A large satellite with multiple solar panels is shown in space against a black background with stars. The satellite is oriented diagonally, with its solar panels extended. The background is a dark, starry field.

Meteosat Third Generation (MTG) Flexible Combined Imager (FCI) for the monitoring of wildfires

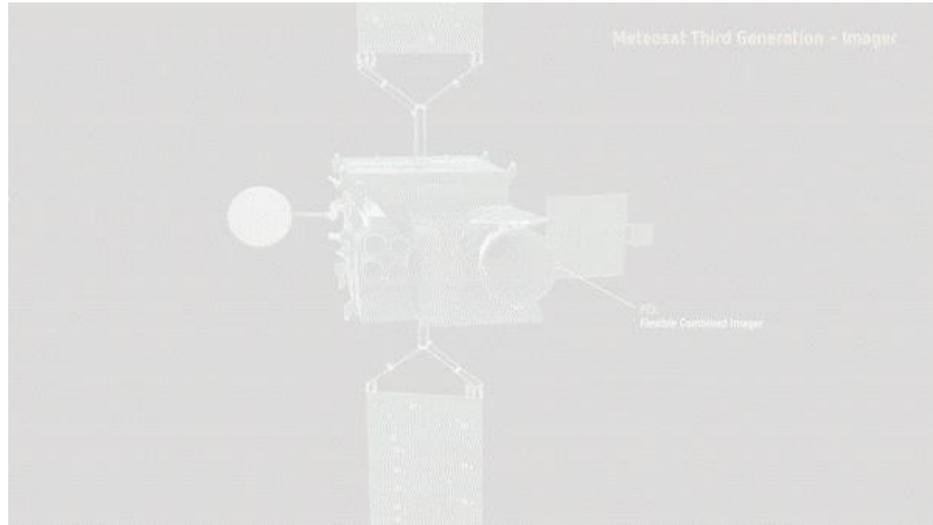
Andrea Meraner
Remote Sensing Scientist for Optical Imagery
EUMETSAT

EUMETSAT short course: Wildfire Monitoring with Next-Generation Satellites
Webinar, 11th of July 2023



- FCI Crash Course
- A walk through first examples of wildfire observations with FCI





- The FCI imager is one of the two main payloads onboard the Meteosat Third Generation Imaging (MTG-I) satellites.

- The first FCI instrument was launched on MTG-I1 on December 13, 2022 and will operate in full disk scanning service (FDSS) with 10min temporal resolution.
- The second FCI instrument (on MTG-I2) will perform rapid scanning service (RSS) over Europe with 2.5min temporal resolution.



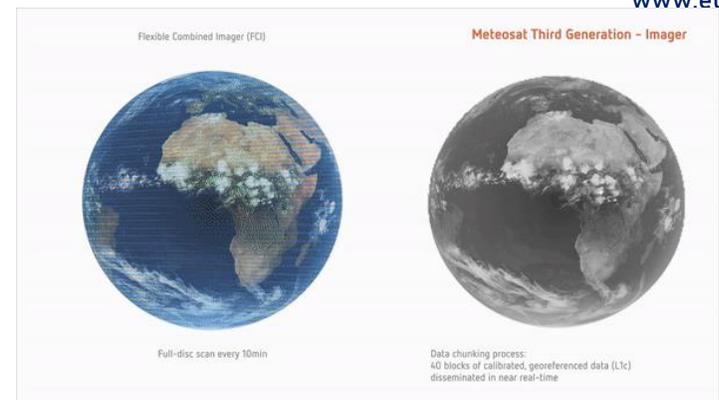
The entire fire cycle can be observed by FCI with unprecedented temporal detail!



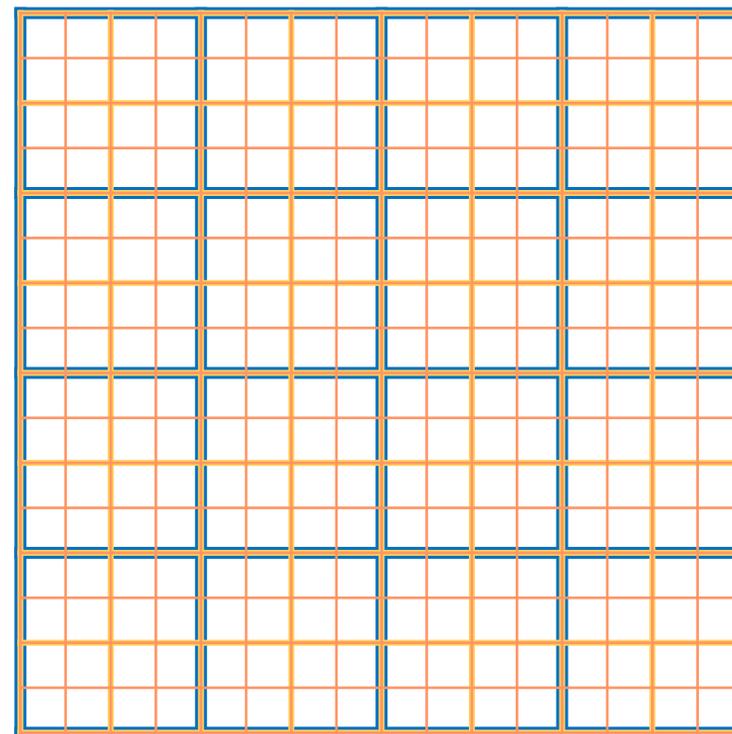
Flexible Combined Imager - Overview

- 8 channels in the solar VIS-NIR domain (0.4 μ m - 2.2 μ m), 1km spatial resolution at nadir (FDHSI).
- 8 channels in the thermal IR domain (3.8 μ m - 13.3 μ m), 2km spatial resolution at nadir (FDHSI).
- 4 channels are also available at higher spatial resolution (HRFI):
 - VIS0.6 and VIS2.2: 0.5km (nadir)
 - IR3.8 and IR10.5: 1km (nadir)

No.	Central λ / μ m	λ width / μ m	Resolution / km	No.	Central λ / μ m	λ width / μ m	Resolution / km
1	0.44	0.06	1.0	9	3.80	0.40	2.0/1.0
2	0.51	0.04	1.0	10	6.30	1.00	2.0
3	0.64	0.05	1.0/0.5	11	7.35	0.50	2.0
4	0.86	0.05	1.0	12	8.70	0.40	2.0
5	0.91	0.02	1.0	13	9.66	0.30	2.0
6	1.38	0.03	1.0	14	10.50	0.70	2.0/1.0
7	1.61	0.05	1.0	15	12.30	0.50	2.0
8	2.25	0.05	1.0/0.5	16	13.30	0.60	2.0



