EUMETSAT

GCRF AFRICAN SWIFT
SCIENCE FOR WEATHER INFORMATION AND FORECASTING TECHNIQUES

Meteosat Third Generation: impact on Nowcasting and main challenges for Africa

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User Training Officer, EUMETSAT

Webinar on Nowcasting in Africa, 15 March 2022

Agenda

MTG-I Imagery mission

Benefits of MTG-I imagery mission for nowcasting

MTG-S Sounding mission

New sounding instrument in geostationary orbit – applications in Nowcasting

Challenges of MTG for Africa

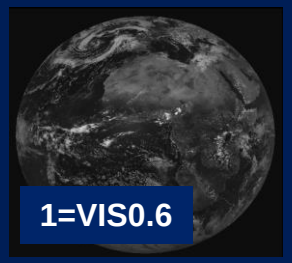
User training

MTG-I imagery mission

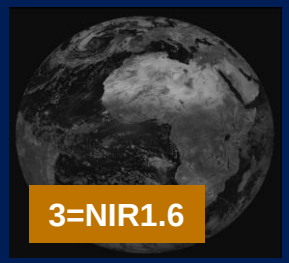
- Imagery mission implemented by two MTG-I satellites
- Full disc imagery every 10 minutes in 16 bands
- Fast imagery of Europe every 2.5 minutes
- New Lightning Imager (LI)
- Start of operations in 2023
- Operational exploitation: ~2023-2043

