By working together,
the Charter's international partners
are helping to save lives across the globe

Ian Pearson - Former UK Minister for Science and Innovation

The International Charter Space and Major Disasters was initiated by the European Space Agency (ESA) and the Centre National d'Etudes Spatiales (CNES) following the UNISPACE III conference in 1999. The Canadian Space Agency (CSA) signed the Charter in 2000.

Today, the Charter helps coordinate an increasing number of space agencies worldwide that cooperate on a voluntary basis, with no exchange of funds. Each member agency has committed resources to support the provision of the Charter.

The Charter is an important step forward in linking the needs of disaster and relief organisations with space technology solutions to help mitigate the effects of disasters on human life, property and the environment.

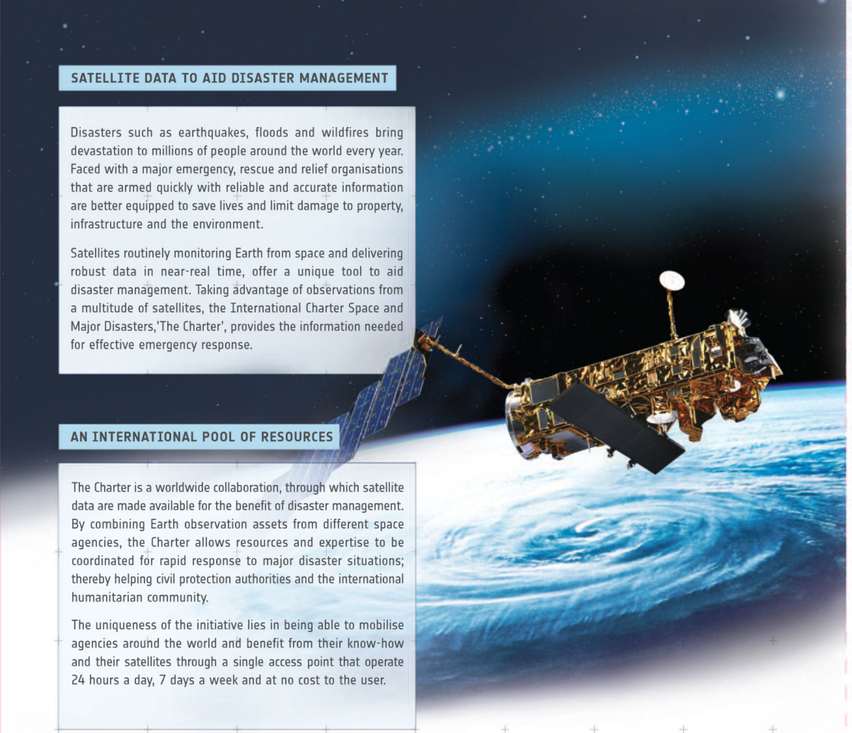
www.disasterscharter.org

→ THE INTERNATIONAL CHARTER SPACE AND MAJOR DISASTERS

SATELLITE DATA TO AID DISASTER MANAGEMENT

Disasters such as earthquakes, floods and wildfires bring devastation to millions of people around the world every year. Faced with a major emergency, rescue and relief organisations that are armed quickly with reliable and accurate information are better equipped to save lives and limit damage to property, infrastructure and the environment.

Satellites routinely monitoring Earth from space and delivering robust data in near-real time, offer a unique tool to aid disaster management. Taking advantage of observations from a multitude of satellites, the International Charter Space and Major Disasters,'The Charter', provides the information needed for effective emergency response.



AN INTERNATIONAL POOL OF RESOURCES

The Charter is a worldwide collaboration, through which satellite data are made available for the benefit of disaster management. By combining Earth observation assets from different space agencies, the Charter allows resources and expertise to be coordinated for rapid response to major disaster situations; thereby helping civil protection authorities and the international humanitarian community.

The uniqueness of the initiative lies in being able to mobilise agencies around the world and benefit from their know-how and their satellites through a single access point that operate 24 hours a day, 7 days a week and at no cost to the user.

ENSURING EFFECTIVE RESPONSE

Empowering rescue and civil defence bodies, the Charter offers the best up-to-date satellite resources available by delivering fast, reliable and clear information on disasters – anywhere in the world.

Earth observation satellites can provide an overall picture of areas often made difficult to access by the very nature of the disaster. A range of spaceborne sensors, including those able to 'see' in the dark and through cloud cover, offer the best possible means on which to base an emergency response. Rapid mapping and damage assessment products, created using Charter data, provide extremely valuable support to decision makers and relief teams out in the field.

Bringing together new and efficient space technologies to support disaster management

THE CHARTER - A UNIQUE WORLDWIDE SYSTEM FOR DISASTER RESPONSE

- Disaster management organisations can access space-based information to support crisis mapping and damage assessment by calling a confidential telephone number, 24 hours a day, 365 days a year.
- The Charter works with Authorised Users – typically disaster management centres from countries of Charter member agencies – who have been granted the right to submit requests. Authorised Users can access the Charter directly in order to request support for emergencies in their own country, or in another country with which they cooperate for disaster relief.
- In addition, the UN Office for Outer Space Affairs (UNOOSA) and the UN Institute for Training and Research Operational Satellite Applications Programme (UNITAR/UNOSAT) both act as gateways, through which relief actors from the United Nations can submit a request.
- Satellite data acquisition and analysis take place on an emergency basis. Although its mandate is limited to supplying satellite data quickly and at no cost, Charter members also generally collaborate with other value-adding capacities to include analysis and interpretation for damage assessment following a disaster.

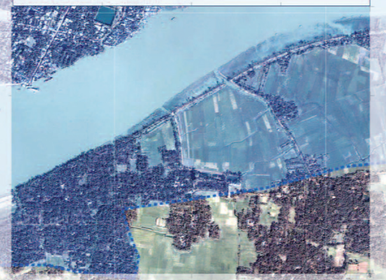
SUPPORTING DISASTER MANAGEMENT

When a disaster strikes, timeliness is crucial. Through the Charter, the acquisition of satellite data over disaster areas can be prioritised, making sure that the necessary information is available directly to those responding to the situation.

In the aftermath of a disaster, information derived through the Charter can help provide further views of how the landscape and infrastructure have been affected, even down to street-level. This information can be used to provide key cartographic information on areas that are difficult to access, helping to identify zones where aid is still needed.

By combining new imagery with pre-disaster data, accurate damage assessment maps can also be produced via the Charter.

Over the last few years, the Charter has continued to demonstrate the importance of space in helping to optimise the capacity of relief organisations dealing with natural and technological hazards.



→ EUROPEAN SPACE AGENCY (ESA)

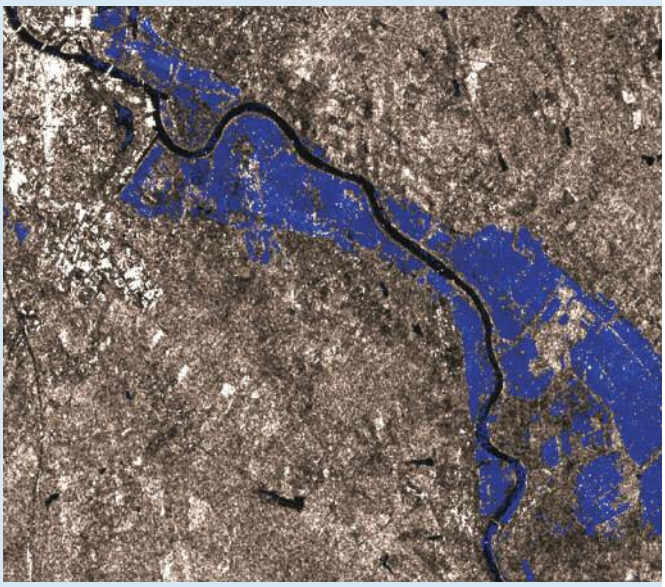
The European Space Agency (ESA) is Europe's gateway to space. ESA has been dedicated to observing Earth from space since the launch of its first metrological mission in 1977. Since then, the Meteosat series of satellites, ERS-1, ERS-2 and Envisat have provided a wealth of data about Earth, which is used in a wide range of application areas.

The current series of Earth Explorer missions are set to advance our understanding of Earth and its environment even further. In addition, the upcoming Sentinel family of satellites, developed for Europe's Global Monitoring for Environment and Security (GMES) initiative, will ensure the provision of data for operational applications, including emergency response.

ERS-2

ESA launched ERS-2 in 1995. With a core payload of two specialised radars and an infrared imaging sensor, as well as an instrument designed to monitor ozone levels in the atmosphere, ERS-2 has collected a wealth of valuable data on Earth and its environment. This mission has contributed to an extensive archive of image data, and has been called upon to monitor natural disasters such as severe flooding and earthquakes.

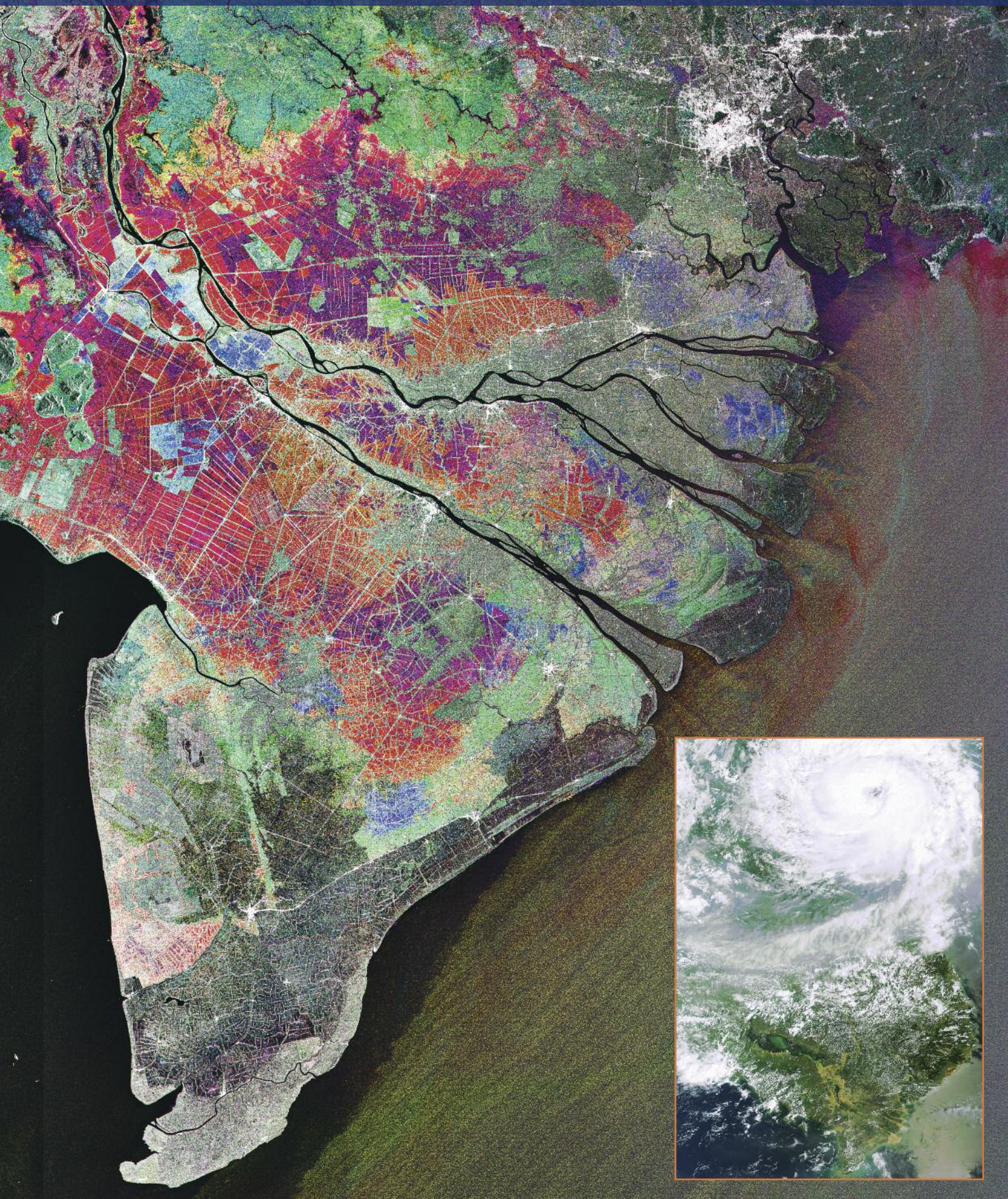
This ERS-2 radar image captures the extent of flooding in March 2001 in the Saône valley, France. At the time, dense cloud hampered optical satellite imaging, but radar images from ERS-2 were used to produce a detailed map of the area to help teams deal with the swollen river waters.
© ESA



ENVISAT

Launched in 2002, Envisat is the largest Earth observation satellite ever built. It carries ten sophisticated optical and radar instruments to provide continuous observation and monitoring of Earth's land, atmosphere, oceans and ice caps. Envisat data collectively provide a wealth of information on the workings of the Earth system, including insight into factors contributing to climate change.

This Envisat MERIS image acquired on 25 November 2006 captures smoke spewing from Europe's largest active volcano, Mt. Etna. Because of their unique vantage point from space, Earth observation satellites are ideal for monitoring regions at risk from natural disaster. Satellite data can be used to produce maps to assess hazards and damage after an event.
© ESA



Spaceborne radar and optical instruments are used to provide complementary information. Radar works in all weather, able to peer through cloud, rain and darkness, as demonstrated by this Envisat Advanced Synthetic Aperture Radar (ASAR) image of Vietnam's Mekong Delta – which is typically covered by cloud.

By comparison, the image in the insert was acquired by Envisat's Medium Resolution Imaging Spectrometer (MERIS), and shows the cloud structure of Typhoon Parma as it passed over northern Vietnam in October 2009.
Credits: ESA

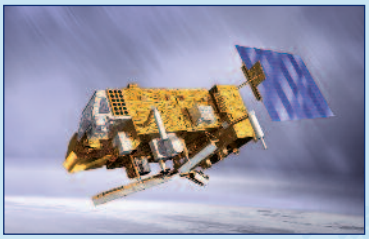
→ EUROPEAN ORGANISATION FOR THE EXPLOITATION OF METEOROLOGICAL SATELLITES (EUMETSAT)

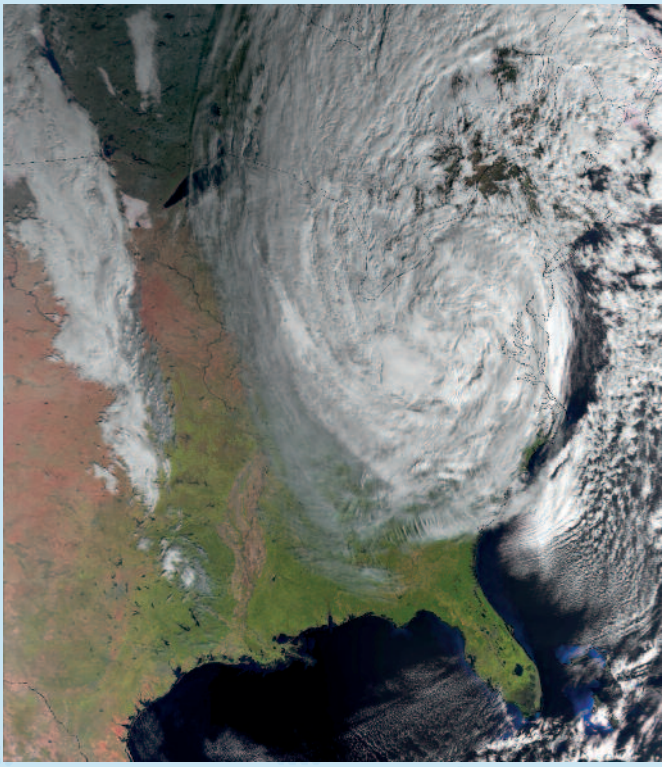
EUMETSAT

EUMETSAT is a user-governed, operational satellite agency tasked to monitor weather and climate from space. Founded in 1986, it delivers relevant space-based observations of the atmosphere, ocean and land surfaces and related data services to the National Meteorological Services of its Member and Cooperating States and to other users worldwide. In order to fulfil the requirements of its Member States and users, EUMETSAT defines, establishes and exploits advanced Earth Observation satellite systems in geostationary and low-earth orbits.

METOP SERIES OF SATELLITES

Flying at an altitude of 817 km, each polar orbiting Metop satellite carries a sophisticated suite of instruments providing measurements of the atmosphere, including temperature and humidity profiles, cloud properties, and greenhouse and trace gases such as ozone, carbon monoxide, and sulphur dioxide. The instruments also observe the ocean and continental surfaces, providing measurements of temperature, wind at the ocean surface, ice, snow and soil moisture.

