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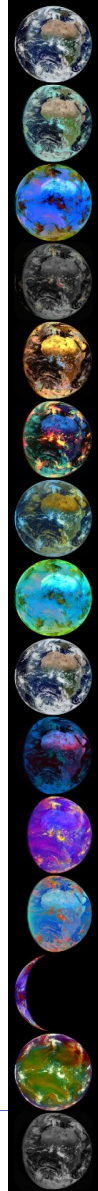
METEO FRANCE
À VOS CÔTÉS, DANS UN CLIMAT QUI CHANGE

Cloud Type RGB
A complete and nuanced product

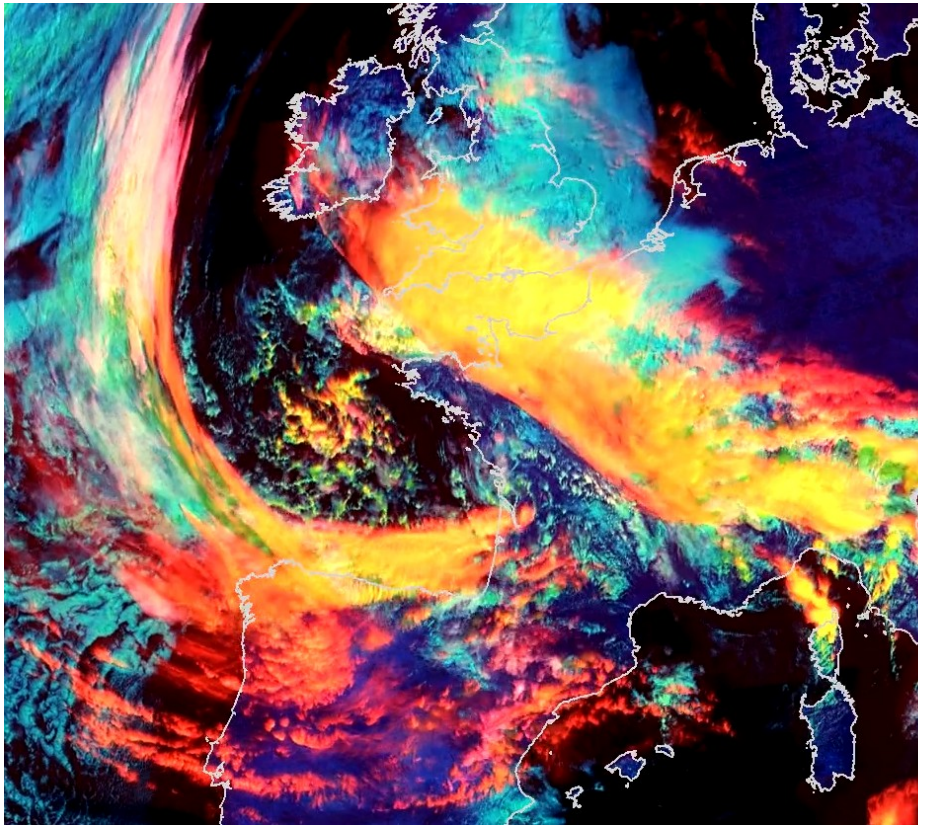
Roxane Désiré

EUMeTrain MTG Event Week
24/06/2025

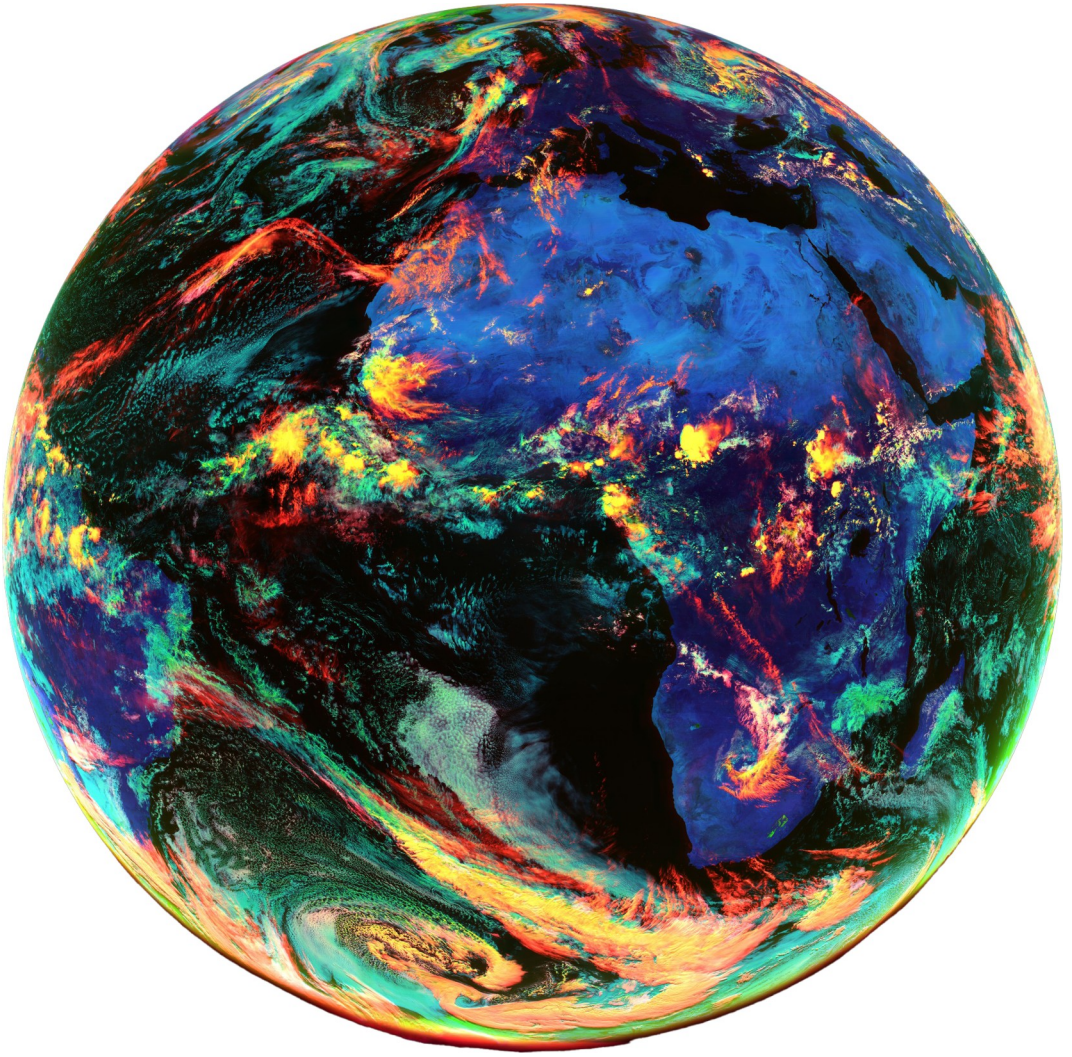


Outline

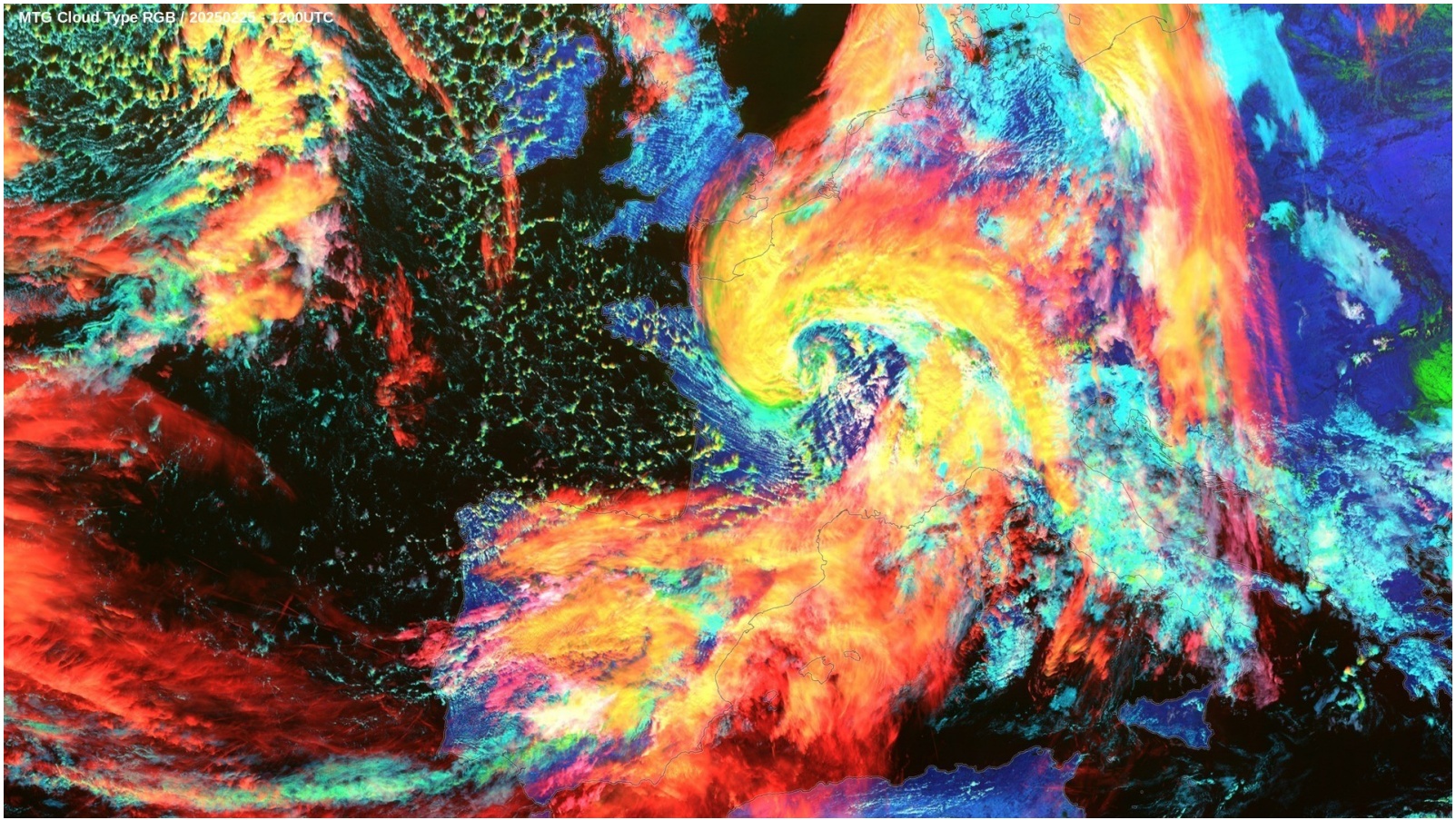
- Product basics and colours
- Applications
- Comparison with other products
- Well-known subtleties
- Hot topic special case



