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Korea Aerospace Research Institute (KARI) – Charter Leadership

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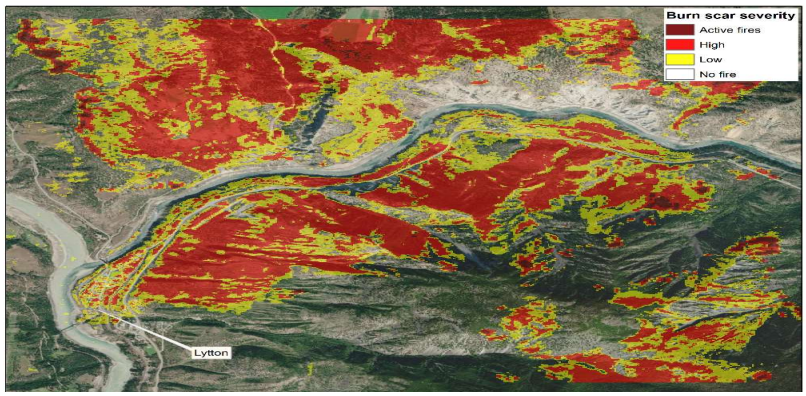

WildFireSat : Enhancing Canada's ability to monitor and manage wildfires

Wildfires make up a significant portion of the activations of the International Charter Space and Major Disasters.

ESA Charter Mapper training event, followed by Activation 777 : Flood in Nigeria

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SATELLITE DATA TO SUPPORT DISASTER RESPONSE WORLDWIDE

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Korea Aerospace Research Institute (KARI) – Charter Leadership

Korea Aerospace Research Institute (KARI) took the responsibility of Charter leadership in October 2022 from National Oceanic and Atmospheric Administration (NOAA) and United States Geological Survey (USGS). Due to the remaining difficult circumstances of COVID-19, KARI organized the 48th meeting of the International Charter 'Space and Major Disasters' in virtual mode.

During the KARI leadership period,

- The Charter had its 800th activation requested by National Disaster Management Agency (NDMA) of Eswatini to provide satellite data in response to floods affecting the nation.
- Solomon Islands has been newly included in the Universal Access Authorized User
- The Charter has supported 27 major disaster events (total of 10,645 images were provided) worldwide.
- In the Northern hemisphere, there were Great earthquakes in Türkiye and Syria, and in the Southern hemisphere, cyclone Freddy, Judy, and Yaku hit the African continent one after another, causing great damage. In February and March 2023, 2-3 Charter calls were received every week.

As per the Charter's rotation policy, the leadership of the Charter changes every six months. The United Kingdom Space Agency (UKSA) will take over as the next lead agency following KARI's lead period, beginning in April 2023.

Charter Members during the 48th Board Meeting for the International Charter Space and Major Disasters

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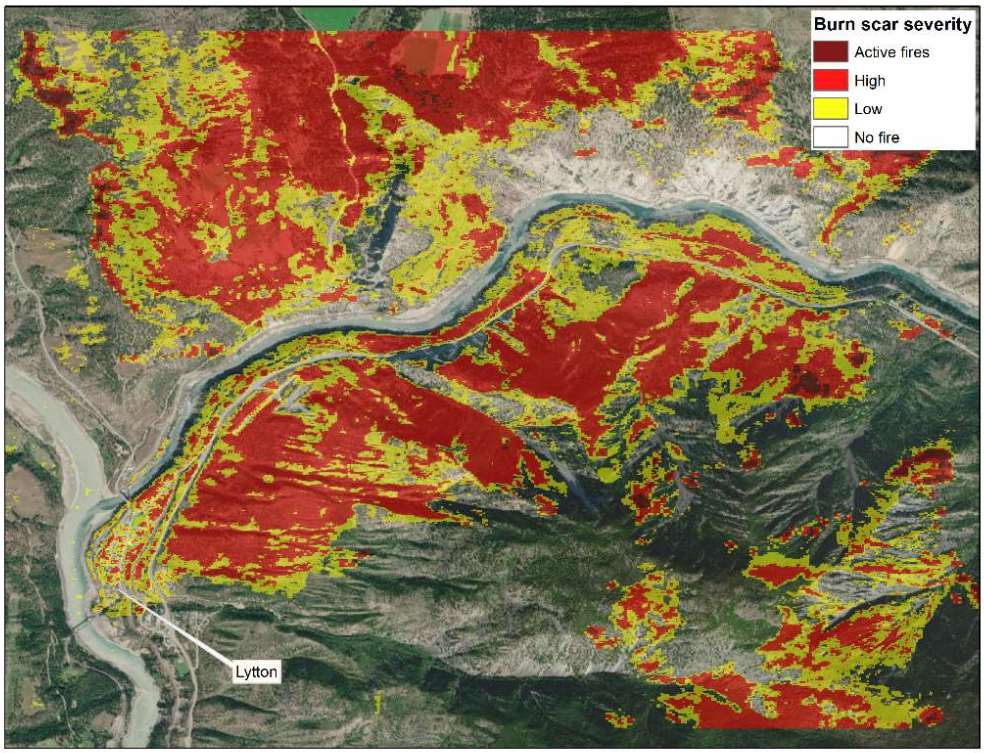
WildFireSat : Enhancing Canada's ability to monitor and manage wildfires

