

MSG Red-Green-Blue(RGB) combinations

Estelle de Coning

South African Weather Service

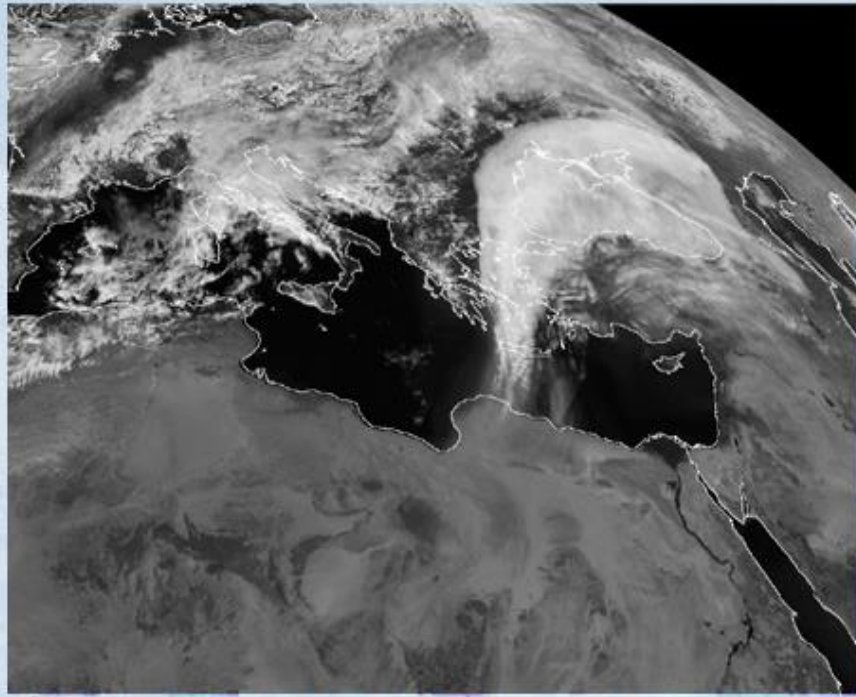
Most slides taken from EUMETSAT training
events, Jochen Kerkmann

Content

- Why RGBs?
- Standard RGBs
- Examples of RGBs and their interpretation
 - Day Natural (3-2-1)
 - Day Microphysical (2-4r-9)
 - Convective Storms (5-6,4-9,3-1)
 - Airmass (5-6, 8-9,5i)
- Summary

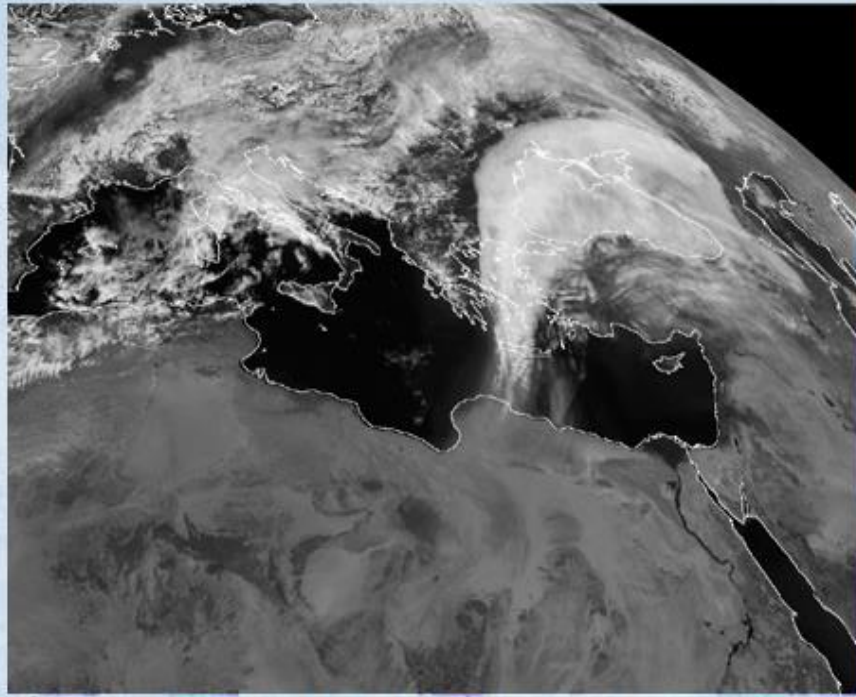
Why RGBs?

Visible (VIS0.6) image

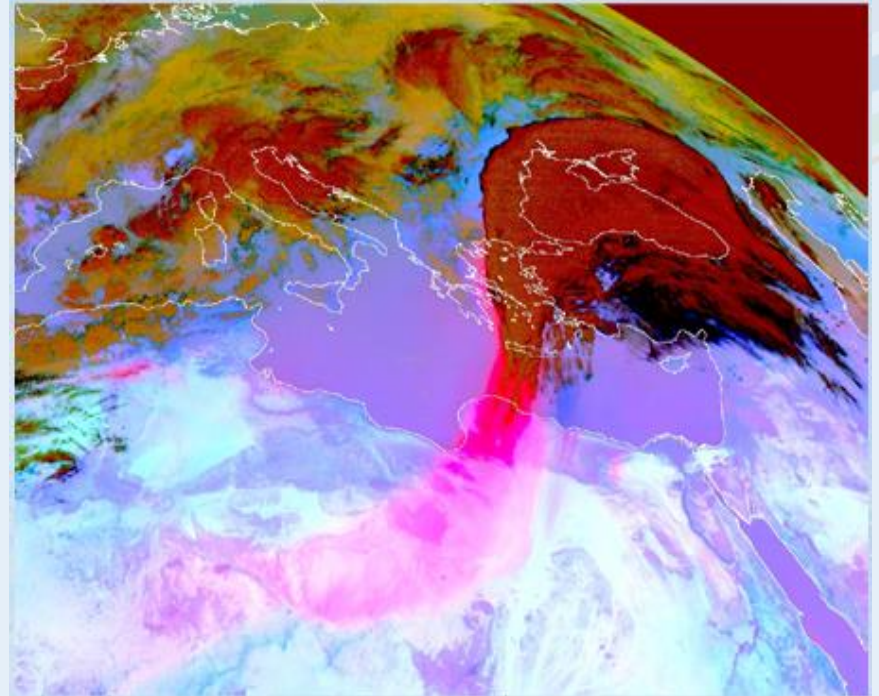


Exercise 1: where is the dust cloud ?

