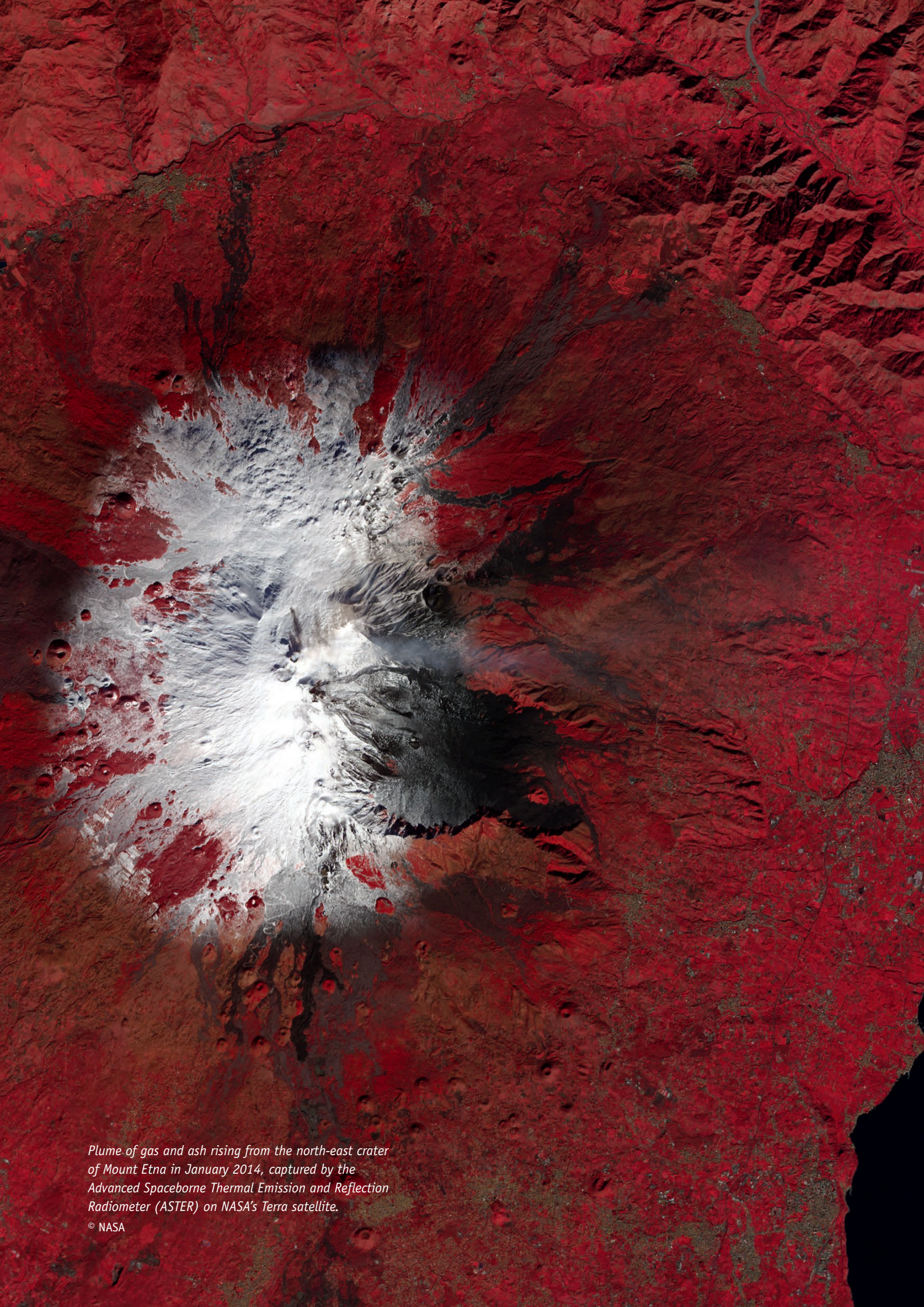


United Nations Platform for
Space-based Information for Disaster
Management and Emergency Response

UN-SPIDER



UNITED NATIONS



Plume of gas and ash rising from the north-east crater of Mount Etna in January 2014, captured by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite.

