APPLICATIONS OF METEOSAT SECOND GENERATION

AIRMASS RGB PRODUCT

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Objectives

- Learn how to generate the Airmass RGB (Recipe)
- Learn how to use/interpret the WV6.2 - WV7.3 and the IR9.7 - IR10.8 brightness temperature difference (BTD)
- In particular, understand the relationship between the IR9.7 - IR10.8 BTD and the total ozone content
- Interpretation of colours of the Airmass RGB
- Usage of the Airmass RGB composite for monitoring jet streams, deformation zones, PV anomalies, cyclogenesis, severe convection

THE "AIRMASS" RGB

R = Difference WV6.2 - WV7.3

G = Difference IR9.7 - IR10.8

B = Channel WV6.2

Applications:	Rapid Cyclogenesis, Jet Stream Analysis, PV Analysis
Area:	Full MSG Viewing Area
Time:	Day and Night

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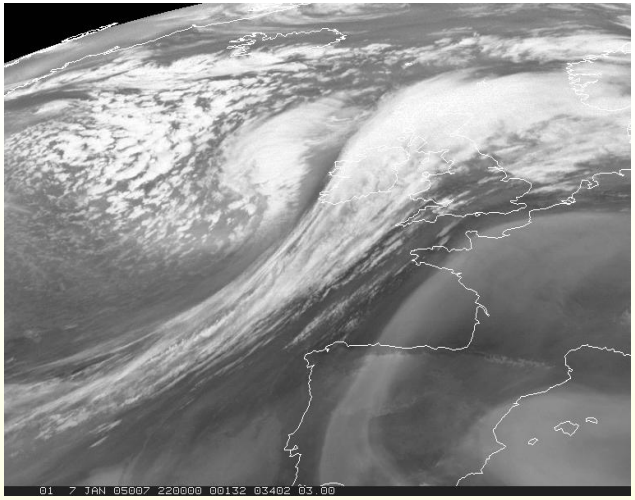
Airmass RGB: Recipe

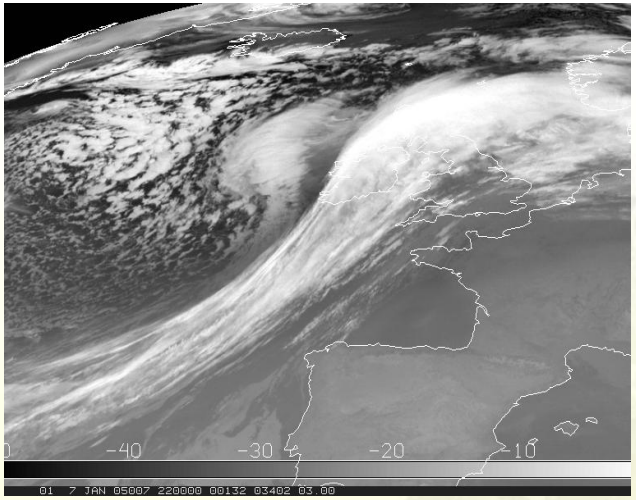
Recommended Range and Enhancement:

Beam	Channel	Range	Gamma
Red	WV6.2 - WV7.3	-25 ... 0 K	1.0
Green	IR9.7 - IR10.8	-40 ... +5 K	1.0
Blue	WV6.2	+243 ... +208 K	1.0

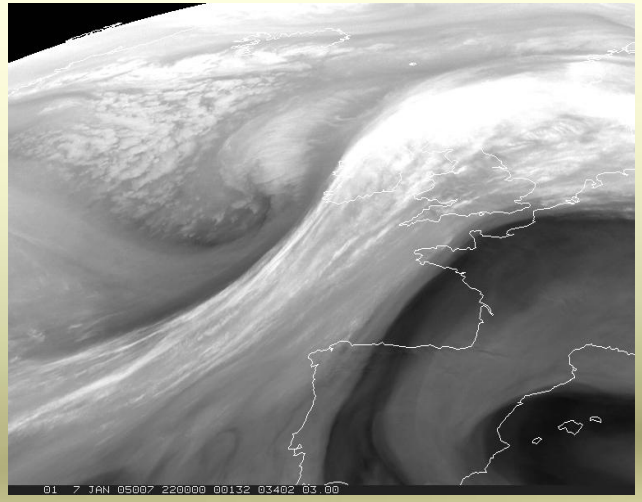
Airmass RGB: Colour Inputs



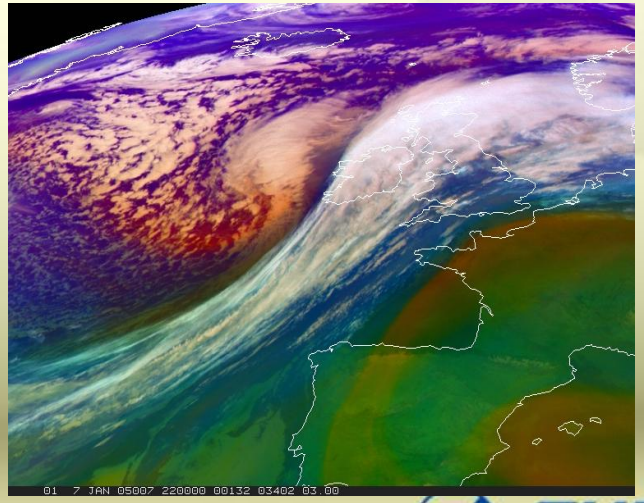
Red = WV6.2 - WV7.3



Green = IR9.7 - IR10.8



Blue = WV6.2i



RGB

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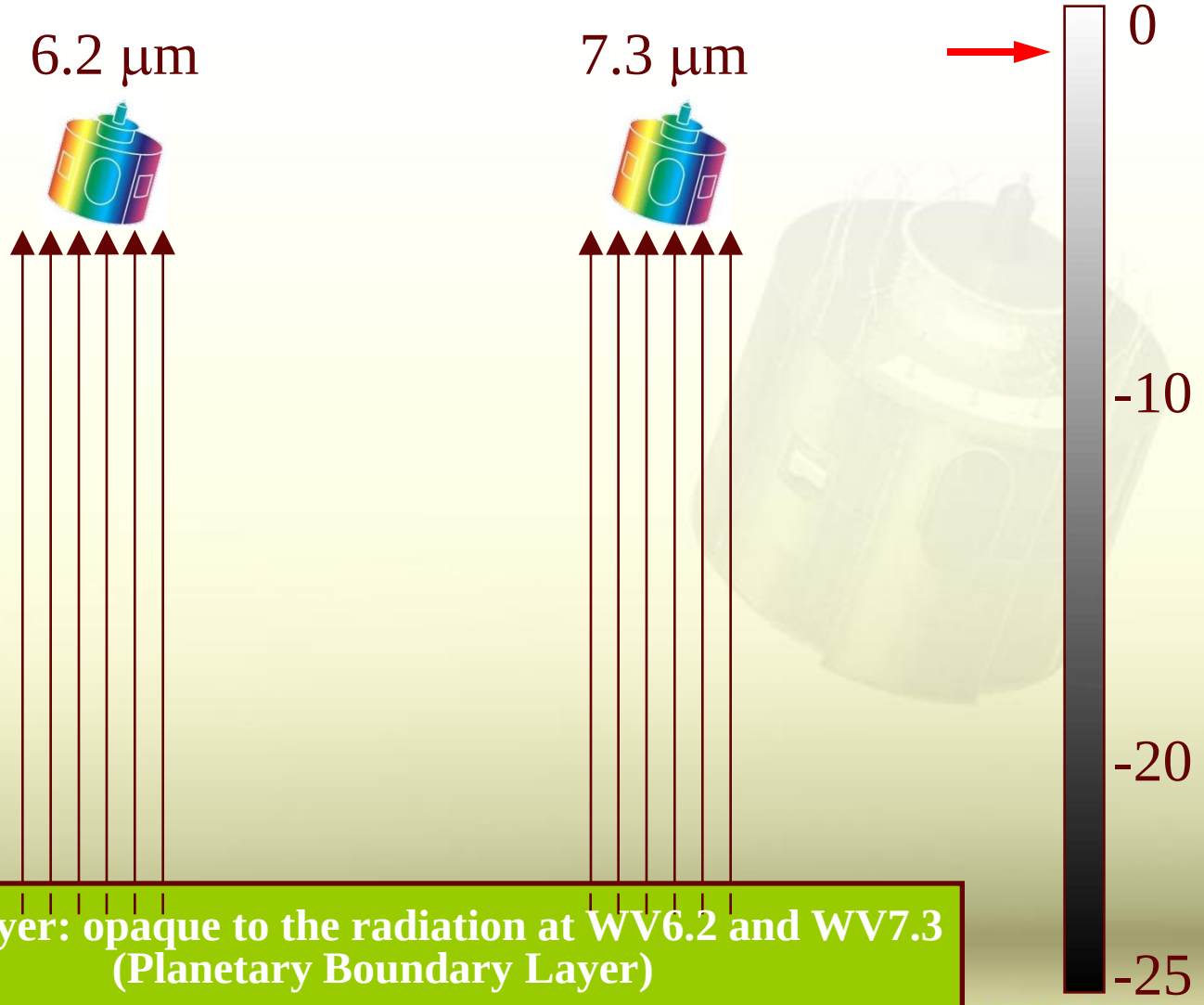
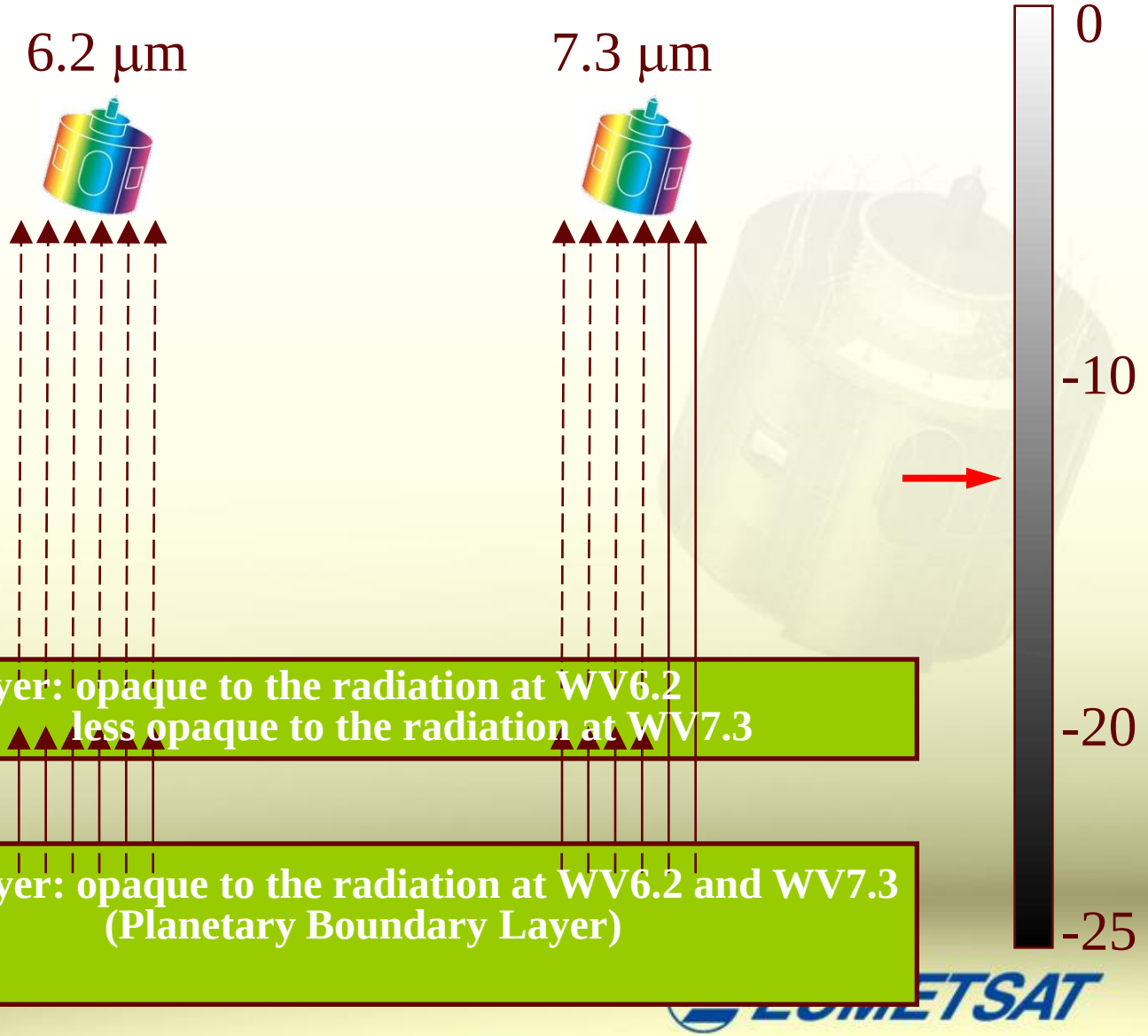
BTD WV6.2 - WV7.3

