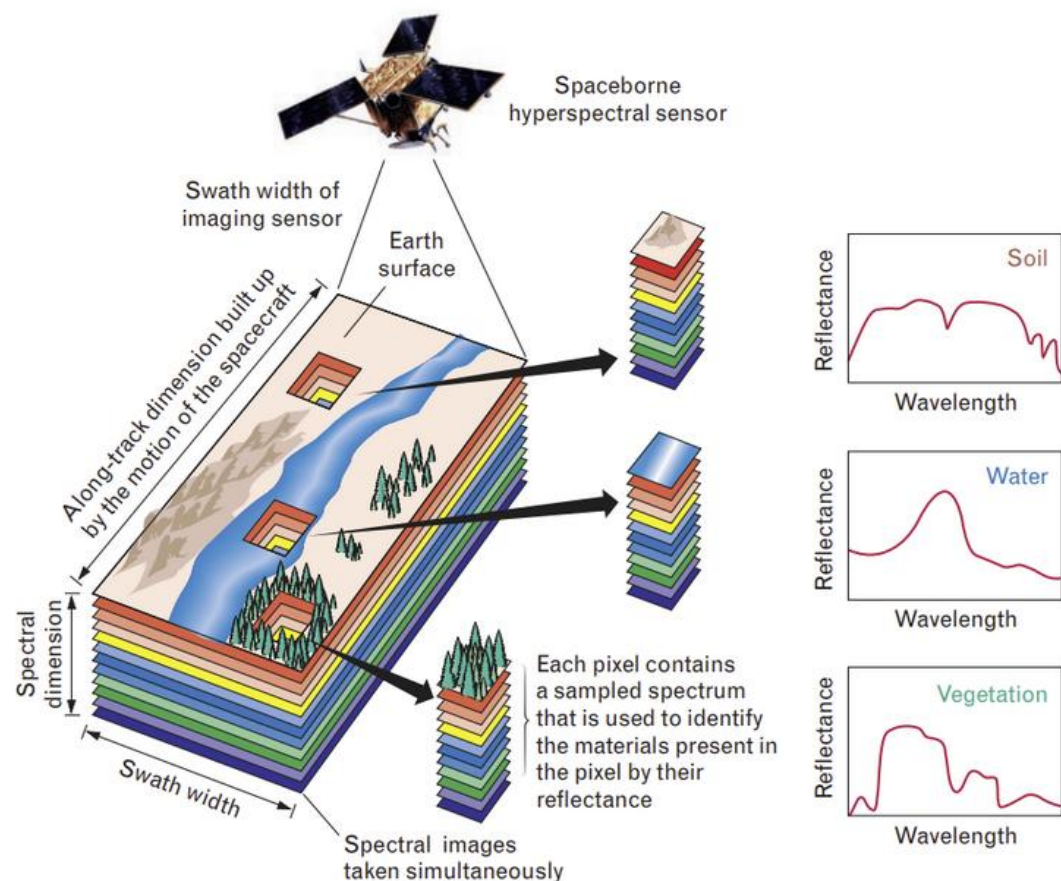




Hyperspectral Earth Observation for Disaster Response

FIRST OPERATIONAL EXPERIENCES WITH ENMAP IN THE INTERNATIONAL CHARTER: SPACE AND MAJOR DISASTERS

First hyperspectral sensor providing data for the Charter



Shaw & Burke 2003

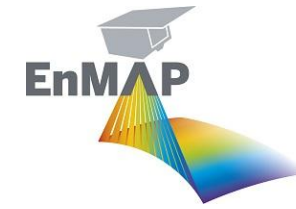
Mission Status

- launched on April 1st, 2022
- nominal lifetime: 5 years
- currently in operational phase
- mission extension past 2027 envisioned

Sensor Characteristics

- pushbroom hyperspectral imager
- spectral range: 420 nm – 2450 nm (VNIR – SWIR)
- 223 bands after flagging (246 total)
- swath width 30 km, max. swath length 1000 km
- spatial resolution 30 m
- nadir revisit time: 27 days (30° off-nadir: 4 days)

Supported Charter Scenarios (Emergency Response Phase)



Flood (large area)

- product: flood extent maps
- Priority 1



Wildfire

- product: burnt area extent, thermal activity (also during nighttime)
- Priority 1