SEVIRI vs. FCI

4 SOLAR CHANNELS

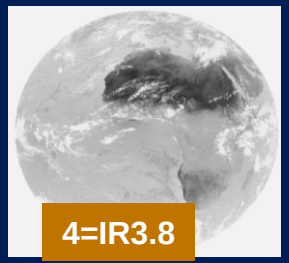


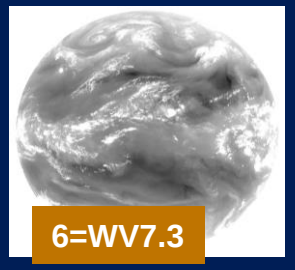
SSD: 1km

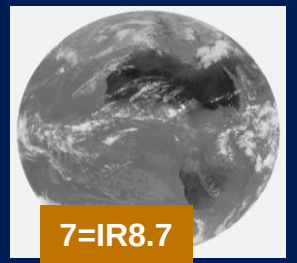


resolution: 3km

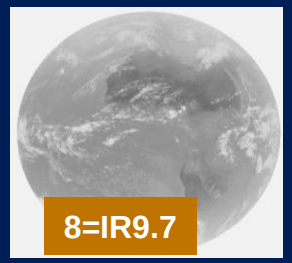
8 THERMAL CHANNELS

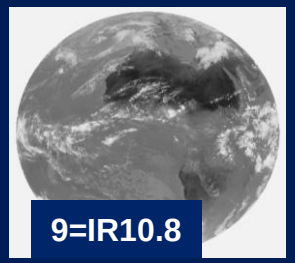


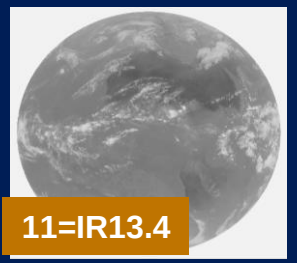




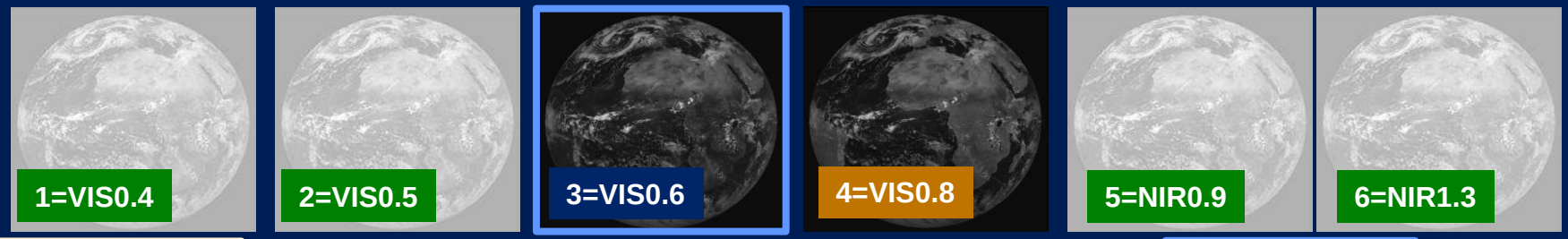
Current SEVIRI



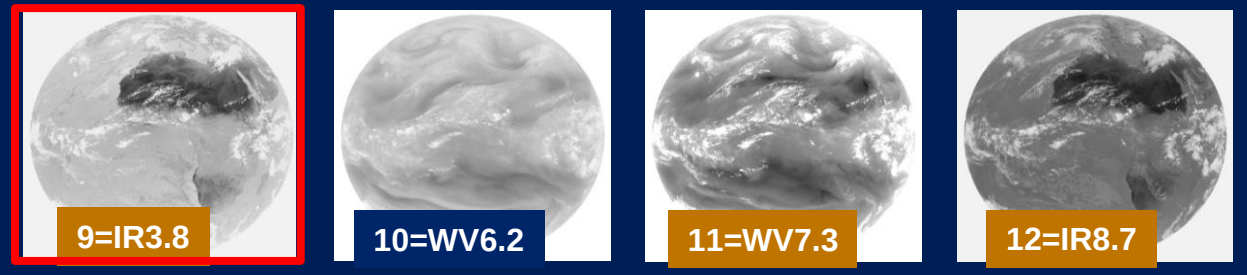




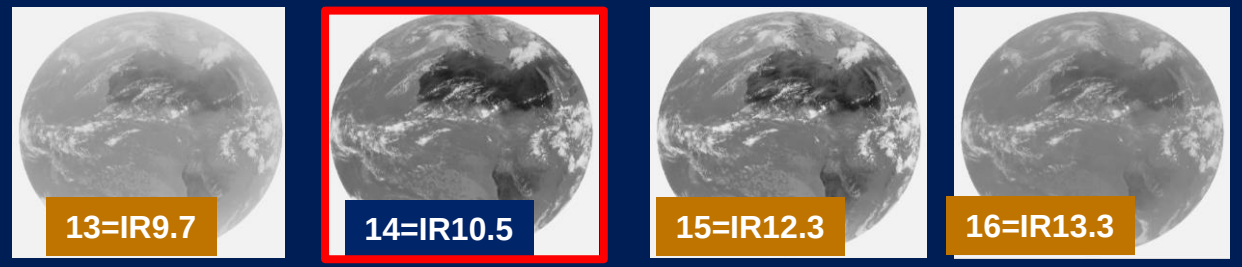
SEVIRI vs. FCI



8 Solar channels provided at 1.0 km (& 0.5 km) resolution



8 Thermal channels provided at 2 km (& 1 km) resolution



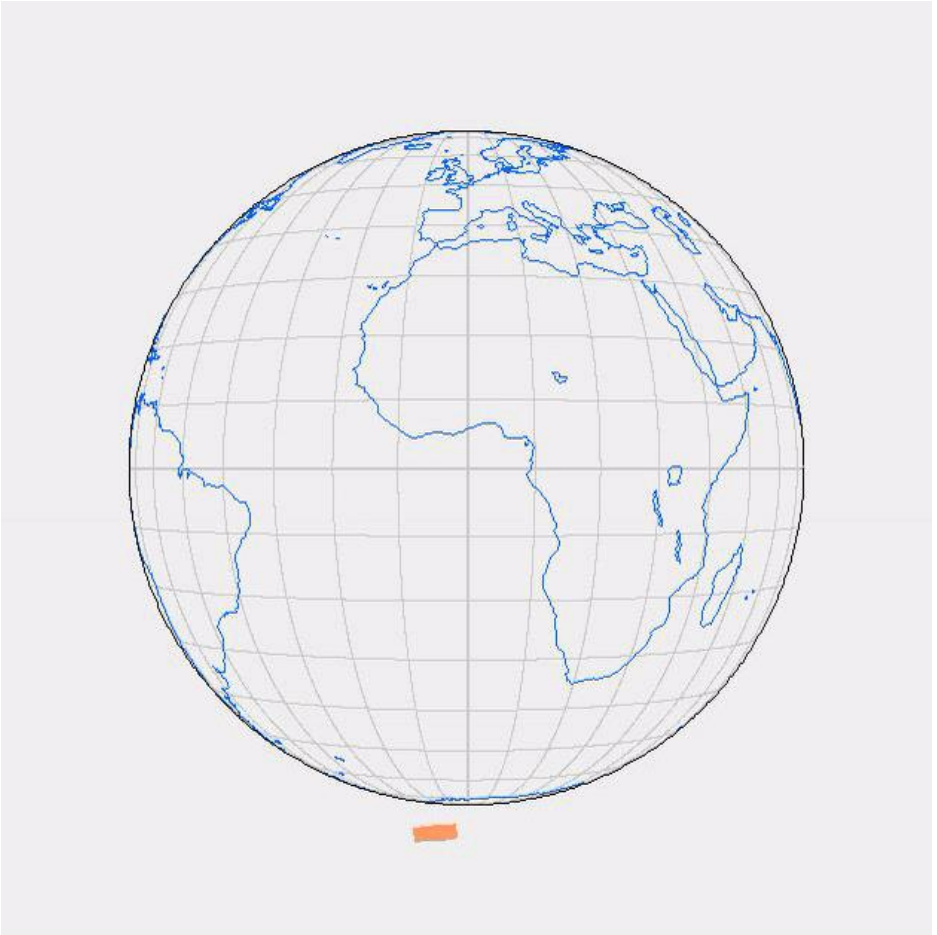
Future FCI

- ✓ **Continuity**
- ✓ **Innovation**

FCI on MTG-I1 will sample 16 channels of the Full Disc every 10 minutes

Applications benefitting from the MTG spectral imager (FCI) include:

- detection of rapid atmospheric processes such as severe storms;
- monitoring of clouds, dust outbreaks, aerosols, fires, land surface changes and a range of other phenomena.



