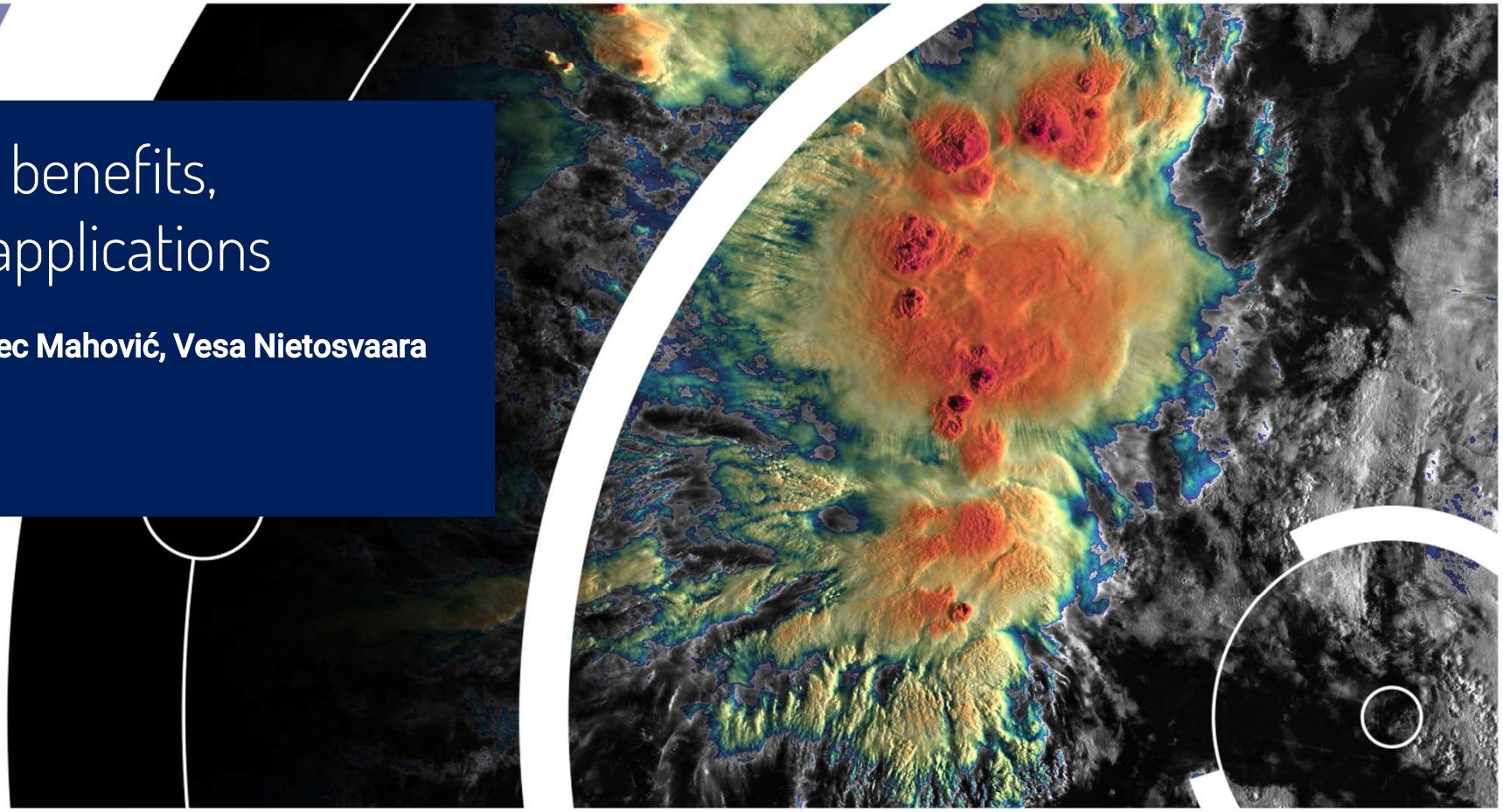
EUMETSAT

# MTG – novelties, benefits, improvements, applications

**Carla Barroso, Nataša Strelec Mahović, Vesa Nietosvaara**

EUMETSAT



# MTG Mission Objectives



**MTG-I**

Full Disc image service

- 16 spectral channels over Europe and Africa every 10 minutes
- Lightning Imager

**MTG-S**

Full Disc sounding service

- Hyperspectral Infrared Sounder
- Copernicus Sentinel-4 UVN

**MTG-I**

Rapid Scanning Service

- 16 spectral channels over Europe every 2.5 minutes

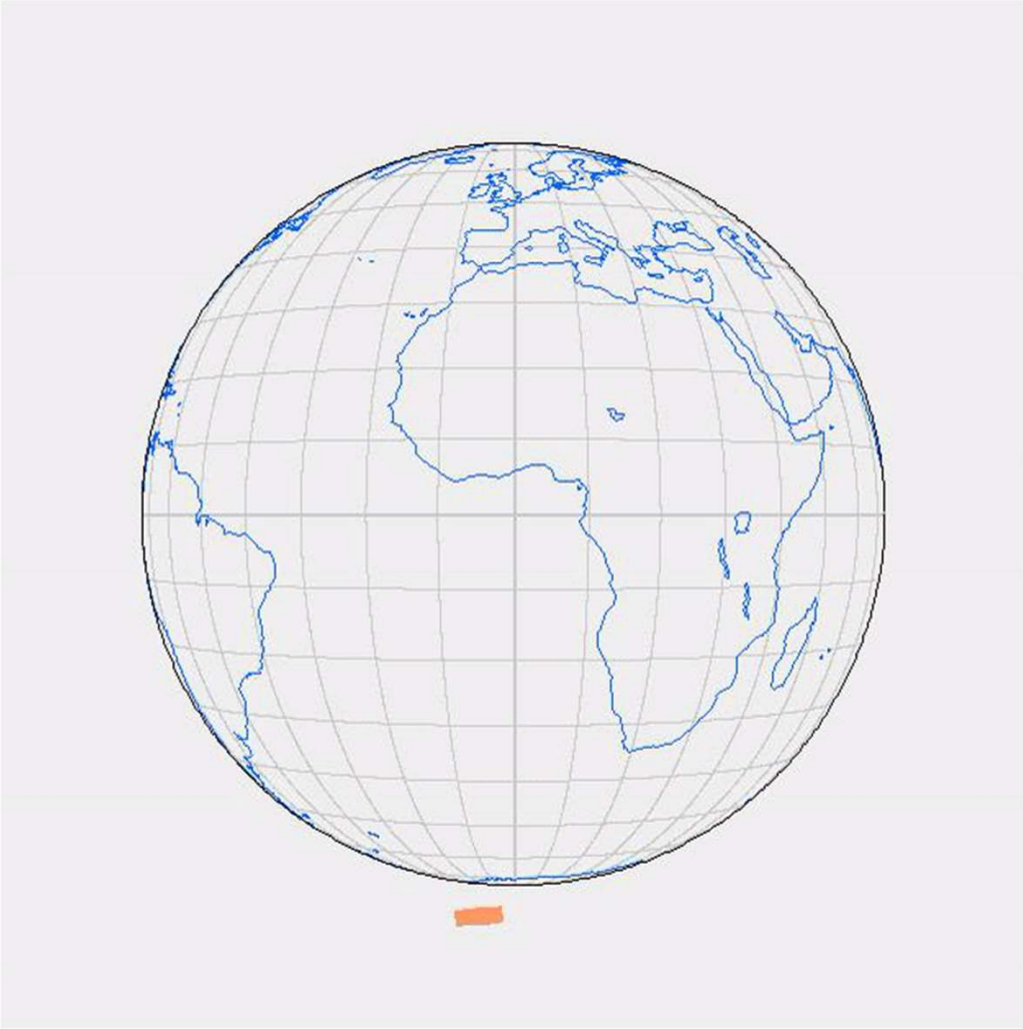
## Primary mission:

- **Support Nowcasting/ Short Range Forecasting of high impact weather**
  - **This is achieved through:**
    - **Continuity and enhancement of MSG imagery**
    - **Addition of a new lightning imaging capability**
    - **New, innovative infrared hyper-spectral sounding**

# MTG-FCI Full Disc Scanning Service (FDSS)



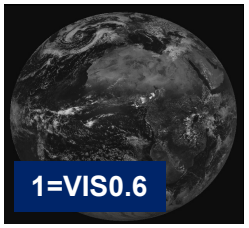
**To support the Full Disc Scanning Service, the FCI on MTG-I1 will sample all channels of the Full Disc every 10 minutes.**

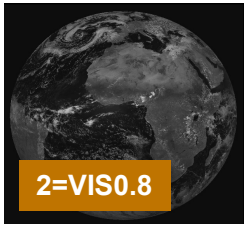


# SEVIRI imager channels



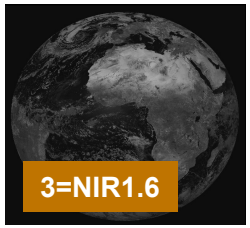
**Narrow-band channels provided at 3.0 km resolution.**

