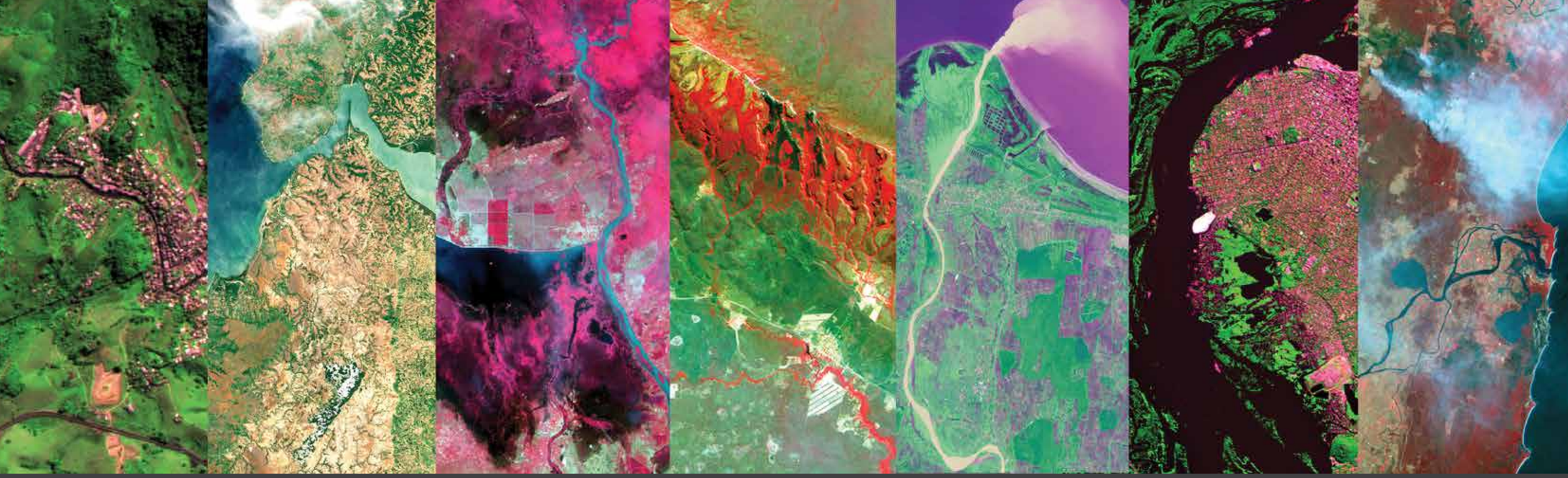
INTERNATIONAL CHARTER – SPACE AND MAJOR DISASTERS

Satellite Data for Disaster Response Worldwide

2021 CALENDAR



INTERNATIONAL CHARTER: SPACE AND MAJOR DISASTERS

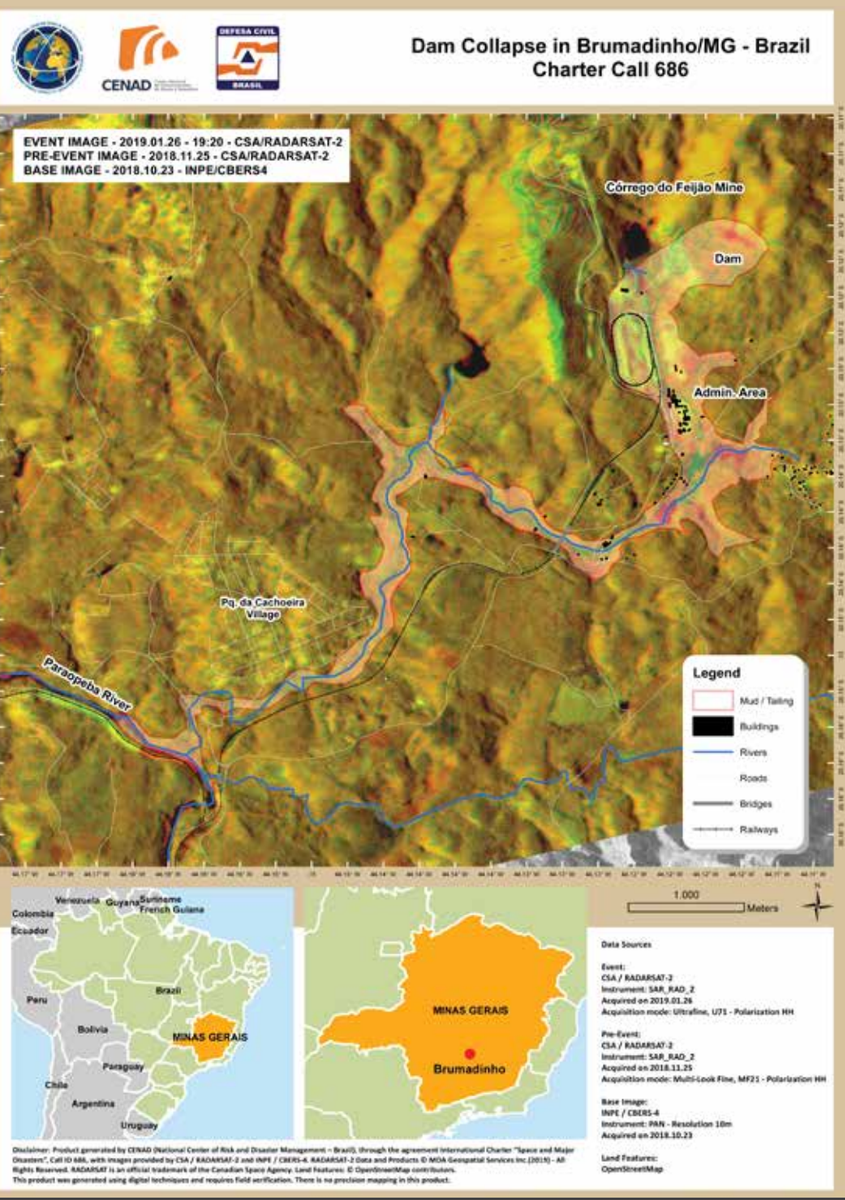
Based on the decision of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna, Austria, in July 1999, to implement an integrated comprehensive Earth observation system through international cooperation in order to manage mitigation, aid, and prevention efforts in the event of natural disasters, the European Space Agency (ESA) and the French Space Agency (CNES - National Centre for Space Studies) proposed to create the International Charter on Space and Major Disasters. And so, on November 1, 2000, the charter officially came into operation with the prompt membership of the Canadian Space Agency (CSA). In subsequent years, Charter Members were to increase in number, starting from 3 founders to the current 17 space agencies with 63 contributing satellites. The National Institute for Space Research of Brazil (INPE), which has been part of this humanitarian initiative since November 2011, now contributes with images of the Chinese-Brazilian satellites CBERS-4 and CBERS-4A.

