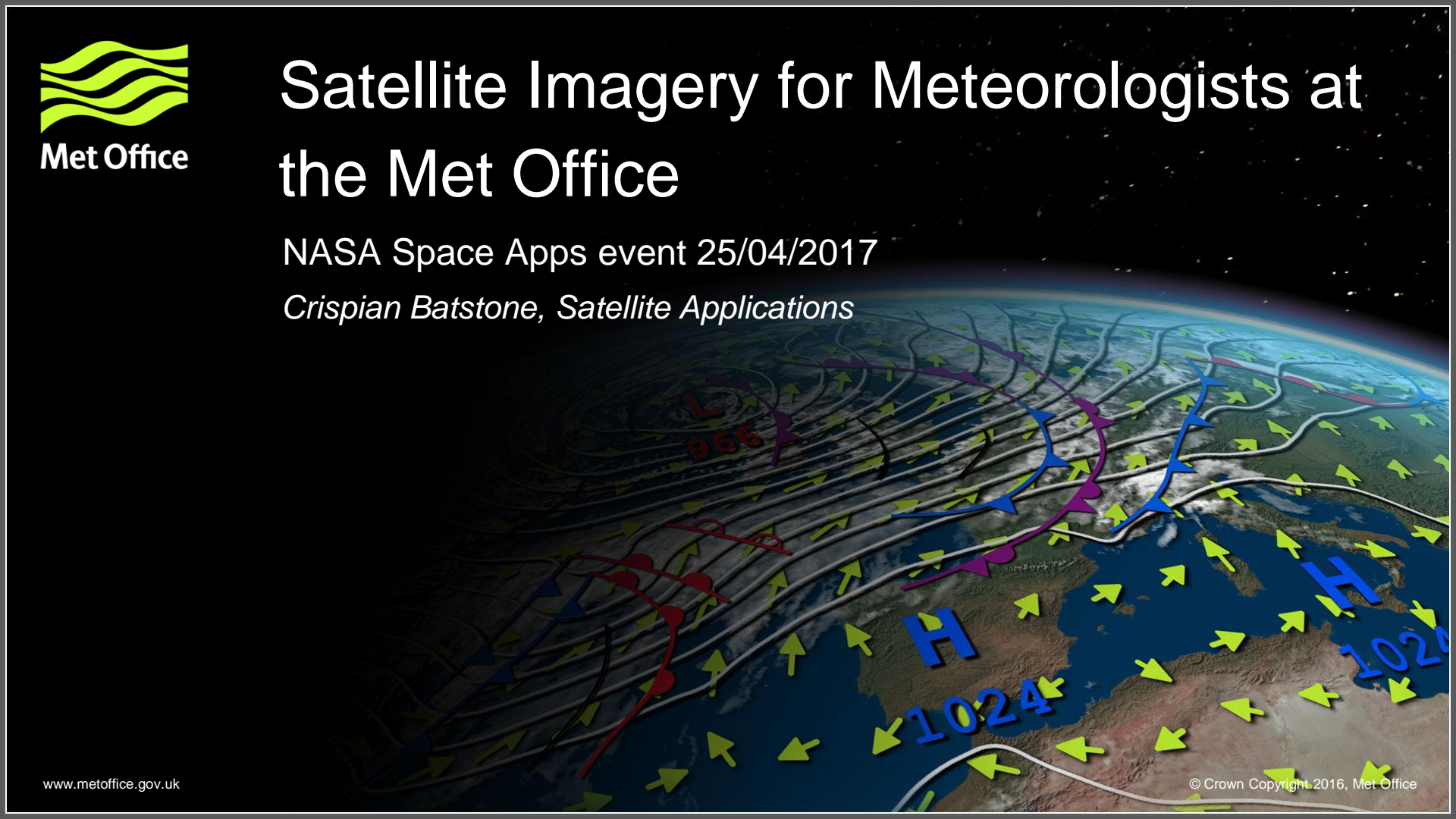


# Satellite Imagery for Meteorologists at the Met Office

NASA Space Apps event 25/04/2017

*Crispian Batstone, Satellite Applications*

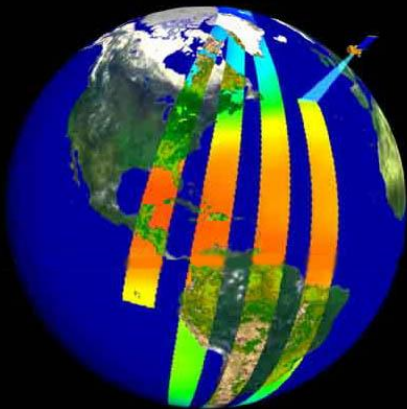








# Polar Orbiting Satellites



## **Worldview-4 (DG)**

- 31cm pixel resolution
- 13km swath
- 617km orbit height

## **Landsat-8 (USGS)**

- 15m pixel resolution