Case I:
Very Dry
Atmosphere
very small BTD



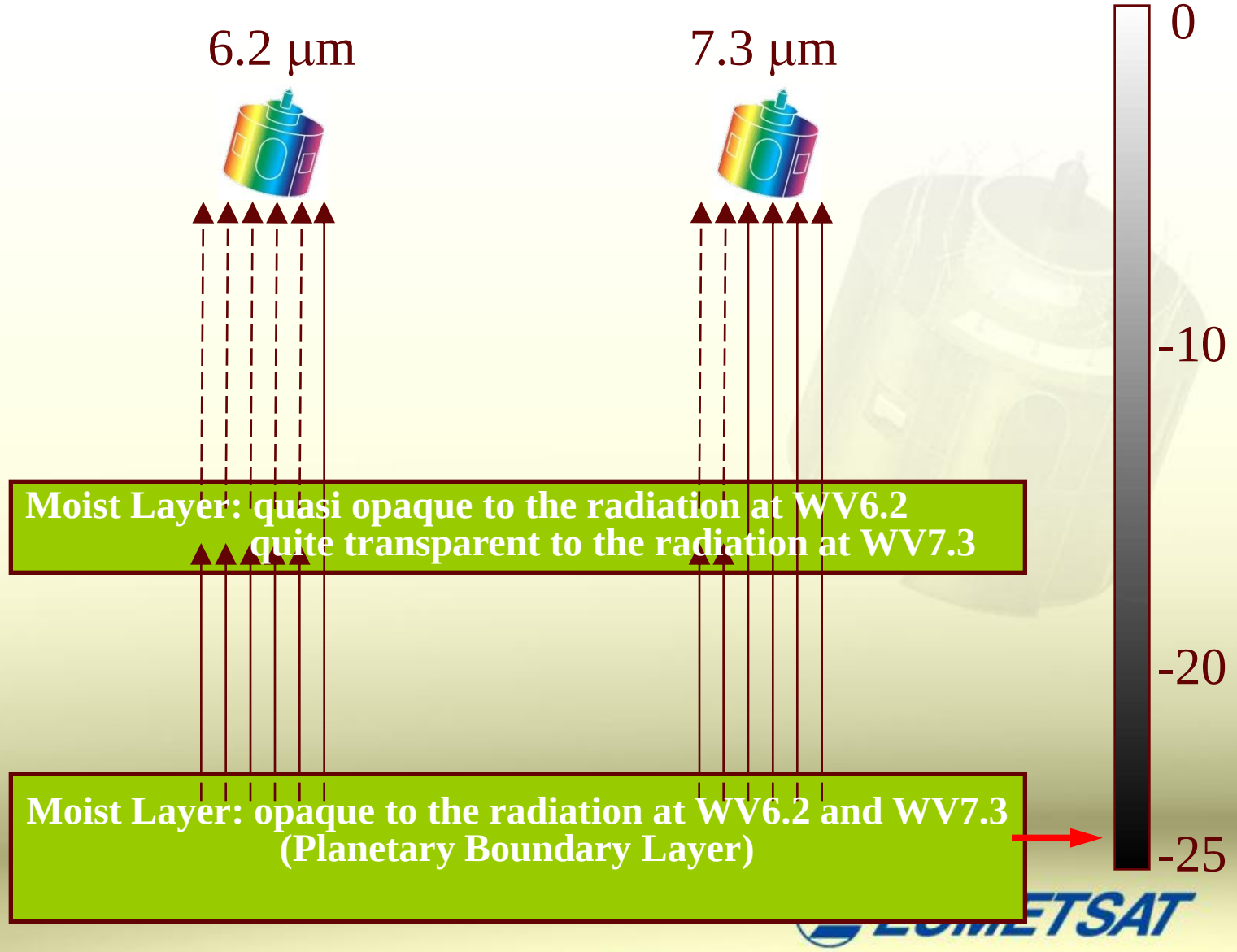
BTD WV6.2 - WV7.3

Case II:
Moist Layer
at 700 hPa
small BTD



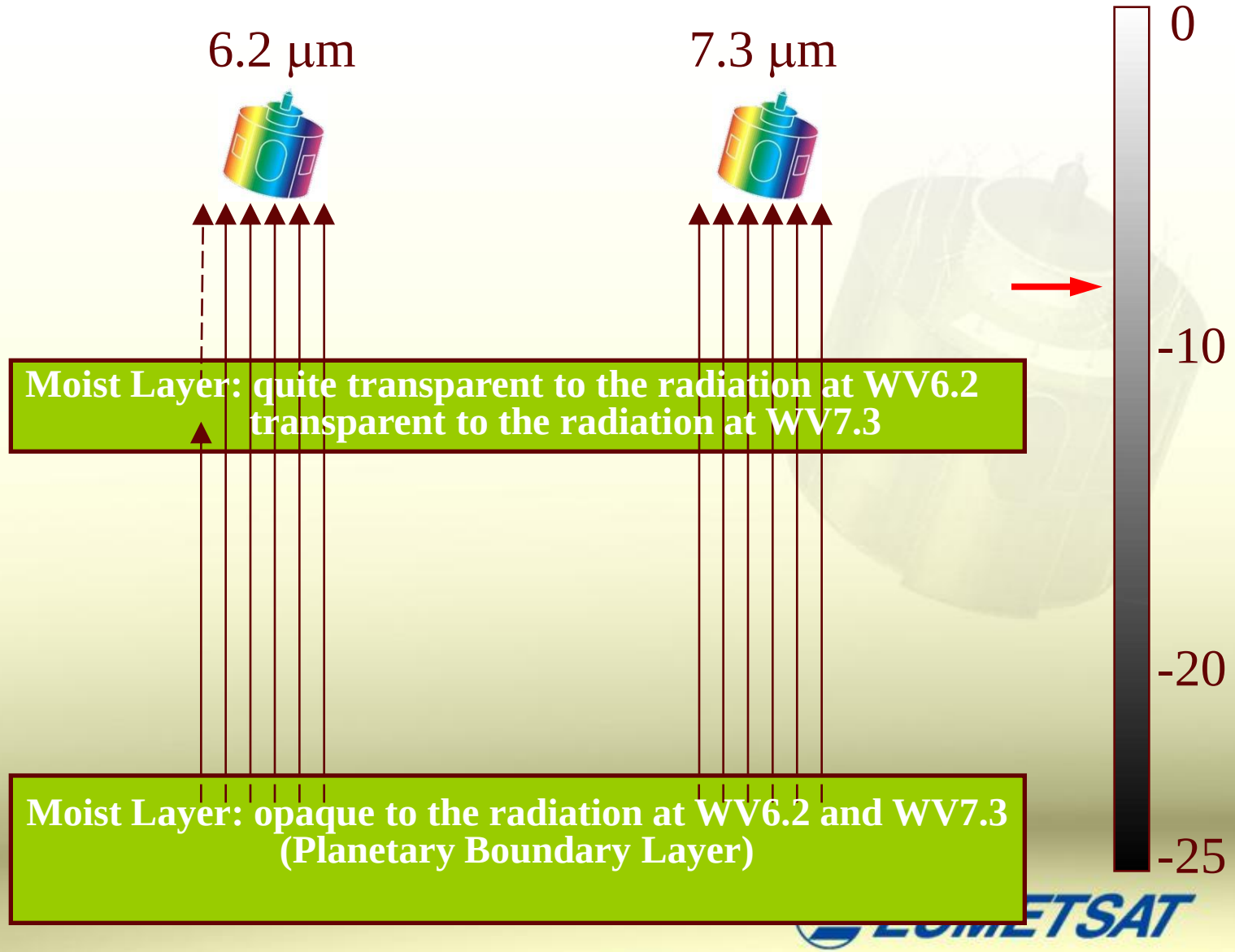
BTD WV6.2 - WV7.3

Case III:
Moist Layer
at 500 hPa
large BTD



BTD WV6.2 - WV7.3

Case IV:
Moist Layer
at 200 hPa
small BTD



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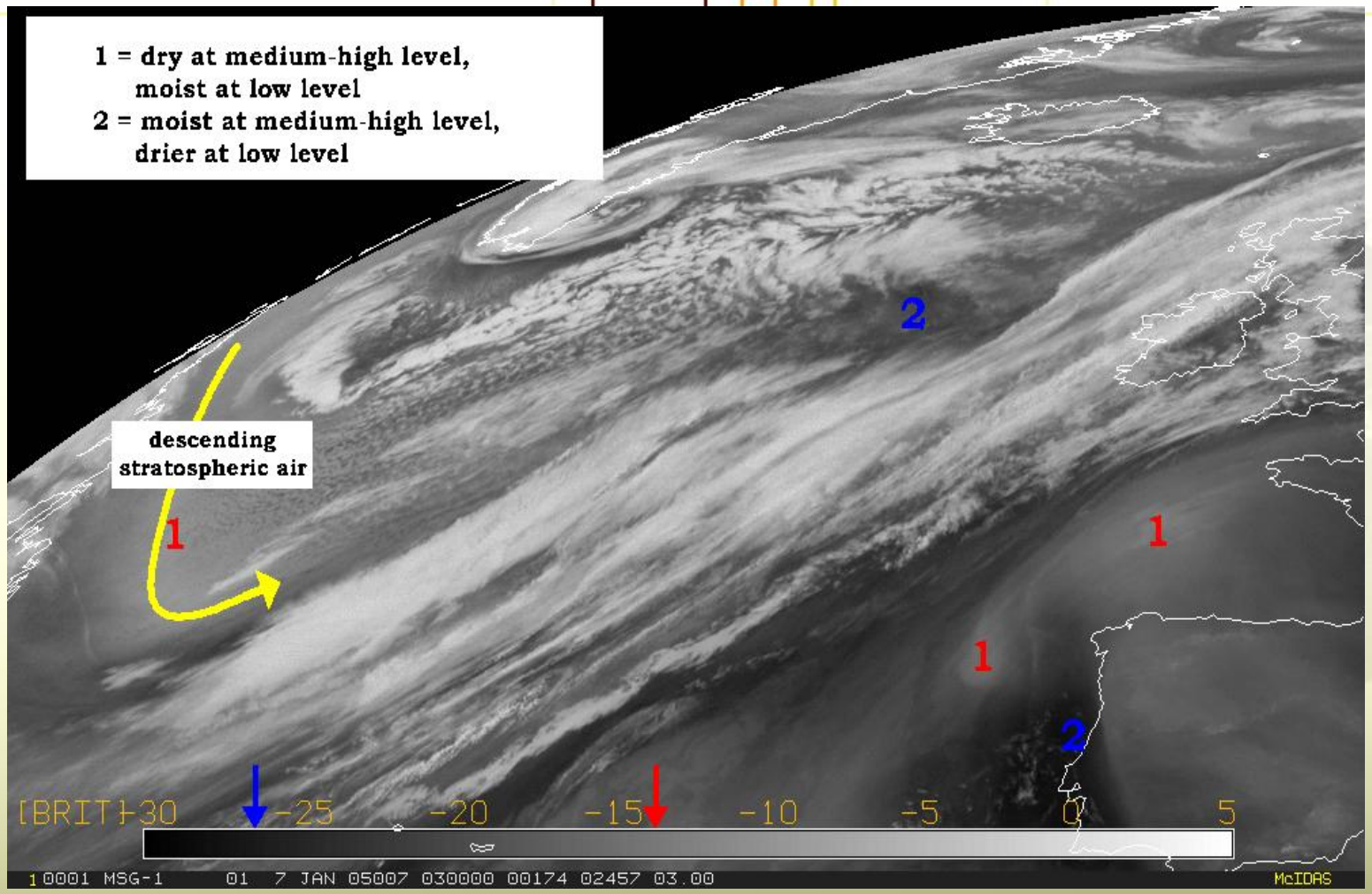
BTD WV6.2 - WV7.3



MSG-1, 07 January 2005, 03:00 UTC, Difference WV6.2 - WV7.3
Range: -30 K (black) to +5 K (white)

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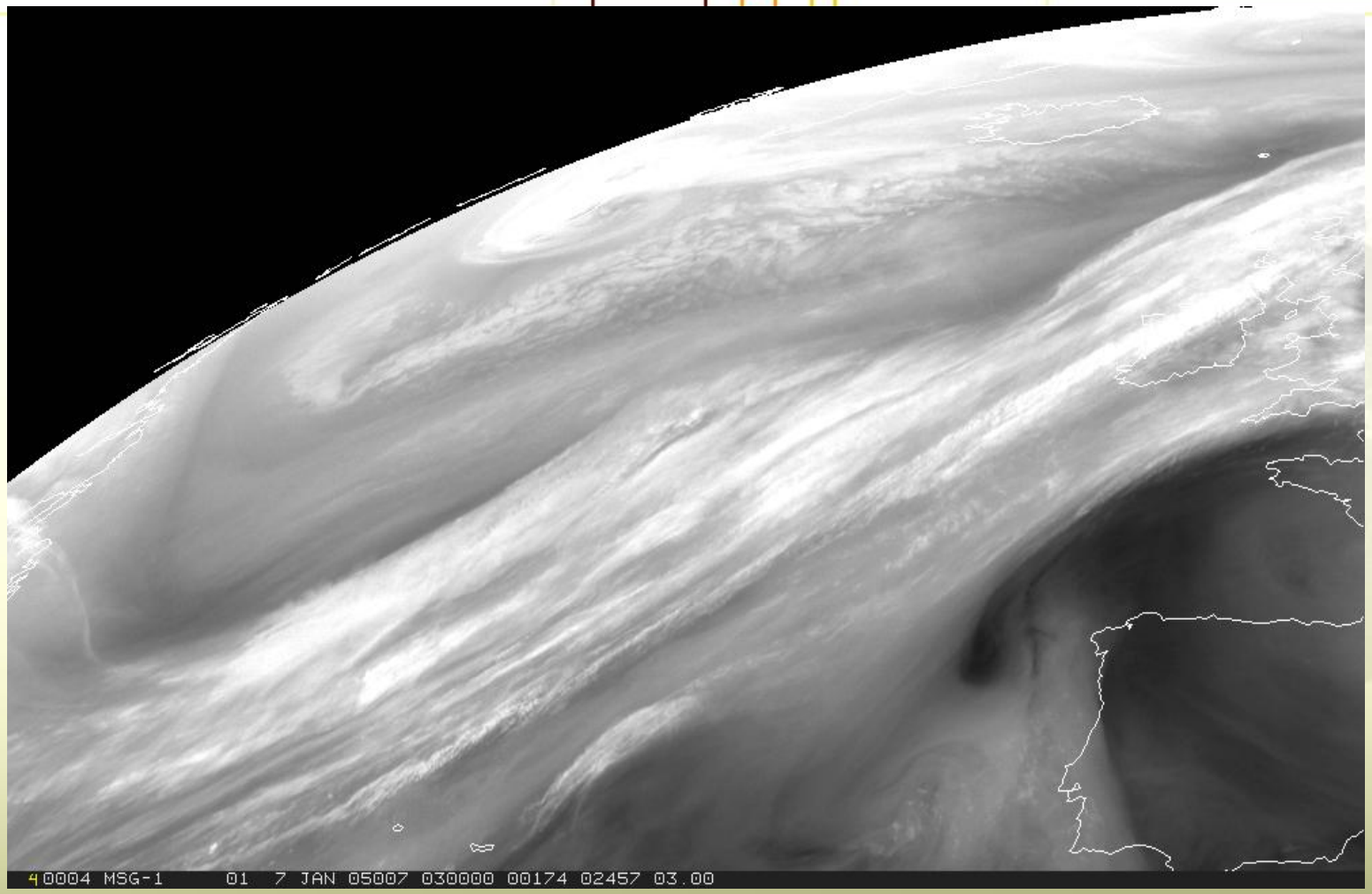
Channel 05 (WV6.2)



MSG-1, 07 January 2005, 03:00 UTC, Channel 05 (WV6.2)
Range: 253 K (black) to 213 K (white)

