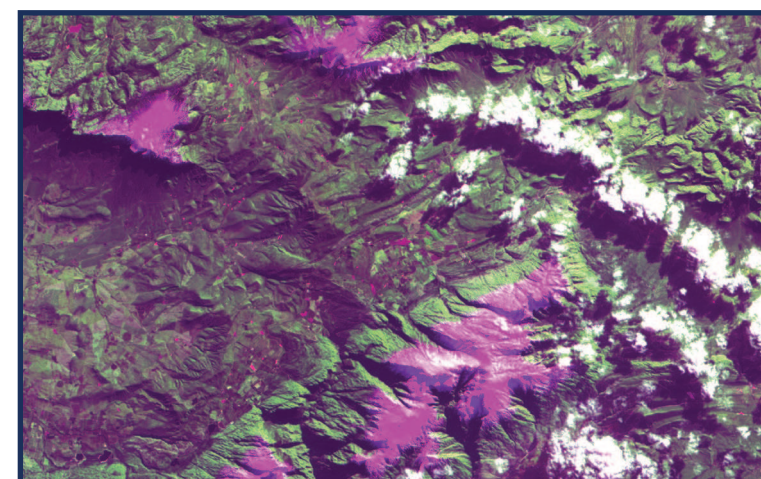


● LandSat 8 false colour composite showing snow cover. This colour combination shows snow as white, different from other land cover types.

● LandSat 8 false colour composite showing a clear distinction between clouds in white, shadows in black and snow in purple.

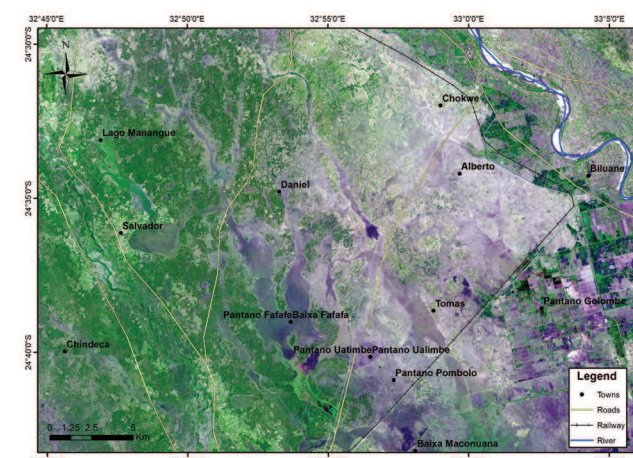
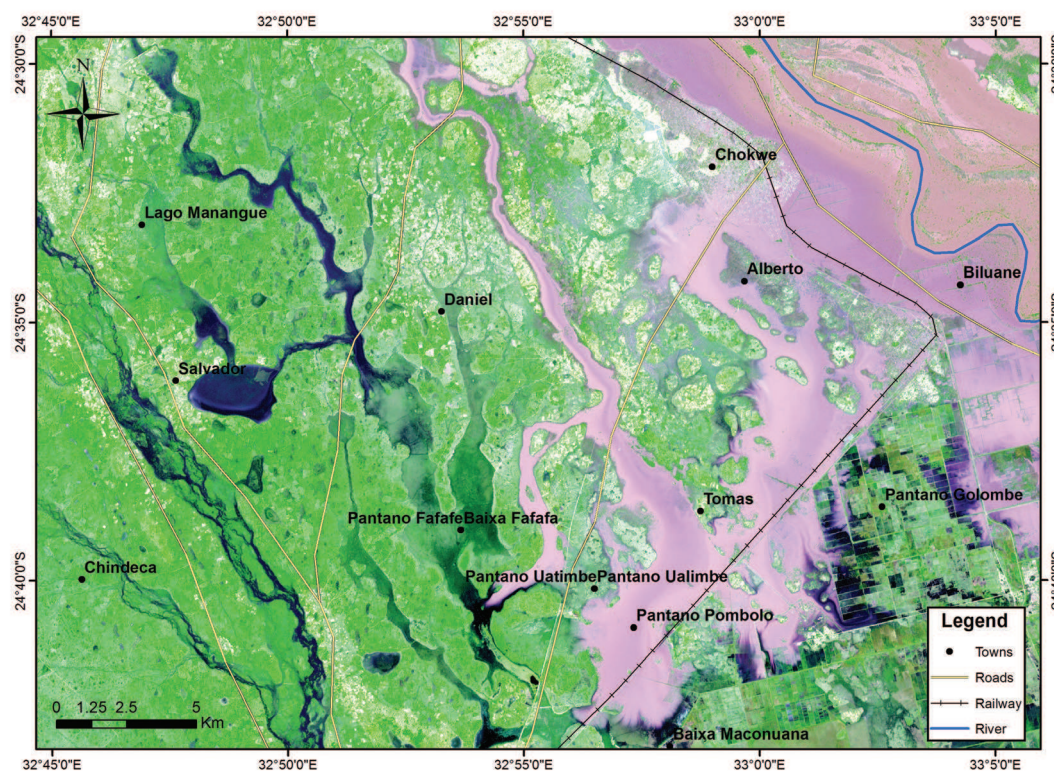