- 185km swath
- 710km orbit height

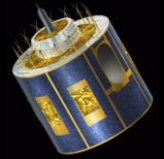
## **Suomi NPP (NASA/NOAA)**

- 375m pixel resolution
- 3000km swath
- 833km orbit height

# Weather satellites' orbits



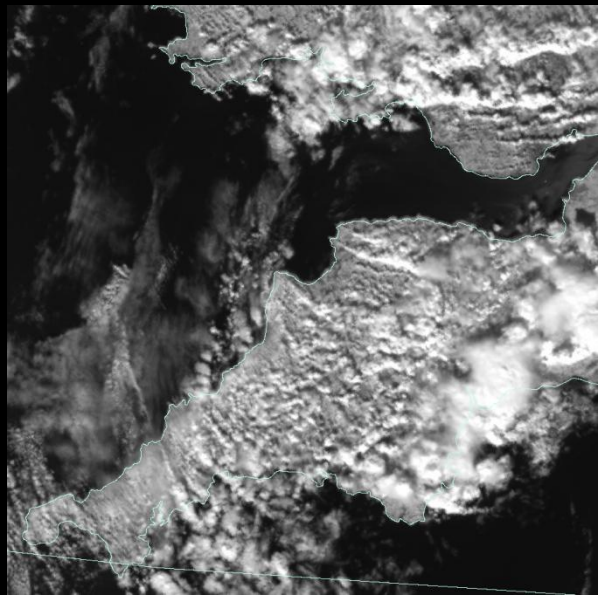
Geostationary orbit (35800km)



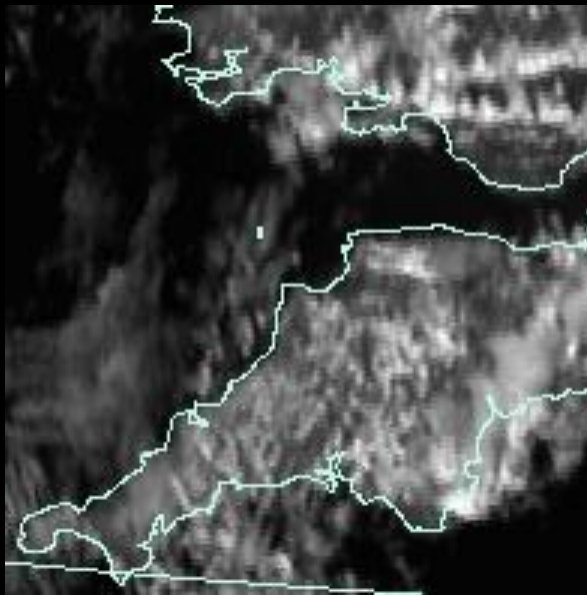
Meteosat-10

Suomi-NPP orbit (833km)