Visible (VIS0.6) image



Dust RGB Product

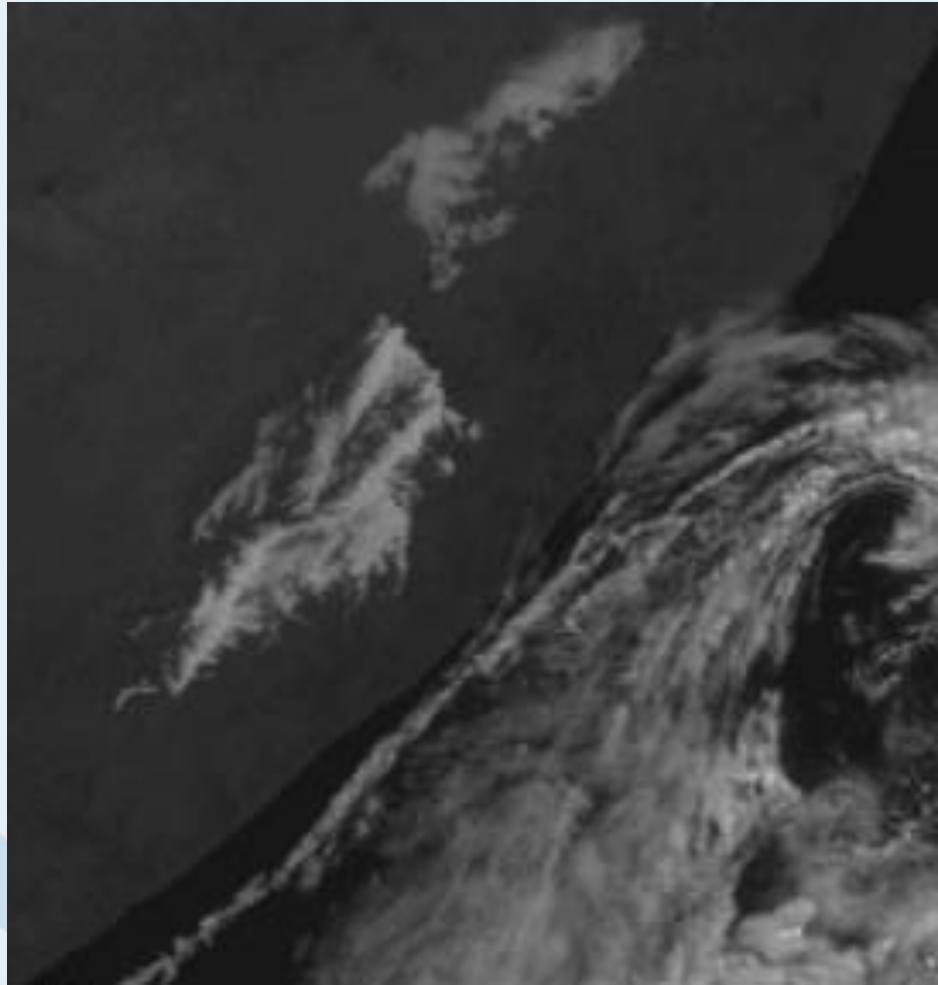


23 March 2008, 12 UTC

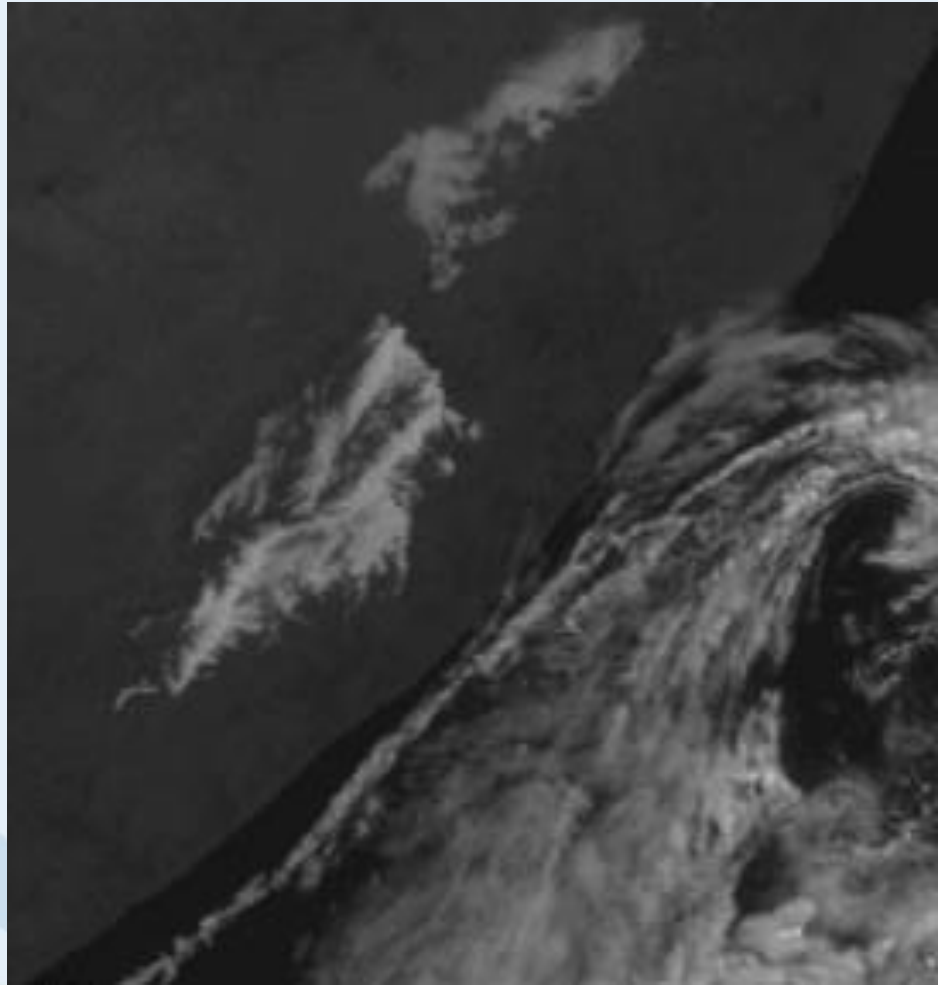
EUMETRAIN Module on RGB images:

http://www.zamg.ac.at/eumetrain/Seiten/CAL_Topic.htm

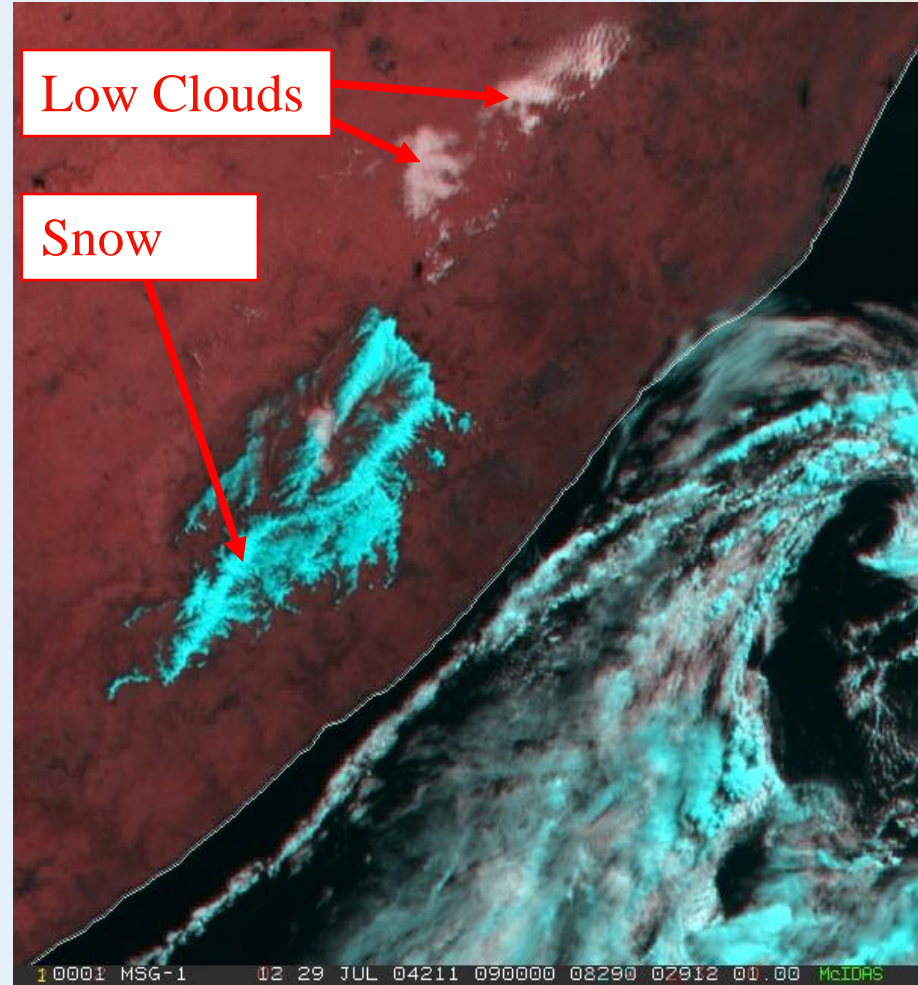
Where is snow and where low clouds ?



MFG VIS Channel



MFG VIS Channel



MSG RGB HRV, NIR1.6

29 July 2004, 09 UTC

RGB Image Composites – Pros & Cons

- **Drawbacks:**

- Millions of colours compared to discrete classes used in quantitative image products → interpretation more difficult;
- Cannot be handled by colour-blind.

- **Advantages:**

- Millions of colours: high information content;
- Easily implemented;
- Preserves “natural look” of images by retaining original textures (in particular for clouds);
- Preserves temporal continuity allowing for smooth animation of RGB image sequences.

Standard RGBs

	RGB Composite	Applications	Time
1.	RGB 10-09,09-07,09:	Dust, <u>Clouds</u> (thickness, phase), Contrails Fog, Ash, SO ₂ , Low-level Humidity	Day & Night
2.	RGB 05-06,08-09,05	<u>Severe Cyclones</u> , Jets, PV Analysis	Day & Night
3a.	RGB 10-09,09-04,09:	Clouds, <u>Fog</u> , Contrails, Fires	Night
3b.	RGB 02,04r,09:	<u>Clouds</u> , Convection, Snow, Fog, Fires	Day
4.	RGB 05-06,04-09,03-01:	<u>Severe Convection</u>	Day
5.	RGB 02,03,04r:	<u>Snow</u> , Fog	Day
6.	RGB 03,02,01:	<u>Vegetation</u> , Snow, Smoke, Dust, Fog	Day

RGB 03, 02, 01 ("Day Natural Colours")

R = Channel 03 (NIR1.6)

G = Channel 02 (VIS0.8)

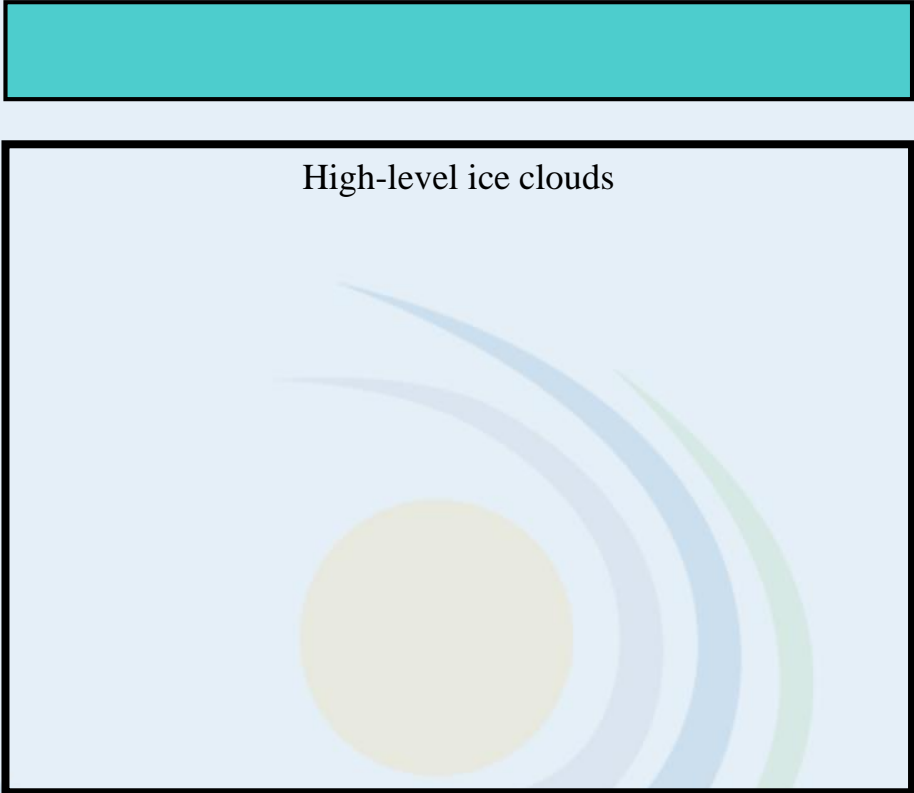
B = Channel 01 (VIS0.6)