Wildfires make up a significant portion of the activations of the International Charter Space and Major Disasters. Over the past two decades, more than 50 activations have been related to these devastating events.

Every year, Canada sees about 7 500 wildfires burn over 2.5 million hectares of forest, mostly between the months of May and September. The amount of forest burned by wildfire is projected to double by 2050, in part due to climate change causing longer wildfire seasons. Approximately $1 billion (CAD) is spent annually to combat wildfires in Canada, but the indirect costs – such as losses stemming from damaged infrastructure, evacuations, health impacts, and interruptions to tourism – are also significant. Canadians may recall the devastating Lytton Creek wildfire in British Columbia in June 2021. It caused civil fatalities and affected Indigenous communities.



Produced in July 2021, this map illustrates the severity of burn scars in the Lytton region in British Columbia, Canada. Credits: Hatfield Consultants. Contains modified Copernicus Sentinel data (2021) processed by ESA.

Canadian wildfire managers rely on geospatial information from space in several ways: to track and monitor wildfires for situational awareness, for use as a planning tool for emergencies, for modeling wildfire behaviour, and for adaptation planning which considers the impacts of climate change on the environments commonly affected by wildfire. The issue of improving and optimizing timely and time-critical satellite-based Earth Observation (EO) of wildfire has come to the fore repeatedly. To date, mid- morning and early afternoon satellite observations have been the standard for general EO sensors, many of which have been relied upon for wildfire-related Charter activations. However, wildfire observation and situational reporting are known to be most effective during the late afternoon and early evening hours, when wildfire activity is usually at its peak.
The Government of Canada has recently allocated funding for a dedicated operational WildFireSat mission, planned for launch in 2029. This funding includes 5 years of operations. WildFireSat is a constellation of satellites with infrared sensors and operating parameters designed specifically for accurate wildfire measurement, time-critical data acquisition, and effective event management.

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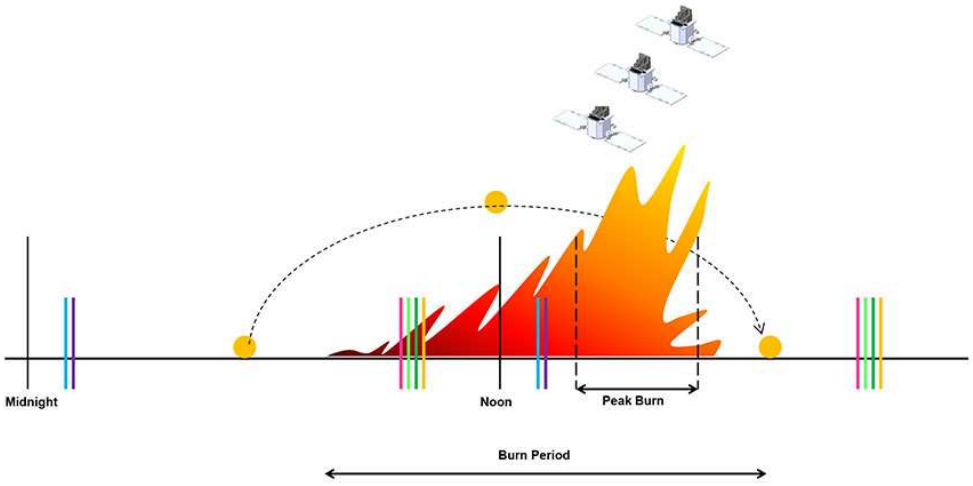
The WildFireSat mission aims to monitor all active wildfires in Canada from space on a daily basis. It is an initiative of the Canadian Space Agency (CSA) in close collaboration with Natural Resources Canada and Environment and Climate Change Canada. Its primary goal is to support wildfire management with more precise information on fire dynamics, improved forecasts of smoke and air quality conditions and more accurate carbon emission measurements. The latter is an important requirement of international agreements on carbon reporting. The operation of and observations made by WildFireSat are geared toward the most critical period of wildfire activity: the late afternoon "peak burn period." During that period, higher daily temperatures, lower humidity and strong winds often result in rapid propagation of wildfires. Thus WildFireSat will broaden our understanding of how wildfires behave and how that behaviour is influenced by changing climate conditions.