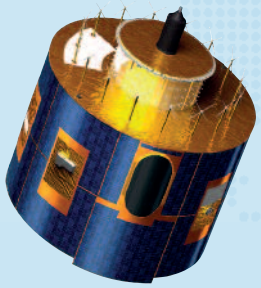


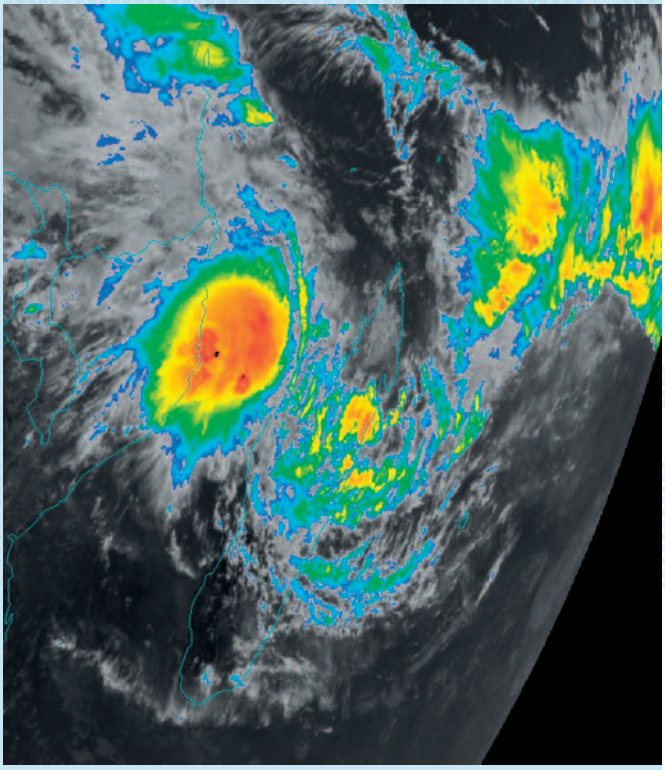


Cyclone
Hurricane Sandy centered over the Northeast US as captured by the AVHRR instrument onboard EUMETSAT's Metop-A satellite on 30/10/12 at 15.37 UTC.

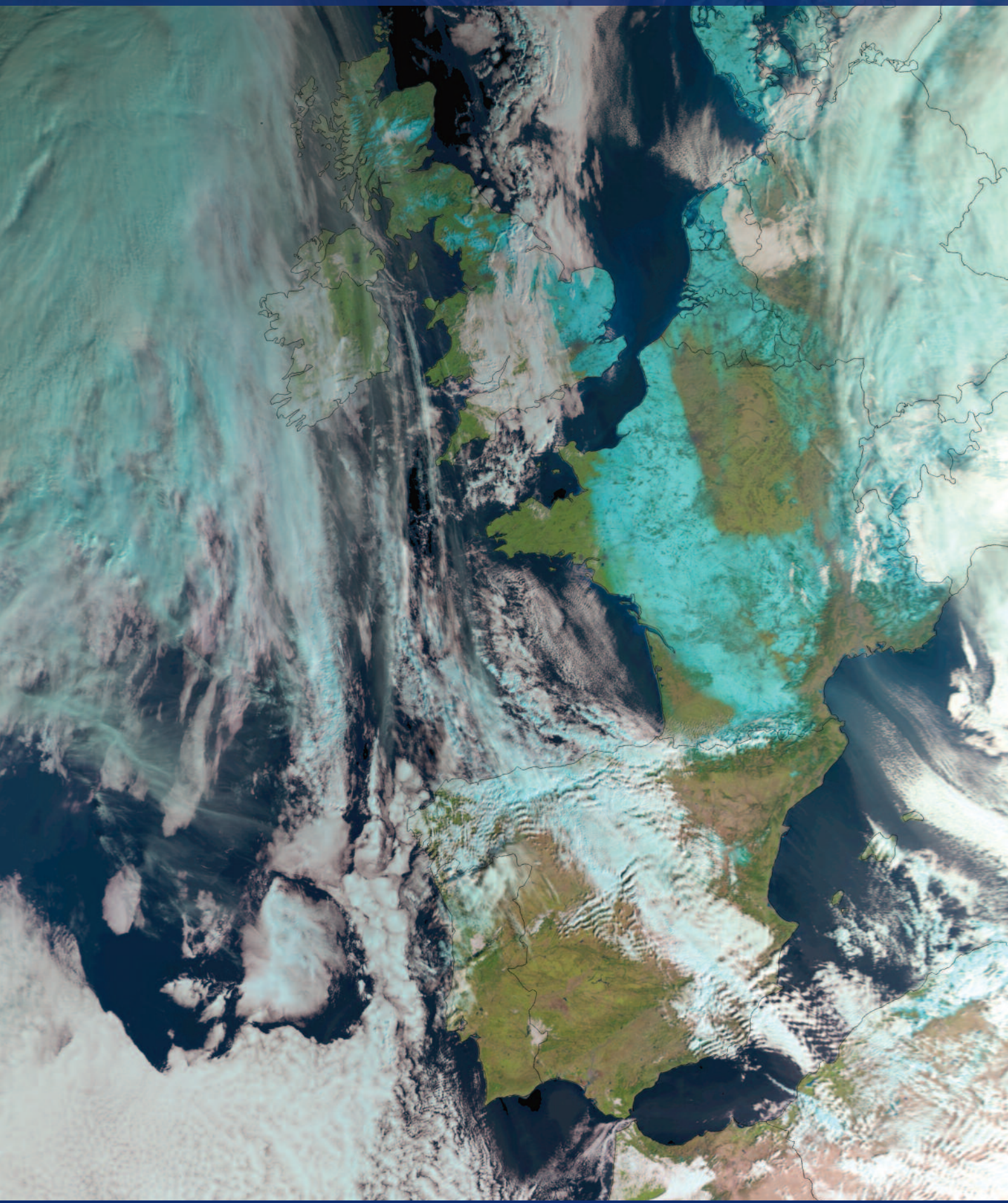
METEOSAT SERIES OF SATELLITES

EUMETSAT operates the Meteosat geostationary satellites over Europe, Africa and the Indian Ocean. Meteosat Second Generation (MSG) carries the primary Spinning Enhanced Visible and Infrared Imager, SEVIRI. This instrument delivers enhanced weather coverage over Europe and Africa in order to improve very short range forecasts, in particular for rapidly developing thunderstorms or fog. It scans the Earth every 15 minutes in 12 different wavelengths, monitoring the atmospheric system.





Cyclone
Tropical Storm Irina moving down the Mozambique Channel. Image taken by Meteosat-9 10.8 channel 27/02/12 07:00 UTC.



The cold weather in Europe as seen from EUMETSAT's Metop satellite. Clear skies give a good view of the snow. The snow and ice clouds are coloured cyan on the image.

→ CENTRE NATIONAL D'ETUDES SPATIALES (CNES)

The French Space Agency CNES

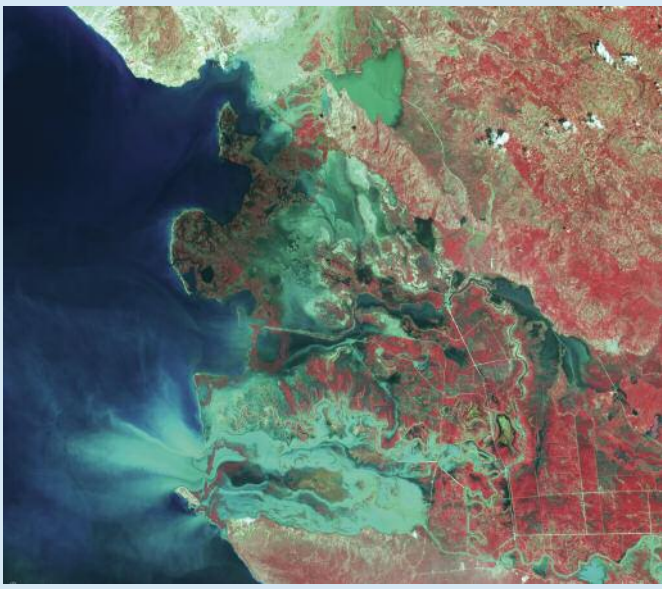
Founded in 1961, the Centre National d'Etudes Spatiales (CNES) is the government agency responsible for shaping and implementing France's space policy. CNES is a pivotal player in Europe's space programmes, and a major source of initiatives and proposals that aim to maintain France and Europe's competitive edge.

CNES aims to make known the challenges of space activities and their contribution to humankind. With their ability to provide global coverage as well as detailed views of Earth's surface in near-real time, satellites are extraordinary tools for keeping track of our planet, monitoring the impact of major disasters and helping us to manage them. CNES is engaged in these efforts with its partners in Europe and worldwide.

Spot optical satellite

The series of Spot (Satellite Pour l'Observation de la Terre) missions carry high-resolution, optical imaging systems operating from space. These missions are part of CNES's Earth observation programme. The Spot family of satellites has been providing high quality images of our planet since 1986. In this time more than 25 million images have been acquired.

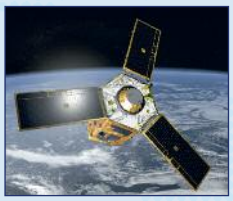
© CNES/Ducros David 2002



Spot-4 natural colour image (10 m resolution) over the area hit by hurricanes Hanna and Ike in the northern part of Haiti. The image was acquired on 9 September 2008. © CNES/distribution Spot Image, 2008

Pléiades a new Earth Observation system

The Pleiades system is a dual-use Earth observation system which provides optical images that meet the most stringent requirements for both defence and civil applications. With its submetric resolution and remarkable agility, the Pleiades system provides single and stereo images that are particularly useful for managing crisis situations, as well as for cartography and urban planning.



© CNES/Ducros David 2002

Before and after Pléiades 1A images show changes to the bed of Gris river and the resulting impact on housing in the north of Port-au-Prince caused by Hurricane Sandy that hit Haiti on 12th October 2012. ©CNES 2012 - distribution Astrium services/Spot Image

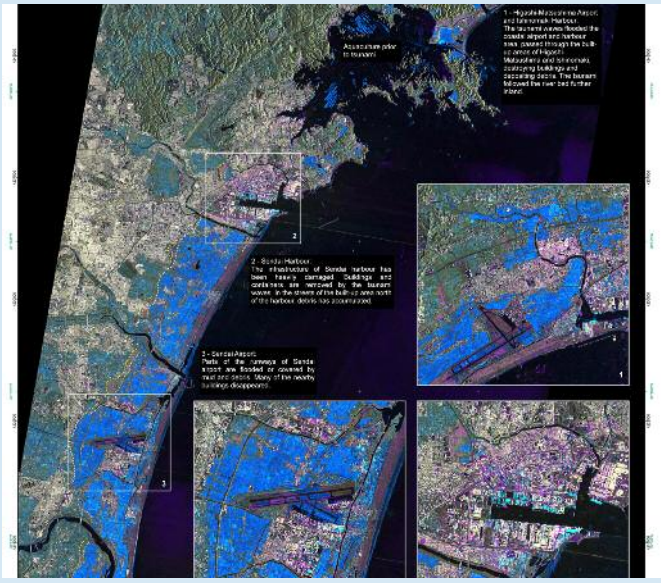
Pléiades image of Hong Kong acquired on 16th February 2012.

→ THE GERMAN AEROSPACE CENTER (DLR)

The German Aerospace Center DLR is Germany's national research center for aeronautics and space. DLR's research portfolio ranges from fundamental research in the fields of aeronautics, space, transportation and energy to innovative development of the applications and products of tomorrow.
As Germany's Space Agency, the German federal government has given DLR responsibility for the forward planning and implementation of the German space programme as well as international representation of Germany's interests.
The Center for Satellite Based Crisis Information (ZKI) presents a service of DLR. It provides a 24/7 availability for the rapid provision, processing and analysis of satellite imagery during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide.

TerraSAR-X

Germany's first national remote sensing satellite that has been implemented in a public-private partnership between DLR and EADS Astrium GmbH. The satellite was launched in June 2007 to create high-quality radar images of the Earth's surface. Its primary payload is an X-band radar sensor with a range of different modes of operation, offering space-based observation capabilities that were previously unavailable.



Change Detection Map - Sendai Area, Japan, 20 October 2010 and 12 March 2011 (after major tsunami)
Source: TerraSAR-X. Copyright © DLR/ZKI

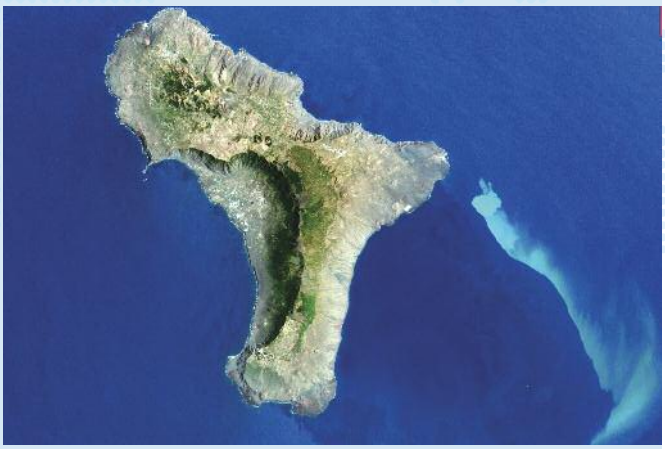
TanDEM-X

In June 2010, TerraSAR-X was joined by its twin satellite, TanDEM-X. Flying in close formation only a few hundred metres apart, the two satellites simultaneously image the terrain below them, from different angles. These images are processed into accurate elevation maps with a 12-metre resolution and a vertical accuracy better than 2 metres.

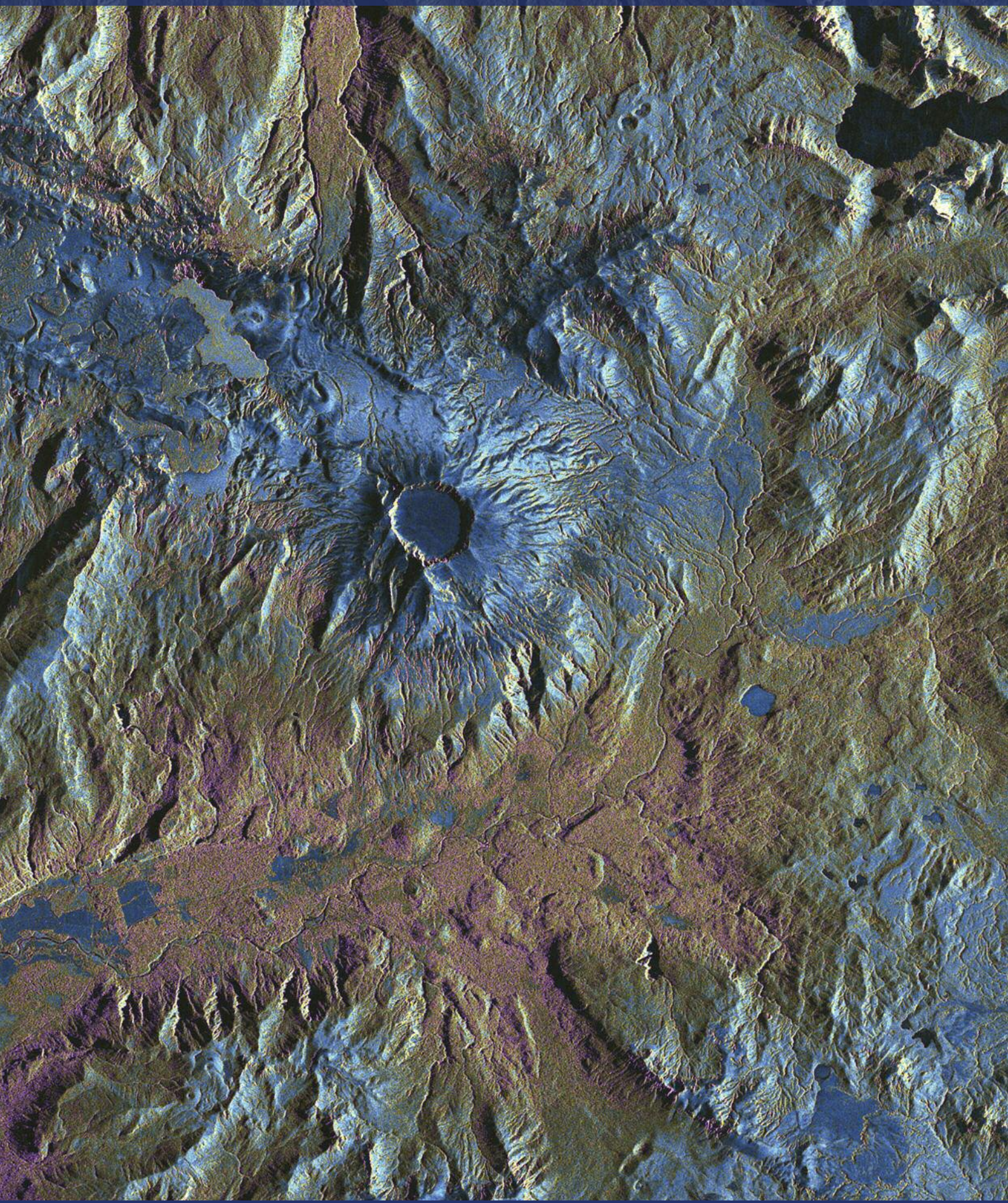
Landscape in Ukraine - Source: TanDEM-X Copyright © DLR

RapidEye

Launched in August 2008, the RapidEye constellation comprises five earth observation satellites equipped with multi-spectral optical imagers. Privately owned by RapidEye AG and supported by DLR with funds from the Ministry of Economics and the Brandenburg state government, data from RapidEye contributes to the International Charter on a case by case basis.