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INTRODUCTION

The United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) was established in 2006 under the United Nations Office for Outer Space Affairs (OOSA). UN-SPIDER develops solutions to address the limited access developing countries have to expensive and highly specialized technologies that can be essential in the management of disasters.

Remote sensing for Earth observation, satellite-based telecommunication and global navigation satellite systems contribute to more effective disaster risk management and emergency response. It is the goal of UN-SPIDER to enable developing countries to use all types of space-based information in all phases of the disaster management cycle including prevention, preparedness, early warning, response and reconstruction.

UN-SPIDER aims at improving actions to reduce disaster risk or support disaster response operations through knowledge sharing and the strengthening of institutions. UN-SPIDER also facilitates cooperation between data and information providers and the different groups of users of such data, such as policymakers, disaster risk managers or emergency responders. The result is a better flow of information between all stakeholders and affected populations.

In doing so, UN-SPIDER and its network of global partners use an array of tools to build capacities in developing countries to access and use space technologies. UN-SPIDER's Knowledge Portal is a hub for pertinent information, links and resources. Through its tailor-made technical advisory support, UN-SPIDER assesses the individual potential of a country, makes specific recommendations and carries out specialized training courses. Additionally, through its conferences, workshops and expert meetings, UN-SPIDER brings together relevant stakeholders from both the space and the disaster communities in order to foster an exchange of innovations and experiences.

UN-SPIDER furthermore promotes and supports the various international mechanisms that provide space-based information and derived maps to requesting users in disaster situations, such as the International Charter: Space and Major Disasters or Sentinel Asia.

A satellite image showing a landscape with a large, winding river on the right side. The river is dark and has a complex, braided pattern. The surrounding land is a mix of green and brown, with several dark, irregular patches indicating areas of fire or deforestation. The overall scene is captured from a high angle, showing the intricate details of the river and the surrounding terrain.

USING SPACE TECHNOLOGY FOR DISASTER RISK MANAGEMENT AND EMERGENCY RESPONSE

*Fires near Yakutsk, Russian Federation, in May 2011
captured by the Advanced Land Imager on NASA's EO-1
satellite.*

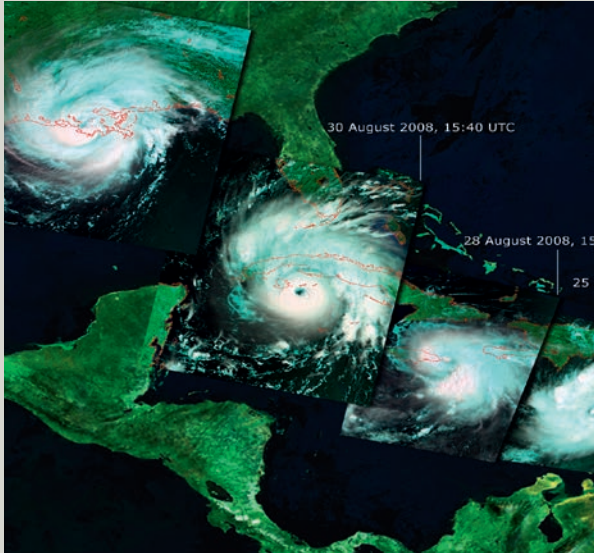
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Reliable and timely information is essential when it comes to dealing with natural hazards and the resulting disasters—especially when infrastructures are hindered or ineffectual. Satellites provide this information in a variety of ways. They help disaster responders by giving a clear picture of inaccessible, flooded or damaged areas. They allow for disaster risk reduction by guiding urban planners. They enable communication in emergency situations and they permit the identification of precise locations of response teams, shelters, disaster areas or vulnerable populations. The information gathered by satellites can even help anticipate disasters such as earthquakes, floods, landslides, fires or tsunamis.