Satellite observations are needed during the peak burn period.

In accordance with the CSA's commitment to open government, it is envisioned that processed and calibrated WildFireSat data will be accessible to the public as soon as it becomes available. WildFireSat will actively collect data when passing over Canada and downlink it to Canadian ground stations. Since the orbital paths of the satellite will allow the sensors to image other parts of Earth as well, WildFireSat could potentially collect data over other wildfire events..

For more information, please visit: https://www.asc-csa.gc.ca/eng/satellites/wildfiresat/

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ESA Charter Mapper training event, followed by Activation 777: Flood in Nigeria

The ESA Charter Mapper continues to grow both in its user base and in its processing capabilities. Some organisations involved with Charter operations as Project Manager or VA provider are utilising the ESA Charter Mapper. In the final quarter of 2022, the ESA Charter mapper was used by a total of 18 users coming from 6 Charter agencies and the UN. 9 users submitted a total of 155 on-demand EO processing jobs, while 9 other users utilised the mapper for visualising full resolution EO data in the context of Charter activations. ESA Charter Mapper is now included in all PM trainings.

On the 6th of September 2022, A four-hour PM/VA training was given to the National Space Research and Development Agency (NASRDA) of Nigeria. The following week, on the 13th and 14th of September, Charter members supported UNOOSA with their training simulation held at NASRDA headquarters in Abuja. Just one day later, on September 15th, the Charter was activated for a serious flooding event across Nigeria (Activation 777). Torrential rain caused flooding in every state in the country, submerging buildings and agriculture, and causing 92 deaths. The activation was requested by the authorized user from Nigeria: The National Emergency Management Agency (NEMA). The NEMA was established in 1999 as the national disaster management authority in the country and is headquartered in Abuja. NEMA has been the Charter requestor for all 6 Charter activations in Nigeria, dating back to the first in September of 2010. As for the PM role, NASRDA assumed this role after having just received training, specifically chief geologist Oyewumi Ademuyiwa. NASRDA has been the PM for nearly all the Charter activations in Nigeria. NASRDA created several VAPs using predominantly Sentinel-1 data, however RCM-1, KOMPSAT3, PlanetScope, and Sentinel-2 data were also used to generate flood extent maps. To assist NASRDA with the creation of VAPs, experts from the University of Bonn ZFL, Terradue, and NOAA were nominated as VAs. Terradue Used VHR optical data from Pleiades and WorldView to map several flooded villages in great detail. NOAA used their Suomi-NPP satellite to create a floodwater depth map. Lastly, Bonn ZFL created detailed flood extent maps of specific towns in the flooded regions using Sentinel-1, and in one case using KOMPSAT3 in collaboration with KARI.

Several processing services available in the Charter Mapper were used to aid in the visualization of flooded areas across Nigeria for this activation. The HASARD service was used to create a binary flood mask using Sentinel-1 data. This result was then combined with the ESA WorldCover auxiliary dataset, which was added to the Charter Mapper in the last release. The STACK service allows for the flood mask and WorldCover to be combined, allowing for the creation of a flood mask which covers only the selected land cover type of interest (ex. Agriculture). A screenshot from the ESA Charter Mapper showing this job can be seen below. Overall, 22 jobs were processed by 4 different users in the Charter Mapper for this activation.