The basics

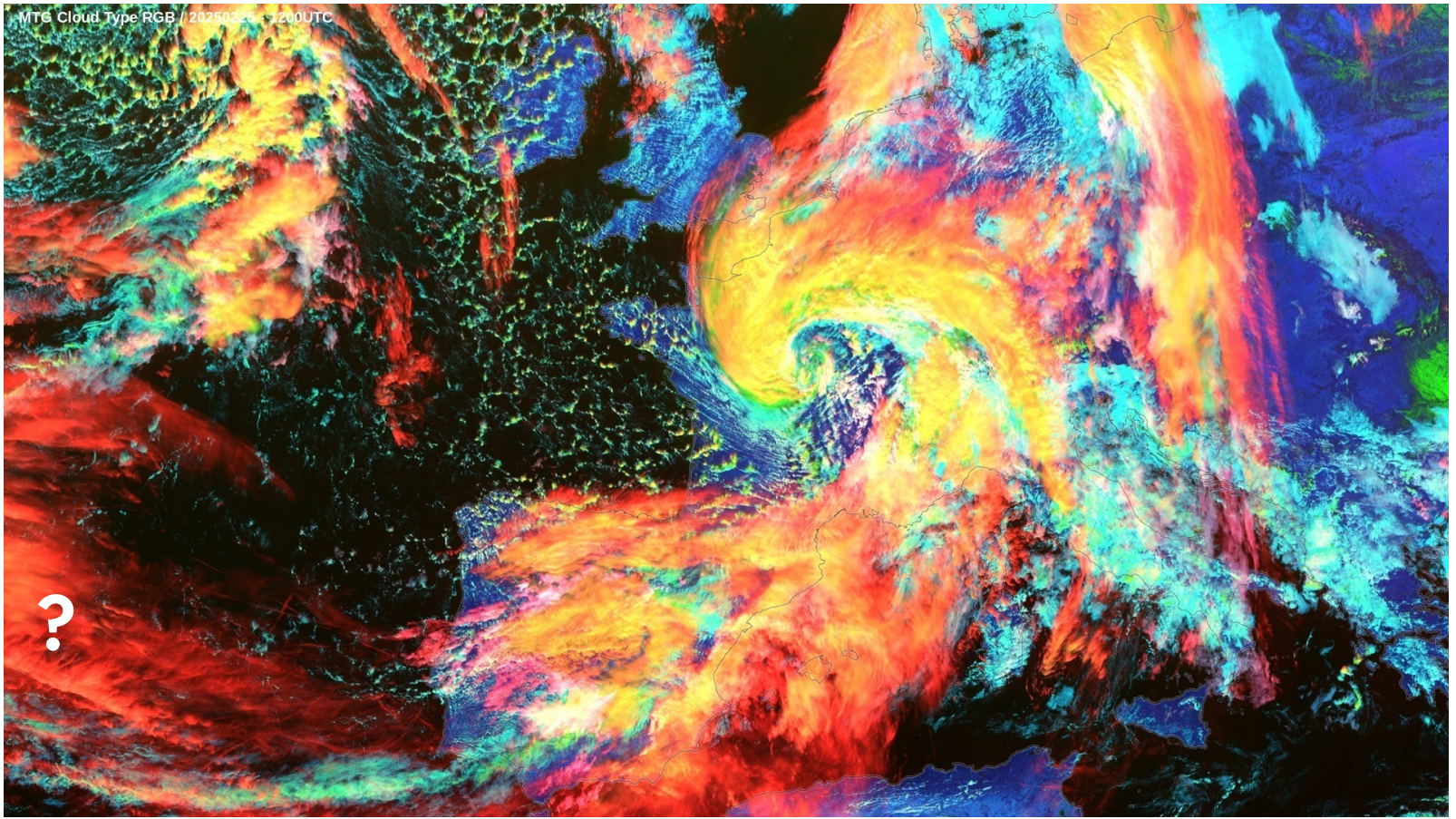


The colours



The colours

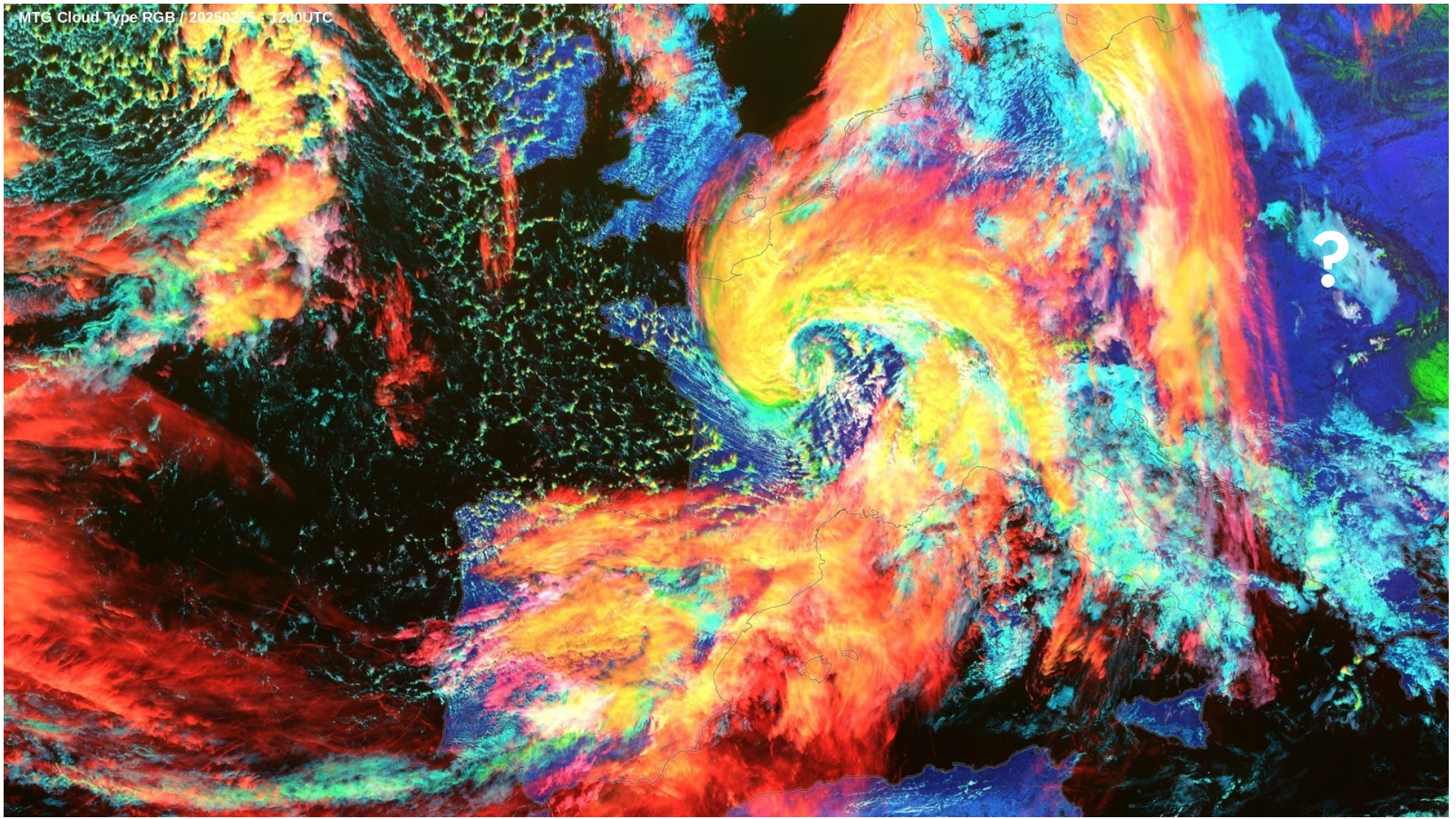
Red ?



The colours

Red = cirrus, thin high clouds

Light blue/cyan ?

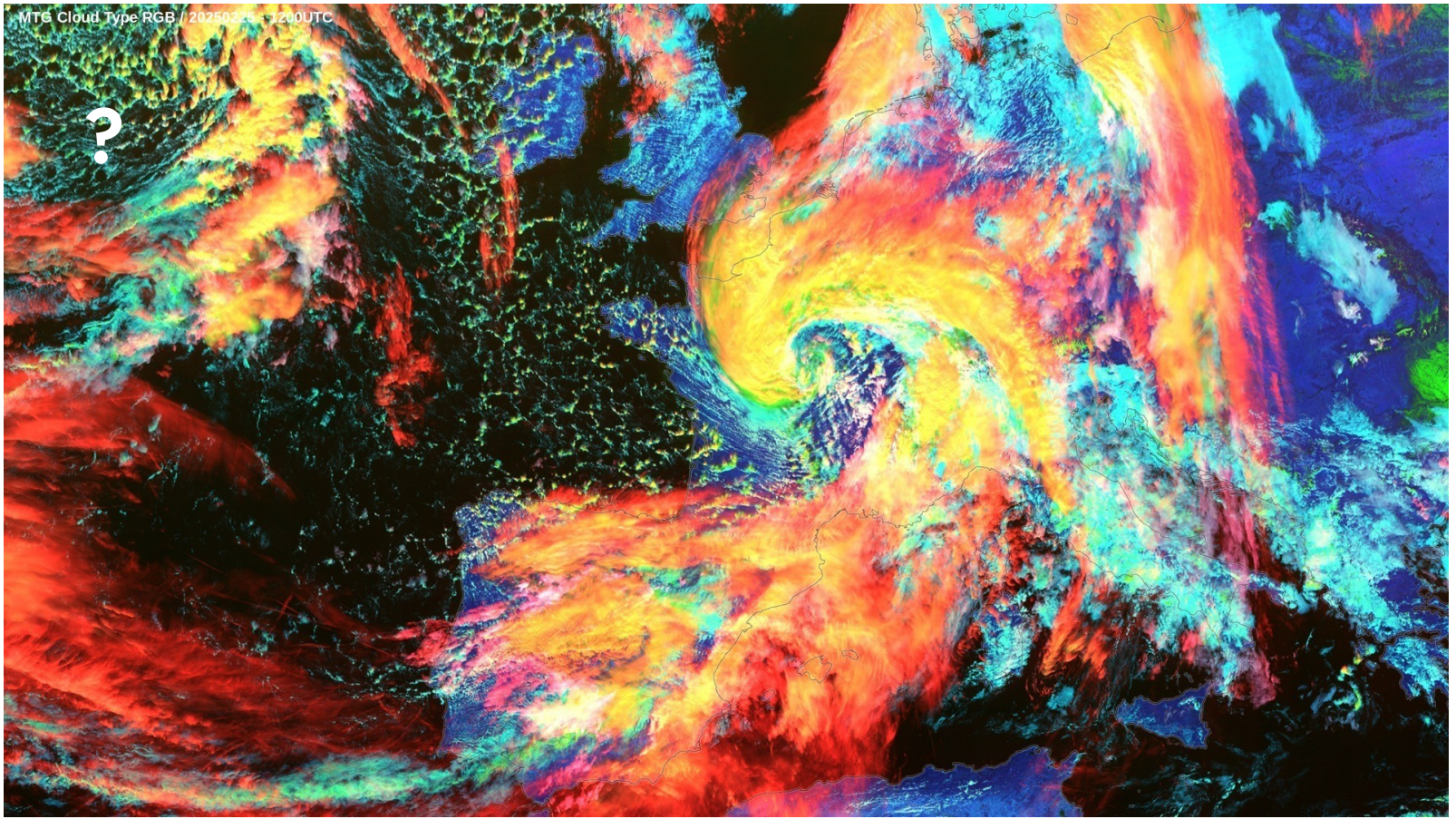


The colours

Red = cirrus, thin high clouds

Light blue/cyan = low-level water clouds

Green ?



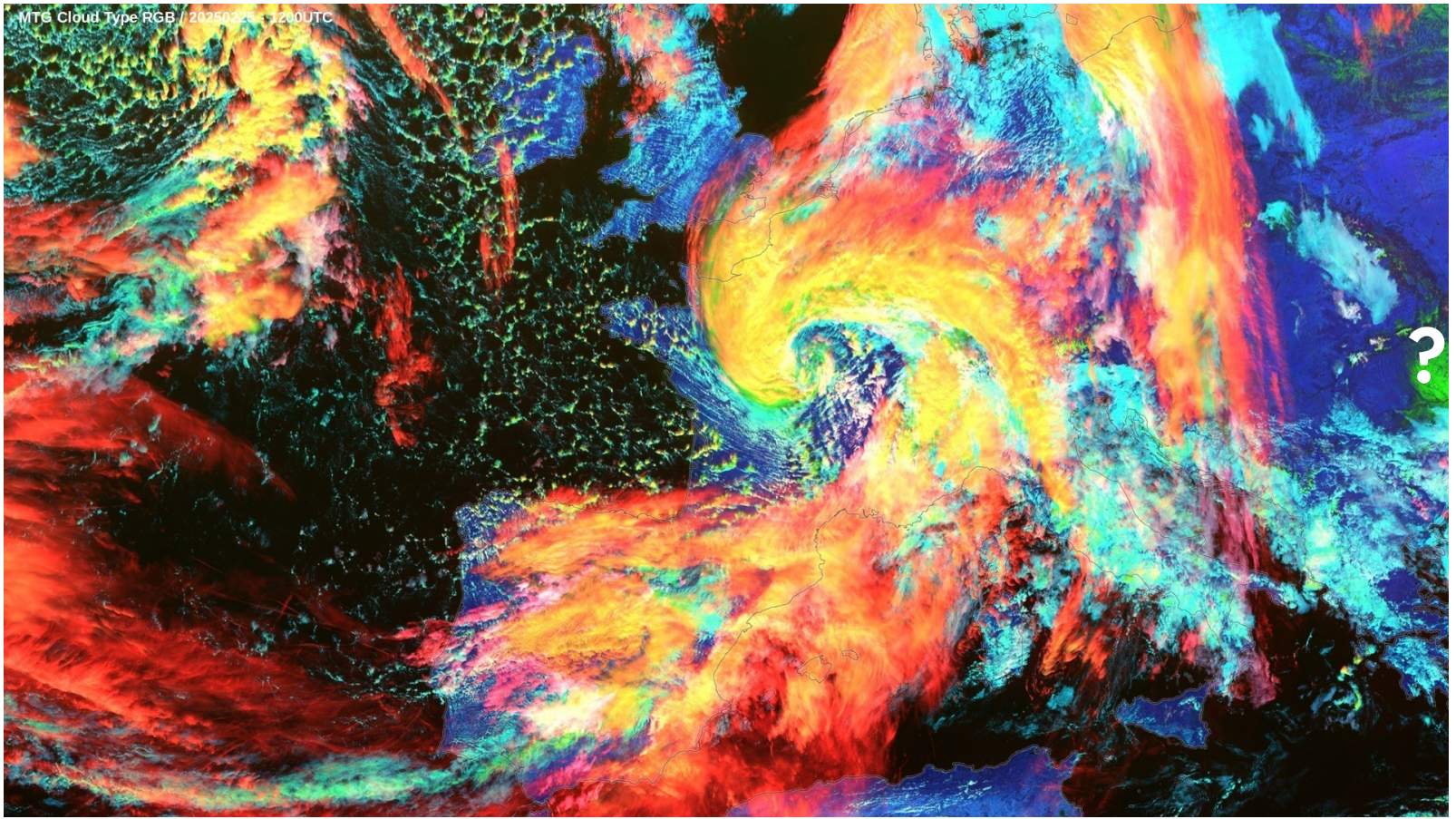
The colours

Red = cirrus, thin high clouds

Light blue/cyan = low-level water clouds

Green = mid-level clouds, mixed phase on top

Other Green ?



The colours

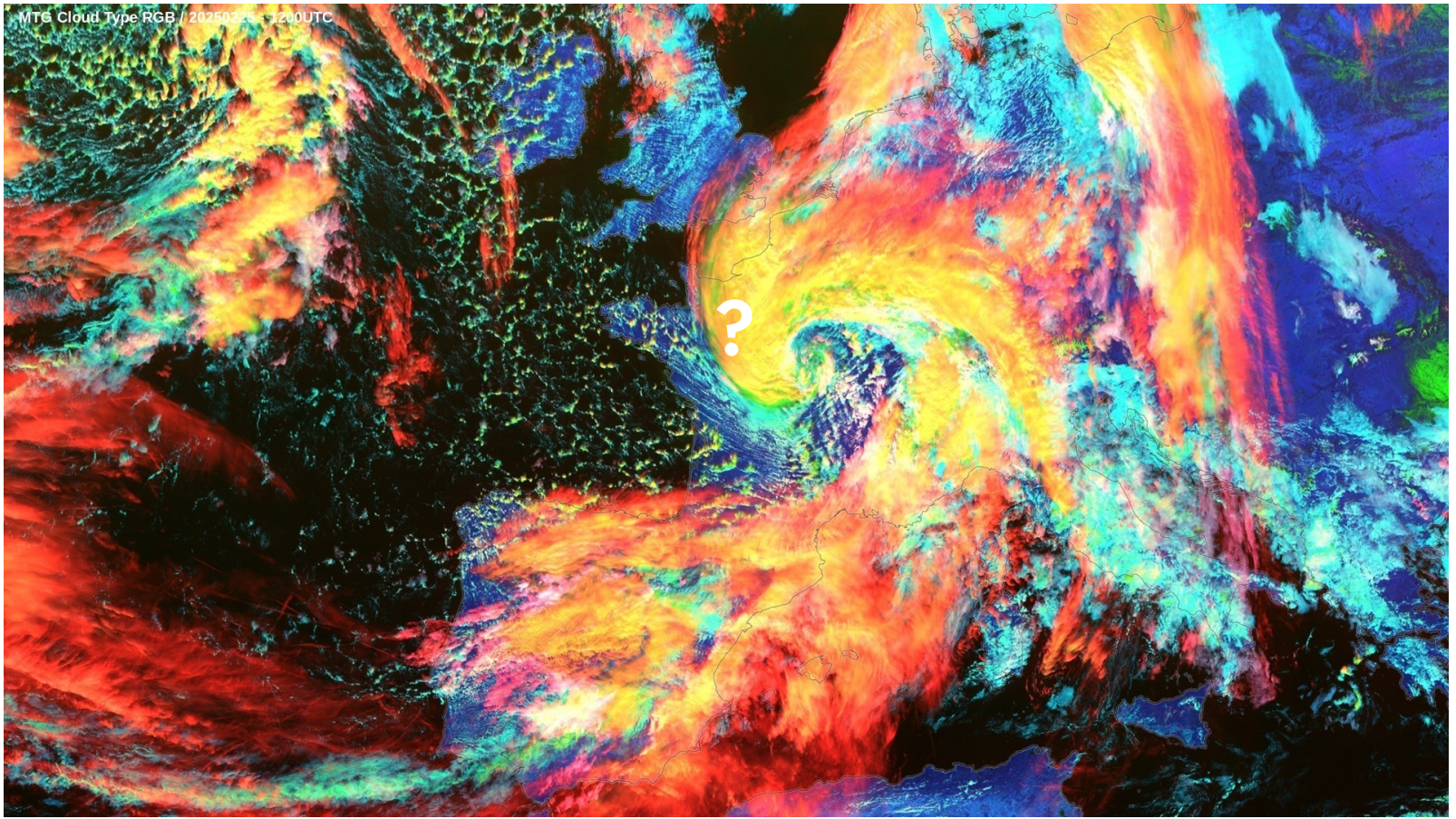
Red = cirrus, thin high clouds

Light blue/cyan = low-level water clouds

Green = mid-level clouds, mixed phase on top

Other Green = snow

Yellow ?