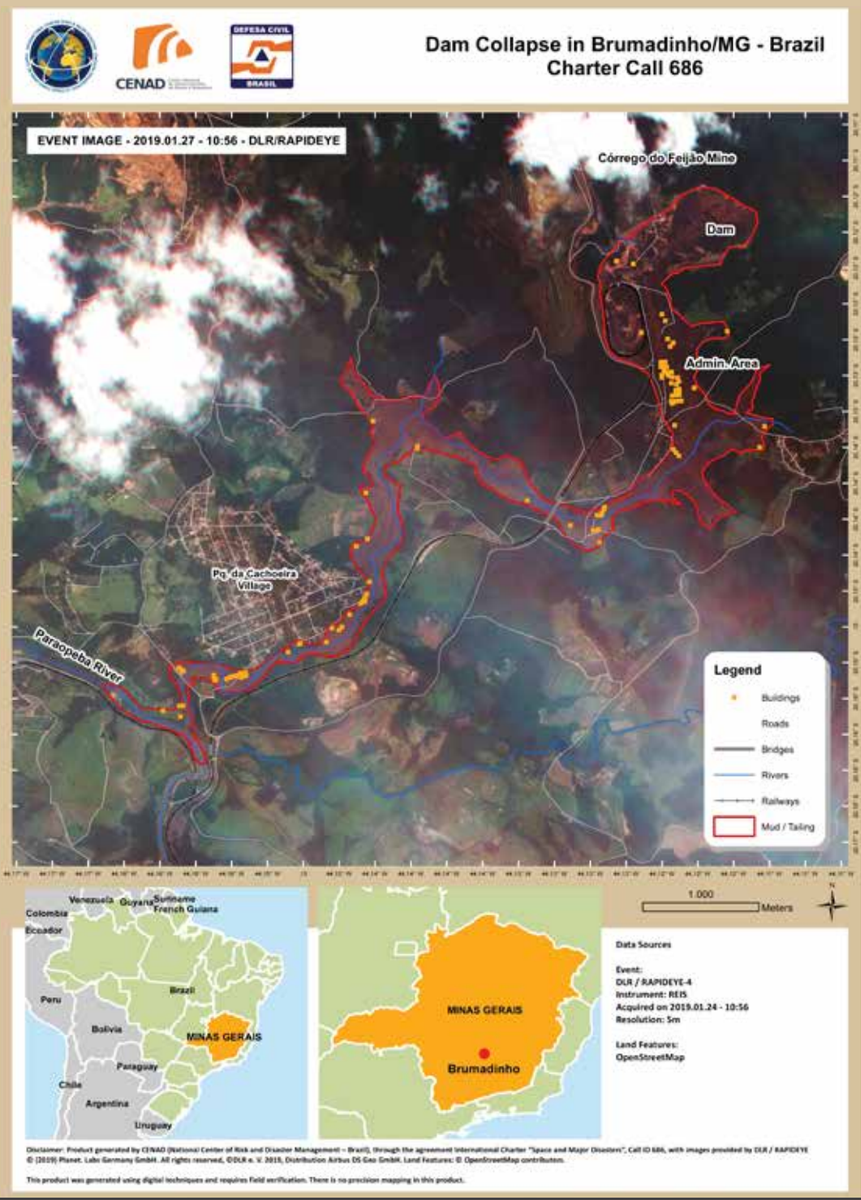
Satellite images are not photographs, but pictorial presentations of measured data. These Earth observation images contribute in the management of major disasters such as floods, cyclones, hurricanes, tsunamis, earthquakes, landslides, forest fires and volcanic eruptions, as well as industrial accidents or large oil spills. In addition to these extreme events, the Charter satellite network is used in technological disasters, cases of ships or aircrafts gone missing in the ocean, epidemics and sandstorms. By mid-September 2020, the Charter was activated in 675 disasters, in 126 countries.