Oil Spill

- product: oil spill extent (water & land), oil thickness
- Priority 1



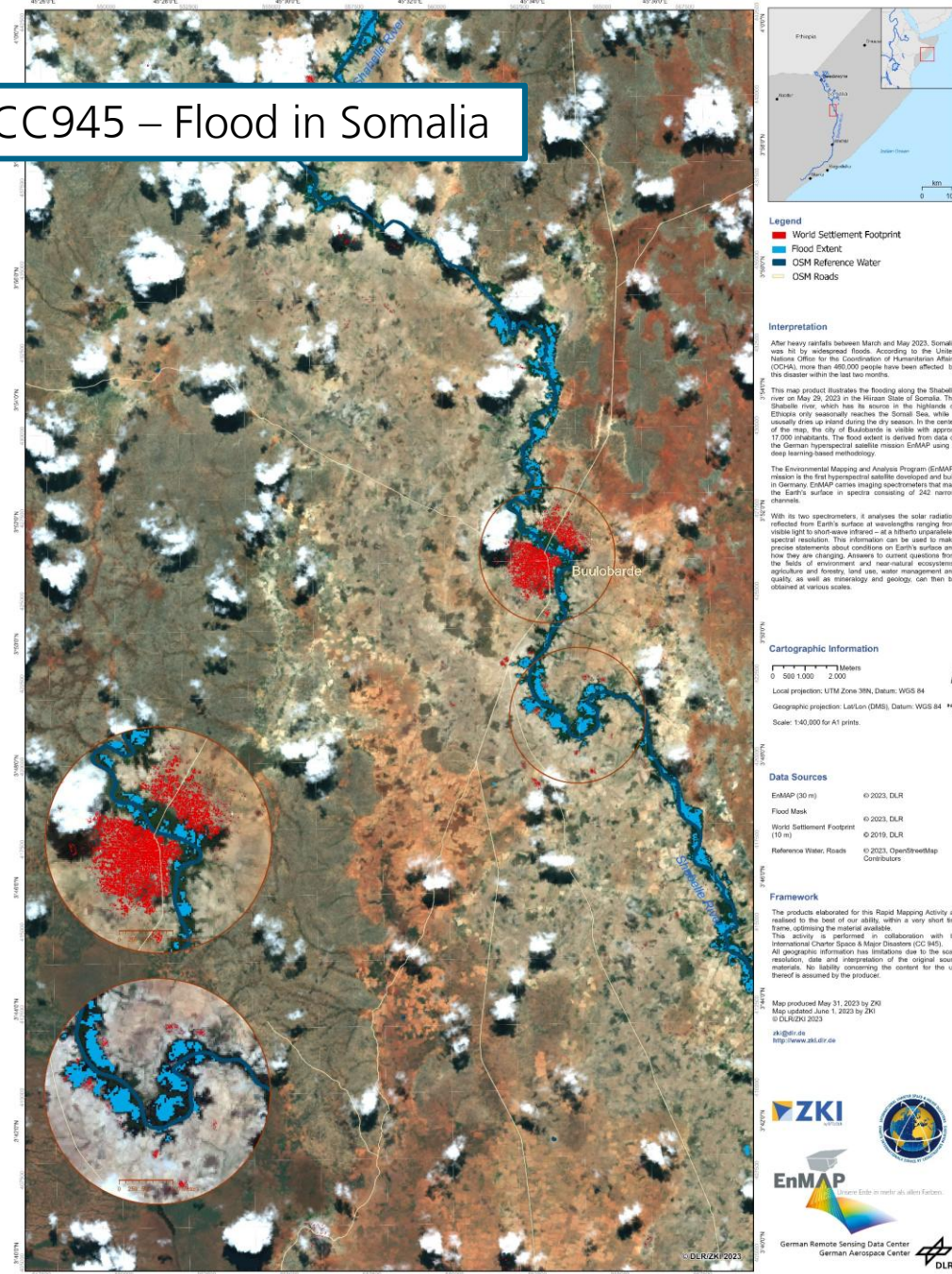
Volcanic Eruption

- product: localisation of thermal activity, extent of volcanic deposits (ash, lava, etc.)
- Priority 2

- 7 Charter activations have been supported with EnMAP data (6 x wildfires, 1 x flood) in the operation phase (May 2026)
- 1.2 days average delivery time (1 delivery with 3 days lowered the average)
- EnMAP acquisitions need to be requested at least 12 hours before acquisition.



CC945 – Flood in Somalia



Data Processing

- Flood detection using convolutional neural network processing chain with globally distributed reference data
- Band combination corresponding to that of Sentinel-2 (R-G-B-NIR-SWIR)

Wieland, M., Fichtner, F., Martinis, S., Krullikowski, C., Plank, S., Motagh, M. (2023). S1S2-Water: A global dataset for semantic segmentation of water bodies from Sentinel-1 and Sentinel-2 data. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 17, 1084-1099. <https://doi.org/10.1109/JSTARS.2023.3333969>.

Wieland, M., Martinis, S. (2019). A modular processing chain for automated flood monitoring from multi-spectral satellite data. Remote Sensing, 11(19), 1-23. <https://doi.org/10.3390/rs11192330>.