Applications: Vegetation, Dust, Smoke, Fog, Snow

Area: Full MSG Viewing Area

Time: Day-Time

RGB 03, 02, 01: Interpretation of Colours



High-level ice clouds

Low-level water clouds

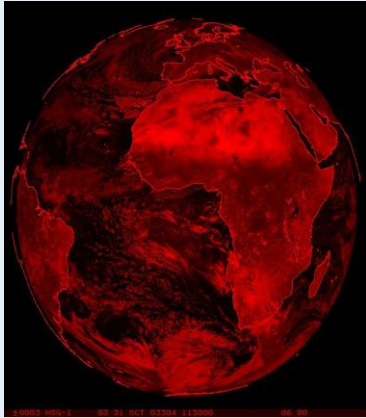
Ocean

Veg. Land

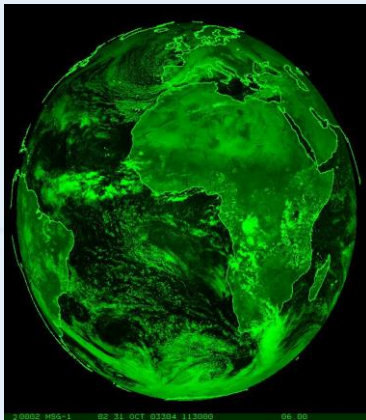
Desert

Snow

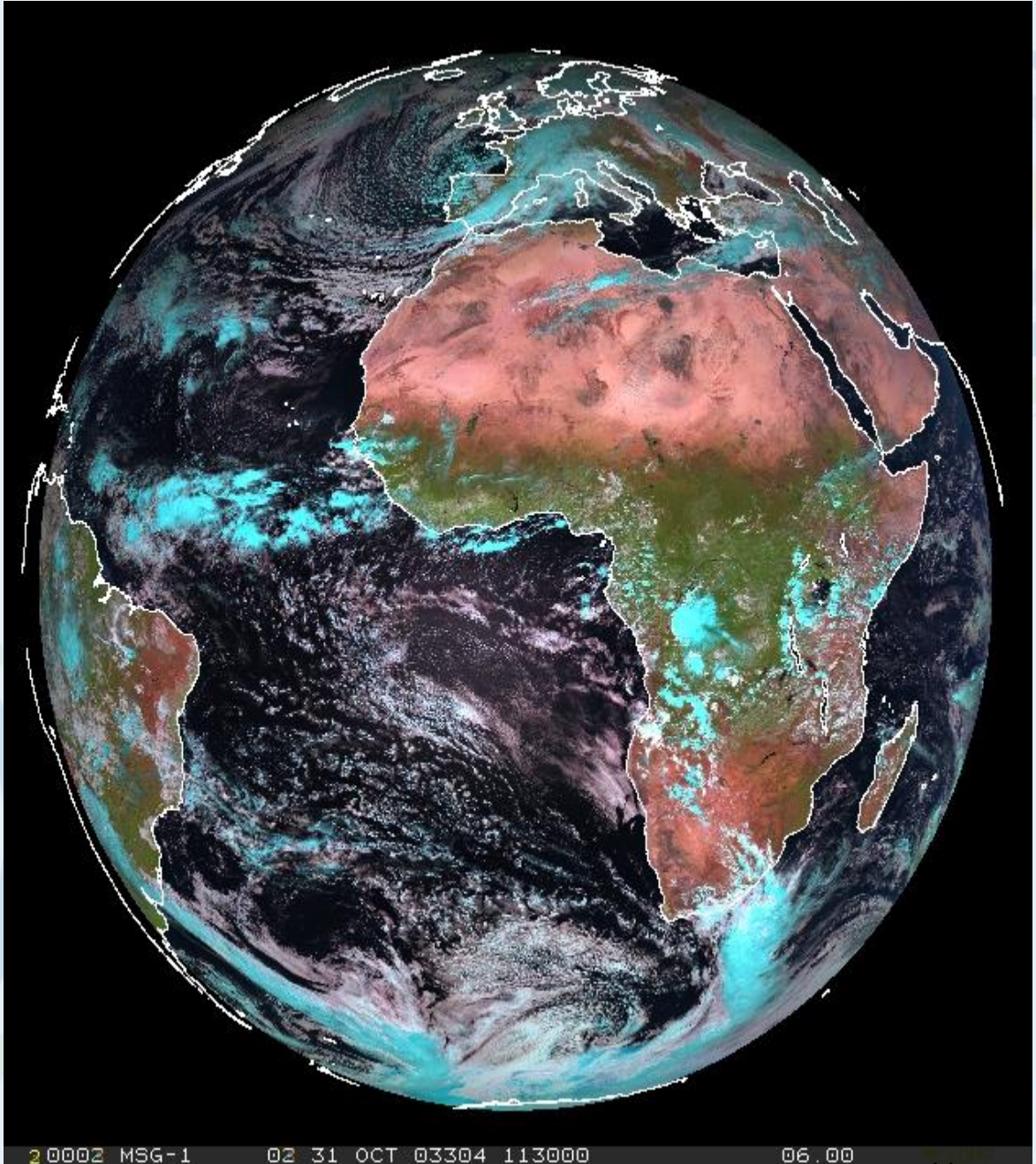
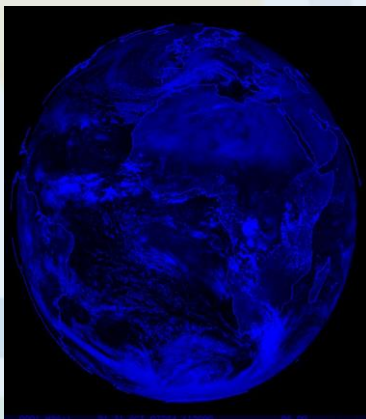
Ch.03
NIR1.6