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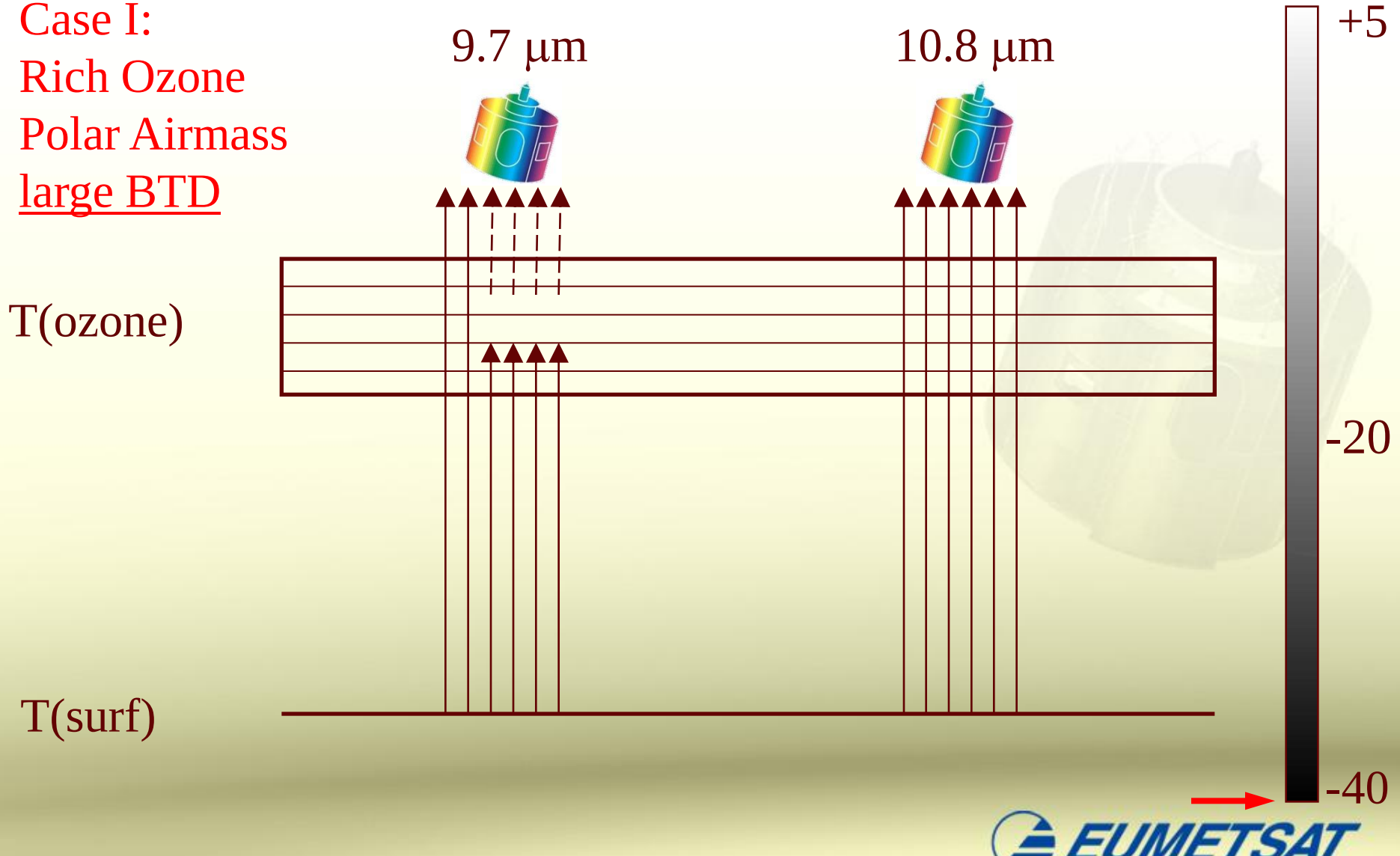
BTD IR9.7 - IR10.8

Case I:
Rich Ozone
Polar Airmass
large BTD



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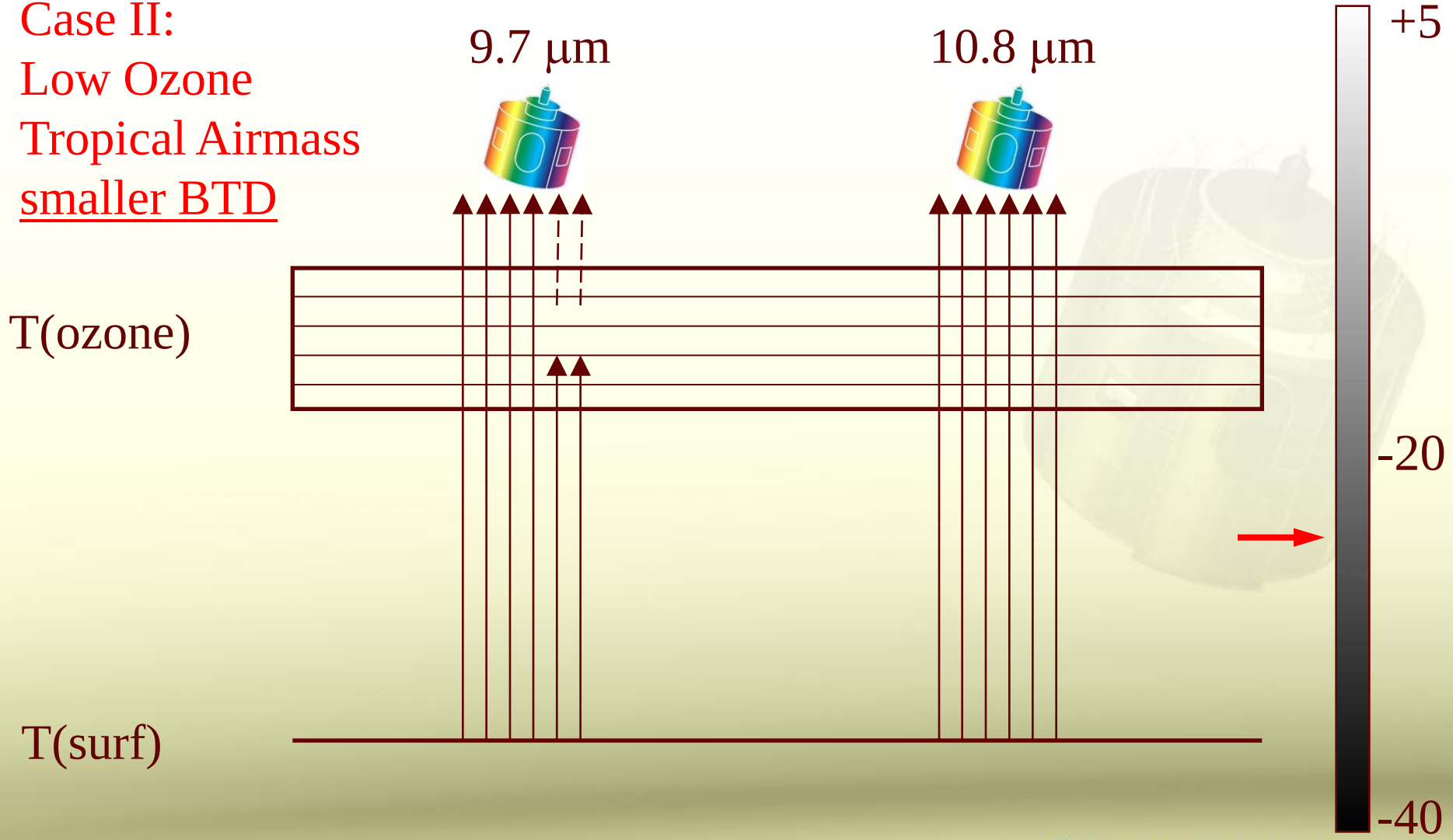
BTD IR9.7 - IR10.8

Case II:
Low Ozone
Tropical Airmass
smaller BTD



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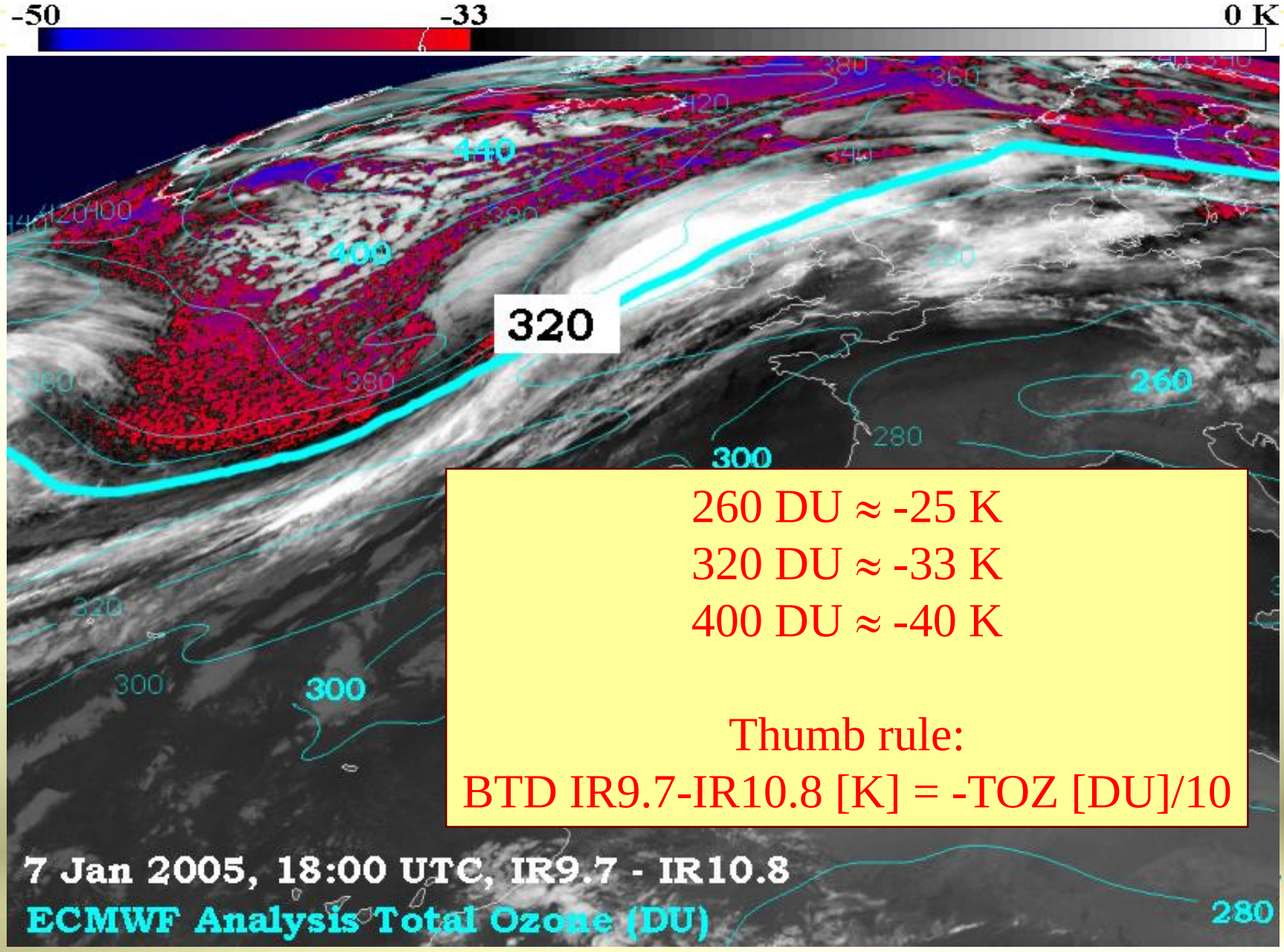
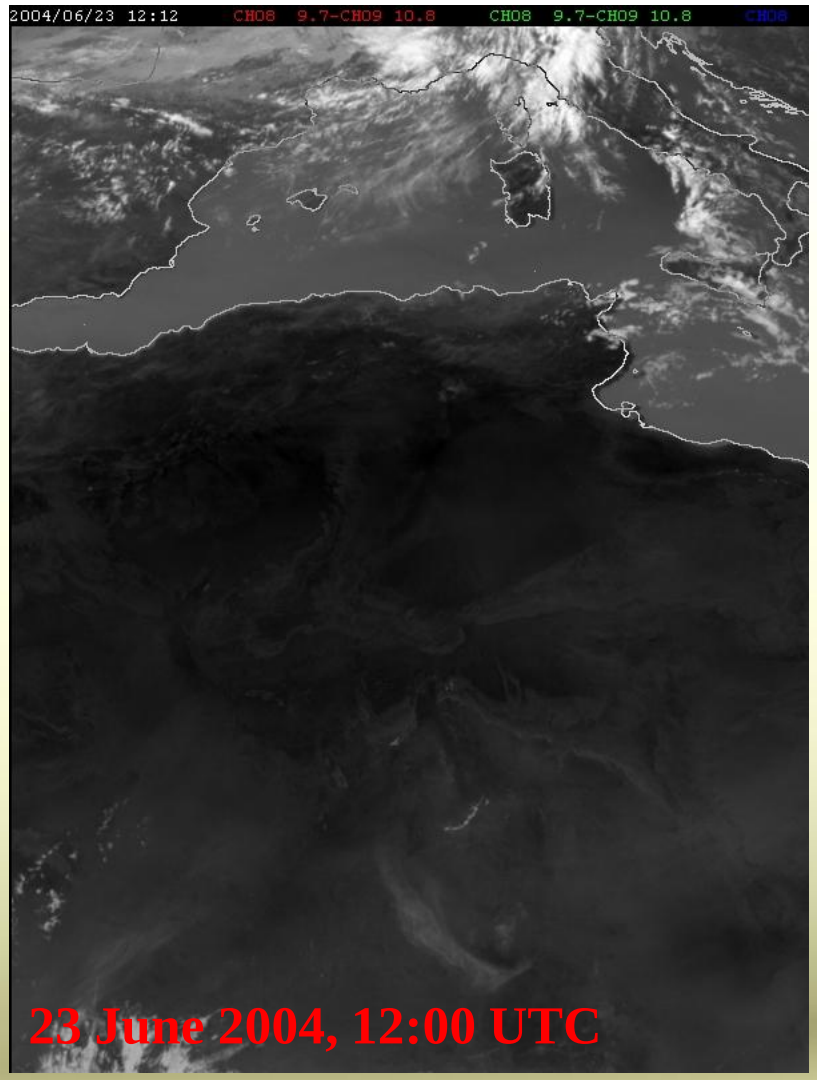
BTD IR9.7-IR10.8: Effect of Ozone