The colours

Red = cirrus, thin high clouds

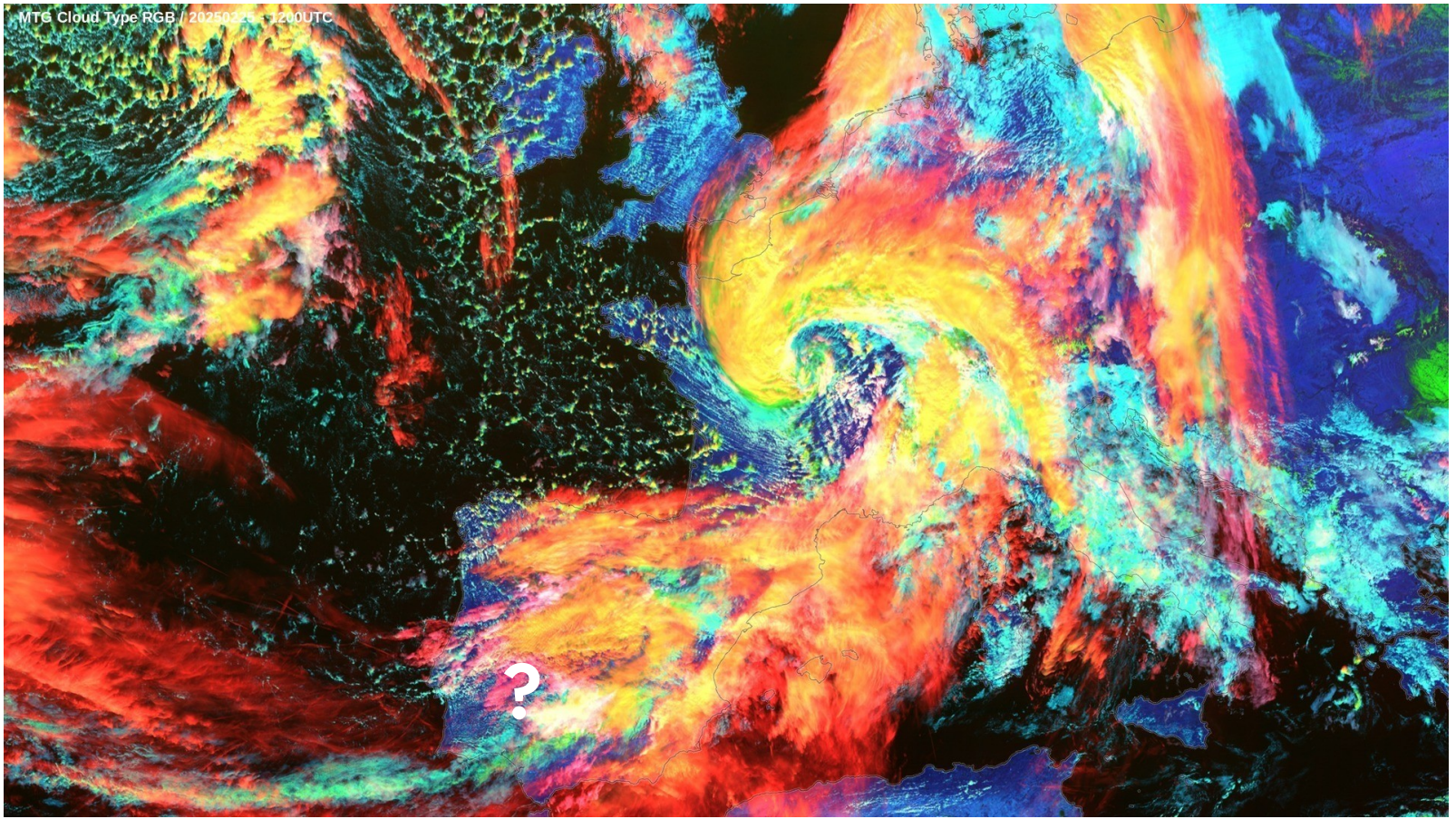
Light blue/cyan = low-level water clouds

Green = mid-level clouds, mixed phase on top

Other Green = snow

Yellow = thick high-level ice cloud

White or pink ?



The colours

Red = cirrus, thin high clouds

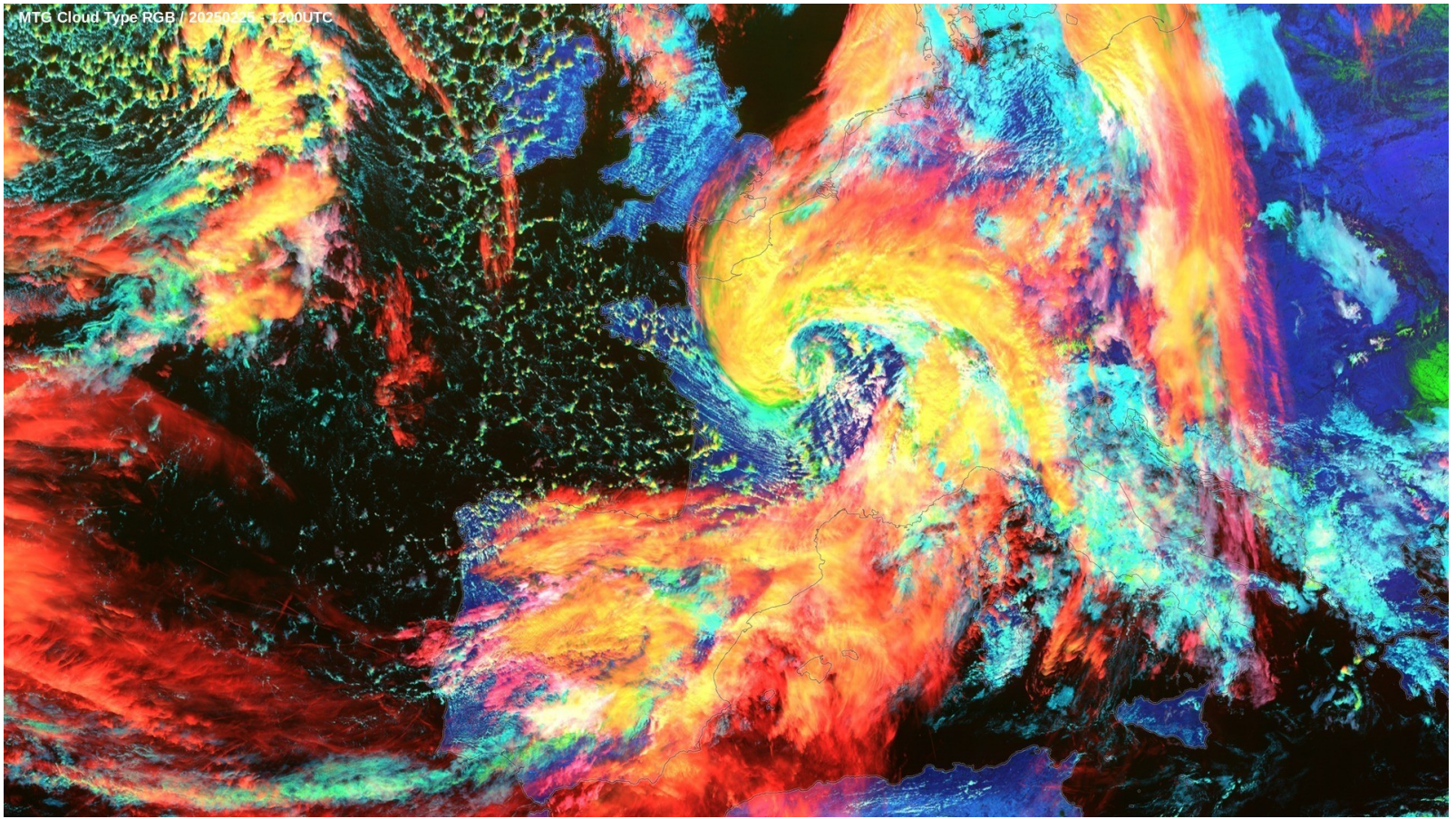
Light blue/cyan = low-level water clouds

Green = mid-level clouds, mixed phase on top

Other Green = snow

Yellow = thick high-level ice cloud

White or pink = supercooled water clouds



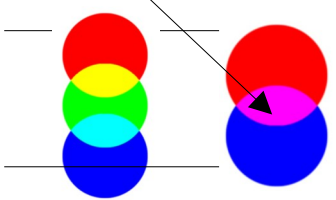
How does it work ?

- Cirrus, thin high clouds
- Thick high-level ice clouds
- Land surface
- Low-level water clouds
- Mid-level clouds, mixed phase on top
- Thin supercooled water clouds
- Thick supercooled water clouds
- Snow on the ground

More and more contribution in the green, then in the red beam as the cloud increases in vertical extension.

Supercooled water clouds in white: contribution from all channels. Little contribution in green if the cloud is thin → it appears in pink.

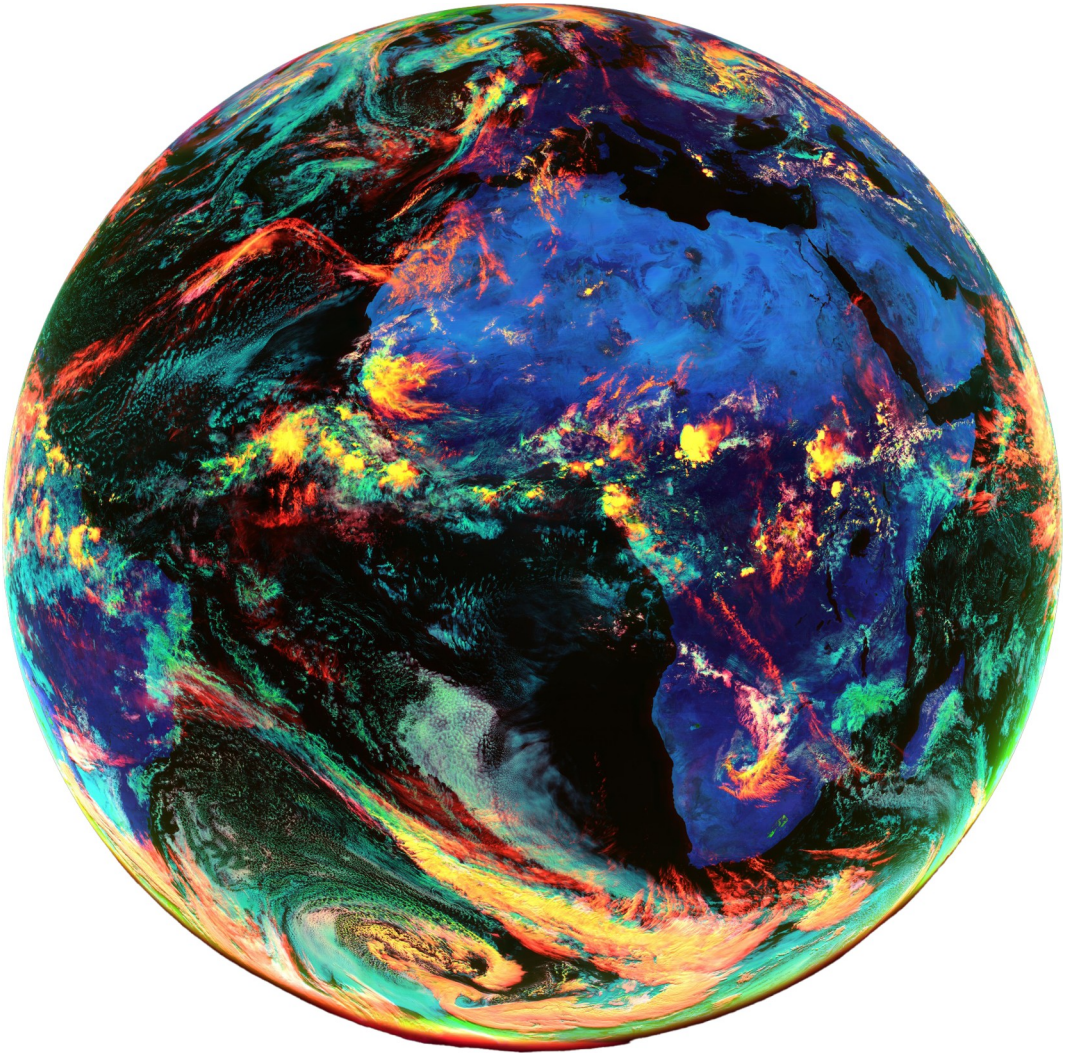
Color	Channel	Physically related to	Low signal contribution	High signal contribution
Red	NIR 1.38	Cloud top height and atmospheric optical thickness	Low clouds	High clouds
Green	VIS 0.64	Cloud optical thickness	Thin clouds	Thick clouds Snow on the ground Sea ice
Blue	NIR 1.61	Cloud top particle phase (and size)	Thick ice clouds Snow on the ground	Thick liquid water clouds



Highly sensitive channel to thin cirrus clouds.
Detection of any surface in the absence of atmospheric water vapor above.

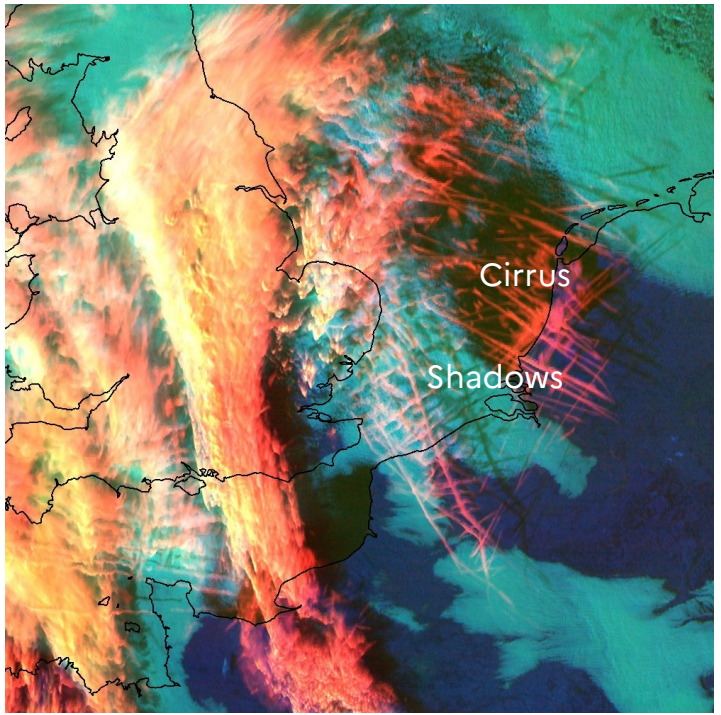
Less and less contribution in the blue beam as the cloud is covered with ice.

Applications
Comparisons



Cloud Type RGB primary application

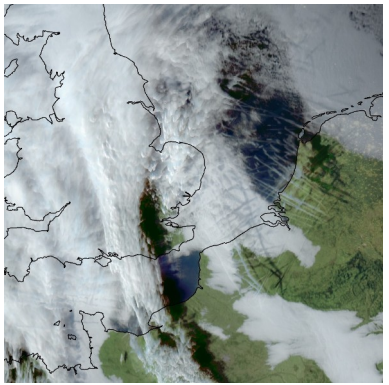
Cloud type differentiation and, in particular, **Cirrus clouds** and contrails detection

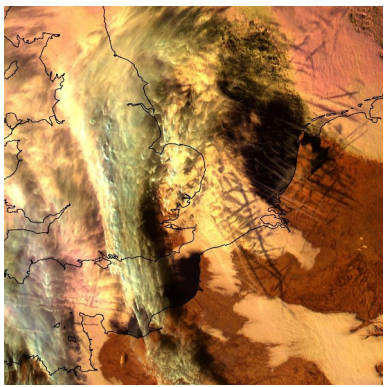


Cloud Type RGB

Much better detection than with

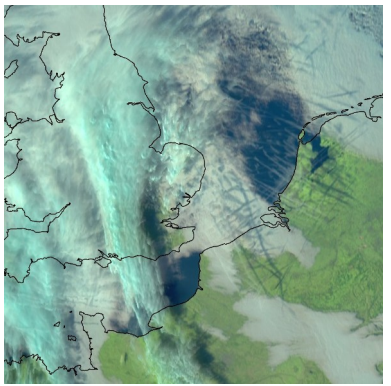
GeoColor RGB





Cloud Phase RGB

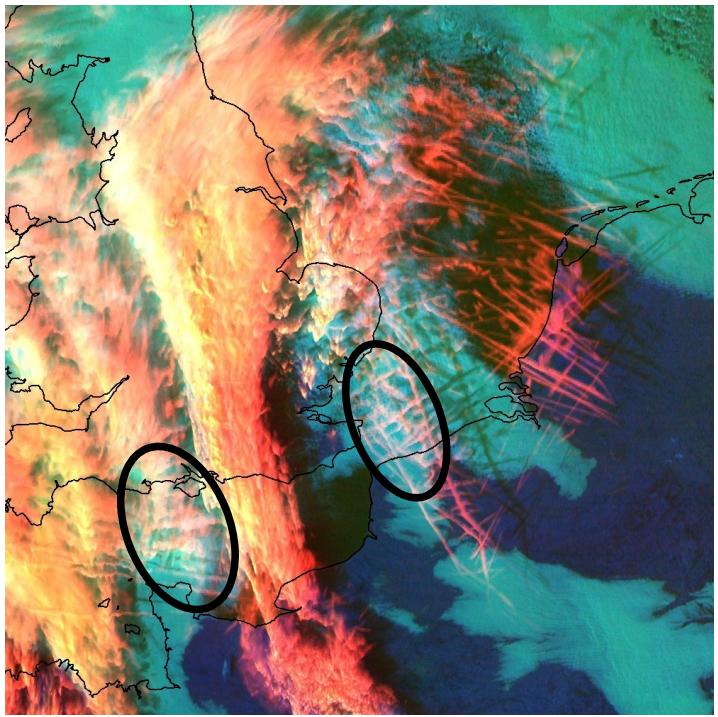
Natural Color RGB



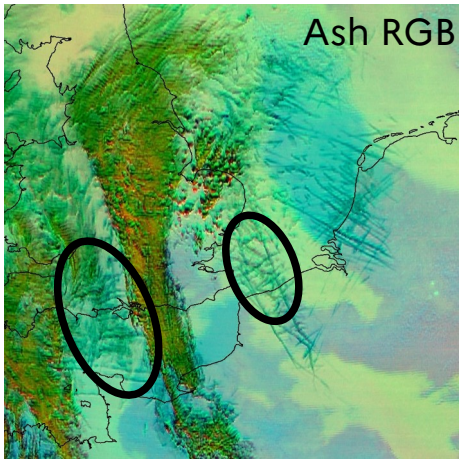
It is mainly the **shadows** that are seen through the visible channels.