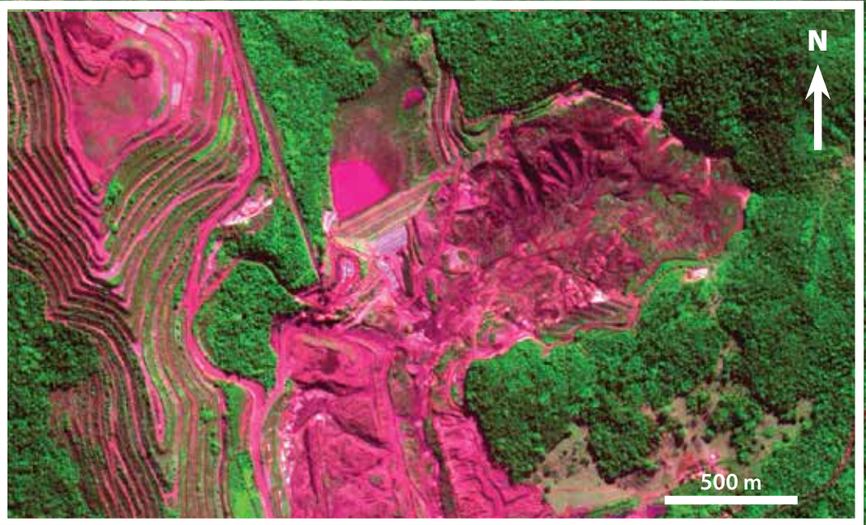
The Charter satellites contribute to mapping disaster areas and assisting search and rescue teams thanks to medium- and high-resolution optical images as well as radar images. Satellites such as CBERS-4, CBERS-4A, Resourcesat, Landsat and Sentinel-1 provide optical images of medium spatial resolution, while PlanetScope, WorldView and Pleiades provide very high resolution images; and RADARSAT and TerraSAR-X provide radar imagery. When available, images obtained before the event are also provided for comparison purposes.

The Charter received the prestigious William Thomas Pecora Award, presented annually by the U.S. Department of the Interior and the National Aeronautics and Space Administration (NASA) to acknowledge exceptional contributions using remote sensing to understand the Earth, educate the next generation of scientists, inform decision-makers, or support rapid responses to natural or human-induced disasters.

This calendar is published in celebration of the 20th anniversary of the Charter and the 10th anniversary of Brazil's entry into this humanitarian initiative to recall some of the images of the CBERS-4 and CBERS-4A satellites used to monitor disasters and provide information on affected sites. The January 2021 and 2022 pages are good examples of the WPM-sensor images produced by the new CBERS-04A satellite launched in December 2019. Not only does this sensor improve the spatial resolution of the images produced, it further complements CBERS-4 satellite images, allows for the capture of images on a daily basis and, therefore, enables faster responses to emergencies.







ACTIVATION 596:

Collapse of Dam in Brazil (Call 686)

SATELLITE / SENSOR:
RADARSAT, RAPIDEYE, CBERS4A / WPM

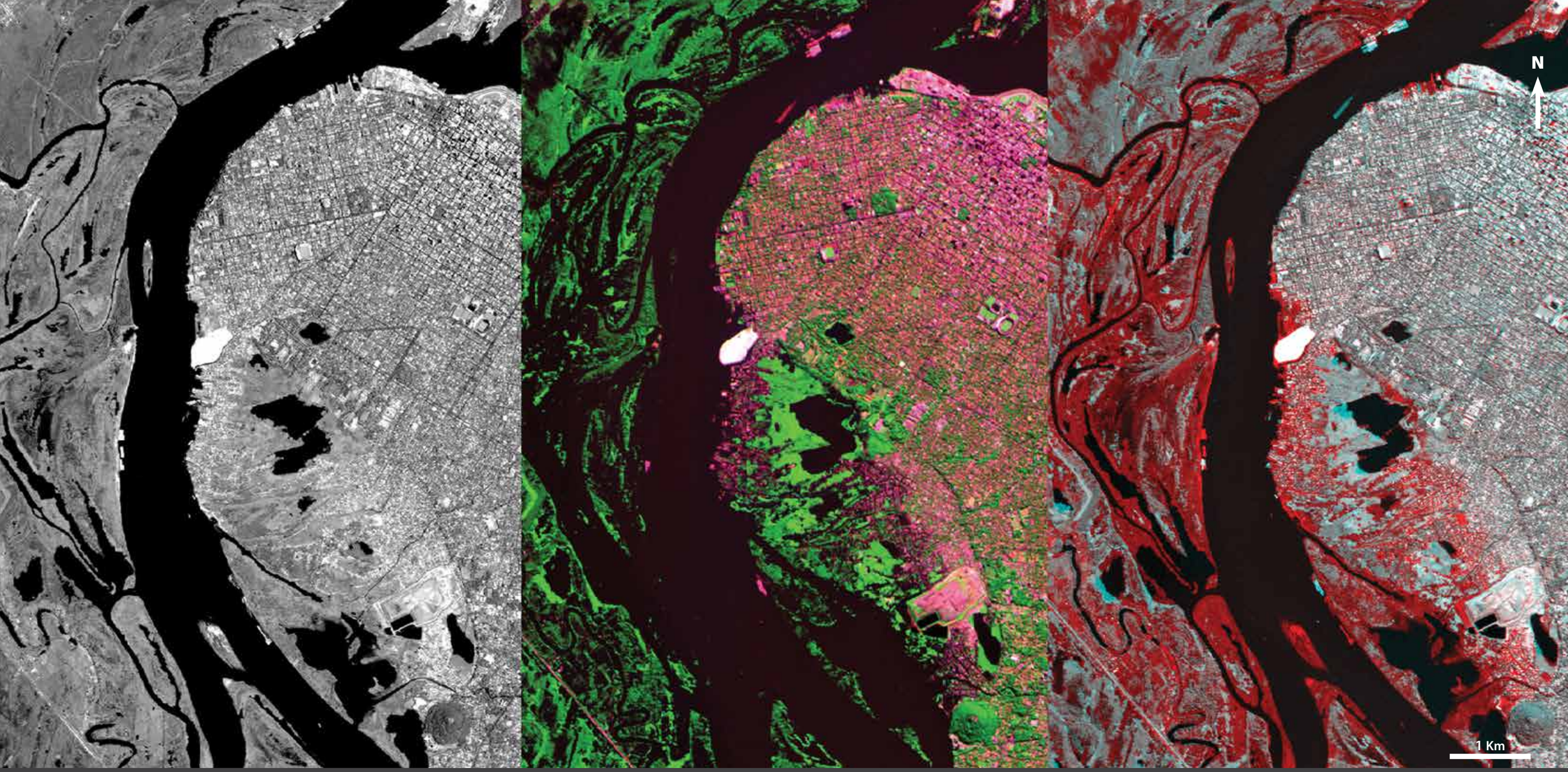
DATE OF ACQUISITION/ CAPTURE: Radarsat (11/25/2018 and 01/26/2019), RapidEye (01/27/2019) and CBERS-4A (06/12/2020)