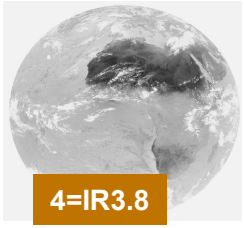


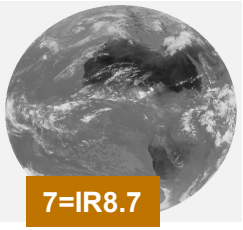


**HRV channel provided at 1.0 km resolution.**

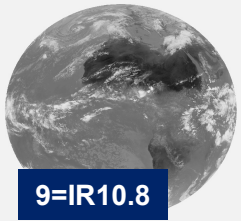


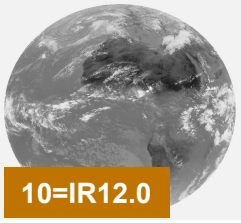









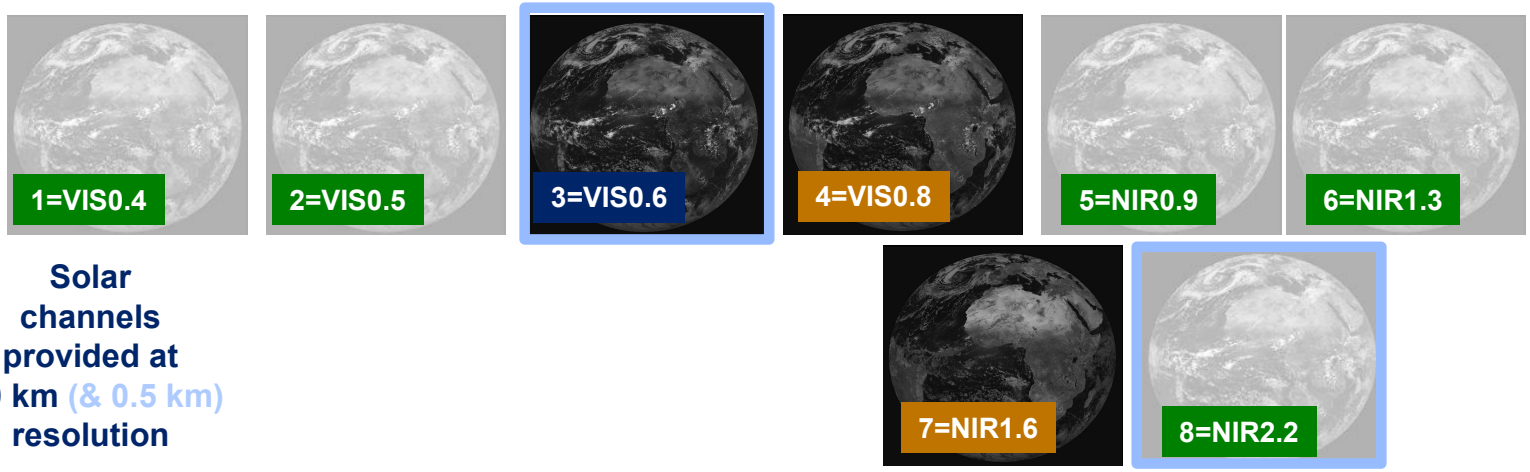





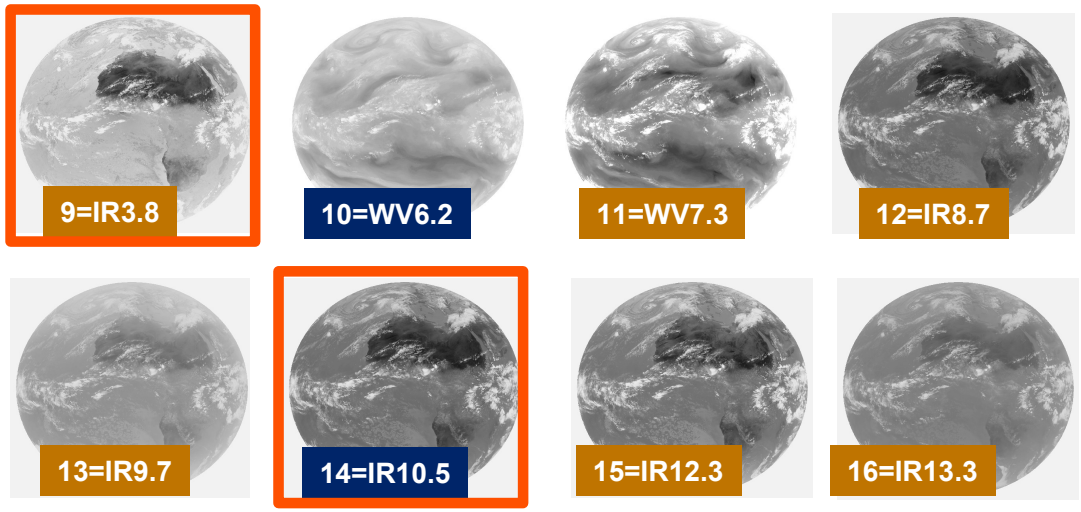
**SEVIRI**

# FCI imager channels



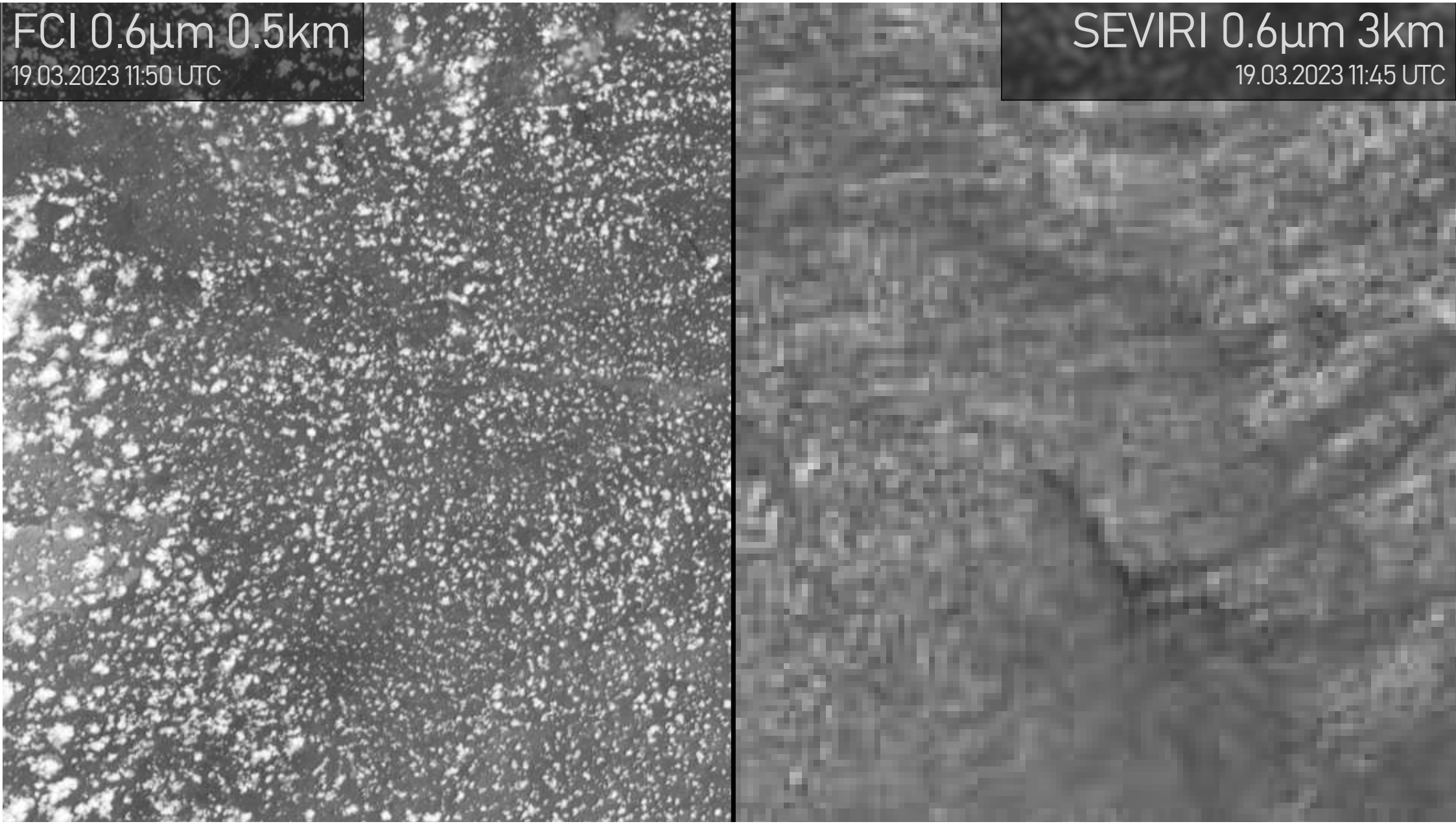



**Solar channels provided at 1.0 km (& 0.5 km) resolution**




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

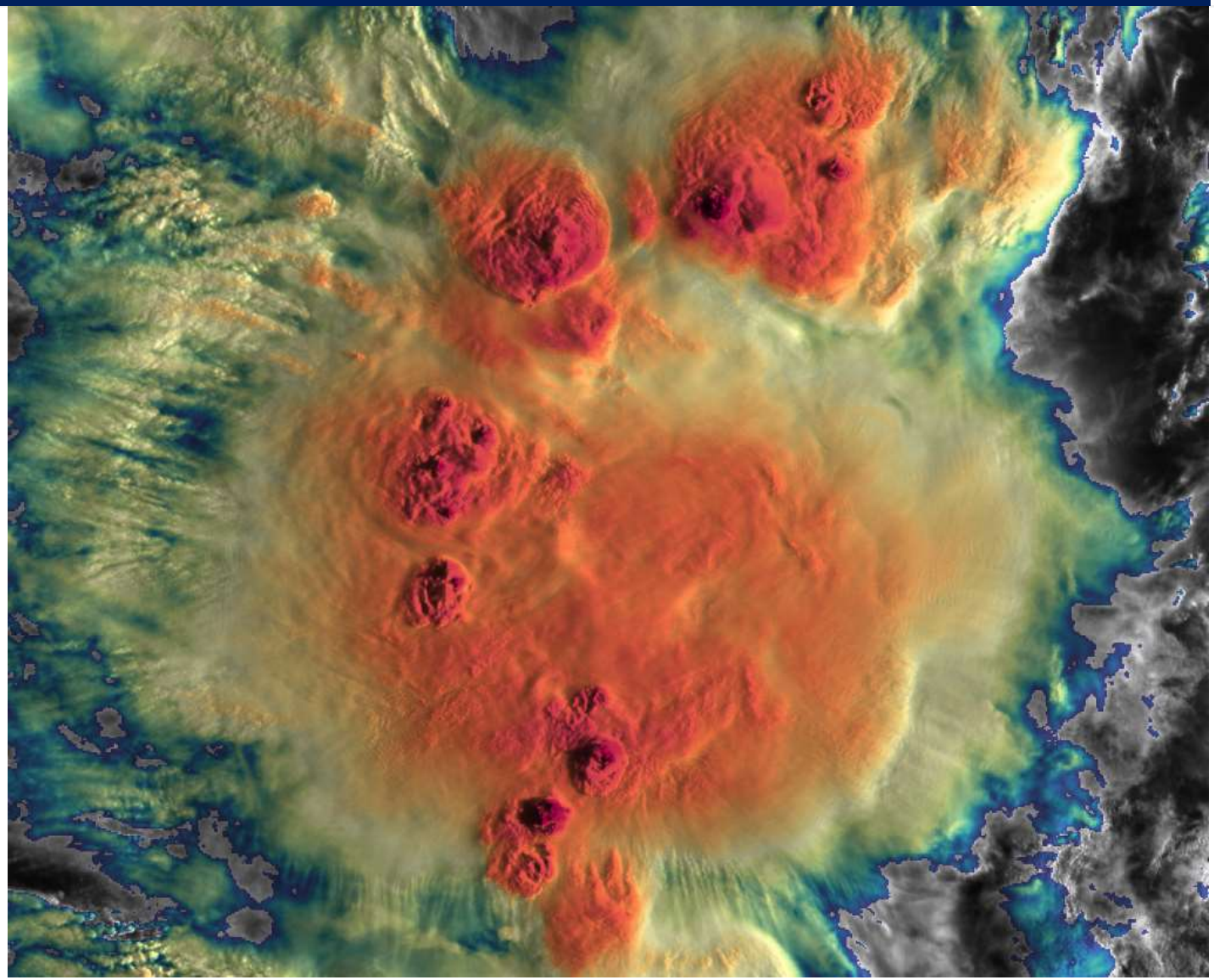
FCI


FCI 0.6µm 0.5km
19.03.2023 11:50 UTC
SEVIRI 0.6µm 3km
19.03.2023 11:45 UTC

# Improvements – Spatial resolution

19 March 2023, 06 UTC

MTG RI



MTG + EPS-SG

# EXPECTED IMPROVEMENTS FROM MTG-I MISSION

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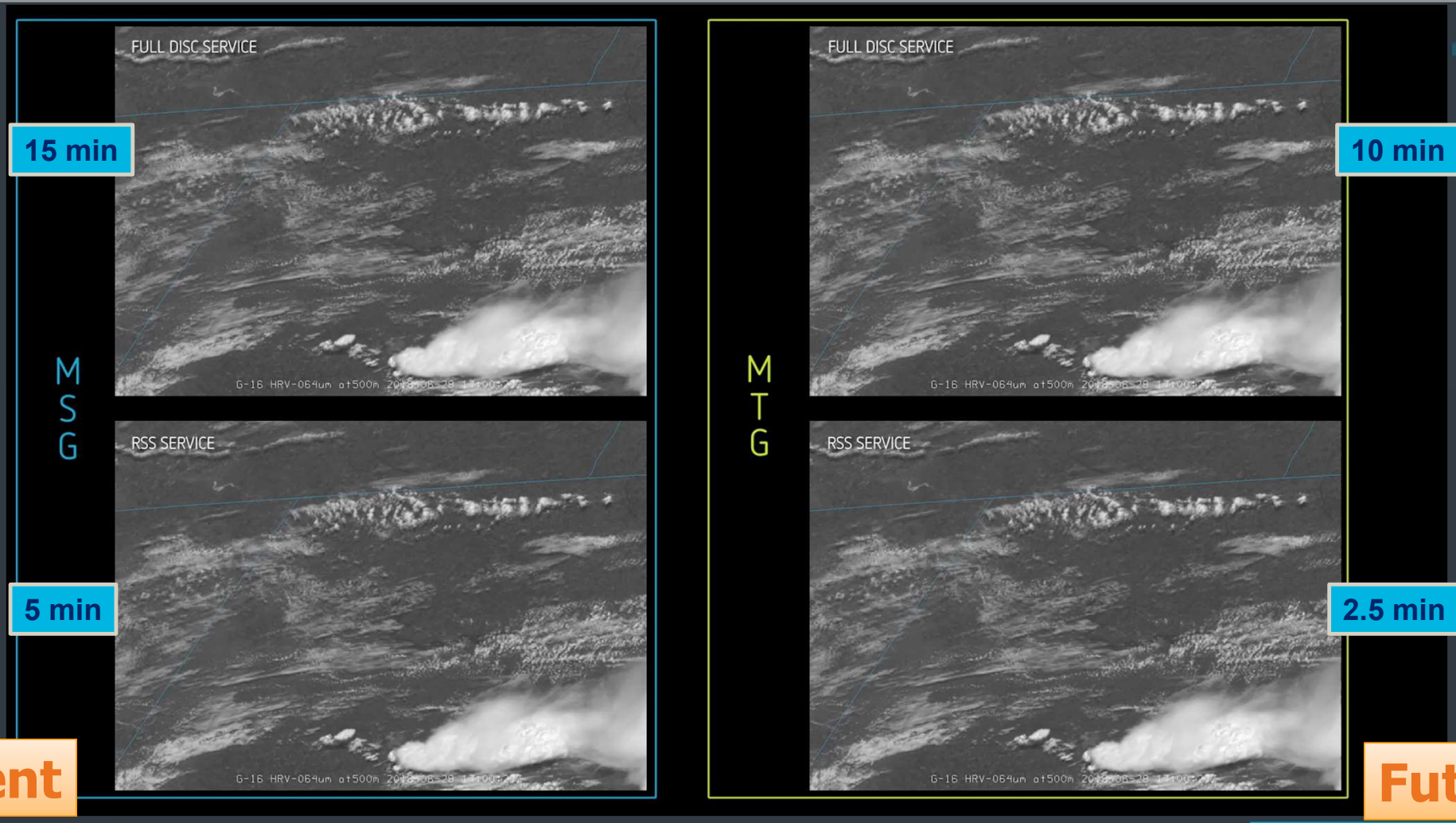
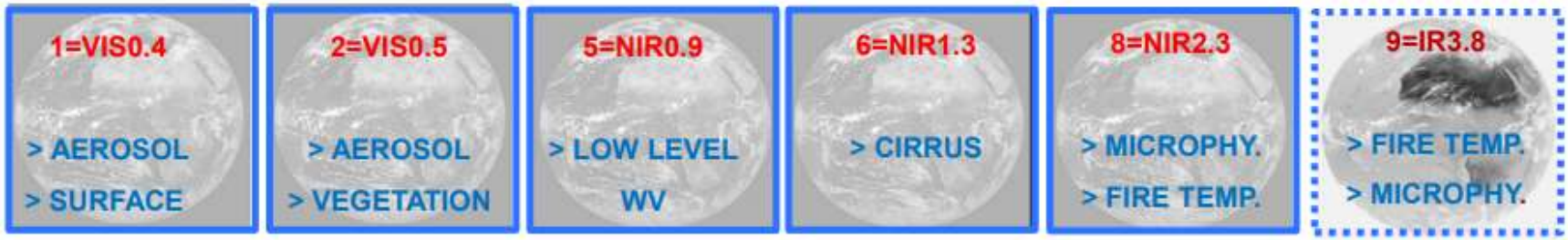