Expected improvements from MTG-I mission – FCI

www.eumetsat.int

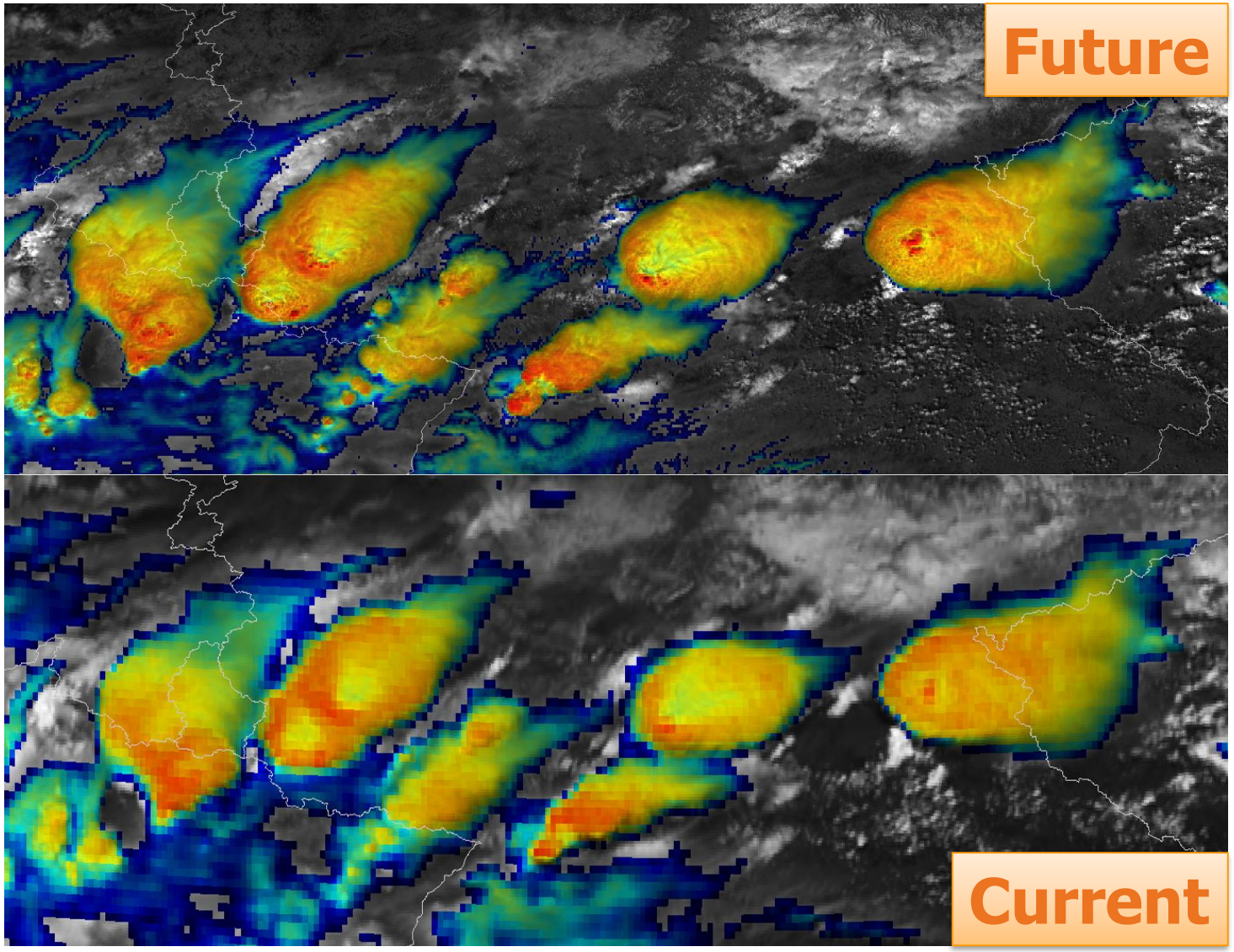
Better spatial resolution

FCI: 0.5, 1 and 2 km
SEVIRI: 3 km

- more detailed analysis of features on top of convective storms

- better view into details of storm top processes

>> nowcast of severe weather occurrence on ground

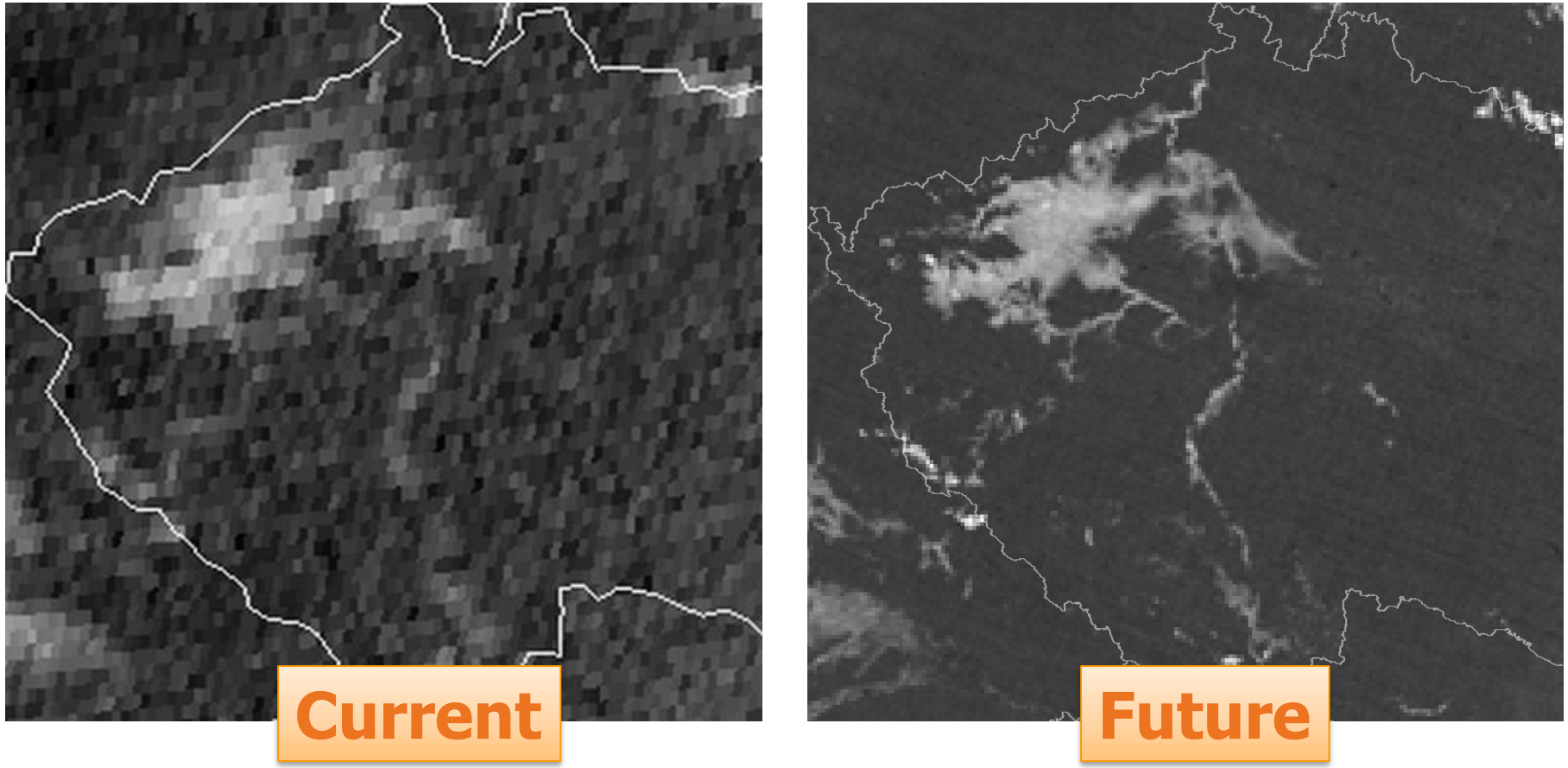


Expected improvements from MTG-I mission – FCI

Fog detection

benefits greatly from satellite imagery at higher spatial and temporal resolution

- Air traffic
- Airport operations
- Monitoring pollution



Example of fog detection

Source: M. Setvak, J. Kerkmann; 16 Nov 2018, 01.37 UTC
Right panel: simulated FCI imagery at ~2 km horizontal resolution (1 km at nadir), based on NOAA Suomi-NPP VIIRS data
Left panel: MSG SEVIRI imagery at 5 km horizontal resolution (3 km at nadir)

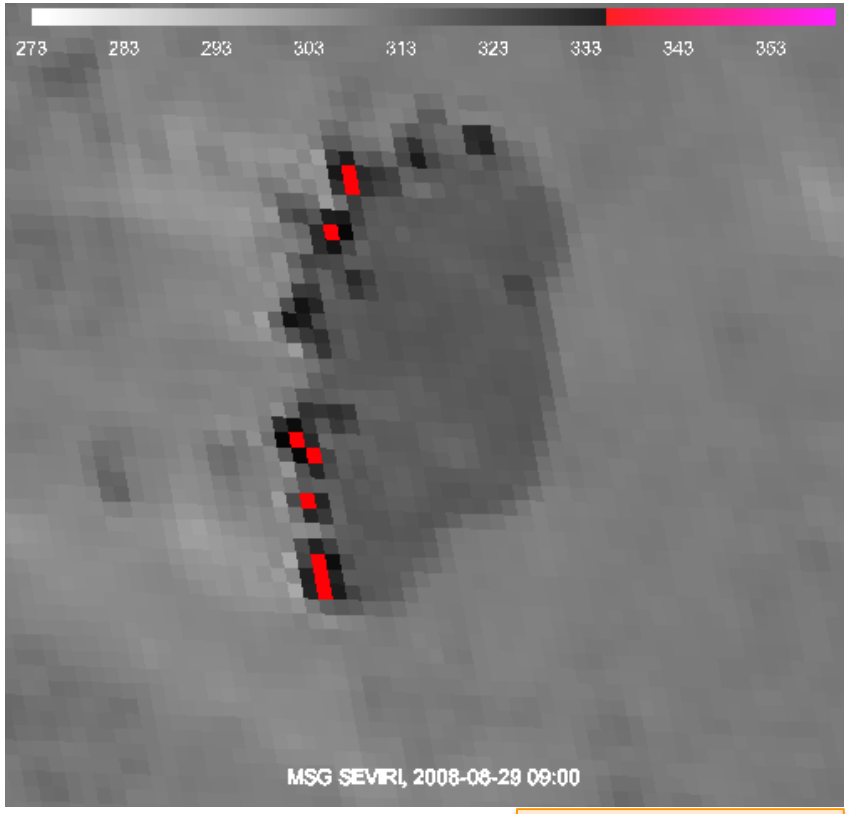
Expected improvements from MTG-I mission – FCI

Fire detection and monitoring

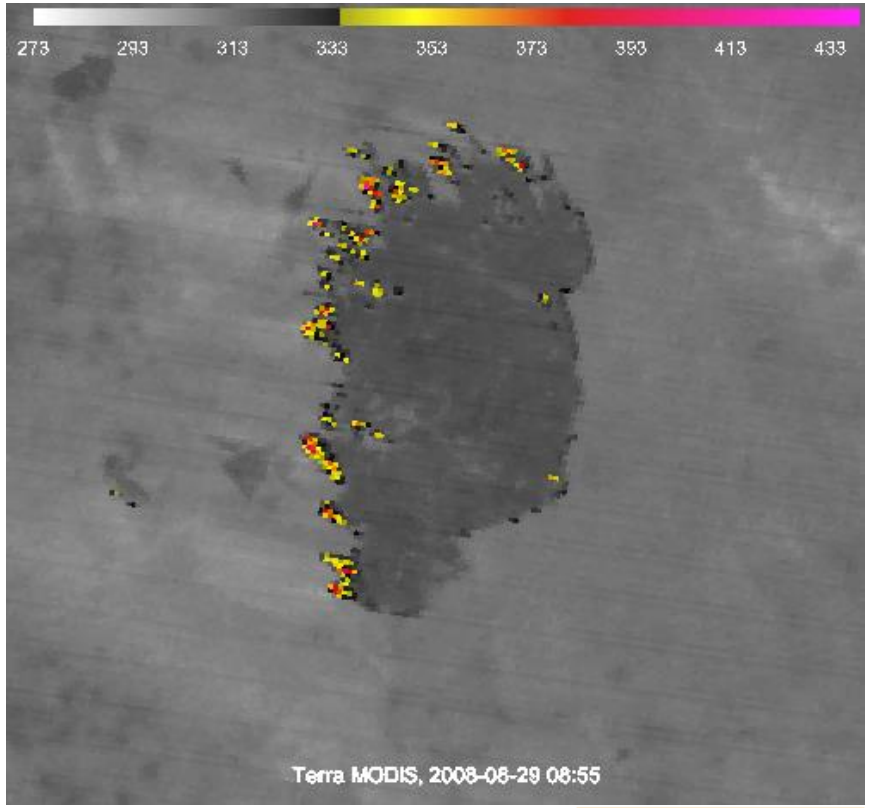
Important new application area!