Ch.02
VIS0.8



Ch.01
VIS0.6

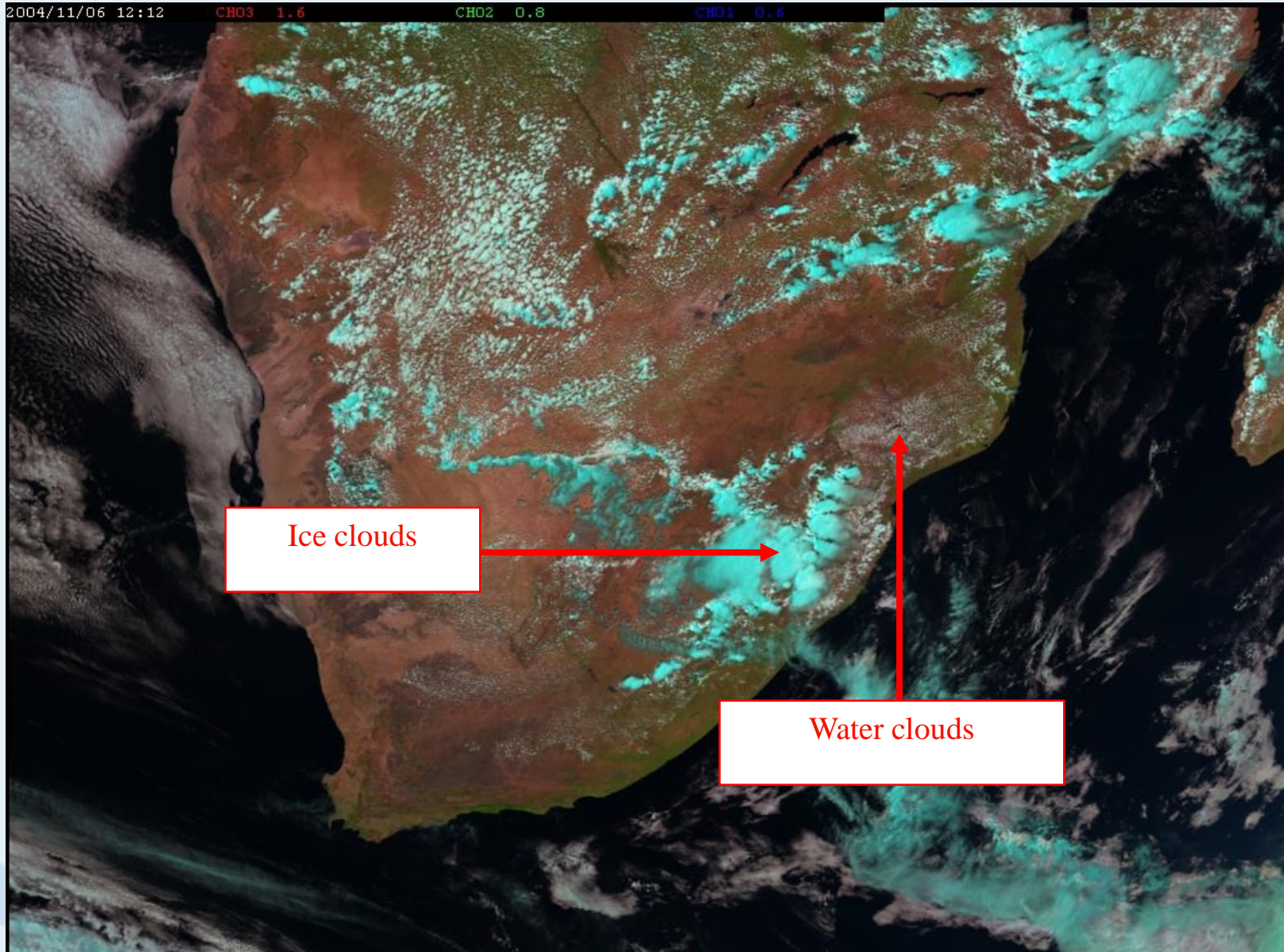


2004/11/06 12:12

CH03 1.6

CH02 0.8

CH01 0.6

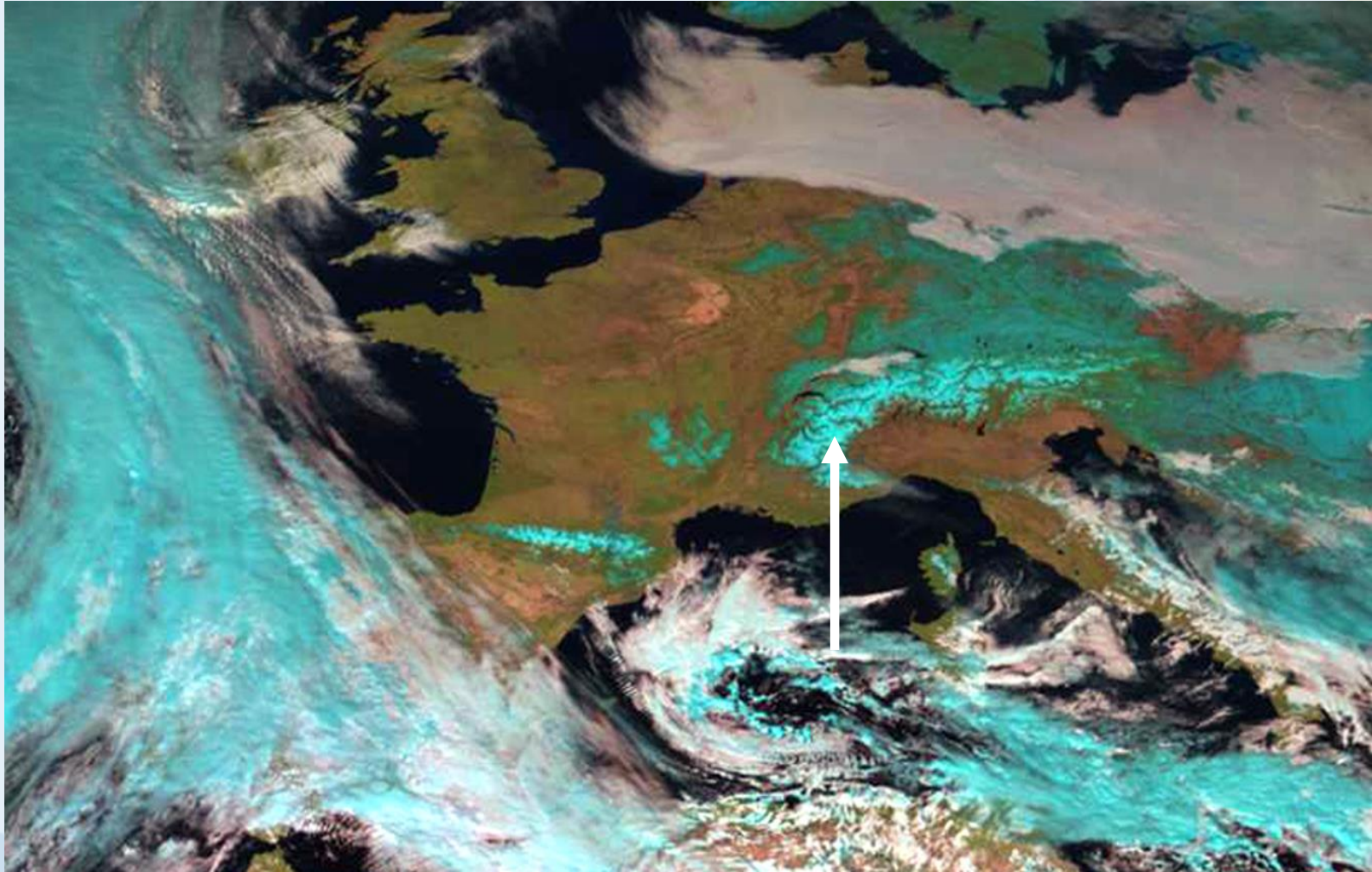


Ice clouds

Water clouds

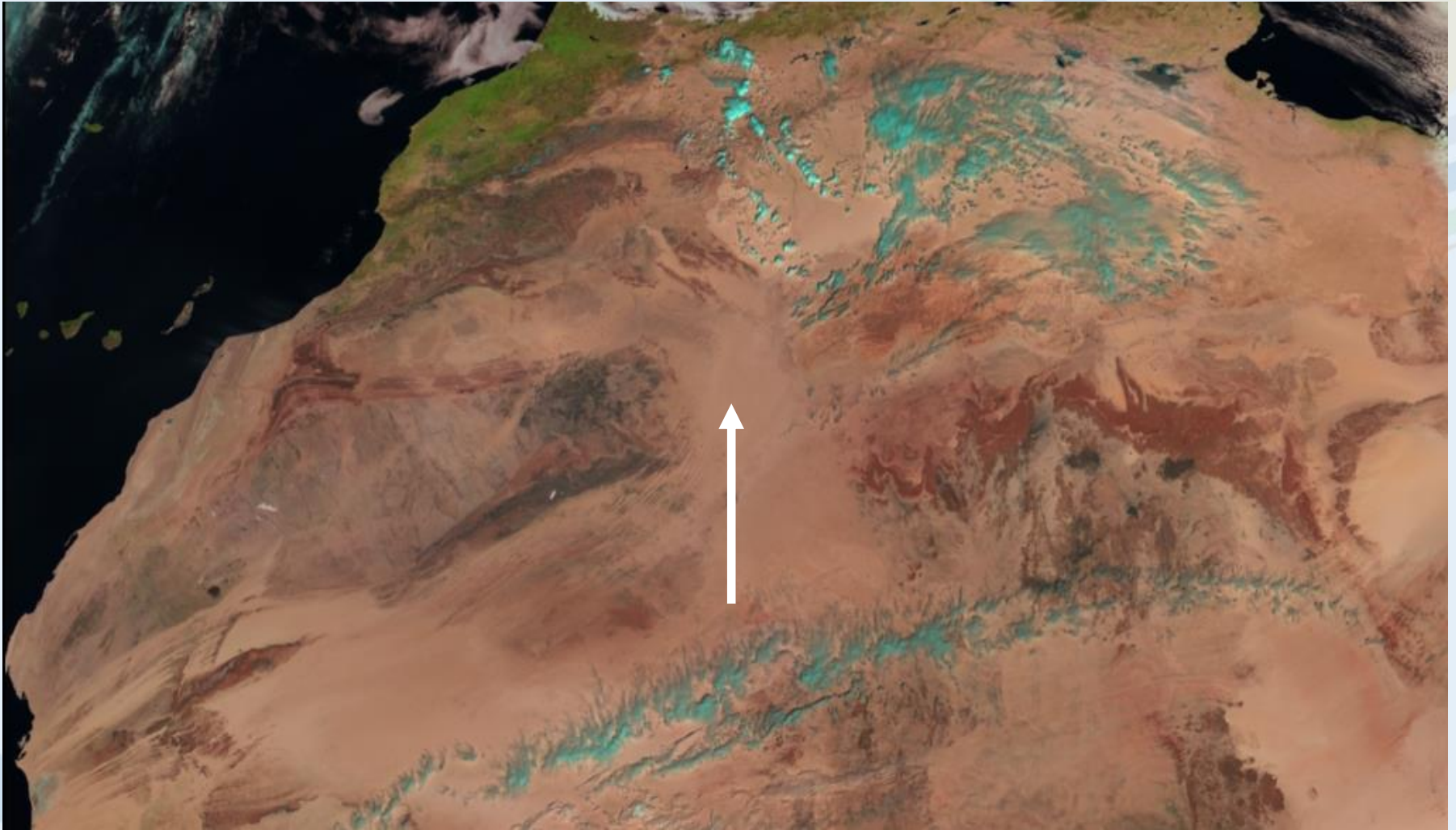
6 November 2004, 12:00 UTC, RGB NIR1.6, VIS0.8 VIS0.6

RGB 03, 02, 01 Example: Snow



MSG-1, 18 February 2003, 13:00 UTC

RGB 03, 02, 01 Example: Desert



MSG-1, 3 February 2004, 11:30 UTC

RGB 02, 04r, 09 ("Day Microphysical")

R = Channel 02 (VIS0.8)

G = Channel 04r (IR3.9, solar component)

B = Channel 09 (IR10.8)

Applications: Cloud Analysis, Convection, Fog, Snow, Fires

Area: Full MSG Viewing Area

Time: Day-Time

RGB 02, 04r, 09: Interpretation of Colours for High-level Clouds



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)