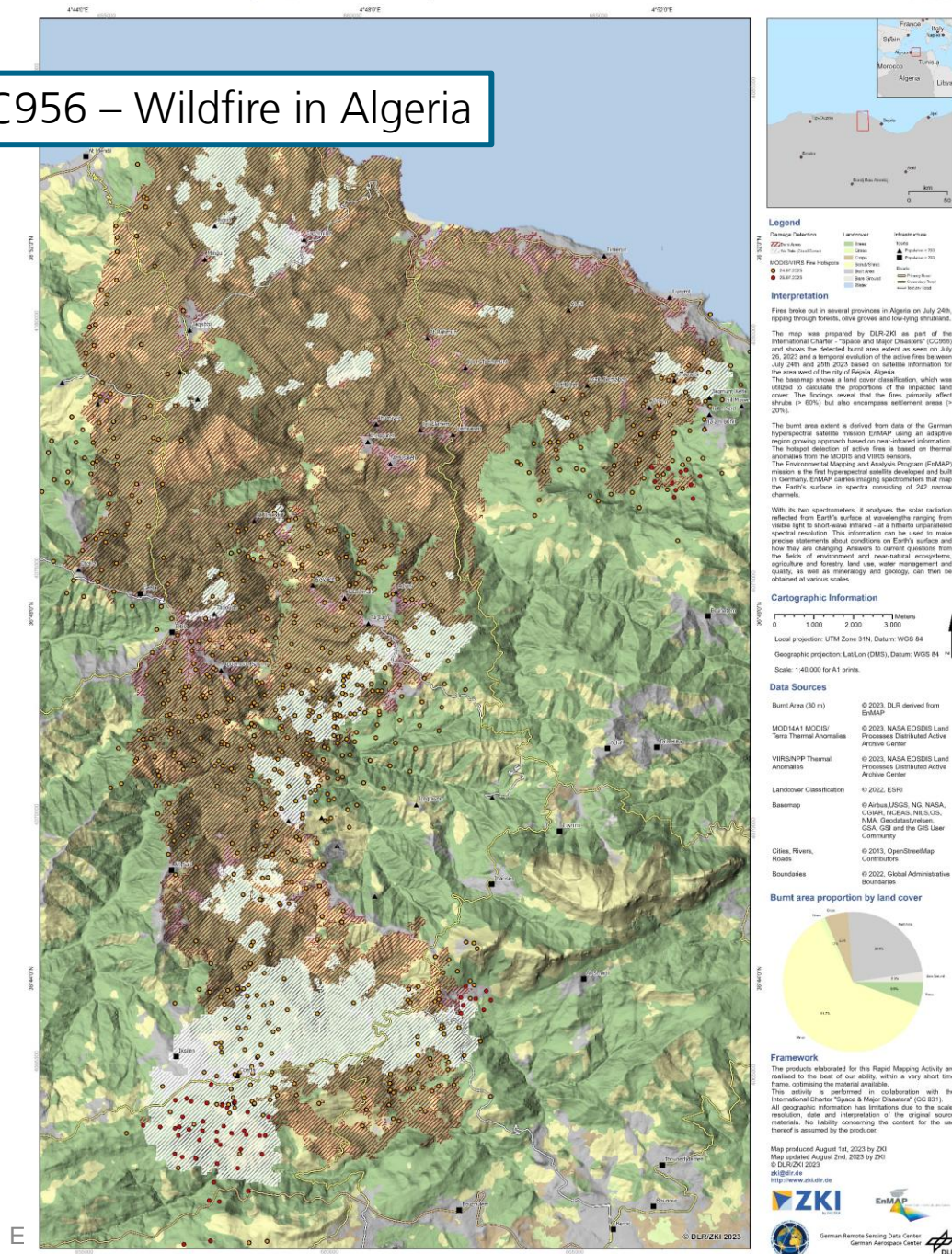
CC956 – Wildfire in Algeria

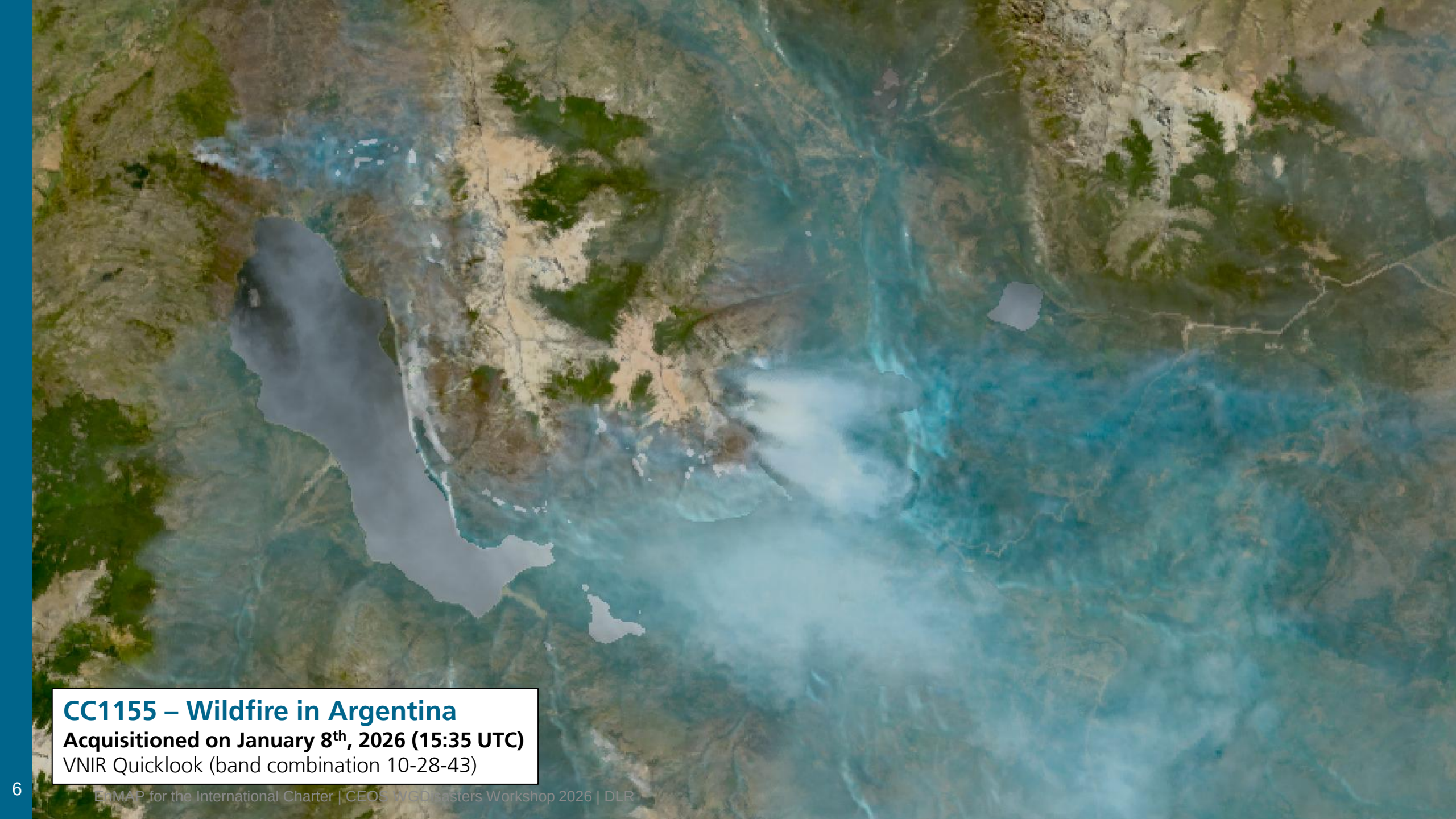


Data Processing

- Burnt area detection combining a superpixel segmentation algorithm, rule-based and deep learning classification techniques
- Band combination corresponding to that of Sentinel-3 (R-G-B-NIR)

Nolde, M., Rösch, M., Riedlinger, T., Taubenböck, H. (2025). Multi-sensor near-realtime burnt area monitoring using a superpixel-based graph convolutional network approach. *GIScience & Remote Sensing* 62, 2498188. <https://doi.org/10.1080/15481603.2025.2498188>.