Earth observation satellites provide valuable additional input that can be used to track the path of tropical storms including typhoons, cyclones and hurricanes worldwide; the changing morphology of volcanic domes in case of eruptions; the dispersion of ash emitted during volcanic eruptions; the geographical extent of flooded regions even under cloudy conditions; the extent of forest fires and oil spills; and the effects of droughts on soils, vegetation and crops.

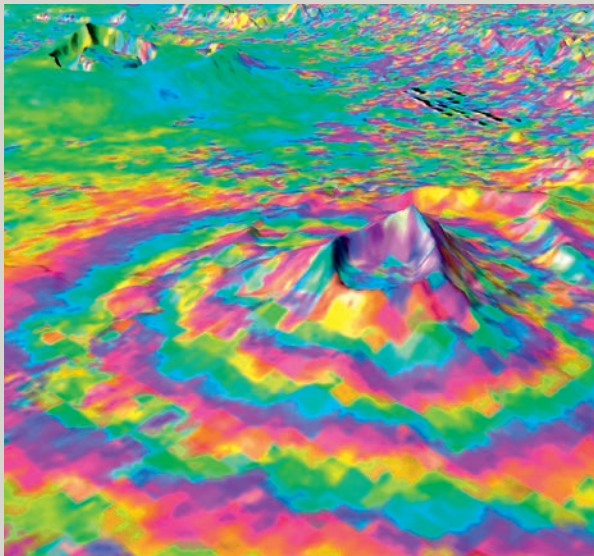
Global navigation and positioning satellites orbit the Earth on a permanent basis and are used to assess the relative motion of tectonic plates and the magnitude of the most powerful earthquakes, particularly when seismometers become saturated. The global coverage of the signals provided by these constellations of satellites allows emergency responders to supply coordinates of landing sites to helicopter pilots in areas affected by disasters. They also help develop more accurate maps of disaster areas and facilitate interoperability of data and information.

Communication satellites are essential when there is a need to transmit messages very rapidly across vast areas. The transmission of messages regarding tsunamis is of particular relevance, not only from one continent to another, but also to small populated islands which may otherwise be unreachable. Communication satellites also allow devices such as deep-sea buoys, rainfall and river level gauges, and seismometers to transmit their data to specialized centres where they are processed to identify possible disasters. Simple applications of geo-referenced photographs also allow crowd-sourcing of in situ data to assess damage. The COSPAS SARSAT programme is especially useful, in that it allows maritime vessels and airplanes to send distress alerts and location information for search and rescue operations.



© ESA

Satellite images of Hurricane Gustav as it approached the United States in August and September 2008.



© ESA

SAR Interferogram image of the Longonot Volcano, Kenya.

SATELLITE INFORMATION FOR DISASTER RISK REDUCTION

In order to take decisive action to reduce disaster risks, it is imperative to become aware of their geospatial location and extension. In combination with ground-based data, space-based data can be used to assess the geographic areas that are exposed to geological and hydrometeorological hazards and the degree of exposure of vulnerable assets. In this context space-based data provides two unmatched capacities:

- High-resolution satellite imagery enables those in charge of disaster risk reduction to become aware of the most up-to-date degree of exposure of vulnerable elements.
- By combining archived and current imagery, disaster risk managers can track how exposure to hazards has been changing in different geographic regions and over time.

Earth observation is equally important in the context of early warning. Through the use of meteorological satellites, typhoons or hurricanes can be tracked before they make landfall. Similarly, radar interferometry can be used to monitor changes in the cones of volcanoes prior to eruptions. Satellites also allow experts to track rainfall, soil moisture, changes in vegetation and crop yields associated with emerging droughts.

Global navigation satellite systems can also play an important role in disaster risk reduction by tracking the relative movement of tectonic plates and the dynamics of hills prone to landslides. By providing accurate and precise location parameters, they also facilitate the integration and overlay of various data sets.