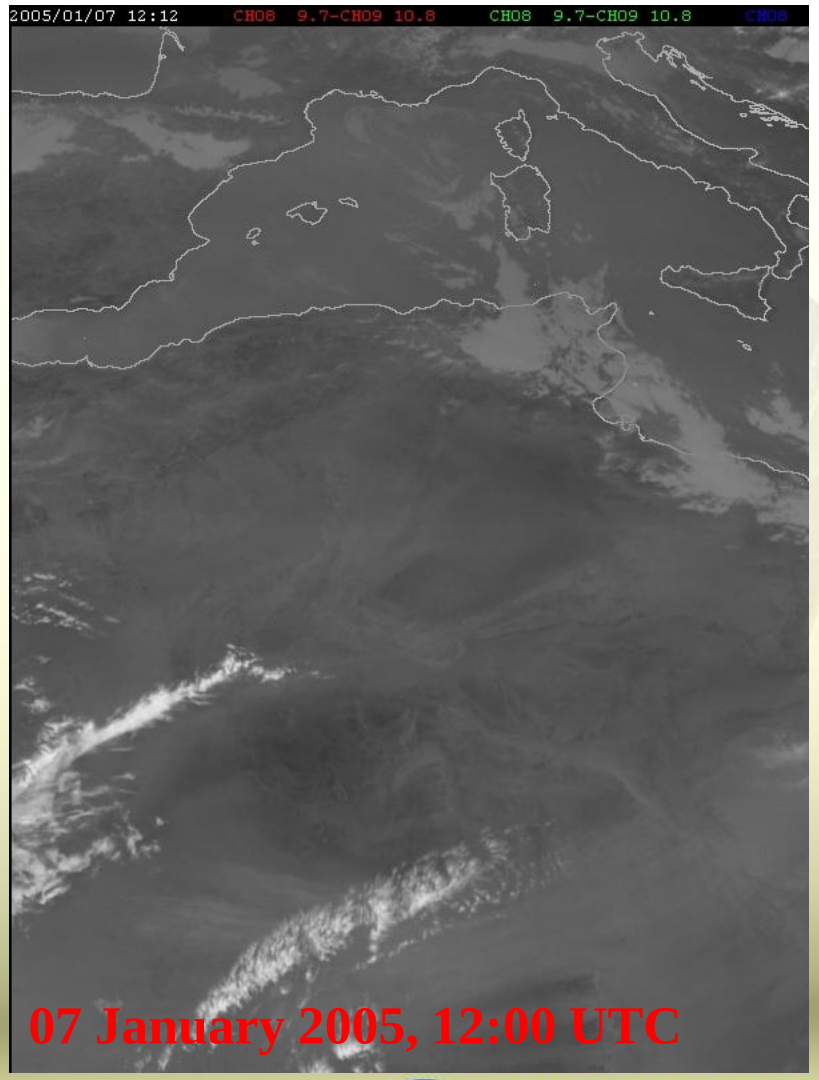


260 DU ≈ -25 K
320 DU ≈ -33 K
400 DU ≈ -40 K

Thumb rule:
BTD IR9.7-IR10.8 [K] = -TOZ [DU]/10

BTD IR9.7 - IR10.8: Effect of T(surf)





Difference IR9.7 - IR10.8
Range: -45 K (black) to +5 K (white)

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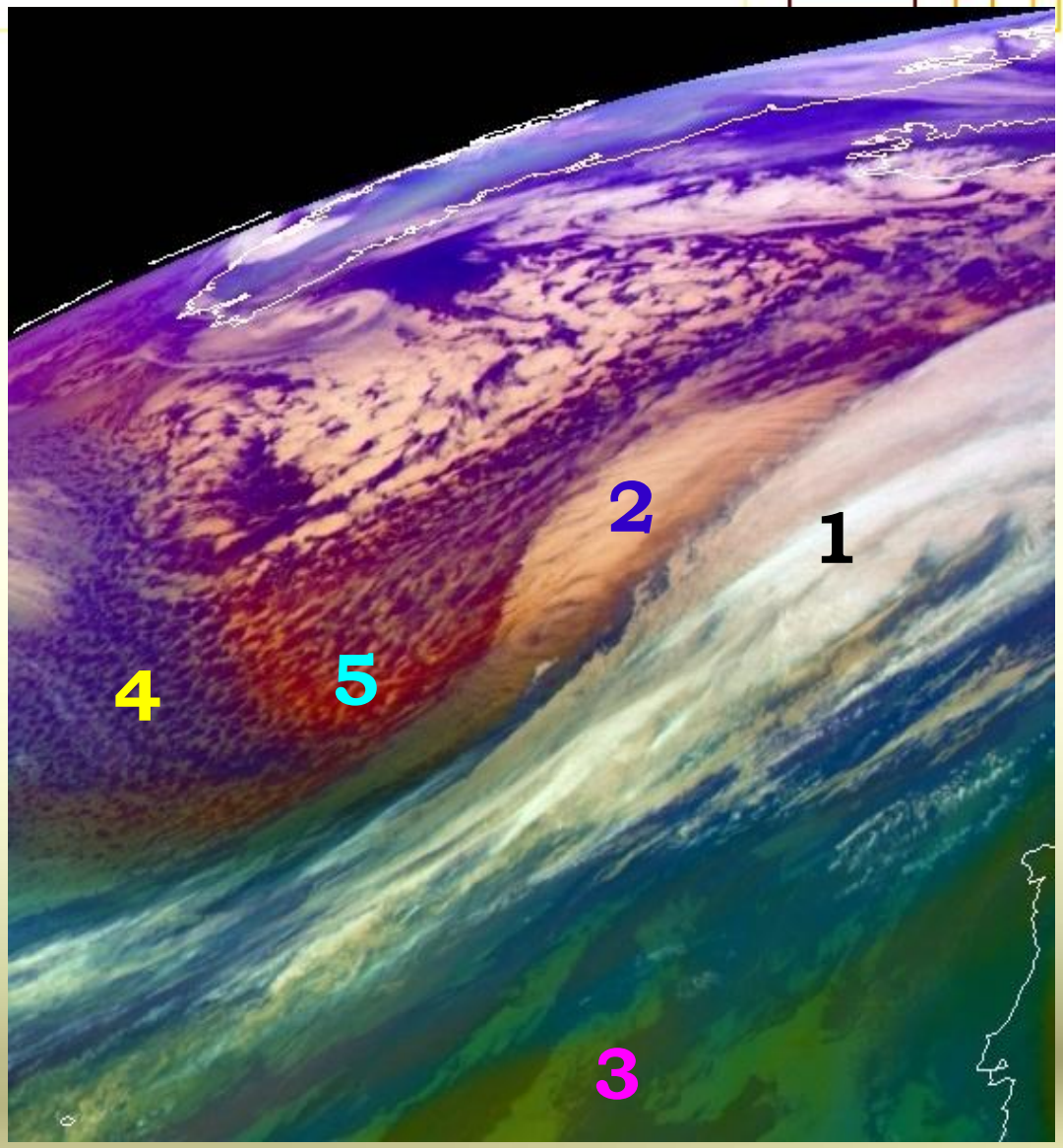
Airmass RGB: Colour Interpretation



1 = high clouds
2 = mid-level clouds
3 = warm airmass, high tropopause
4 = cold airmass, low tropopause
5 = dry descending stratospheric air

MSG-1
07 January 2005
15:00 UTC
RGB Composite
R = WV6.2 - WV7.3
G = IR9.7 - IR10.8
B = WV6.2

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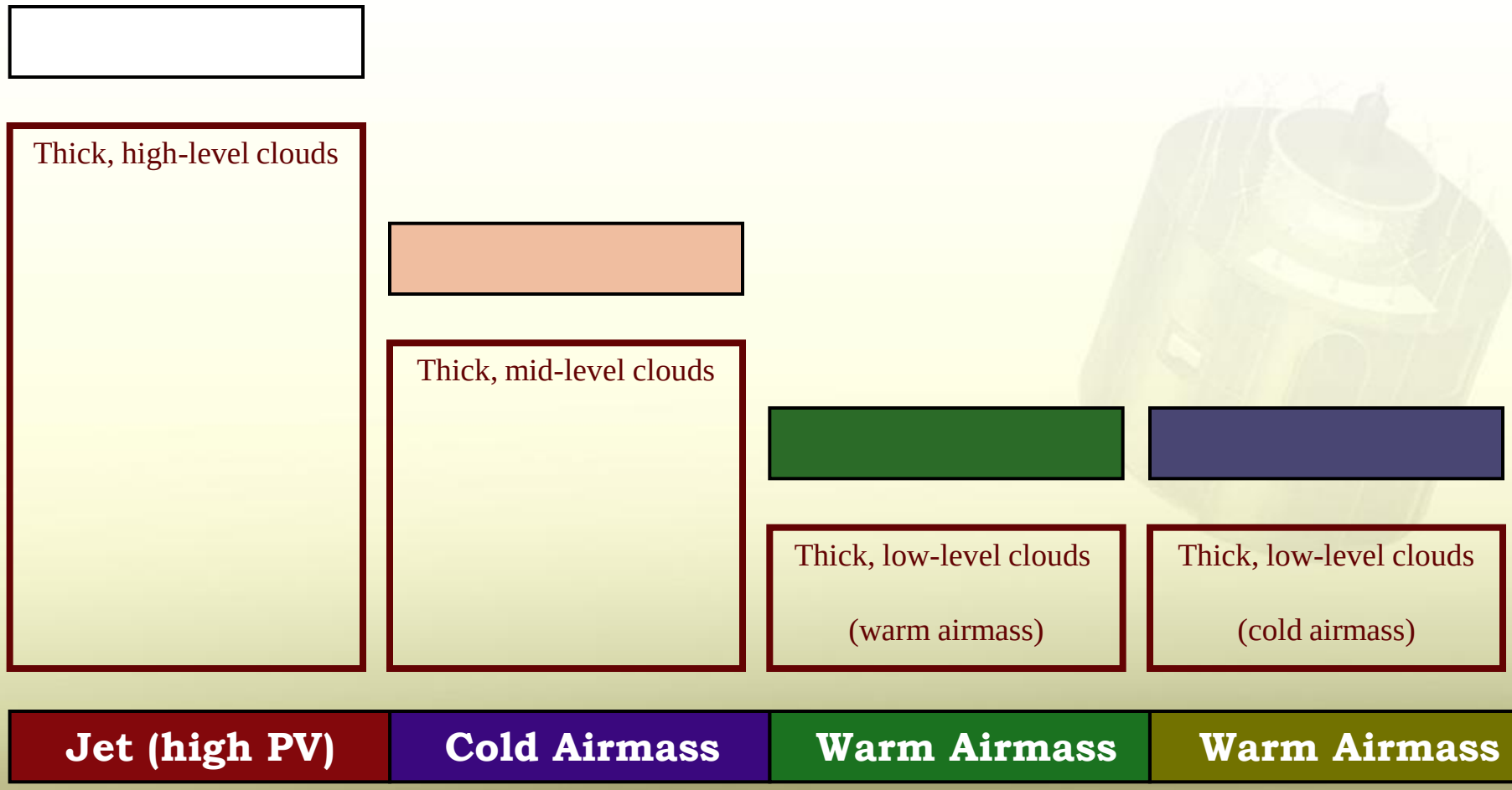
Airmass RGB: Interpretation of Colours



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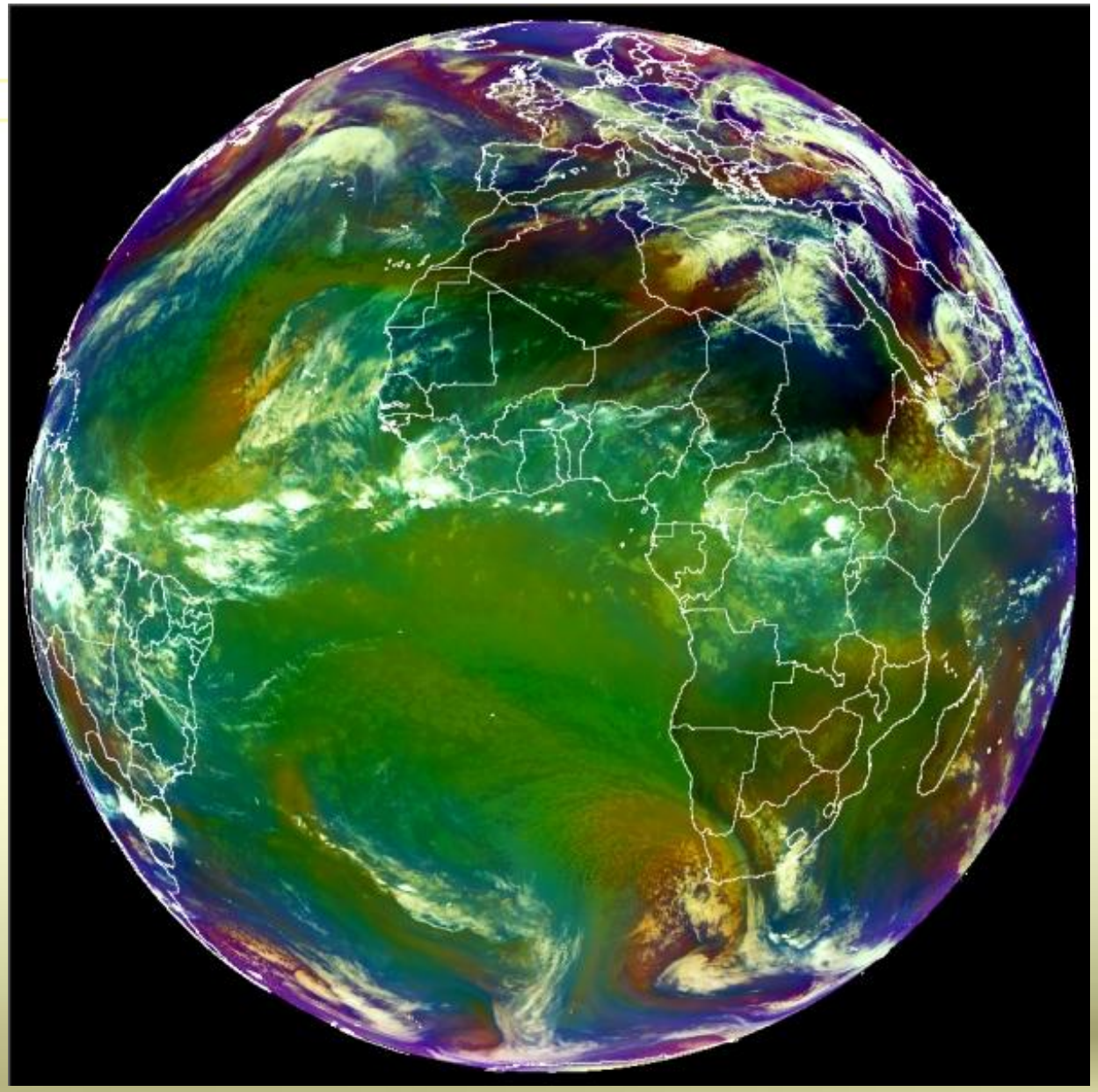

Airmass RGB Global View

Note: warm airmasses seen at a high satellite viewing angle appear with a bluish colour (limb cooling effect) !