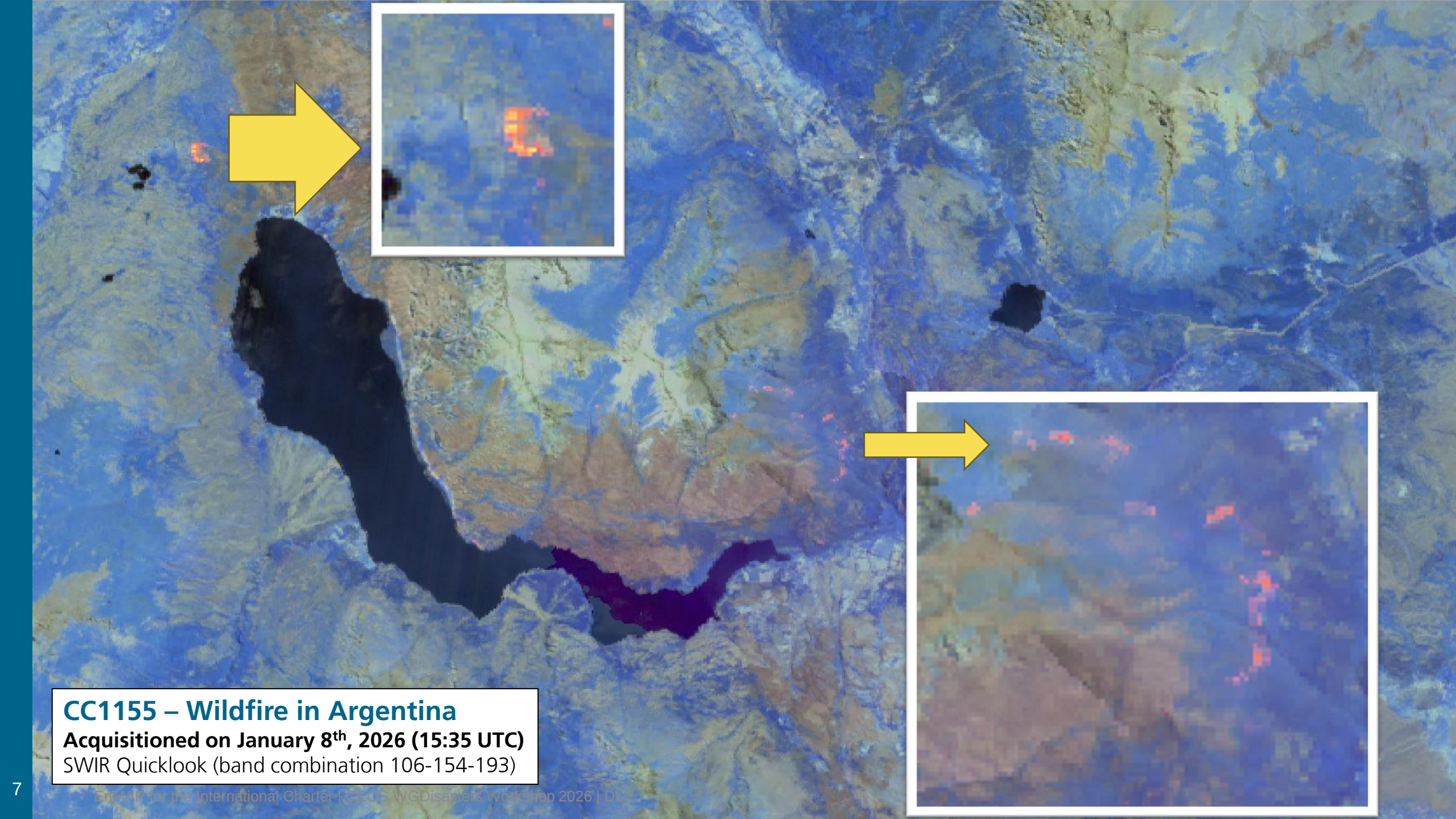


A satellite image showing a large wildfire in Argentina. The fire is visible as a bright, irregular white and yellow shape in the center-right of the frame, surrounded by dark, charred vegetation. The surrounding landscape is a mix of green and brown, indicating a forested area with some cleared land. The image is a Quicklook from the Sentinel-2 satellite, showing a combination of the 10, 28, and 43 spectral bands.

CC1155 – Wildfire in Argentina

Acquisitioned on January 8th, 2026 (15:35 UTC)

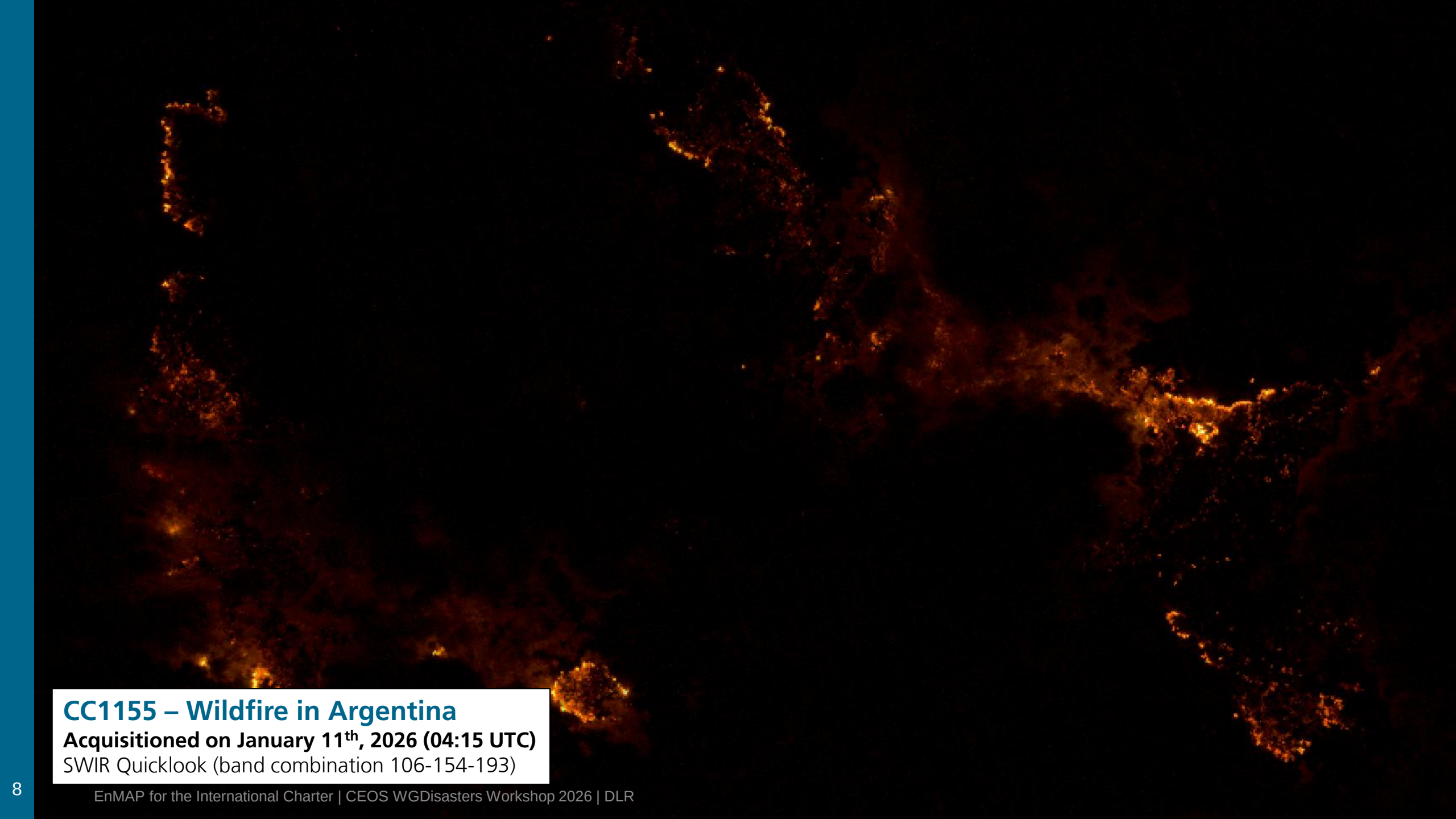
VNIR Quicklook (band combination 10-28-43)