Ocean

Veg. Land

Fires / Desert

Snow

RGB 02, 04r, 09: Interpretation of Colours for Mid-level Clouds



Supercooled, thick water cloud

- bright, thick
- large droplets

Supercooled, thick water cloud

- bright, thick
- small droplets

Supercooled thin water cloud with large droplets

Supercooled, thin water cloud with small droplets *

* or, in rare occasions, thin Ci cloud with small ice particles

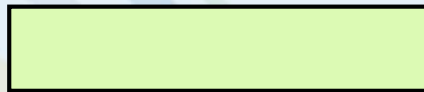
Ocean

Veg. Land

Fires / Desert

Snow

RGB 02, 04r, 09: Interpretation of Colours for Low-level Clouds



Thick water cloud
(warm rain cloud)
- bright, thick
- large droplets

Thick water cloud
(no precipitation)
- bright, thick
- small droplets

Thin water cloud with
large droplets

Thin water cloud
with small droplets

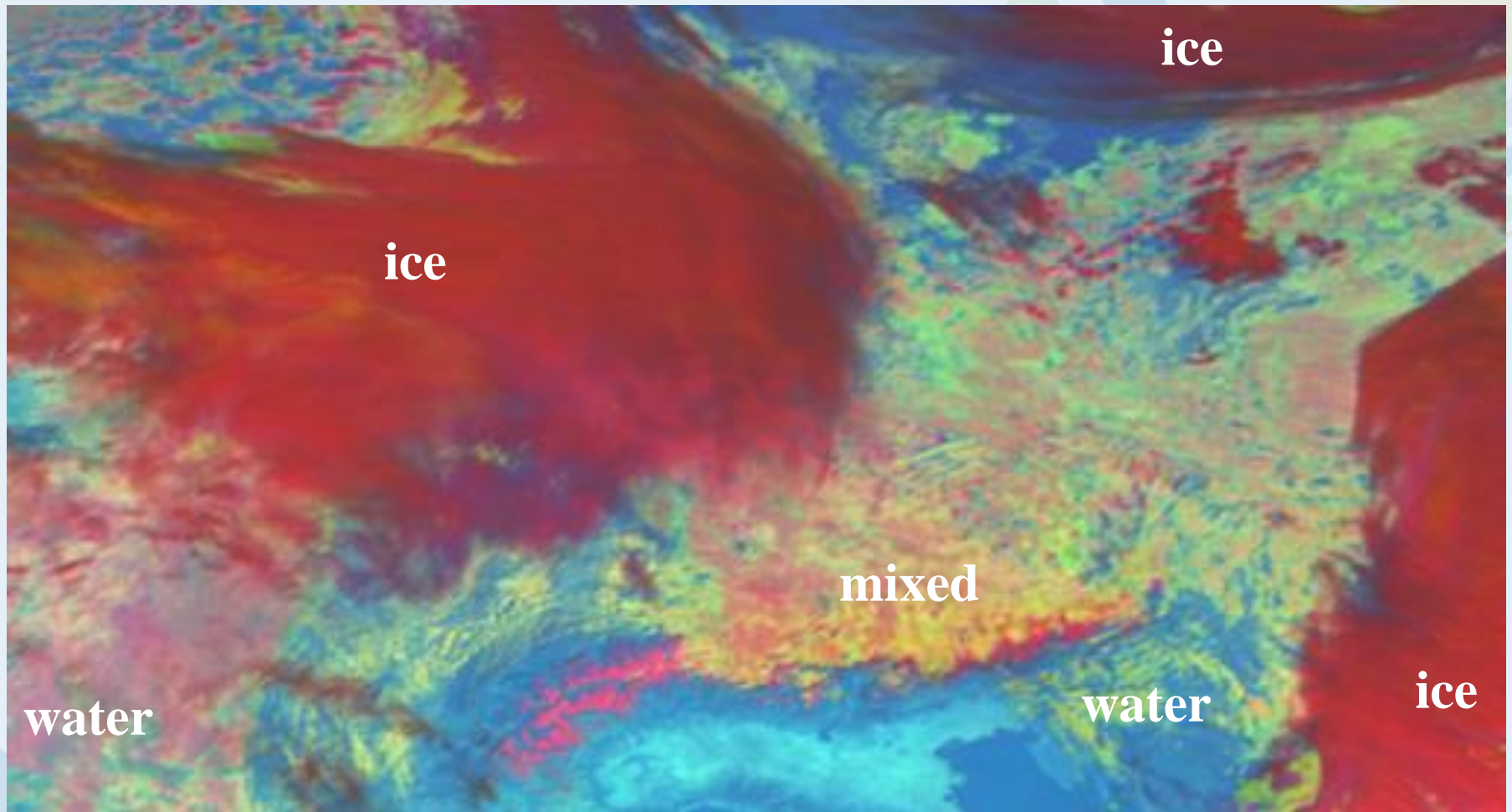
Ocean

Veg. Land

Fires / Desert

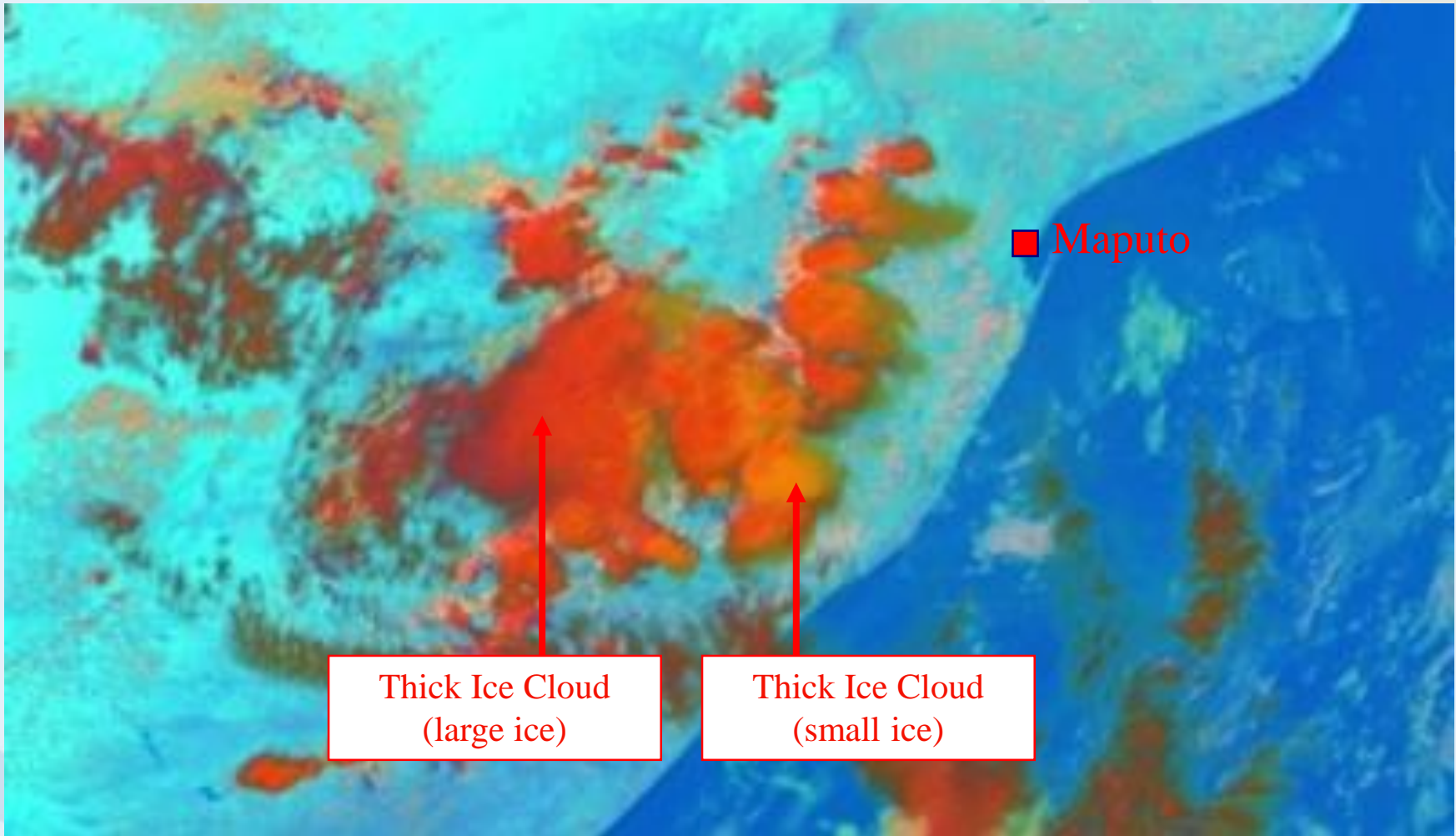
Snow

Example: Cloud Phase



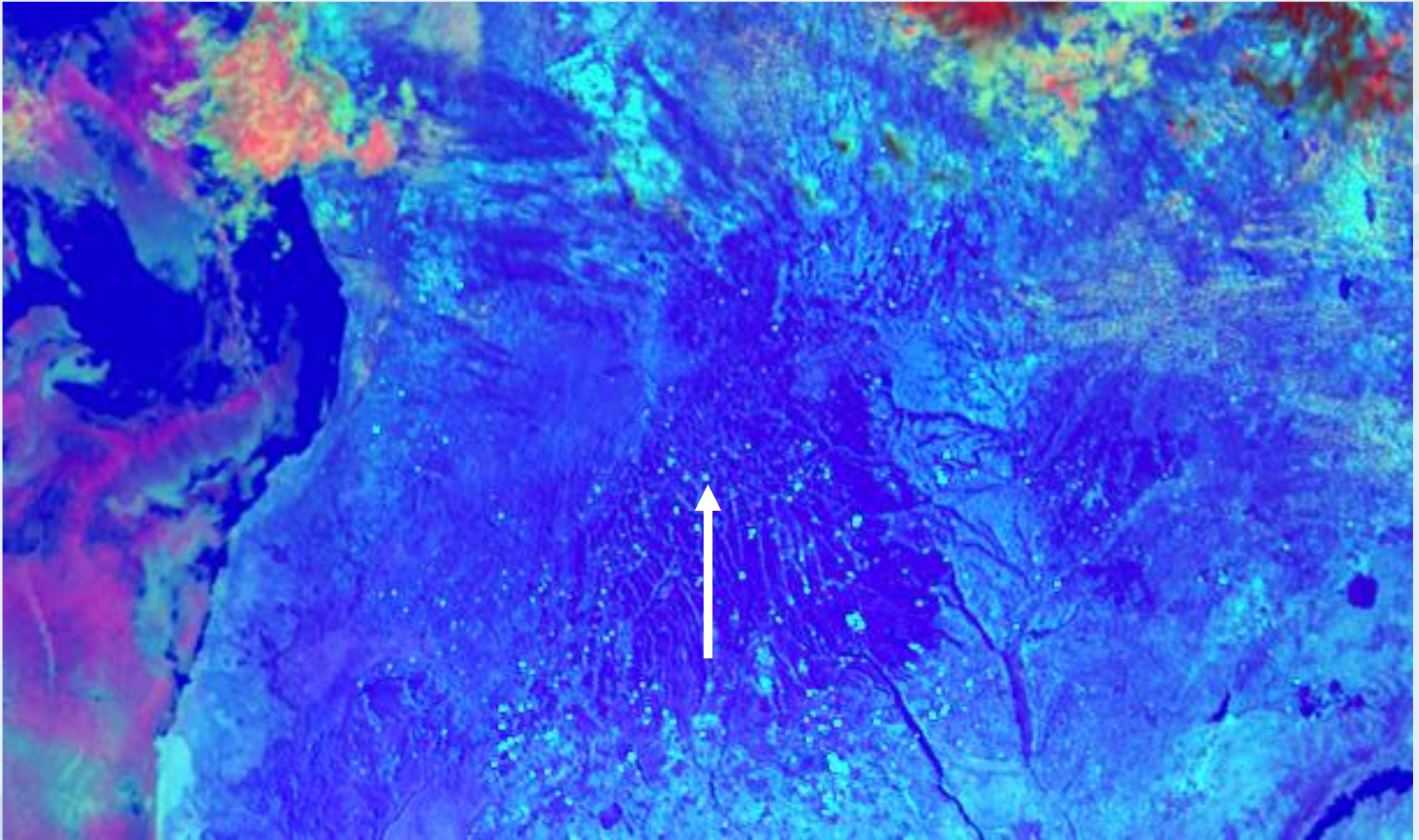
8 October 2003, 12:00 UTC, RGB VIS0.6, IR3.9r, IR10.8