Collapse of Dam in Brumadinho, Brazil, in January 2019

The failure of the dam retaining the ore tailings from the Córrego do Feijão Mine reached Brumadinho, a town located in the central state of Minas Gerais (MG), killing 270 people, destroying properties and contaminating the environment. The two maps above outline the area of the disaster with RADARSAT images of the Canadian Space Agency, and RAPIDEYE images of the German Aerospace Center (DLR). On the right, the CBERS-4A images show the very same area today in defined details highlighting the area of collapse.

JANUARY | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31



ACTIVATION 609:

Flood in Paraguay
(Call 700)

SATELLITE / SENSOR:
CBERS4 / PAN5M and PAN10M

DATE OF ACQUISITION/ CAPTURE:
01/25 and 05/18/2019

Flood in Asunción, Paraguay, in May 2019

Torrential rains in Paraguay caused flooding in Asunción, as shown in the mosaic of images of the Paraguay River bordering the capital: before the climate event, on the left, in black and white; and the resulting flooding, in the center, in true color (or apparently natural), in the dark areas, and also, on the right, in the color red to highlight the areas most affected.

FEBRUARY | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7

ACTIVATION 601:

Flood in Iran
(Call 692)

SATELLITE / SENSOR:
CBERS4 / PAN10M

DATE OF ACQUISITION/ CAPTURE:
04/03/2019

Floods in Gīlān Province, Iran, in March 2019

Heavy and persistent rains in the thawing season at the end of winter caused the flooding and overflowing of rivers throughout much of the land in Iran. The image in false color (unnatural colors) shows shades of red representing the areas of vegetation. The viewer's gaze is immediately drawn to the huge plume of sediments that was carried away into the Caspian Sea by the overflowing of the River Sefīd-Rūd, in Gīlān Province.

MARCH | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4

ACTIVATION 647:

Cyclone in Vanuatu
(Call 745)

SATELLITE / SENSOR:
CBERS4 / AWFI

DATE OF ACQUISITION/ CAPTURE:
04/07/2020

Cyclone Harold in northern Vanuatu, in April 2020

Category 5 Cyclone Harold crossed the northern islands of Vanuatu, an archipelago nation of volcanic origin located northeast of Australia. The passage of the cyclone caused destruction and affected thousands of people, the islands of Holy Spirit and Pentecost being the most severely impacted. The image, in false color (unnatural colors) or shades of red, shows the vegetation cover of the Vanuatu islands and in the lower right corner, the white vortices of the cyclone leaving the archipelago and heading southeast.

APRIL | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2

ACTIVATION 608:

Cyclone Fani, India
(Call 699)

SATELLITE / SENSOR:
CBERS4 / MUX

DATE OF ACQUISITION/
CAPTURE:
05/10/2019

Cyclone Fani in the State of Odisha, India, in May 2019

The forecasted impact of Cyclone Fani with a Category-4 maximum intensity motivated the evacuation of over one million people to approximately 9,000 shelters in the State of Odisha, located in East India. The false-color image (in unnatural colors) shows the contrasts (in blue-green tones) of the flood in the Balasore District and the outflow of Budhabalanga River pouring out into the Bay of Bengal.

MAY | 2021

Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg
27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

ACTIVATION 611:

Flood in Russia
(Call 702)

SATELLITE / SENSOR:
CBERS4 / AWFI

DATE OF ACQUISITION/
CAPTURE:
06/29/2019

Floods in the Irkutsk Region of Russia, in June 2019

The heavy rains caused extensive floods in the Irkutsk Oblast, an administrative region of East Russia, and hit 107 urban centers and rural communities. The true-color image shows how the Iya River (from the left) advanced towards the city of Tulun (upper right, in light pink) washing away a great deal of sediments and affecting more than 10,000 people, as well as 3,000 homes and infrastructure, such as streets, roads and bridges.

JUNE | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4

ACTIVATION 643:

Floods and Landslides in Madagascar (Call 741)