Satellite telecommunication satellites enable the transmission of data collected by DART (Deep-ocean Assessment and Reporting of Tsunamis) buoys and other sea-level gauges regarding tsunamis, and to transmit tsunami alert messages across vast oceans.

SATELLITE INFORMATION FOR EMERGENCY RESPONSE

When a disaster strikes, situational awareness is essential. This includes reliable knowledge of the geographical extent of the event, the impact on people, and the degree of damage to housing and other private and public infrastructure. Responders also need to assess the status of critical assets such as telecommunication networks, roads, shelters, informal assembly points and health facilities.

Satellite data makes it possible to assess and map the extent of events such as floods, landslides, the flow of debris or forest fires. In addition, through a comparison of high-resolution images just before and after a disaster, Earth observation experts can detect areas affected or destroyed by the event more precisely.

This information can then be used by decision makers to provide humanitarian assistance. For example, in the case of floods, information on houses affected can be used to properly allocate funds for insurance payments and reconstruction purposes. When droughts occur, the precise identification of crops destroyed can be used to provide new seeds to farmers. With earthquakes, high-resolution satellite imagery can be employed to assess the roads that are still usable, providing critical information for civil protection agencies that need to deliver humanitarian assistance or indicate evacuation routes to affected communities.

The demarcation of helicopter landing sites using coordinates provided via global navigation satellite systems helps helicopter pilots to deliver critical supplies and to support the timely evacuation of injured persons. Navigation satellite systems also help in the accurate location of damage, thus allowing for precise assessments and damage maps.



© NASA

Satellite view of the Japanese city of Ishinomaki after the tsunami on 11 March 2011.



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Impact of Hurricane Mitch on Tegucigalpa, Honduras in 1998.