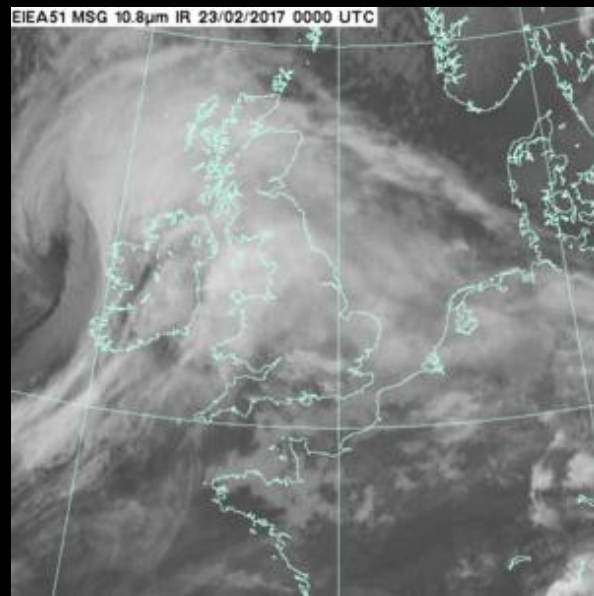
# Imager resolution



Suomi-NPP

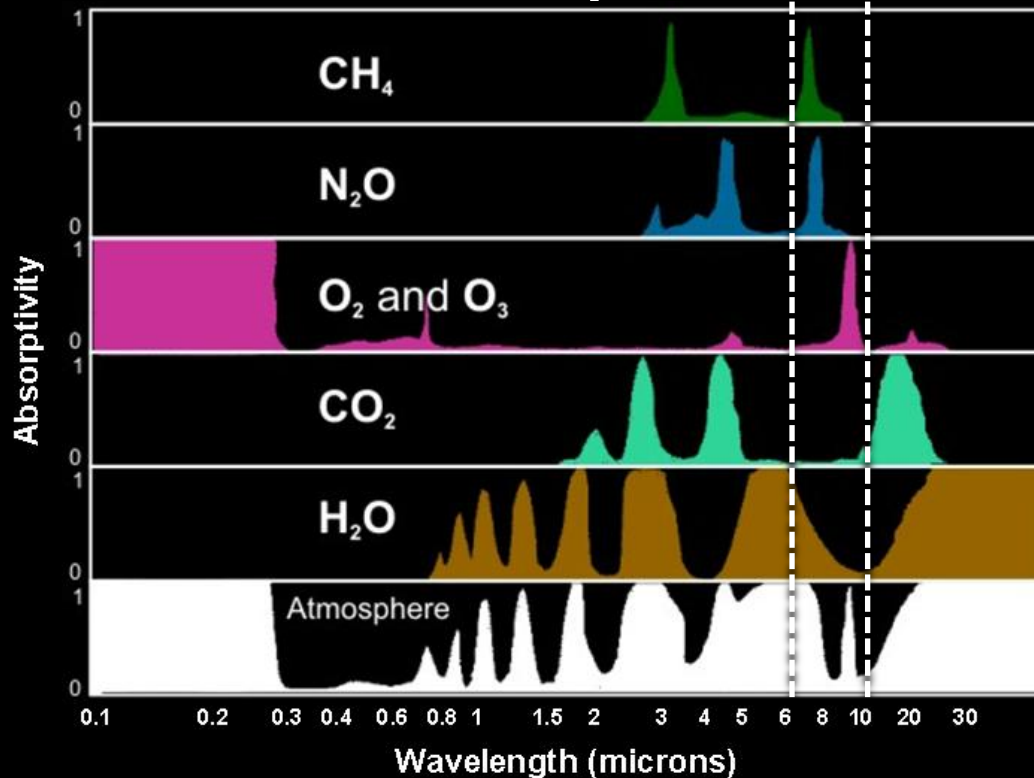


Meteosat-10 (HRV)



Meteosat-10 (IR)