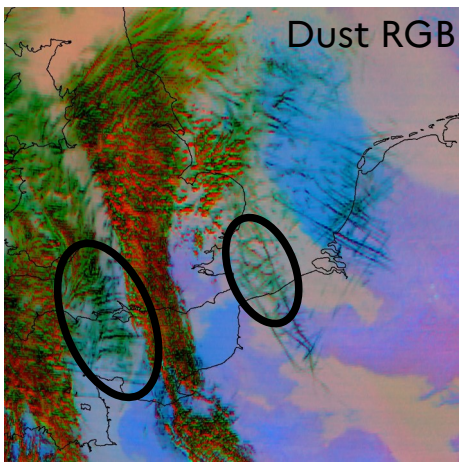
Cloud Type RGB primary application

But perhaps, in certain circumstances, not better than with :

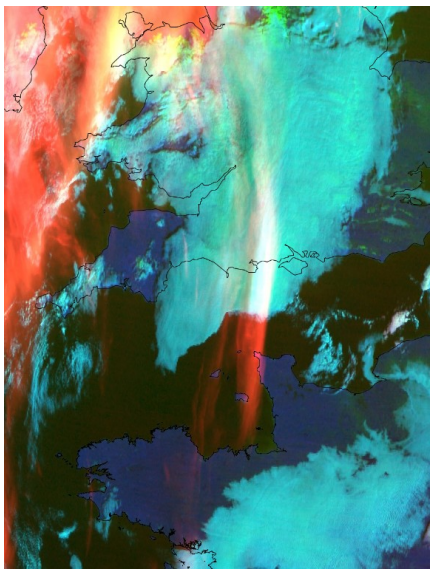


Cloud Type RGB





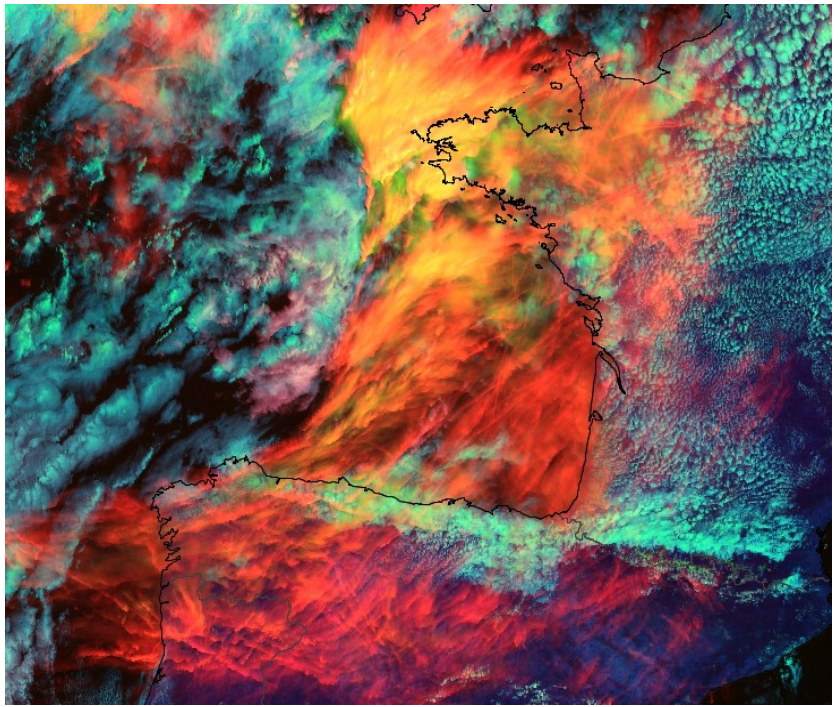
Only IR channels, so no shadow, but very fine and precise detection above any cloud layer, including low-level clouds.



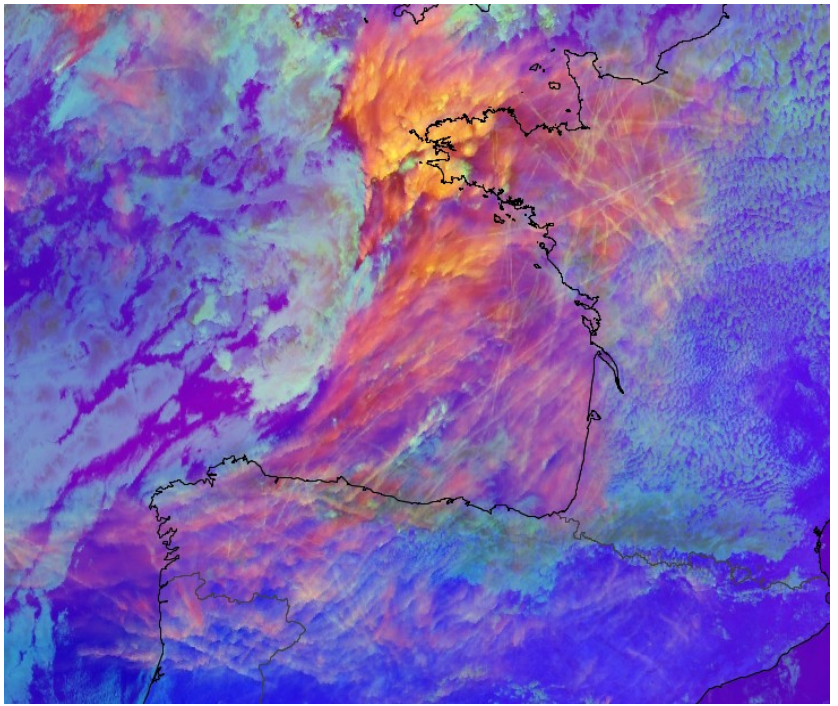
Depending on several factors, cirrus clouds may appear in whitish tones above low-level clouds.

Cloud Type RGB primary application

Another (surprising !) example :



Cloud Type RGB



Convection RGB

Cloud Type RGB much more sensitive to cirrus clouds.

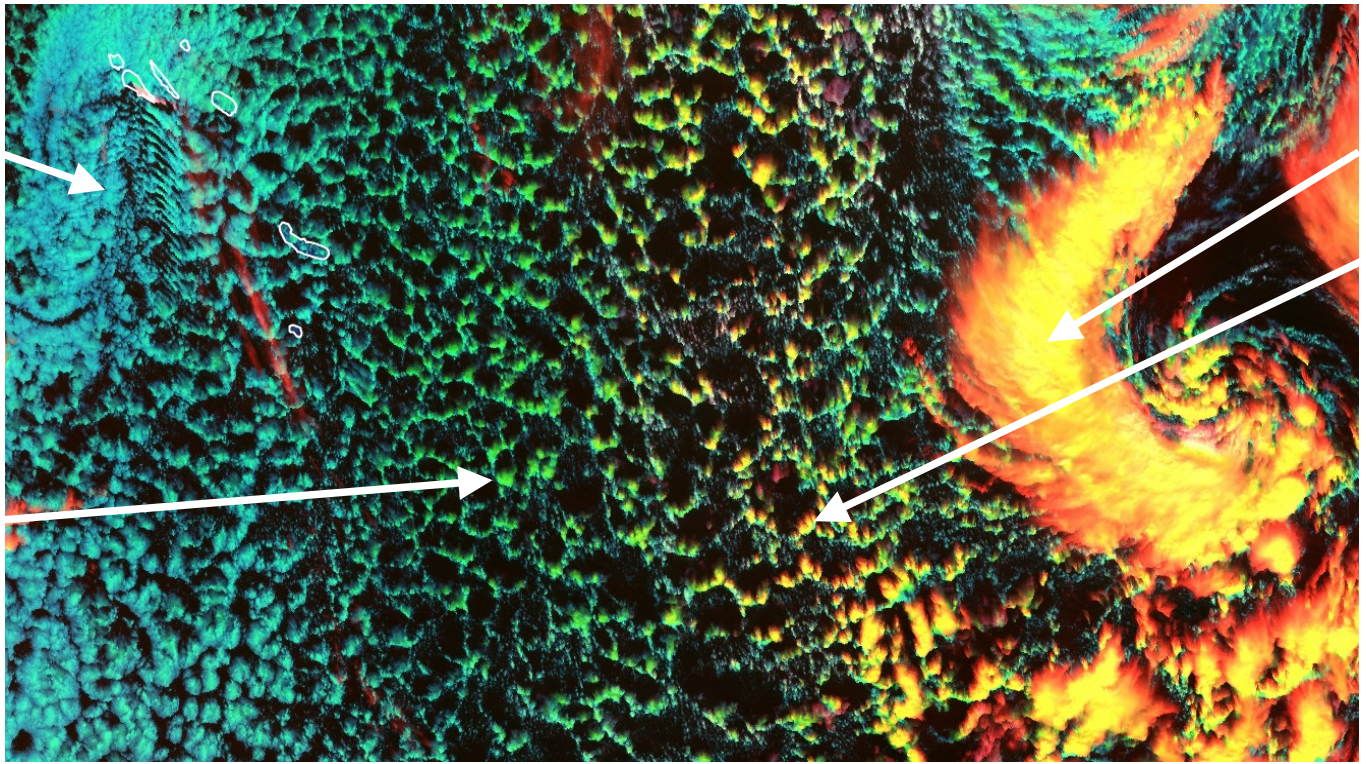
But thin cirrus clouds are not well detected above thick ice clouds.

Another major application of Cloud Type RGB

Qualitative assessment of **cloud vertical extension**, detection of cloud top **glaciation**

Light blue/cyan
→ low-level water clouds

Green
→ ongoing vertical extension
→ mid-level clouds
→ beginning of glaciation with mixed phase on the top



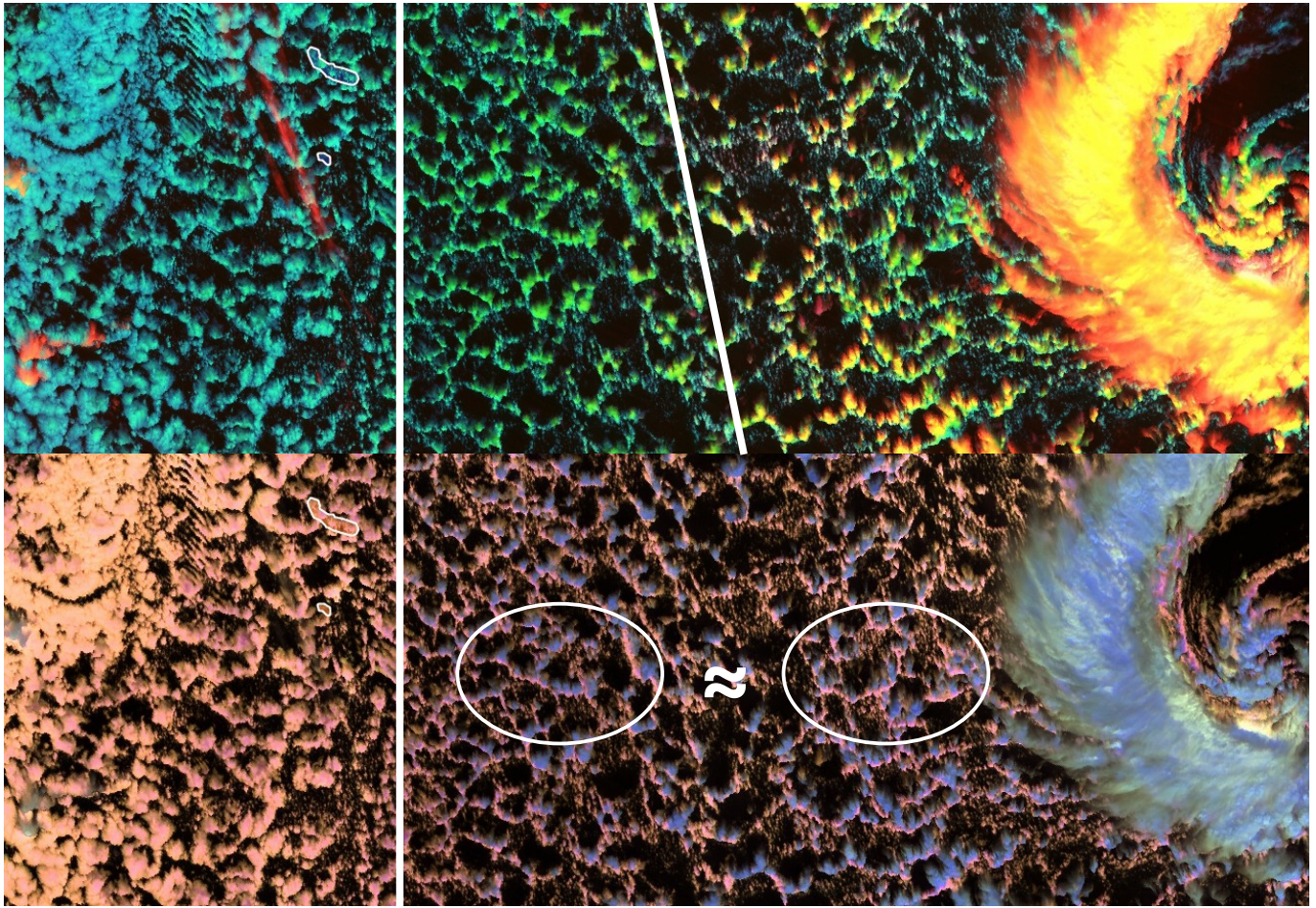
Yellow
→ more vertical extension, higher cloud top
→ thick clouds with ice on top
→ typically TCU, Cumulonimbus clouds or frontal zone

Another major application of Cloud Type RGB

Cloud Phase RGB also allows, of course, to identify the particles phase at the top of the clouds.

However, the intermediate (mixed phase) stage of vertical extension is not as well represented as with Cloud Type RGB.

Cloud Phase RGB may be more accurate and closer to the truth when it comes to phase, but Cloud Type RGB offers, with a colour contrast, an additional stage thanks to its sensitivity to the height of cloud tops.



However, Cloud Type RGB is not recommanded for...