In-person participants of the training

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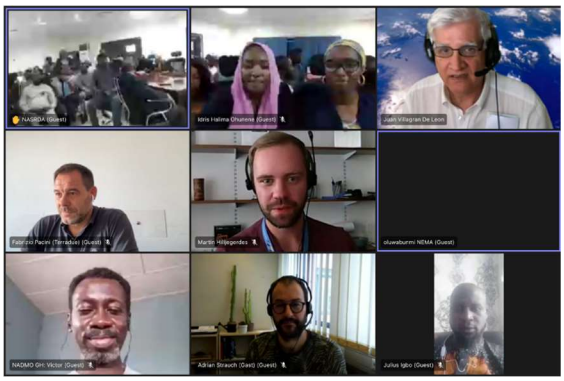
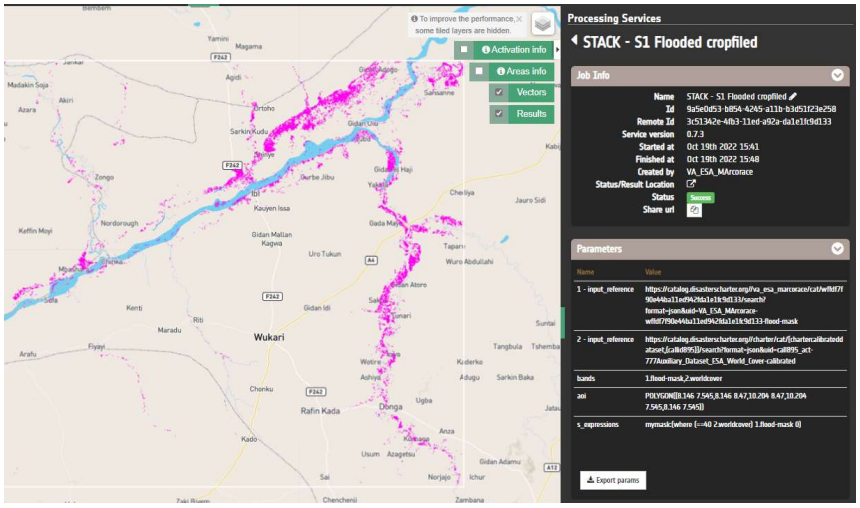
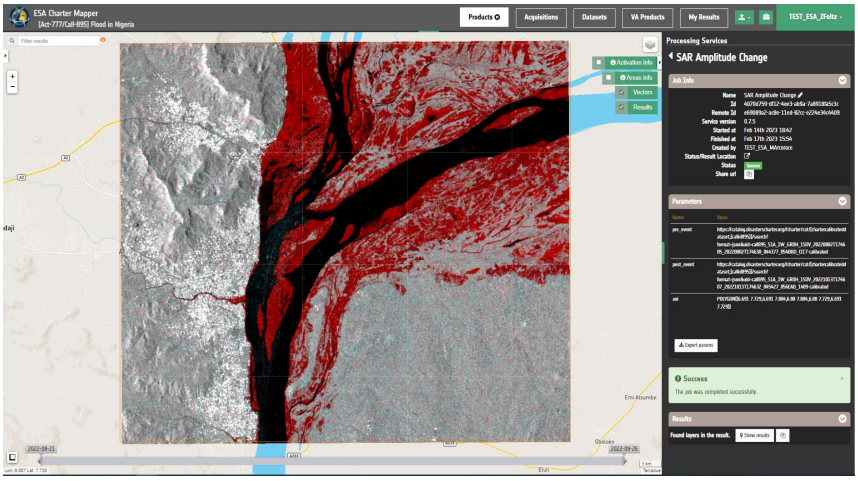


On-line participants of the training



Raster bitmask representing flooded agriculture



SAR change service over Lokoja

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Wide field images and flooding areas by WFI sensor on board CBERS-4, CBERS-4A and AMAZONIA-1 satellites

Flooding is the most common type of major disaster worldwide, corresponding to more than 40% of the activations of the International Charter in most years. Although SAR imagery is useful in mapping floods due to the usually cloudy conditions which cause floods, optical images still can be used, and are sometimes preferred for being of easier interpretation.

The estimation of flooded areas is important for rapid response not only for estimating the number of flooded habitations and affected population, but also for identifying current accessibility to urban facilities, such as shelters and hospitals.

The Wide Field Imager (WFI) sensor used by INPE satellites was designed to provide estimations of land cover change, especially deforestation, in a high temporal revisit scheme, between 3 and 5 days, with spatial resolution of 55 to 64 meters in Near-Infrared, Red, Green, and Blue bands. Since the WFI sensor is onboard three satellites, CBERS-4, CBERS-4A, and AMAZONIA-1, there is a combined temporal resolution of almost two days.

The medium spatial resolution is also optimal to map most flood events, which are too large for the relatively small area covered by very-high spatial resolution satellite images.