Example: Cloud Particle Size



MSG-1, 6 November 2004, 12:00 UTC, RGB VIS0.8, IR3.9r, IR10.8

RGB 02, 04r, 09 Example: Fires



MSG-1, 7 September 2003, 11:45 UTC ("winter" enhancement)

RGB 05-06, 04-09, 03-01 ("Convective Storms")

R = Difference WV6.2 - WV7.3

G = Difference IR3.9 - IR10.8

B = Difference NIR1.6 - VIS0.6

Applications:	Severe Convective Storms
Area:	Full MSG Viewing Area
Time:	Day-Time

RGB 05-06, 04-09, 03-01: Interpretation of Colours



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

- high-level cloud
- large ice particles

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

- high-level cloud
- small ice particles

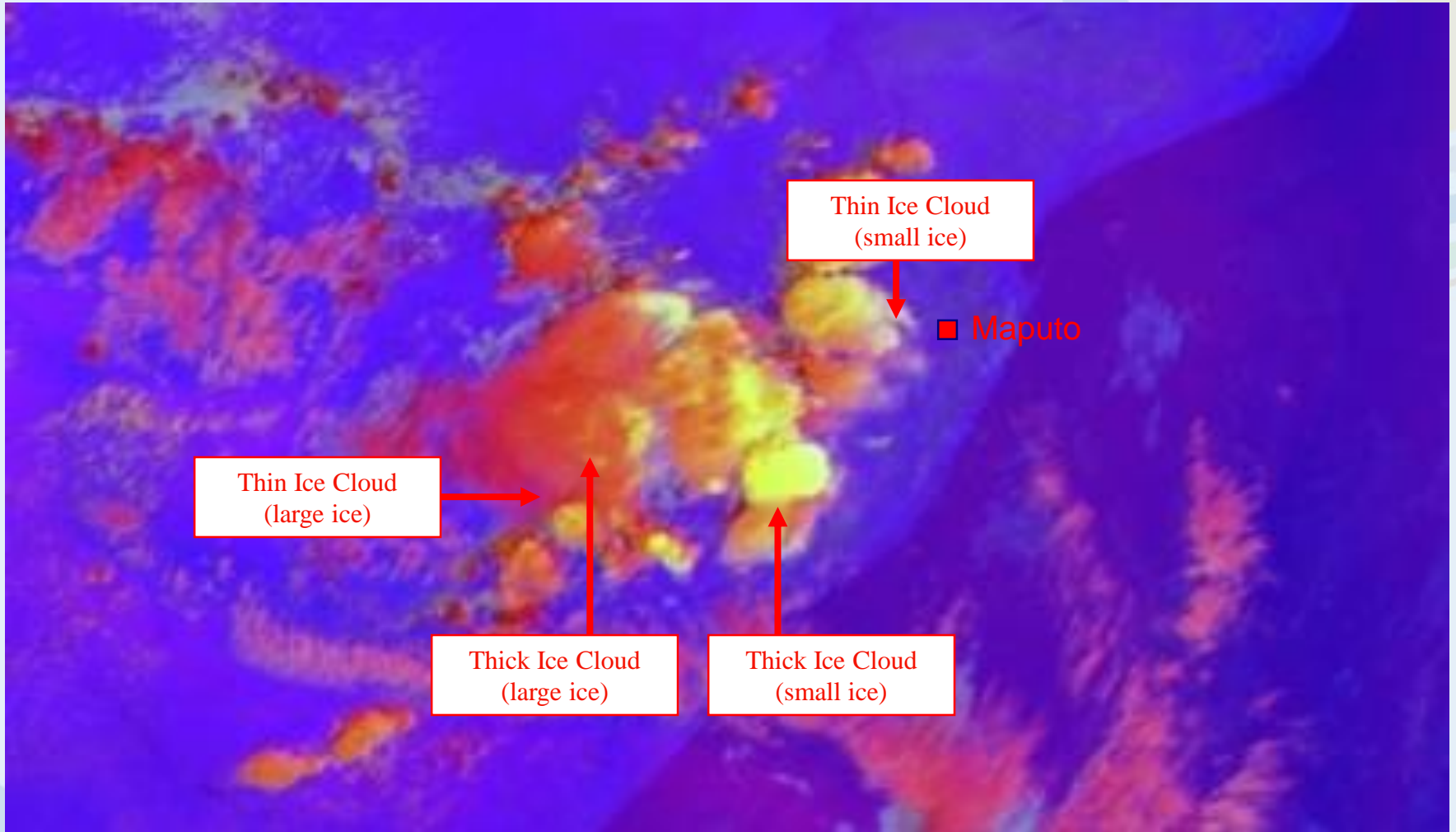
*or thick, high-level lee
cloudiness with small ice
particles

Thin Cirrus cloud
(large ice particles)

Thin Cirrus cloud
(small ice particles)

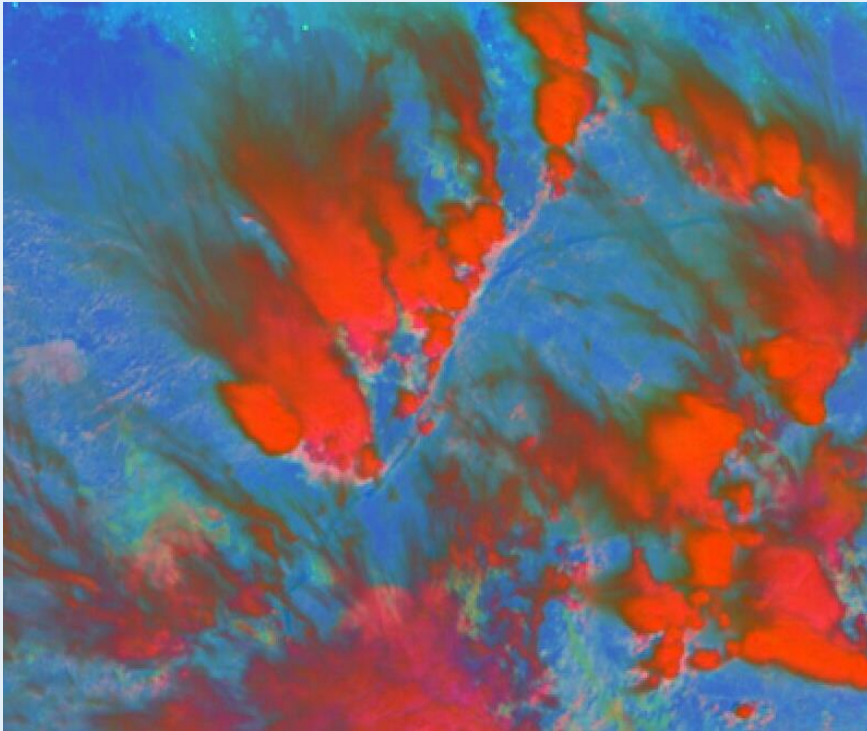
Ocean

Land

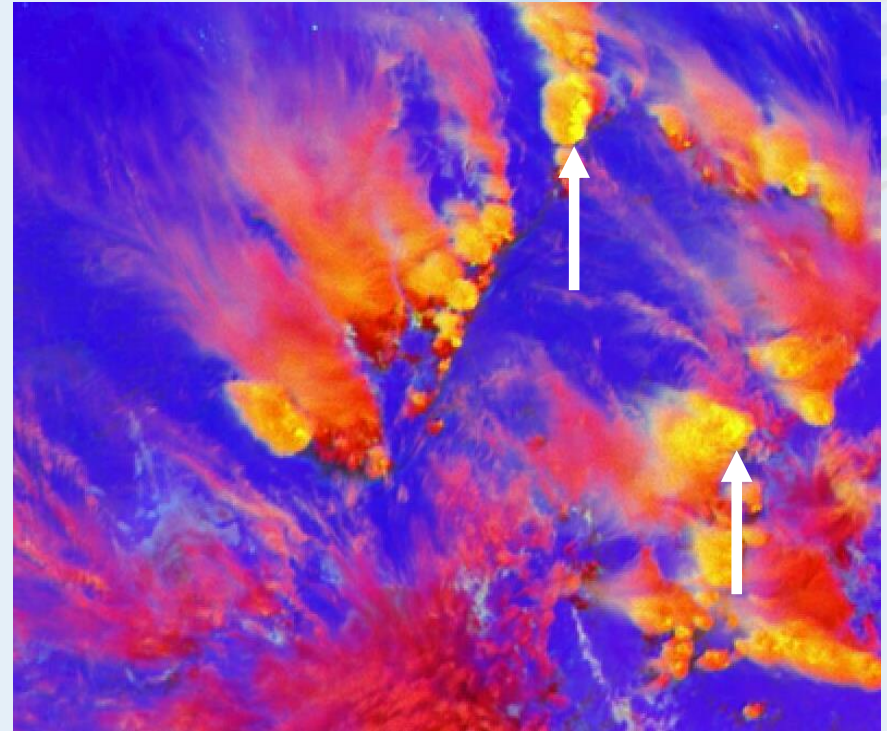


MSG-1, 6 November 2004, 12:00 UTC, RGB 05-06, 04-09, 03-01

RGB 05-06, 04-09, 03-01 Example: Severe Convection



RGB 02,04r,09
(for comparison)