RapidEye satellite image featuring a gigantic stain visible on the surface of Las Calmas Sea resulting from an underwater eruption off the coast of El Hierro, Spain. Copyright © RapidEye AG



Volcanic eruption in Chile - Radar image acquired by TerraSAR-X shows the Puyehue-Cordón Caulle volcano region on 6 July 2011 – a month after its eruption. The blue-coloured area is a lava field that has formed to the northwest of the new crater.

→ THE NATIONAL INSTITUTE FOR SPACE RESEARCH (INPE)

Created in 1971, the National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais; INPE) is a research unit of the Brazilian Ministry of Science and Technology.

Mission

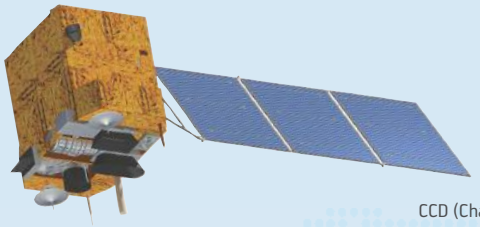
Fostering science and technology in earth and space context and be able to offer products and regular services in benefit of the country.

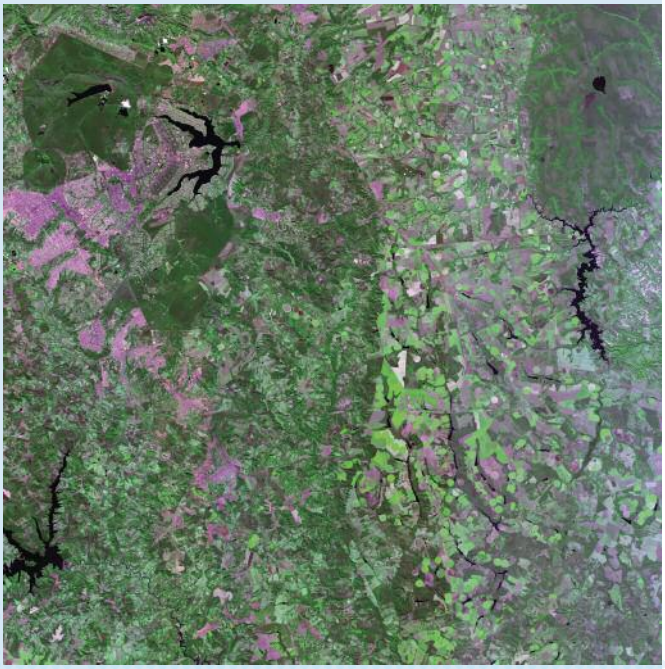
Vision

Become a National and international reference in both space and earth environment fostering knowledge and attending and anticipating demands on Brazilian society life quality progress.

CBERS

The China-Brazil Earth Resources Satellite (CBERS) was born from a partnership between Brazil and China in the space technical scientific segment. There have been three CBERS satellites since 1999, and the fourth in the series is scheduled for launch in late 2012. The CBERS remote sensing satellites have brought significant scientific and technological advances to Brazil. Today, CBERS ranks among the main remote sensing programmes in the world, alongside Landsat, Spot and ResourceSat.

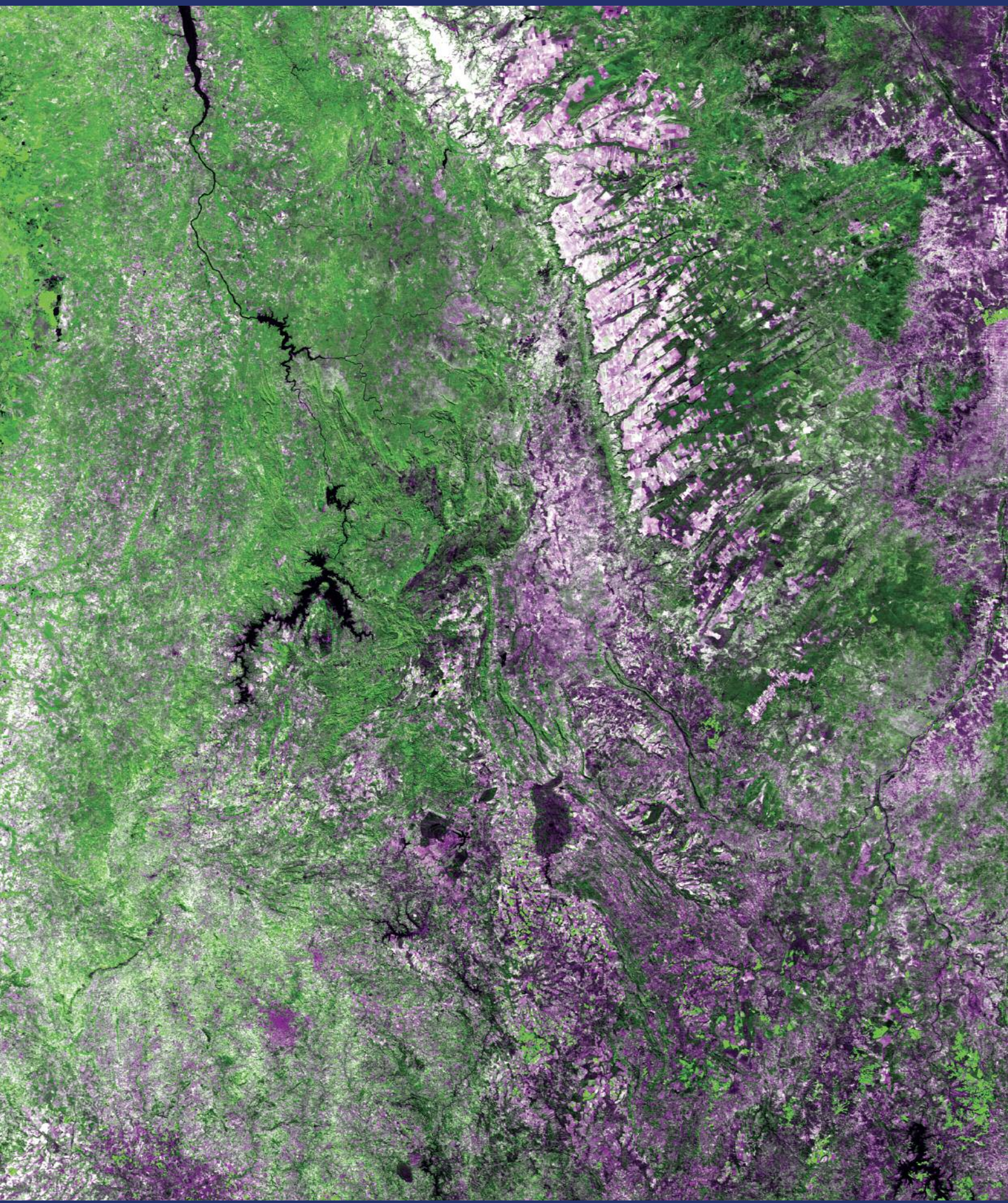




CCD (Charge-Coupled Device)
Camera aboard CBERS-2 satellite. Brasilia-DF, Brazil.
Image Credits: CBERS/INPE

Due to the success of CBERS-1 and -2, both governments decided to expand the cooperation and include new satellites of the same class. CBERS-2B is similar to the two previous members of the series, but with the addition of a new instrument – the High Resolution Panchromatic Camera (HRC) - providing improved monitoring capabilities.

HRC (High Resolution Camera)
Camera aboard CBERS-2B satellite. Brasilia-DF, Brazil.



WFI (Wide Field Imager) Camera aboard CBERS-2B satellite. Brasilia-DF, Brazil.
Image Credits: CBERS/INPE

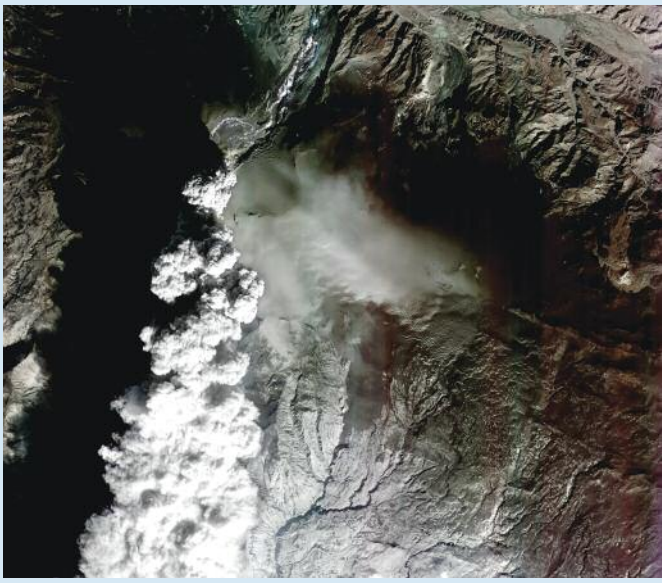
→ KOREA AEROSPACE RESEARCH INSTITUTE (KARI)

Established in 1989, the Korea Aerospace Research Institute (KARI) has been fulfilling its role as the leading national aerospace R&D institute, since the beginning of aerospace history in Korea. KARI leads the development of aircraft, satellite and space launch vehicle technology as well as performing the quality certification of aircraft and space products for the government.

In the satellite area, KARI successfully launched KOMPSAT-1 (Korea Multi-Purpose Satellite-1), KOPMSAT-2, COMS (Communication, Oceanography and Meteorology Satellite) in 1999, 2006, and 2010 respectively. The KOMPSAT-3/5 projects are ongoing, and remote sensing research and space environment tests are also being carried out.

KOMPSAT-2

KOMPSAT-2 was successfully launched on July 28, 2006. The high resolution images will be used for various applications such as surveillance of massive natural disasters, utilization of mineral resources, construction of Geographic Information System (GIS), and cartography.



Iceland's Eyjafjallajokull Volcano observed (1m resolution) by KOMPSAT-2 on 11 May 2010. The area continues to spew out a thick plume of ash. © KARI 2010

KOMPSAT-2 natural color image (1m resolution) over the flood damaged area of Nashville in Tennessee, USA. This image was acquired on 4 May 2010. © KARI 2010

Forest fires observed (1m resolution) by KOMPSAT-2 on 28 October 2007 over California, USA. The burnt area shown in dark blue, vegetation in red and the smoke of active fires in light blue and white. ©KARI 2007

Tsunami damaged area observed by KOMPSAT-2 on 14 March 2011 over Sendai, Japan after an earthquake and tsunami struck the region.
The destroyed infrastructure, debris and flooded area are visible in this image.

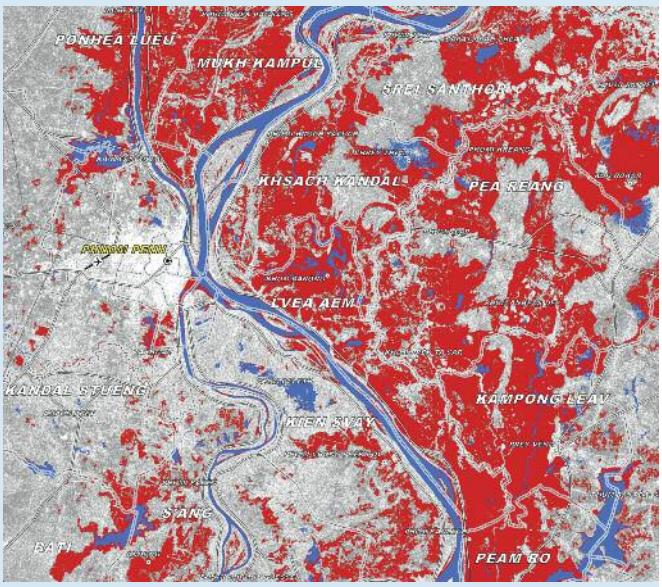
→ CANADIAN SPACE AGENCY (CSA)

Established in 1989, the Canadian Space Agency (CSA) coordinates all civil space-related policies and programmes on behalf of the Canadian government. The CSA directs its resources and activities through four key areas: Earth Observation, Space Science and Exploration, Satellite Communications, and Space Awareness and Learning.

By leveraging international cooperation, the CSA generates world-class scientific research and industrial development for the benefit of humankind.

RADARSAT-1

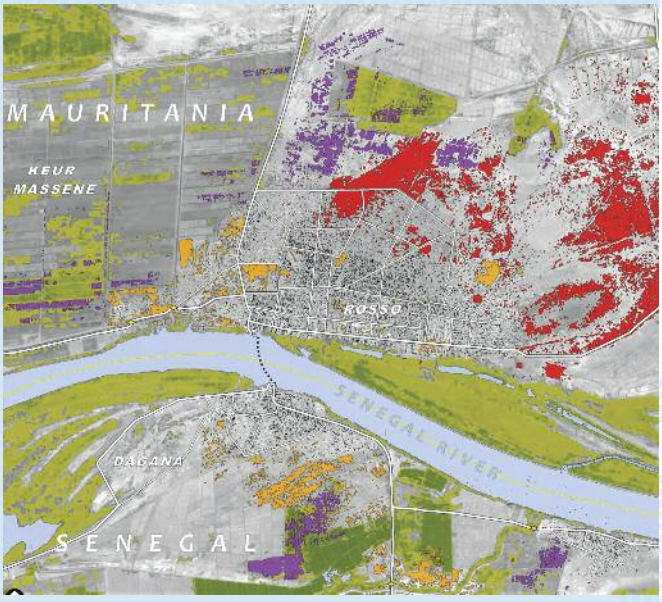
This sophisticated Earth observation satellite has been developed by Canada to monitor environmental changes and the planet's natural resources. Launched in November 1995, RADARSAT provides Canada and the world with an operational radar satellite system capable of delivering large amounts of timely data. Equipped with a powerful Synthetic Aperture Radar (SAR) instrument, it acquires images of Earth – day and night, in all weather and through cloud cover, smoke and haze.



Mekong River flood water
in the area around Phnom Penh, Cambodia.
Map created by UNITAR/UNOSAT
© Canadian Space Agency, 2008.

RADARSAT-2

Canada's next-generation commercial radar satellite RADARSAT-2 was launched in December 2007. It offers powerful technical advancements that will enhance marine surveillance, ice monitoring, disaster management, environmental monitoring, resource management and mapping in Canada and around the world. This project represents a unique collaboration between government and industry. MacDonald, Dettwiler and Associates Ltd. (MDA) own and operate the satellite and ground segment.



Flooding in Rosso, Mauritania
RADARSAT Data and Products © MacDonald
Dettwiler and Associates Ltd. 2009.
All rights reserved. RADARSAT is an official mark
of the Canadian Space Agency

Flooding in Rosso, Mauritania

The surfaces coloured in red are affected by floods in Rosso, Mauritania (tan coloured surfaces are possibly flooded).

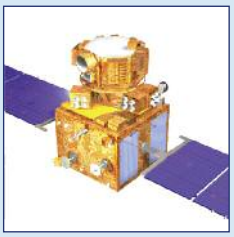
→ INDIAN SPACE RESEARCH ORGANISATION (ISRO)

The Indian space programme was established in 1969 with the formation of Indian Space Research Organisation (ISRO). The Indian Government constituted the Space Commission and established the Department of Space (DOS) in June 1972 and brought ISRO under DOS in September 1972. The Space Commission formulates the policies and oversees the implementation of the Indian space programme to promote the development and application of space science and technology for the socio-economic benefit of the country. The implementation of these programmes is mainly through ISRO in coordination with other centres that have developed state-of-the-art facilities in space-related technologies.

The Indian Remote Sensing Satellite (IRS) series provide remote sensing data in various spectral and spatial resolutions. Presently, IRS-1D, IRS-P4 (Oceansat-1), IRS-P5 (Cartosat-1), IRS-P6 (Resourcesat-1), and Cartosat-2 are operational, providing data for medium resolution, large area thematic mapping and high resolution local area mapping.

IRS-P6 (Resourcesat-1)

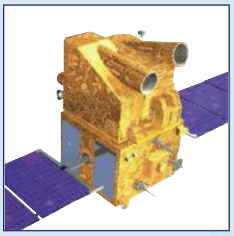
Launched in 2003, Resourcesat-1 carries three sensors: a Linear Imaging and Self Scanning Sensor (LISS-III), an Advanced Wide Field Sensor (Awifs) and a high resolution multispectral camera LISS-IV.