MSG-1
19 April 2005
10:00 UTC

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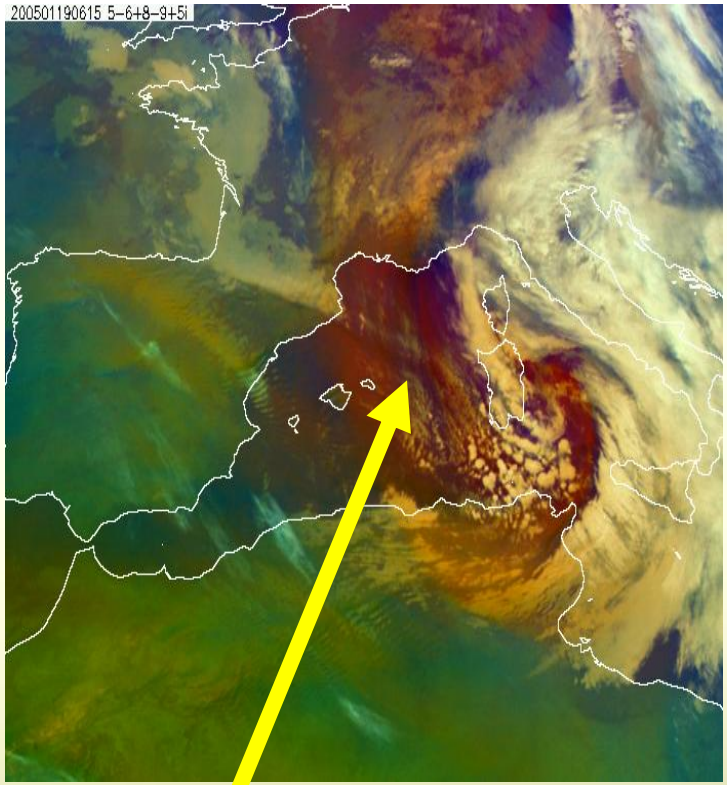
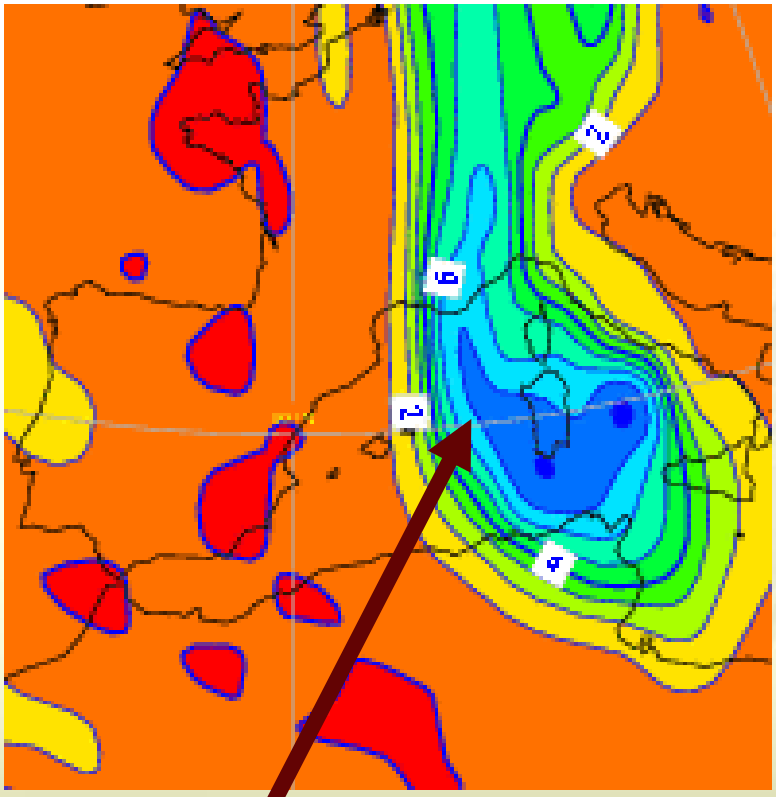
Airmass RGB as PV Proxy





reddish areas

high PV values

19 January 2005, 06:15 UTC

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SUMMARY

- **The "Airmass" RGB is a combination of 4 channels: WV6.2, WV7.3, IR9.7 and IR10.8**
- **It helps to detect the position of jet streams, deformation zones and PV anomalies (red areas)**
- **It also helps to discriminate airmasses (low ozone tropical airmass, rich ozone polar airmass)**
- **It is also useful to detect typical WV features like deformation zones and wave features**
- **At the same time, through the use of the IR channels, it allows to monitor cloud development at low, mid and high levels**

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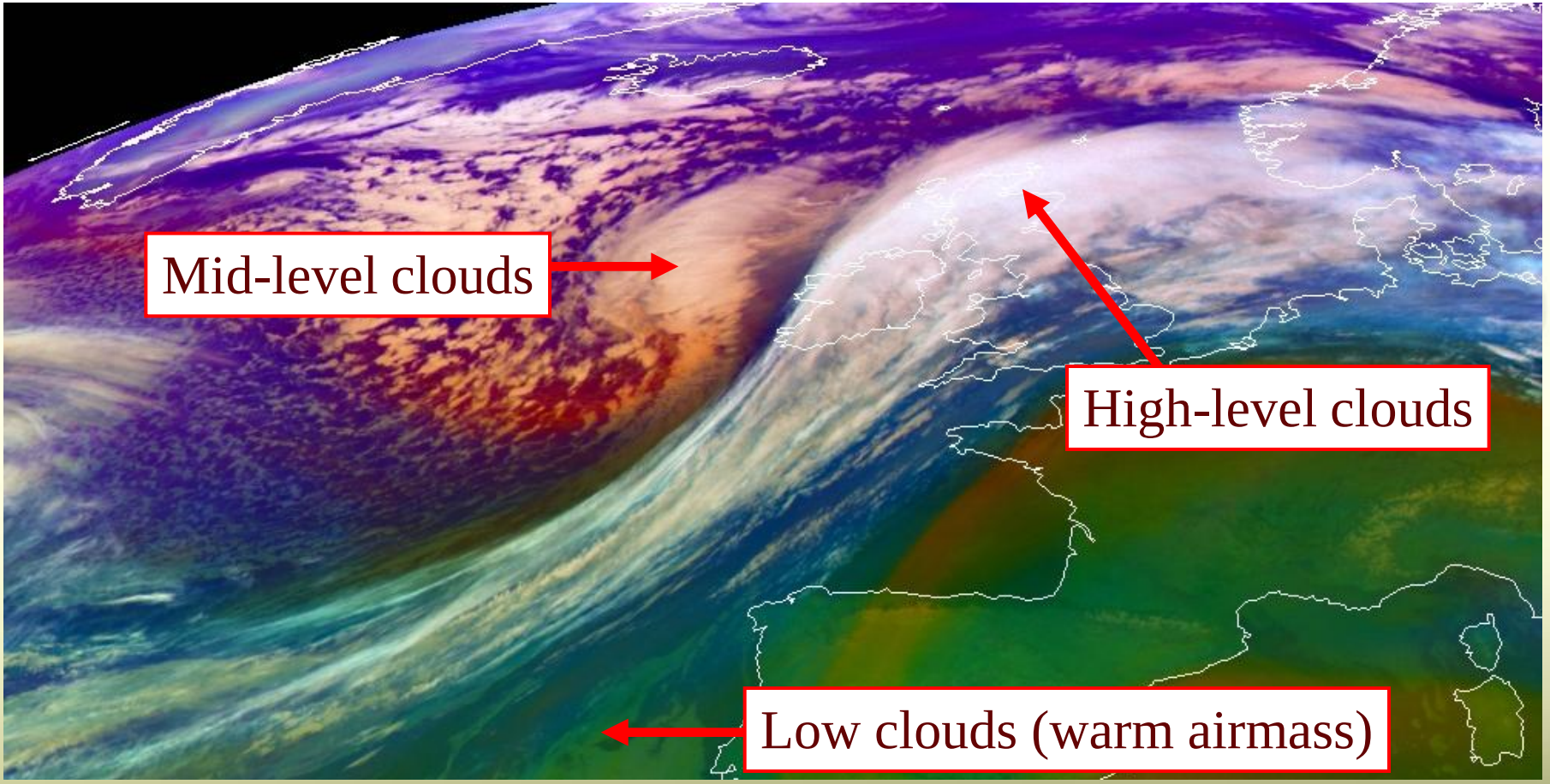
Examples

Clouds



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

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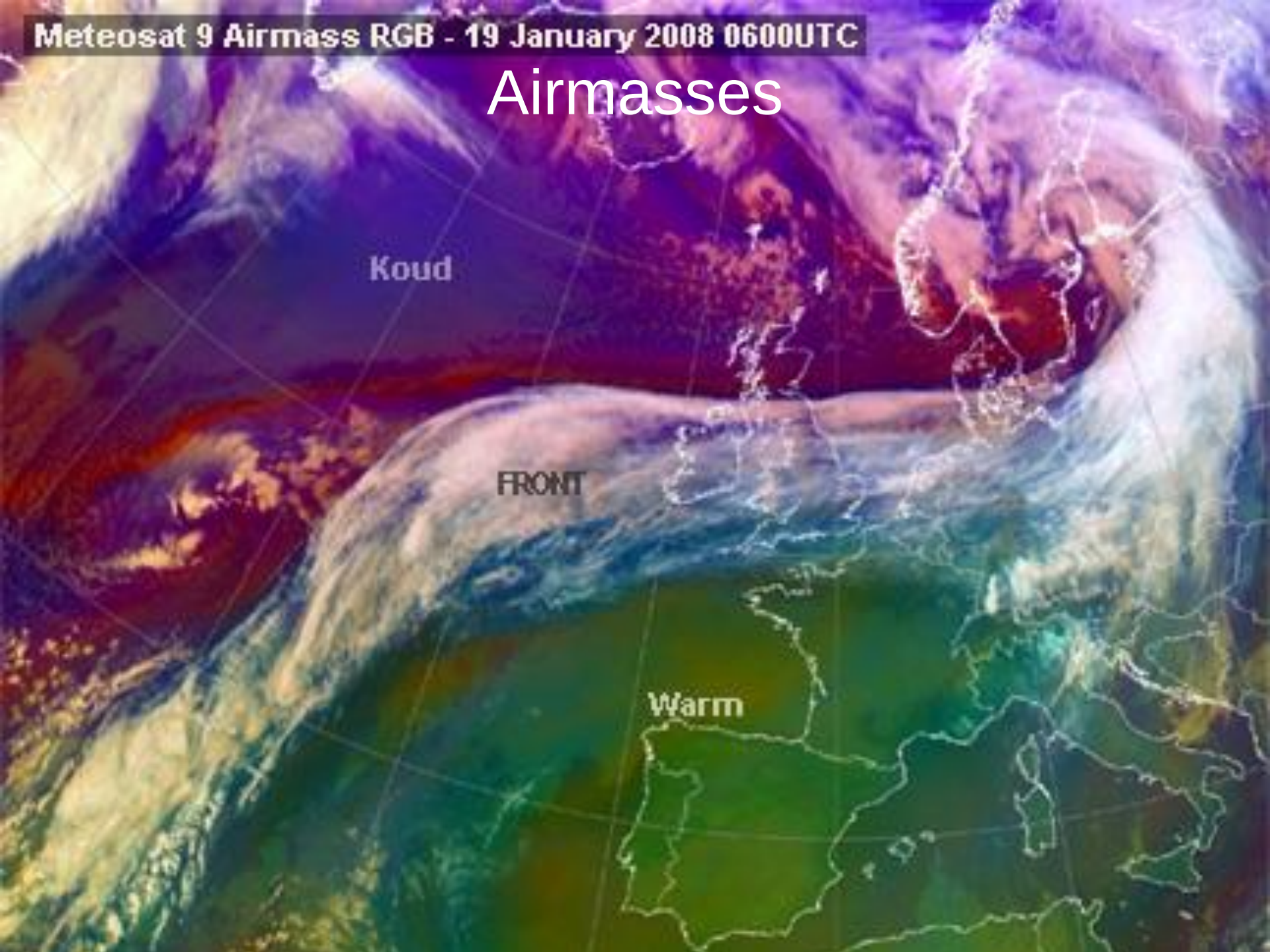
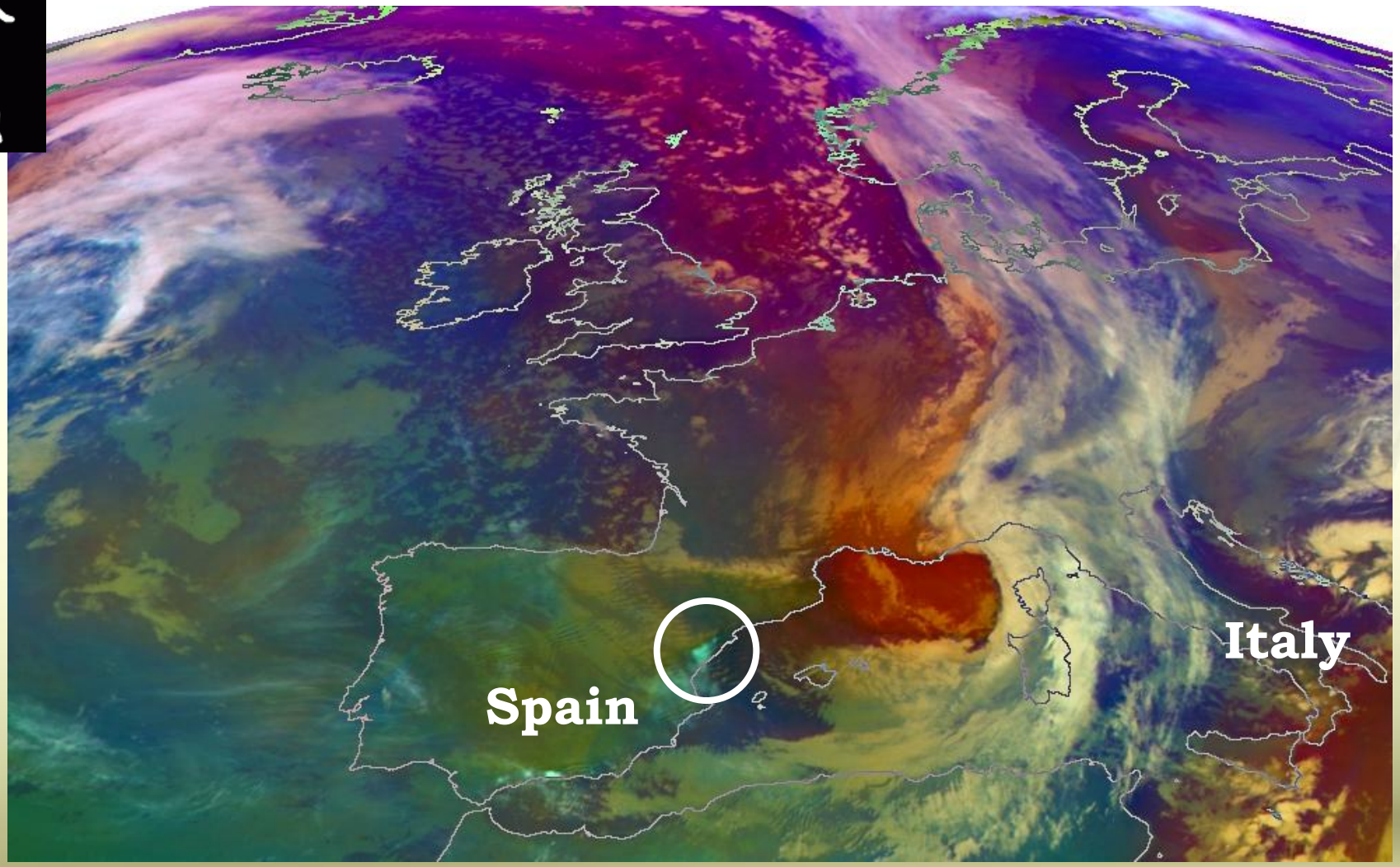
Airmasses