Current

Future

# MTG FCI new RGBs

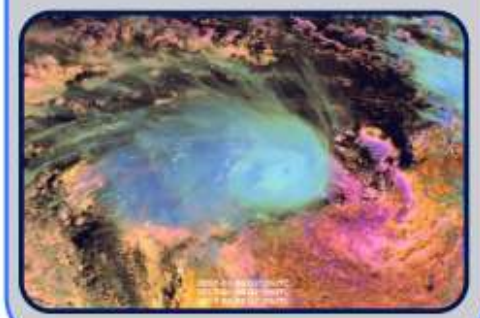



## True Colour RGB

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

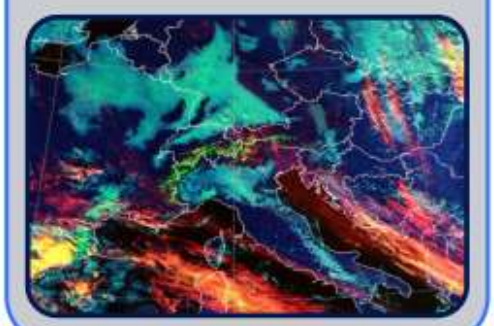
## Cloud Phase RGB

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



## Cloud Type RGB

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



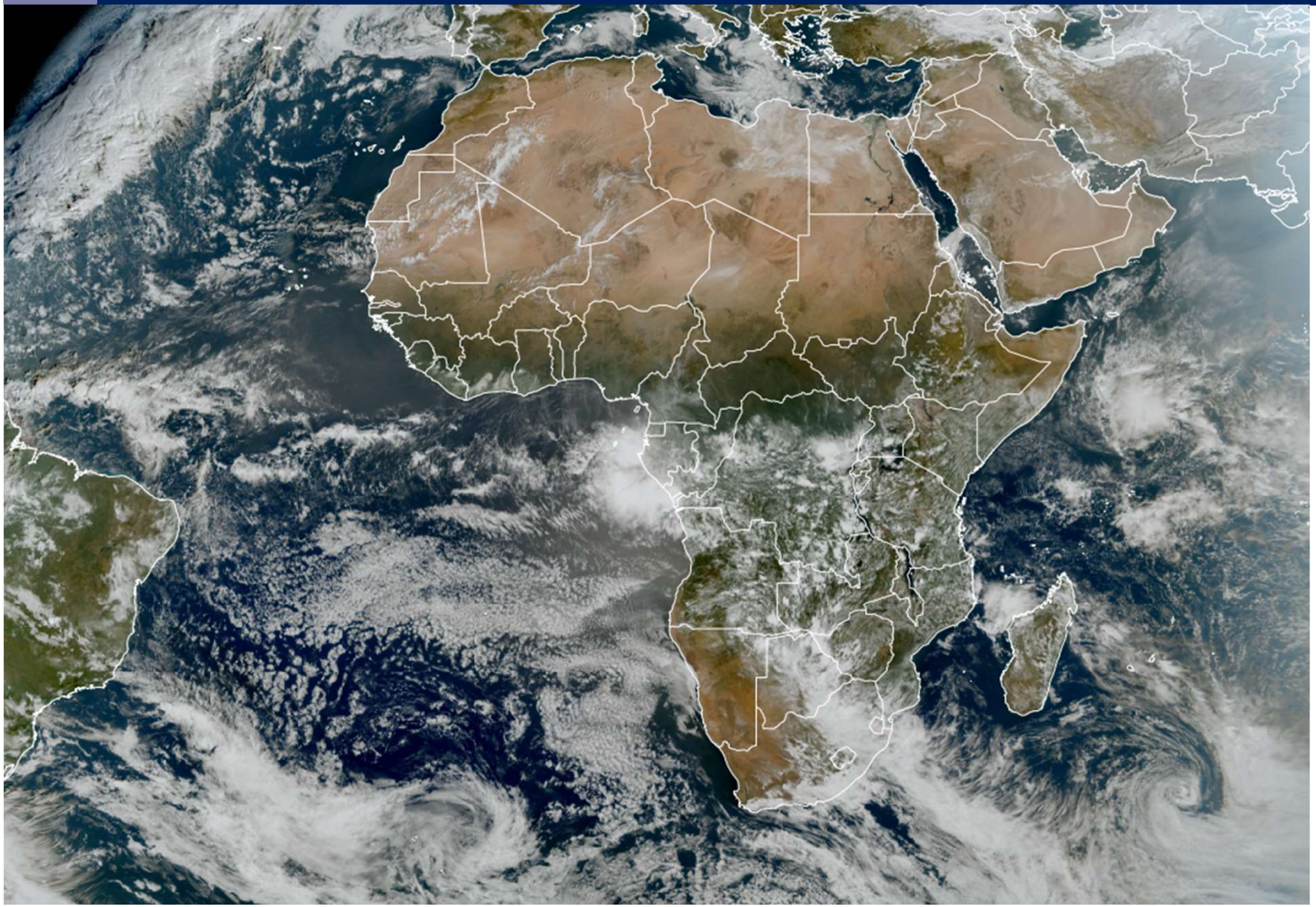
## Fire Temp. RGB

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

# MTG FCI new RGBs

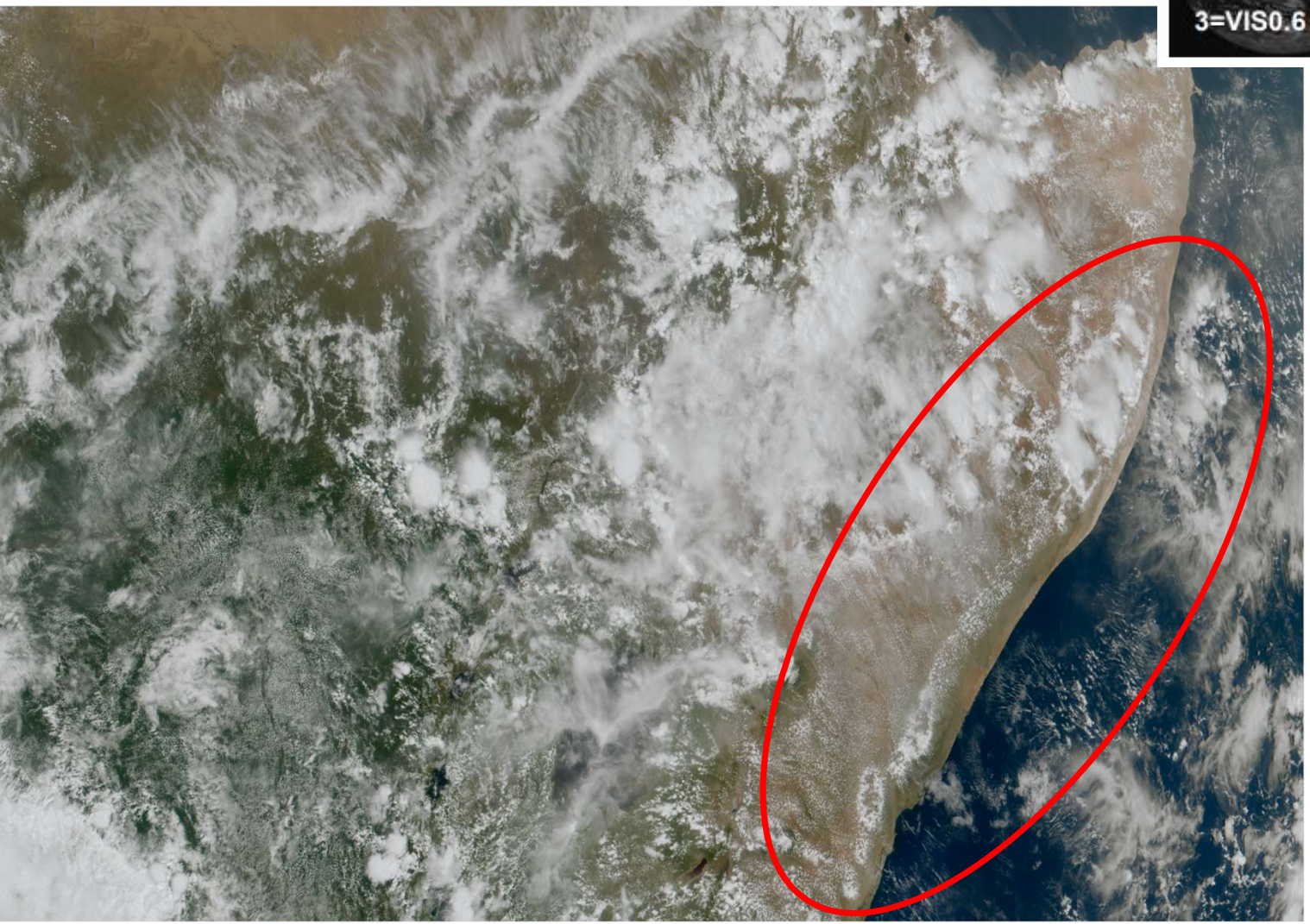
# True colour RGB

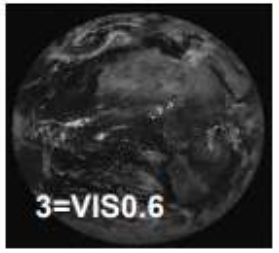


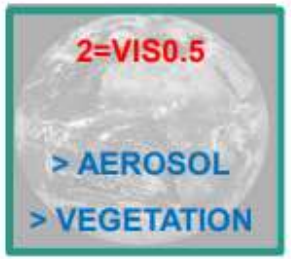


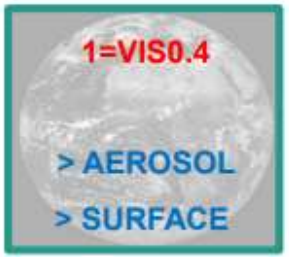
True colour RGB
25 December 2023,
10:30 UTC