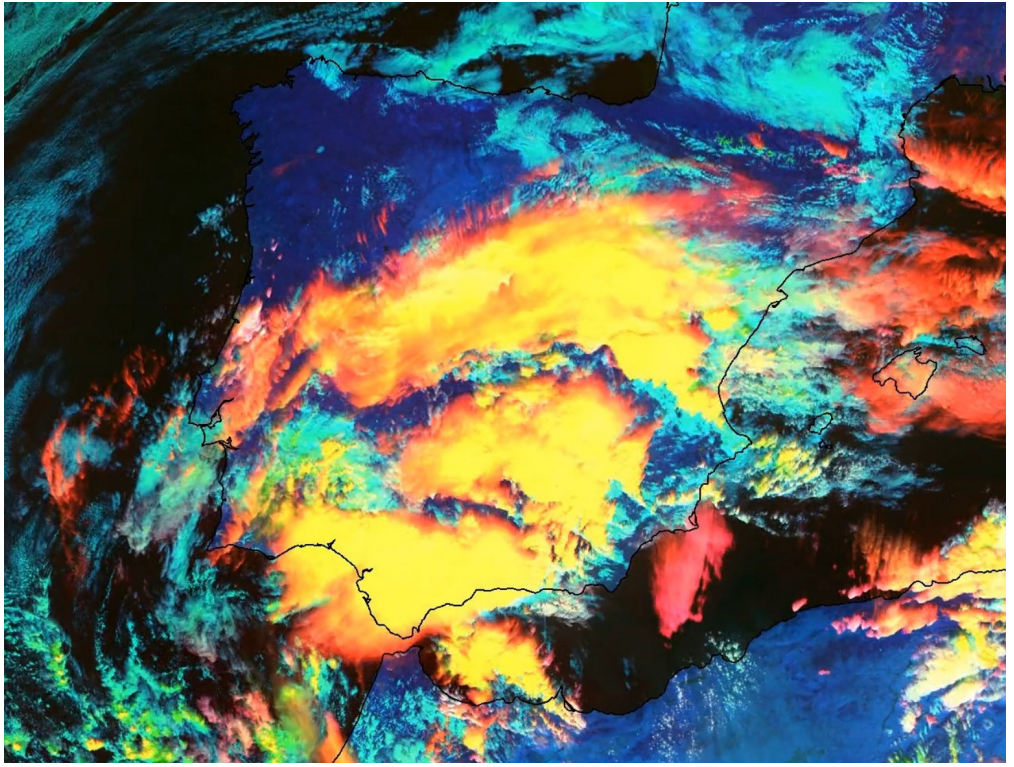
... severe and well established convective situations

Due to saturation of the reflected NIR1.38 signal, clouds tops appear completely yellow without any detail.

Cloud top features are generally not seen with this product, unless there is a very significant solar angle (in which case the colours are also affected)...

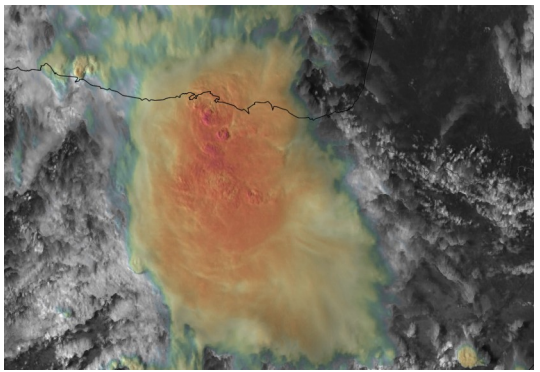
Now, it is precisely these cloud top features that allow forecasters to determine the severity of a storm.

→ Other satellite products are necessary.

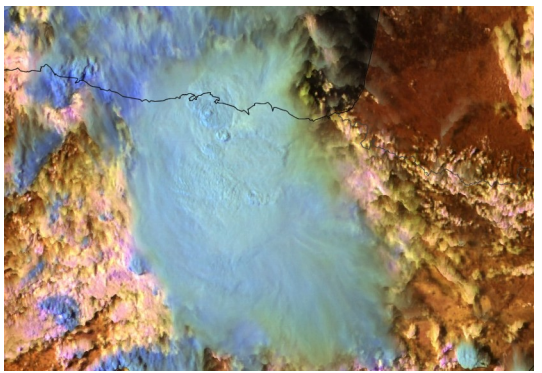


Recommanded products for severe convective situations

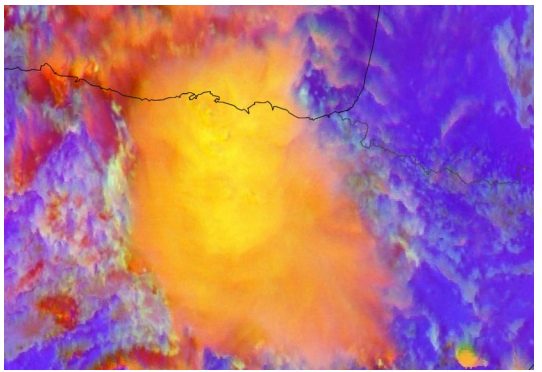
Recommended products : Sandwich, Cloud Phase RGB, Convection RGB



Cloud top features and temperature



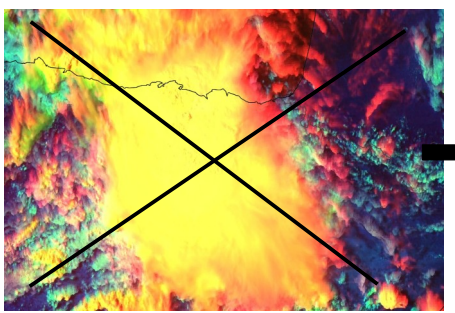
Intense updrafts, glaciation, cloud top features

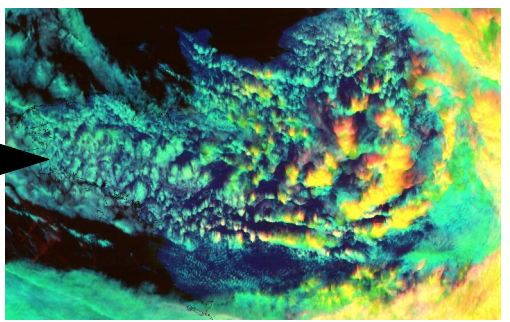


Intense updrafts, strong or developing convection

Recommended during convection initiation or with changeable rear sky : Cloud Type RGB

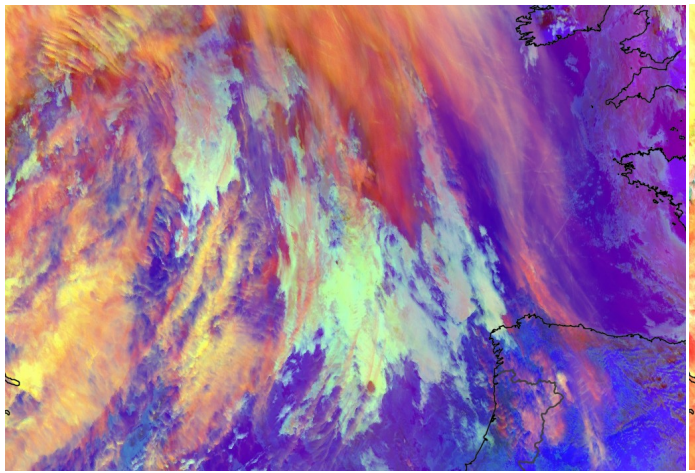
Vertical extension and cloud top glaciation during the developing phase



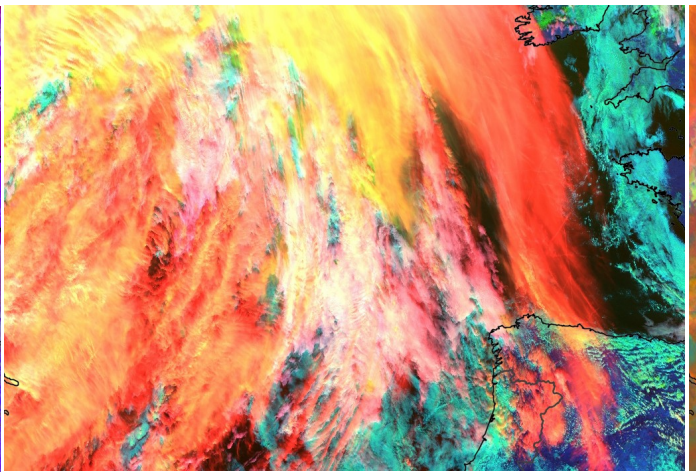


Supercooled water clouds : a small revolution in remote sensing

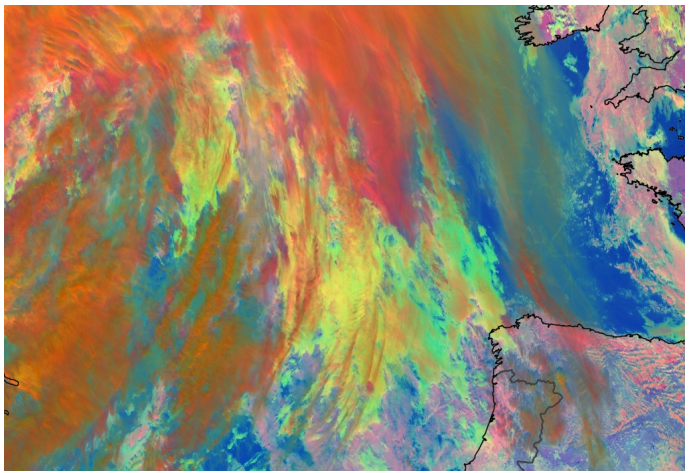
3 RGB products for detecting them



Convection RGB

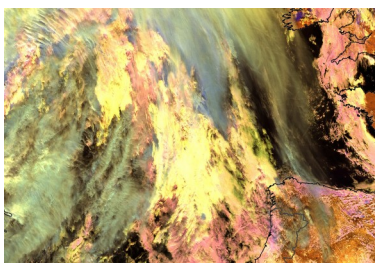


Cloud Type RGB



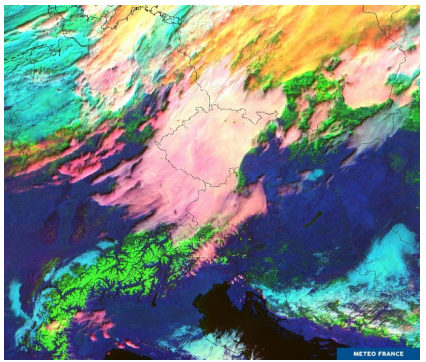
Day Microphysics RGB

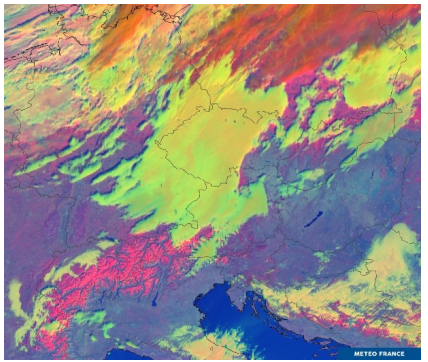
And one to confirm the liquid phase of water

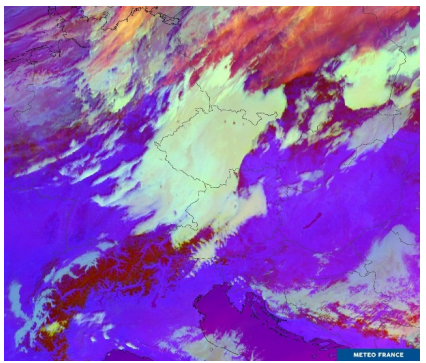


Cloud Phase RGB

Supercooled water clouds : a small revolution in remote sensing







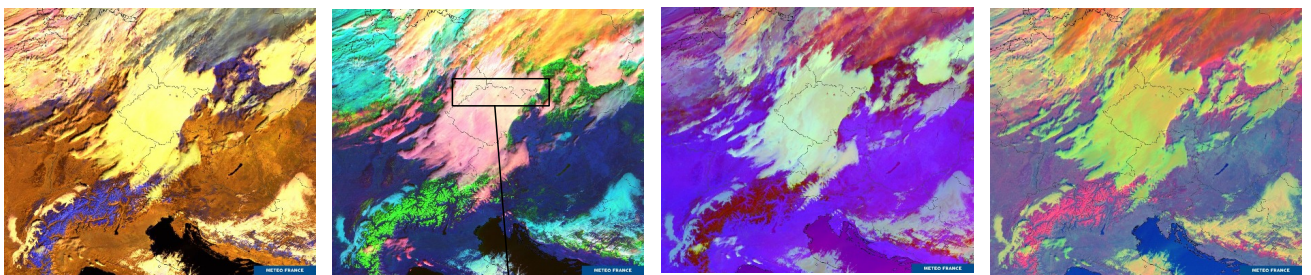
The 3 products are complementary and provide different information

Qualitative thickness information is provided by Cloud Type RGB (white/pink) and Day Microphysics RGB (orange/green)
--> helps forecasters anticipate potential precipitating clouds

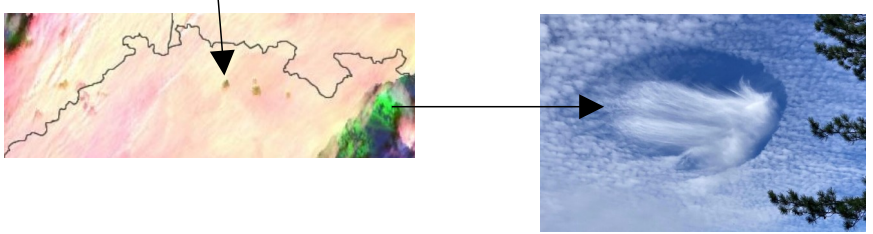
Day Microphysics RGB	Supercooled, thin water cloud, large droplets
	Supercooled, thin water cloud, small droplets
	Supercooled, thick water cloud, small droplets
	Supercooled, thick water cloud, large droplets
Cloud Type RGB	Supercooled, thick water cloud
	Supercooled, thin water cloud
Convection RGB	Supercooled water cloud (green shades when very cold)

Supercooled water clouds : a small revolution in remote sensing

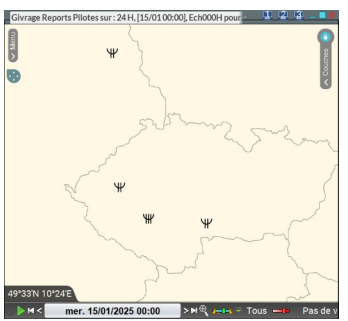
Supercooled water clouds are a major hazard for **aeronautical meteorology**, and their detection is a crucial information.
Freezing rain sometimes resulting from this kind of clouds also represents another significant challenge for forecasters.