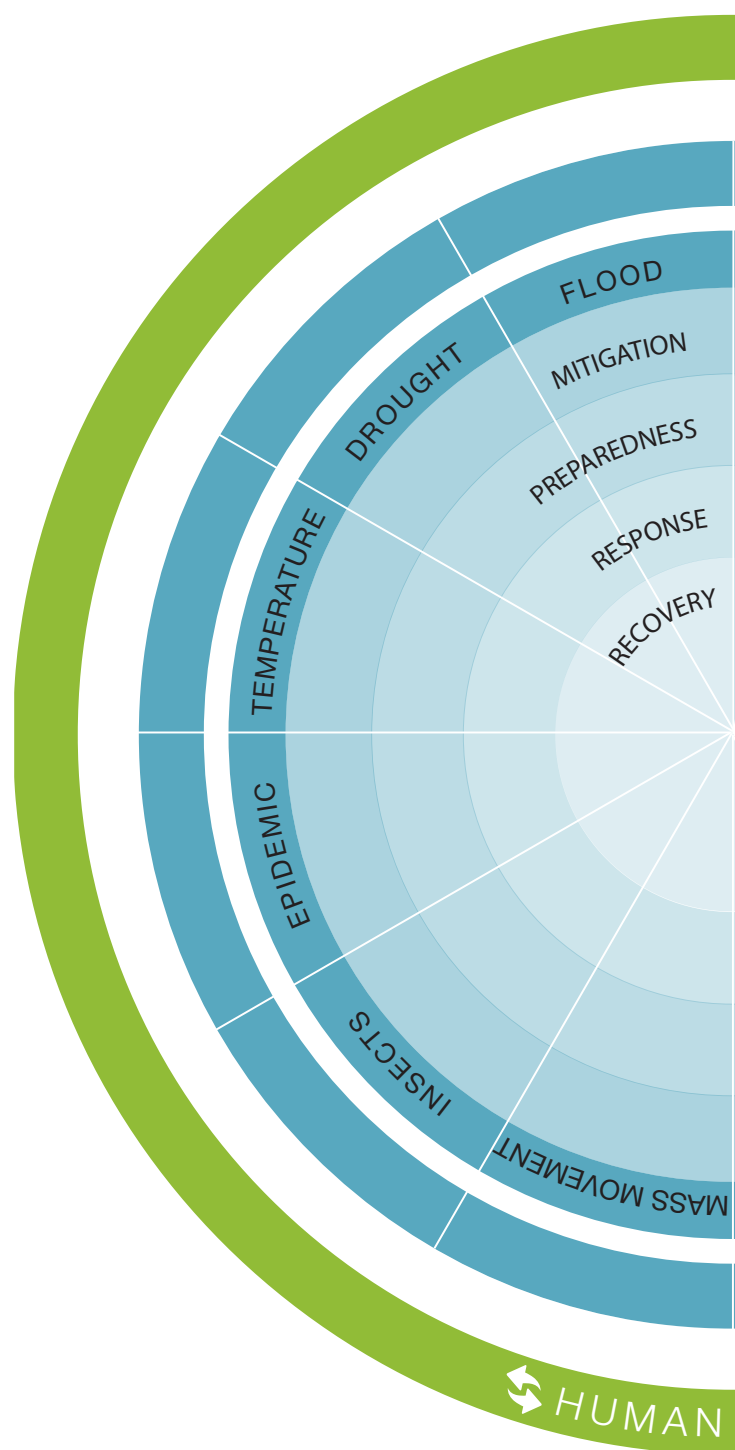
UN-SPIDER'S KNOWLEDGE PORTAL

Knowledge management is at the core of UN-SPIDER's activities. By systematically and continuously compiling the knowledge and available resources held by individuals and institutions, UN-SPIDER aims to transfer lessons learned, point out innovations and foster collaborative practices.

The communities involved in UN-SPIDER's field of work include many different actors: disaster responders, disaster risk specialists, policymakers, remote sensing experts, space technology providers, academics and researchers. The needs, prerequisites and capabilities of all these actors can vary considerably from region to region and from country to country.

In addition to providing technical advice and organizing capacity-building activities and international conferences that bring stakeholders together in person, UN-SPIDER wants to make information and knowledge available in a more global way.

Consequently, the programme established its UN-SPIDER Knowledge Portal (www.un-spider.org) in 2009. This website is available in multiple languages and serves as a knowledge hub for all relevant information regarding the access to and the use of space technologies and products in the context of disasters and disaster risks. The portal makes available good practices, data sources, tools and lessons learned as well as news, events and training course announcements to the different communities.



UN-SPIDER's Space Application Matrix is a search engine providing access to over 200 case studies and scientific papers. Users can browse this database by hazard type, space technology and disaster management cycle phase.



As the thematic contexts and levels of detail required can vary greatly from one user to the next, the structure of the portal embraces the fact that each user has an individual knowledge need. It provides various individual entry points to the inter-linked content it holds, ranging from very general background information to highly specific technical instructions.

For example, the news and events sections provide a general overview of the current trends in the community without entering into excessive detail. The portal's network and institutional databases point out focal points and contact information of relevant stakeholders in many countries and regions.

As the portal's central search engine to over 200 case studies and scientific papers, the Space Application Matrix offers access to more specific information. It guides users towards a compilation of possible space applications for their specific hazard, disaster cycle phase and space technology of interest.

Although the Matrix is important for increasing awareness of space-based information for various hazards, a user might want to get specific hands-on information. The portal's links and resources section allows each user to find data sets and information on software for geographic information systems and remote sensing according to specific criteria, such as region, hazard, disaster cycle phase, resolution or file format.

Once users have identified the data and tools that are relevant for their situation, the portal takes them one step further by pointing out specific tutorials, training courses and recommended practices.

More information: www.un-spider.org



Training course for Mesoamerican countries on using radar images for flood mitigation.



Practical demonstration of space-based technology by the Director of the Mt. Cameroon Seismological Observatory during a mission to Cameroon.