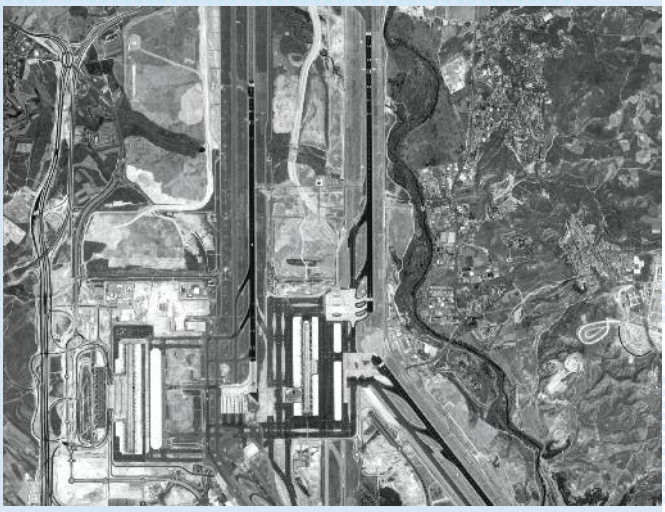


Part of New Jersey, United States acquired by Awifs, Resourcesat-1.
Credits NRSC, ISRO

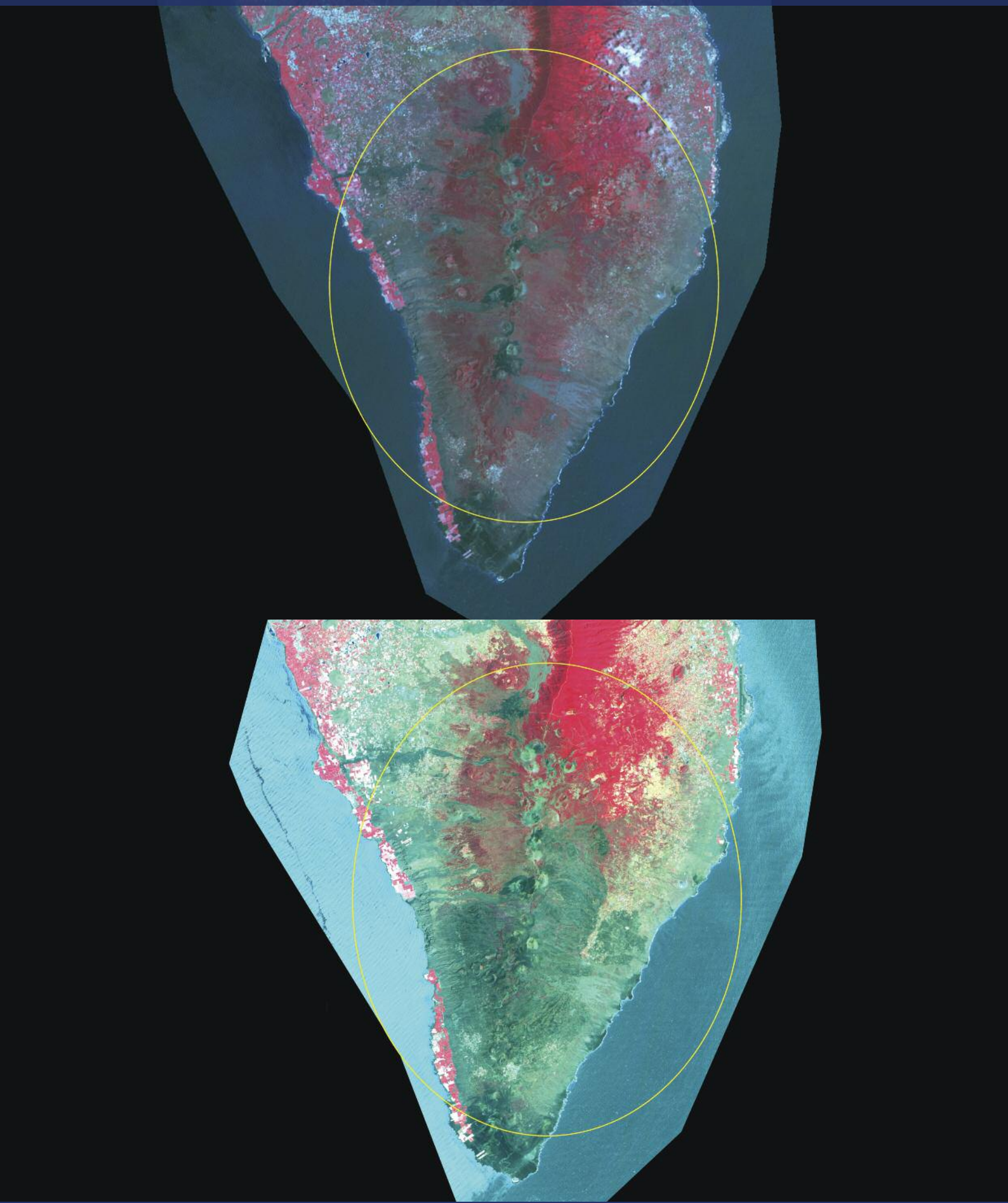
IRS-P5 (CartoSat-1)

Launched in 2005, Cartosat-1 is dedicated to stereo viewing for large-scale mapping and terrain modelling applications. Cartosat-1 carries two panchromatic cameras, which generate stereoscopic images of the area along the satellite track.





Madrid, Spain acquired by Cartosat-1.
Credits NRSC, ISRO



The wildfire on the island of La Palma in the Canary Islands in the summer of 2009 destroyed around 1000 hectares of land and forced some 4000 evacuations.

Top image: pre disaster LISS III - 25/07/2008
Bottom image: post disaster LISS IV - 08/08/2009

→ NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

The National Oceanic and Atmospheric Administration (NOAA) was established in 1970 under the United States Department of Commerce. NOAA provides timely access to global environmental data and products from satellites and other sources to promote, protect, and enhance the nation's economy, security, environment – and quality of life. This includes protecting life and property through enhanced prediction, response and mitigation of severe weather hazards such as tornadoes and floods, natural hazards such as fires and volcanic activity, and technological hazards such as oil spills.

NOAA manages and operates two satellite programmes: Polar-orbiting Operational Environmental Satellites (POES) and Geostationary Operational Environmental Satellites (GOES).

Polar-orbiting Operational Environmental Satellites (POES)

Data from POES satellites are used to provide continuous global data for numerical weather prediction models and a variety of operational products. Many of these products support the management of aviation, ship navigation, and natural resources. In a 24-hour period, NOAA's operational POES and EUMETSAT's operational MetOp satellite provide two complete global views.

Wildfires in southern California, USA,
23 October 2007.
Image from NOAA-18 satellite
Credits: NOAA

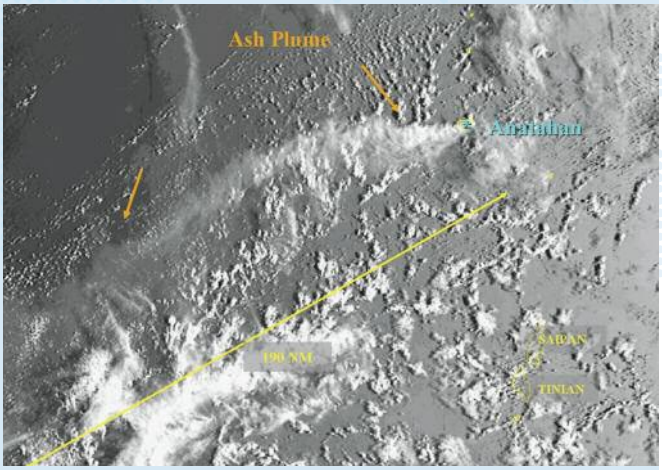
Geostationary Operational Environmental Satellites (GOES)

GOES continuous imaging of the western hemisphere provides critical data for severe weather warnings. GOES data are used to estimate rainfall during thunderstorms and hurricanes and for flash flood warnings, and to estimate snowfall accumulation and the extent of snow cover. In addition, GOES sensors detect ice fields and map the movements of sea and lake ice.

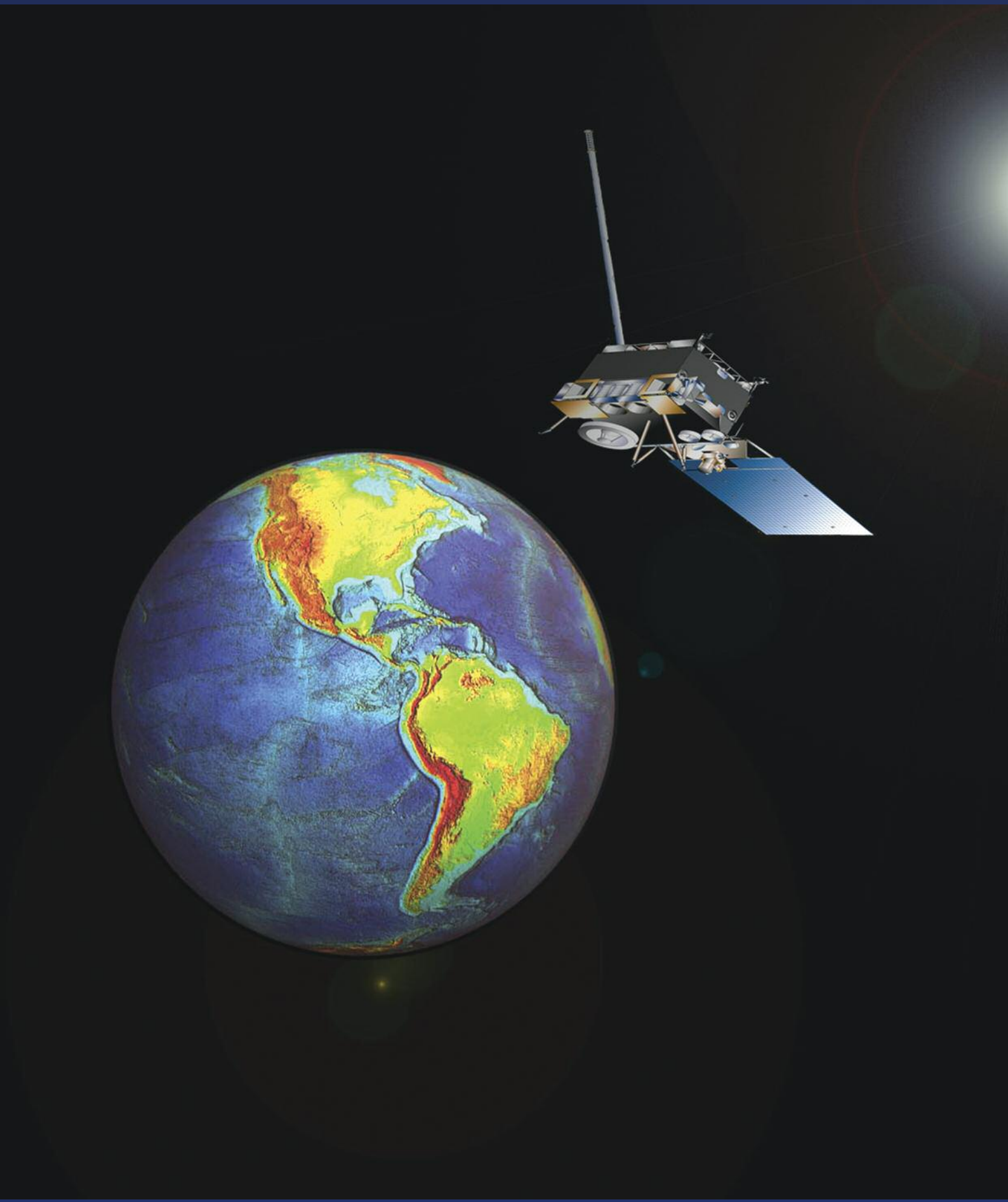
Hurricane Katrina over southern USA,
29 August 2005.
Image from GOES-12 satellite
Credits: NOAA

Defense Meteorological Satellite Program (DMSP)

NOAA operates the Defense Meteorological Satellite Program (DMSP) for the US Air Force and the Jason-2 altimetry satellite. Jason-2 is a joint effort between NOAA, NASA, CNES and EUMETSAT that measures sea-surface height. NOAA also provides US-manufactured instruments for EUMETSAT's MetOp satellites. DMSP imagery supports the mitigation of disasters caused by fires and volcanic eruptions.



Volcanic eruption on Anathan Island, Northern
Marianas Islands in the western Pacific,
25–31 March 2005.
Image from DMSP satellite
Credits: US AFWA



NOAA GOES satellite in orbit above Earth
Credits: NOAA

→ COMISIÓN NACIONAL DE ACTIVIDADES ESPACIALES (CONAE)

Created in 1991, Comisión Nacional de Actividades Espaciales (CONAE) is under the scope of the Argentinean Ministry of Foreign Affairs. In accordance with the national space programme, CONAE's mandate is to design, manage and execute space-related projects and activities for peaceful purposes. CONAE currently has three satellites in orbit: SAC-A, SAC-B and SAC-C, and will add three more in the near future: SAC-D/Aquarius, SAOCOM 1A and SAOCOM 1B. Two further missions, SABIAMAR and SARE, are also foreseen.

CONAE's missions are operated from the Agency's centre in the Province of Córdoba. The Gulich Institute for Advanced Space Studies, also in Córdoba, promotes applications for disaster management and health in Latin America.

SAC-C

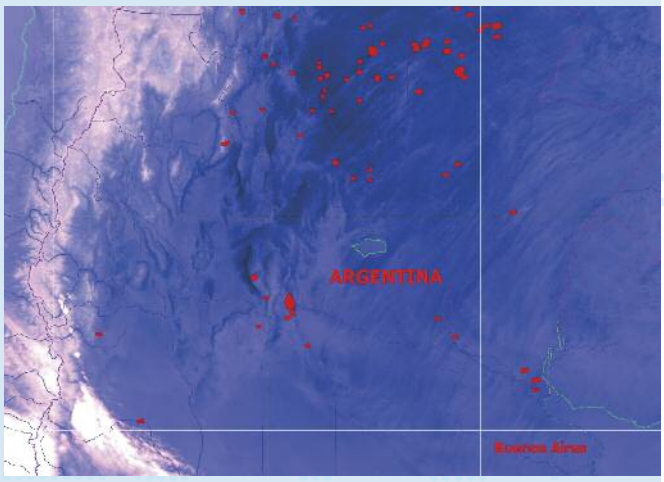
Launched in 2000, SAC-C is Argentina's first Earth observation satellite for agriculture and hydrology, and disaster management. This international mission comprises an Argentinean-built platform carrying optical instruments developed by CONAE and scientific instruments provided by NASA, the Italian Space Agency (ASI), the Centre National d'Etudes Spatiales (CNES), the Danish Space Research Institute (DSRI) and CONAE. Environmental tests took place in the Instituto Nacional de Pesquisas Espaciais (INPE).

SAC-C image of fires in the pasture and wet lands around the Delta of the Paraná River in Argentina. The image was acquired on 3 April 2008. Band combination: 321-RGB. Provided by CONAE.

AQUARIUS SAC-D

Due for launch in 2010, AQUARIUS SAC-D is an observatory for ocean, climate and environmental monitoring. The mission's primary goal is to estimate sea-surface salinity and also several oceanic, atmospheric and land geophysical parameters. The satellite is equipped with eight instruments, including contributions from NASA/JPL, ASI, CNES and the Canadian Space Agency (CSA). INPE are responsible for carrying out the environmental tests.