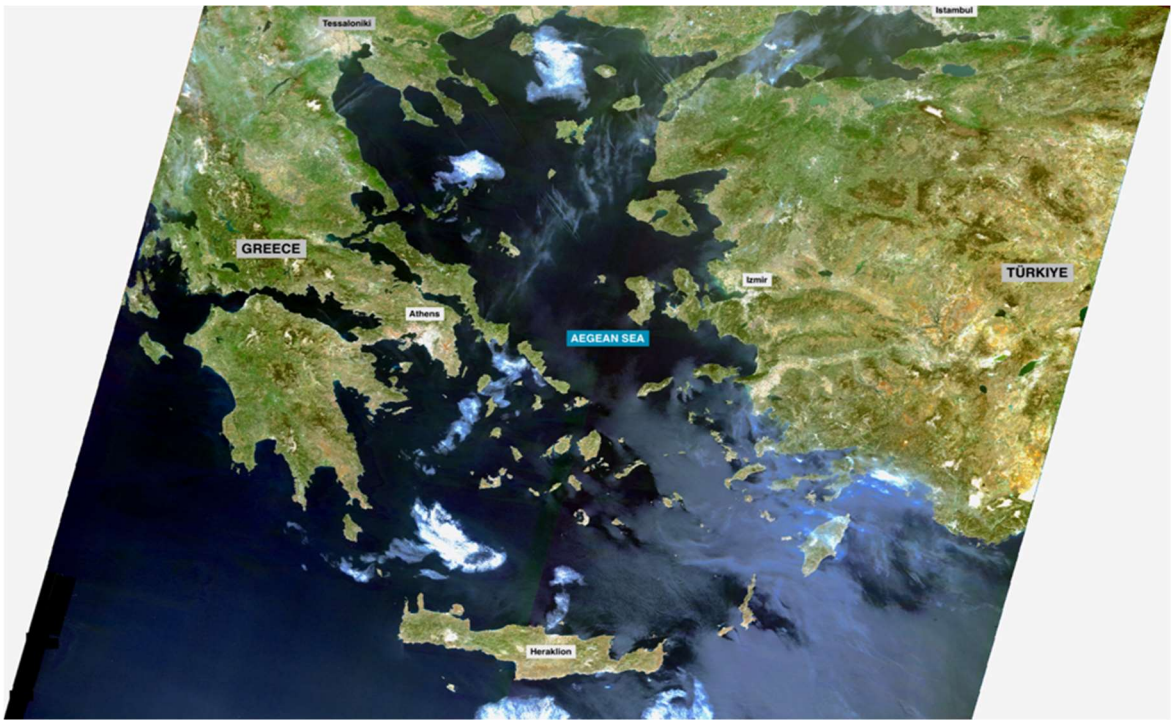

Image acquired over the Aegean Sea by CBERS-4 using WFI sensor, highlighting the area covered of up to 866 km wide.

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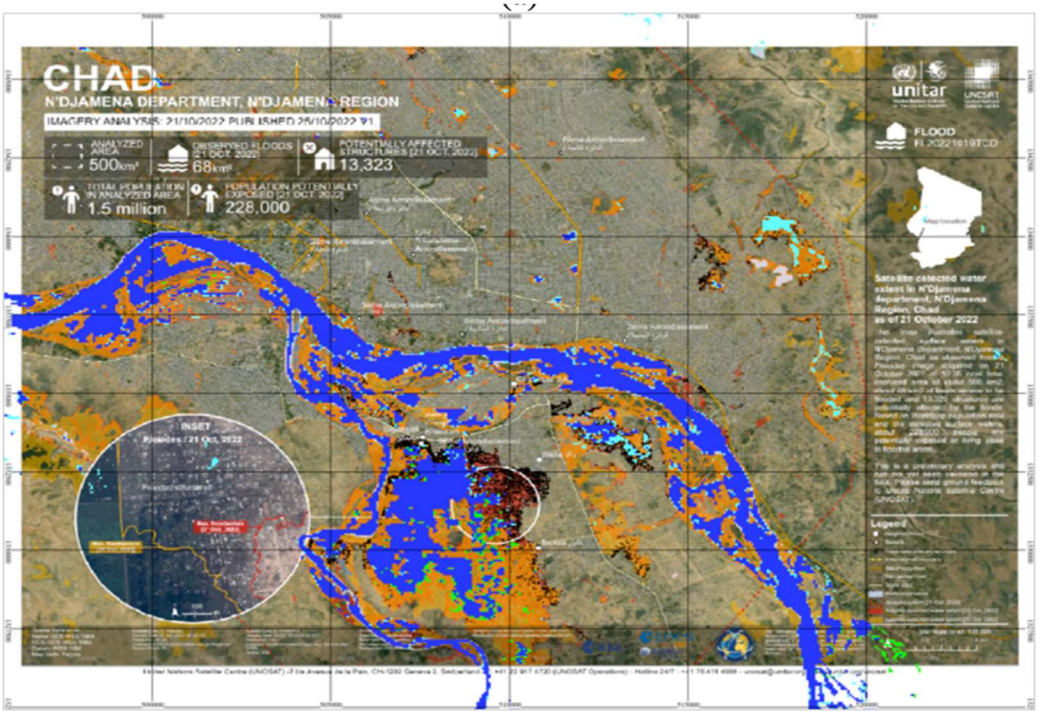
Since 2018, WFI sensor has been used to produce Value Added Products (VAPs) by 6 activations for flood disasters of the International Charter. They include the very first contribution from INPE in 2018 for floods in Venezuela (Activation 581). The other activations were in India (Activations 623 and 653) , Japan (Activation 674), Sudan (Activation 667), and Russia (Activation 611).

In addition, INPE has developed a method to automatically extract flooded areas from WFI sensor images. The method uses color information from the Hue component of the band composition using the Near-Infrared, Green and Blue bands. Flooded areas appear in the Hue component at a fixed range of values, allowing a much faster approach than more sophisticated classification methods.