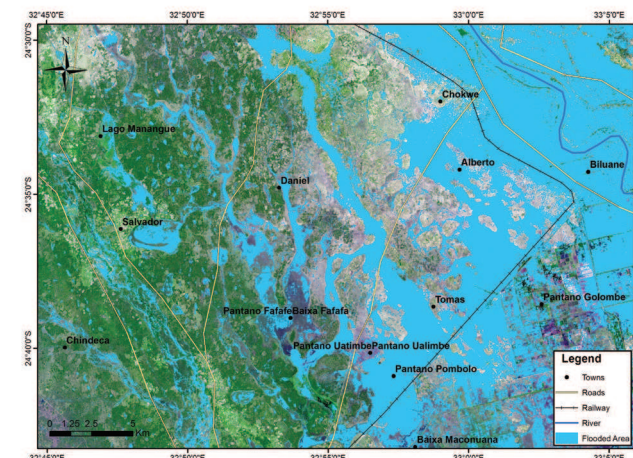
# Post-flood analysis



Flooded areas within and around Chokwe, the satellite image shows how the road and railway infrastructure were affected. Such information is critical in identifying alternative routes during rescue and recovery operations.



Chokwe before the floods



Chokwe during the floods

Natural disasters are catastrophic events which result from natural processes of the earth affecting human livelihood and at times claiming lives. Remote sensing is significant in disaster management to prepare, recover and respond to disasters such as floods. Remote sensing makes it possible to do a post analysis assessment of the area affected after the floods by identifying the affected infrastructure and the extent of the flooded area.