2 km 1 km 0.5 km

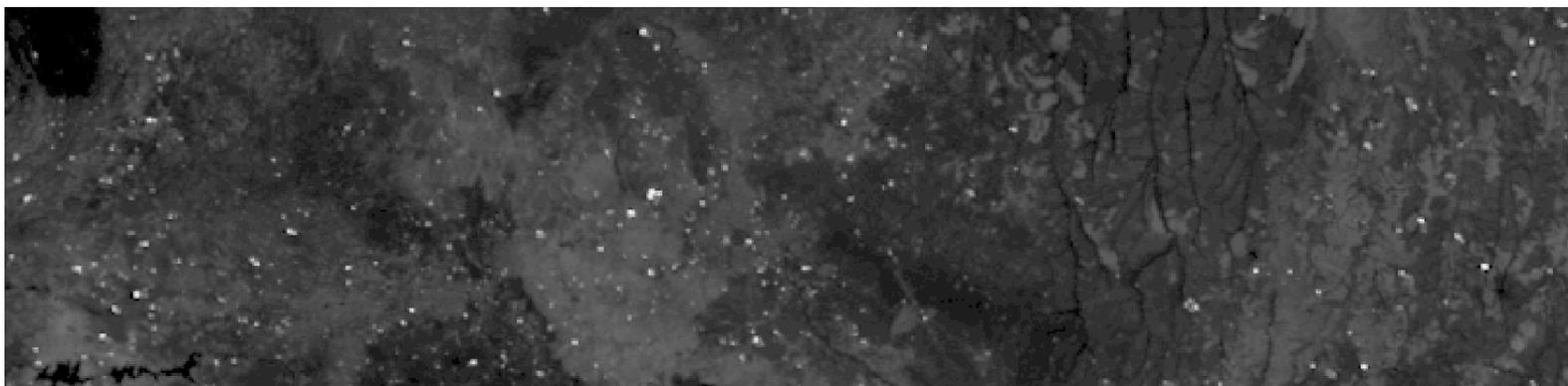


All channels have the same reference grid



The 3.8 μ m “fire” channel on FCI

- Most sensitive channel for (sub-pixel) wildfires
- Particular efforts during the instrument design to maximise detection performance
- Main Improvements on FCI compared to SEVIRI:
 - Better spatial resolution -> from 3km to 1km (9 times more pixels!)
 - Higher saturation brightness temperature -> from ~335K to ~490K (TBC)
 - Less CO₂ absorption and limb cooling -> from 3.9 μ m to 3.8 μ m central wavelength
 - Higher radiometric resolution -> from 10 bits to 13 bits
 - Less “blinding” effect -> from spinning to 3-axis stabilised platform



FCI 3.8 μ m @500m, central Africa, 01/07/2032, 14:20 UTC



- FCI will initially ensure continuity of the key L2 products currently disseminated for SEVIRI
- Enhanced and new FCI L2 products will be developed and disseminated by EUMETSAT after start of operations. This will further exploit the additional channels and improved spatial and temporal resolution of FCI.
- A suite of additional products relevant for wildfire observations will also be generated and further developed by the Satellite Application Facilities (SAFs), in particular the LSA-SAF.

Product	Temporal resolution (min)	Spatial resolution at nadir (km)	Format
Active Fire Monitoring 	10	2	NetCDF
Atmospheric Motion Vectors	30	NA	NetCDF, BUFR
All Sky Radiances	10	32	NetCDF, BUFR
Clear-Sky Reflectance Map	10	1	NetCDF
Cloud Mask	10	2	NetCDF, GRIB
Cloud Type	10	2	NetCDF
Cloud Top Temperature and Height	10	2	NetCDF
Global Instability Index	10	6	NetCDF
Optimal Cloud Analysis	10	2	NetCDF
Outgoing Longwave Radiation	10	2	NetCDF



A walk through first FCI imagery

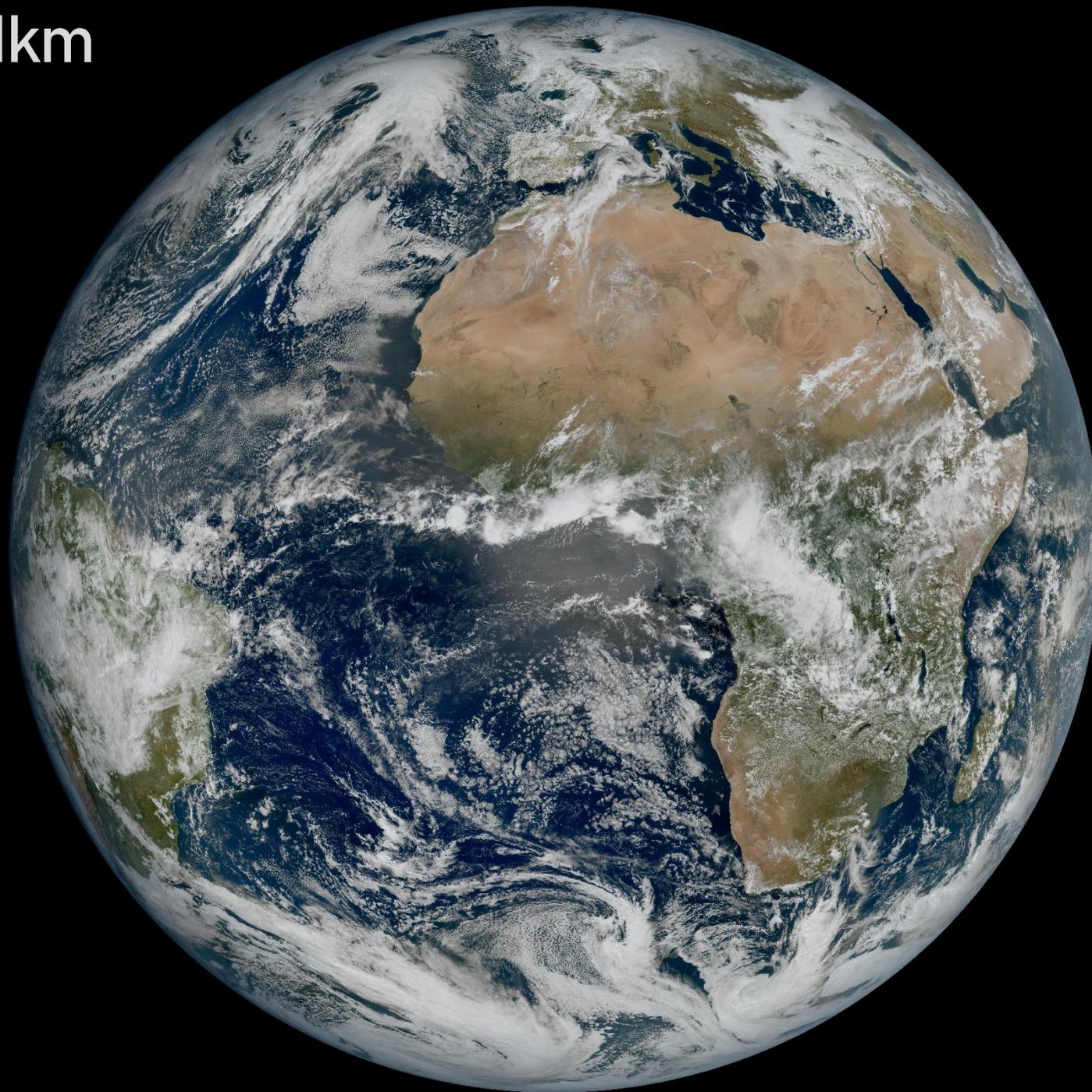
What you will see is imagery from the early commissioning phase of FCI with preliminary geometric and radiometric calibration.