Flooded areas extracted from CBERS-4 WFI sensor are shown on the map produced by UNITAR for Activation 788, indicating that although there is difference in extracted areas, with less detailed information from WFI, the flooded areas extracted using CBERS-4 images correspond the same extracted from the much higher spatial resolution from Pleiades.



Map produced for floods in Chad by UNITAR for International Charter Activation 788, using images from Pleiades (https://disasterscharter.org/image/journal/article.jpg?img_id=16662635&t=1667848639687) . CBERS-4 flooded areas are presented in green, cyan and blue colors. Pleiades flooded areas extracted by UNITAR are presented in orange color. Copyright: © CNES (2022), distribution by Airbus DS; Source: Airbus DS

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JAXA and PHIVOLCS organized a Project Manager Training in the Philippines

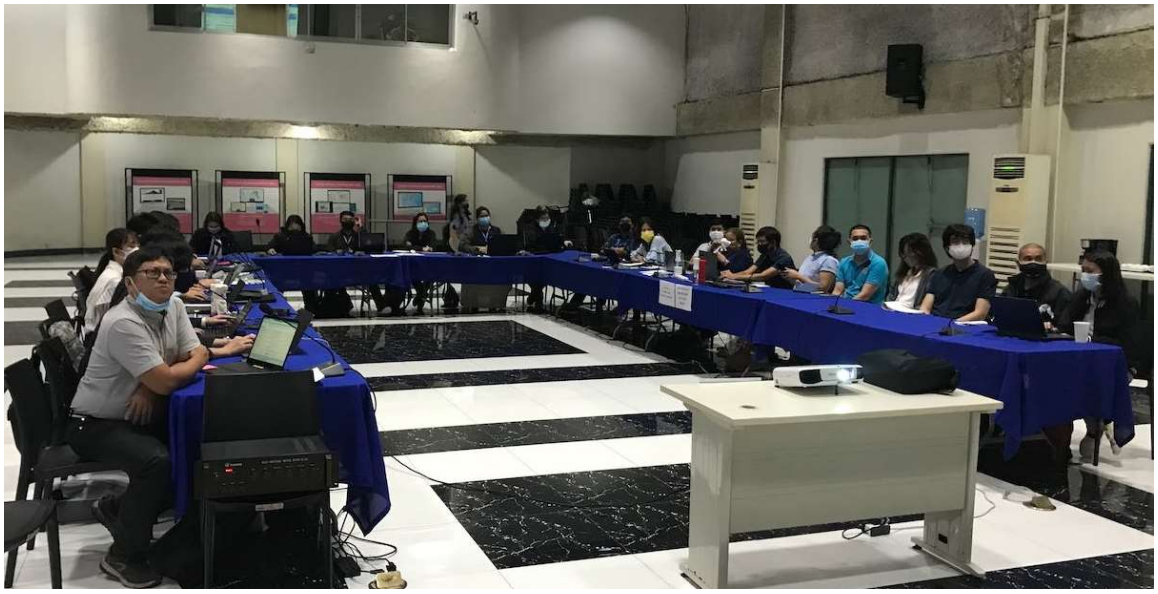
"WORLD RISK REPORT 2022"* lists the Philippines as one of the countries with the highest disaster risks. The country suffers from the storms, volcano eruptions and earthquakes.

The Philippine Institute of Volcanology and Seismology (PHIVOLCS) is a service institute of the Department of Science and Technology (DOST) that is principally mandated to mitigate disasters that may arise from volcanic eruptions, earthquakes, tsunami and other related geotectonic phenomena. They are an active member of Sentinel Asia, a framework to supply the earth observation data for the disasters in Asia-Pacific region, and have contributed with their ability for the emergency response in the Philippines, sometimes working as a Project Manager of the Disasters Charter activations,

On 24th January 2023, PHIVOLCS, with support by Japan Aerospace Exploration Agency (JAXA), organized a Project Manager Training at PHIVOLCS in Quezon city, Philippines. PHIVOLCS invited other Filipino Sentinel Asia member agencies including the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), the Mines and Geoscience Bureau (MGB), the Department of Environment and Natural Resources, the Advanced Science and Technology Institute (ASTI), the Manila Observatory, and the newly established Philippine Space Agency (PhilSA) for the training and 38 people participated in total.

The training started with remarks by Dr. Teresito C. Bacolcol, Director of PHIVOLCS, and the participants learned about how the Charter works and the role of the Project Manager in Charter activations, including the introduction to the Charter operation system COS-2. European Space Agency joined the training and lectured about the Charter Mapper, Charter's newly introduced processing environment. They also deepened their understanding of the Charter and Sentinel Asia and discussed the role of each participating agency and protocol when a disaster occurs in the Philippines.