# True colour RGB (0.64 – 0.51 – 0.44 μm)





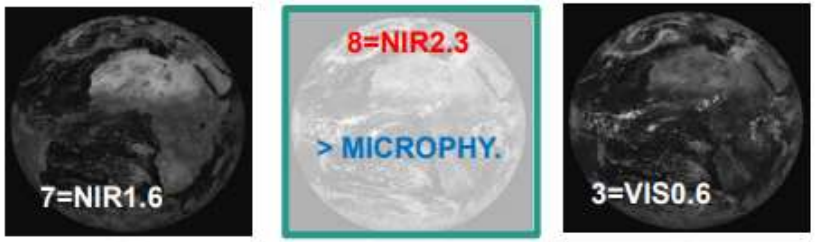

- Clouds
- Aerosols (dust, ash, smoke, smog)
- Ocean Colour
- Vegetation

Coast of Somalia

18 March 2023, 11:50 UTC

Sea-breeze front with convection initiating in the northern part

# Cloud Phase RGB (1.61 – 2.25 – 0.64 µm)




- Cloud phase
- Particle size
- Snow/ice
- Vegetation

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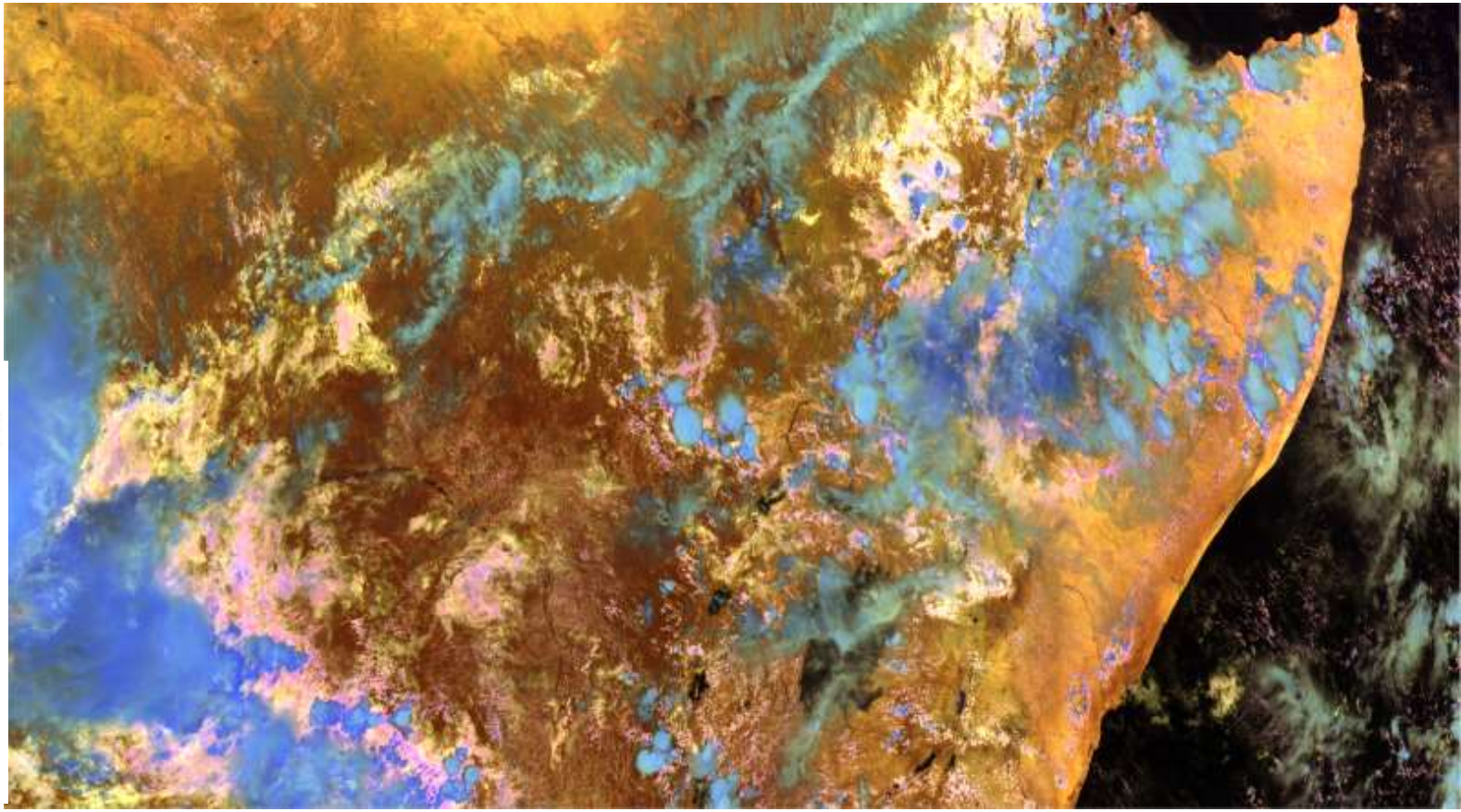
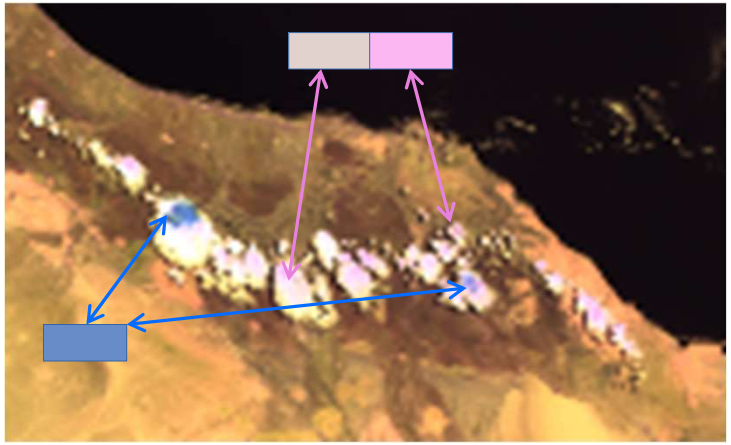
MTG-I1 Cloud Phase RGB - 18 March 2023, 11.50 UTC

| | |
|---|---|
| 1 | Thick ice clouds, large particles |
| 2 | Thick ice clouds, small particles |
| 3 | Thin ice clouds |
| 4 | Thick water clouds, small droplets |
| 5 | Thick water clouds, larger droplets (larger the droplets are darker pink) |
| 6 | Thick water clouds, extreme large droplets (or thick mixed phase clouds) |
| 7 | Thin water clouds over sea |
| 8 | Vegetated land (snow free) |
| 9 | Sea (ice free) |
| 10 | Desert |
| 11 | Snow on ground or sea ice |



# Cloud Phase RGB

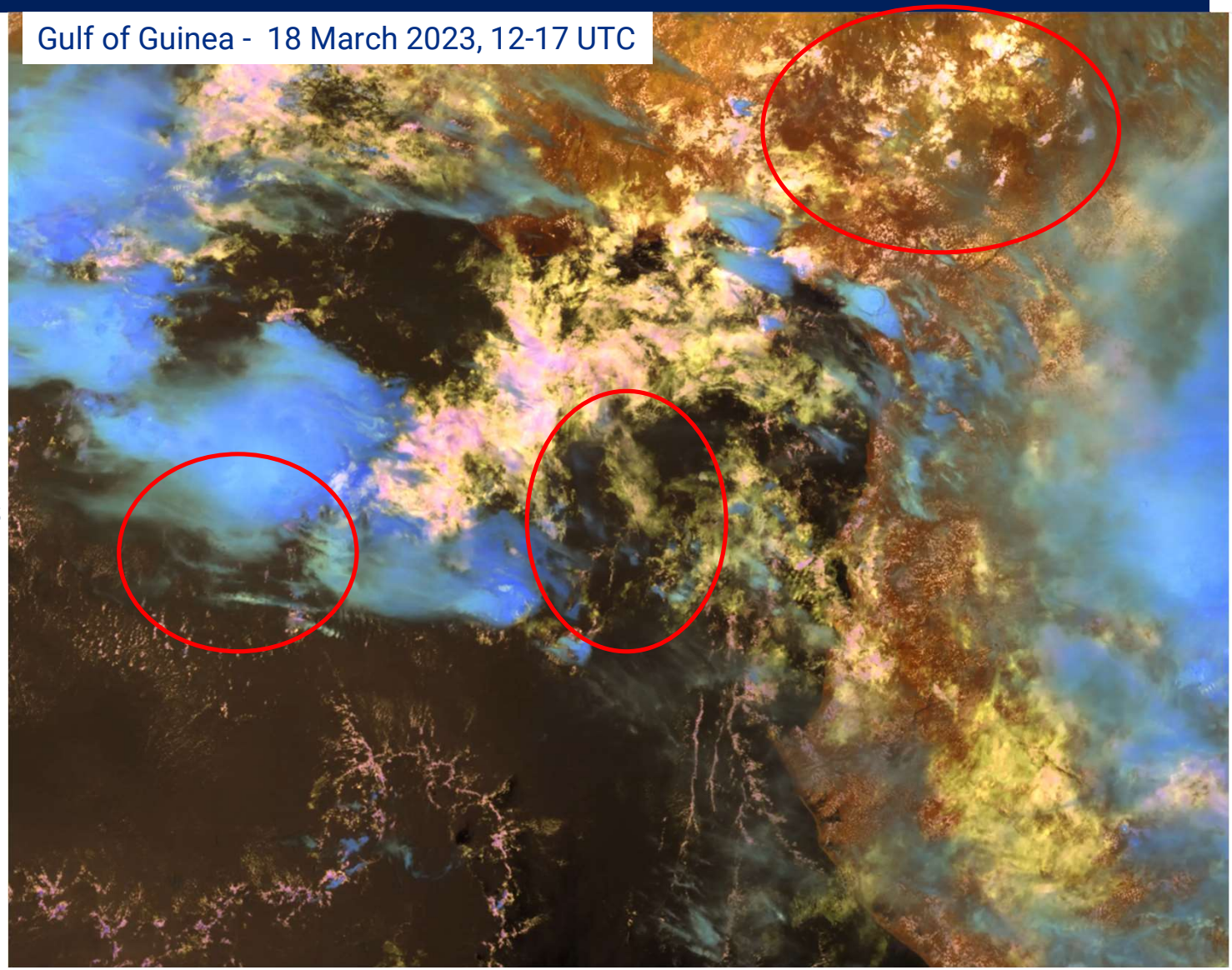


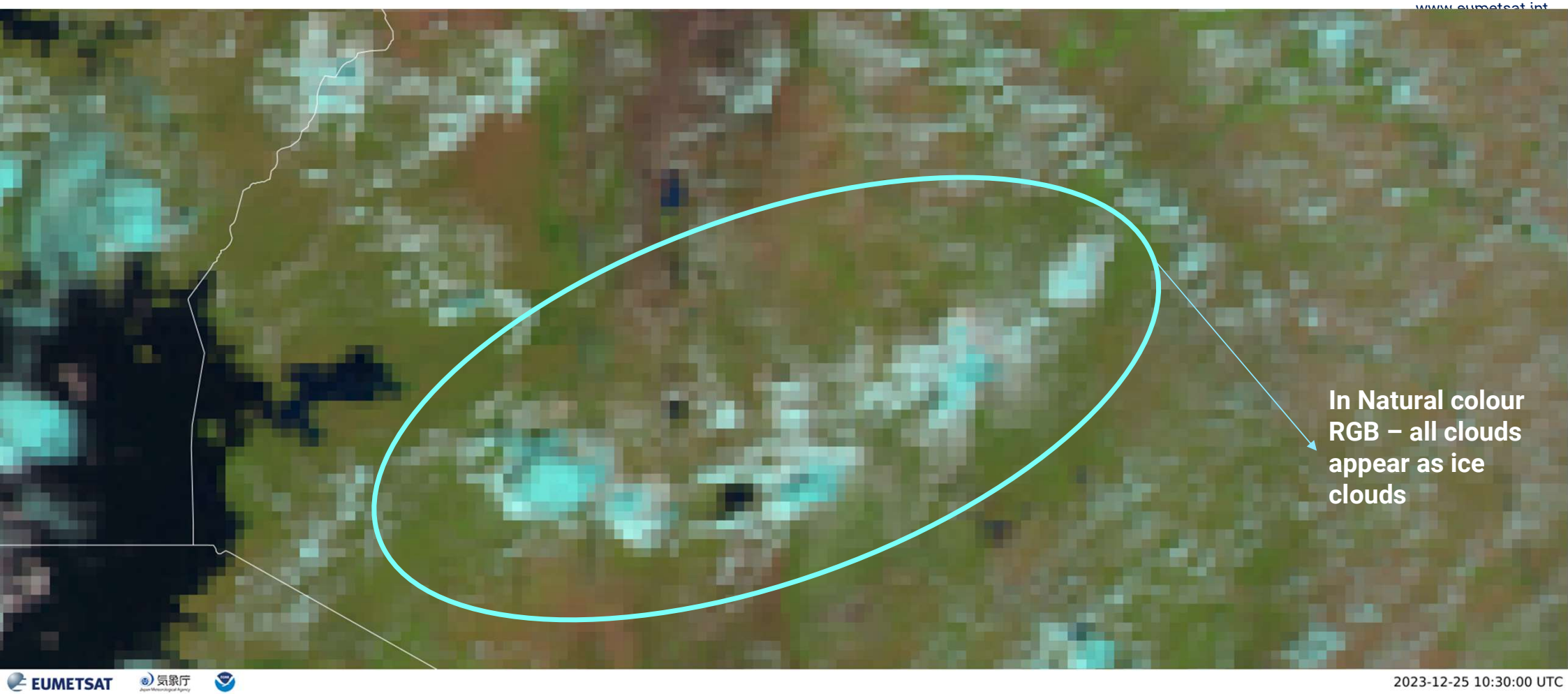
HP Roesli

- Reveals cloud phase (water, ice)
- Reveals the size of cloud particles – droplets or ice crystals

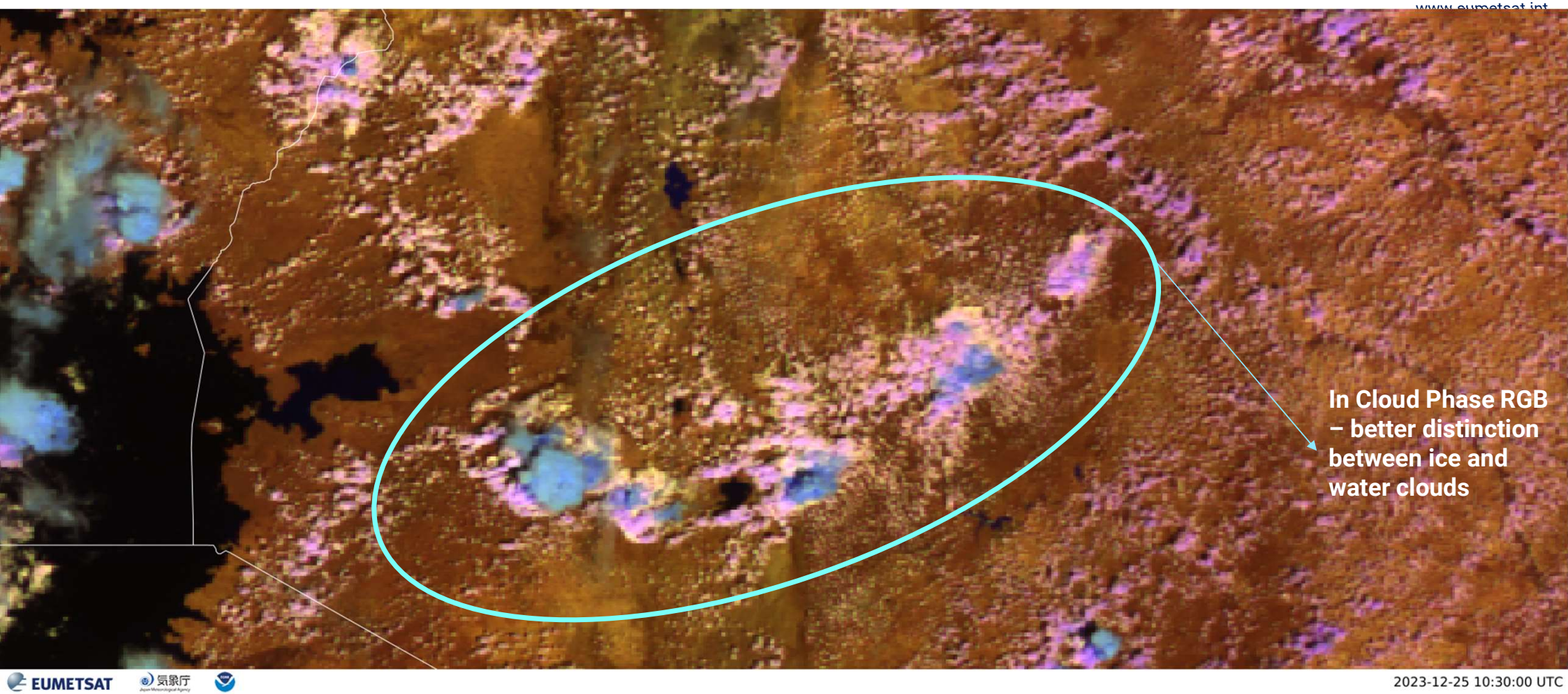
- light- to dark-pink hues >> water clouds with increasing droplet size