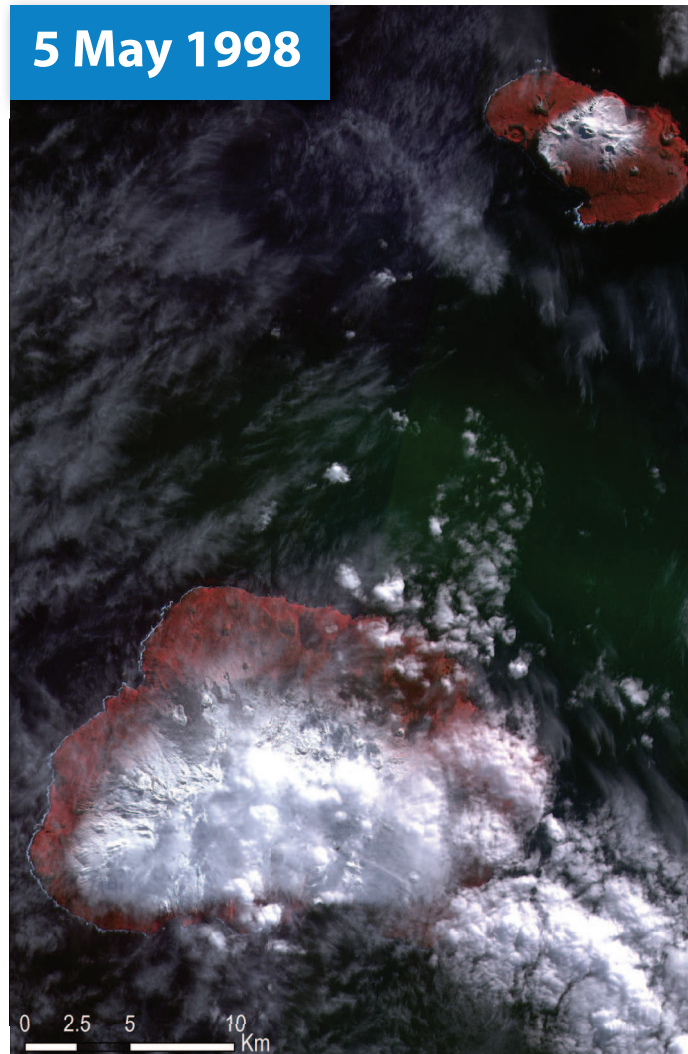


# Climate change

An 11-year comparison of Marion and Prince Edward Islands indicate the disappearing ice cap. A SPOT-2 false colour composite satellite image, acquired in May 1998, and an EO-1 ALI image, acquired in May 2009, demonstrate the changes in snow cover within an 11-year period. The disappearance of the ice cap at these islands is astounding – this is visible evidence of the consequences of climate change. Studies conducted at the islands have indicated that between 1948 and 2009, about 42-million cubic meters of ice melted from the mountain top. Furthermore, the ice continues to melt at a rate of between 1 to 1.5m every year.

This is **visible evidence**  
of the consequences of  
**climate change.**

5 May 1998



5 May 2009



# Satellite specifications

Sensor	Launch date	Spatial resolution	Spectral bands	Swath
SumbandilaSat	17 September 2009	6,25m	Blue, Xanthophyll, Green, Red, Red-Edge, NIR	40km
ASTER	18 December 1999	VNIR 15m SWIR 30m TIR 90m	VNIR, SWIR, TIR	60km
SPOT 5	3 May 2002	Pan 2,5m MS 10m SWIR 20m	Pan, Green, Red, NIR, SWIR	60km
SPOT 6	9 September 2012	PAN 1,5m VNIR 6,0m	PAN, VNIR	60km
LandSat 8	11 February 2013	SWIR 30m Cirrus 30m TIRS 100m	Pan, VNIR, SWIR, Cirrus, TIR	185km
GeoEye-1	6 September 2008	Pan 0,46m MS 1,5m	Pan, VNIR	15,2km
RapidEye	29 August 2008	5m	VNIR, Red-Edge	77km
Worldview 2	8 October 2009	0,5m	VNIR, Red-Edge, Coastal, Yellow, NIR2	16,4km



# Image credits

## Page 6-7

- Global Map, Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo and GIS user community.

## Page 8

- Design: Tarina Coetzee

## Page 15

- Simplified geology of South Africa, courtesy of the Council for Geoscience (CGS), South Africa.
- The Bushveld Igneous Complex, courtesy of NASA/GSFC/METI/JapanSpaceSystems, and U.S./Japan ASTER Science Team.

## Page 16

- Tswaing crater: SPOT-6, Copyright © Airbus DS 2013. All rights reserved.
- Cross section of Tswaing crater published with permission from David Kring. [http://www.lpi.usra.edu/science/kring/epo\\_web/impact\\_cratering/enviropages/Tswaing/Tswainggeologypage.html](http://www.lpi.usra.edu/science/kring/epo_web/impact_cratering/enviropages/Tswaing/Tswainggeologypage.html).