Supercooled water cloud, Czech Republic, 2025/01/14

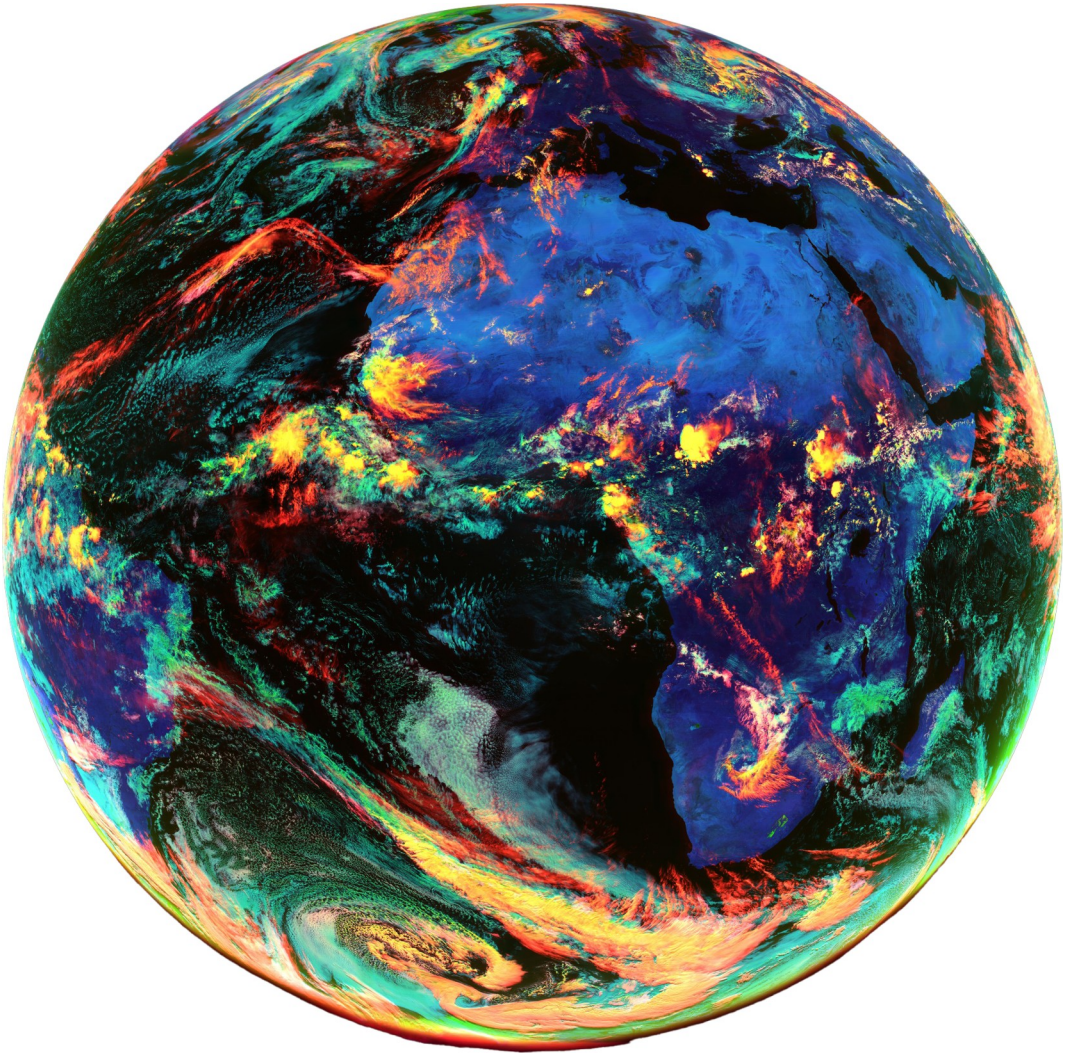


Cavum : cloudy feature formed in the presence of supercooled water



Icing pilot reports the same day

Well-known subtleties



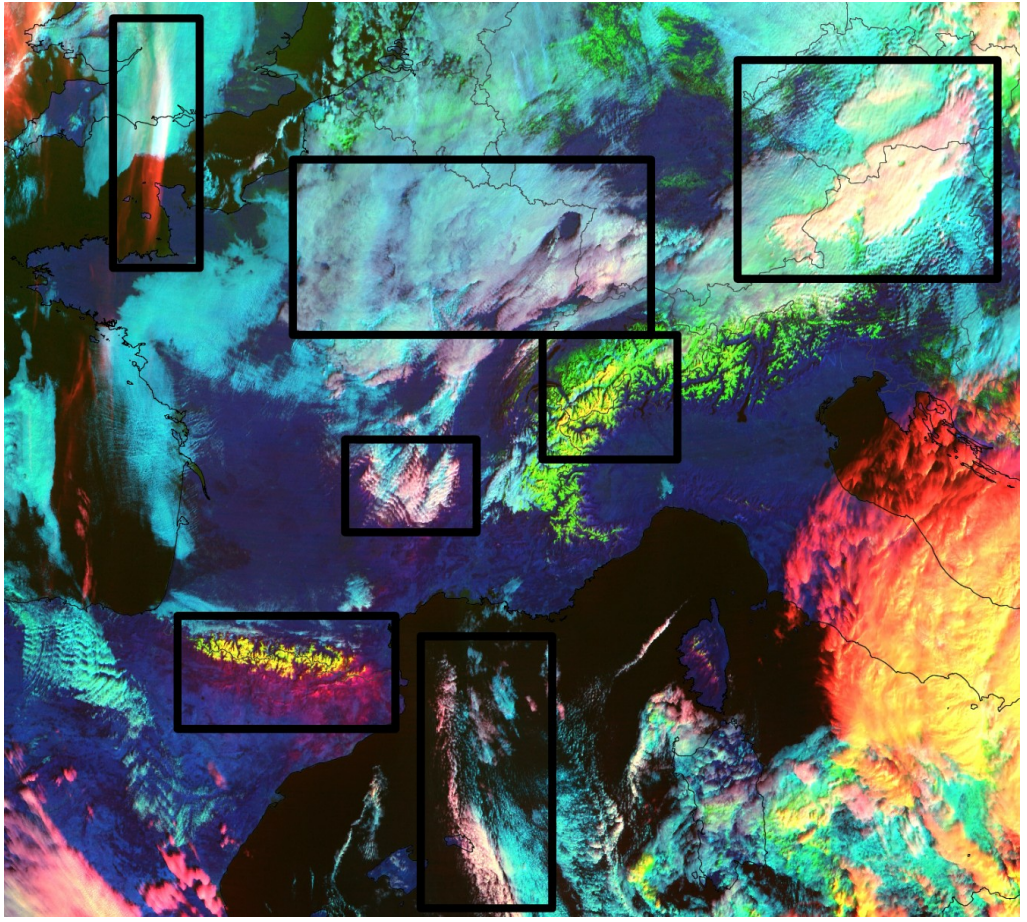
Supercooled water clouds or dry atmospheric conditions ?

Cloud Type RGB,
a product full of exceptions

High contribution of NIR1.38 channel in the red band in case of a very dry atmosphere.

→ A red contribution is added for every features, cloud or ground.
→ Colours are modified.

In particular, low clouds become more whitish/greyish/pinkish… just like supercooled water clouds.

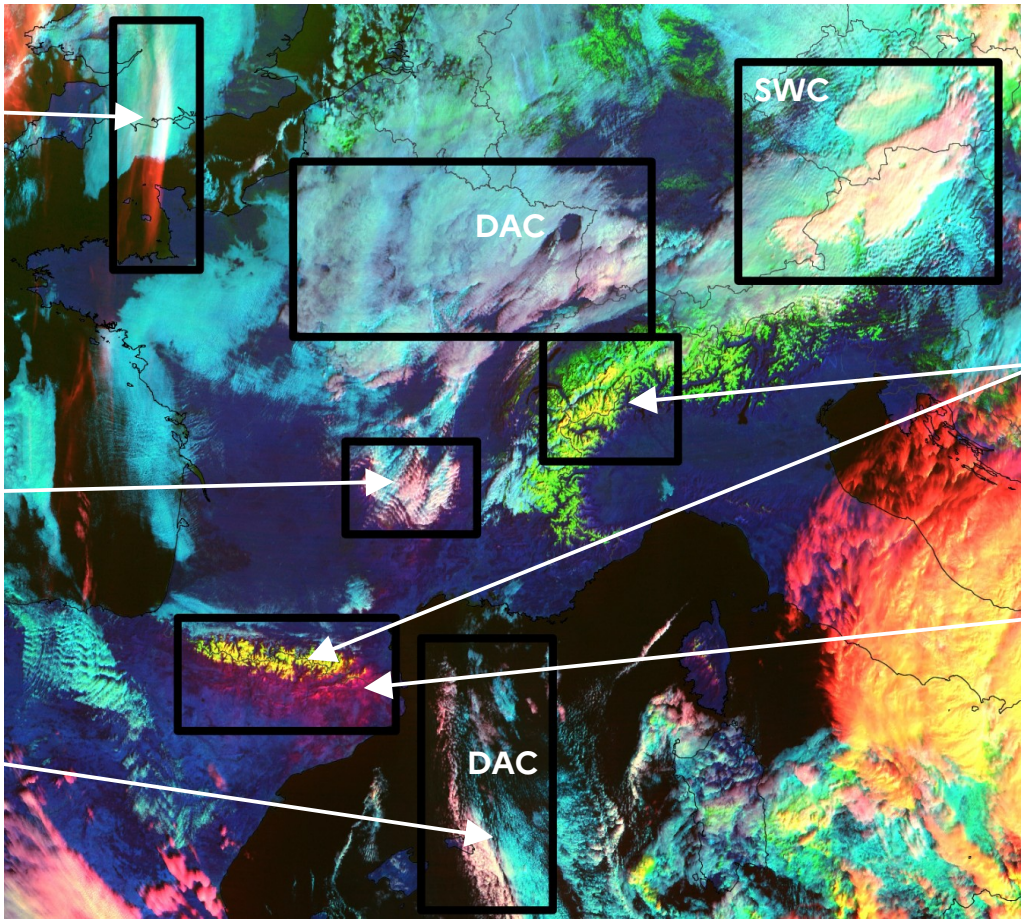


Supercooled water clouds or dry atmospheric conditions ?

Neither, just cirrus clouds above low-level water clouds

Probably both

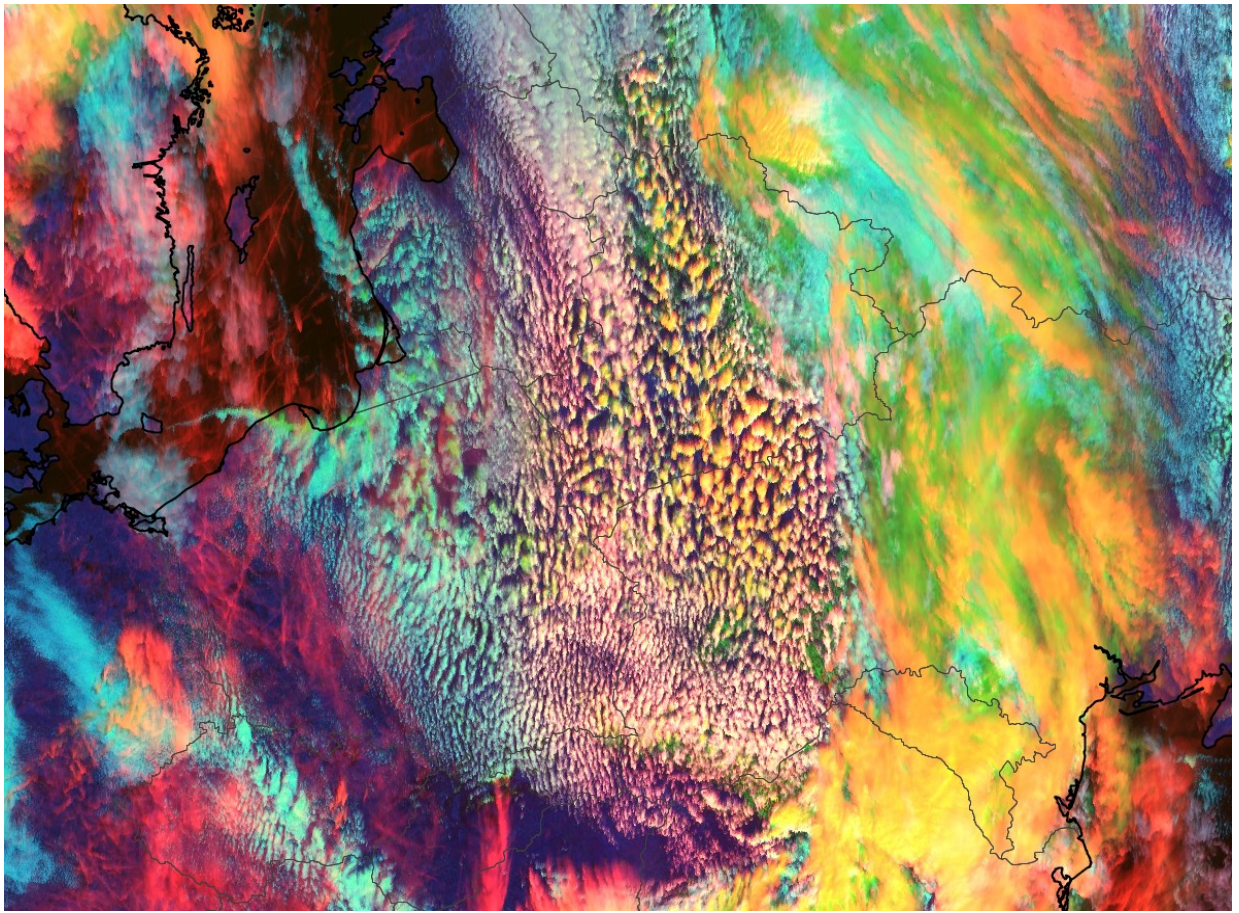
Airmass limit
→ what could be considered as a weakness of the product is actually good information !



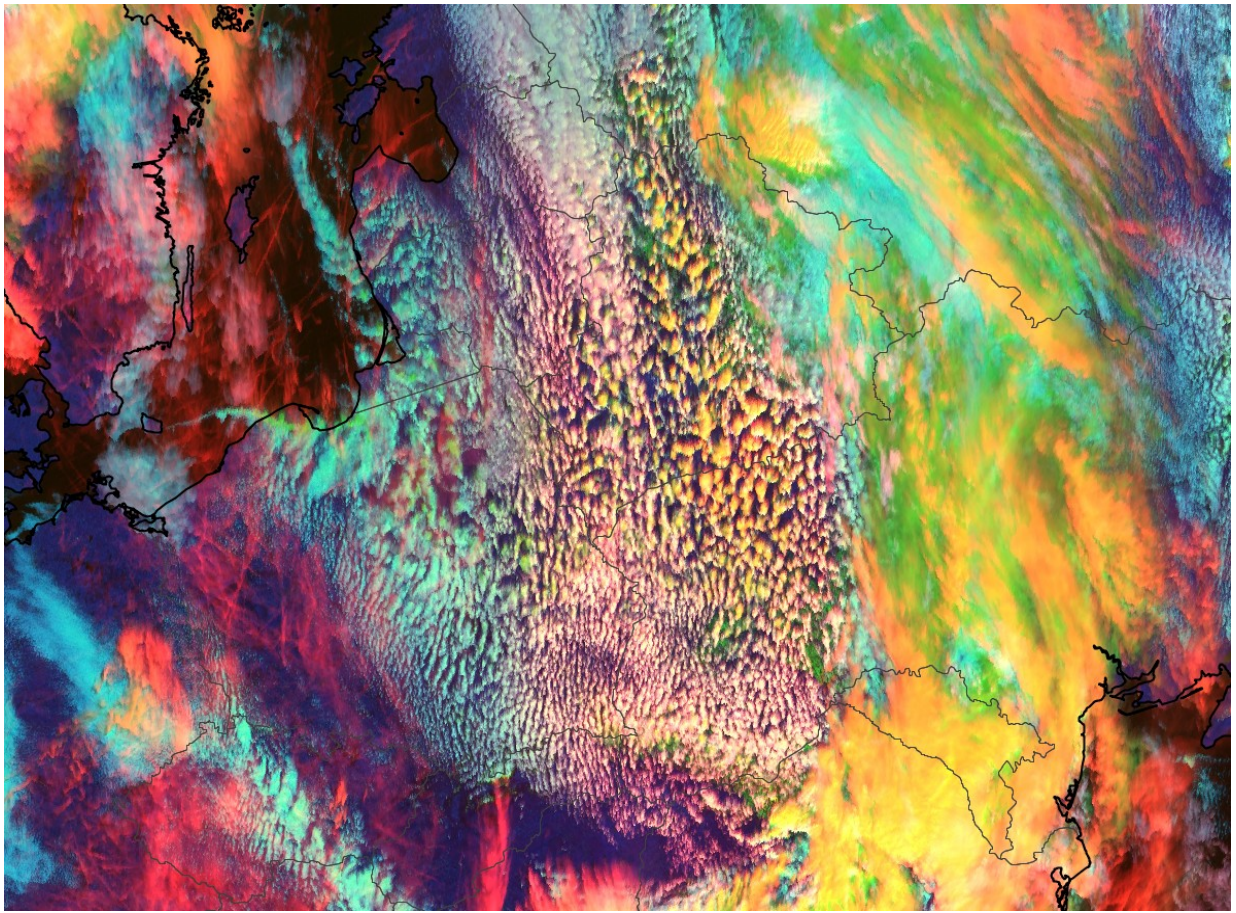
Typical yellow snow with dry atmosphere above
Green + red = yellow