Image processing and RGB generation has been done using the open-source python library Pytroll/Satpy, visualisations with the open-source visualisation software SIFT



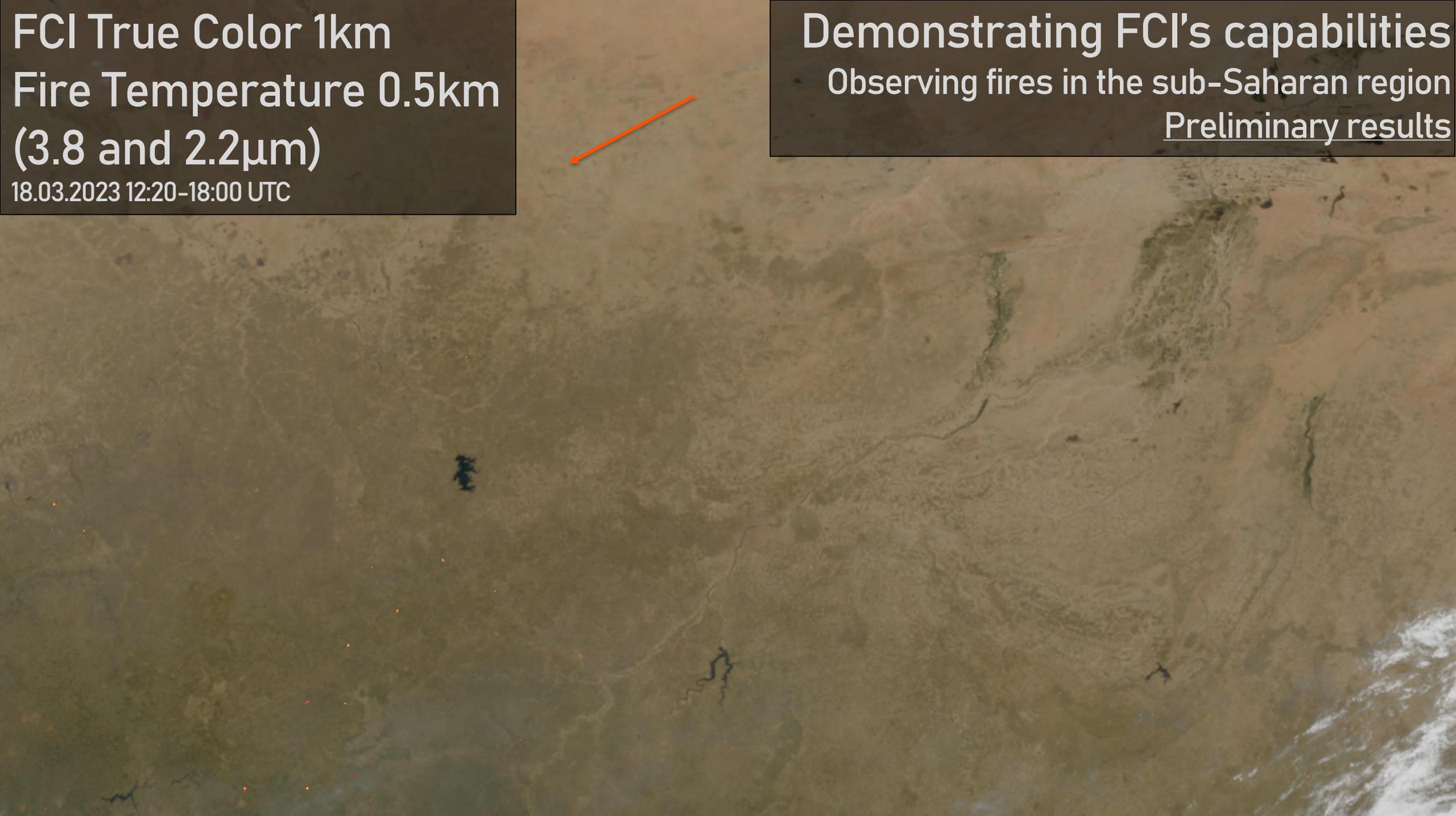
FCI True Color 1km

18.03.2023 11:50 UTC



FCI True Color 1km
Fire Temperature 0.5km
(3.8 and 2.2 μ m)
18.03.2023 12:20-18:00 UTC

Demonstrating FCI's capabilities
Observing fires in the sub-Saharan region
Preliminary results



SEVIRI Natural color 3km

Fire Temperature 3km

(3.8 μ m)

18.03.2023 15:45 UTC

Demonstrating FCI's capabilities

Observing fires in the sub-Saharan region

Preliminary results



FCI True Color 1km

Fire Temperature 0.5km
(3.8 and 2.2 μ m)

18.03.2023 15:40 UTC

Demonstrating FCI's capabilities

Observing fires in the sub-Saharan region

Preliminary results



FCI True Color 1km
Fire Temperature 0.5km
(3.8 and 2.2 μ m)

18.03.2023 15:40 UTC

Demonstrating FCI's capabilities

Observing fires in the sub-Saharan region

Preliminary results

Burn
Scar

Fire
core

Smoke



Fire Temperature RGB 1km (3.8, 2.2, 1.6 μm)

01.07.2023 13:00 UTC

Demonstrating FCI's capabilities

Observing fires in Southern Africa

Preliminary results



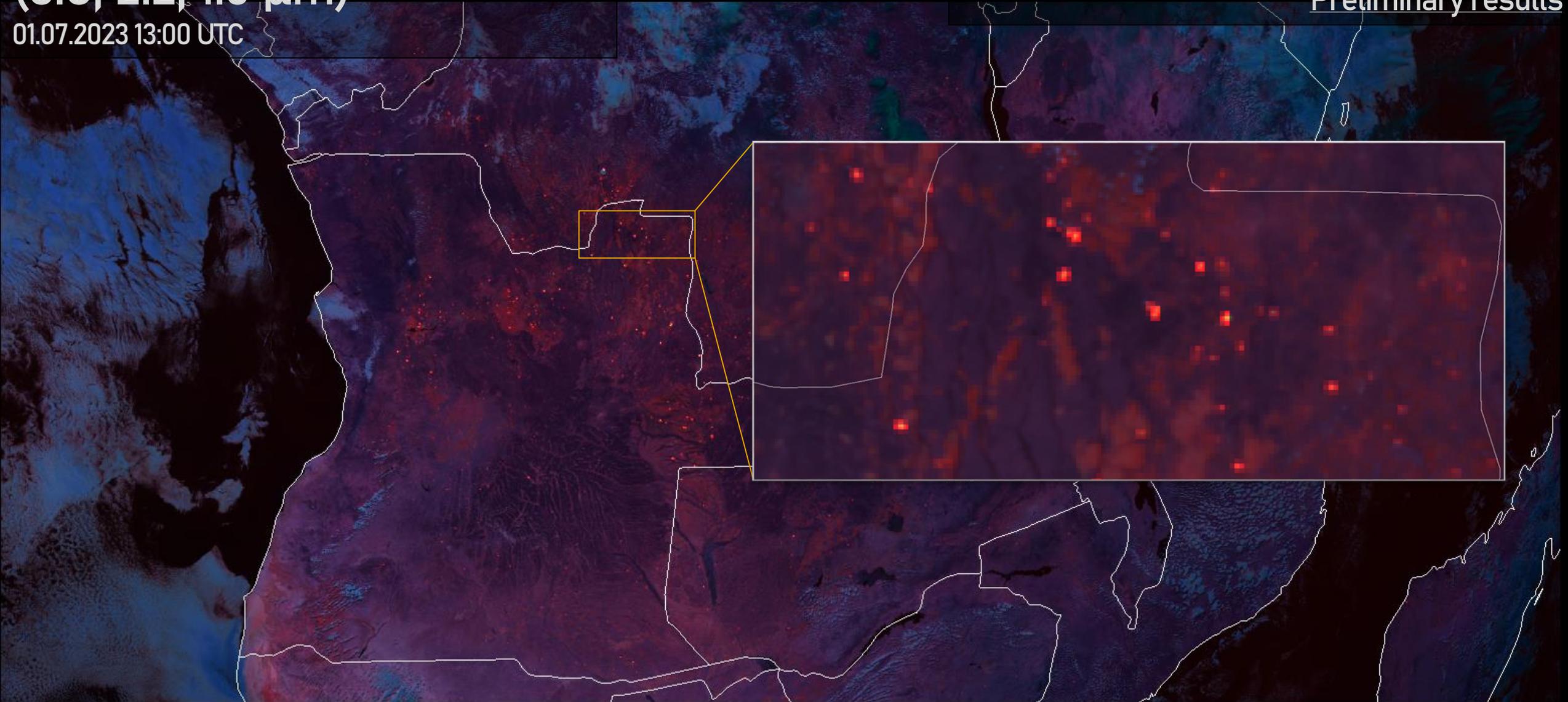
Fire Temperature RGB 1km (3.8, 2.2, 1.6 μm)

