utilises the vast capability of a cloud-based system.



Example of DEM derived from Stereo Collection in Victoria
Left: Natural colour © DigitalGlobe
Right: Generated Digital Elevation Model (DEM) or topographic model © DigitalGlobe, showing low elevation in magenta, increasing through blue, green, yellow and orange to a maximum elevation in red

An example of the use of an access, delivery and processing platform utilising cloud capability and emerging technology © PSMA and Pitney Bowes