Data at higher spatial and temporal resolution provide a powerful tool for:

- detecting and fighting fires,
- detecting smoke,
- mapping fire-burned areas



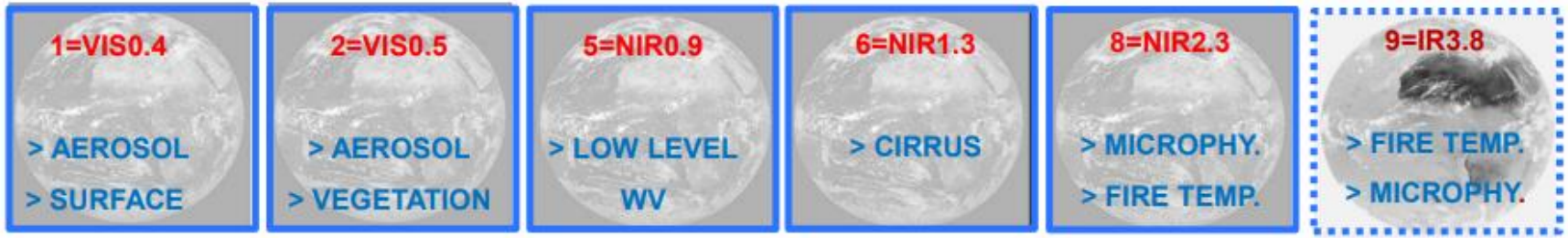
Current



Future

Bushfire line in Botswana as seen in imagery from current Meteosat (left panel) compared to future MTG imagery simulated by proxy data (right panel). MTG imagery will enable more precise detection of fire location and better fire intensity estimates.