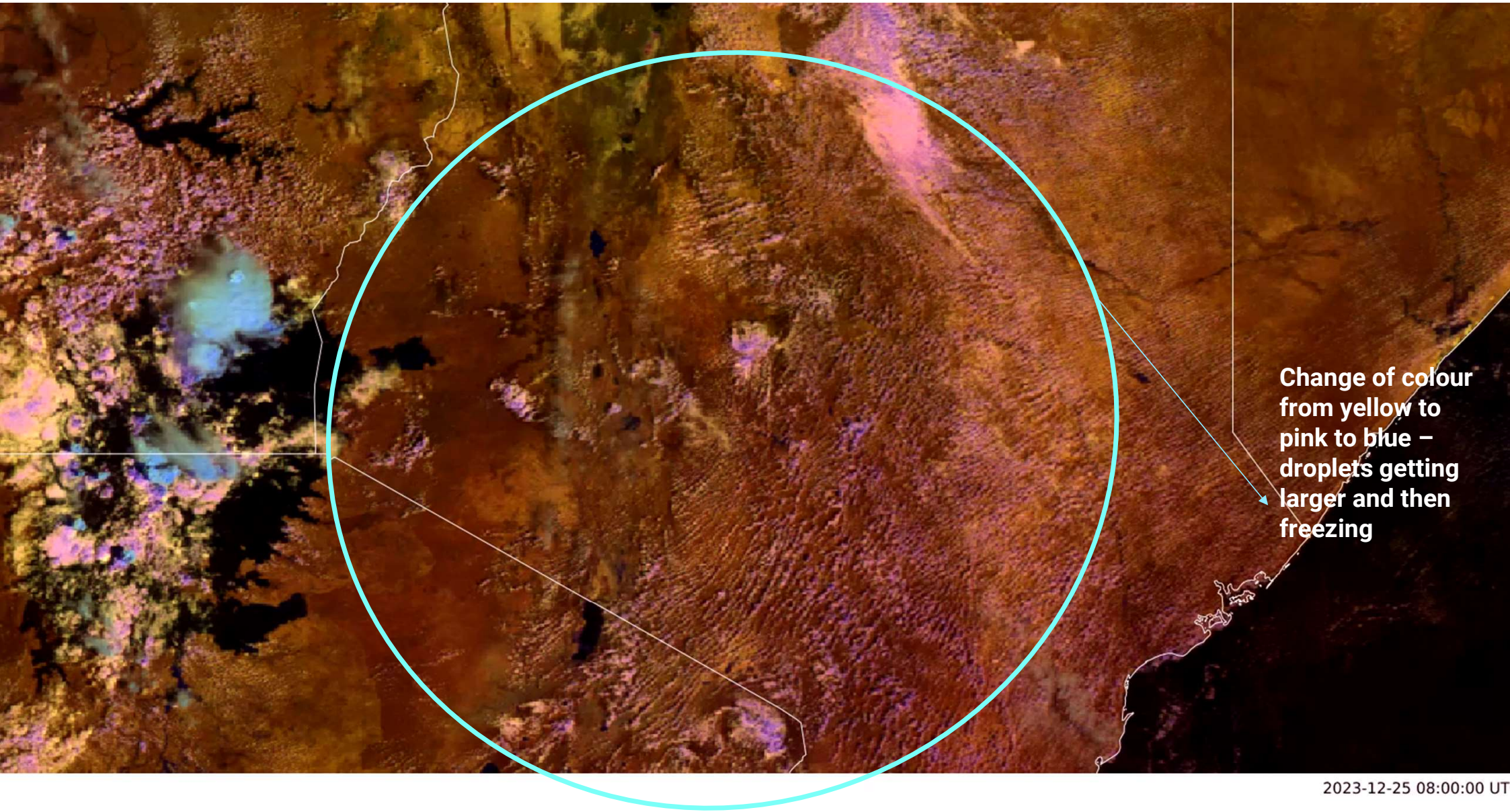
- the middle-blue spots correspond to freezing/frozen tops






# MSG Natural colour RGB

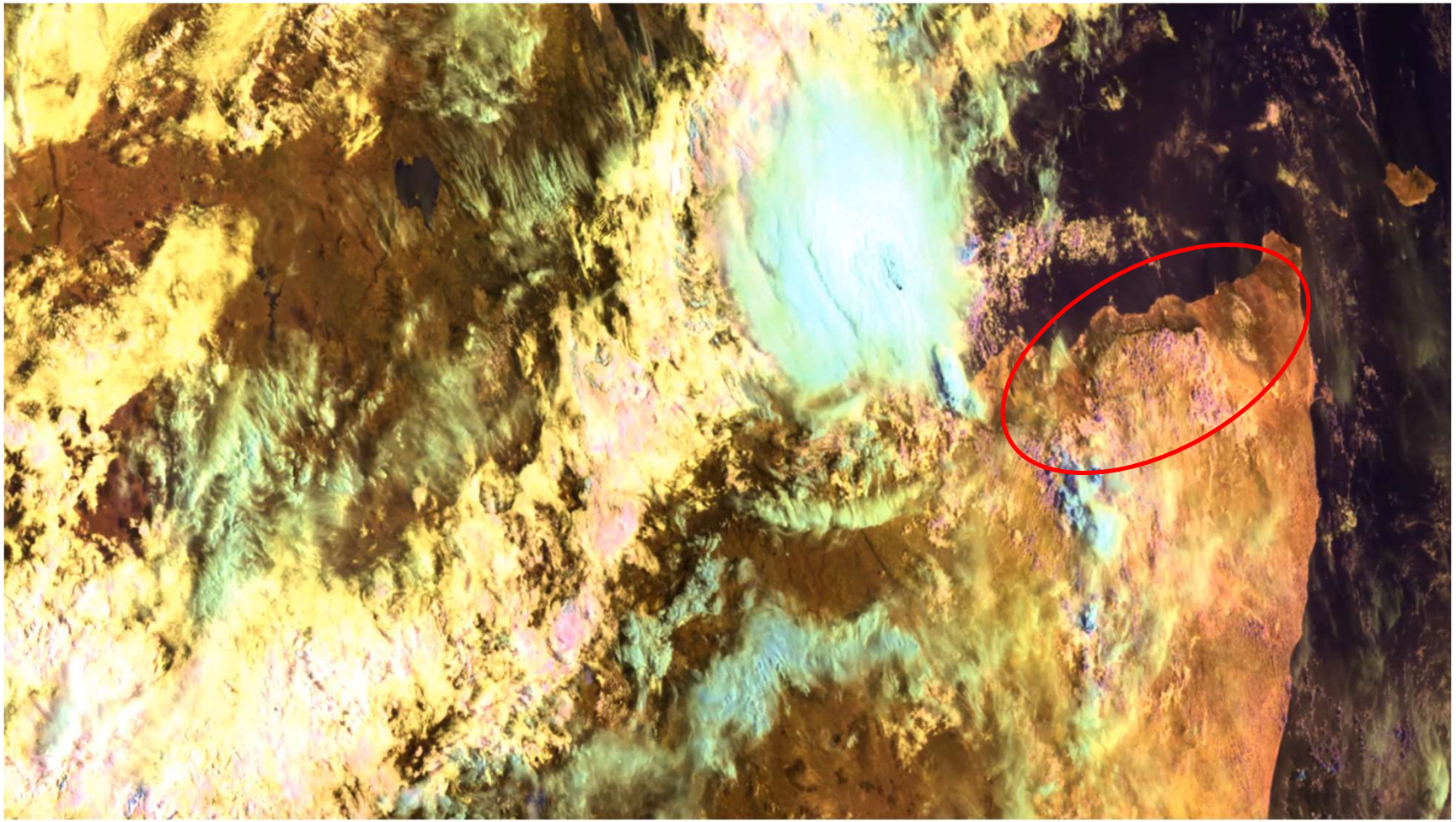

In Cloud Phase RGB – better distinction between ice and water clouds
EUMETSAT
2023-12-25 10:30:00 UTC


Change of colour from yellow to pink to blue – droplets getting larger and then freezing
2023-12-25 08:00:00 UT

# Cloud Phase RGB



Somalia, 19 March 2023, 05:30 – 11:50 UTC



OT and new updrafts in the existing storm

Sea-breeze convection:

First signs – small pink-coloured cells

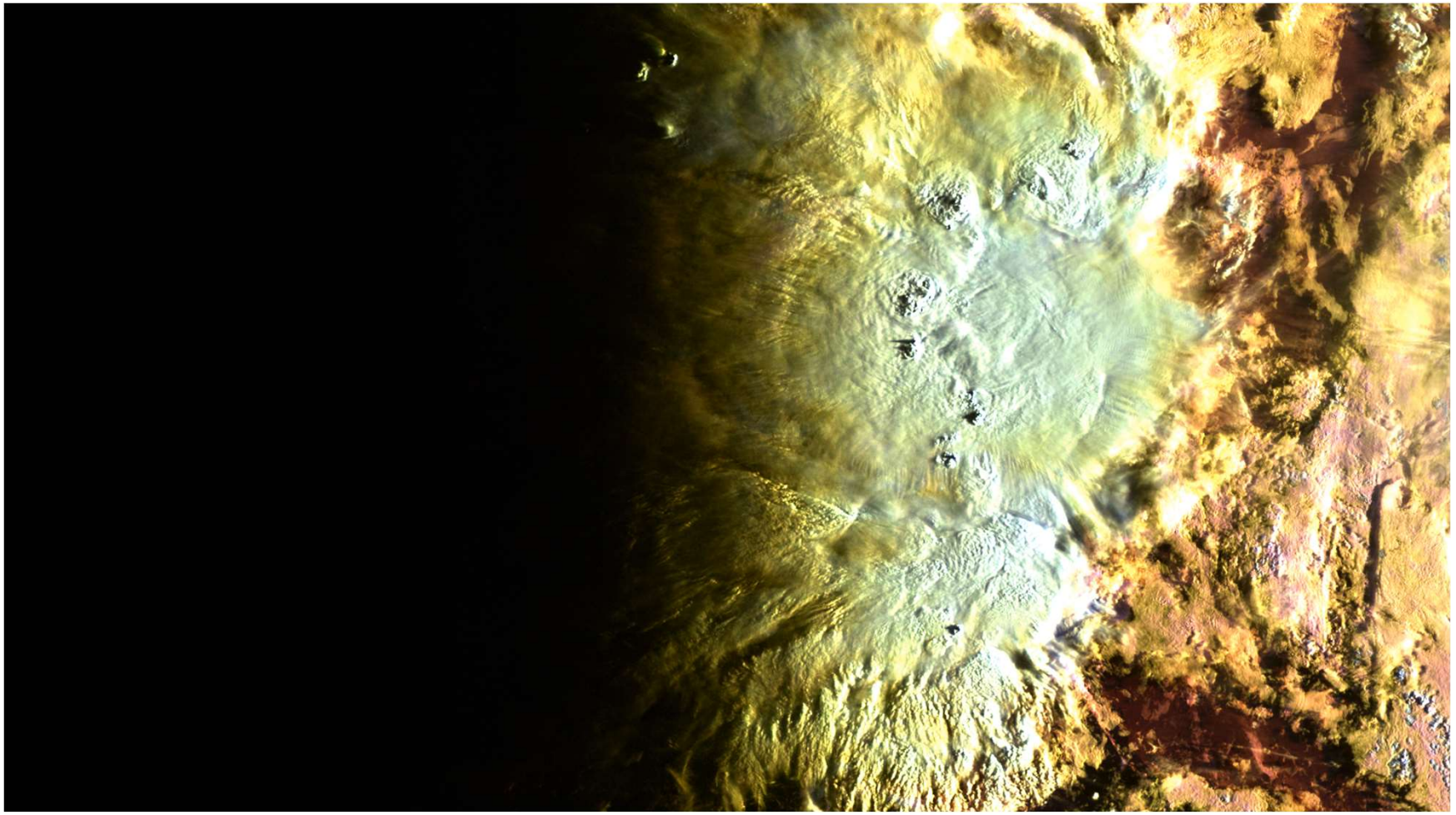
Glaciation – colour changing to blue shades