01.07.2023 13:00 UTC

Demonstrating FCI's capabilities

Observing fires in Southern Africa

Preliminary results



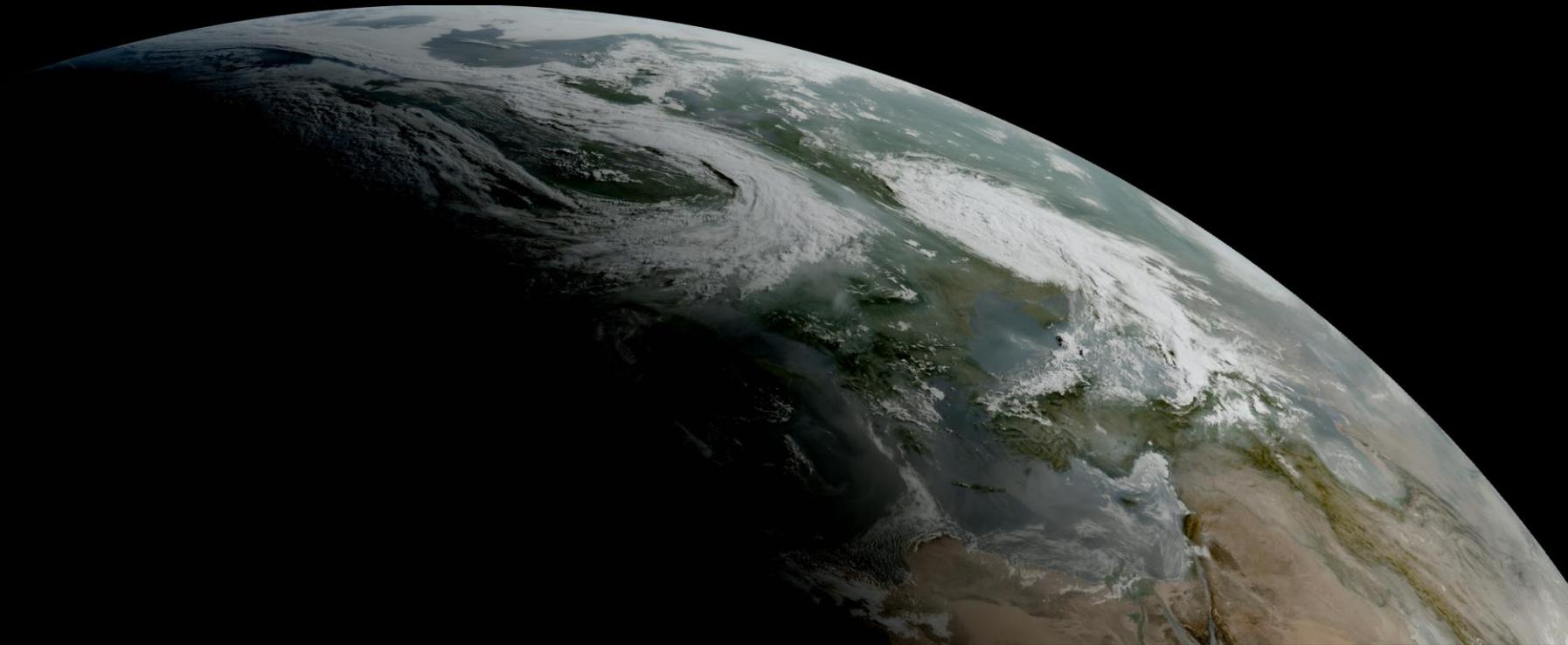
FCI True Color 1km

27.06.2023 04:30-23:40 UTC

Demonstrating FCI's capabilities

Observing Canadian wildfire smoke
over Europe

Preliminary results