CC1155 – Wildfire in Argentina

Acquisitioned on January 8th, 2026 (15:35 UTC)

SWIR Quicklook (band combination 106-154-193)



CC1155 – Wildfire in Argentina

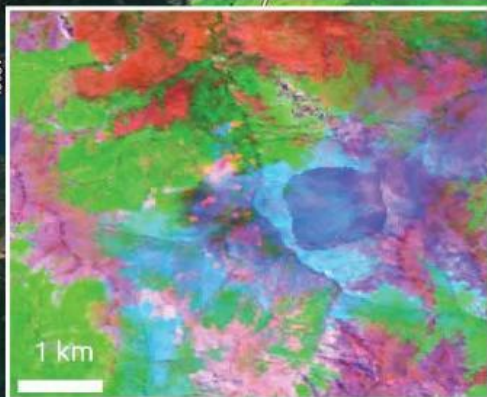
Acquisitioned on January 11th, 2026 (04:15 UTC)

SWIR Quicklook (band combination 106-154-193)

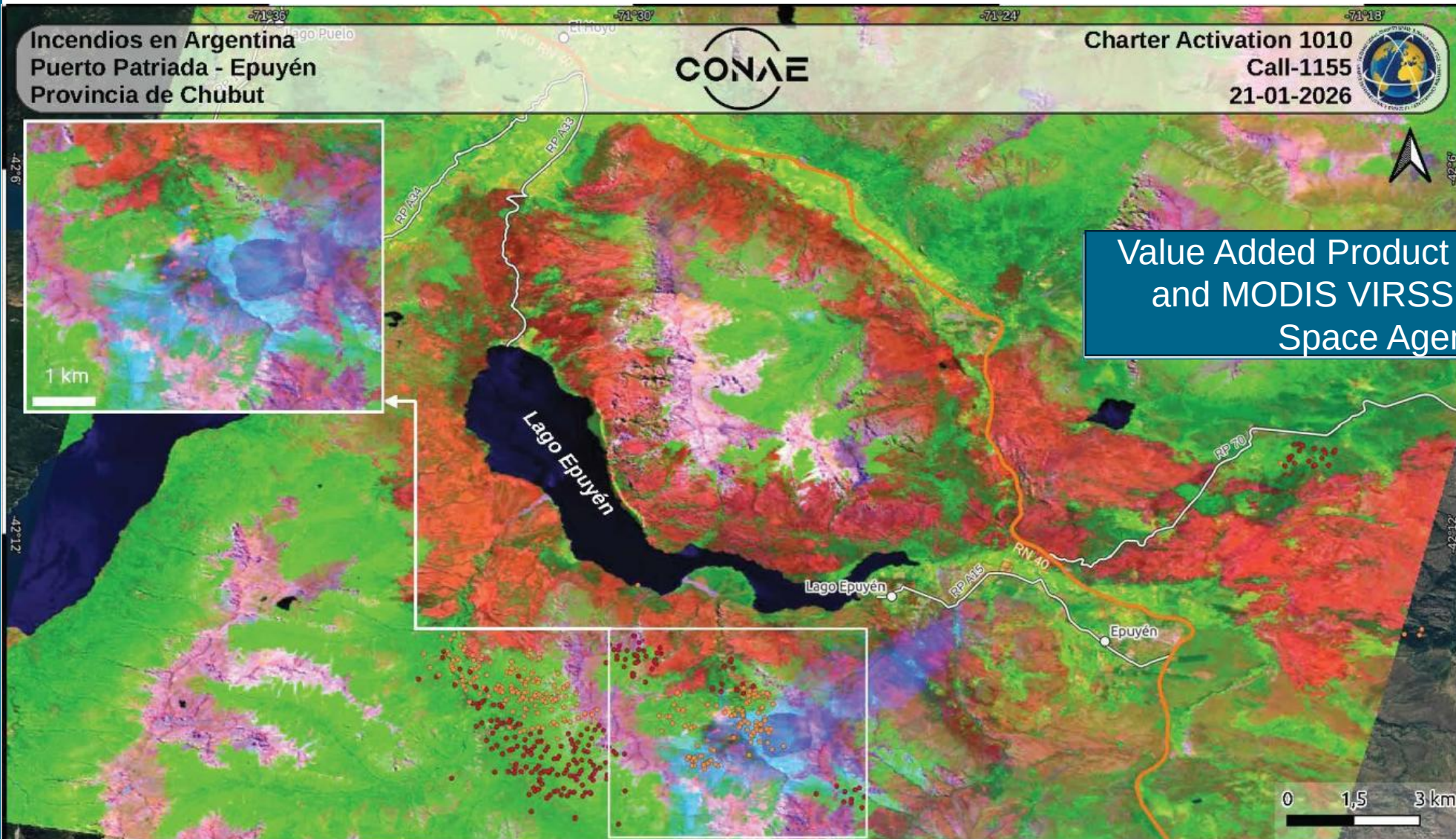
Incendios en Argentina
Puerto Patriada - Epuyén
Provincia de Chubut



Charter Activation 1010
Call-1155
21-01-2026



Value Added Product created using EnMAP
and MODIS VIRSS data by Argentinian
Space Agency CONAE



Ministerio de
Seguridad Nacional

AGENCIA FEDERAL
DE EMERGENCIAS

INFORMACIÓN SOBRE LA IMAGEN

Imagen hiperspectral ENMAP-01 en RGB 201-76-04 a la que se le superponen focos de calor MODIS/VIRS. Se observan las regiones de laderas rocosas en colores fucsia/rojos, distinguiéndose de las áreas afectadas las cuales presentan colores rojizos/anaranjados. El humo se denota en colores grises.