Typical redish ground features = very dry atmosphere including at low levels

Cloud Type RGB with dry atmospheric conditions



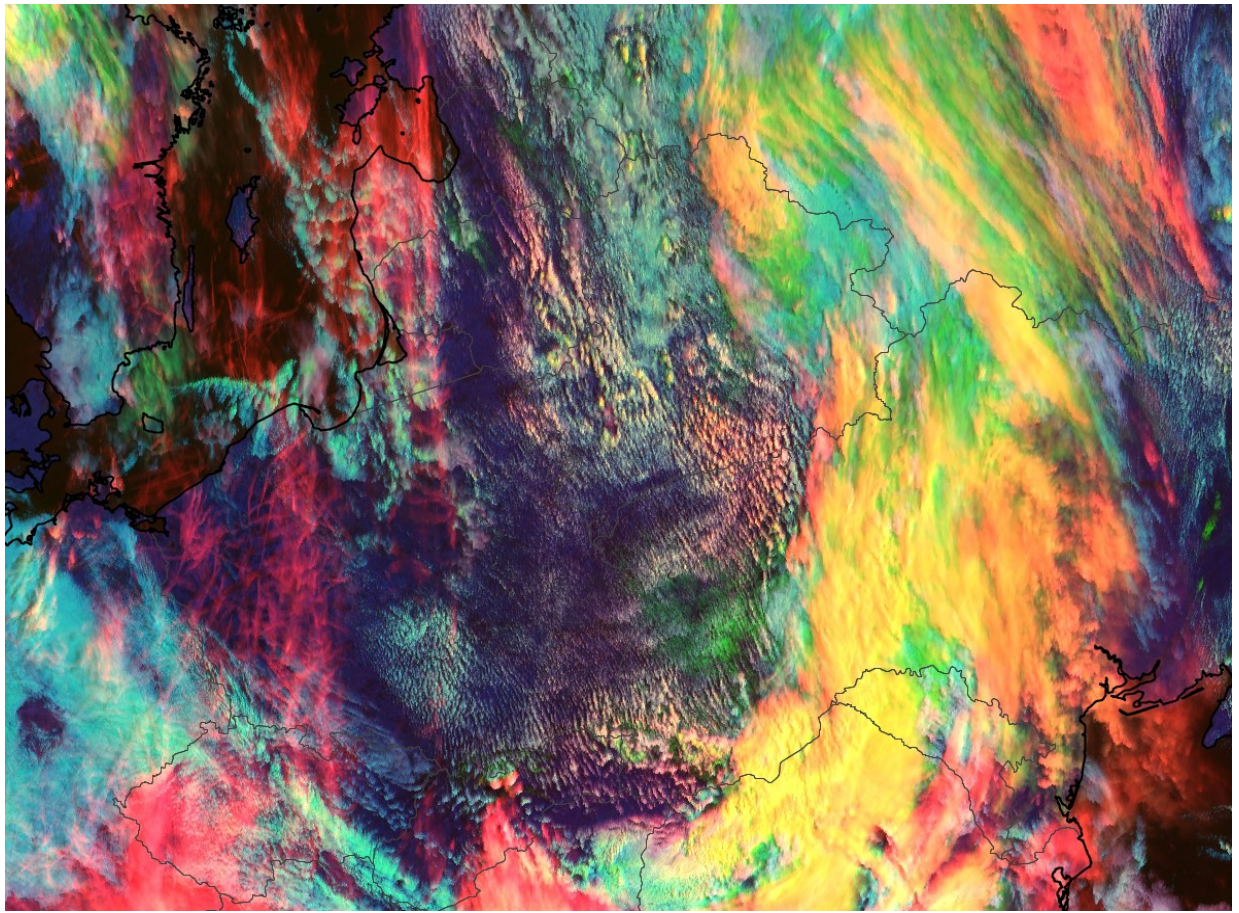
Dry atmospheric conditions : rainbow cumulus clouds !



- Blue Cumulus clouds : low-level water clouds
- Green Cumulus clouds : mixed phase, with higher cloud top
- Yellow Cumulus clouds : TCU, high vertical extension, ice on top
- Greyish/whitish/pinkish Cumulus clouds : very dry atmosphere above
  OR
  cirrus clouds above

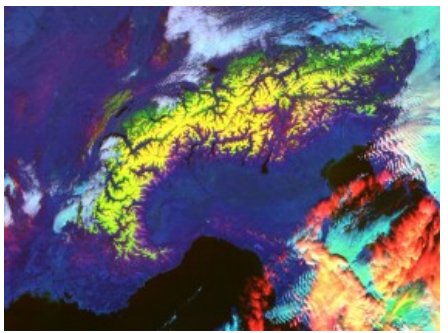
2025/04/10
10 h UTC

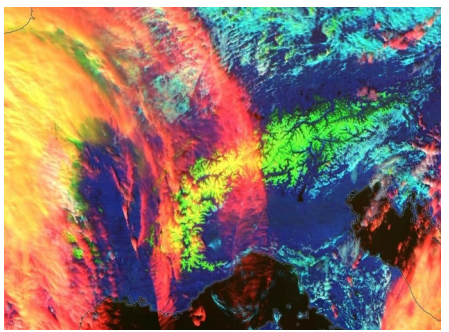
Snow and mid-level clouds



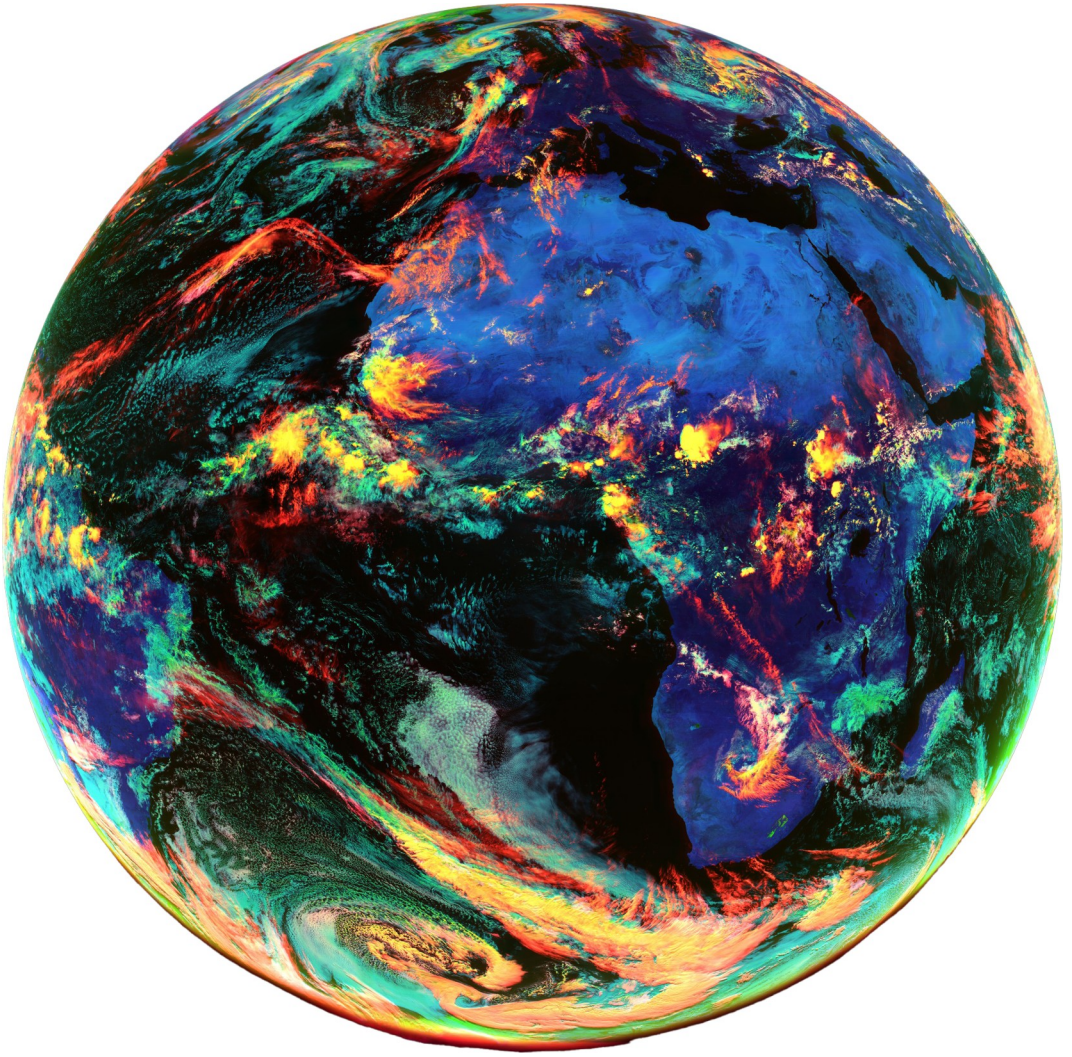
2025/04/10
7 h 30 UTC

- The snow is green, very similar to mid-level/mixed-phase clouds.
- It turns yellow if the atmosphere is very dry or if cirrus clouds are above it.



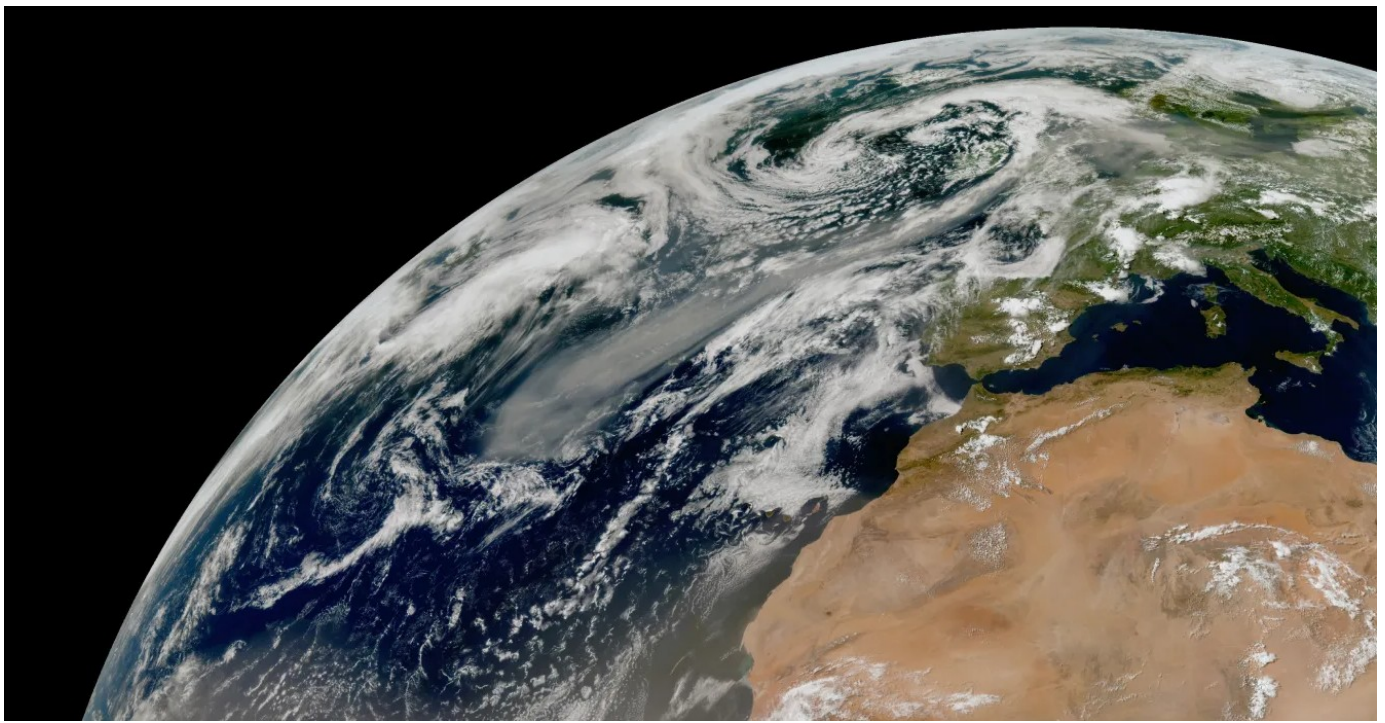


Hot topic special case



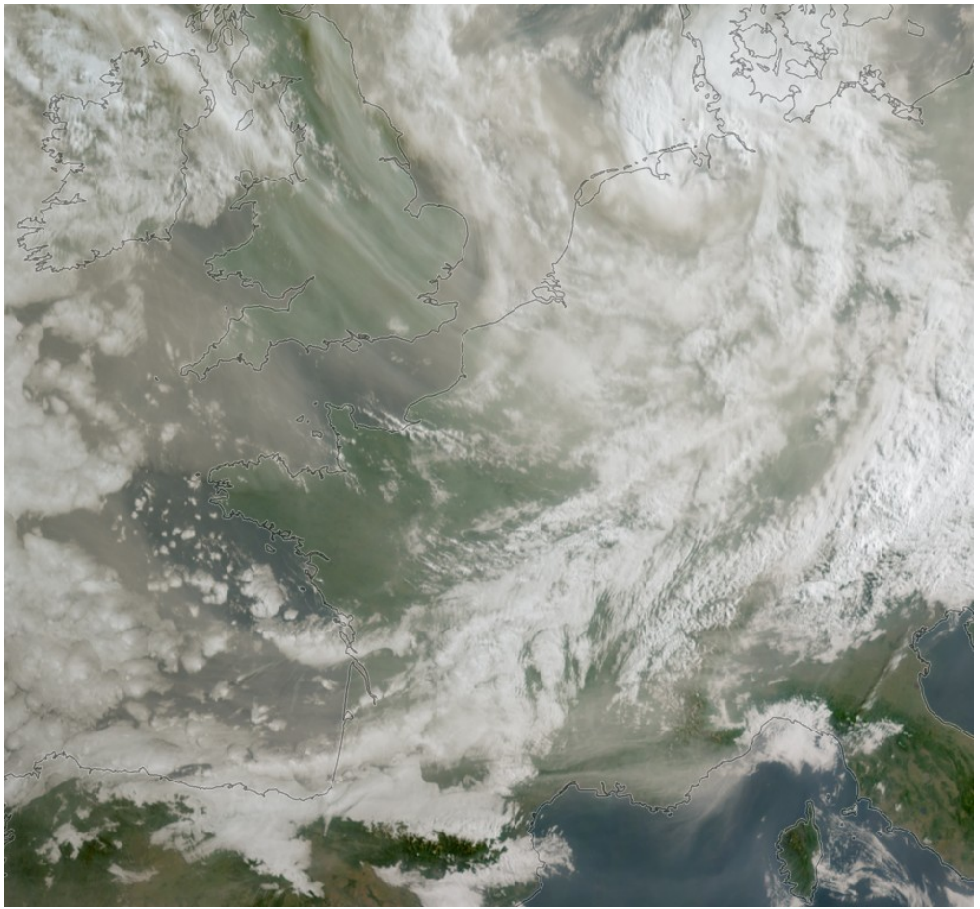
Smoke from Canadian fires

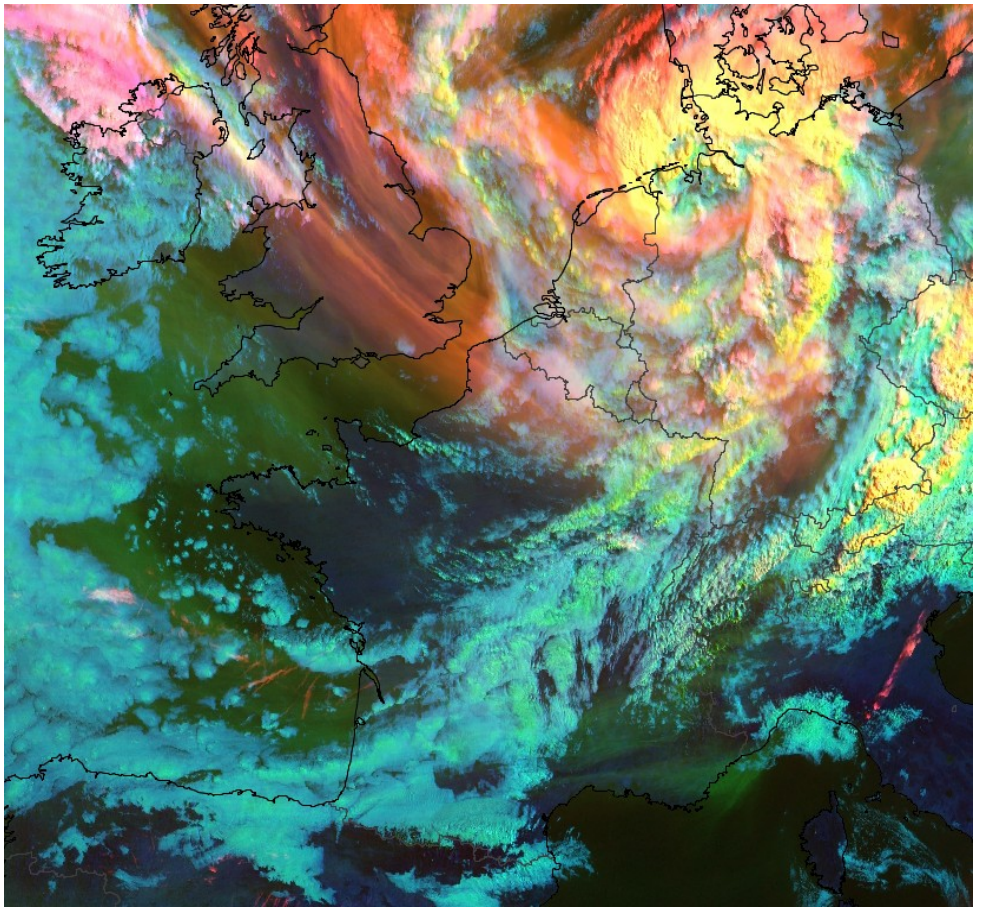
Massive fires have been raging in Canada since the end of May. A few days later, the smoke plumes have reached Europe.