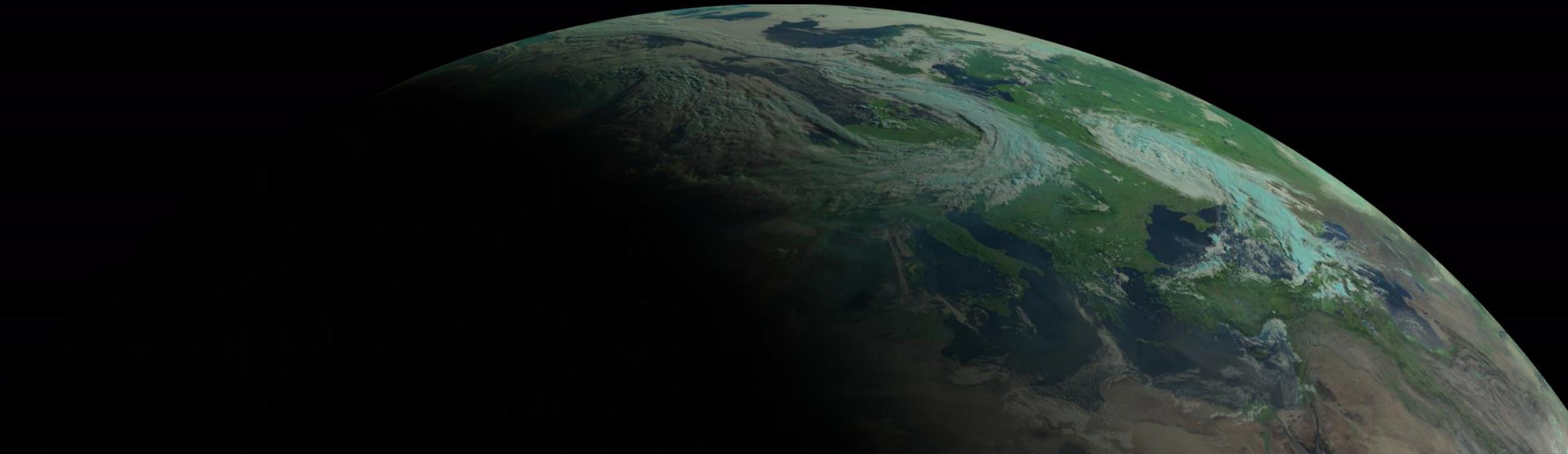
FCI Natural Color 1km

27.06.2023 04:30-23:40 UTC

Demonstrating FCI's capabilities

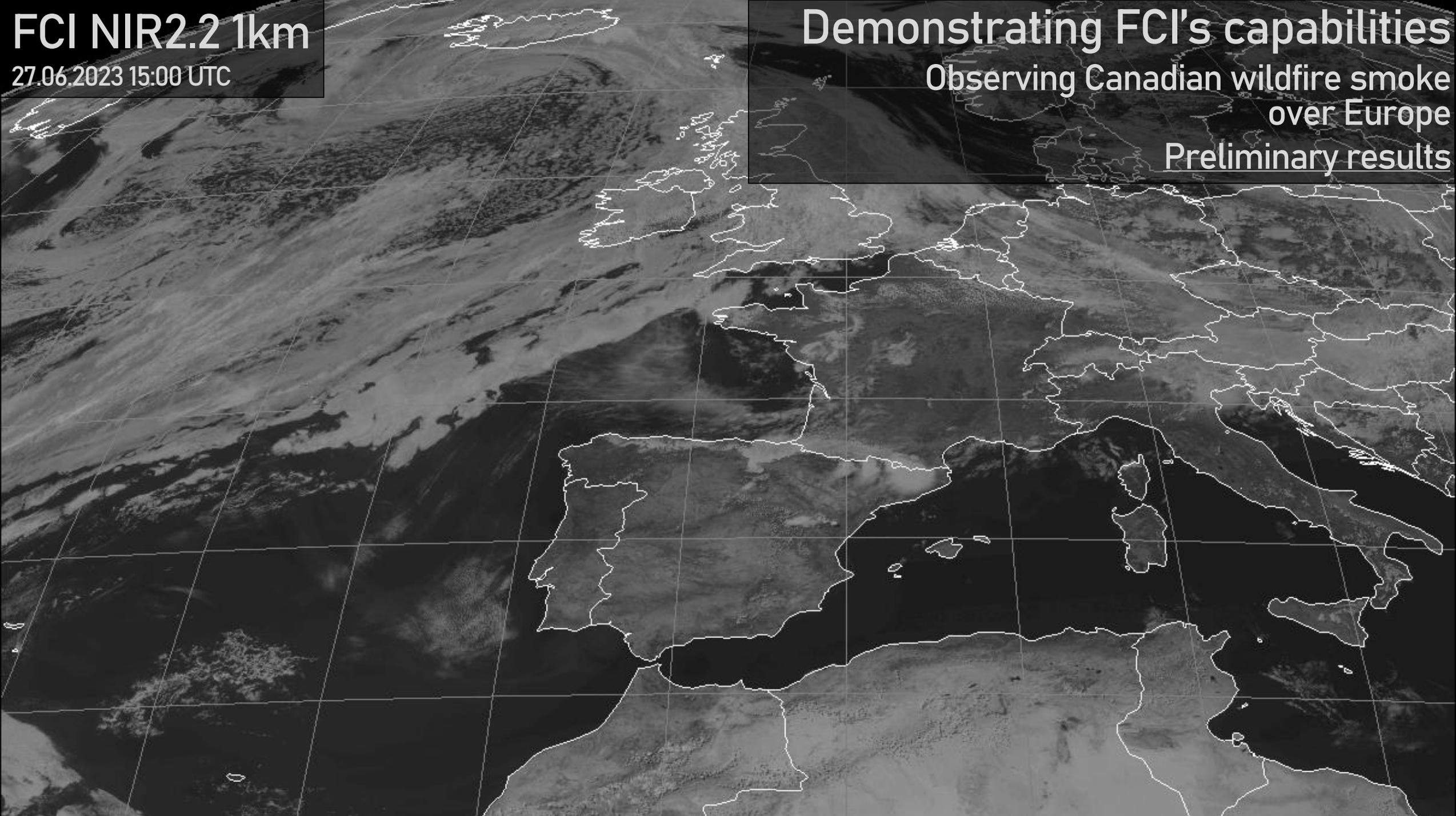
Observing Canadian wildfire smoke
over Europe

Preliminary results



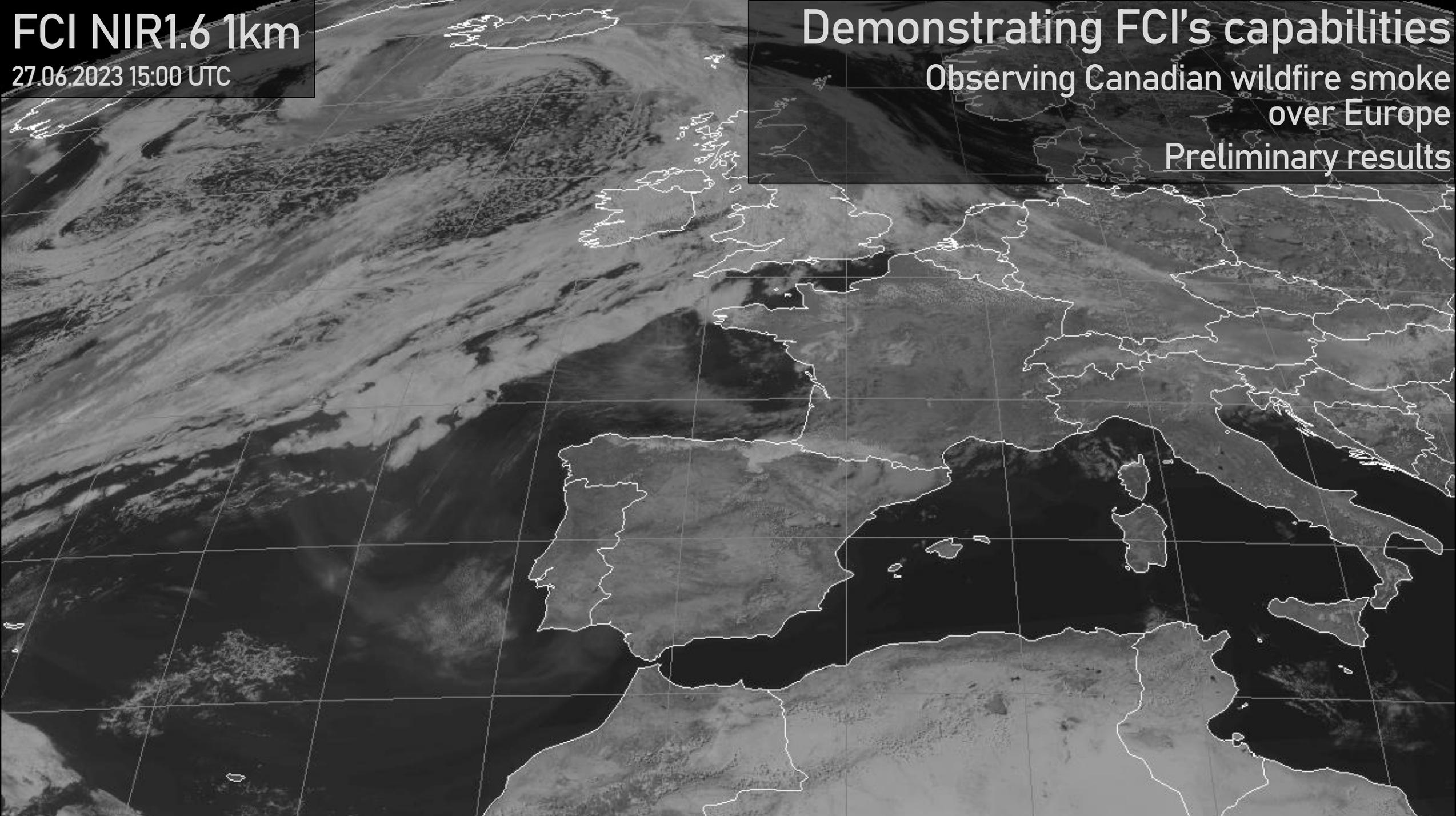
FCI NIR2.2 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