FUENTES
Imagen satelital
Satélite: ENMAP-01
Sensor: HSI
Resolución: 30m
Fecha: 19-01-2026

Focos de calor
Satélites: MODIS*,
NOAA-20 y 21** y SNPP**
Sensor: MODIS*, VIIRS**
Resolución: 1000m*,
375m**
Fechas: 20-21/01/2026

CRS: WGS84
EPSG: 4326
Información vectorial: IGN.
Copyright: EnMAP data ©DLR [2026]
All rights reserved.
Fecha de producción: 21-01-2026

Leyenda

- Localidades
- Ruta provincial
- Ruta nacional
- Límite provincial

Focos de calor
(fecha/hora UTC)
● 2026-01-20
● 2026-01-21



Oil Spill at Coast of Oman June 2026

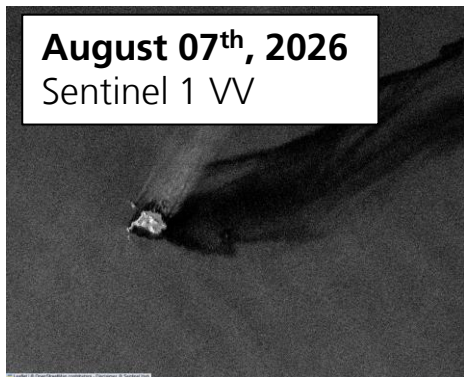
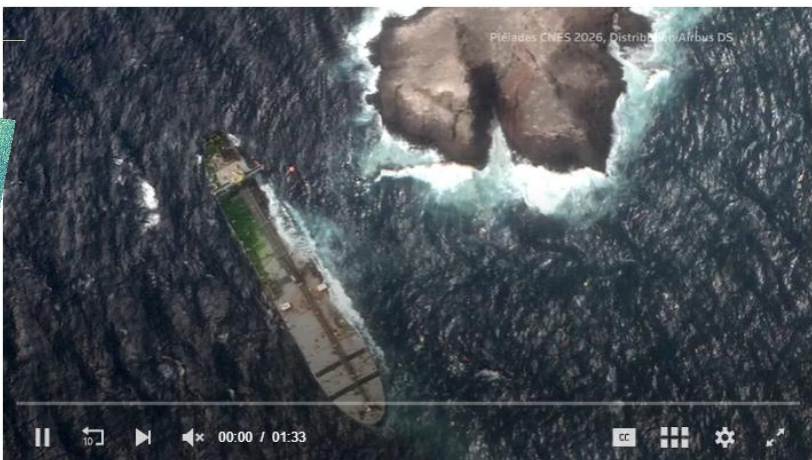
Huge oil slick hitting Oman's shoreline as agencies warn of disaster

By Jonathan Saul and Catherine Cartier

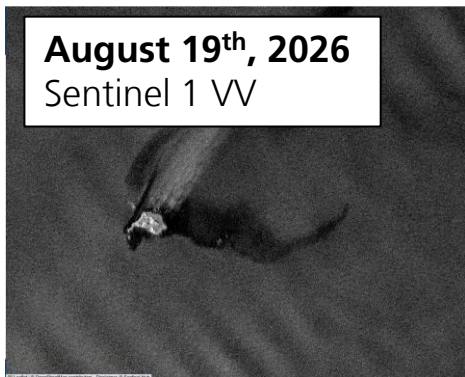
August 12, 2026 11:14 AM GMT+2 · Updated August 12, 2026