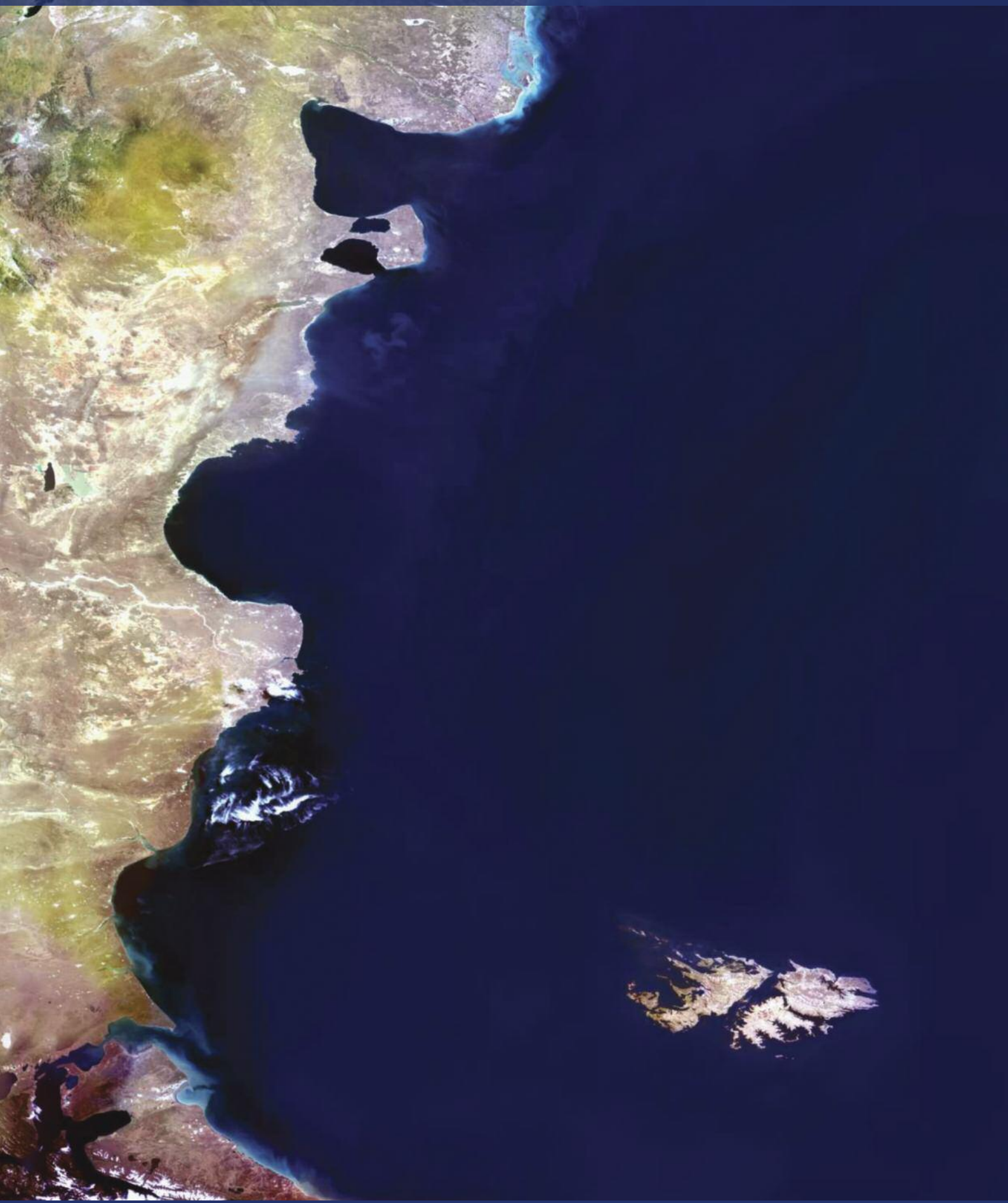
'Hot spots' in Argentina detected by the MODIS sensor on NASA's Terra satellite. The infrared camera on Aquarius SAC-D will generate similar images to monitor events such as fires and volcanic eruptions.



SAOCOM

SAOCOM is the first Argentinean constellation carrying synthetic aperture radar (SAR). It comprises two satellites: SAOCOM 1A and 1B, which each carry a full polarimetric SAR operating at L-band to provide information on soil moisture. The constellation forms the Argentinean component of the Sistema Italo Argentino de Satélites para la Gestión de Emergencias (SIASGE system) an Italian-Argentinean constellation focusing on disaster management.

False colour L-band SAR image acquired by SARAT (SAOCOM test bench) of agricultural fields near CONAE's facilities in Falda del Carmen, Argentina. Provided by CONAE.



SAC-C images – mosaic of the Patagonian coast, Argentina.
Provided by CONAE

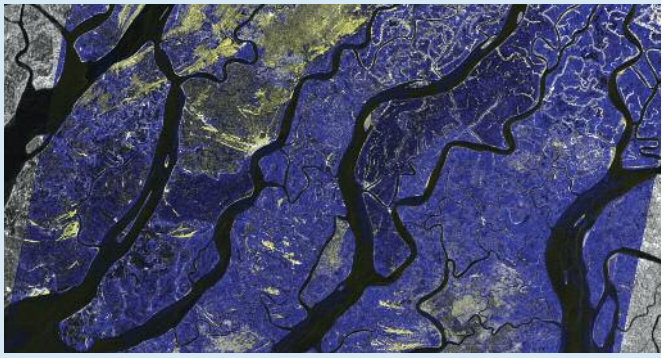
→ JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)

The Japan Aerospace Exploration Agency (JAXA) was established in 2003 through the merger of three separate Japanese space and aeronautics organisations: the Institute of Space and Astronautical Science (ISAS), the National Aerospace Laboratory of Japan (NAL) and the National Space Development Agency of Japan (NASDA).

The consolidation of these three organisations has allowed a continuous and systematic approach to space exploration; from basic research to development and practical application. As a leading industrial nation, Japan is responsible for taking the initiative in the creation of scientific knowledge. JAXA, therefore, endeavours to add a new page to the history of aerospace development, putting Japan on the same footing as other nations with advanced space technology.

ALOS

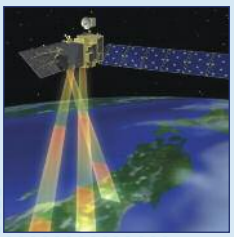
The Advanced Land Observing Satellite (ALOS), which carries three different sensors, was developed to contribute to precise observations of land, disaster monitoring and resource surveying. It enhances land observation technologies acquired through the development and operation of its predecessors, the Japanese Earth Resource Satellite-1 (JERS-1 or Fuyo) and the Advanced Earth Observing Satellite (ADEOS or Midori).



Region of Myanmar

PRISM

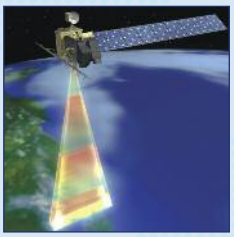
The Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) is a panchromatic radiometer with 2.5m spatial resolution at nadir. PRISM has three independent optical systems for viewing nadir, forward and backward producing a stereoscopic image along the satellite's track.



Tokyo, Japan
17 January 2008

AVNIR-2

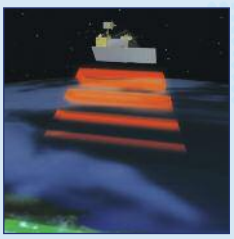
The Advanced Visible and Near Infrared Radiometer–2 (AVNIR-2) is a visible and near infrared radiometer for observing land and coastal zones. It provides better spatial land-coverage maps and land-use classification maps for monitoring regional environments.



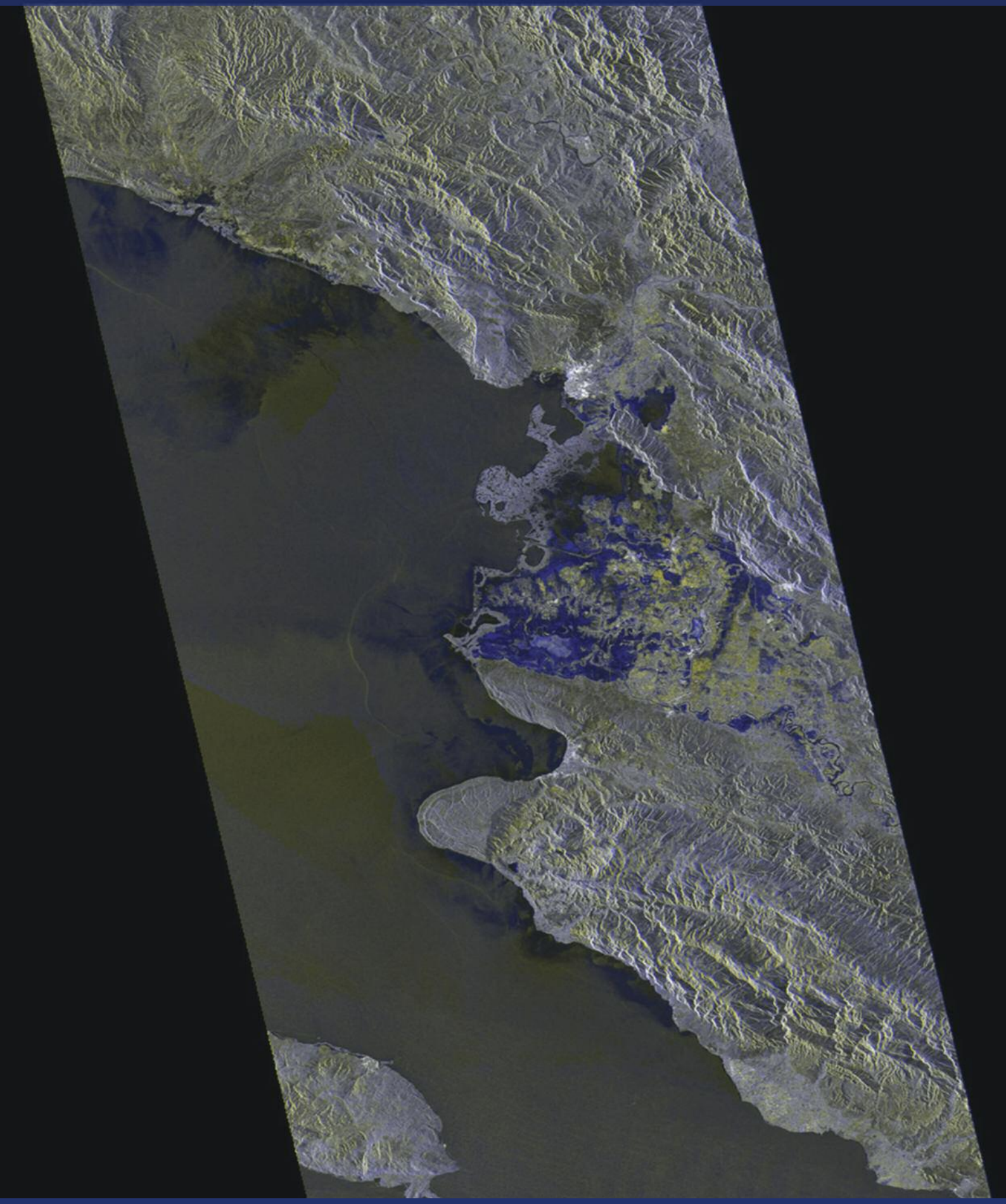
Helsinki, Finland
22 July 2007

PALSAR

The Phased Array type L-band Synthetic Aperture Radar (PALSAR) is an active microwave sensor to achieve cloud-free and day-and-night land observation. It provides higher performance than the JERS-1's synthetic aperture radar (SAR).



Louisiana, USA
6 April 2008



PALSAR image of eastern Haiti affected by Hurricane Ike. The image is a colour composite of before and after hurricane Ike, taken on 9 February and 9 September 2008.

→ CHINA NATIONAL SPACE ADMINISTRATION - CNSA

China National Space Administration (CNSA) was established, as a government institution to develop and fulfil China's international obligations. CNSA assumes the following main responsibilities: signing governmental agreements in the space area on behalf of organisations, inter-governmental scientific and technical exchanges; and also in charge of the enforcement of national space policies and managing the national space science, technology and industry. So far, China has signed governmental space cooperation agreements with countries such as, Brazil, France, Germany, India, Italy, Pakistan, Russia, Ukraine, the United Kingdom. Significant achievements have been scored in the bilateral and multilateral and technology exchanges and cooperation. China's Center for Resources Satellite Data and Applications (CRESDA) acts as the Charter Emergency Call Officer on behalf of CNSA.

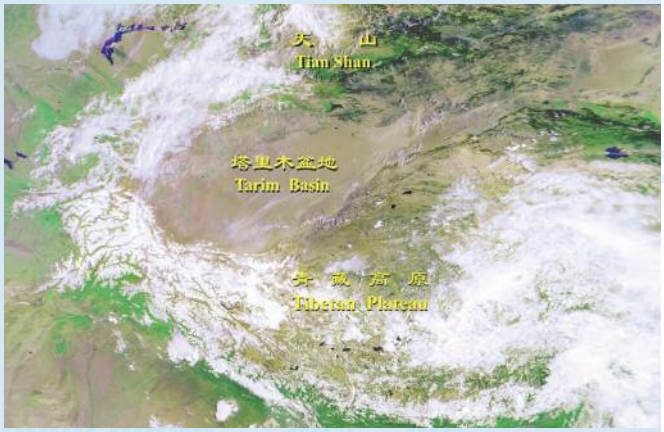
CBERS

China-Brazil Earth Resources Satellite (CBERS) was developed jointly by China and Brazil. Since September 2007, CBERS-2B, the third CBERS satellite has been in orbit. CBERS satellite data can be used for agriculture, forestry, hydrology, mapping, environment and disaster monitoring.

Hong Kong, China
acquired by CBERS CCD on 1 December 2007.
The image shows a burnt area on the Dayu Hill.
Credit: CRESDA

FY-1 Polar Orbit Meteorological Satellite Series

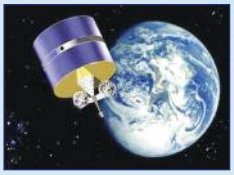
FengYun-1 (FY-1) polar orbiting meteorological satellites are China's first-generation meteorological observation satellites. China has developed and launched four FY-1 satellites since 1988. FY-1D is still operational and in good condition.



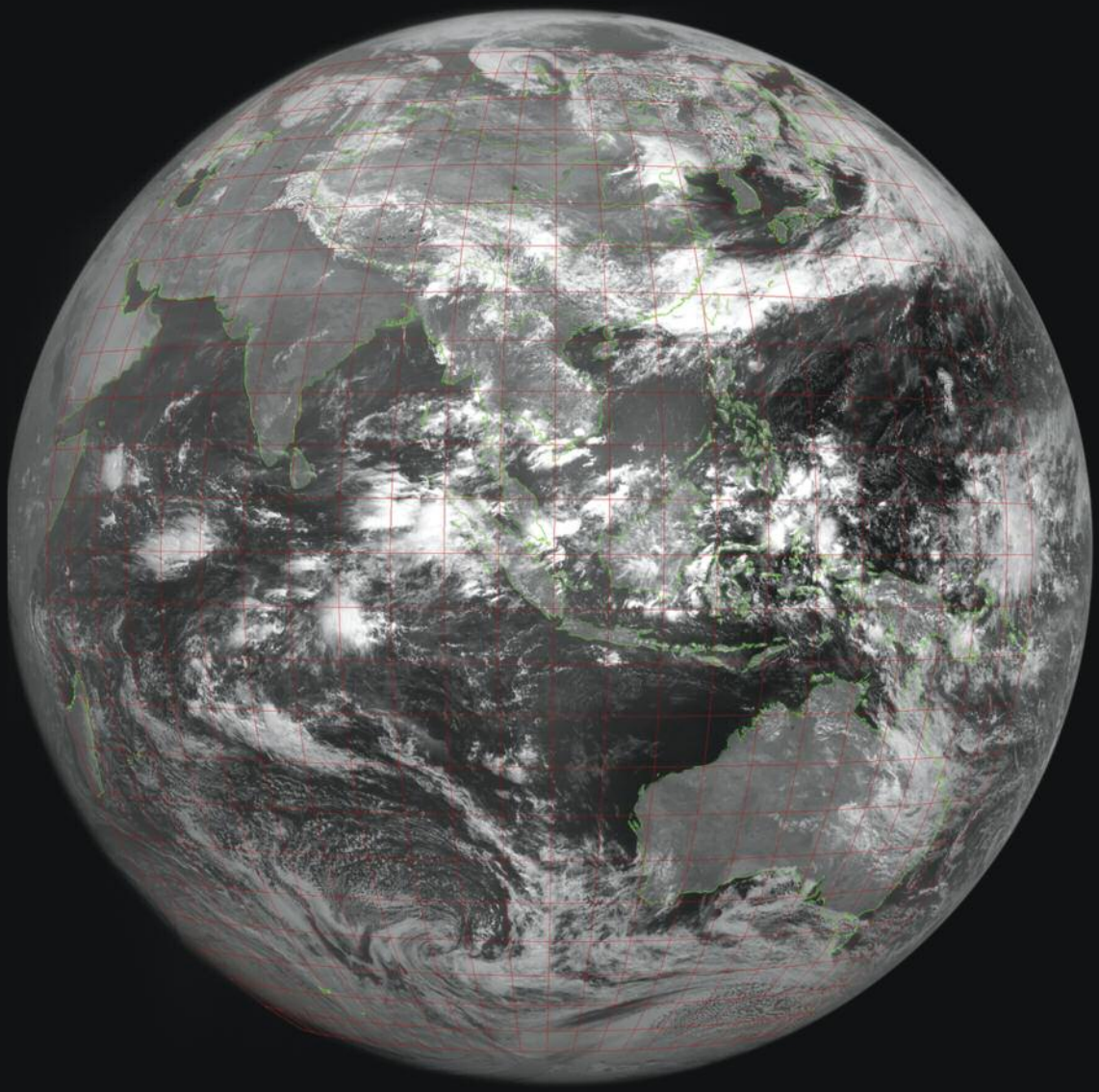
The first stretched cloud image of FY-1C
Credit: CMA

FY-2 Geostationary Satellite Series

Fenyun-2 (FY-2) meteorological satellites are China's first-generation of meteorological satellites operating from geostationary orbit. So far, China has developed and launched five FY-2 satellites. FY-2C and 2D are operational and FY-2E is a backup in orbit.