SATELLITE / SENSOR:
CBERS4 / MUX

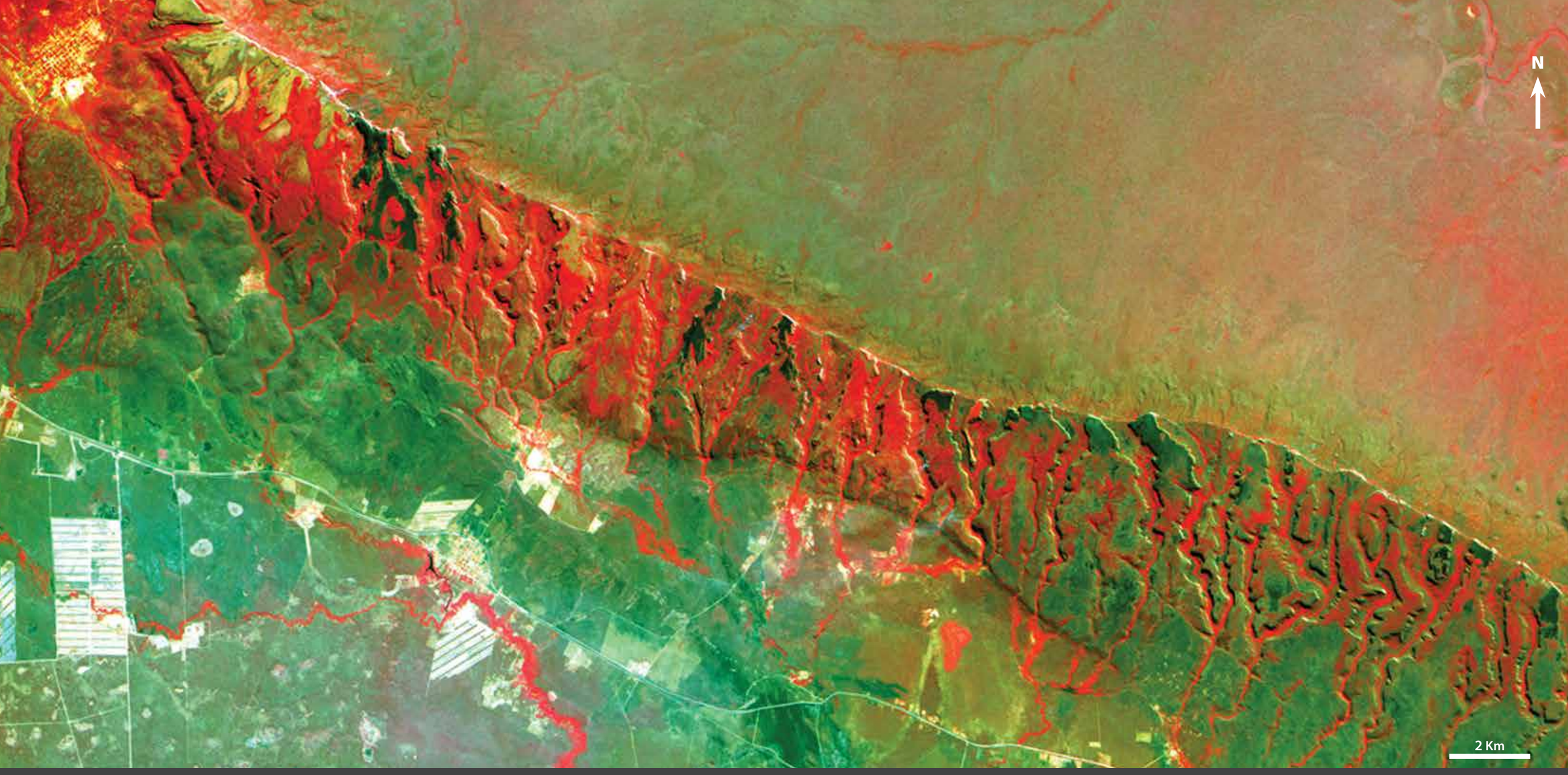
DATE OF ACQUISITION/ CAPTURE:
02/02/2020

Floods and Landslides in Madagascar, in January 2020

Heavy rains caused floods and landslides in several regions of Madagascar, including the capital Antananarivo, causing destruction and motivating evacuation operations. The true-color image of the flooded areas in the North of the Boeny Region clearly shows the sinuous trail of the Maevarano and Ankofia Rivers, whose sediments discharged into the Loza Estuary before flowing towards the Narinda Bay and extending to the Mozambique Channel.

JULY | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2



ACTIVATION 616:

Fires in Bolivia
(Call 708)

SATELLITE / SENSOR:
CBERS4 / PAN10M
(fused with PAN5M)

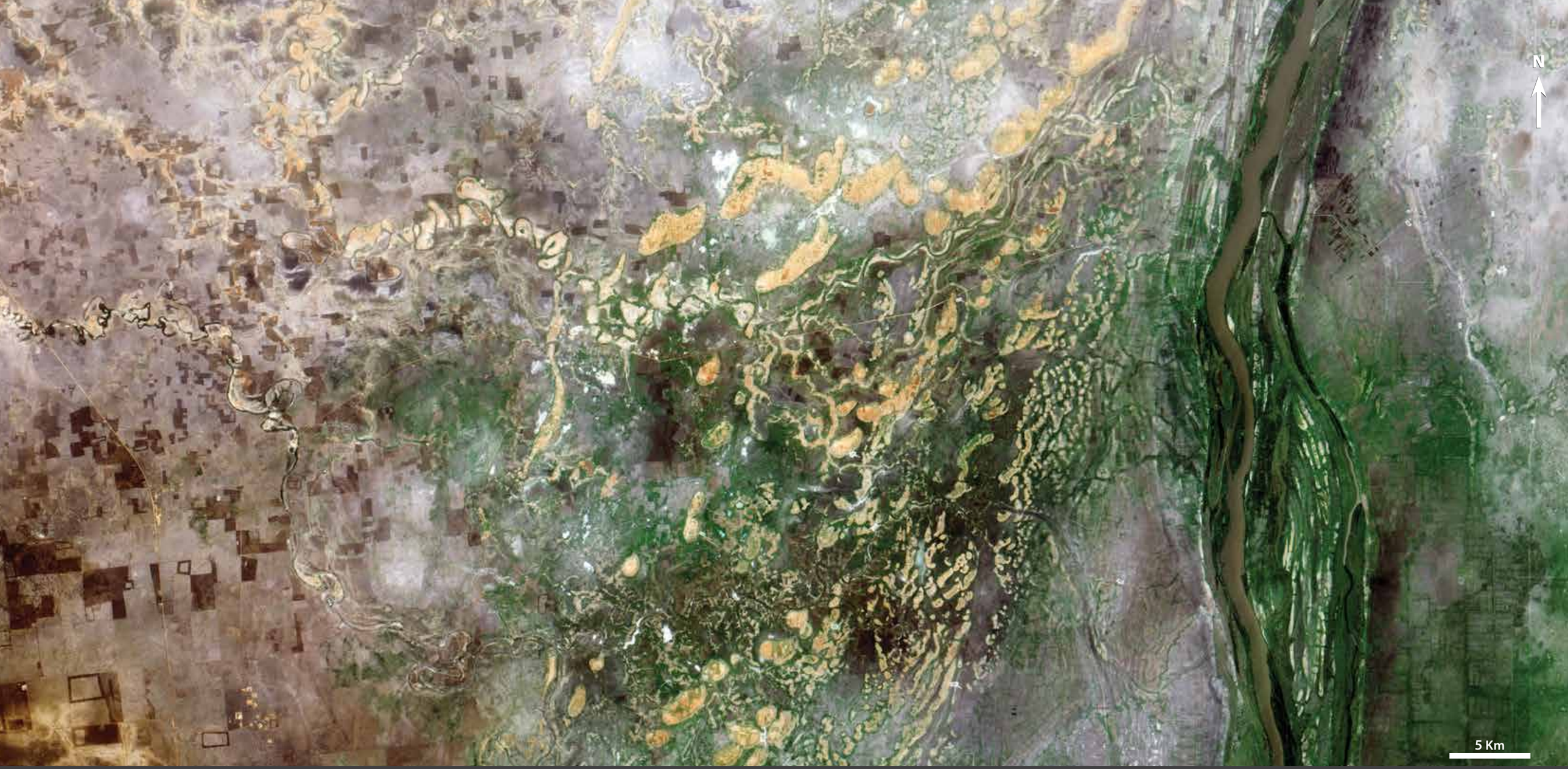
DATE OF ACQUISITION/
CAPTURE:
08/24/2019