Direction of upper-level wind seen from the spread of the anvils

# Cloud Phase RGB



Gulf of Guinea, 19 March 2023, 05:50 – 11:50 UTC



**Mature storms**

overshooting tops

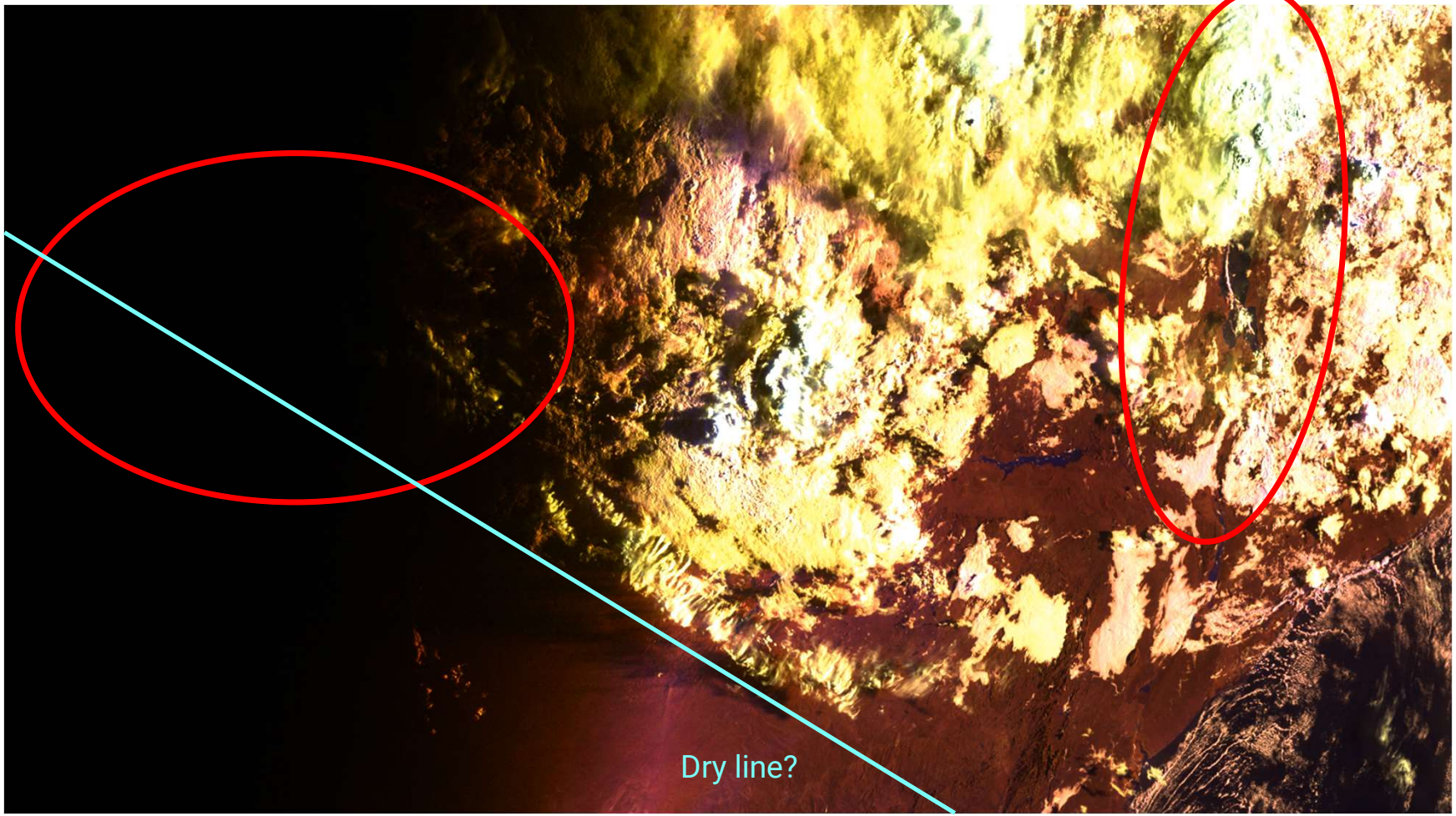
Radial spreading cirrus clouds – divergent flow

Decaying storm – change of light blue to darker blue

# Cloud Phase RGB



Southern Africa (Angola-Zambia-Mozambique)19 March 2023, 04:30 - 11:50 UTC




Lake-breeze convection

Fog in the narrow valleys in the morning

Dry line

- below (south) there is no or only shallow cumulus clouds
- above (north) deeper convective storms

# Cloud type RGB (1.38 – 0.64 – 1.61 μm)

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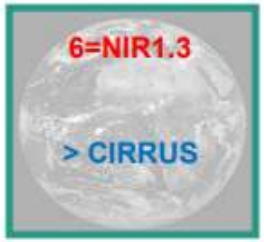
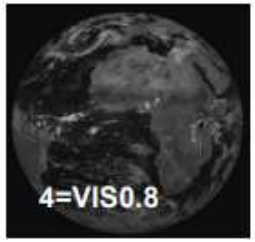
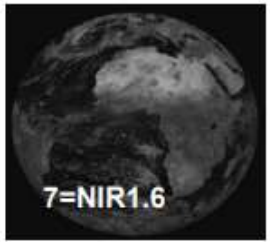


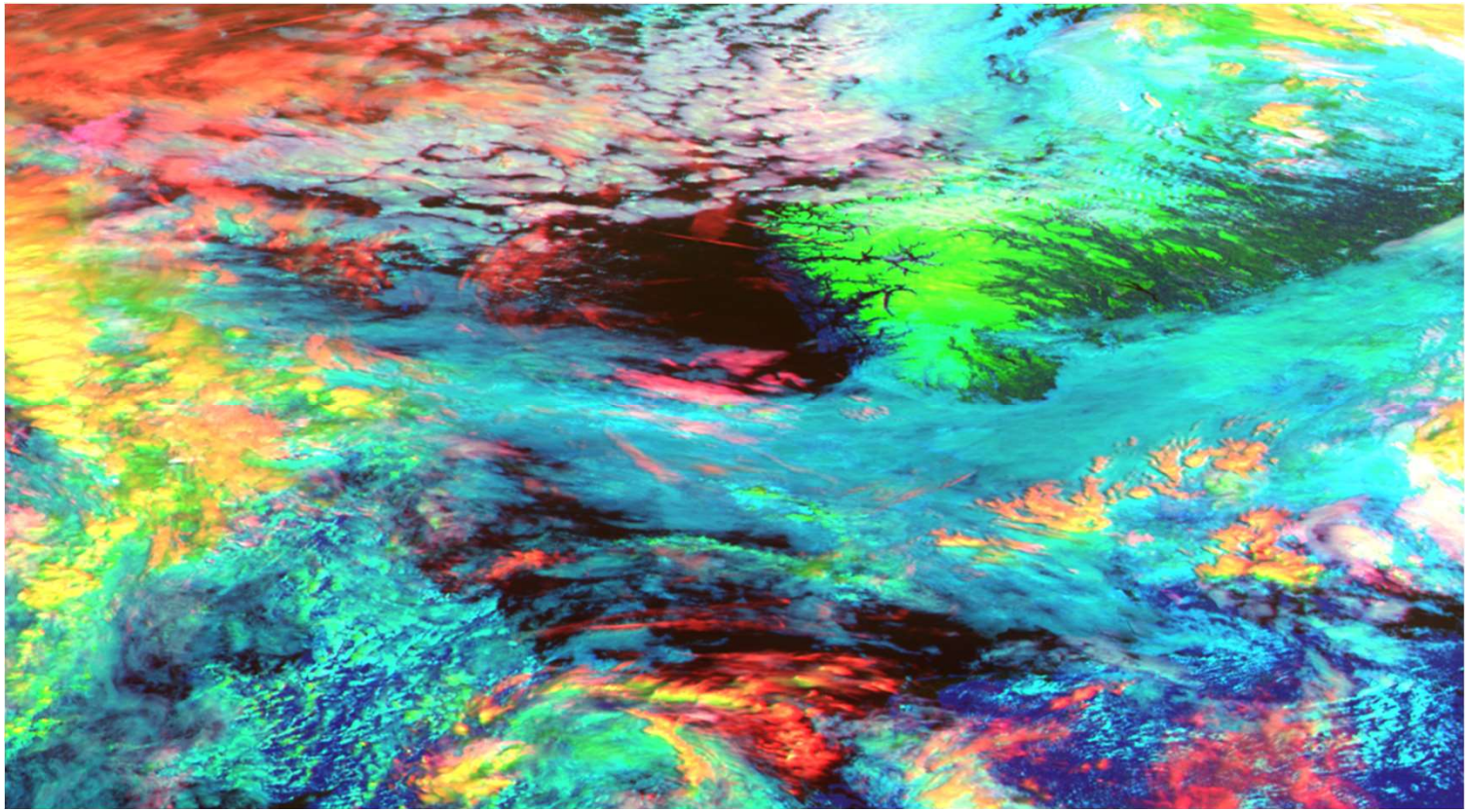




- Cloud optical depth
- Cloud phase
- Snow/ice
- Vegetation

MTG-I1 Cloud Type RGB - 18 March 2023, 11.50 UTC

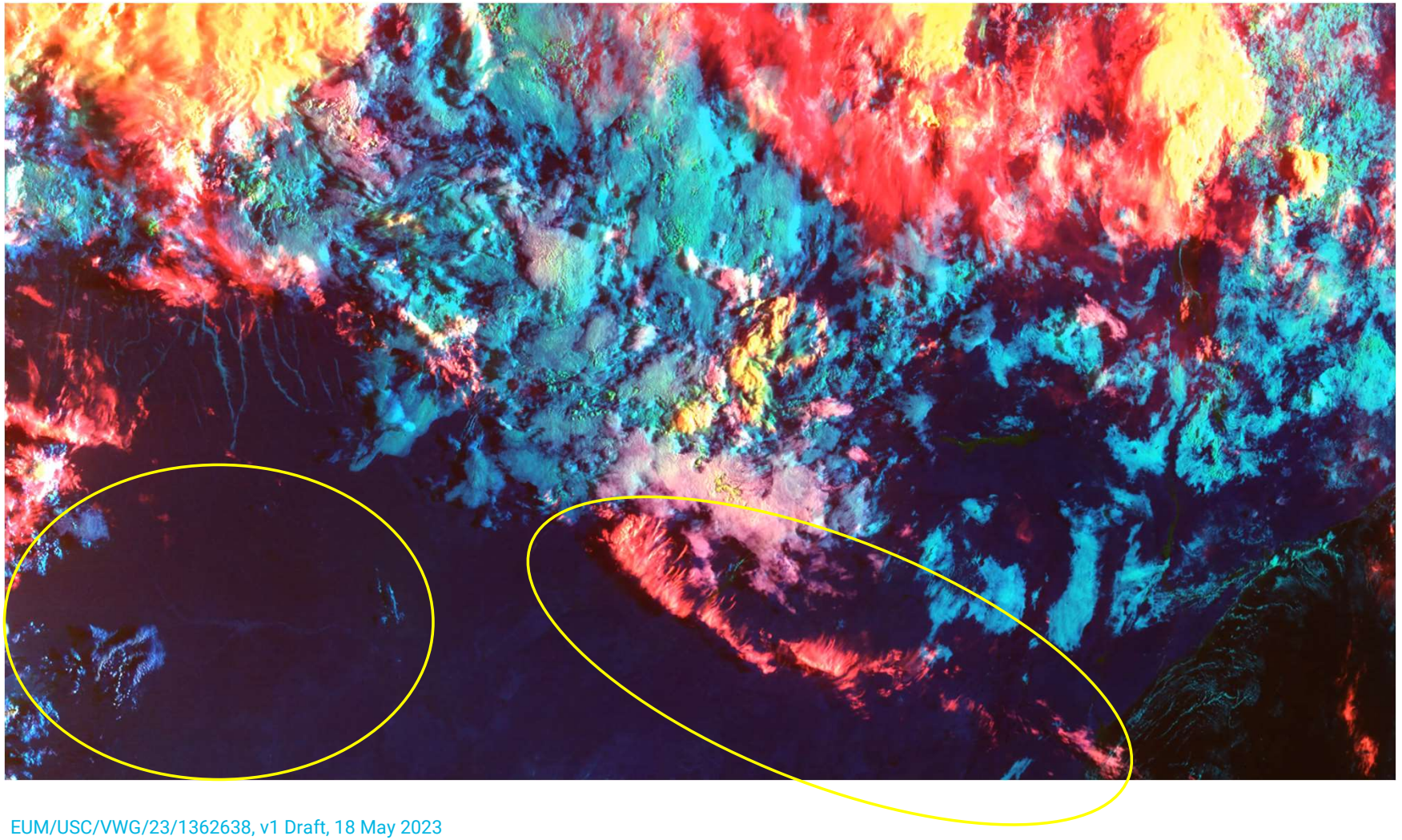
| | |
|---|---|
| 1 | Thin cirrus clouds over land and sea (darker red over the seas) |
| 2 | Thick ice clouds (multi-layered clouds with ice on top) |
| 3 | Land |
| 4 | Low to mid-level water clouds |
| 5 | Mixed phase clouds (at low and mid-levels) |
| 6 | High and thin water clouds (more orange if ice is present) |
| 7 | Super-cooled water clouds |
| 8 | Snow and ice on the ground |