New RGBs with FCI



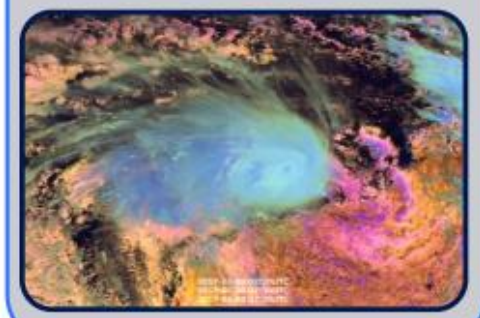
True Colour RGB

R VIS0.6
G VIS0.5
B VIS0.4

Clouds
Aerosols (dust, ash, smoke, smog)
Ocean colour
Vegetation

Cloud Phase RGB

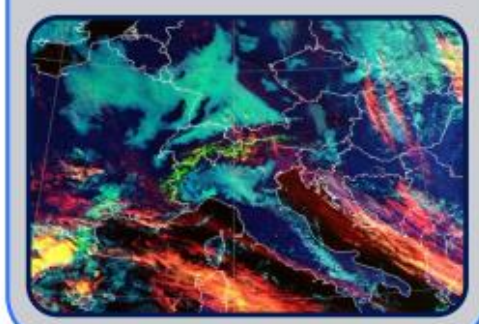
R NIR1.6
G NIR2.3
B VIS0.5/VIS0.6



Cloud phase
Particle size
Snow/ice
Vegetation

Cloud Type RGB

R NIR1.3
G VIS0.8
B VIS1.6



Cloud optical depth
Cloud phase
Snow/ice
Vegetation

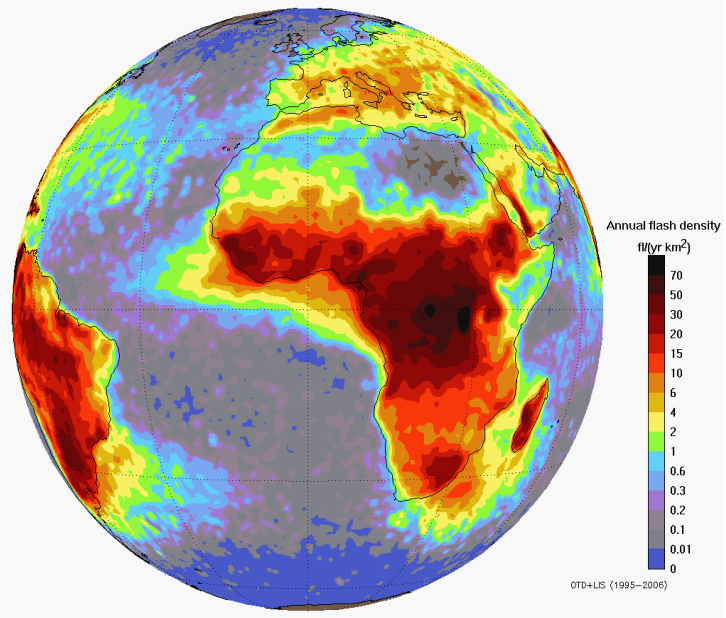
Fire Temp. RGB

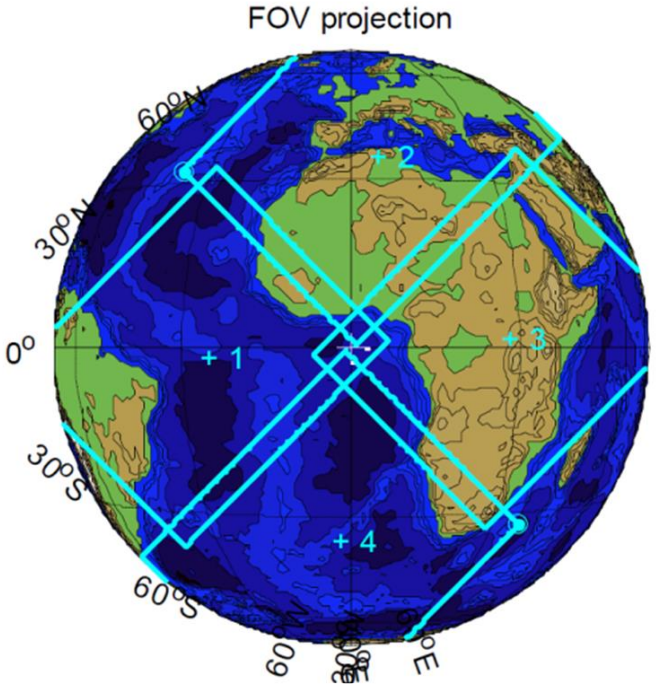
R IR3.9
G NIR2.3
B NIR1.6

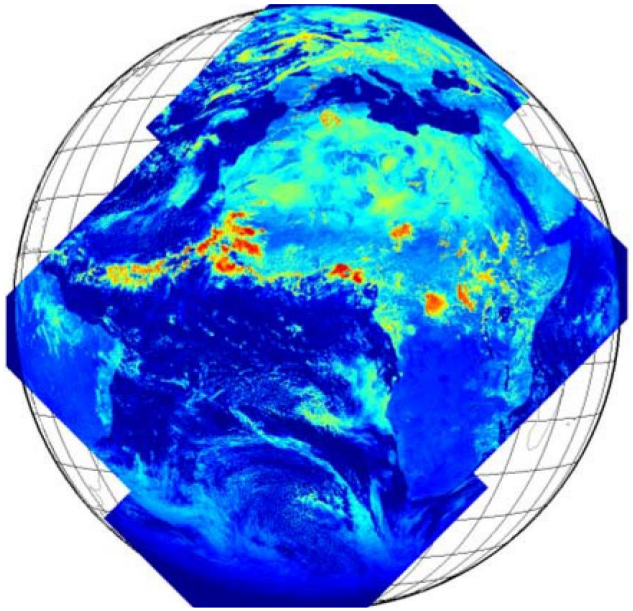
Fire temperature

New instrument – Lightning imager - LI

- Lightning is a precursor of severe weather, with a lead time of tens of minutes
- High annual flash density over Africa!
- MTG LI will measure total lightning, whereas ground-based networks are mostly sensitive to cloud-to-ground lightning



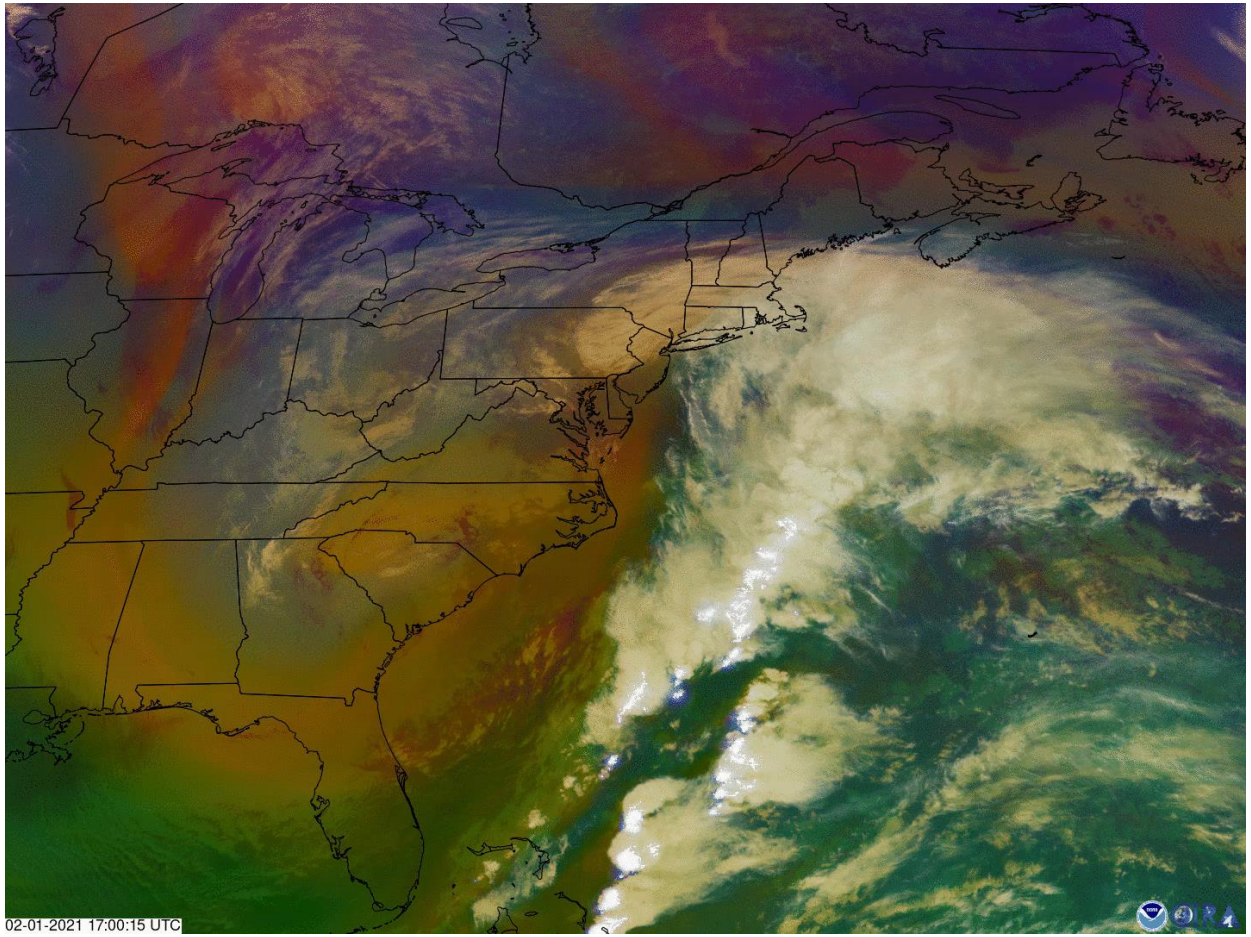




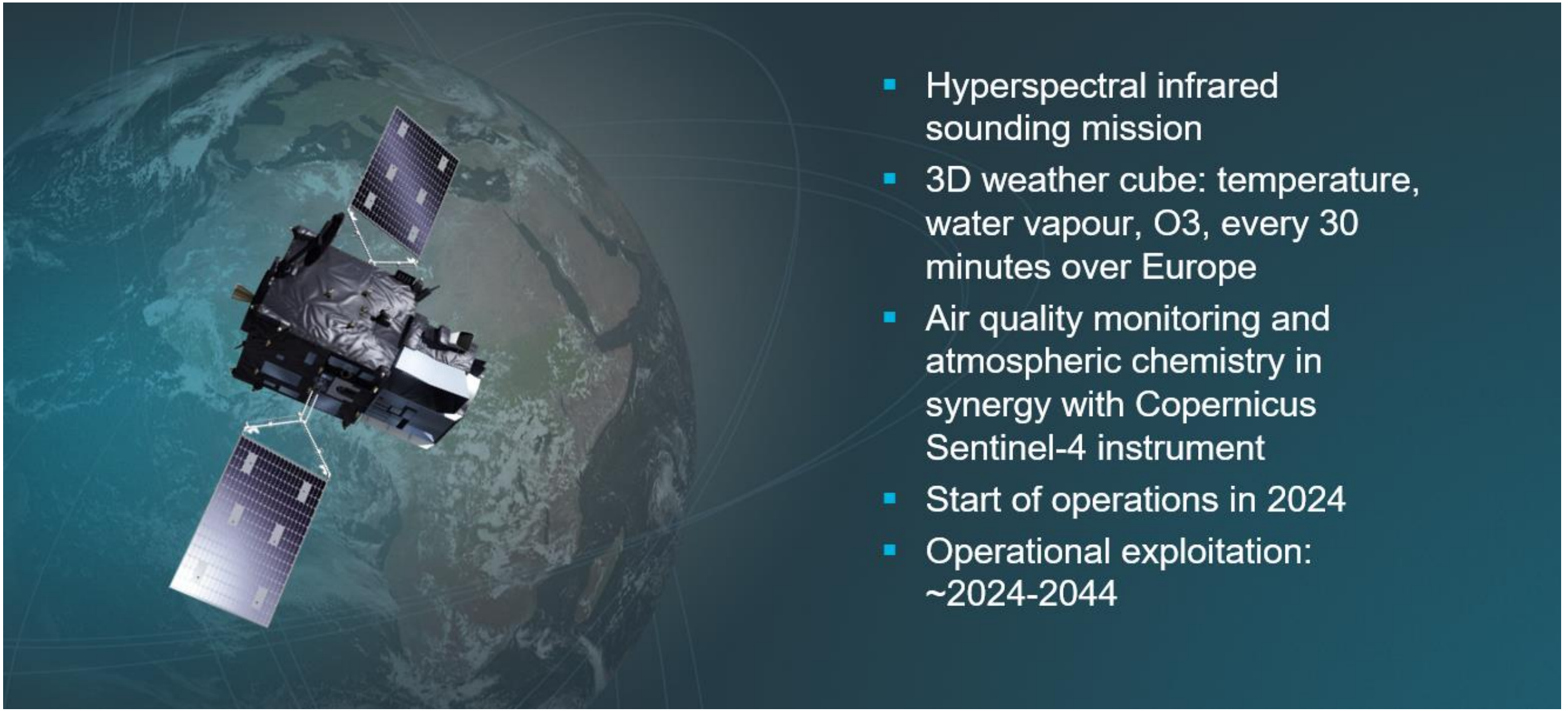
Expected improvements from MTG-I mission - LI