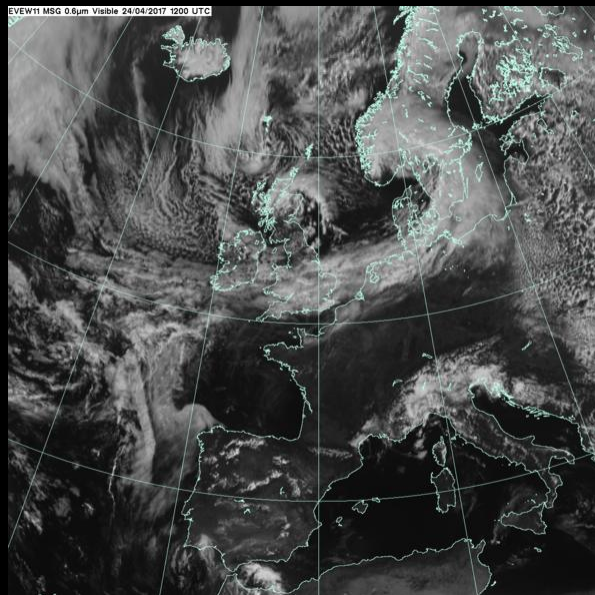
# Atmospheric absorption of radiation



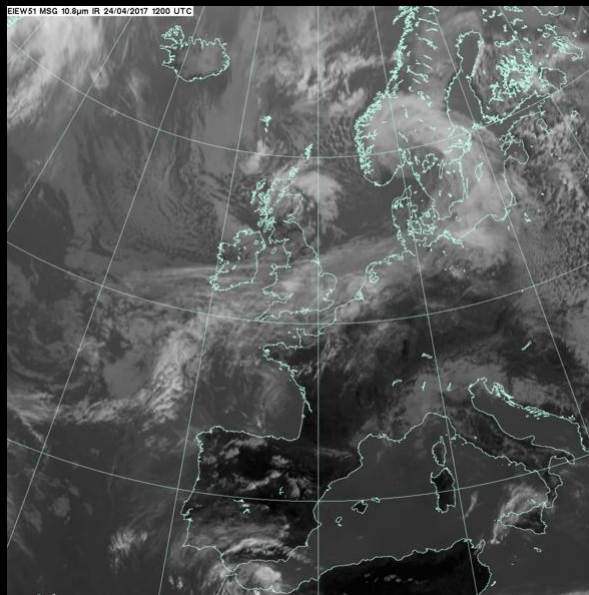
- LW emission from Earth  $>5\mu\text{m}$
- LW absorption by water  $\sim 6.3\mu\text{m}$
- IR 'window' at  $\sim 10.5\mu\text{m}$



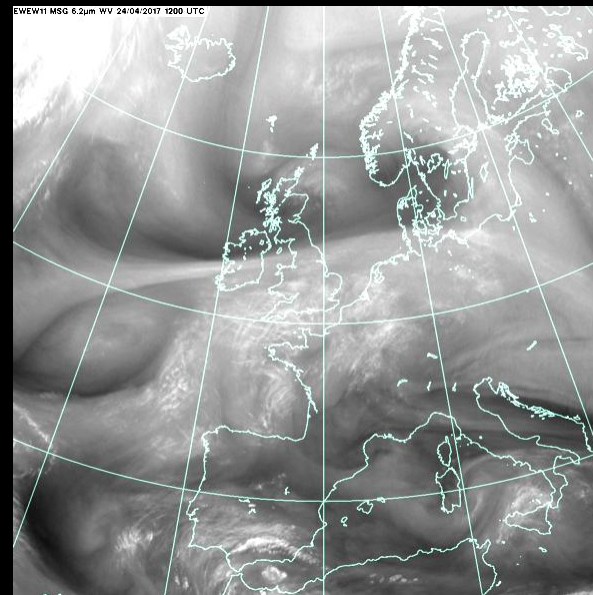
# Imagery for different wavelengths



Visible (0.8µm)

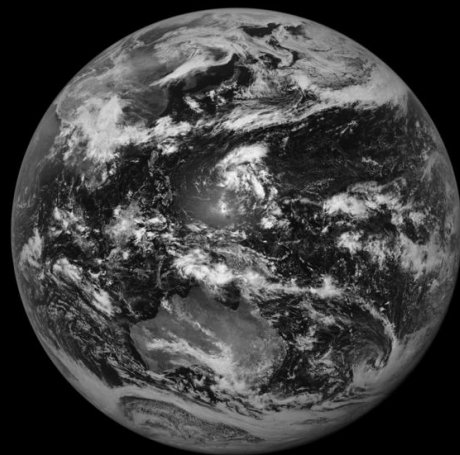


Infra-red (10.8µm)