After the training, the PhilSA assumed the role of Project Manager for the first time for the Charter activation for the oil spill in the Philippines in February, 2023.



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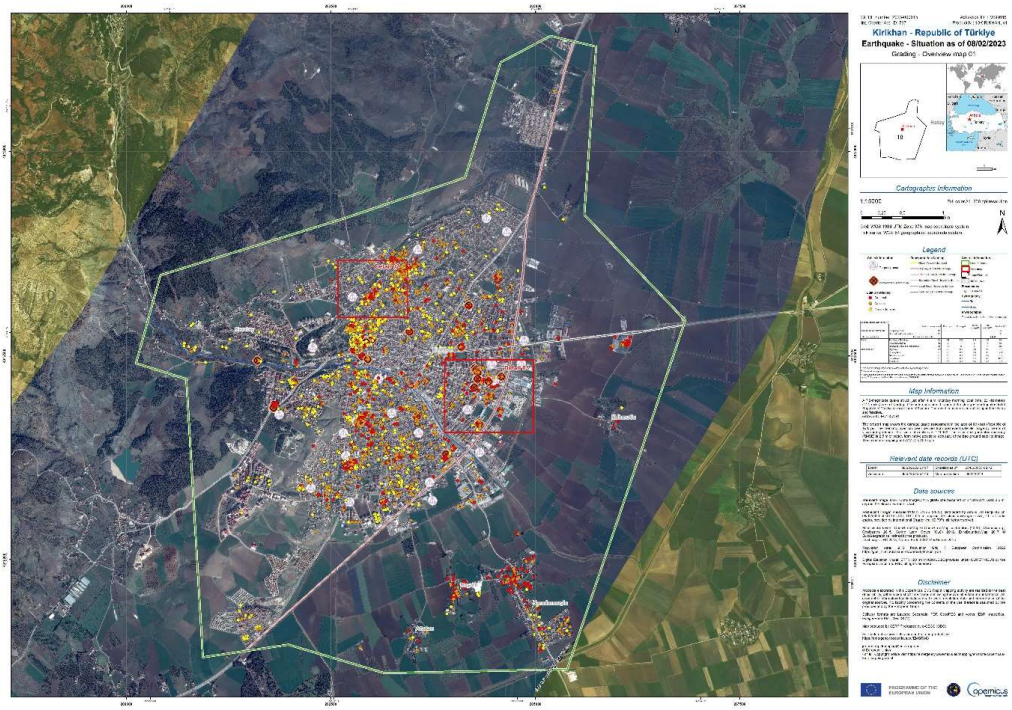
Earthquake in Türkiye

A 7.8-magnitude earthquake declared as ‘major’, struck southern Türkiye early in the morning on the 6th of February 2023 (local time). It broke about 100 km long along the fault line, inflicting serious damage on the cluster near the fault, resulting in the destruction of a huge amount human resources. This earthquake was one of the three deadliest earthquakes to occur in the last 100 years.

The earthquake occurred due to the collision of two moving plates, the Arabian plate and the Anatolian plate, with the fault line located under the Earth’s crust near southern Türkiye. The earthquake was centred in the town of Pazarcik in Kahramanmaras province, south-east Türkiye, at a depth of around 9 km, causing destruction and damage to buildings and human lives over a large area. In the week following the initial earthquake, aftershocks numbering in the thousands with magnitudes as strong as 6.7 rumbled across the region, according to the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA).

Rescue and relief teams from all around the world arrived to the site of the disaster to give aid, Nearly 240,000 rescuers continue to work in the affected area. Over 1.9 million people are seeking shelter in tents and temporary shelters in Turkey and 500,000 people in Syria are homeless. Turkish authorities estimate there were 50,000 totally destroyed buildings and 1,000,000 damaged buildings. Total loss of life in 10 provinces around the epicentre records more than 40,000 in Turkey and more than 6,000 in Syria as of February 20.

Considering the situation in the devastated area, satellite remote-sensing technologies and data are vital since it is difficult for humans to reach some destroyed areas. Therefore, the Disaster and Emergency Management Authority of Türkiye (AFAD) requested to activate the Charter immediately on 6th of February 2023 as an Authorised User (AU) of the International Charter, and AFAD also took a role as a Project Manager (PM). The Charter provided approximately 1550 satellite data products from 30 different satellites to support the earthquake response. Thus remote-sensing data were provided with contributions from the Charter. 14 organizations participated as Value Adders (VAs), and various domestic and international experts helped actively by participating in satellite imagery analysis for damage assessment and recovery plans. More than 60 value added products were produced by the VAs of the Charter regarding the earthquake. KARI participated in providing useful data for the damage assessment using the data of KOMPSAT-3 satellite, as shown below. The data and imagery provided by the Charter will support reconstruction in the aftermath of the disaster and enable early damage assessment and reconstruction planning. The activation was opened on February 6th and closed on March 23rd.