UN-SPIDER'S TECHNICAL ADVISORY SUPPORT

One of UN-SPIDER's main activities is to provide countries with technical advisory support. This includes technical advisory missions to meet with key disaster management authorities in Governments, United Nations agencies, regional and international organizations or initiatives, and private entrepreneurs to discuss topics in depth, make recommendations and develop guidelines to improve the use of space-based information for disaster risk management and emergency response.

Such missions take place at the official invitation of Member States, often via their national disaster management agencies. UN-SPIDER puts together the mission team comprising experts from different countries and organizations. Typically, technical advisory missions last five days, including a one-day national workshop and a briefing on the mission's outcomes, preferably to the relevant ministers or deputy ministers.

After the mission, the team submits a comprehensive report that assesses the current use of space-based technologies and information for disaster risk management and emergency response, identifies potential areas where space-based information could play a greater role and contributes to improving access to such information. The report contains observations, assessments, suggested best practices and recommendations.

The host Government and local United Nations agencies act upon these recommendations. This establishes long-term cooperation between UN-SPIDER and the Member State, allowing UN-SPIDER to facilitate further follow-up actions such as training courses or support during emergencies.

When providing technical advisory support to countries, UN-SPIDER often finds that space-based information is not yet institutionalized. Hence, a typical recommendation is for civil protection agencies to incorporate the use of such information in standard operating procedures, national contingency plans or emergency response plans.

At the same time, some Government agencies possess very relevant data, but it is not shared. UN-SPIDER therefore recommends the development of national spatial data infrastructures so that data can be shared. UN-SPIDER also strongly promotes policies and guidelines that encourage the full and open exchange of data, metadata and products.

Another frequent observation in several developing countries is that disaster responders are not aware of international emergency mechanisms that provide free satellite products such as the International Charter: Space and Major Disasters. During its missions, UN-SPIDER therefore promotes these mechanisms and explains how they can be triggered.

In cases where ministries or Government agencies have staff with skills on remote sensing and geographic information systems applications, UN-SPIDER recommends the implementation of inter-institutional teams as a way of generating relevant space-based information.

In addition, UN-SPIDER, its Regional Support Offices and the Regional Centres for Space Science and Technology Education affiliated to the United Nations carry out one-week training courses to strengthen the skills of Government officials and other stakeholders in countries where technical advisory missions have been conducted.

More information: www.un-spider.org/advisory-support



UN-SPIDER technical advisory missions include discussions with all key ministries and other stakeholders.



UN-SPIDER expert giving technical advice to members of an inter-institutional team on geospatial information for disaster-risk management and emergency response in the Dominican Republic.



Third Regional Support Offices Meeting in Vienna in 2012.



Training course conducted by UN-SPIDER and the two Regional Support Offices CATHALAC (Panama) and CONAE (Argentina) in Mexico.

UN-SPIDER'S PARTNERS

UN-SPIDER works closely with its network of regional and national partners and benefits from different types of support. The Governments of Austria, Germany and China strongly support the programme and its offices in Vienna, Bonn and Beijing. UN-SPIDER also greatly benefits from seconded experts from national institutions and associate experts funded by their home countries.

In order to promote the access to and the use of space-based information throughout the world, UN-SPIDER cooperates with centres of expertise on all continents. As of 2014, the programme has a network of 16 Regional Support Offices offering important experience and capabilities. These Regional Support Offices are national space agencies, geographic institutes, civil protection agencies, universities and regional remote sensing centres with notable expertise in the use of space technologies for disaster risk reduction and emergency response in Africa, Asia, Europe, Latin America and the Caribbean.

Recognizing the fact that disaster risk reduction and emergency response efforts are conducted via a variety of Government agencies with the support of non-government actors and civil society, UN-SPIDER has also established National Focal Points: national institutions nominated by the Government of a Member State that represent the disaster management and space application communities. Their role is to work with UN-SPIDER to strengthen national disaster management planning and policies and to implement specific national activities that incorporate space-based technology solutions in support of disaster management.