RGB 05-06,04-09,03-01
better identification of young, severe storms

MSG-1, 3 February 2004, 11:30 UTC

RGB 05-06, 08-09, 05i ("Airmass")

R = Difference WV6.2 - WV7.3

G = Difference IR9.7 - IR10.8

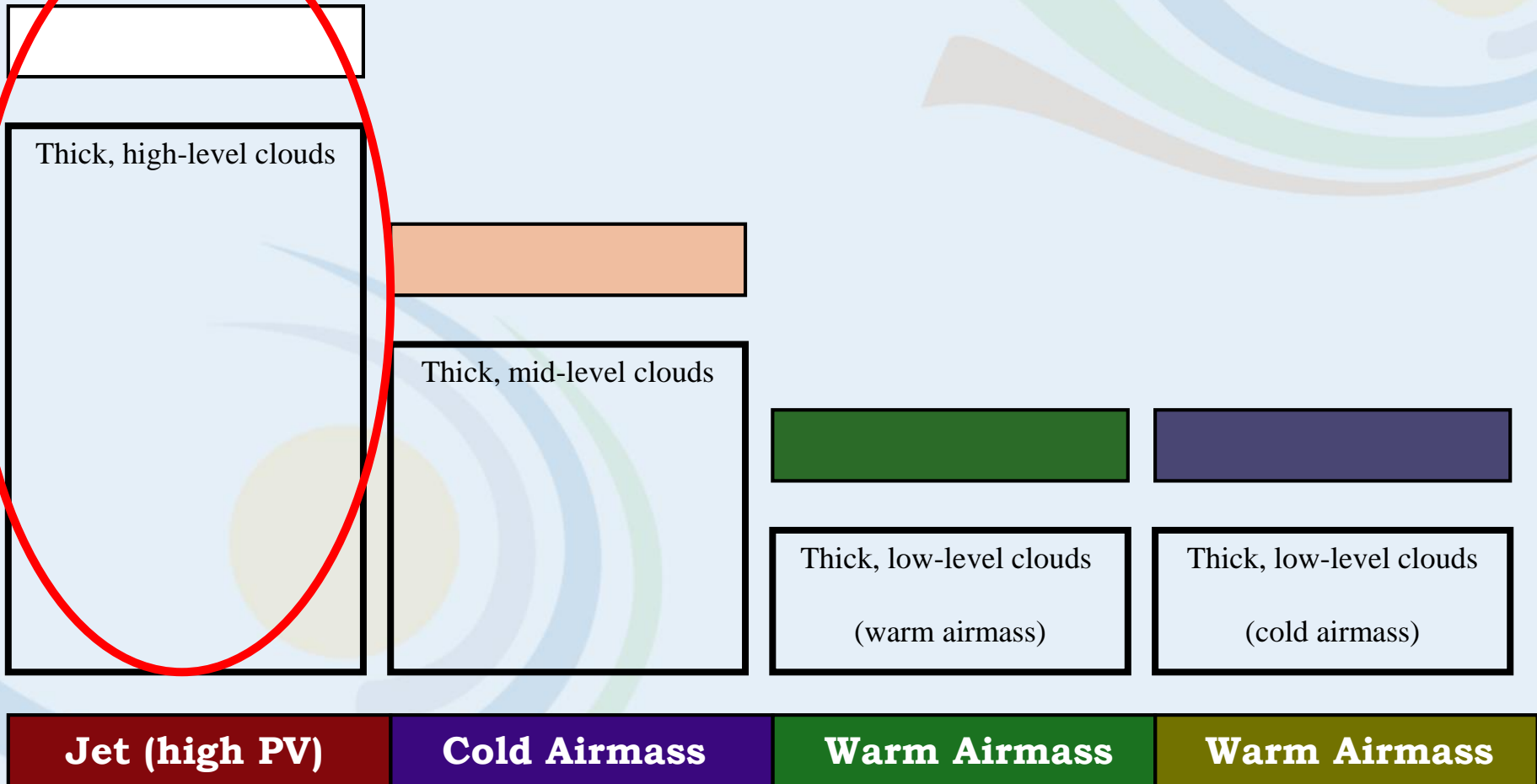
B = Channel WV6.2i

Applications: Rapid Cyclogenesis, Jet Stream Analysis, PV Analysis

Area: Full MSG Viewing Area

Time: Day and Night

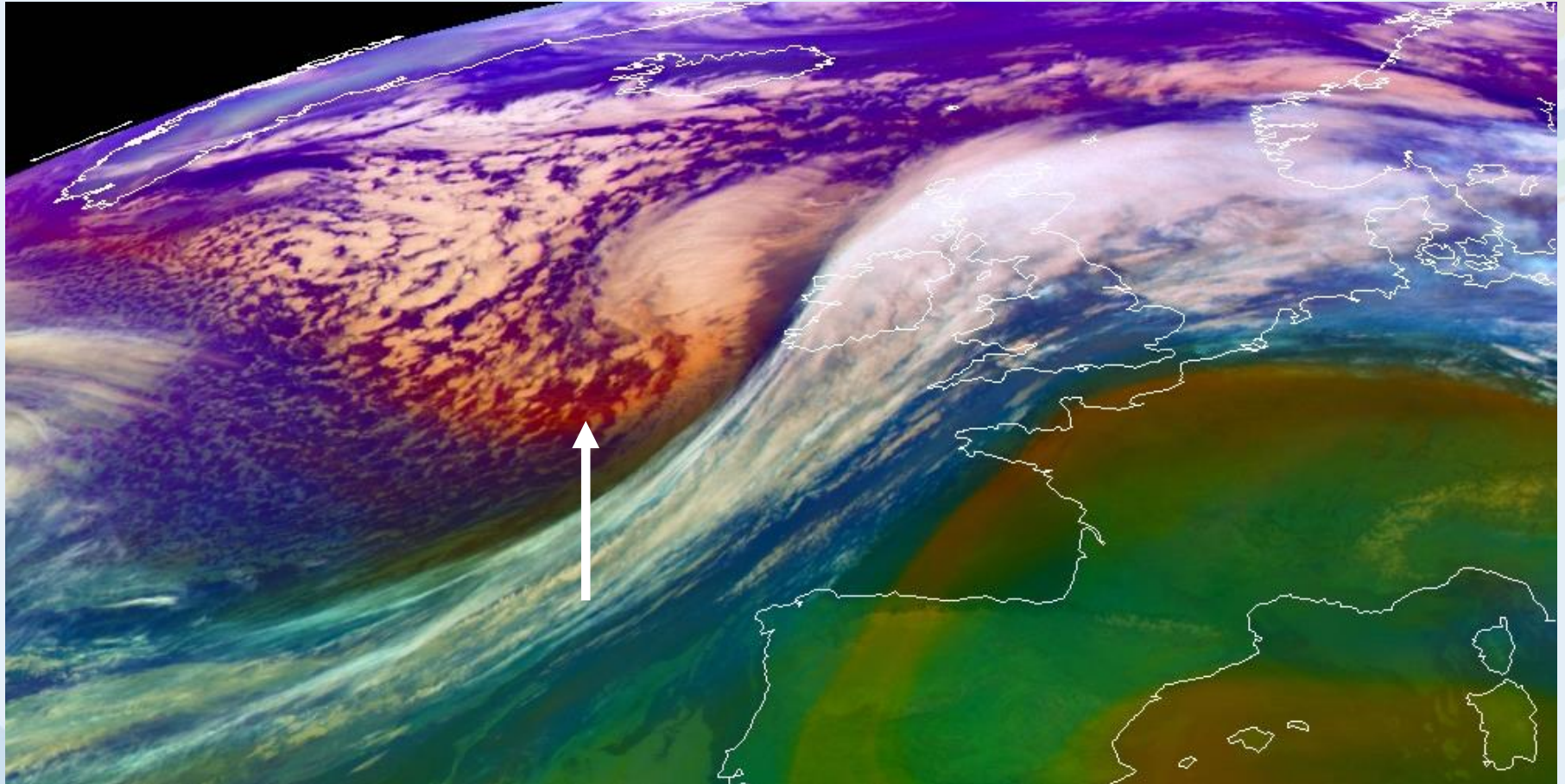
RGB 05-06, 08-09, 05i: Interpretation of Colours