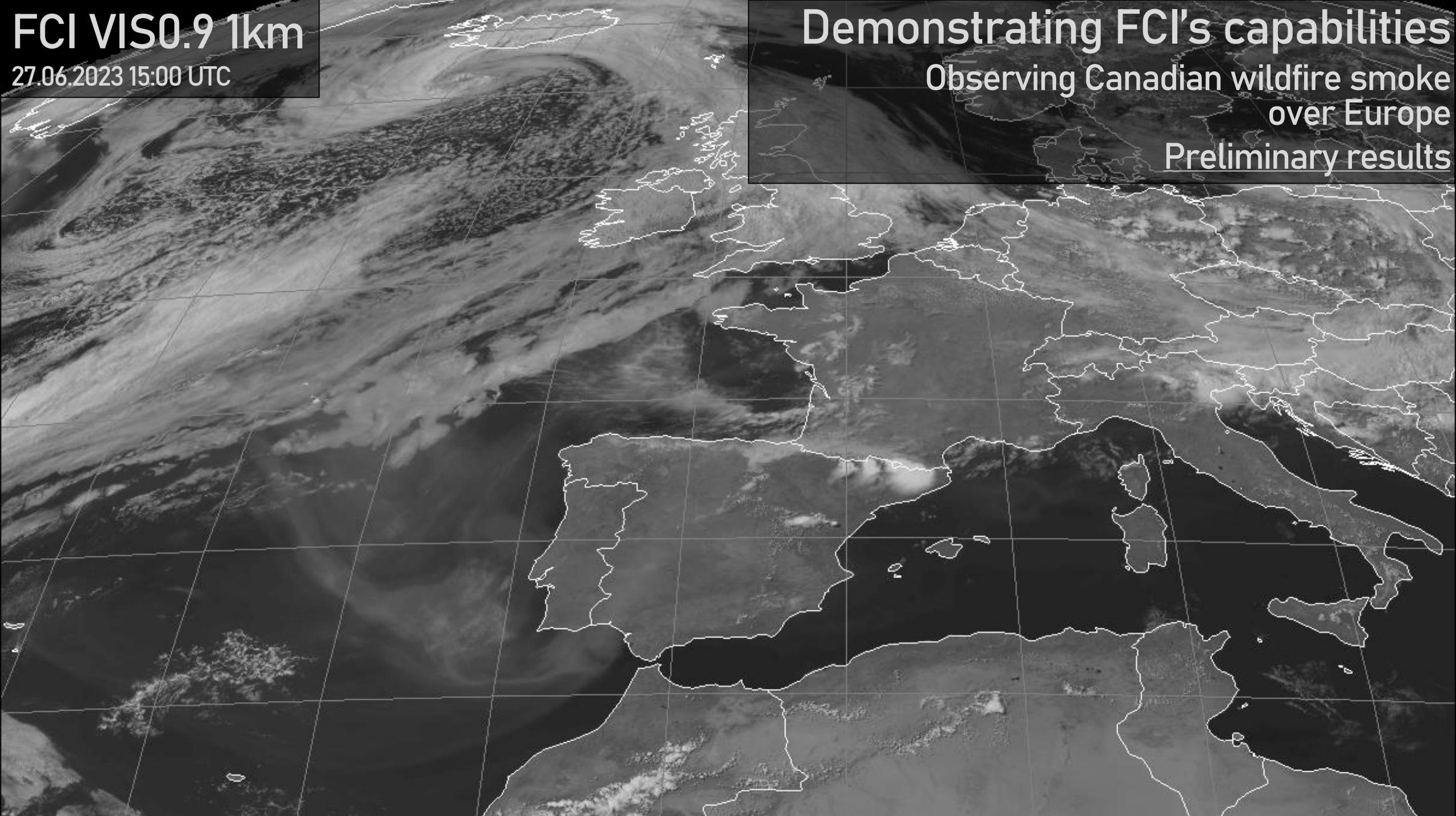
FCI NIR1.6 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



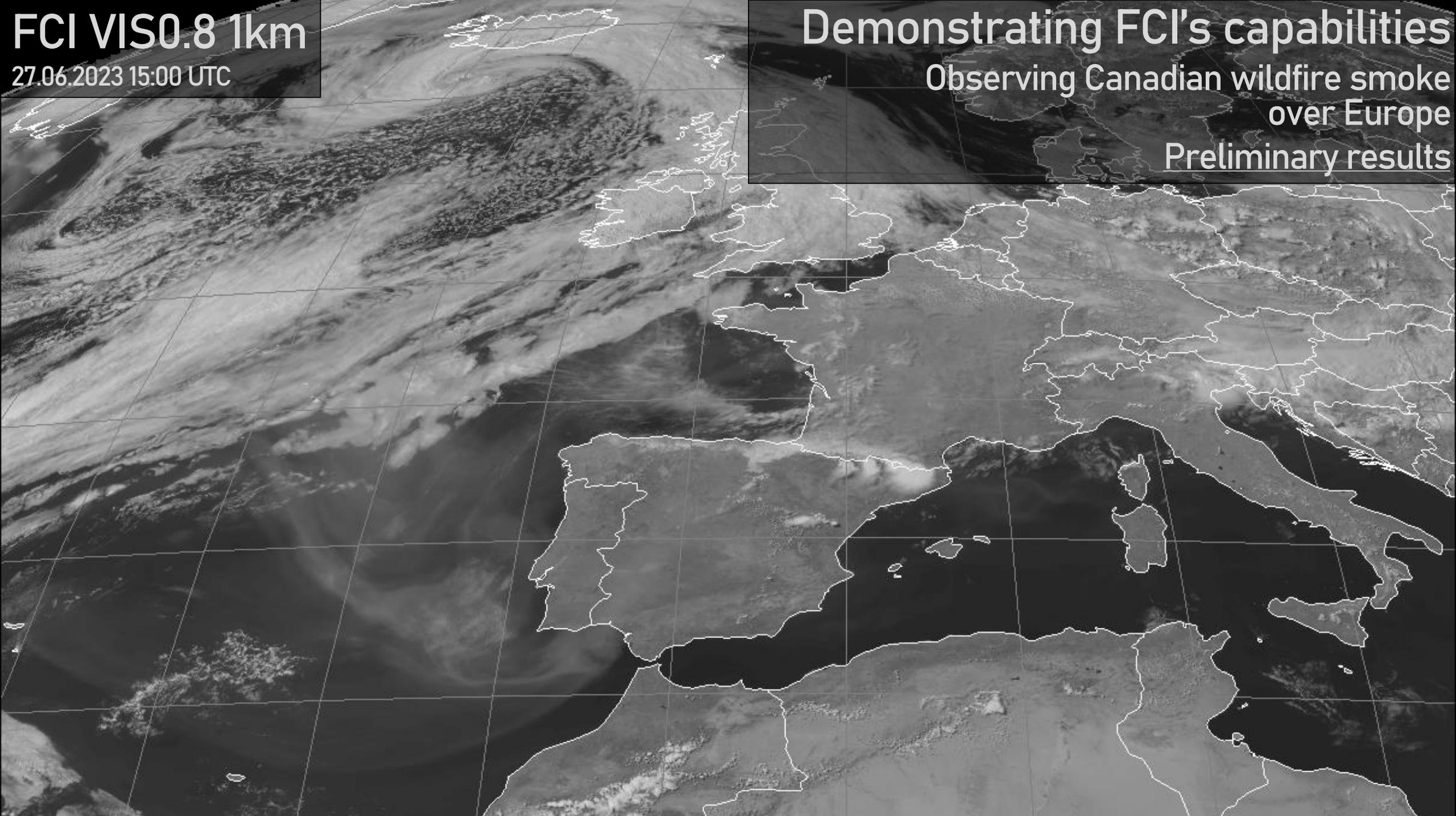
FCI VIS0.9 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