Forest fires in the Department of Santa Cruz, Bolivia, in August 2019

The fires hit vast areas of tropical dry forests in the Department of Santa Cruz burning down more than 460,000 hectares of the Chiquitano dry forest and grassland. The false-color image (in unnatural colors) reveals the already burned areas (in very dark green) amid large areas of vegetation shown in red when it is thick and in shades of green when it is sparser.

AUGUST | 2021

Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4



ACTIVATION 617:

Flood in Sudan
(Call 710)

SATELLITE / SENSOR:
CBERS4 / MUX

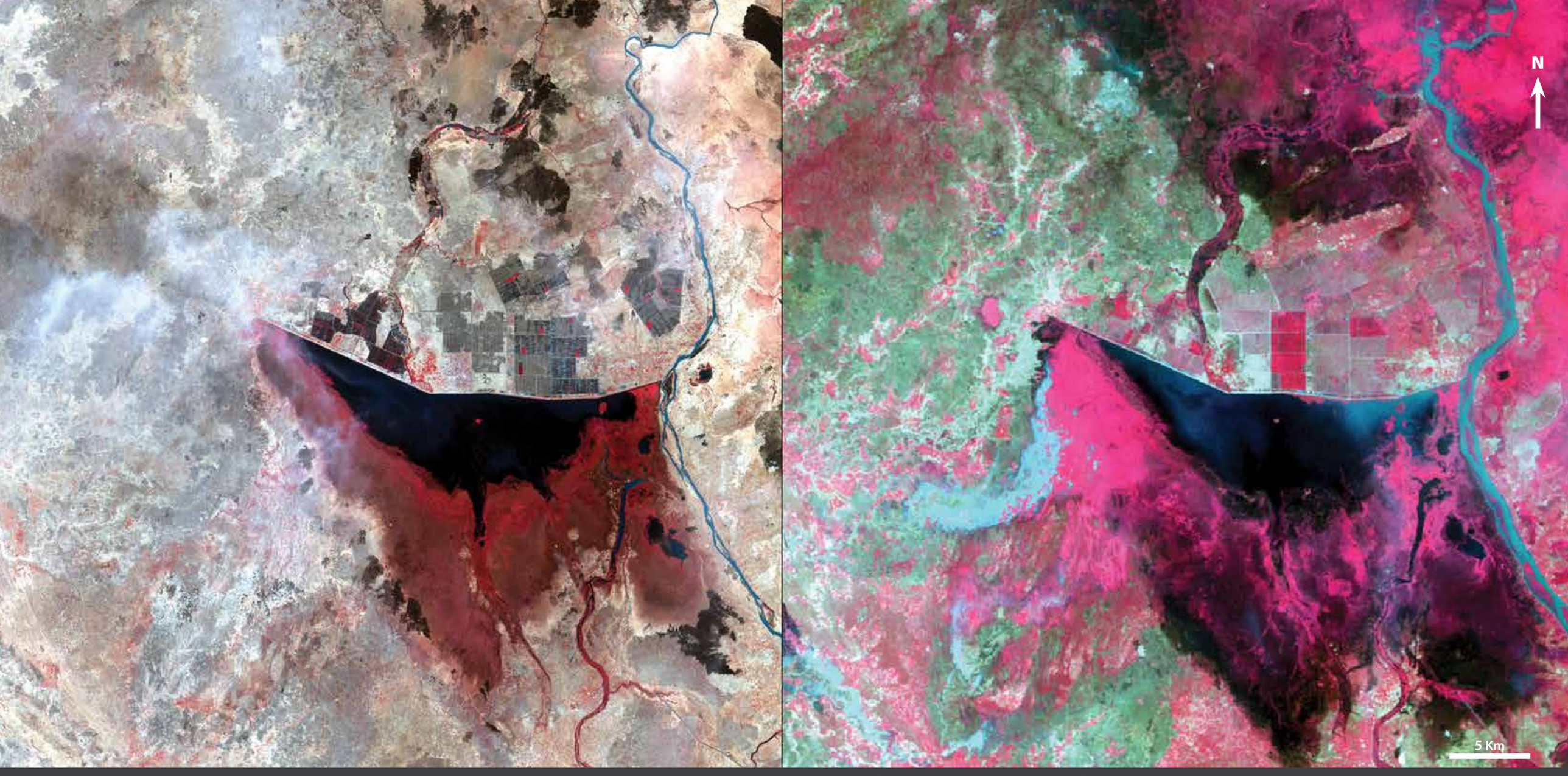
DATE OF ACQUISITION/ CAPTURE:
07/21/2019

Floods in Sudan, in August 2019

Continuous torrential rains caused flooding in 17 of the 18 states of Sudan, hitting more than 500,000 people and destroying about 40,000 homes. The image obtained before these floods shows the city of Kosti in the upper right corner, next to farming areas (polygonal fields) and arid areas along the banks of the White Nile, which runs through this Sudanese state.