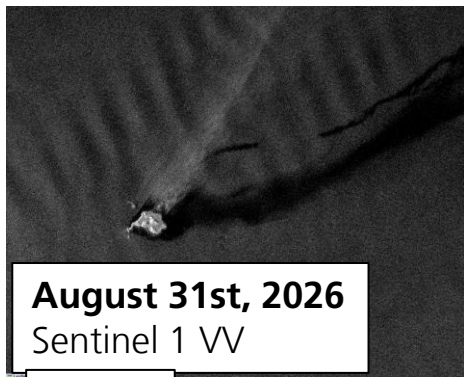
<https://www.reuters.com/>



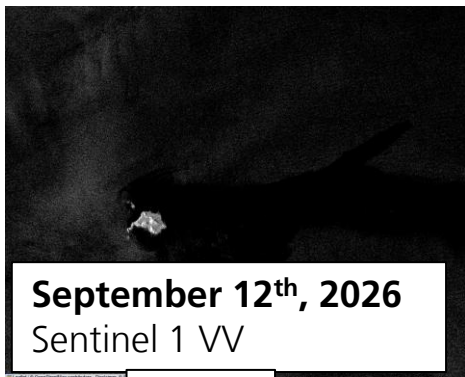
August 07th, 2026
Sentinel 1 VV



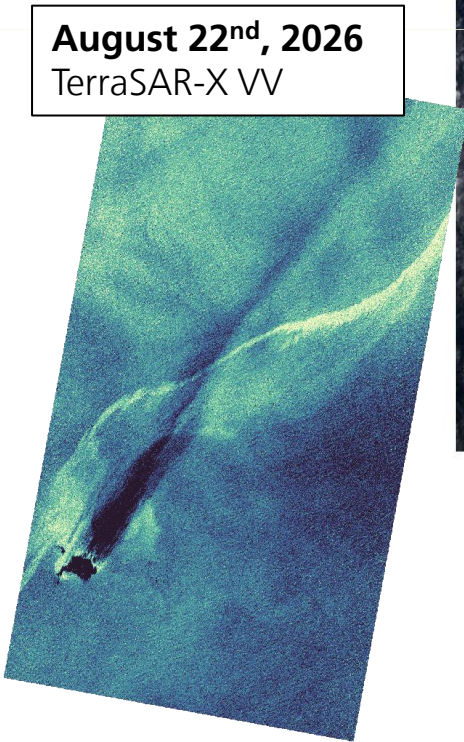
August 19th, 2026
Sentinel 1 VV



August 31st, 2026
Sentinel 1 VV



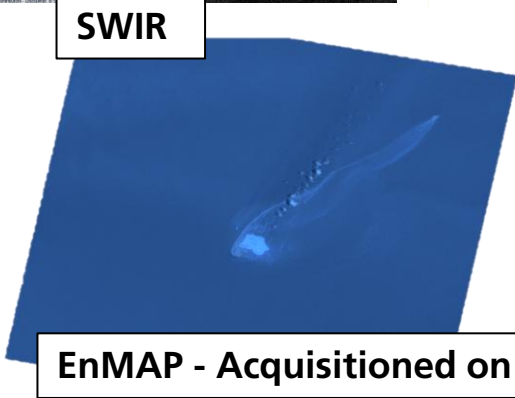
September 12th, 2026
Sentinel 1 VV



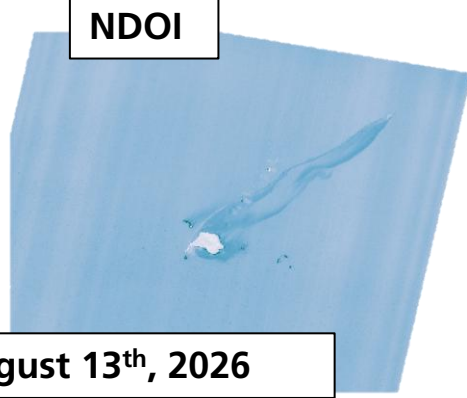
August 22nd, 2026
TerraSAR-X VV



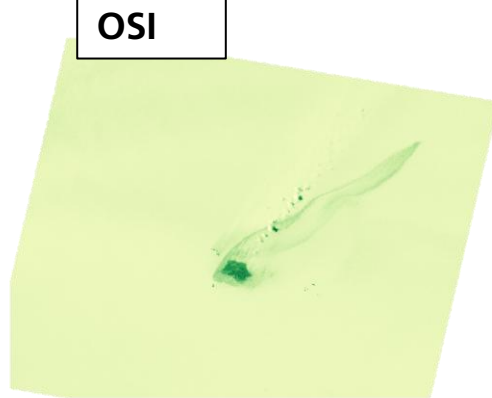
VNIR



SWIR



NDOI



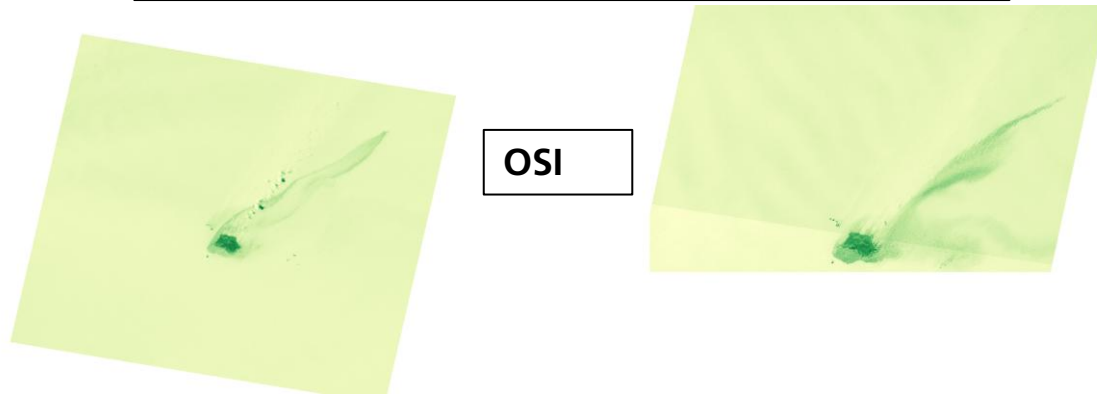
OSI

EnMAP - Acquisitioned on August 13th, 2026

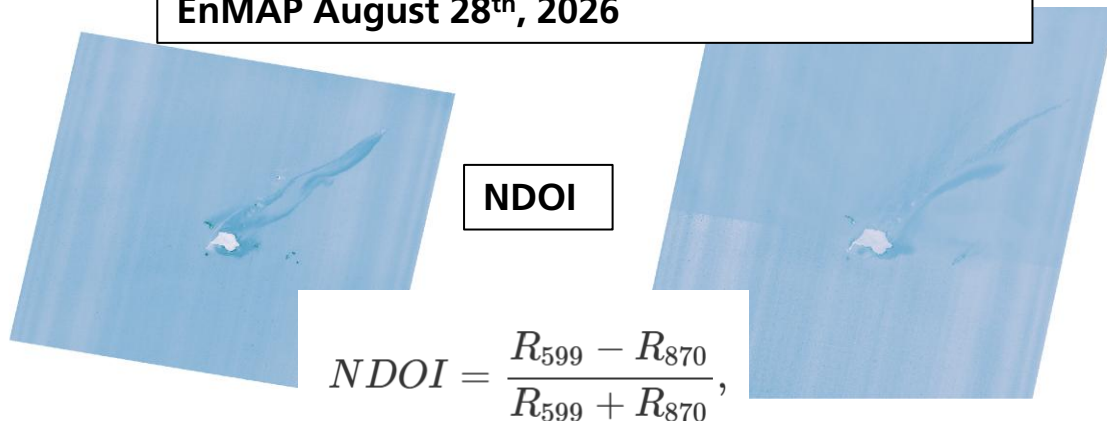
Oil Spill at Coast of Oman June 2026

Oil Spill in Oman (no
Charter activation)