The first colour composite image of FY-2C
Credit: NSMC/CMA

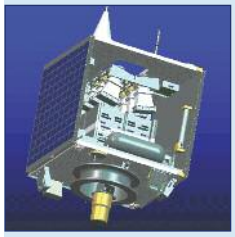


Visible image from FY-2C
Credit: NSMC/CMA

→ THE DISASTER MONITORING CONSTELLATION (DMC)

DMC International Imaging Ltd (DMCii) coordinates the multi-satellite Disaster Monitoring Constellation (DMC) to supply optical satellite imagery for disaster response and commercial imaging campaigns. DMC's small satellites provide multispectral imaging and combine daily revisit with wide swath for frequent and broad area coverage.

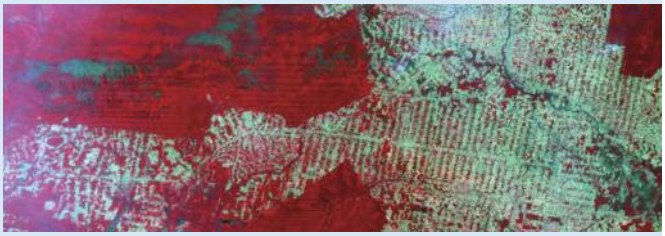
The DMC satellites are independently owned and operated by a consortium of organisations representing member nations. These comprise: the Centre des Techniques Spatiales, Algeria, the National Space Research and Development Agency, Nigeria and Surrey Satellite Technology Ltd, United Kingdom. All the satellites were built by SSTL UK except for NigeriaSat-X which has been built by NASRDA at SSTL.



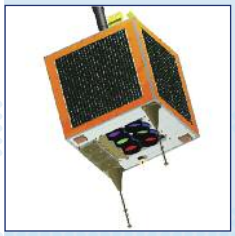
AlSat-1 launched in 2002 for Centre des Techniques Spatiales (CTS), Algeria.

Uluru, or Ayres Rock, Australia acquired by AlSat-1. Image©2007 CTS, all rights reserved, supplied by DMCii.

NigeriaSat-1 launched in 2003 for the National Space Research and Development Agency (NASRDA), Nigeria.

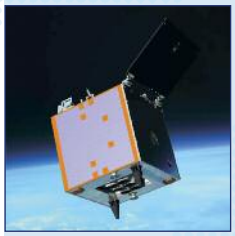


Deforestation in the Amazon Basin acquired by NigeriaSat-1. Image©2008 NASRDA, all rights reserved, supplied by DMCii.



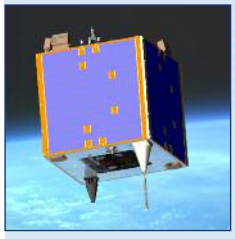
UK-DMC launched in 2003 and operated by DMC International Imaging (DMCii).

Flooding in Myanmar (Burma) acquired by UK-DMC. Image©2004 SSTL, all rights reserved, supplied by DMCii.



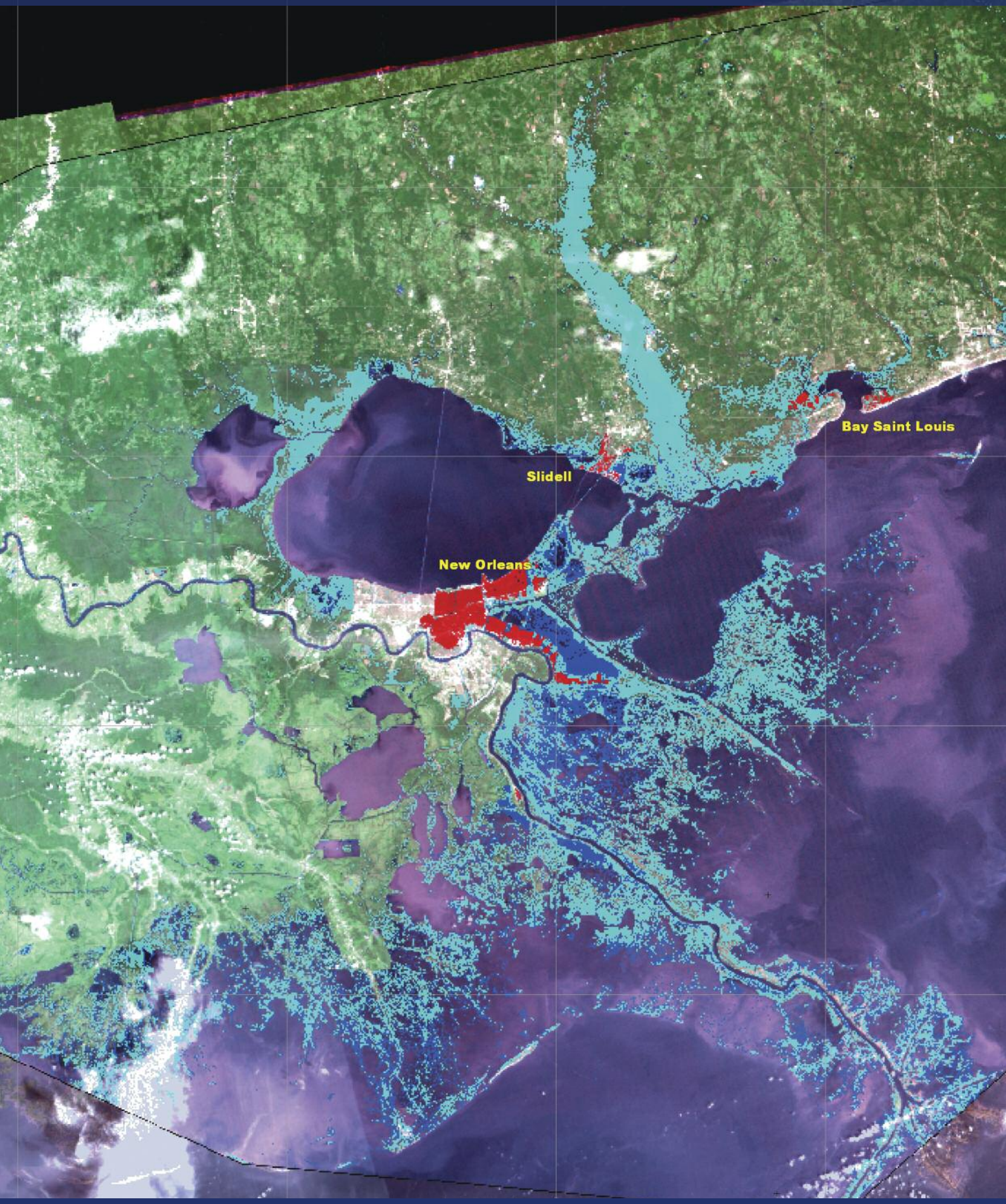
UK-DMC2 satellite launched in 2009 and operated by DMC International Imaging (DMCii).

Wildfires in California, USA acquired by UK-DMC2. Image©2009 SSTL, all rights reserved, supplied by DMCii.



NigeriaSat-X satellite to be launched in 2010 for the National Space Research and Development Agency (NASRDA), Nigeria.

NigeriaSat-2 is a small 120 kg satellite to be launched in 2010 for the National Space Research and Development Agency (NASRDA), Nigeria.



Flood impact map over New Orleans, Louisiana, and Mobile, Alabama, US,
using NigeriaSat DMC International data from 2 September 2005. © SERTIT 2005

→ UNITED STATES GEOLOGICAL SURVEY (USGS)

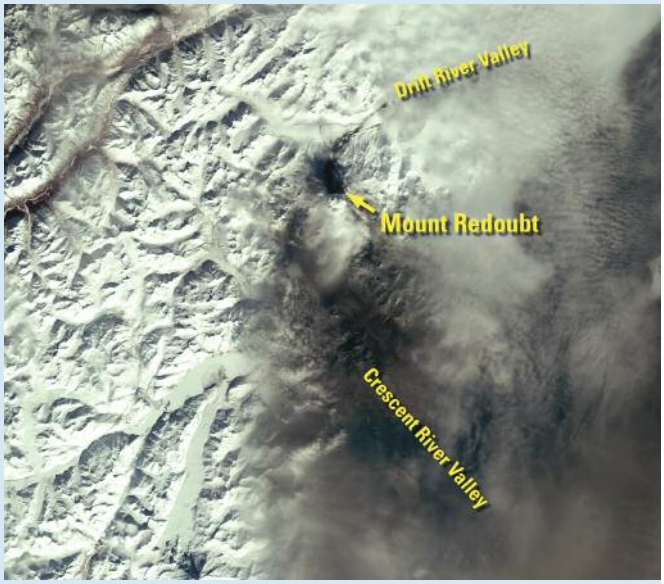
Since it was founded in 1879, the United States Geological Survey (USGS) has counted the monitoring and study of natural hazards among its many research mandates. From 1972 onwards, with the launch of the first Earth Resources Technology Satellite, now known as Landsat, data from remote-sensing instruments are among the resources of the USGS.

The USGS provides reliable scientific information to describe and understand Earth, minimise the loss of life and property from natural disasters, manage water, biological, energy, and mineral resources, and enhance and protect the quality of life.

LANDSAT

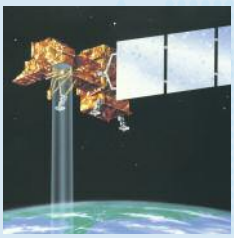
The USGS manages the Landsat series of satellite missions. The current active missions are Landsat-5 and Landsat-7. Landsat-5 has been collecting global observations since 1984 and Landsat-7 since 1999. The USGS also archives and distributes commonly-used data for Earth monitoring.

On 22 March 2009, Mount Redoubt, off the coast of Alaska erupted sending ash more than 15 km into the atmosphere. On 23 March, the ash plume drifted north, just missing Anchorage. Landsat-5 data were used to evaluate the ash plume size and direction. This was important for planning air quality issues for regional populations and for aircraft routing. Credit: US Geological Survey

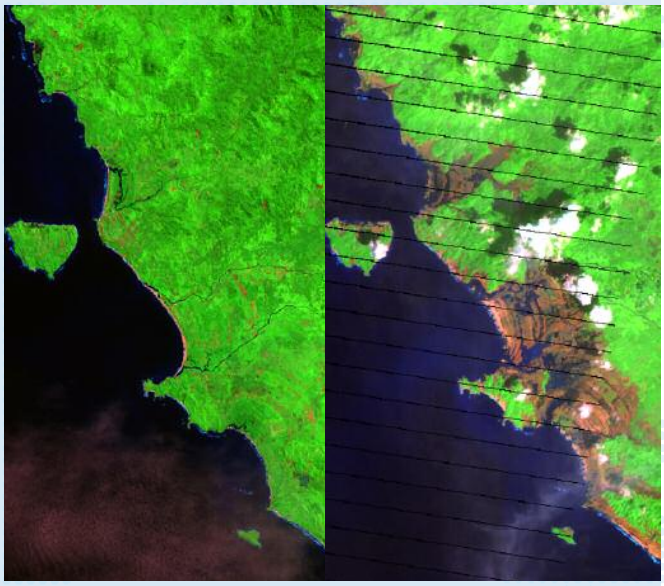


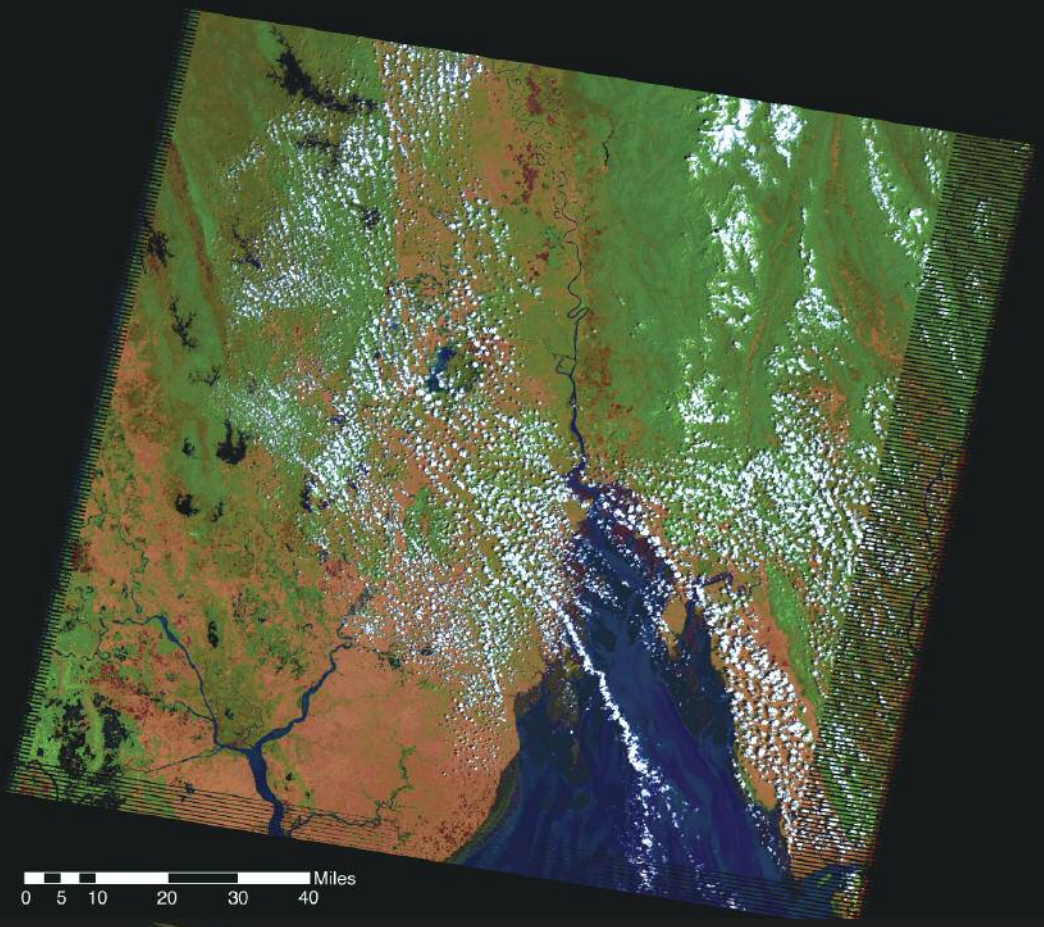
LANDSAT 7

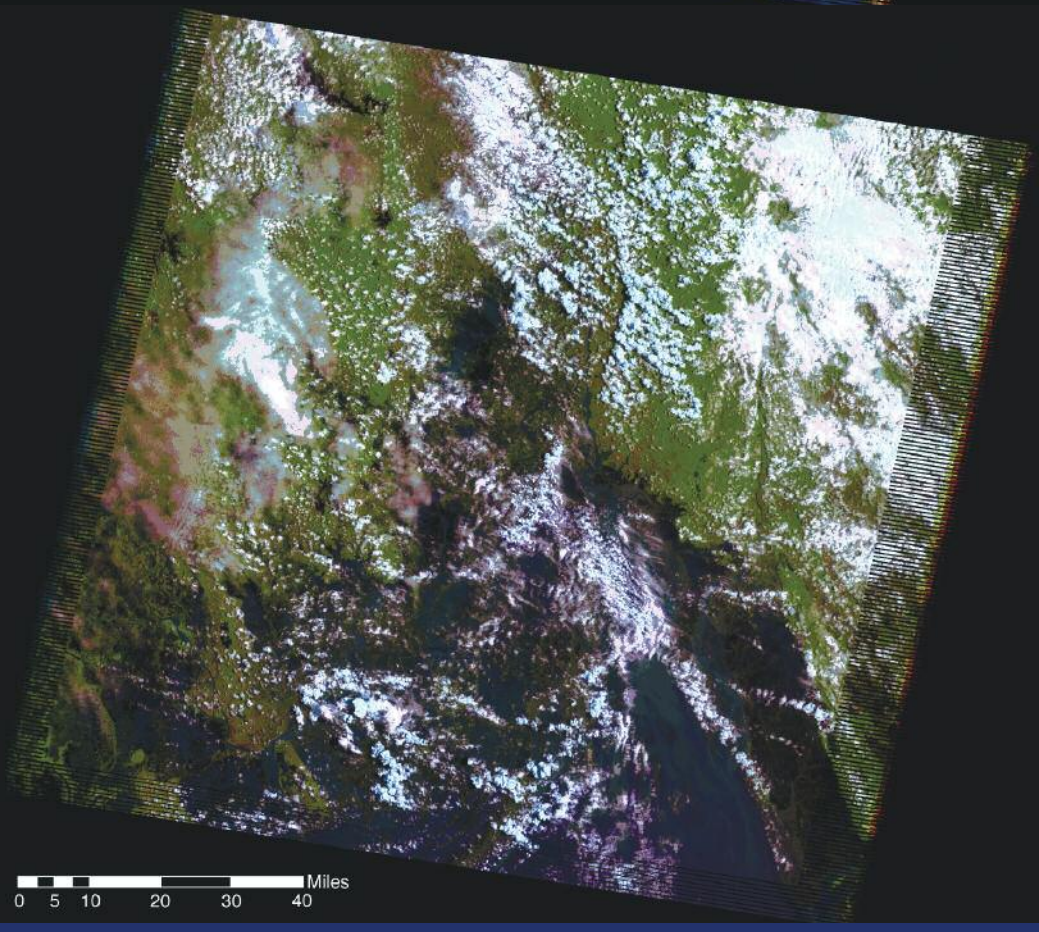
Landsat-7 continues to provide global observations of land. The Landsat series offers over 35 years of consistent medium-resolution data. The data continuity of the Landsat observations provide the global science community with an unmatched record of land-surface features.