The Regional Support Offices work in close cooperation with UN-SPIDER staff in Vienna, Beijing and Bonn on the organization of international and regional workshops and conferences, technical advisory missions and training activities, the provision of support to other countries during emergencies or disasters and the elaboration of content for the UN-SPIDER Knowledge Portal.

UN-SPIDER's Regional Support Offices possess the expert knowledge required to provide support adapted to specific conditions in a given country. These offices take an active role in UN-SPIDER's technical advisory missions throughout the world, and guide national agencies in their efforts to improve their capacity to access space-based data and generate information regarding risks or areas affected by disasters.

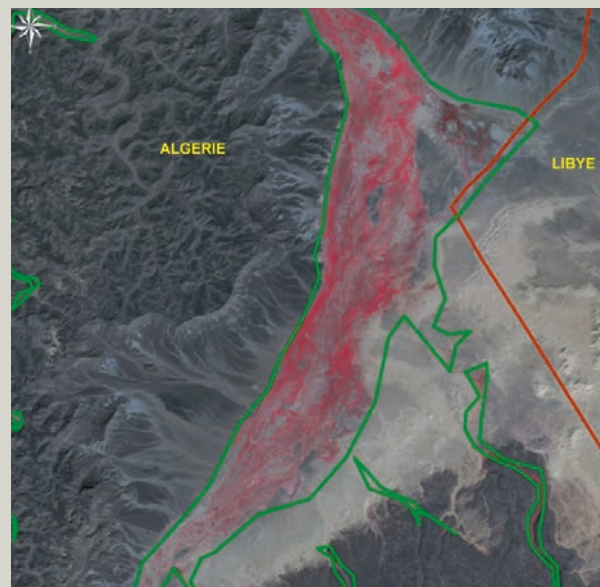
For example, the Regional Support Offices use their expertise and knowledge to develop tailor-made training material and to conduct one-week training courses with the aim of strengthening the skills of staff in Government agencies on the use of specific software applications to process satellite imagery.

Regional Support Offices are also developing step-by-step procedures on processing satellite imagery to generate specific products such as flood maps, or to track the impact of droughts on particular regions. These procedures constitute the set of recommended practices that the programme is promoting and that are available on the UN-SPIDER Knowledge Portal.

More information: www.un-spider.org/network



Fifth Regional Support Offices Meeting in Vienna in 2014.



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Map showing possible locust breeding zones at the border between Algeria and Libya in 2012 elaborated by the two Regional Support Offices ASAL (Algeria) and RCMRD (Kenya).



UN-SPIDER: MEET THE TEAM

UN-SPIDER is a programme of the United Nations Office for Outer Space Affairs (OOSA). It was created in 2006 by the General Assembly of the United Nations to ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle. The programme has three offices—one in Vienna, Austria, where OOSA is headquartered, one in Bonn, Germany and one in Beijing, China.

Since UN-SPIDER works at the crossroads of space technologies and disasters, its interdisciplinary team is composed of experts in remote sensing, disaster risk management, humanitarian affairs, IT, geographic information, communication and political science.

Due to the wide-ranging experience and the complementary skills of its team, UN-SPIDER can provide tailor-made support and services to requesting Member States.

Broadly speaking, the Vienna office coordinates the overall programme and the UN-SPIDER network. The Beijing office is primarily involved in organizing technical advisory support missions, training courses or conferences. The Bonn office focuses on knowledge management and handles the maintenance and further development of UN-SPIDER's Knowledge Portal (www.un-spider.org).