Meteosat 9 Airmass RGB - 19 January 2008 0600UTC
Koud
FRONT
Warm

PV Anomaly (Genoa Cyclone)



MSG-1, 28 December 2004, 20:45 UTC

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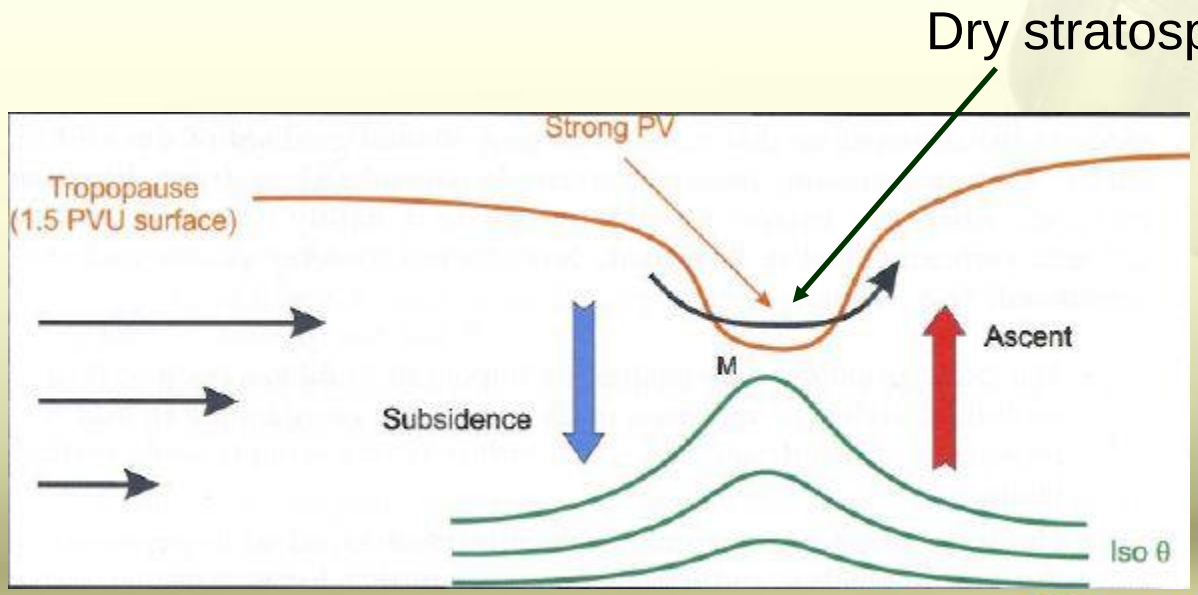
Potential Vorticity (PV)

= Stability * Absolute vorticity

- **Growing from ground to stratosphere**
- **Conserved along the flow (except for turbulence or heating)**
- **Positive PV anomalies induce ascents ahead**



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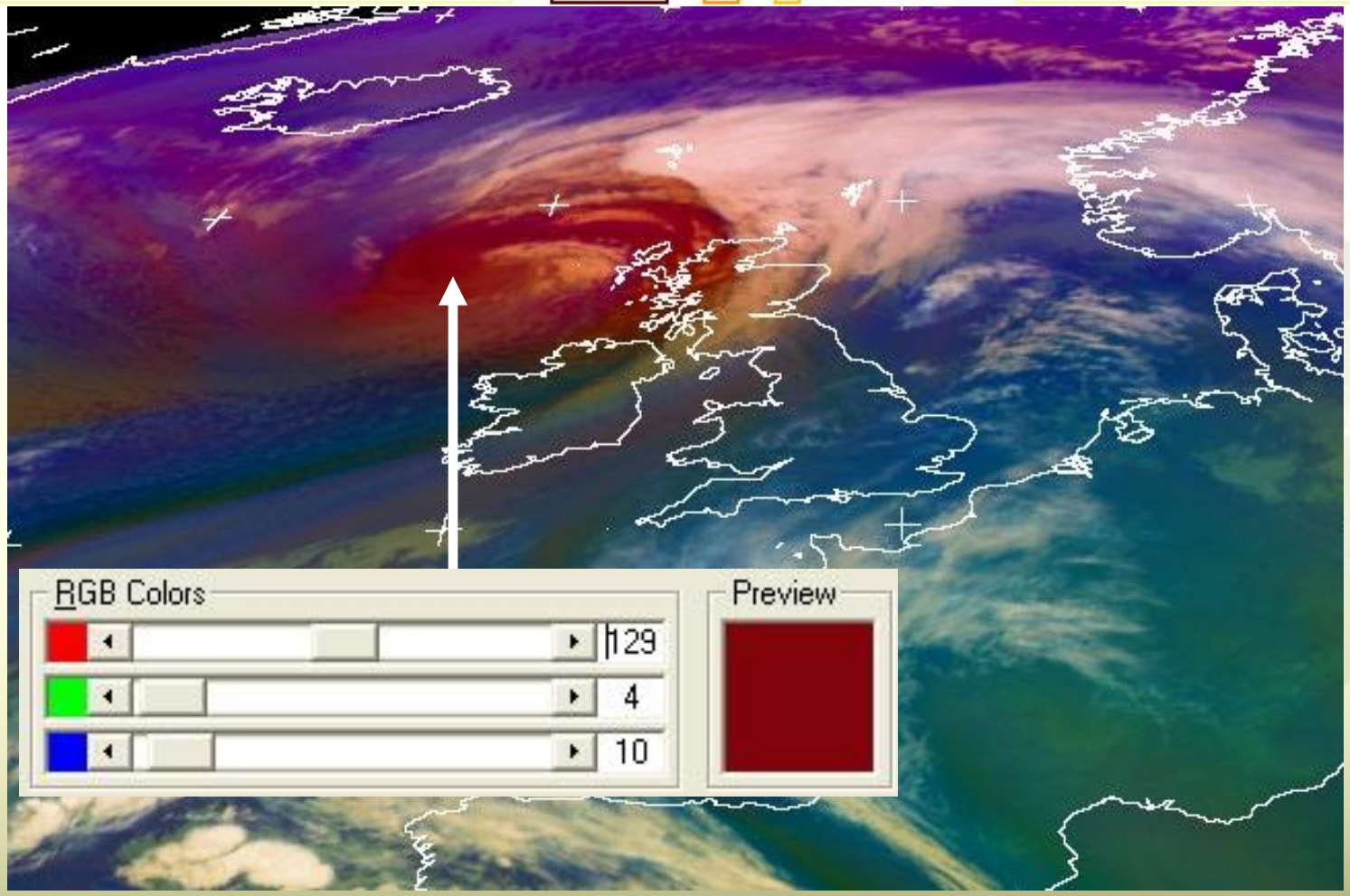
PV Anomaly North Atlantic



MSG-1, 30 October 2006, 20:00 UTC

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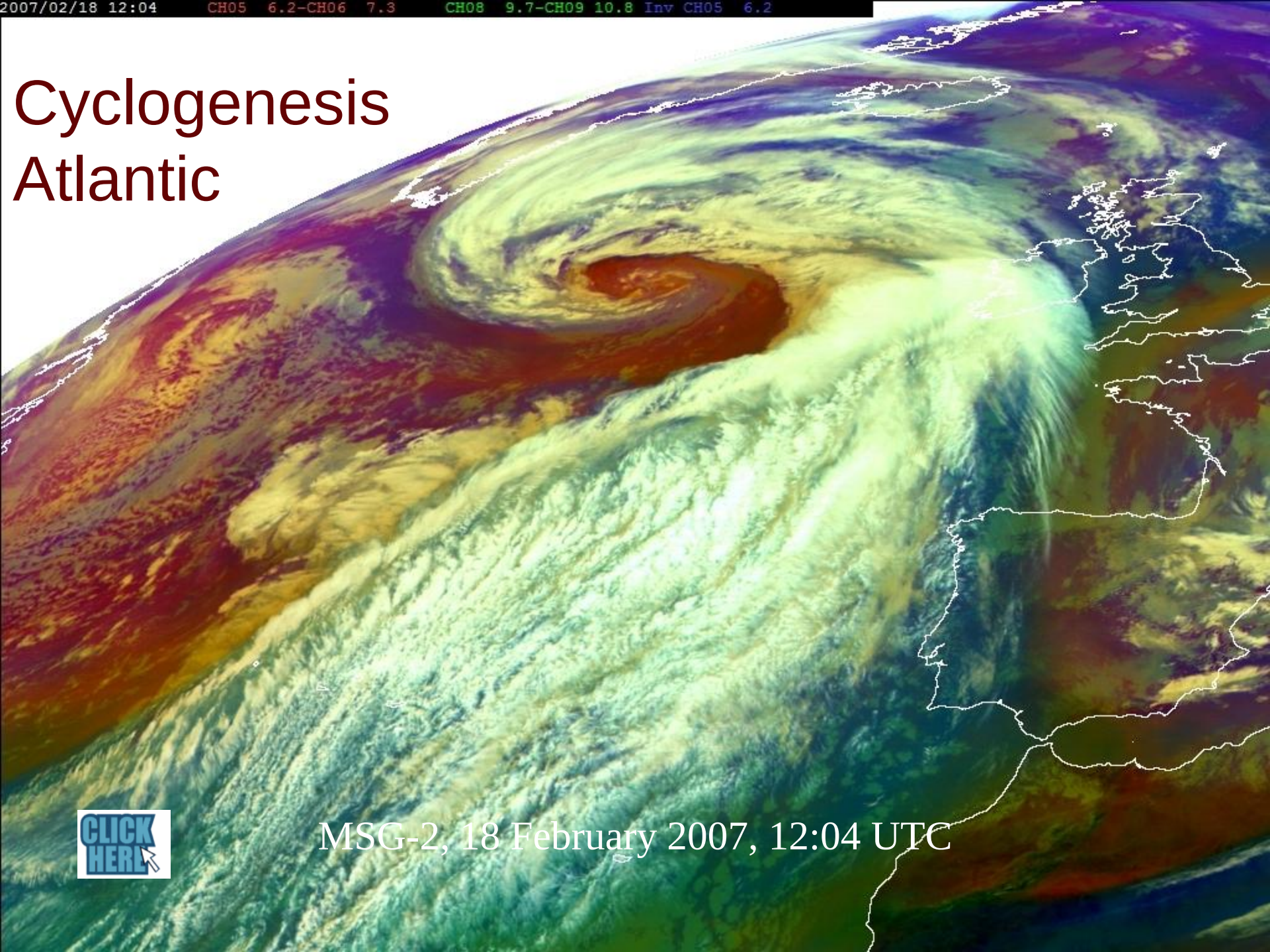
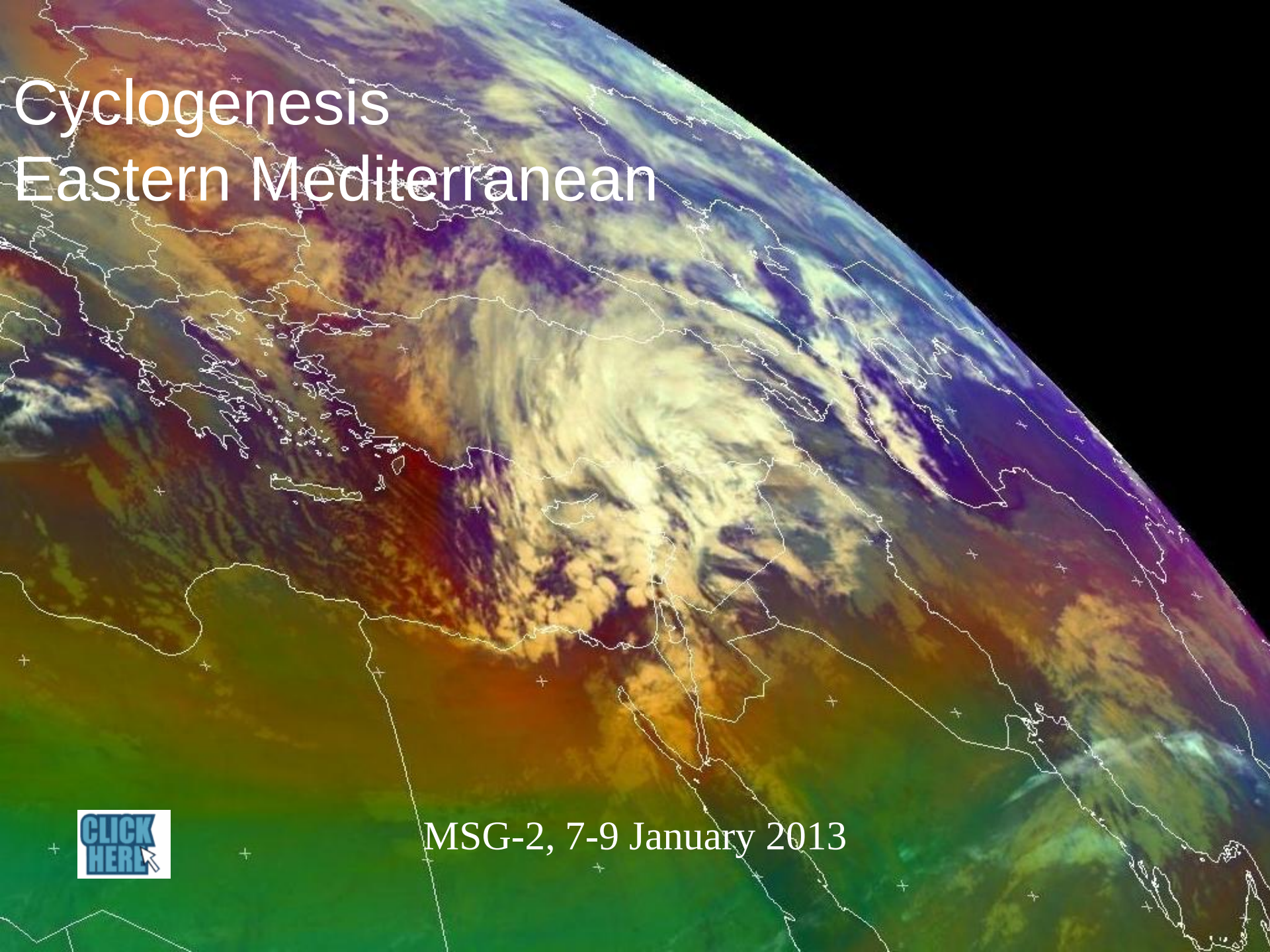
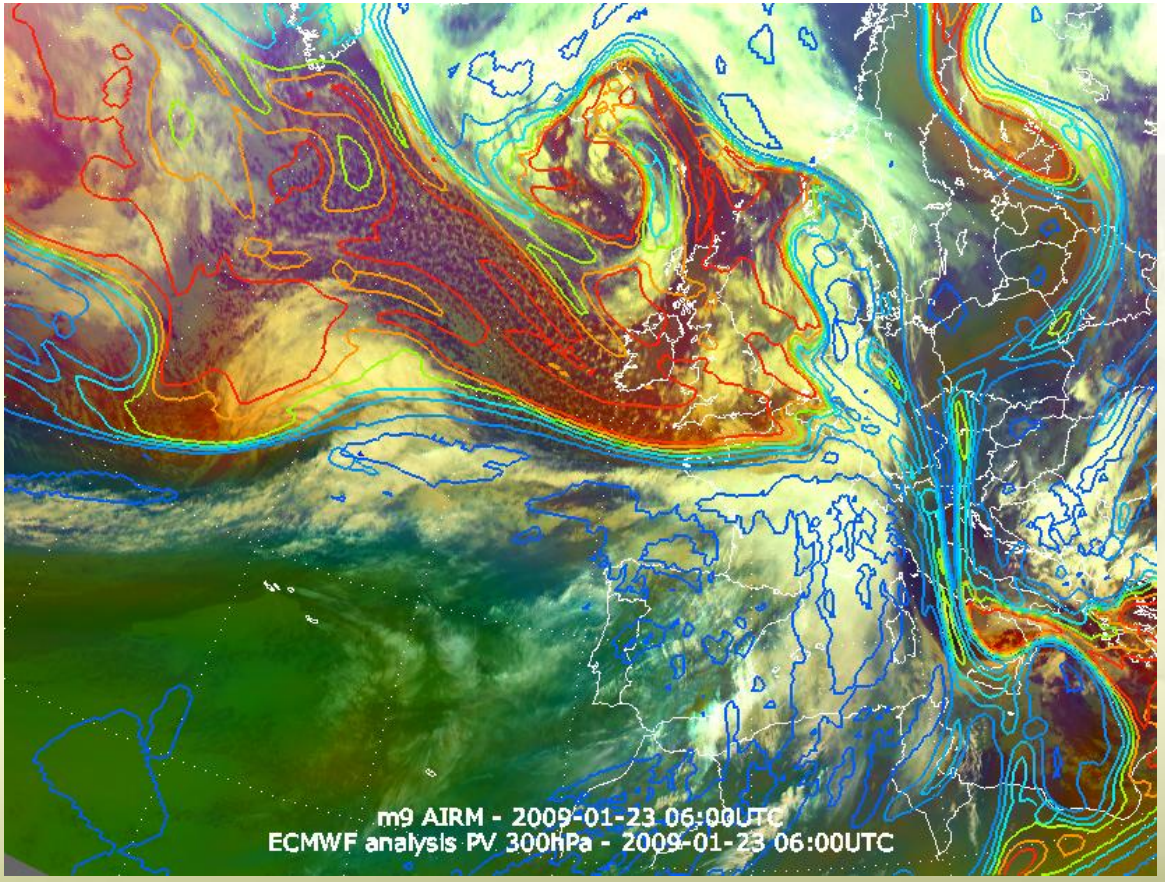