The two Landsat-7 images show the northwest coastline of Sumatra. The image on the left was acquired on 12 June 2001 and the image on the right was acquired on 29 December 2004, shortly after a tsunami struck. Landsat Data courtesy of the U.S. Geological Survey



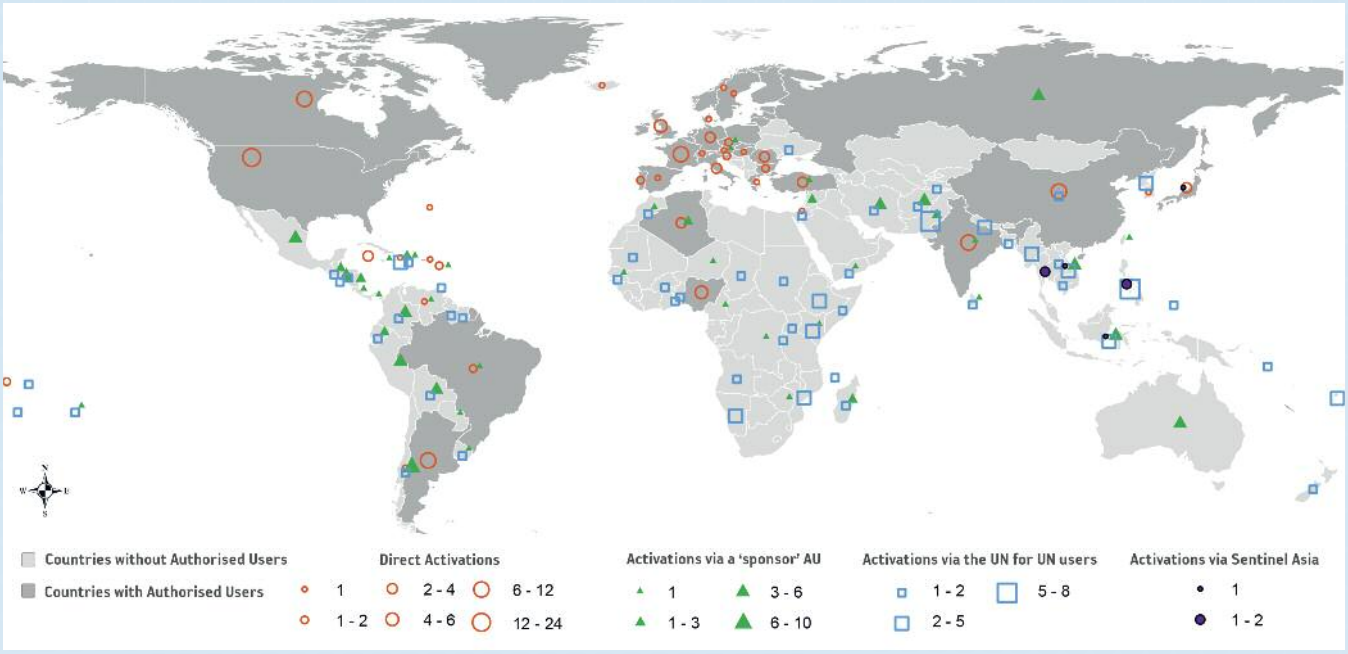




Landsat satellite imagery, acquired shortly before and after Cyclone Nargis hit the coastal region of Myanamr on 3 May 2008. The cyclone created a 3.6 metre storm surge causing widespread flooding and destruction. At least 50 000 deaths were reported. Credits: Landsat Data, courtesy of the U.S. Geological Survey

→ ACTIVATING THE CHARTER

CHARTER ACTIVATION MECHANISMS 2000 – 2012



CHARTER ACTIVATION MECHANISMS

○ Direct Activation

A pre-defined list of appointed users, known as 'Authorized Users' (AUs), can submit a request for a disaster occurring in their country*. The only bodies authorised to directly request the Charter to be activated are the Aus (typically civil protection agencies, governmental relief organisations, or other authorities with a mandate related to disaster management).

▲ Activation via an Authorised User on behalf of a user from a non-member country ('sponsor Authorised User')

Authorised Users can access the Charter to request support for a disaster in a country with which they cooperate for relief purposes.

□ Activation via the UN for UN users

The Charter has an agreement with UN OOSA (Vienna) and UNITAR/UNOSAT (Geneva) to provide support to UN agencies. UN OOSA and UNITAR/UNOSAT may submit requests on behalf of users from the United Nations.

● Activation for Asia Pacific users via Sentinel Asia's partner, the Asian Disaster Reduction Centre

Sentinel Asia is a regional collaboration for Earth observation based emergency response in 32 Asia Pacific countries **. Since 2009 the Charter has granted the Asian Disaster Reduction Centre the right to submit activation requests on behalf of national users of Sentinel Asia.

*****
There are currently 41 countries with Authorized Users: Algeria, Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, China, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Nigeria, Norway, Poland, Romania, Russia, Portugal, Slovakia, Slovenia, Republic of Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

******
Sentinel Asia collaboration from: Armenia, Australia, Azerbaijan, Bangladesh, Bhutan, Brunei, Cambodia, Fiji, India, Indonesia, Japan, Kazakhstan, Kyrgyzstan, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, People's Republic of China, Philippines, Republic of Korea, Russian Federation, Singapore, Sri Lanka, Tajikistan, Thailand, Uzbekistan, Vietnam and Yemen.

Universal Access

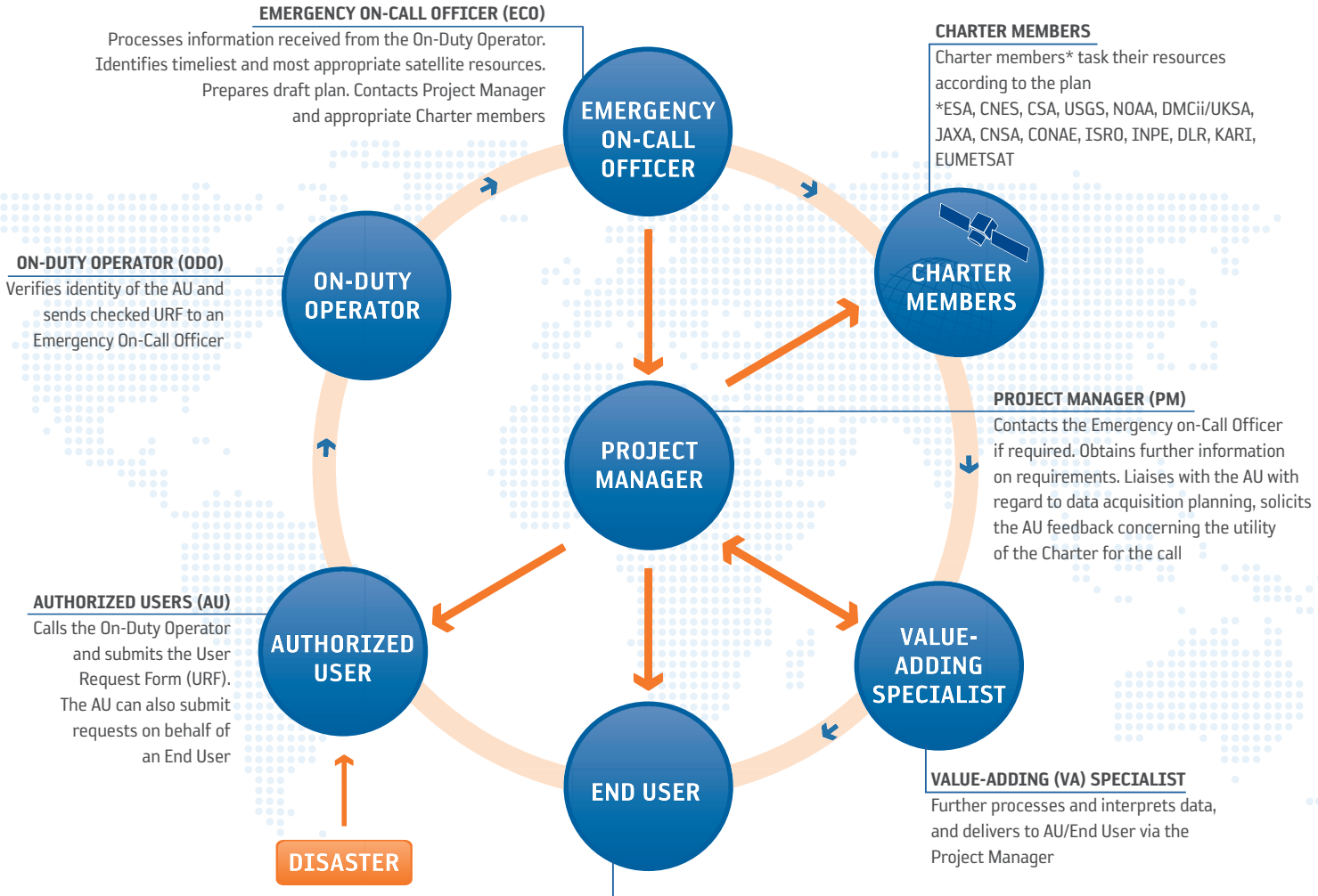
The International Charter is now opening its doors even wider by adopting the principle of Universal Access: ***any national disaster management authority will be able to submit requests to the charter for emergency response. Proper procedures will have to be followed, but the affected country will not have to be a charter member***.
National entities interested in participating in the Charter as an "Authorized User" must follow a registration process. This is to assess the ability of the national authority to access and use Charter assets for disaster response, in accordance with Charter operational procedures. Steps and applicable conditions are explained in the **Universal Access Information Brochure.**
(www.disasterscharter.org/web/charter/activate)

→ HOW THE CHARTER WORKS

Disaster management organisations can access space-based information to support crisis mapping and damage assessment by calling a confidential telephone number which is available, 24 hours a day, 365 days a year.

Satellite data acquisition and analysis take place on an emergency basis. A Project Manager, who is qualified in data ordering, handling and application, assists the user throughout the process.

Although the Charter mandate is limited to supplying satellite data quickly and at no cost, members also generally collaborate with other value-adding capacities to include analysis and interpretation.



EMERGENCY ON-CALL OFFICER (ECO)
Processes information received from the On-Duty Operator. Identifies timeliest and most appropriate satellite resources. Prepares draft plan. Contacts Project Manager and appropriate Charter members

CHARTER MEMBERS
Charter members* task their resources according to the plan
*ESA, CNES, CSA, USGS, NOAA, DMCii/UKSA, JAXA, CNSA, CONAE, ISRO, INPE, DLR, KARI, EUMETSAT

ON-DUTY OPERATOR (ODO)
Verifies identity of the AU and sends checked URF to an Emergency On-Call Officer

PROJECT MANAGER (PM)
Contacts the Emergency on-Call Officer if required. Obtains further information on requirements. Liaises with the AU with regard to data acquisition planning, solicits the AU feedback concerning the utility of the Charter for the call

AUTHORIZED USERS (AU)
Calls the On-Duty Operator and submits the User Request Form (URF). The AU can also submit requests on behalf of an End User

VALUE-ADDING (VA) SPECIALIST
Further processes and interprets data, and delivers to AU/End User via the Project Manager

END USER (EU)
Final products are delivered to the End User

Emergency-related queries from new users without direct access to the Charter should be addressed to:

executivesecretariat@disasterscharter.org

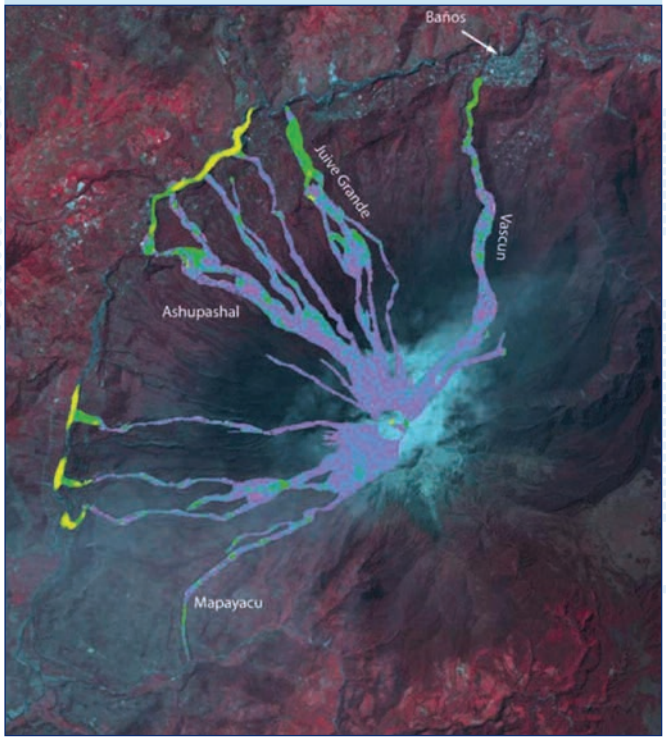
General queries concerning Charter operations and provisions should be addressed to:

webmaster@disasterscharter.org

→ VOLCANIC ERUPTION

It is estimated that there are about 1500 active volcanoes on the surface of Earth, the majority of which are within the Pacific 'Ring of Fire'. About 50 of these active volcanoes erupt each year. Since at least 500 million people worldwide live in regions of volcanic activity, sudden and intense volcanic eruptions have the potential to be amongst the most devastating natural disasters on Earth. In the immediate term, lava flows wipe out everything in their path and volcanic ash can blanket the landscape for kilometres around. In the medium to long term, ash and gases injected into the atmosphere by large-scale eruptions can affect the chemistry of the atmosphere and also reflect solar radiation back to space, leading to possible changes in the weather and climate.

Long-term observations of surface deformation changes, such as sinking and uplift of terrain can be associated with changes in volcanic activity and indicators of a potential eruption. In the event of an eruption, spaceborne optical and radar instruments are able to monitor lava flows, mudslides, ground fissures and earthquakes, to provide updated information on how the landscape has been affected.



Simulation of pyroclastic flows at Tungurahua, Ecuador on a SPOT image

Source	Spot-5, 5m/pixel resolution
Acquired	Archive image from 20/01/05
Map created	Image processing, map created February 2008 by IG-EPN

Volcanic eruption in Ecuador

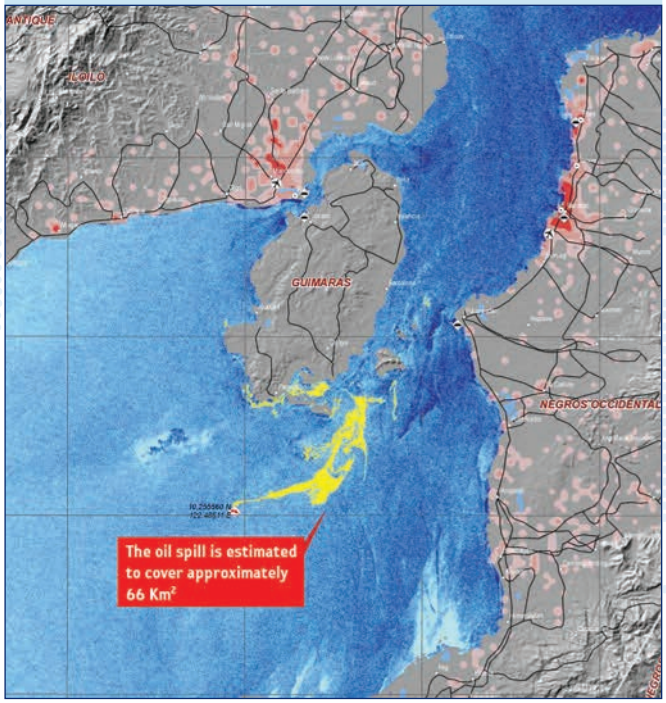
The Tungurahua volcano in central Ecuador began showing increasing signs of activity in October 2007.

Throughout December, activity intensified and eventually peaked on 2 January 2008. By 6 January 2008, almost 1000 people had been evacuated. The Charter was activated on 22 January 2008 by Sistema Federal de Emergencias (SIFEM). The project was managed by Ecuador's Insituto Geofísico (IG-EPN).

→ OIL SPILL

Millions of tonnes of oil make it into the ocean every year, sometimes devastating marine and coastal ecologies. Reasons for oil spills range from deliberate activities, such as the illegal rinsing of oil tanks at sea, to accidents, such as damage to oil pipes and the sinking of oil tankers. Since the 1960s, more than 20 million gallons of oil has ended up in the sea as a result of oil spills. Major oil spills have occurred off the coast of Mexico, in the Middle East, off South Africa, in the North Pacific, and off Alaska. Oil slicks are difficult to control – once formed they are governed by a number of factors such as the weather, currents, tides, proximity to land and the presence of icebergs.