Earthquake damage in Kirikhan, Türkiye . Copyright: Includes Pleiades material © CNES (2023), Distribution Airbus DS.
Map produced by Copernicus EMS

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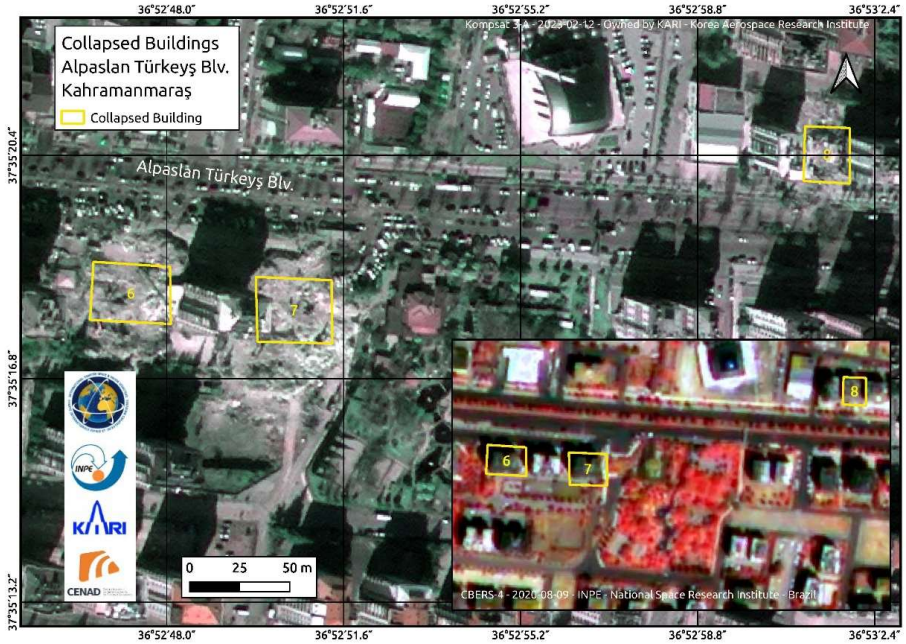
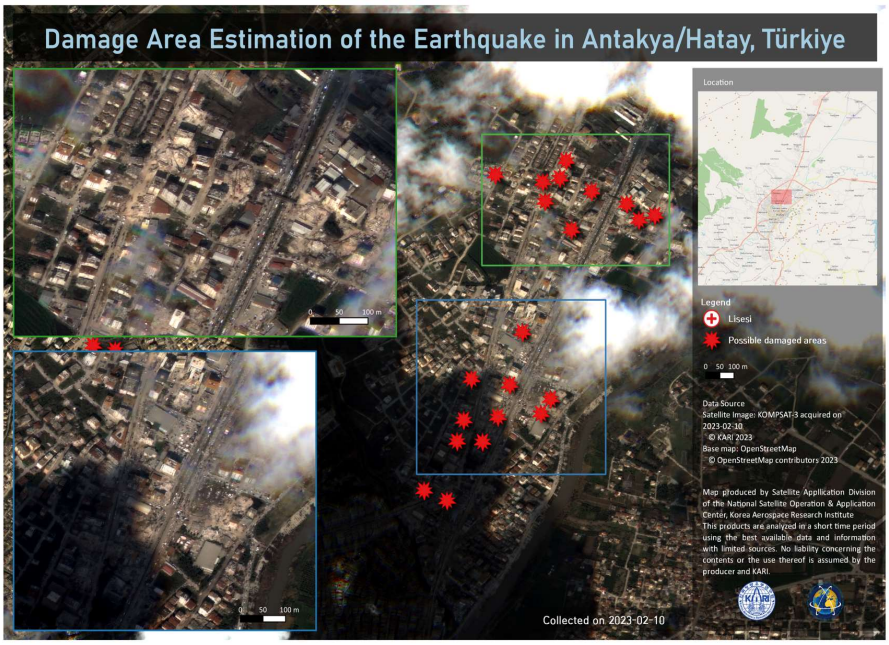


Collapsed Buildings Alpaslan Türkiye Blv. Kahramanmaraş KOMPSAT-3 © KARI (2023).



Damage Area Estimation of the Earthquake in Antakya/Hatay, Türkiye. KOMPSAT-3 @ KARI (2023).
Map produced by Satellite Application Division of the National Satellite Operation & Application Center, Korea Aerospace Research Institute

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