Applications benefitting from the MTG lightning imager (LI) include:

- improved monitoring and forecasting of severe storms;
- enhanced lightning-related safety for air traffic routing and control.



MTG-S sounding mission



- Hyperspectral infrared sounding mission
- 3D weather cube: temperature, water vapour, O3, every 30 minutes over Europe
- Air quality monitoring and atmospheric chemistry in synergy with Copernicus Sentinel-4 instrument
- Start of operations in 2024
- Operational exploitation: ~2024-2044

New instrument – Infra-red Sounder - IRS

Operational spectro-imagery at high spectral, spatial & temporal resolution:

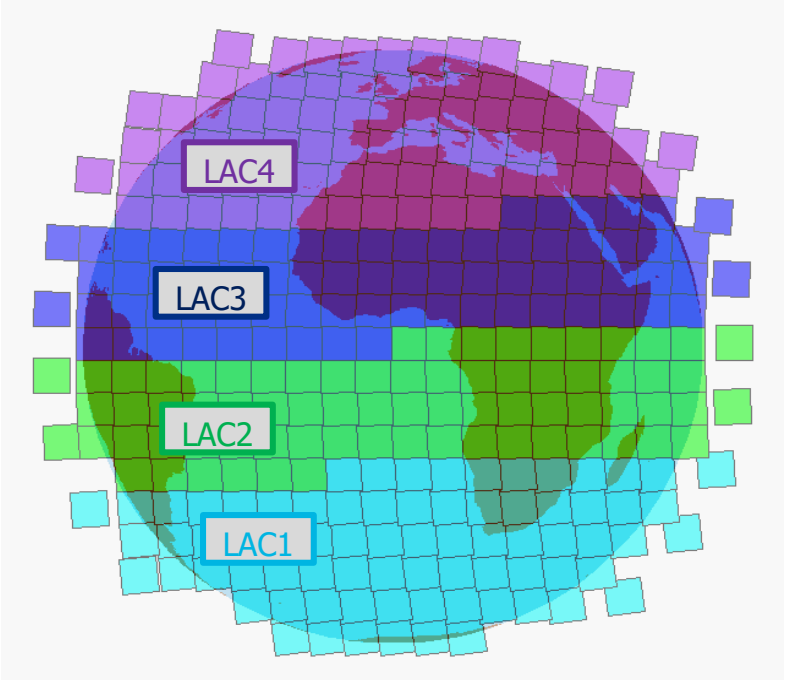
Two spectral bands: MWIR: 1600 to 2250 cm-1 (4.44–6.25 µm)
LWIR: 680 to 1210 cm-1 (8.26–14.70 µm)

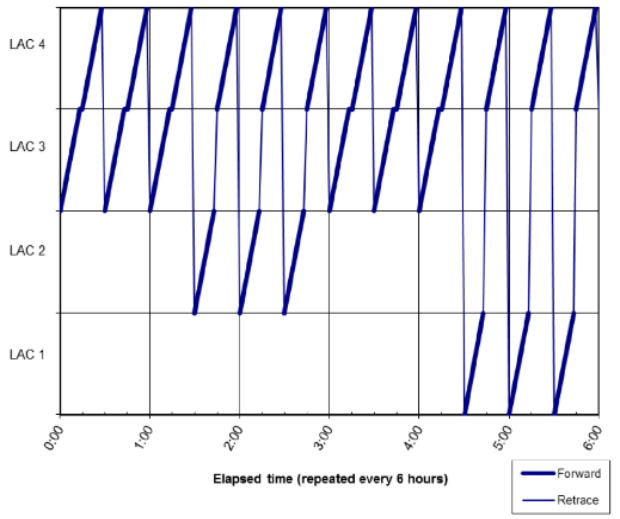
Spatial resolution : 4x4 km at nadir

The Earth disk is split in 4 Local Area Coverage (LAC) zones

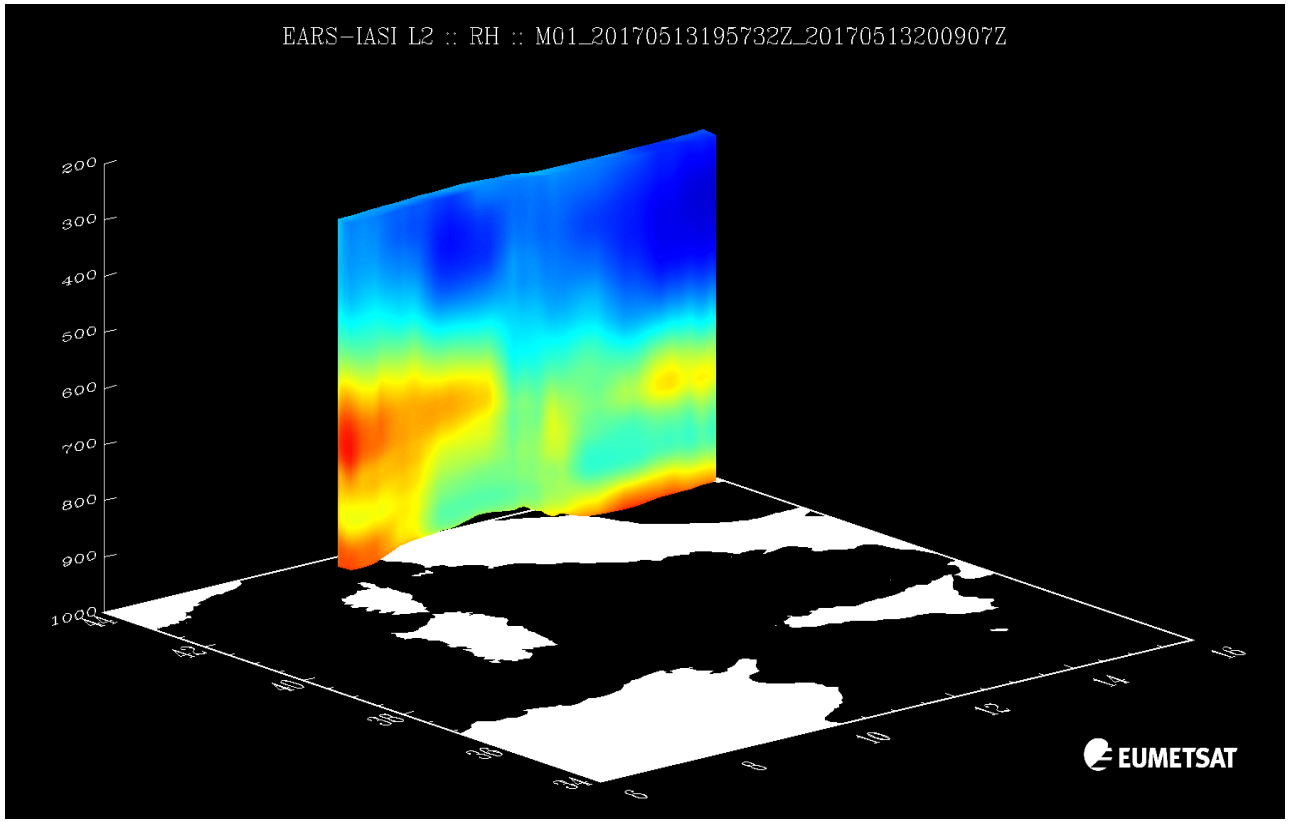
LAC 4 (northern mid-latitudes) covered every 30 minutes