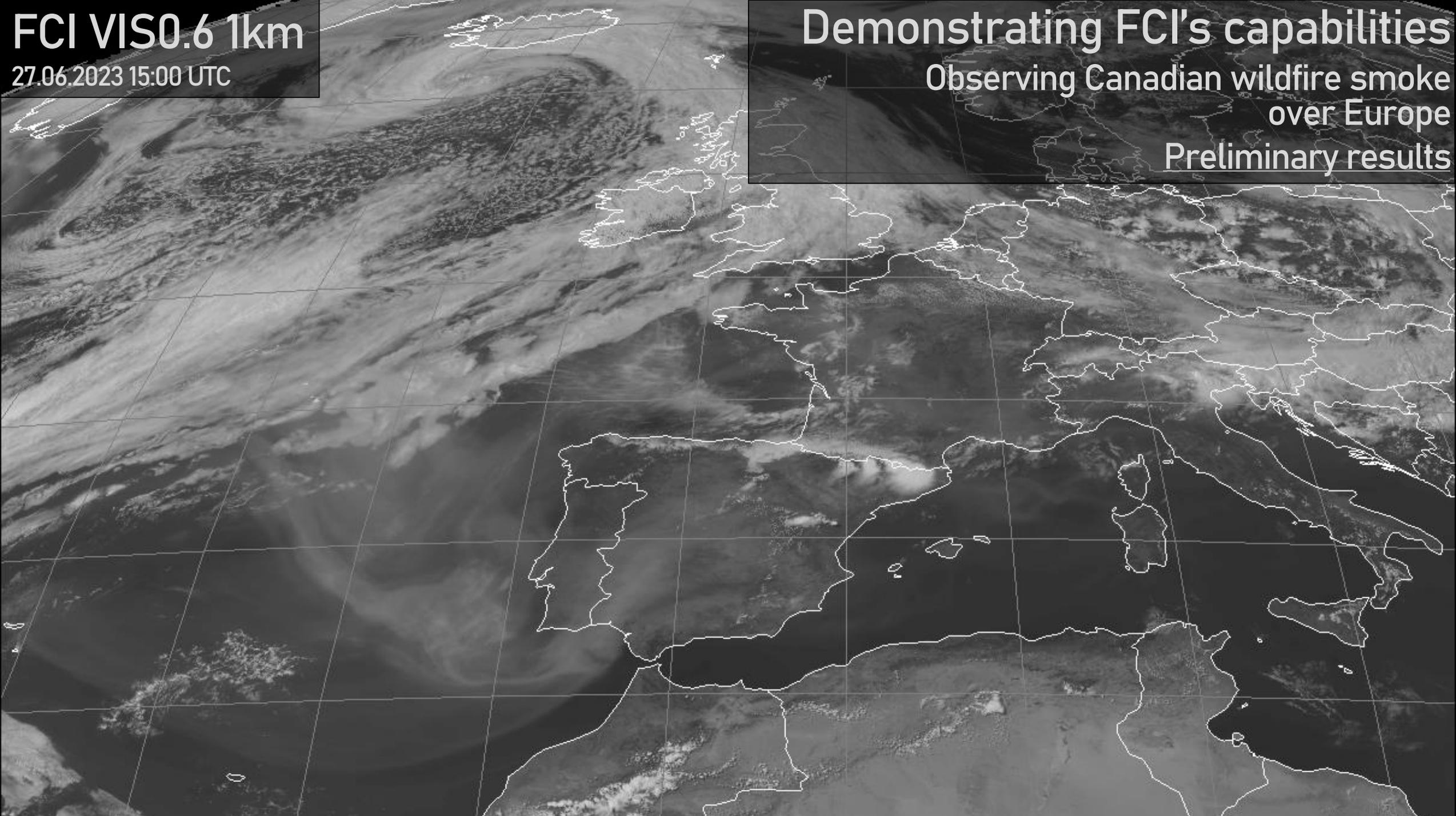
FCI VIS0.8 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



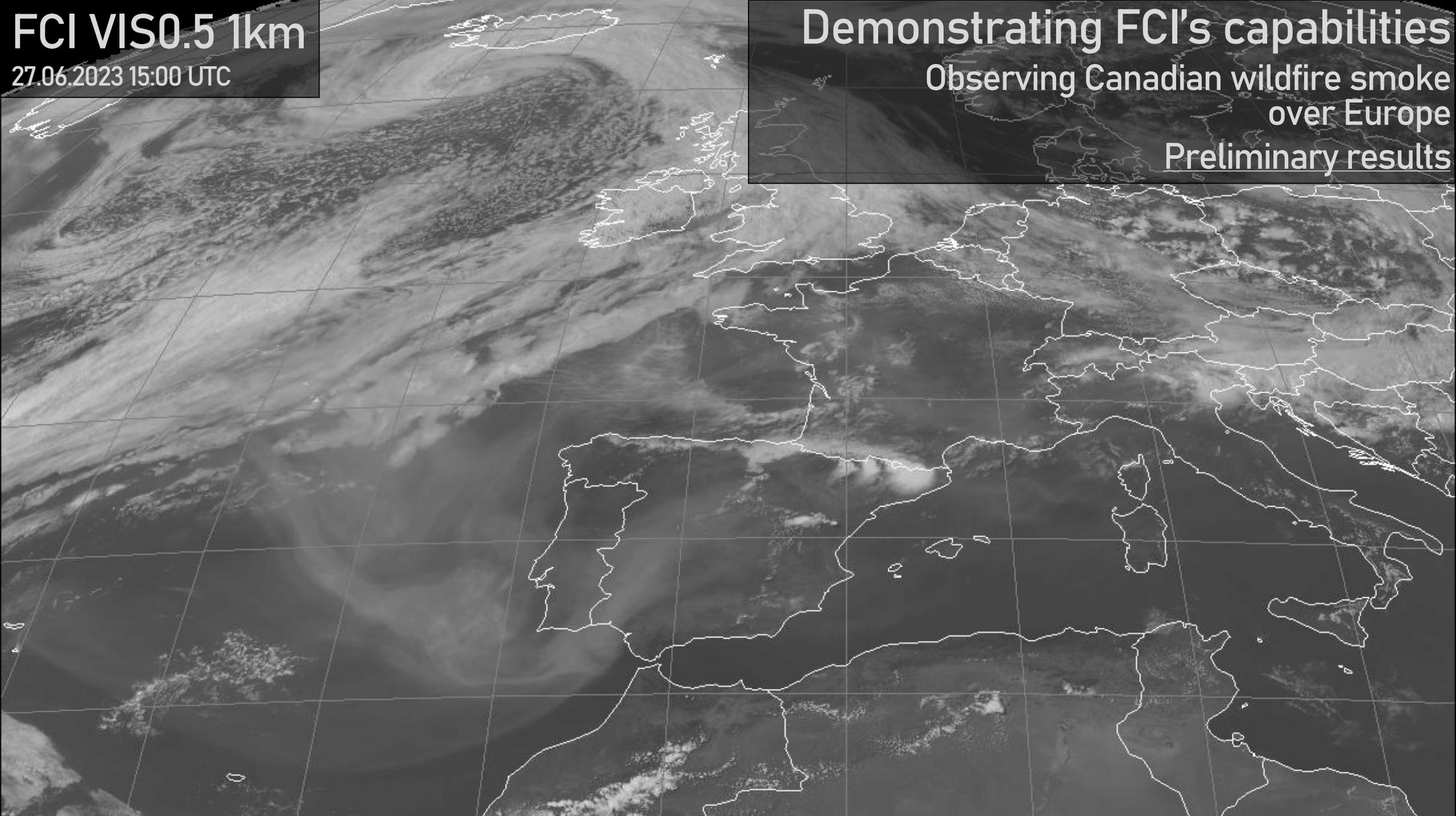
FCI VIS0.6 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