## Page 17

- Vredefort Dome: SPOT 6 ©Airbus Defense and Space 2015. All rights reserved.
- The Great Dyke: ASTER, NASA/GSFC/MITI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team. 20-meter Digital Elevation Model, Vredefort dome courtesy of SANSA Earth Observation.

## Page 18

- Aerial photograph of Mogalekwena Mine courtesy of National Geo-spatial Information (CD NGI), South Africa.

## Page 19

- Aerial photograph of Lephalale Mine courtesy of National Geo-spatial Information (CD NGI), South Africa.

## Page 20

- Jan Kempdorp in Northern Cape: SumbandilaSat, Copyright © Sunspace.
- Bothaville: Landsat 8, Copyright © USGS.

## Page 21

- Bushbuck ridge and Kirkwood: SumbandilaSat, Copyright © Sunspace.

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- Aerial photograph of Kruger National Park courtesy of National Geo-spatial Information (CD NGI), South Africa.

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- Hartbeespoort dam and Rustenburg dam: Landsat 8, Copyright © USGS.

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- Cape Town Stereo Optical: WorldView-1, Copyright © Digital Globe.

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- Robben Island, Cap Town: SumbandilaSat, Copyright © Sunspace.

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- Aerial photograph of Rustenburg courtesy of National Geo-spatial Information (CD NGI), South Africa.

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- Union Buildings, Pretoria: SPOT-6, Copyright © Airbus DS 2013. All rights reserved.

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- Ceres: Landsat 5 Copyright © USGS.
- Western Cape Province: Landsat 8, Copyright © USGS.

## Page 30-31

- Ceres, Western Cape: Landsat 8, Copyright © USGS.

## Page 32

- Chokwe, Mozambique: ASTER, NASA/GSFC/METI/JapanSpace Systems, and U.S./Japan ASTER Science Team.

## Page 33

- Prince Edward Islands. SPOT-2, Copyright © CNES 2002, Distribution Airbus DS / Spot Image. All rights reserved.
- EO-1 ALI: NASA Earth Observatory image created by Jesse Allen, using EO-1 ALI data provided courtesy of the NASA EO-1 team and the United States Geo-logical Survey.

Visit the SANSA online catalogue for more satellite images and the SANSA Fundisa Student Portal for interaction with SANSA personnel.  
<http://catalogue.sansa.org.za/> and <http://fundisa.sansa.org.za>





# Abbreviations

## **SANSA (South African National Space Agency)**

Our vision is to position South Africa as an international Hub for Space Solutions for the world of the future. SANSA's mission is to Lead and Inspire the South African Space Community to create a better future.

## **CNES (Centre national d'études spatiales)**

### **(English: National Centre for Space Studies)**

CNES is the French government agency responsible for shaping and implementing France's space policy in Europe. Its task is to invent the space systems of the future, bring space technologies to maturity and guarantee France's independent access to space.

## **NASA (National Aeronautics and Space Administration)**

The National Aeronautics and Space Administration (NASA) is the United States government agency responsible for the civilian space programme as well as aeronautics and aerospace research.

## **NSDI (National Spatial Data Infrastructure)**

National spatial data infrastructure is a South African data infrastructure implementing a framework of geographic data, metadata, users and tools that are interactively connected to use spatial data in an efficient and flexible way.

## **NOAA (National Oceanic and Atmospheric Administration)**

NOAA uses cutting-edge research and high-tech instrumentation to provide citizens, planners, emergency managers and other decision-makers with reliable information when they need it – from daily weather forecasts, severe storm warnings and climate monitoring to fisheries management, coastal restoration and it supports marine commerce.