2007/02/18 12:04 CH05 6.2-CH06 7.3 CH08 9.7-CH09 10.8 Inv CH05 6.2
Cyclogenesis
Atlantic
CLICK HERE
MSG-2, 18 February 2007, 12:04 UTC

Cyclogenesis Eastern Mediterranean



MSG-2, 7-9 January 2013

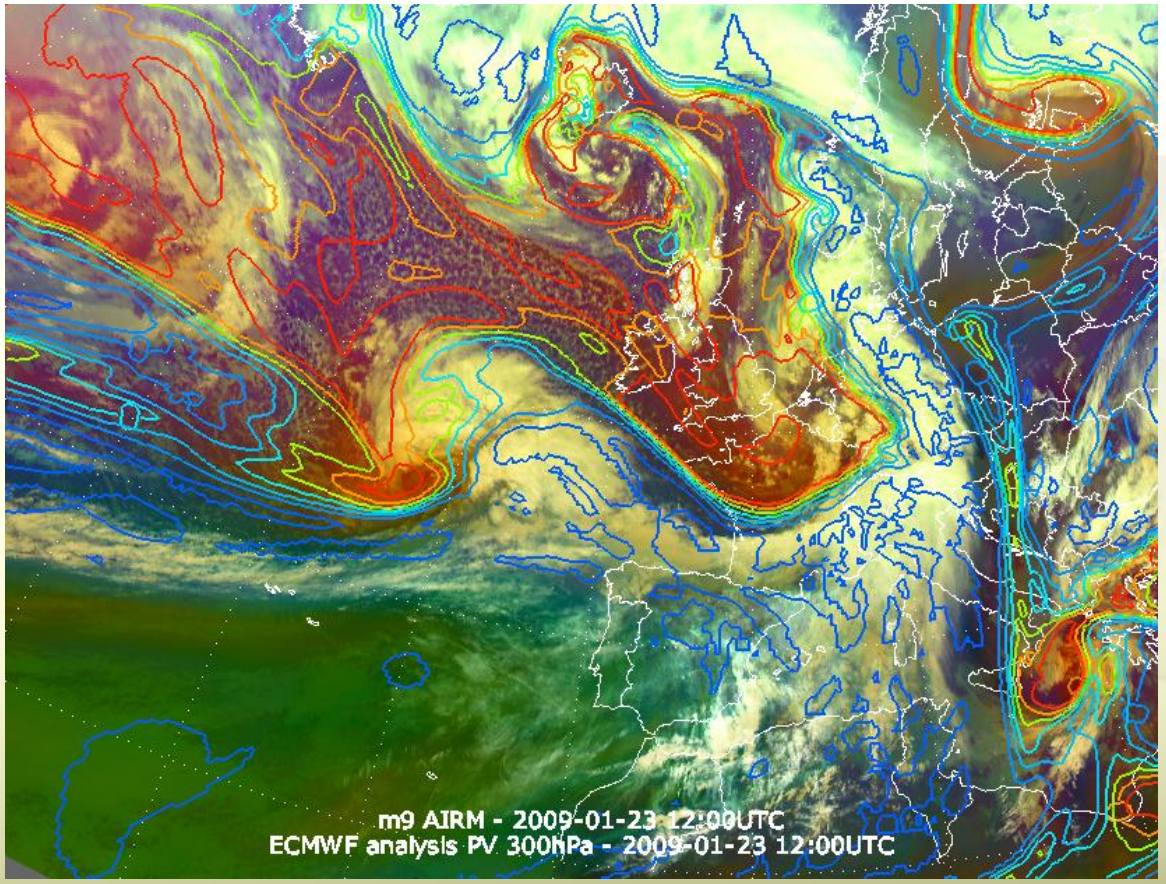
Airmass RGB and PV at 300 hPa



23 January 2009, 06:00 UTC

EUMETSAT

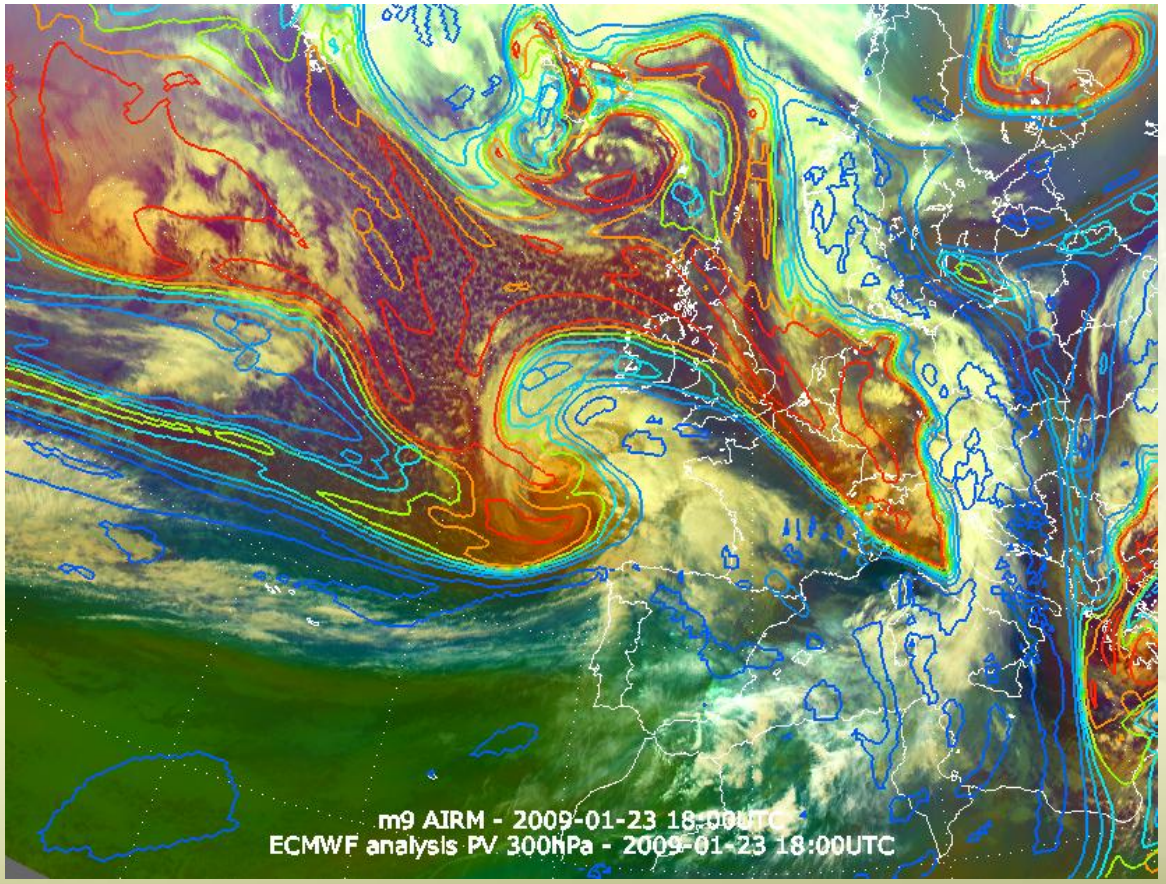
Airmass RGB and PV at 300 hPa



23 January 2009, 12:00 UTC

EUMETSAT

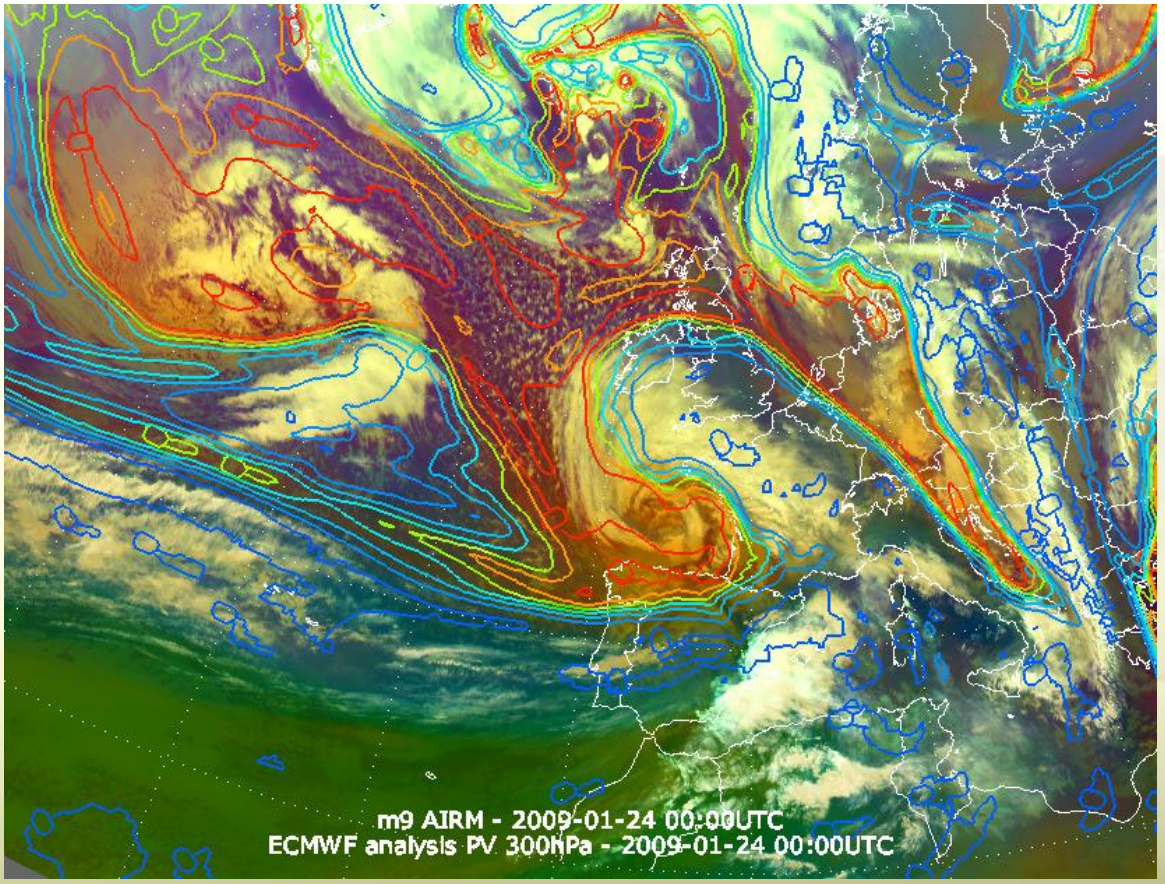
Airmass RGB and PV at 300 hPa



23 January 2009, 18:00 UTC