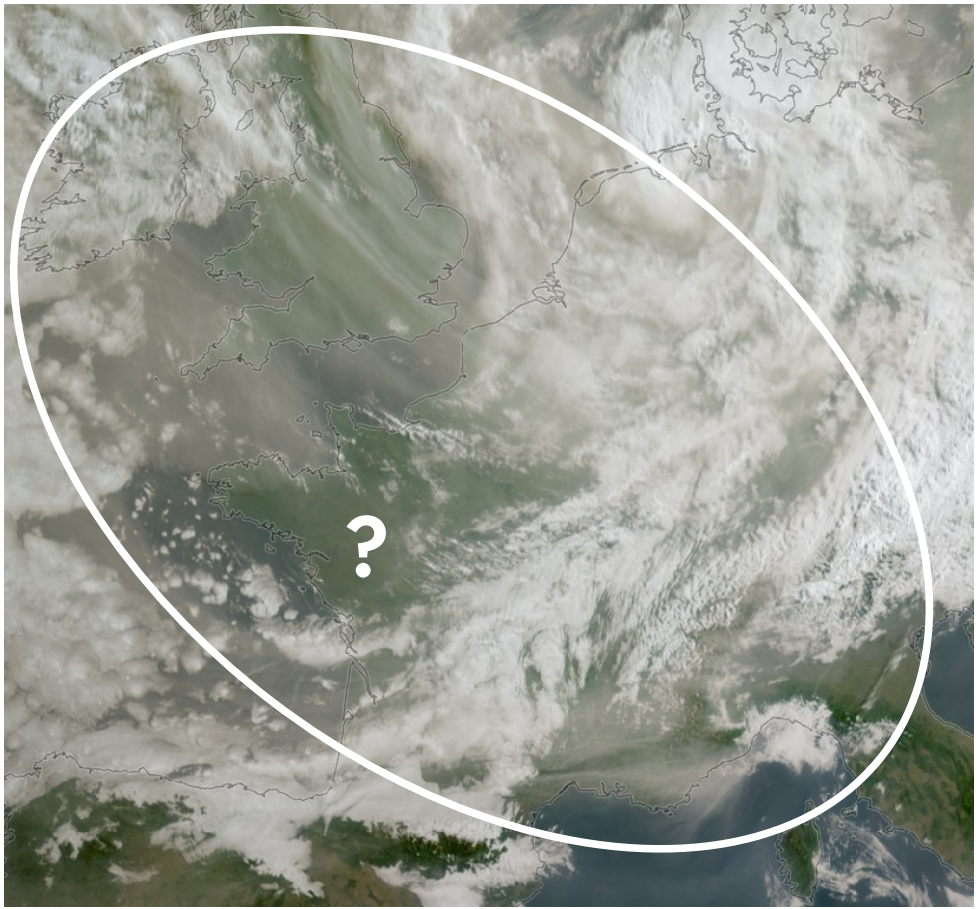
METEOSAT-12
2025/05/31 15 h UTC

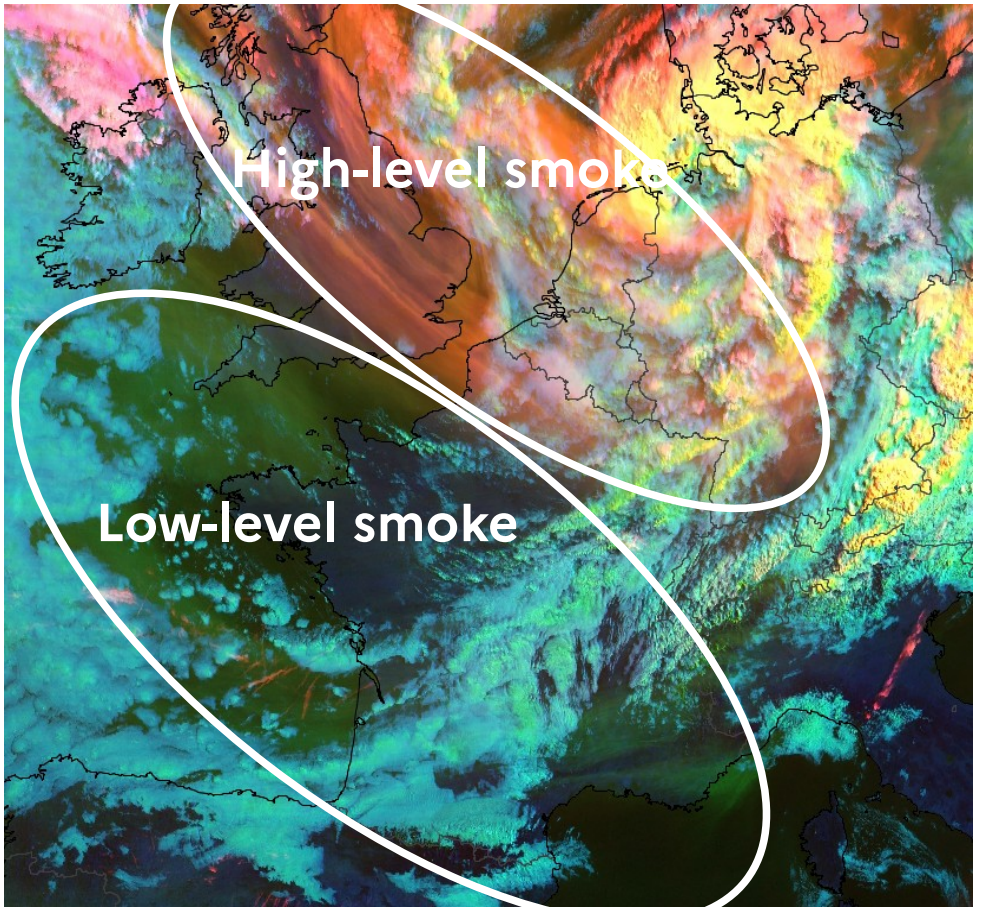
Smoke from Canadian fires





Smoke from Canadian fires



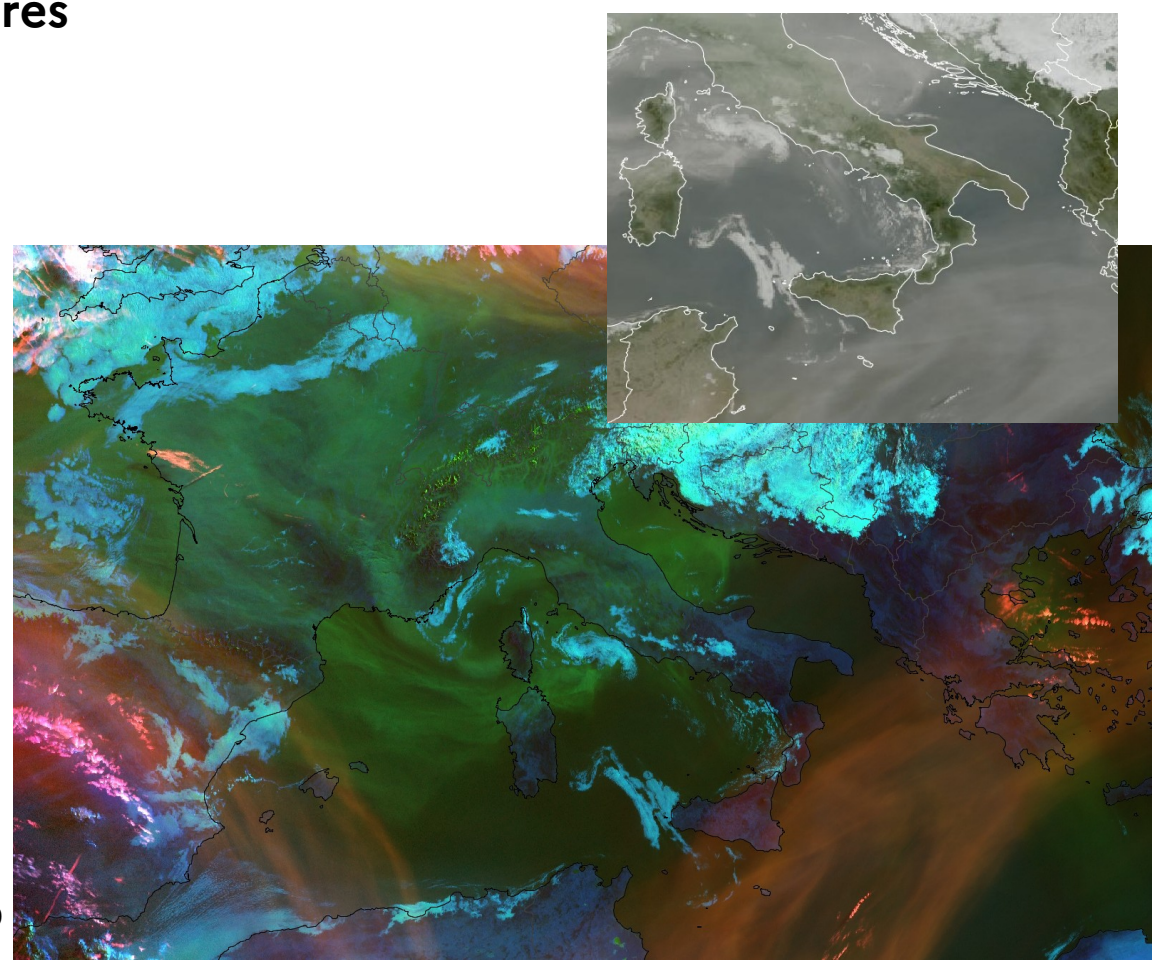


Smoke from Canadian fires

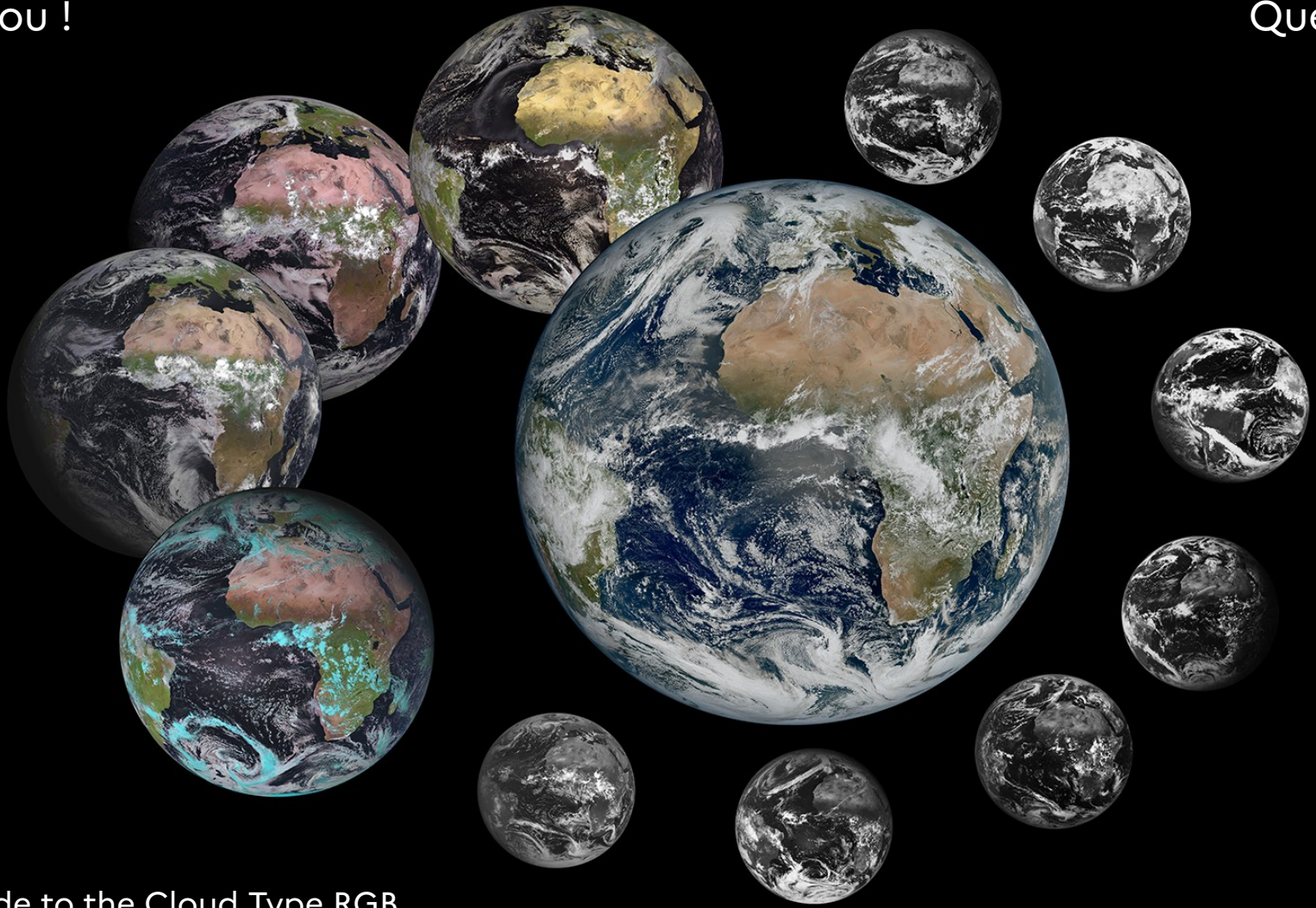
True Colour RGB gives no height indication, whereas there is a colour contrast between low-level and high-level smoke.

Again, thanks to channel NIR1.38, one can get qualitative aerosol height informations.

Low solar angle makes it easier to detect aerosols.



2025/06/09
5h UTC

Thank you !

Questions ?