LAC 1, 2, 3 alternatively viewed in-between

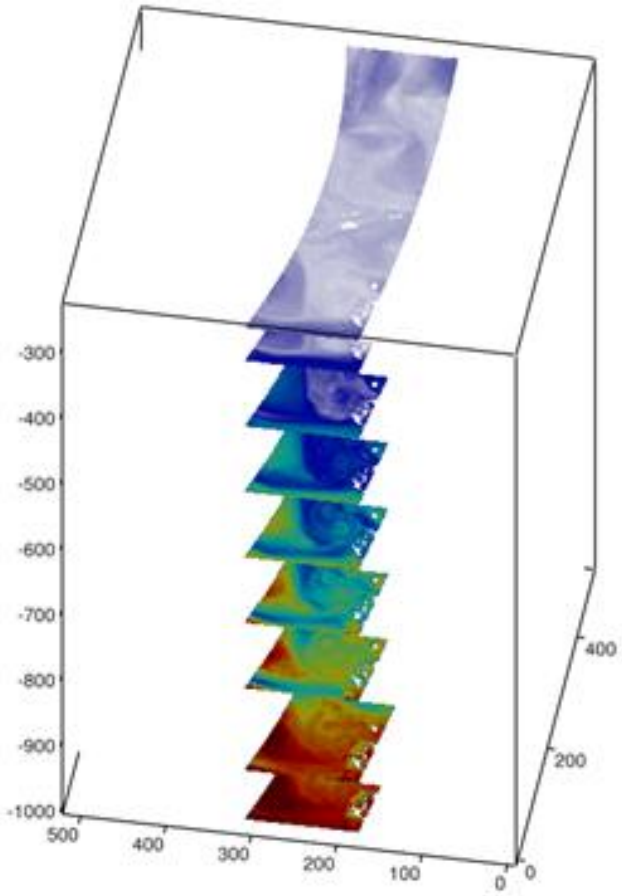




IRS data and applications



Profiles of temperature and humidity
3D weather cube - view of the thermodynamic conditions



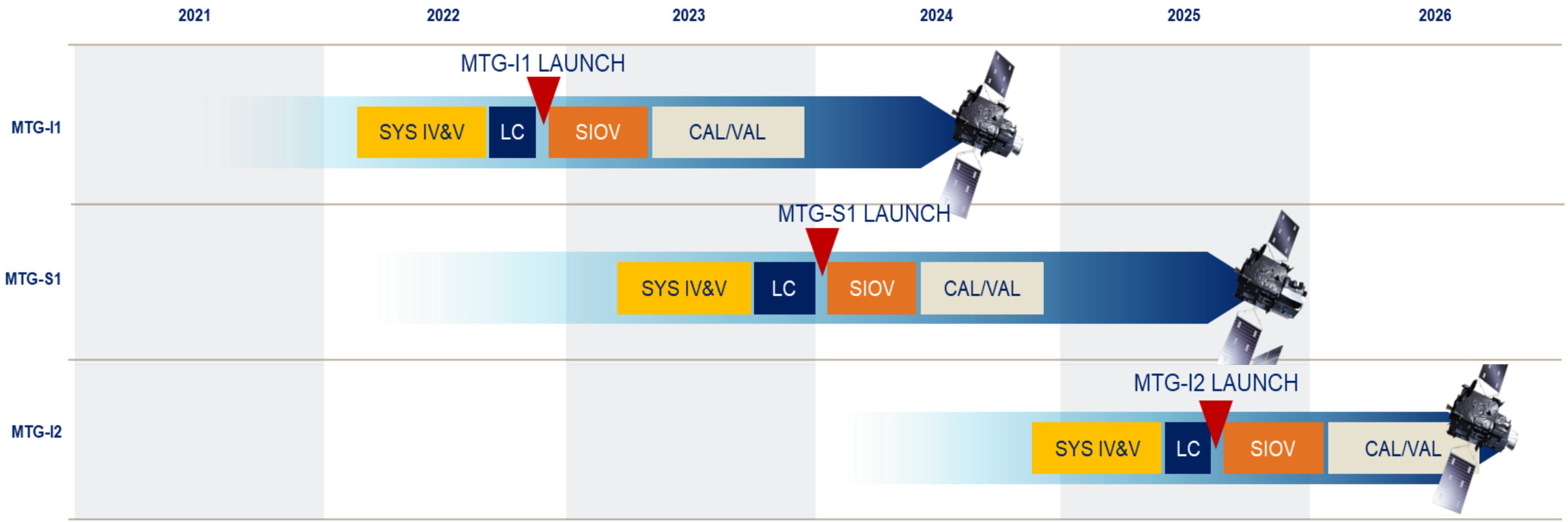
IRS – 3D winds
Wind profiles retrieved at 19 standard pressure levels from 10 to 1000 hPa

IRS data and applications

Applications benefiting from the IRS mission:

- Filling large spatial and temporal gaps in the 12-hour standard radiosonde observations
- Better depiction of the hydrological cycle in models through information on tropospheric moisture structures and their variation in time.
- Four-dimensional information on humidity, temperature and wind (‘4D weather cube’) for support of nowcasting applications:
  - detecting pre-convective situations and convective initiation
  - giving rise to improved warnings on location and intensity of convective storms.
- Information on vertically resolved atmospheric motion vectors with improved height assignment is beneficial for the tropical areas.
- Forecasting pollution and monitoring of atmospheric trace gases as O3 and CO.
- Improved volcanic ash prediction through information on the composition and density of the ash cloud.