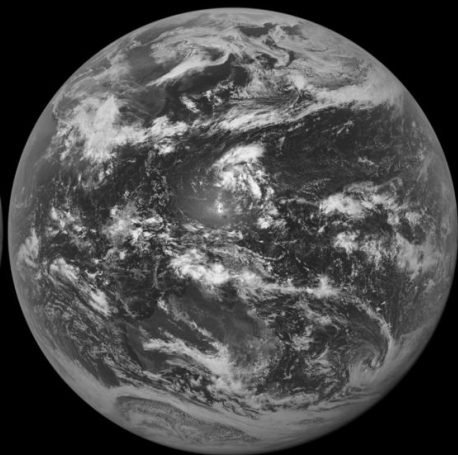


Water vapour (6.2µm)

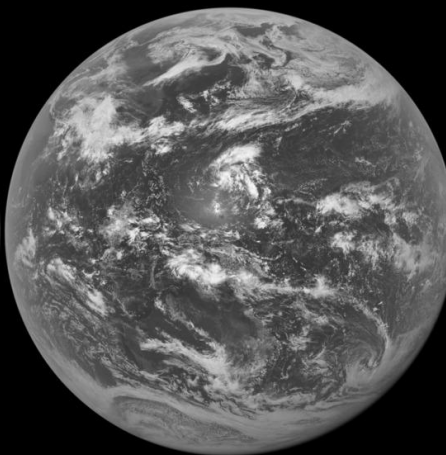
# True colour RGB imagery



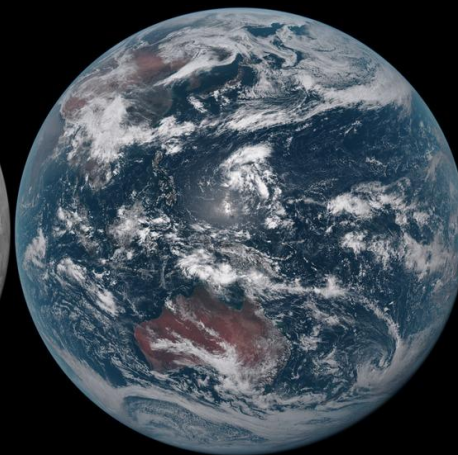
Red (0.7µm)



Green (0.5µm)



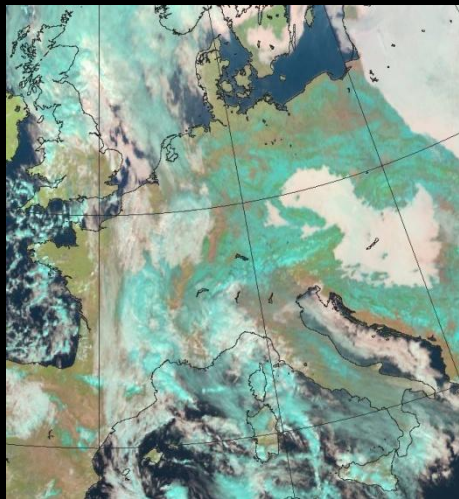
Blue (0.45µm)