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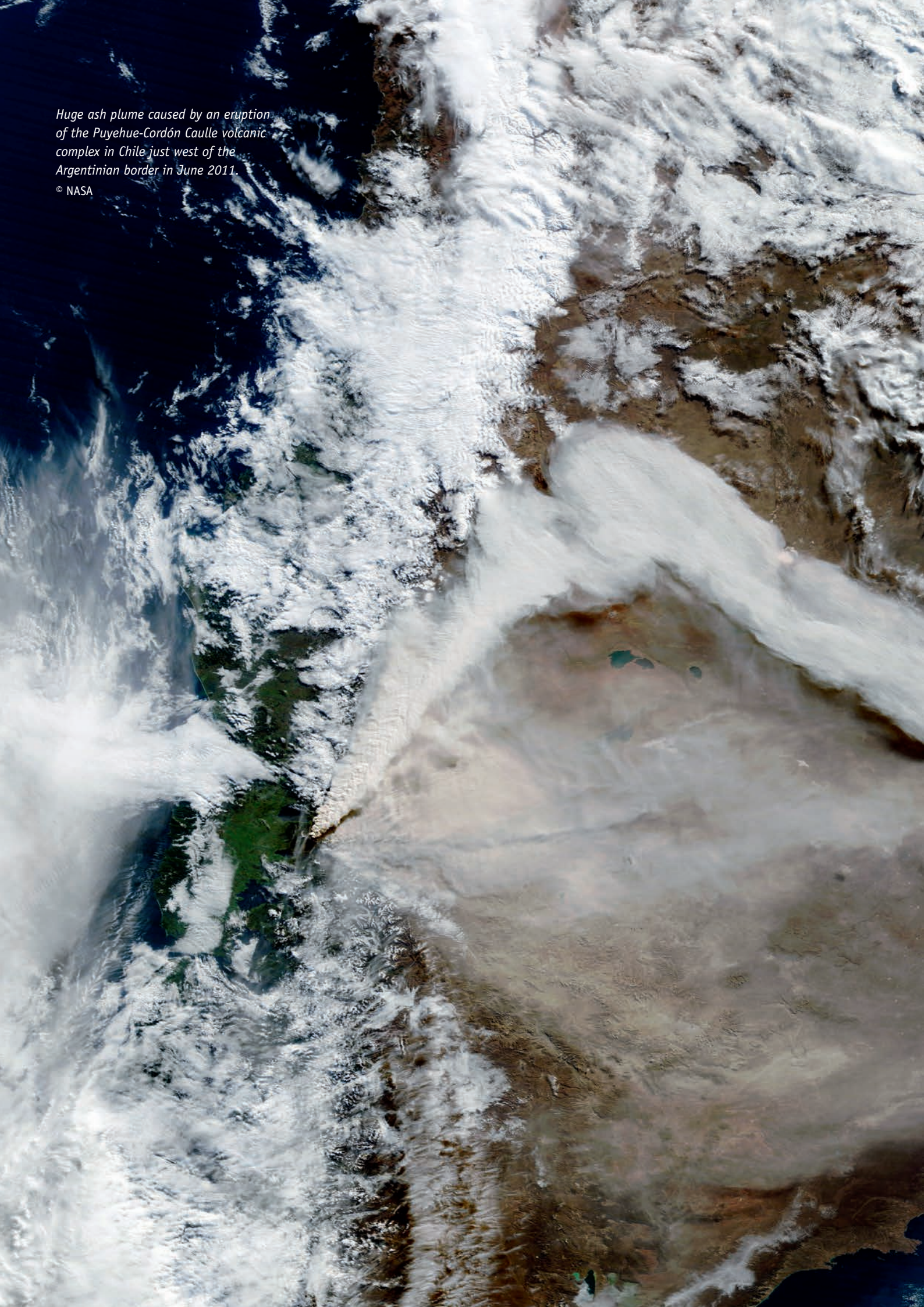
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*Huge ash plume caused by an eruption
of the Puyehue-Cordón Caulle volcanic
complex in Chile just west of the
Argentinian border in June 2011.*

© NASA



■ The United Nations Office for Outer Space Affairs (OOSA) is responsible for promoting international cooperation in the peaceful uses of outer space and assisting developing countries in using space science and technology.

Typhoon Haiyan approaching Viet Nam in November 2013, captured by NASA's Terra satellite.

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