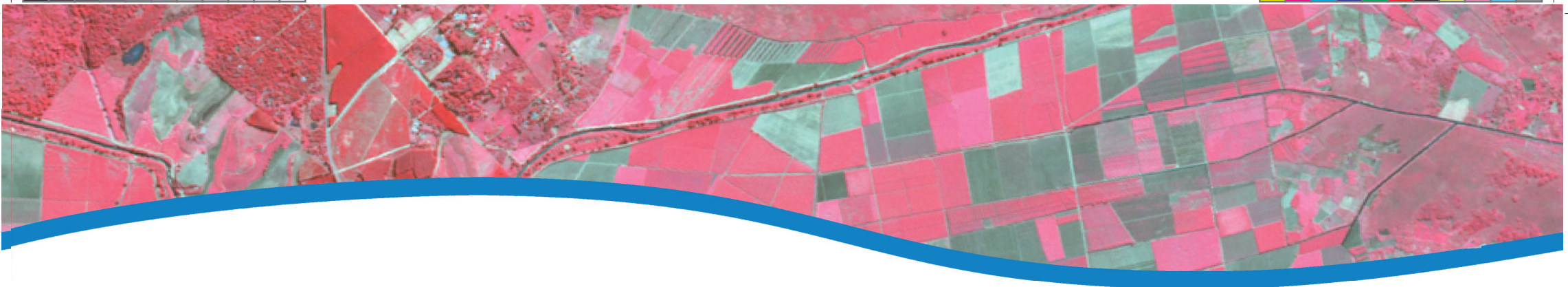
## **USGS (United States Geological Survey)**

The USGS is a science organization that provides impartial information on the health of our ecosystems and environment, the natural hazards that threaten us, the natural resources we rely on, the impacts of climate and land-use change, and the core science systems that help us provide timely, relevant, and useable information.

## **ERS (European Remote Sensing)**

ESA's two European Remote Sensing (ERS) satellites, ERS-1 and -2, were launched into the same orbit in 1991 and 1995 respectively. Their payloads included a synthetic aperture imaging radar, radar altimeter and instruments to measure ocean surface temperature and wind fields. ERS-2 added an additional sensor for atmospheric ozone monitoring. The two satellites acquired a combined data set extending more than two decades.





### **TRL (Technology readiness level)**

Technology Readiness Level (TRL) is a method of estimating technology maturity of Critical Technology Elements (CTE) of a program during the acquisition process. They are determined during a Technology Readiness Assessment (TRA) that examines program concepts, technology requirements, and demonstrated technology capabilities. TRL is based on a scale from 1 to 9 with 9 being the most mature technology. The use of TRL enables consistent, uniform, discussions of technical maturity across different types of technology.

### **TTC (Telemetry, Tracking and Command)**

Satellites are a big investment and making sure they stay on target and operate for as long as possible is essential. TTC antenna systems are critical to maintaining and addressing satellite "housekeeping" items to ensure optimal performance. The antennas can do everything from adjust the satellite's orbit, realign the solar panels, perform system back-up, and more.

### **CSIR (Council for Scientific and Industrial Research)**

The CSIR is one of the leading scientific and technology research, development and implementation organisations in Africa. Constituted by an Act of Parliament in 1945 as a science council, the CSIR undertakes directed and multidisciplinary research, technological innovation, as well as industrial and scientific development to improve the quality of life of the country's people. The CSIR is committed to supporting innovation in South Africa to improve national competitiveness in the global economy. Science and technology services and solutions are provided in support of various stakeholders, and opportunities are identified where new technologies can be further developed and exploited in the private and public sectors for commercial and social benefit. The CSIR's shareholder is the South African Parliament, held in proxy by the Minister of Science and Technology.



# Glossary

## Acquisition

When a satellite in space takes a picture of the Earth.

## Astrobleme

An eroded remnant of a large crater made by the impact of a meteorite or comet.

## Classification

The computational process of assigning individual pixels in a digital image into different groups.

## Change detection

The process of monitoring an event and observing its changes over time.

## Digital Elevation Model (DEM)

An image representing the Earth's altitude from sea level.

## Dome

A circular feature consisting of symmetrically dipping anticlines.

## Earth observation

A process of looking down at the Earth and capturing images of the Earth using an elevated platform such as an aircraft or satellites of various sensors.