By their very nature, oil spills in the open ocean are difficult to detect and monitor. The use of remote sensing by satellites provides synoptic information to help identify a spill and how it spreads over time, which is useful for planning clean-up operations more effectively. In particular, Synthetic Aperture Radar (SAR) sensors, which collect data independently of weather and darkness, are useful for detecting and monitoring oil on the surface of water.



Map derived from radar data showing extent of oil spill in the Philippines

Source	Envisat (ASAR)
Acquired	24/08/2006
Map created	24/08/2006 by UNITAR/UNOSAT

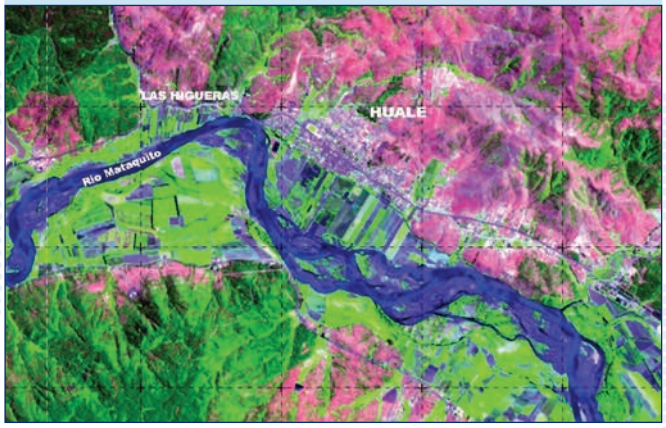
Oil spill off the coast of the Philippines

On 11 August 2006, an oil tanker sank off the coast of Guimaras Island in the Philippines. By 24 August 2006, some 50 000 gallons of oil had spilled into the sea, polluting more than 300 km of coastline and threatening other Philippine islands. The UN Office for the Coordination of Humanitarian Affairs (OUCHA) activated the Charter on 22 August.
A state of emergency was declared on 25 August.
The Call was managed by the United Nations Institute for Training and Research/Operational Satellite Applications Programme (UNITAR/UNOSAT). Maps were subsequently produced showing the extent of the spill.

→ FLOOD

Floods affect more people worldwide than any other natural disaster and indications are that these extreme events are on the increase. Not just affecting the least developed nations, floods also bring devastation to the more industrialised parts of the world. Through the destruction of property, agriculture and infrastructure, floods are estimated to be the world's most expensive disaster, and cost lives – being responsible for 15% of all fatalities related to natural disasters.

Data from satellites observing Earth are becoming increasingly crucial to help mitigate the effects of flooding through better forecasting, and for deriving timely maps and assessing risk for more effective disaster management. Data provided in near-real time from spaceborne instruments such as optical sensors and radar, which can 'see' through cloud cover and darkness, can provide clear views of flooded areas to aid disaster response. Recognised by relief communities worldwide as an extremely valuable tool for responding to and mitigating the effects of flood events, rapid flood mapping has been the most frequently used application of Charter data since 2000.



Zoom over Haule, Chile, based on a composite of Spot-5 and Radarsat-1 imagery

Source	ALOS; Spot, 10m/pixel (Spot-5), 12.5m/pixel (Radarsat-1) resolution
Acquired	10/12/2006 (Spot-5), 28/05/2008 (Radarsat-1) Spot-5 natural colour image over an ALOS/PALSAR image
Map created	28/05/2008 by INA

Flood in Chile

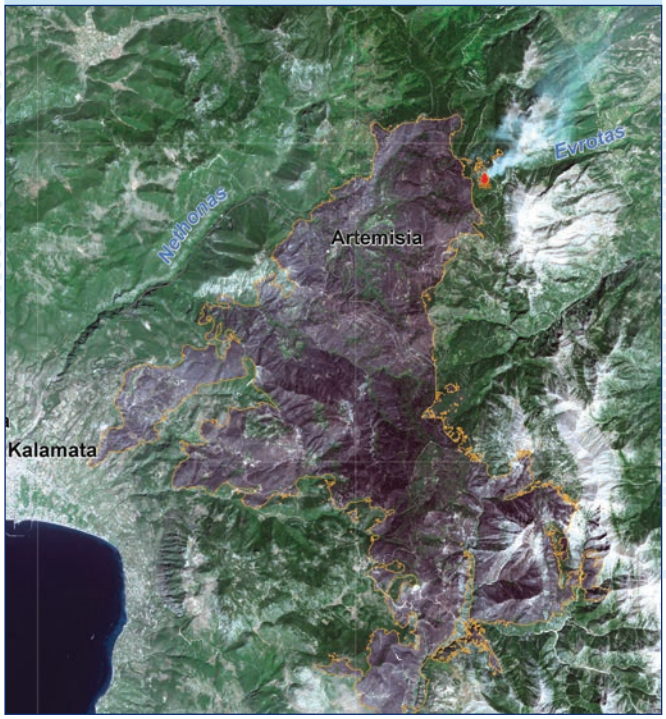
Heavy flooding occurred in central and southern Chile in May 2008. Some 13 000 people were affected. The towns of Lincantén and Lontué were the hardest hit.

The Charter was activated on 23 May 2008 by Sistema Federal de Emergencias (SIFEM) and the project was managed by the Instituto Nacional del Agua (INA). Maps showing the flooded area were produced by INA Argentina.

→ FOREST FIRE

While controlled fires are an important agricultural practice, wildfires rage across millions of hectares of forest and vegetation every year. They can result in loss of life, destruction of property and damage to the environment coupled with huge economic costs. At the same time, fires degrade air quality and release vast amounts of carbon dioxide and other greenhouse gases into the atmosphere, contributing to climate change. Sub-Saharan Africa and Australasia are typically prone to wildfires, though recent hot dry summers in Europe and the United States are leading to an increasing number of devastating fire events.

Satellites sensors that are able to detect heat, smoke and scorched land are proving to be a valuable tool for mapping and monitoring wildfire. In particular, spaceborne thermal infrared sensors can provide data to map and monitor wildfire. Maps provided through the Charter and made available within a few hours of data being acquired, enable fire fighters to predict the path a fire is likely to take. In combination with other information, satellite data are also being used for risk assessment to help prevent fires breaking out in the first place.



Crisis map showing burnt areas in Greece

Source	Spot-5, Landsat-7 ETM
Acquired	02/09/07 (Spot), Landsat background image 15/08/00
Map created	10/09/07 SERTIT

Fires in Greece

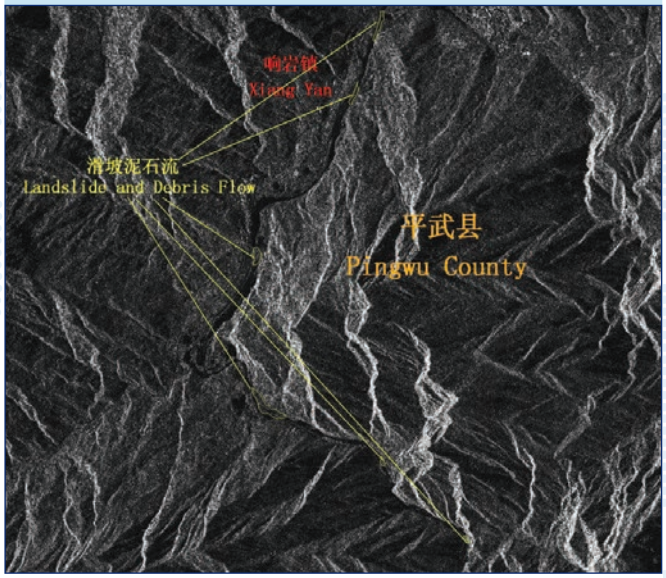
As a result of the severe wildfires that swept across parts of Greece in 2007, a total of 2700 km^2 of forest and farmland was destroyed and more than 80 lives lost.

The Charter was activated on 29 August by the Greek Civil Protection Agency's Department of Emergency Planning and Response. The project was managed by ESA in collaboration with the French Centre National d'Etudes Spatials (CNES) and a team was organised to deliver a series of maps to help manage the disaster. Service Régional de Traitement d'Image et de Télédétection (SERTIT) and the German Aerospace Center DLR carried out this service under the scope of the Risk-EOS service network. In response to the wildfires in 2009, a similar service was delivered to the Greek Civil Protection Agency by the Global Monitoring for Environment and Security (GMES) SAFER project.

→ EARTHQUAKES

It is estimated that there are 500 000 detectable earthquakes in the world each year, of which 100 cause serious damage. Unlike volcanic eruptions, they strike without warning, giving little chance to escape – which makes large earthquakes amongst the most deadly of all natural disasters. While the numbers of earthquakes remain relatively constant, population growth and increased construction within earthquake zones mean the number of potential victims is growing. In the event of a large earthquake, numbers of casualties can be huge and the damage can take years to repair with industry, agriculture and communications infrastructure often in ruins.

Following an earthquake, Earth observation satellite data are extremely valuable in providing a picture of damaged areas and for creating reference mapping to aid emergency operations. For example, knowing if roads are passable, especially in mountainous areas, is vital for getting timely relief to victims. Satellite images can provide updated views of how the landscape has been affected, while before and after images enable damage assessment as a basis for planning immediate humanitarian relief and longer-term restoration.



Landslide and debris flow after the Wenchuan earthquake

Source	Radarsat-1, 6.25m/pixel resolution.
Acquired	17/05/2008
Map created	18/05/2008 by NDRCC

Earthquake in China

On 12 May 2008, an earthquake measuring 7.8 on the Richter scale struck southwest China. Over 15 million people lived in the disaster region, including 4 million in the province of Sichuan's capital Chengdu, around 90 km from the epicentre. The epicentre of the earthquake was in the mountainous region of Wenchuan. The death toll reached 69 000 and 5 million people were made homeless, making it China's worst natural disaster in over 30 years.

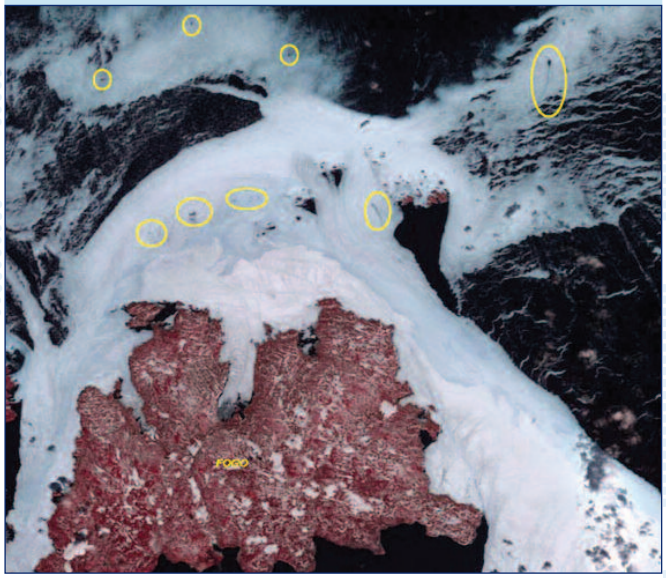
The Charter was activated by the National Disaster Reduction Centre of China (NDRCC) to provide maps for disaster relief, which was hampered in the following days by aftershocks, heavy rain and landslides.

→ ICE JAM

Marine navigation through polar waters is often reliant on ice-monitoring and icebreaker services. Ship operators require precise up-to-date information on the location of ice edges, ice type and extent along their routes. Ice-monitoring services, providing this kind of information, are derived from data acquired by aircraft, ships and land stations, and now more commonly from satellites. Ice cover in the Arctic is becoming less predictable; for example, recent summers have seen record minimums of sea-ice extent with the prospect of the fabled Northwest Passage – a long-sought short cut between Europe and Asia – becoming ice-free during the summer.

However, the polar seas remain dangerous, inhospitable regions, with ships still running the risk of being trapped in the pack ice.

The polar seas are amongst the Earth's most inaccessible regions, so obtaining information about the condition of sea ice was limited before satellite observations. For more than 20 years, data have been available from spaceborne sensors to understand and monitor the polar environment. These data are now being used through the Charter to locate and help ships trapped in heavy ice pack.



Ice-bound vessels off the coast of Newfoundland

Source	NigeriaSat-1
Acquired	22/04/2007
Map created	22/04/2007 by CSA

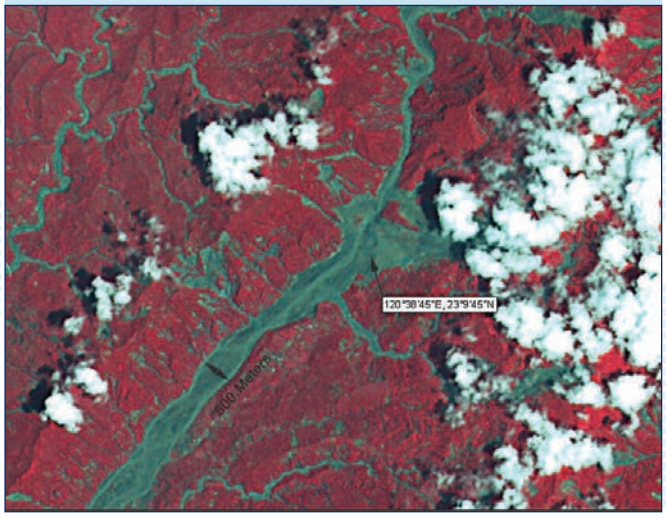
Ice jam off the coast of Newfoundland, Canada

The Charter was activated by Public Safety Canada on 19 April 2007 because of risks associated with the sea ice off the east coast of Newfoundland. About 100 ships were trapped in pack ice and information was urgently needed to help locate where the vessels were imprisoned. As a result, maps were produced by the Canadian Space Agency (CSA) showing the positions of the trapped vessels.

→ HURRICANE

'Hurricane' and 'typhoon' are regionally specific names for a strong tropical cyclone. In general, these cyclones are given the name 'hurricane' in the Atlantic and eastern Pacific, and 'typhoon' in the western Pacific. As large rotating storms with winds blowing in excess of 118 km per hour, they are one of the most dangerous natural hazards to people and the environment. They form over warm ocean water and can cause serious damage when they hit land.

Hurricanes and typhoons account for 20% of Charter activations. Earth observation satellites can provide essential data to help understand the strength and path of a storm, which is critical for the issue of timely warnings. Spaceborne optical and radar instruments are used to monitor changes in cloud structure, winds and waves, sea-surface temperature and sea-surface height. A single image can span the entire storm – from the eye to the outermost fronts.



Landslide and flood damage following Typhoon Morakot

Source	Spot HRVIR, Landsat
Acquired	16/08/2009
Map created	Pacific Disaster Center/USGS

Typhoon in Taiwan

Typhoon Morakot hit Taiwan on 5 August 2009, causing landslides and extensive flooding throughout the central and southern parts of the country. High winds and heavy rain washed away bridges and roads, damaged crops, livestock, and agricultural land before moving on to China, where up to one million people along the eastern coast were evacuated.

The Charter was activated on 10 August 2009 by the US Geological Survey (USGS) on behalf of the National Science and Technology Center for Disaster Reduction (NCDR), Taiwan. The project was managed by the Office of US Foreign Disaster Assistance. Maps showing flood and landslide damage were produced by USGS.

→ LANDSLIDES

Landslides and mudslides represent a serious hazard in mountainous regions across the world. Landslides, which can be a consequence of events such as heavy storms, volcanic eruptions or earthquakes, occur when masses of rock and earth break away and slide down a slope. Like landslides, mudslides are also the result of sudden movement of earth and debris downhill, but are triggered when excessive water accumulates in the ground. Landslides and mudslides can be catastrophic, causing loss of life, damage to property and infrastructure.

Since, by their very nature, landslides and mudslides occur on slopes – the topography of the affected area can make access difficult, especially if the road network has been disrupted. In order to plan rescue missions and assess the damage caused, data from optical and radar instruments on Earth observation satellite are invaluable.

Pre-disaster and post-disaster mudflow extent Tajikistan – Aini Jamoat, Khuroson District, Khatlon Province

Source	Spot-5, 2.5 m pixel
Acquired	06/09/2007, 17/05/2009
Map created	20/05/2009 by DLR/ZKI

Landslide in western Tajikistan

On 14 May 2009 heavy rainfall led to a mudslide in western Tajikistan. About 6000 people were affected by the event. Heavy rains over several weeks caused floods and mudslides in more than 25 districts, killing more than 20 people. An earlier mudslide on 21 April had also affected the same area and destroyed over 60 houses. Two camps were established to provide shelter for people who were affected by the mudslides.

The Charter was activated by United Nations Office for Outer Space Affairs (UNOOSA) on behalf of the United Nations Development Programme (UNDP) Tajikistan. The project was managed by the German Aerospace Center (DLR). Maps showing the area before and after the mudflow were created by ZKI/DLR.