# Cloud type RGB



Southern Africa (Angola-Zambia-Mozambique)19 March 2023, 05.10–11.50 UTC



Best RGB to see thin cirrus clouds due to 1.3 micron

- in bright red

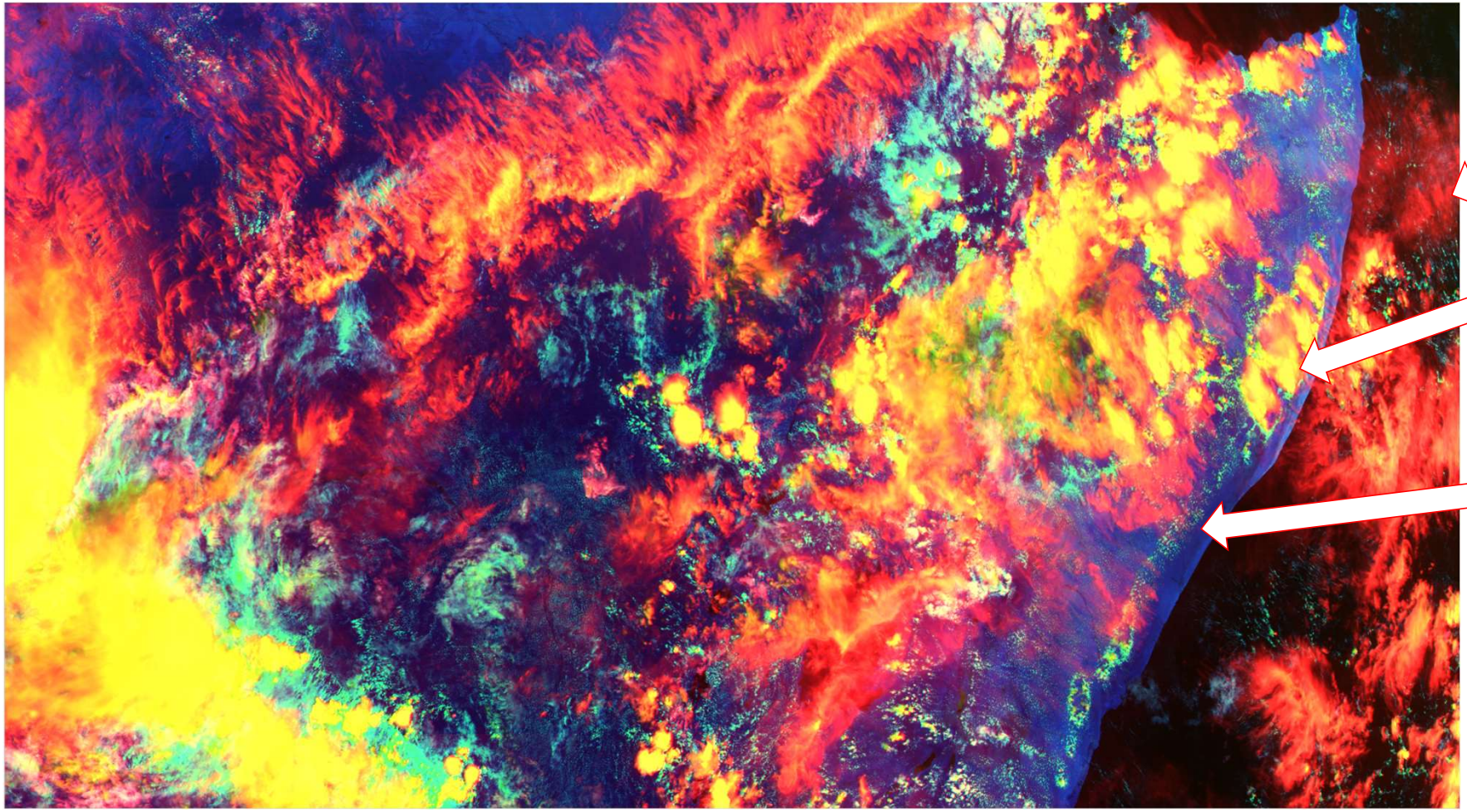
Clear distinction of low level water clouds

- in cyan colour

# Cloud type RGB



NE Africa – Somalia coast , 18 March 2023, 11:50 UTC



High, thin cirrus clouds

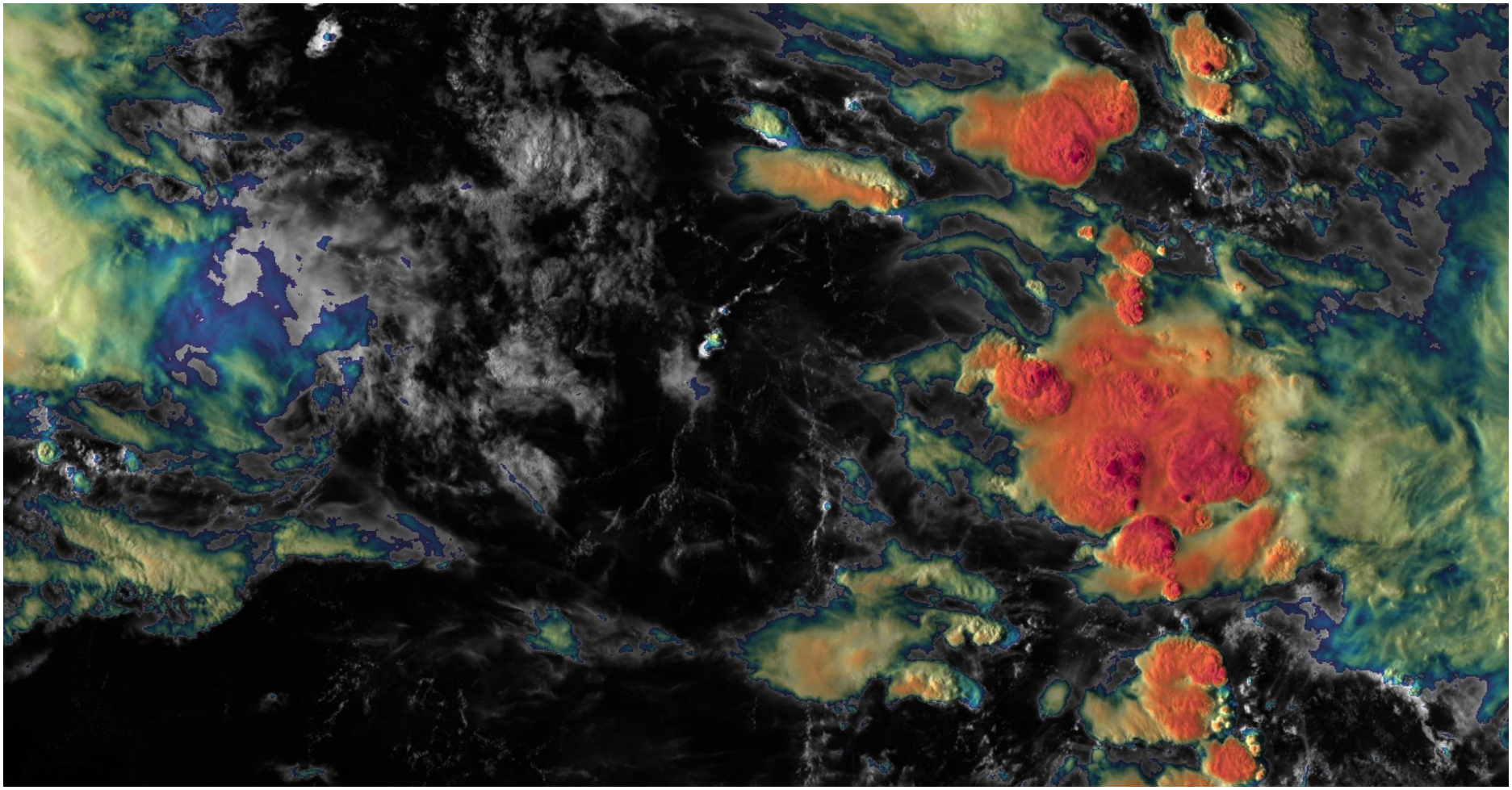
Thick ice clouds developing on the sea-breeze front