## Electromagnetic radiation

Energy propagated from the sun or through material media in the form of an advancing interaction between electrical and magnetic fields.

## Electromagnetic spectrum

The range of energy in the visible, infrared, ultraviolet, microwave, gamma ray, x-ray and radio, which travels at the speed of light.

## False colour composite

An image colour combination not representing a true colour.

## Geostationary orbit

The circular path around the Earth equator at a distance of 36 000km following the movement of the Earth.

## Gravity field

A model used to explain the influence that a massive body extends into space around itself, producing a force on another massive body.

## High-resolution camera

See Spatial Resolution.

## Launch vehicle

A rocket used to carry a payload from the Earth's surface into outer space.

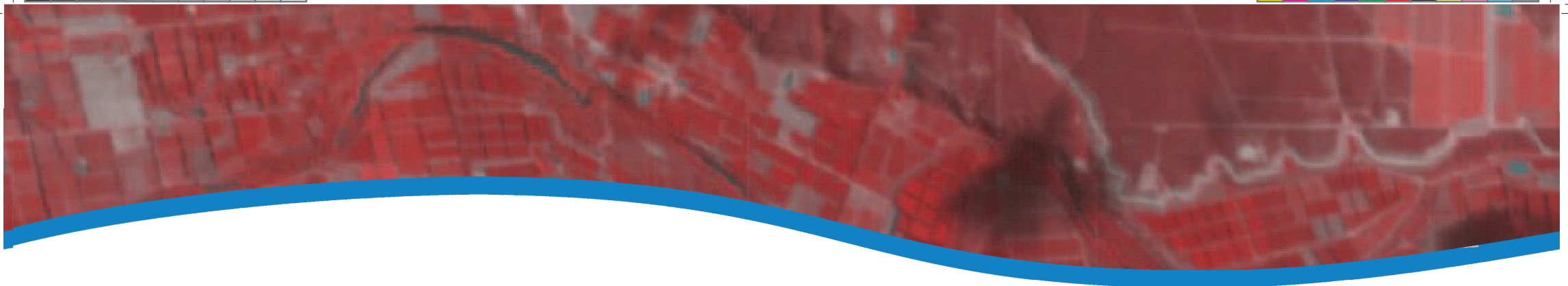
## Low Earth Orbit (LEO) Satellite

A satellite that circumnavigate Earth at a distance of between 160km and 2 000km.

## Minitrack station

See Receiving Station.





### **Multispectral cameras**

A section of cameras that captures image data at specific frequencies across the electromagnetic spectrum.

### **Meteorite**

A meteorite is a solid piece made up of fragments, from asteroids or comets, that originates in outer space and survives its impact with the Earth's surface. Before impact it is called a meteoroid.

### **Orbit**

The gravitational curved path traced by a satellite as it passes around a planet.

### **Panchromatic band**

A higher-resolution image of a satellite.

### **Rocket**

An aircraft or a vehicle that is used to propel satellites to orbit.

### **Spatial (geometric) resolution**

The distance each image pixel covers on the ground.

### **Sensor**

A scanner and/or camera that records a remote-sensing image.

### **Spectral band**

Satellite image captured at a specific wavelength of the electromagnetic spectrum.

### **Swath width**

The linear ground distance in the across-track direction that is covered by a sensor on a single overpass.

### **Satellite**

The platform that carries imaging sensors in space orbiting the Earth.

### **Subset**

A section cut off from a larger satellite image or a scene.

### **Temporal resolution**

The length of time it takes for a satellite to complete an entire orbit cycle or the period it takes a satellite sensor to capture the same area.

### **Telecommunications**

Communication at a distance by technological means, particularly through electrical signals or electromagnetic waves.

### **Tracking Telemetry and Command**

Provides the monitoring of the health and status of the satellite through the collection, processing and transmission of data from the various satellites.

### **Transmitting**

To send signals or commands to a satellite in space or from space to ground receiving stations.

### **True Colour Composite**

An image colour combination representing a true colour.