EnMAP August 13th, 2026



EnMAP August 28th, 2026



$$NDOI = \frac{R_{599} - R_{870}}{R_{599} + R_{870}},$$

Data Processing

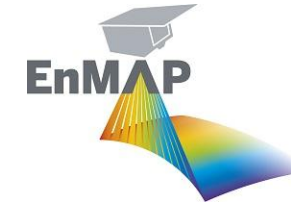
Exploratory oil spill detection using spectral indices

- VNIR & SWIR visualization
- Oil Spill Index (OSI) – Sentinel 2-based approach transferred to corresponding EnMAP bands
- Normalized Difference Oil Index (NDOI) – spectral index for oil detection
- Proposed as EnMAP visualization products for the Charter Mapper

Rajendran, S., Fahad, A.S., Sadooni, F.N., Al-Kuwari, H.A.S., Vethamony, P., Anisimov, O., Nasir, S., Al-Khayat, J., Govil, H., Seegobin, V.O. (2021). **Oil Spill Index (OSI)** to Sentinel-2 satellite data: QU in International Contribution. Qatar University Annual Research Forum and Exhibition (QUARFE 2021). <https://doi.org/10.29117/quarfe.2021.0020>

Pérez-García, Á., Horstrand, P., López, J.F. (2022). **NDOI, a Novel Oil Spectral Index**: Comparisons and Results. 2022 12th Workshop on Hyperspectral Imaging and Signal Processing: Evolution in Remote Sensing (WHISPERS). <https://doi.org/10.1109/WHISPERS56178.2022.9955062>

Future added value of hyperspectral



Contamination of Water & Land

Identification of leaked pollutants

(e.g. before – during – after floods)

Algal blooms



Volcanic Eruptions

Identification of Mineral Materials

assessment of crater stability after volcanic eruption

Thermal Activity

volcanic activity (also during nighttime)

Methane & CO₂ Emissions



Explosive Events

Identification of released chemicals and materials

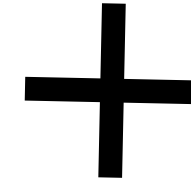
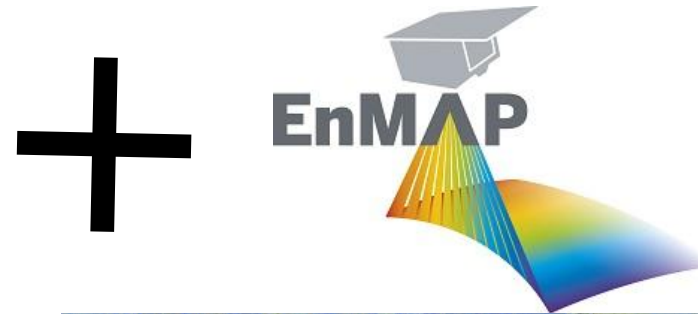
Mapping of burn residues and debris fields

Delineation of contaminated surfaces

The challenge: translating spectral capabilities into actionable products for disaster response.

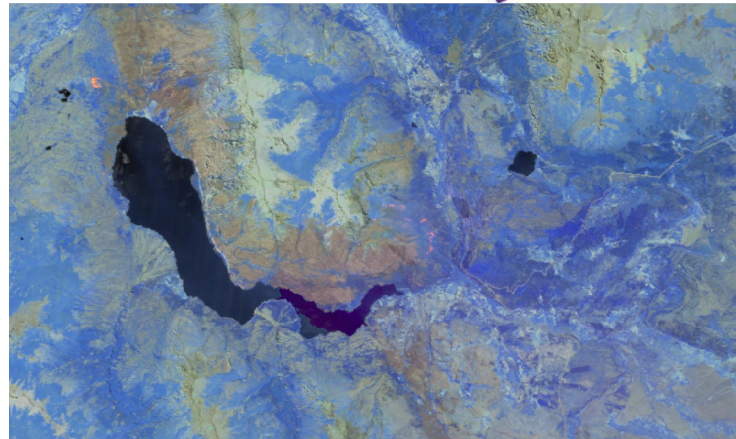
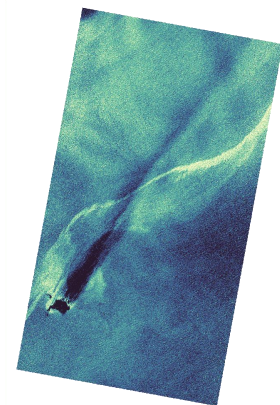
What's Next?

We are looking to expand the use of EnMAP for disaster response within the Charter.



OroraTech

Q4 2026



Thermal-Infrared-Data

- MWIR: 3.4-4.2 μm ,
- LWIR1: 8.1-9.3 μm ,
- LWIR2: 10.4-12.5 μm

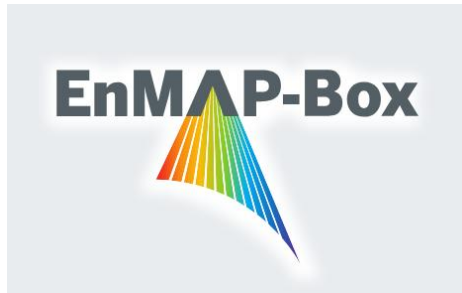
Wildfire Hot-Spot layer

- Are you developing methods, products or applications where hyperspectral observations could provide additional value for disaster response?
- Let's explore whether they could become part of the future contribution to the Charter.
Contact: charter.sec@dlr.de



EnMAP mission

- Mission website: <https://www.enmap.org/>
- EnMAP product specifications: https://www.enmap.org/data/doc/EN-PCV-ICD-2009-2_HSI_Product_Specification_Level1_Level2.pdf



EnMAP-Box

- Download the QGIS plugin: <https://plugins.qgis.org/plugins/enmapboxplugin/>
- Documentation: <https://enmap-box.readthedocs.io/en/latest/>



Tutorials on HyperEDU

- Tutorials: https://www.enmap.org/events_education/hyperedu/

CC1001 – Volcanic Eruptions in Indonesia
Acquisitioned on April 20th, 2024 (06:05 UTC)
VNIR Quicklook (band combination 106-154-193)

THANK YOU