SEPTEMBER | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3



ACTIVATION 627:

Flood in Cameroon
(Call 721)

SATELLITE / SENSOR:
CBERS4 / AWFI

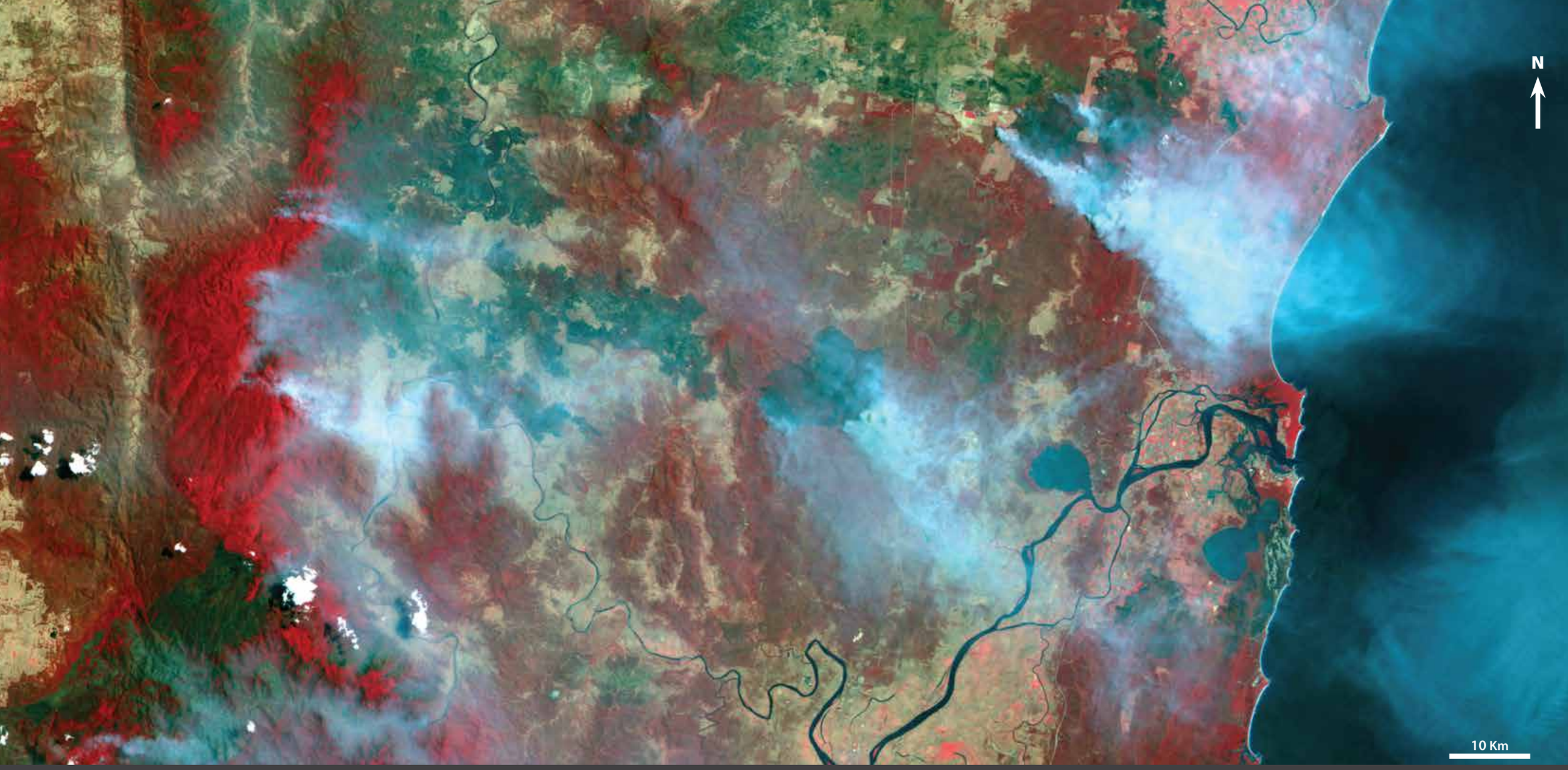
DATE OF ACQUISITION/ CAPTURE:
10/11/2019

Flood in Cameroon, in October 2019

For weeks, heavy rains in Cameroon caused several floods, the overflow of rivers affecting more than 100,000 people. The images captured during the drought period, on the left, and the images captured during the rainy period, on the right, illustrate the size of the impact of the floods in villages North and South of Lake Maga (dark spots), in the commune of Maga, located in the Department of Mayo-Danay, and on the banks of the Logone River, whose flooding is clearly visible.