Timeline


2021
2022
2023
2024
2025
2026
MTG-I1
MTG-I1 LAUNCH
SYS IV&V
LC
SIOV
CAL/VAL
MTG-S1
MTG-S1 LAUNCH
SYS IV&V
LC
SIOV
CAL/VAL
MTG-I2
MTG-I2 LAUNCH
SYS IV&V
LC
SIOV
CAL/VAL

Delivering MTG data for Africa

FCI imager

The EUMETCast Africa service will provide data products **derived** from the FCI Full Disc Scanning Service (FDSS)

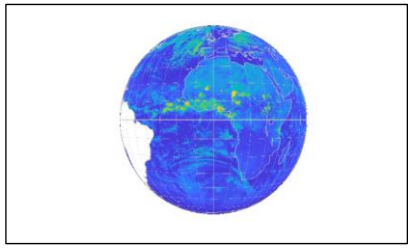


Figure 1: Coverage Full Disc, but no America.

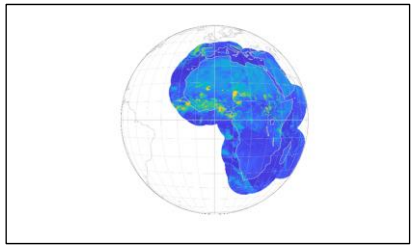


Figure 2: Coverage Africa + 1650km offshore.

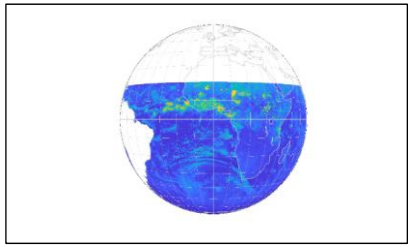


Figure 3: Coverage Subsahara but no America.

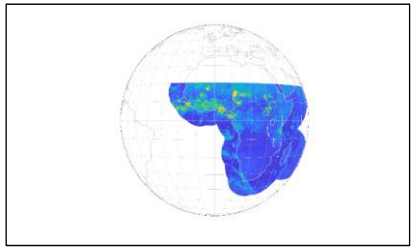


Figure 4: Coverage Subsahara + 1650km offshore.

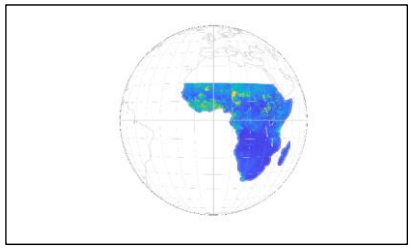


Figure 5: Coverage Subsahara + 100km offshore.

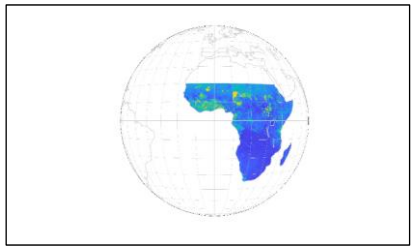
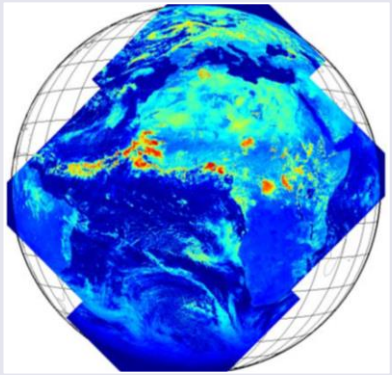


Figure 6: Coverage Subsahara + 20 km offshore.

LI instrument

LI **ACCUMULATED FLASH AREA** will be disseminated via EUMETCast Africa in its native format



Description	Spectral Channel	Coverage	Periodicity
Tuned MSG continuity	VIS 0.4	Subsahara land only	≤4 times/day
with MTG innovation,	VIS 0.5	Subsahara land only	≤4 times/day
3km SSD	VIS 0.6	Full Disc but no America	10 minutes
	VIS 0.8	Full Disc but no America	10 minutes
	VIS 0.9	Africa + 1650 km offshore	30 minutes
	NIR 1.3	Full Disc but no America	30 minutes
	NIR 1.6	Full Disc but no America	10 minutes
	NIR 2.2	Full Disc but no America	30 minutes
	IR 3.8	Full Disc but no America	10 minutes
	WV 6.3	Full Disc but no America	20 minutes
	WV 7.3	Full Disc but no America	20 minutes
	IR 8.7	Africa + 1650 km offshore	10 minutes
	IR 9.7	Full Disc but no America	10 minutes
	IR 10.5	Full Disc but no America	10 minutes
	IR 12.3	Full Disc but no America	10 minutes
	IR 13.3	Subsahara land only	≤4 times/day
HRV continuity, same as 3KM VIS06 product, but with 1km SSD	VIS 0.6	Africa + 500 km offshore	10 minutes

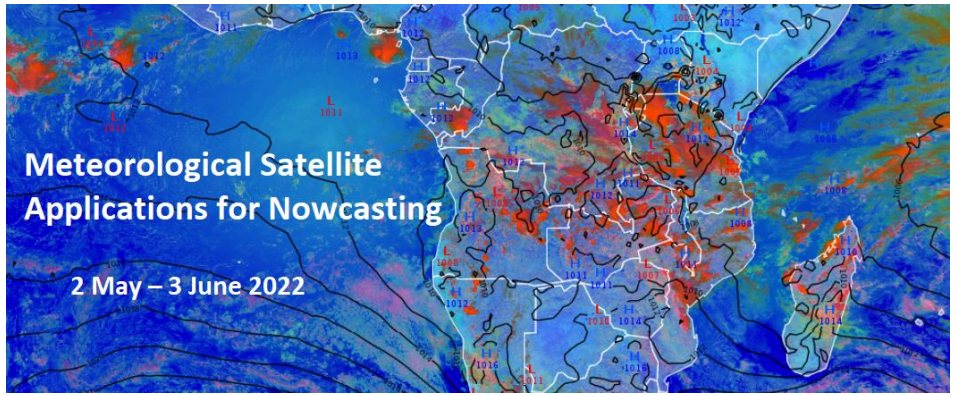
NWC SAF products

Some products (CRR, RDT) will be produced in EUMETSAT and disseminated on EUMETCast Africa

Product Name	Coverage Mask	Periodicity	SSD
Severe Convection RGB	Subsahara + 20km offshore	10 minutes	1x1km
Night Microphysics RGB	Subsahara + 20km offshore	20 minutes	1x1km
True Colour RGB	Full Disc	20 minutes	3x3km
Fire Temperature RGB	Subsahara + 20km offshore	30 minutes	1x1km
Cloud Phase RGB	Subsahara + 20km offshore	10 minutes	1x1km

User training

- Satellite applications courses in English and French
- ✓ upcoming course **2 May – 3 June** focusing on identification of weather features with nowcasting aspects
- ✓ applications are open (https://training.eumetsat.int/)
- ✓ letter of invitation to PRs with WMO will be sent soon



- ASMET Africa – online training - resources, case studies at: https://asmet.africa/

ASMET African Satellite Meteorology Education and Training

- SWIFT project

The EUMETSAT User Service Helpdesk can answer your questions regarding MTG. Contact our team at **ops@eumetsat.int**

Key features of Meteosat Third Generation - MTG

- Innovation for monitoring and forecasting **severe weather**:
  - Near real-time tracking of the 3-dimensional atmospheric structure, to gain lead time in forecasting severe storms.
  - Real-time data on the location and intensity of lightning flashes, to better forecast thunderstorms.
- Improved monitoring of **key meteorological parameters** such as water vapour, temperature and clouds at higher resolution, precision, using new spectral measurements.
- First-time high-frequency monitoring of **air quality** from space.

Enhanced continuity of data for monitoring atmosphere, land surfaces, and oceans, building on Meteosat Second Generation heritage.

Thank you!

Questions are welcome.