FCI VIS0.5 1km
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities
Observing Canadian wildfire smoke
over Europe
Preliminary results



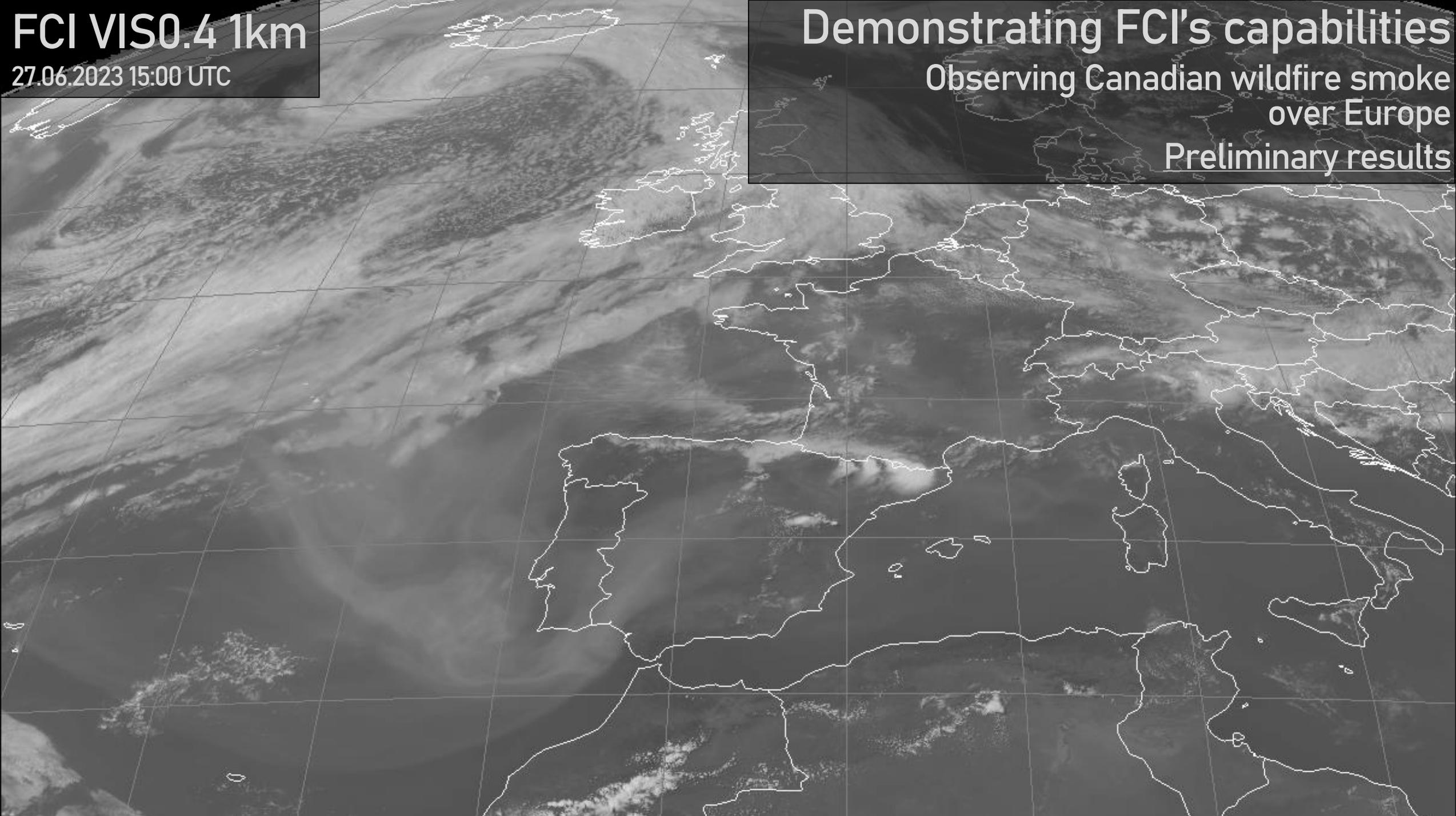
FCI VIS0.4 1km

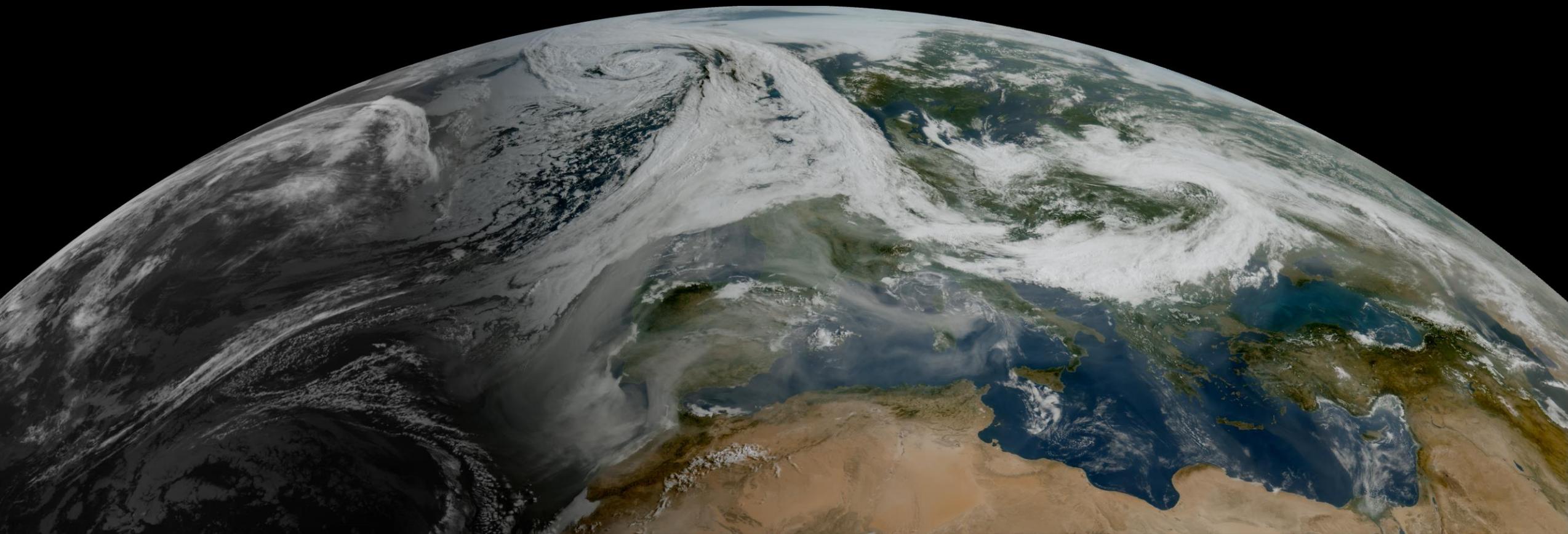
27.06.2023 15:00 UTC

Demonstrating FCI's capabilities

**Observing Canadian wildfire smoke
over Europe**

Preliminary results





Thank you!
Questions are welcome.