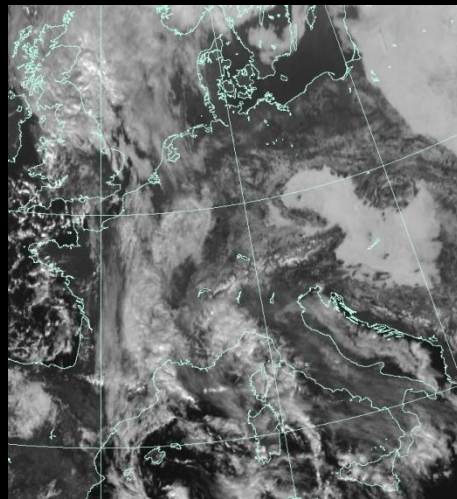
Himawari-8 / JMA



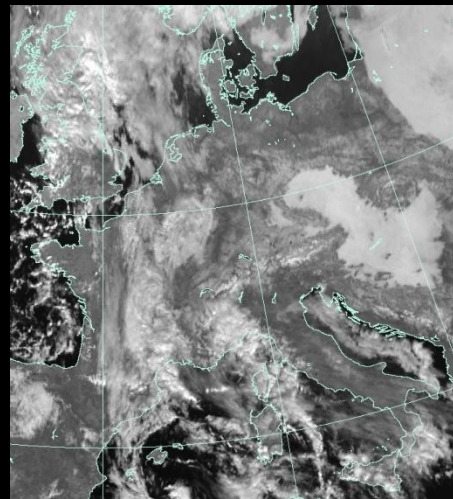
# Natural colour RGB imagery



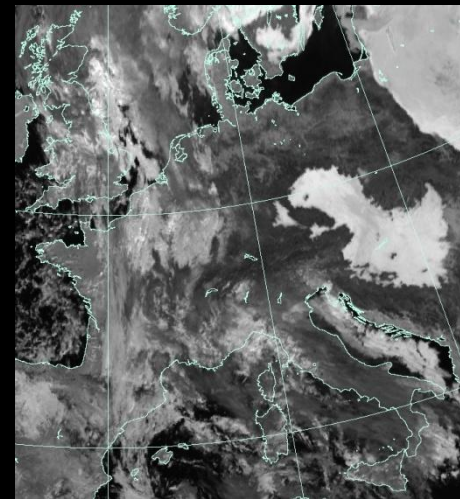
Meteosat-10



0.6µm → Blue



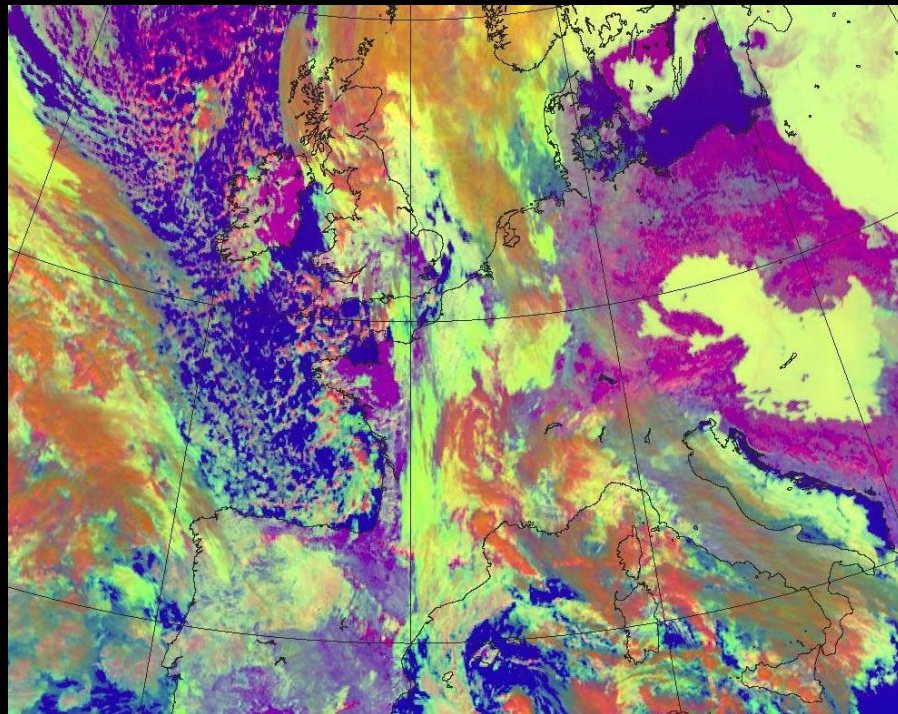
0.8µm → Green



1.6µm → Red

# Day microphysical RGB imagery

- $0.8\ \mu\text{m}$  → Red
- $3.9\ \mu\text{m}$  → Green
- $10.8\ \mu\text{m}$  → Blue
- Cold ice clouds = Orange
  - Cold = low contribution from Blue
  - Ice = low contribution from Green
- Cold liquid water clouds = Yellow
  - Water = more contribution from Green
- Warm liquid water clouds = cream/pink
  - Warm = greater Blue contribution