Small shallow cells of sea-breeze front

# “Sandwich” product – IR 10.5 + VIS 0.6



Gulf of Guinea, 18 March 2023, 15.40 UTC



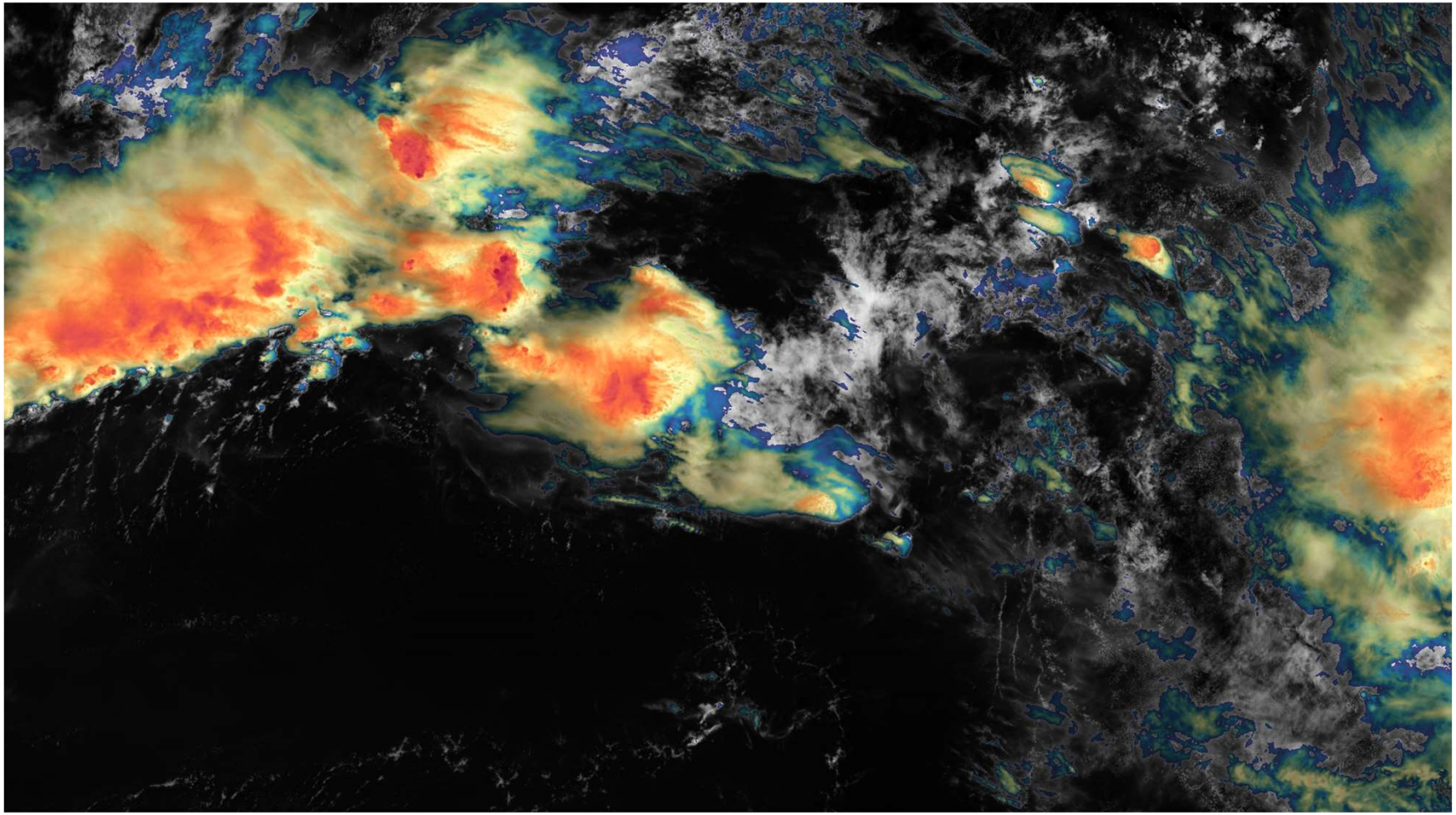
Red = cold

Overshooting
Cirrus plumes

# “Sandwich” product – IR 10.5 + VIS 0.6



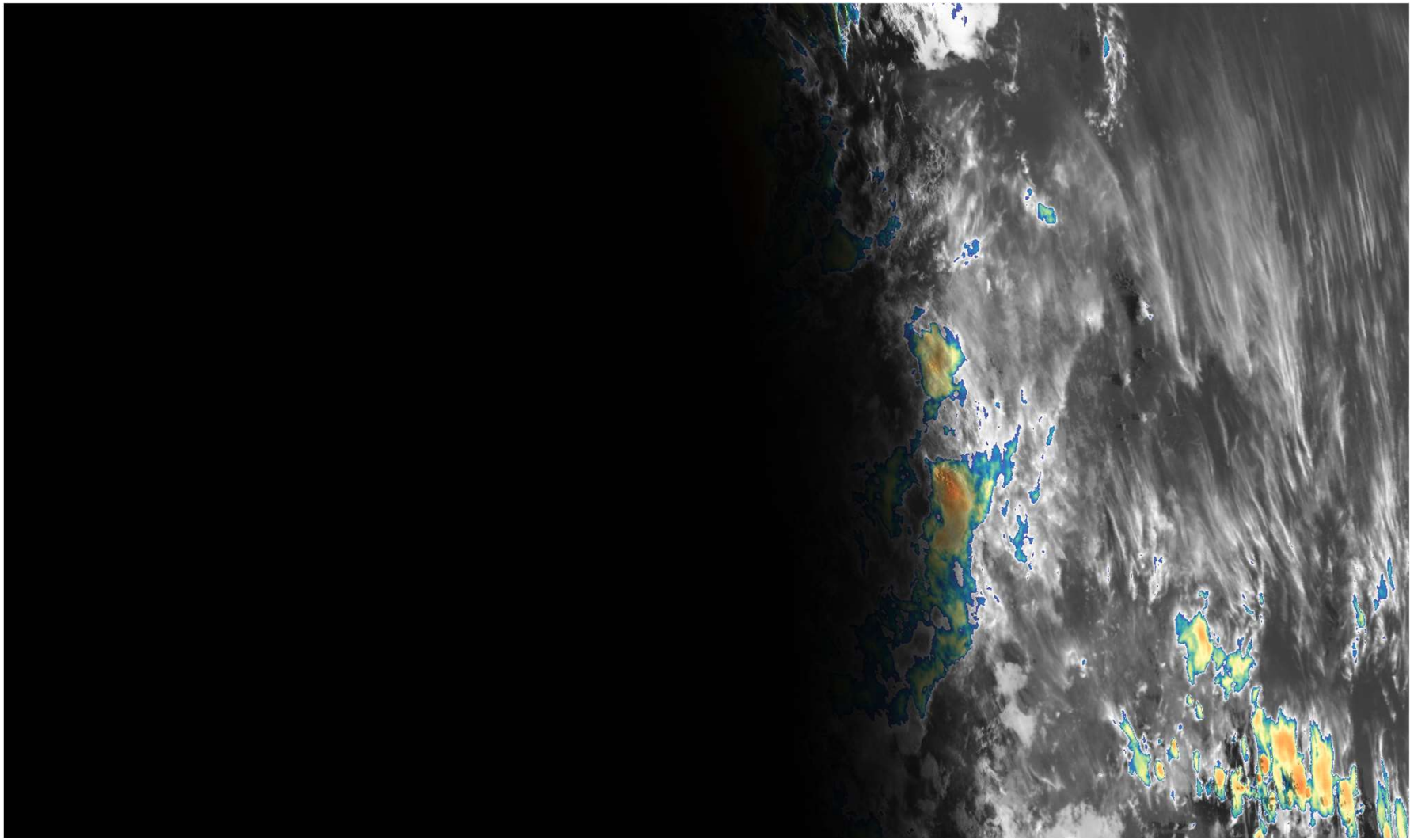
Gulf of Guinea, 18 March 2023, 12-17 UTC



# “Sandwich” product – IR 10.5 + VIS 0.6



Somalia, 19 March 2023, 03:00-11:50 UTC



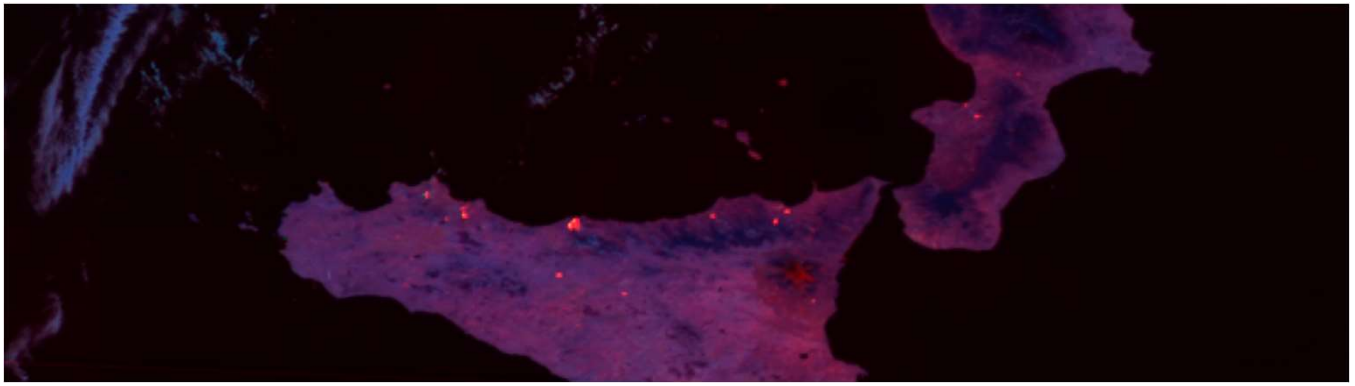
# Fire RGB Visualisation Techniques: Fire Temperature RGB

- "Classic" Fire Temperature RGB:
  - Combination of 3.8, 2.2 and 1.6 to show fire temperature in classic RGB scheme
  - New for EUM-GEO, heritage from e.g. VIIRS and ABI

Quick Guide:
https://resources.eumetrain.org/rgb_quick_guides/quick_guides/FireTemperatureRGB.pdf
... or search for "fire temperature rgb eumetrain"

| Colour | Channel [µm] | Physically relates to | Smaller contribution to the signal | Larger contribution to the signal |
|---|---|---|---|---|
| Red | IR3.7 | **(Fire) temperature** *Cloud top microphysics* | **Cold land surfaces** *water, snow/ice, cold clouds* | **Low fire temperature, hot spots** *Warm land surfaces* |
| Green | NIR2.25 | **Fire temperature** *Land type, cloud top particle size* | *Green vegetation, water, snow/ ice, large cloud particles* | **Medium fire temperature,** *Dry grass, bare ground, small cloud particles* |
| Blue | NIR1.6 | **Fire temperature** *Land type, cloud top phase* | *Green vegetation, water, snow/ice, ice clouds* | **High fire temperature** *Dry vegetation, bare ground, water clouds* |

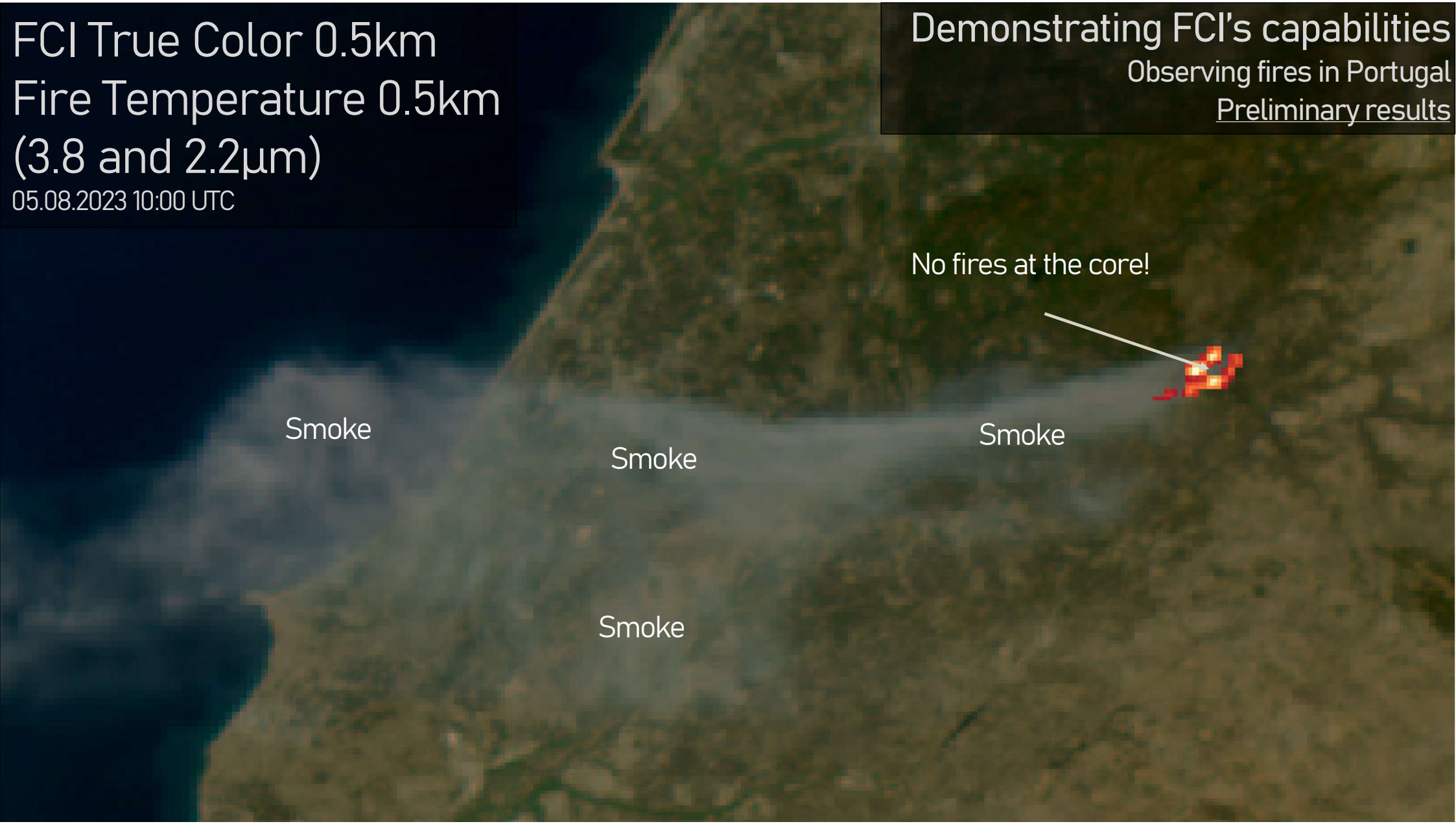
| Range | | | Gamma |
|---|---|---|---|
| 273 | 333 | K | 0.4 |
| 0 | 100 | % | 1 |
| 0 | 75 | % | 1 |



**Interpretation**

| | |
|---|---|
| 1 | warm fire, hot spot |
| 2 | very warm fire |
| 3 | hot fire |
| 4 | extreme intense fire |
| 5 | burn scars (day) |
| 6 6 | land surface (day) |
| 7 | water, snow, ice, night-time |
| 8 | water cloud (day) |
| 9 | ice cloud (day) |

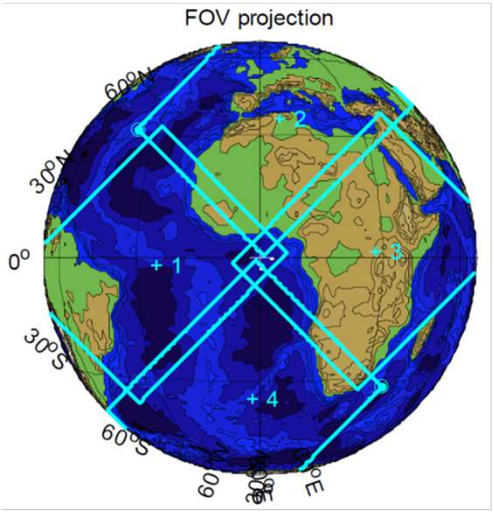

SEVIRI Natural Color 3km
Fire Temperature 3km
(3.8µm)
05.08.2023 10:00 UTC
MSG-SEVIRI
For comparison
Intense fires at
the core?
Smoke
Smoke?
Smoke?

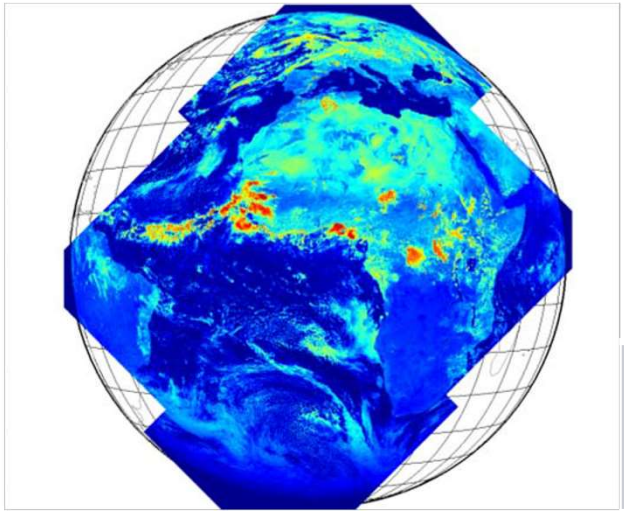

FCI True Color 0.5km
Fire Temperature 0.5km
(3.8 and 2.2µm)
05.08.2023 10:00 UTC
Demonstrating FCI's capabilities
Observing fires in Portugal
Preliminary results
No fires at the core!
Smoke
Smoke
Smoke
Smoke

# MTG Lightning Imager




- Lightning is a precursor of severe weather, with a lead time of tens of minutes
- **Most ground-based lightning location systems** are mainly sensitive to cloud-to-ground lightning (CG)
- Often, no increase in CG due to “weather intensification” observable → **Total lightning is the parameter of interest**
- Total lightning
  = cloud-to-ground + intra-cloud lightning
- **MTG LI will measure total lightning**



| | |
|---|---|
| Spatial Resolution at Nadir | 4.5 km (variable throughout the Field of View, FOV) |

# Monitoring lightning from space




## East camera

Lightning recorded on
2 June 2023

# Thank you!

Questions are welcome.