OCTOBER | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	38	29	30	31



ACTIVATION 631:

Fires in Australia
(Call 725)

SATELLITE / SENSOR:
CBERS4 / MUX

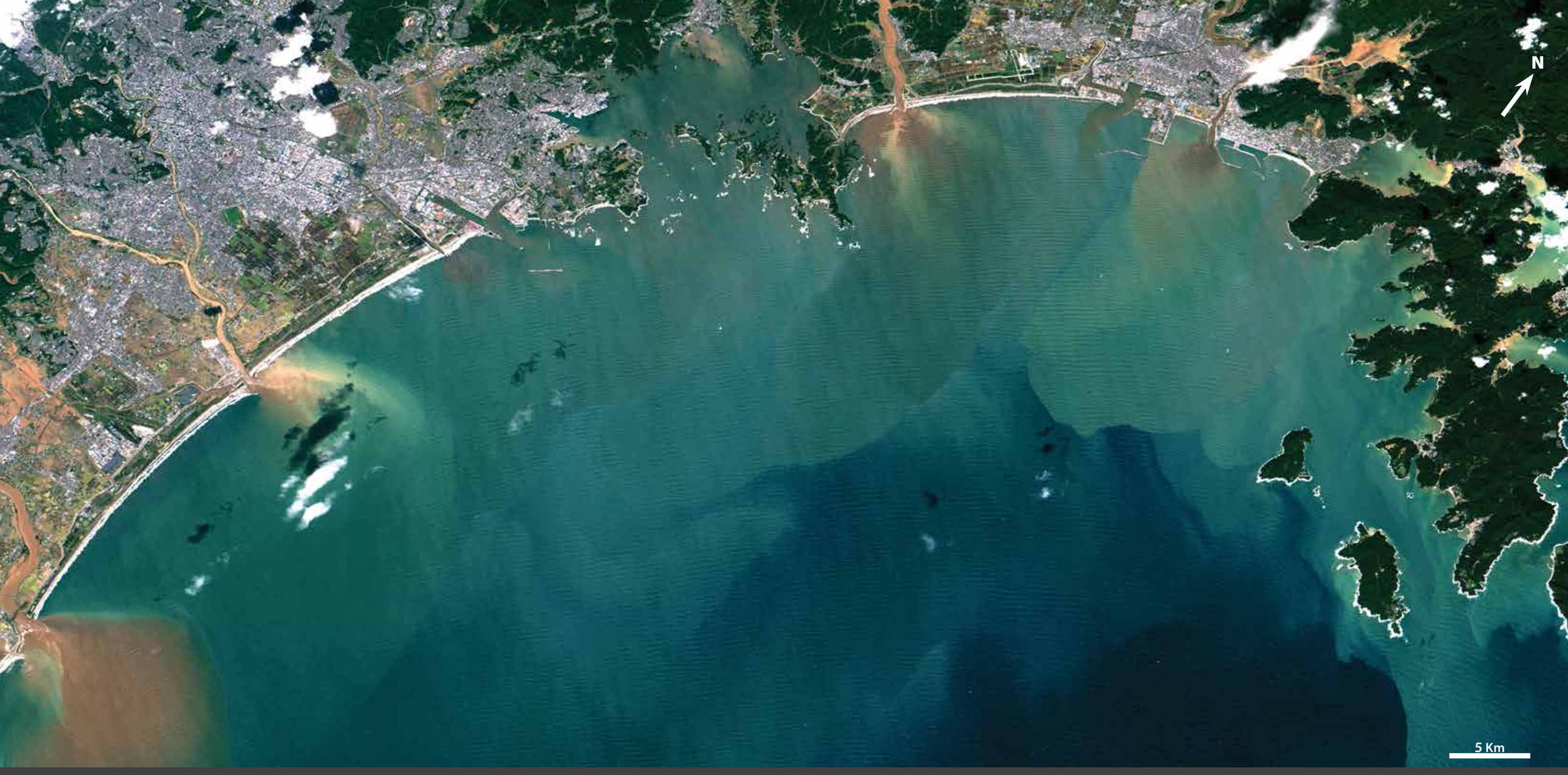
DATE OF ACQUISITION/ CAPTURE:
11/16/2019

Fires in Australia, in November 2019

More than one million hectares of forests were burned by the fires in Australia. More than 3,000 firefighters were called up to deploy in the States of New South Wales and Queensland mainly. The shades of dark green in the false-color image (in unnatural colors) outline the areas burned in the Bungawalbin and Washpool National Parks, and in Banyabba, on the north coast of New South Wales, where the shades of blue reveal the smoke of still active fires and the shades of red represent the areas of thicker vegetation.

NOVEMBER | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5



ACTIVATION 625:

Typhoon Hagibis, Japan
(Call 719)

SATELLITE / SENSOR:
CBERS4 / MUX

DATE OF ACQUISITION/ CAPTURE:
10/13/2019

Typhoon Hagibis, on Honshū Island, Japan, in October 2019

Typhoon Hagibis, Category 4, swept the east coast of Honshū Island, the largest in the Japanese archipelago. Over 250,000 houses were left without electric power and 120,000 without water; as a result, 50,000 people had to be evacuated. The image shows the voluminous discharge into the Sendai Bay of fine-grained materials from the rivers Abukuma, Natori, Taki, Naruse, Jo and Kyukitakami, in addition to the floods (in shades of brown) in the cities of Sendai, Matsushima and Higashimatsushima.

DECEMBER | 2021

Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom
29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2

ACTIVATION 642:

Floods and Landslides
in Brazil
(Call 740)

SATELLITE / SENSORES:
CBERS4A / WPM
CBERS4 / PAN10M
(fused with PAN5M)

DATE OF ACQUISITION/ CAPTURE:
05/06 and 06/01/2020

Floods and Landslides in Brazil, in January 2020

The new Chinese-Brazilian satellite CBERS-4A was launched in December 2019. The WPM-sensor image (left) shows the city of Iconha, in the state of the Espírito Santo, Brazil with bridges destroyed by the heavy rains that flooded the city and caused landslides, in January 2020. Though the image (on the right) obtained with the PAN camera of the CBERS-4 satellite has a relatively lower spatial resolution, one can clearly see the qualitative evolution of the emergency response.

JANUARY | 2022

Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg	Ter	Qua	Qui	Sex	Sáb	Dom	Seg
27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

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cnes

esa

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