Met Office



Supercooled, thick water cloud

- Bright, thick
- Large droplets



Supercooled, thick water cloud

- Bright, thick
- Small droplets



Supercooled thin water cloud

- Large droplets



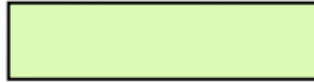
Supercooled, thin water cloud

- Small droplets



Thick water cloud (warm rain cloud)

- Bright, thick
- Large droplets



Thick water cloud (no precipitation)

- Bright, thick
- Small droplets



Thin water cloud

- Large droplets



Thin water cloud

- Small droplets



Deep precipitating cloud  
(precip. not necessarily reaching the ground)

- Bright, thick
- Large ice particles
- Cold cloud



Deep precipitating cloud  
(Cb cloud with strong updrafts and severe weather)\*

- Bright, thick
- Small ice particles
- Cold cloud

\*or thick, high-level lee cloudiness with small ice particles



Thin Cirrus cloud  
(Large ice particles)



Thin Cirrus cloud  
(Small ice particles)

# 'Night' RGB imagery

- $12.0\text{ }\mu\text{m} - 10.8\text{ }\mu\text{m} \rightarrow \text{Red}$
- $10.8\text{ }\mu\text{m} - 3.9\text{ }\mu\text{m} \rightarrow \text{Green}$
- $10.8\text{ }\mu\text{m} \rightarrow \text{Blue}$

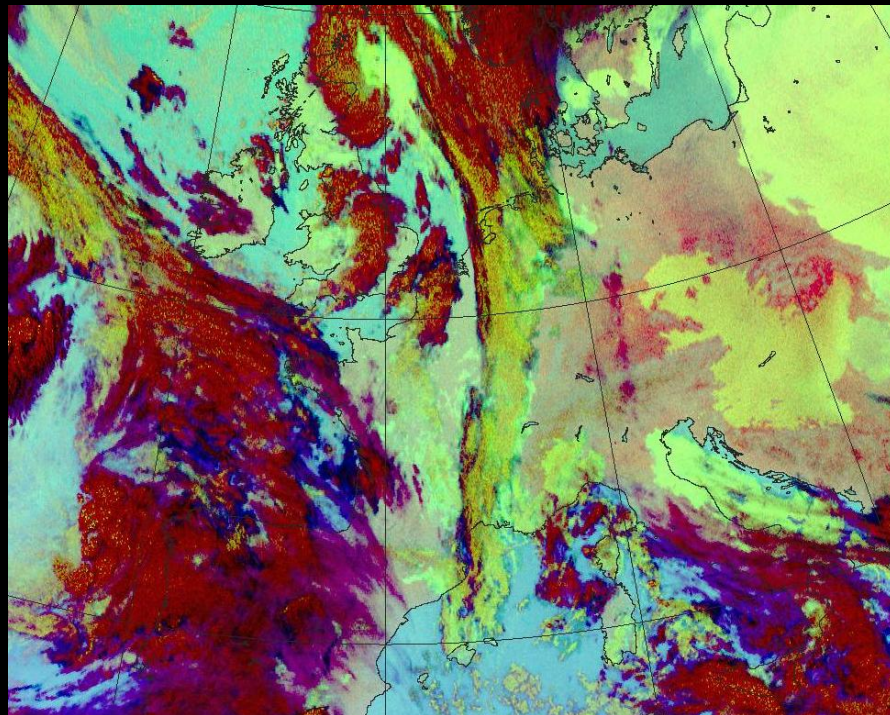


Cold fog/low cloud

Thin high cirrus

Cold, thick, high cloud

Very cold (e.g. Cb)





# Any questions?