High UTH

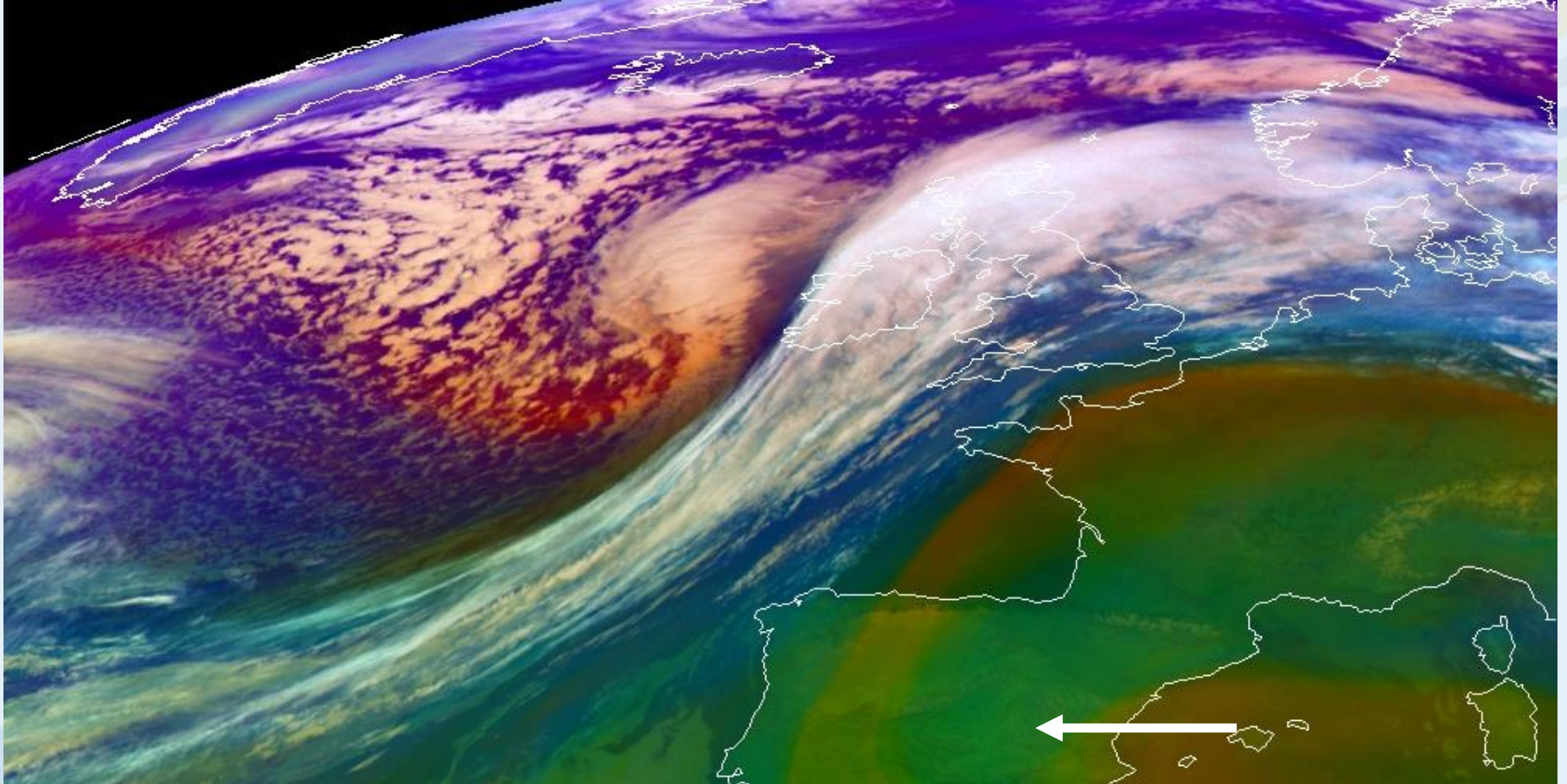
Low UTH

RGB 05-06, 08-09, 05i Example: Advection Jet



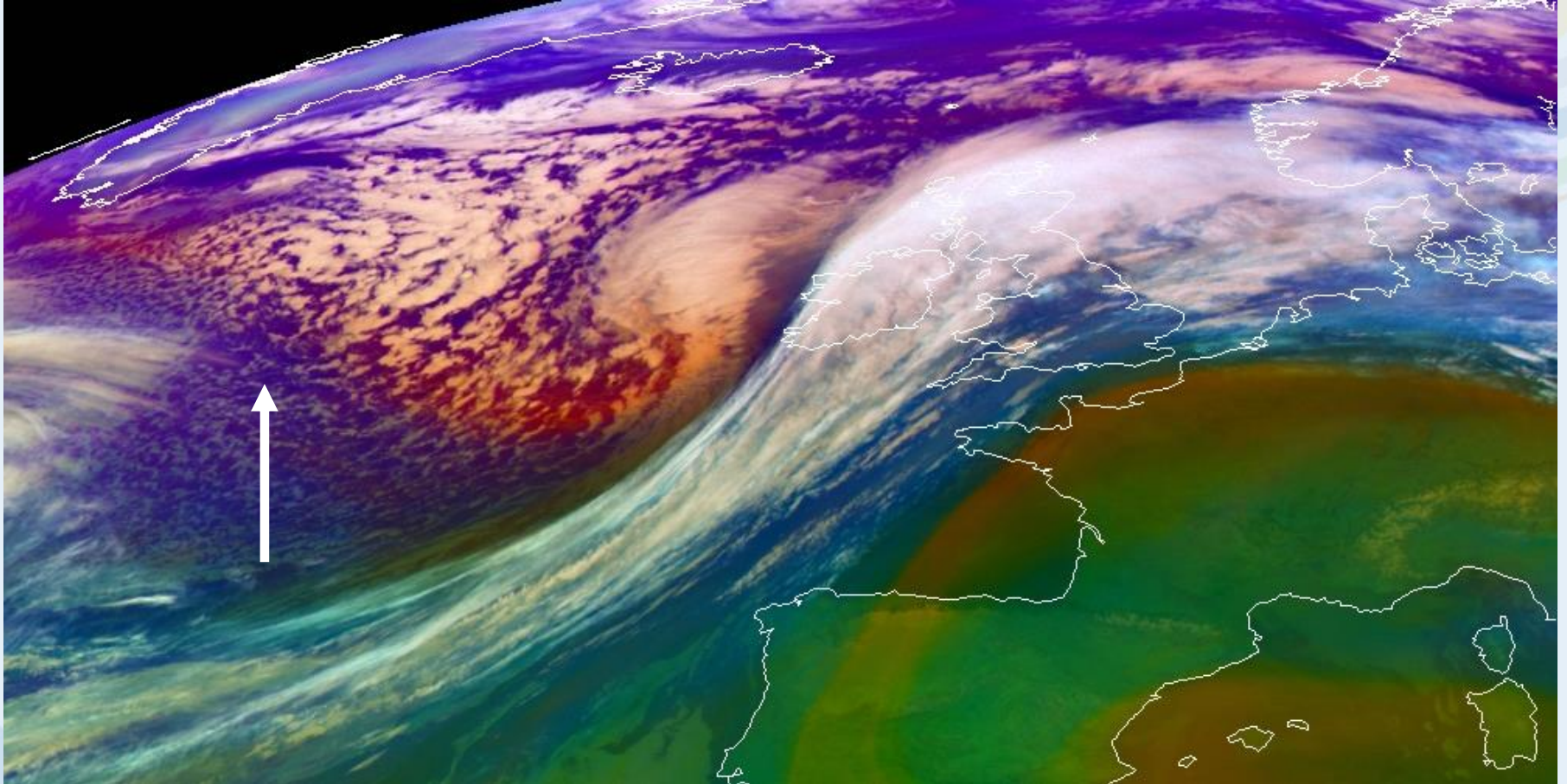
MSG-1, 7 January 2005, 22:00 UTC

RGB 05-06, 08-09, 05i Example: Warm Airmass



MSG-1, 7 January 2005, 22:00 UTC

RGB 05-06, 08-09, 05i Example: Cold Airmass



MSG-1, 7 January 2005, 22:00 UTC

Standard RGBs

	RGB Composite	Applications	Time
1.	RGB 10-09,09-07,09:	Dust, <u>Clouds</u> (thickness, phase), Contrails Fog, Ash, SO ₂ , Low-level Humidity	Day & Night
2.	RGB 05-06,08-09,05	<u>Severe Cyclones</u> , Jets, PV Analysis	Day & Night
3a.	RGB 10-09,09-04,09:	Clouds, <u>Fog</u> , Contrails, Fires	Night
3b.	RGB 02,04r,09:	<u>Clouds</u> , Convection, Snow, Fog, Fires	Day
4.	RGB 05-06,04-09,03-01:	<u>Severe Convection</u>	Day
5.	RGB 02,03,04r:	<u>Snow</u> , Fog	Day
6.	RGB 03,02,01:	<u>Vegetation</u> , Snow, Smoke, Dust, Fog	Day

Summary

- Different RGB products exist for different purposes
- Using the standard RGBs provided, gives us common ground from comparisons
- Nowcasting of Convection is done best with the Convection RGB and HRV
- The Airmass RGB gives more information about synoptic scale systems

EUMETSAT case study website

- <http://www.eumetsat.int/website/home/Images/ImageLibrary/index.html>

The screenshot shows the EUMETSAT website's Image Library page. At the top, the EUMETSAT logo is on the left, and the tagline "MONITORING WEATHER AND CLIMATE FROM SPACE" is in the center. A search bar is on the right. Below the header is a navigation menu with "HOME", "IMAGES", "ABOUT US", "SATELLITES", "DATA", "NEWS", and "QUICK LINKS". The main content area is titled "IMAGE LIBRARY" and features a sidebar on the left with navigation options: "IMAGES", "REAL-TIME IMAGES", "IMAGE LIBRARY" (highlighted), and "IMAGE GLOSSARY". Below this is a "REFINE RESULTS" section with dropdown menus for "Feature", "Country/Region", "Satellite", "Instrument", "Month", "Year", and "Product", all set to "All". The main content area contains a descriptive paragraph: "Our image library contains imagery and case studies of weather phenomena and environmental events observed by EUMETSAT's fleet of weather satellites." Below this are four featured case studies, each with an image, a title, a date, and a brief description:

- Image 1:** A satellite image of a typhoon. **TITLE:** SUPER TYPHOON HAIYAN DEVASTATES THE PHILIPPINES. **DATE:** 11 November 2013. **DESCRIPTION:** The equivalent of a category-5 hurricane, possibly the strongest typhoon ever recorded, struck the Philippines causing major loss of life, flooding and extensive damage to buildings.
- Image 2:** A satellite image of a solar eclipse. **TITLE:** RARE HYBRID SOLAR ECLIPSE. **DATE:** 03 November 2013. **DESCRIPTION:** Meteosat-10 captures images at 15-minute intervals of the solar eclipse over Africa.
- Image 3:** A satellite image of a typhoon over the South China Sea. **TITLE:** TYPHOON KROSA OVER THE SOUTH CHINA SEA. **DATE:** 03 November 2013. **DESCRIPTION:** Typhoon Krosa was classified as a category-1 storm when captured by Meteosat-7.
- Image 4:** A satellite image of a thunderstorm over Mallorca. **TITLE:** THUNDERSTORM IN MALLORCA. **DATE:** 29 October 2013. **DESCRIPTION:** One of the first thunderstorms of autumn caused large amounts of rainfall and extreme winds in Mallorca.