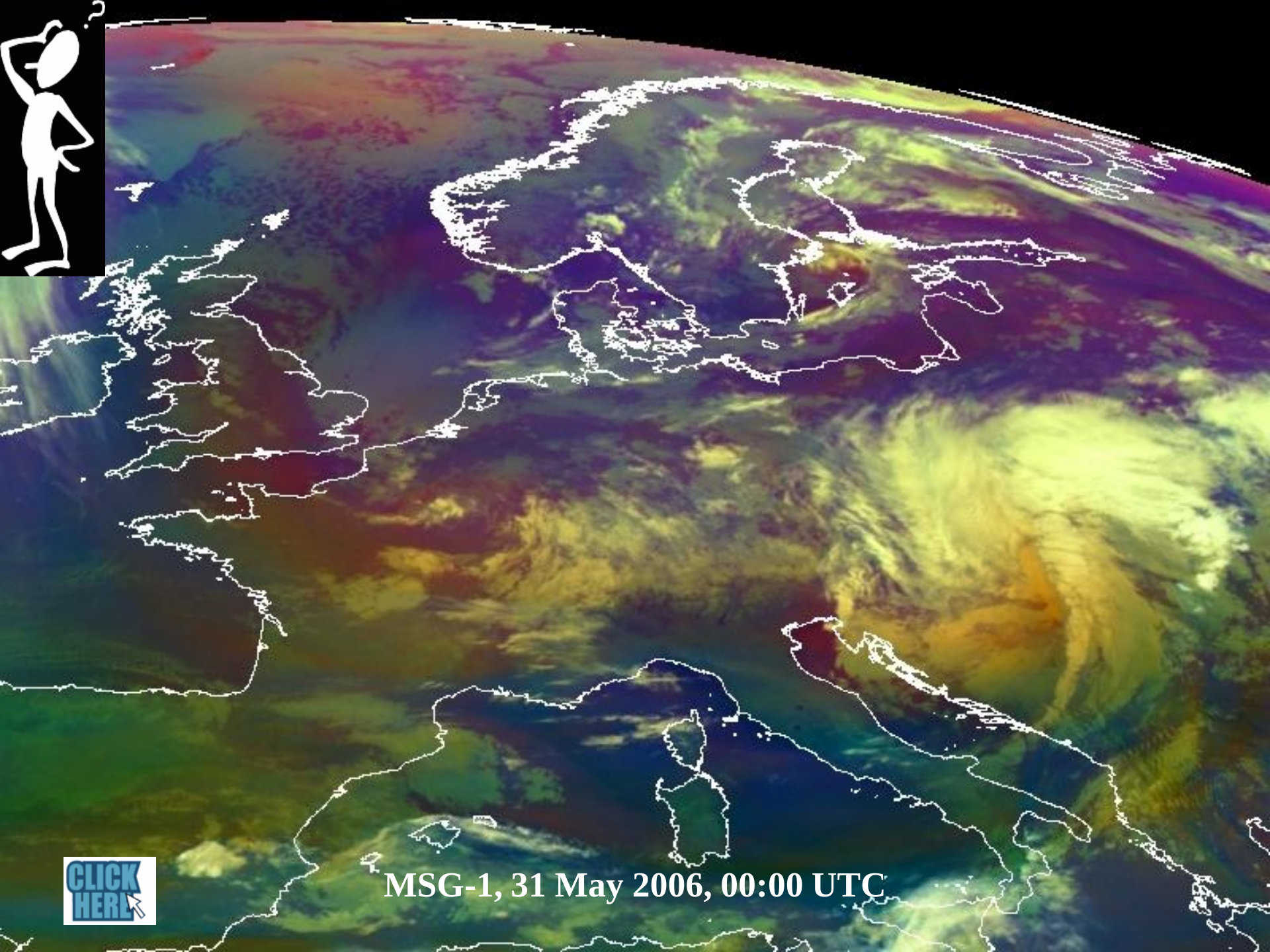
EUMETSAT

Airmass RGB and PV at 300 hPa

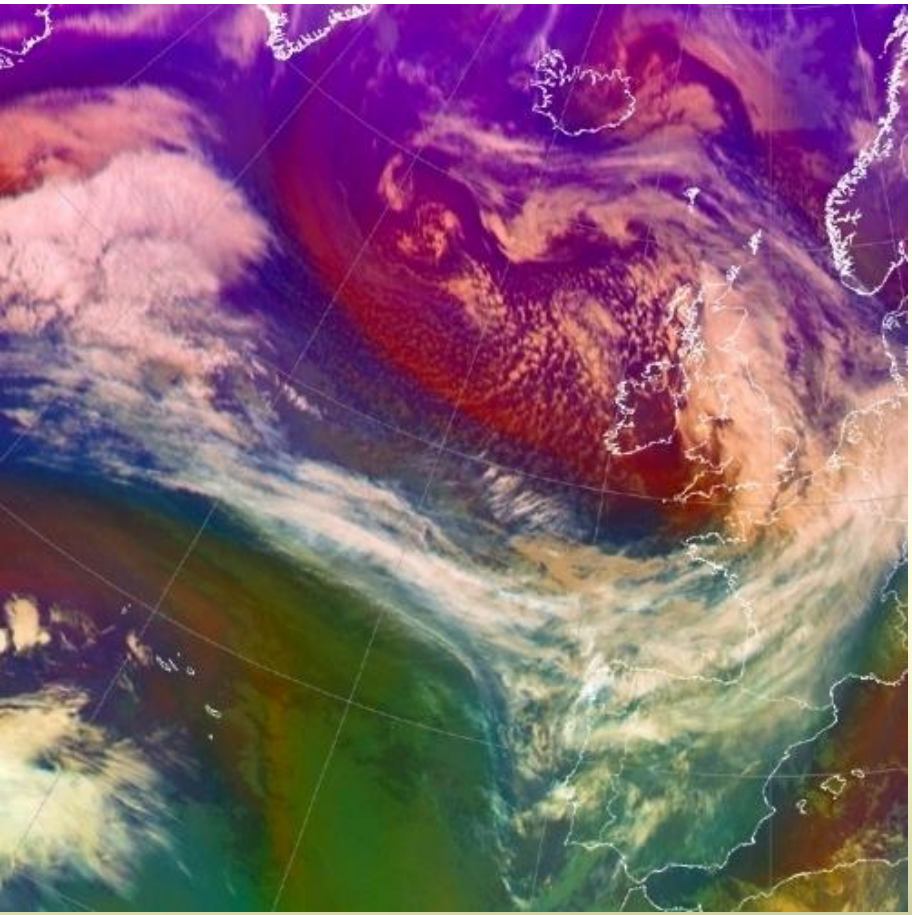


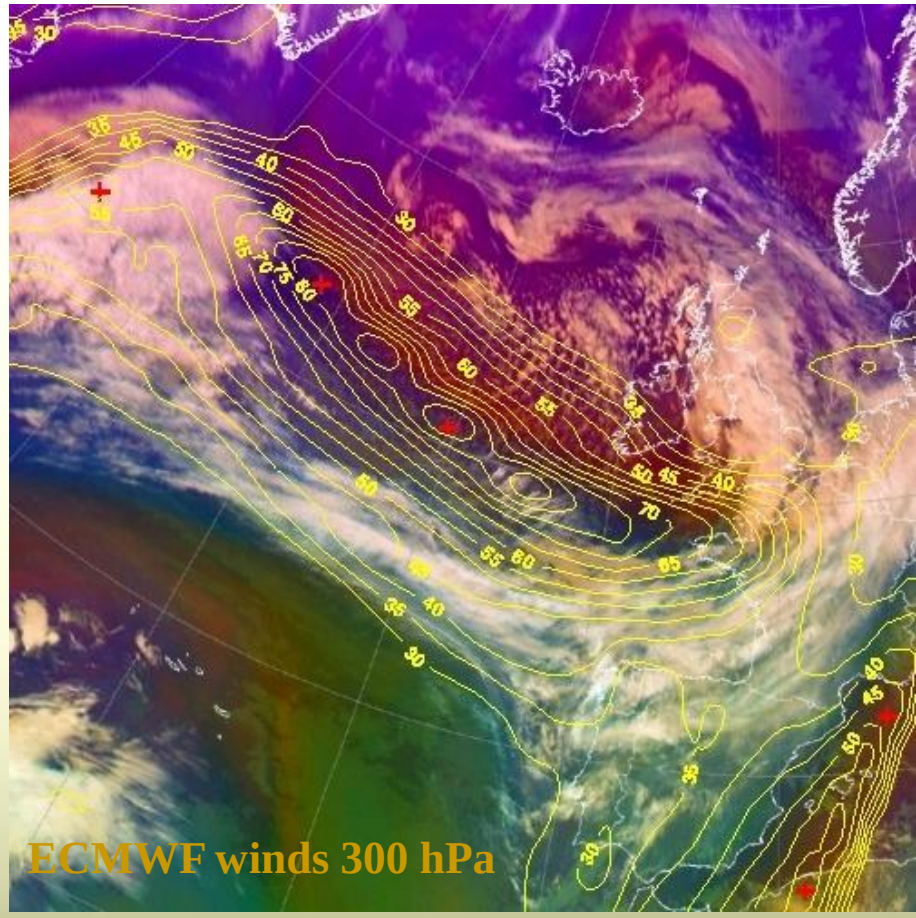
24 January 2009, 00:00 UTC

EUMETSAT


CLICK HERE
MSG-1, 31 May 2006, 00:00 UTC

Jets (Shear Zone) North Atlantic





MSG-1, 4 December 2008, 06:00 UTC (source: SatRep Online)

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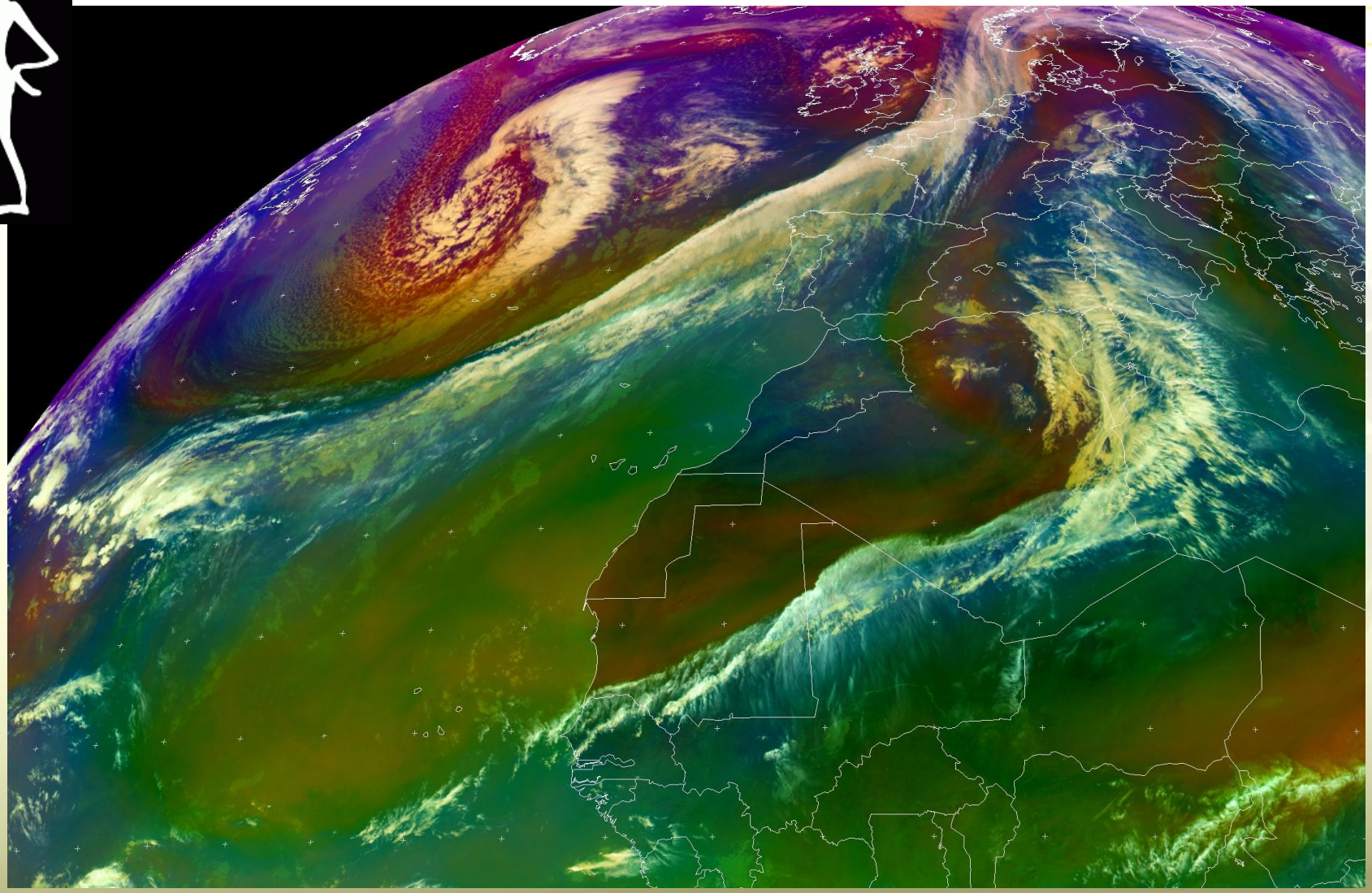
Polar & Subtropical Jets



MSG-2, 20 November 2009

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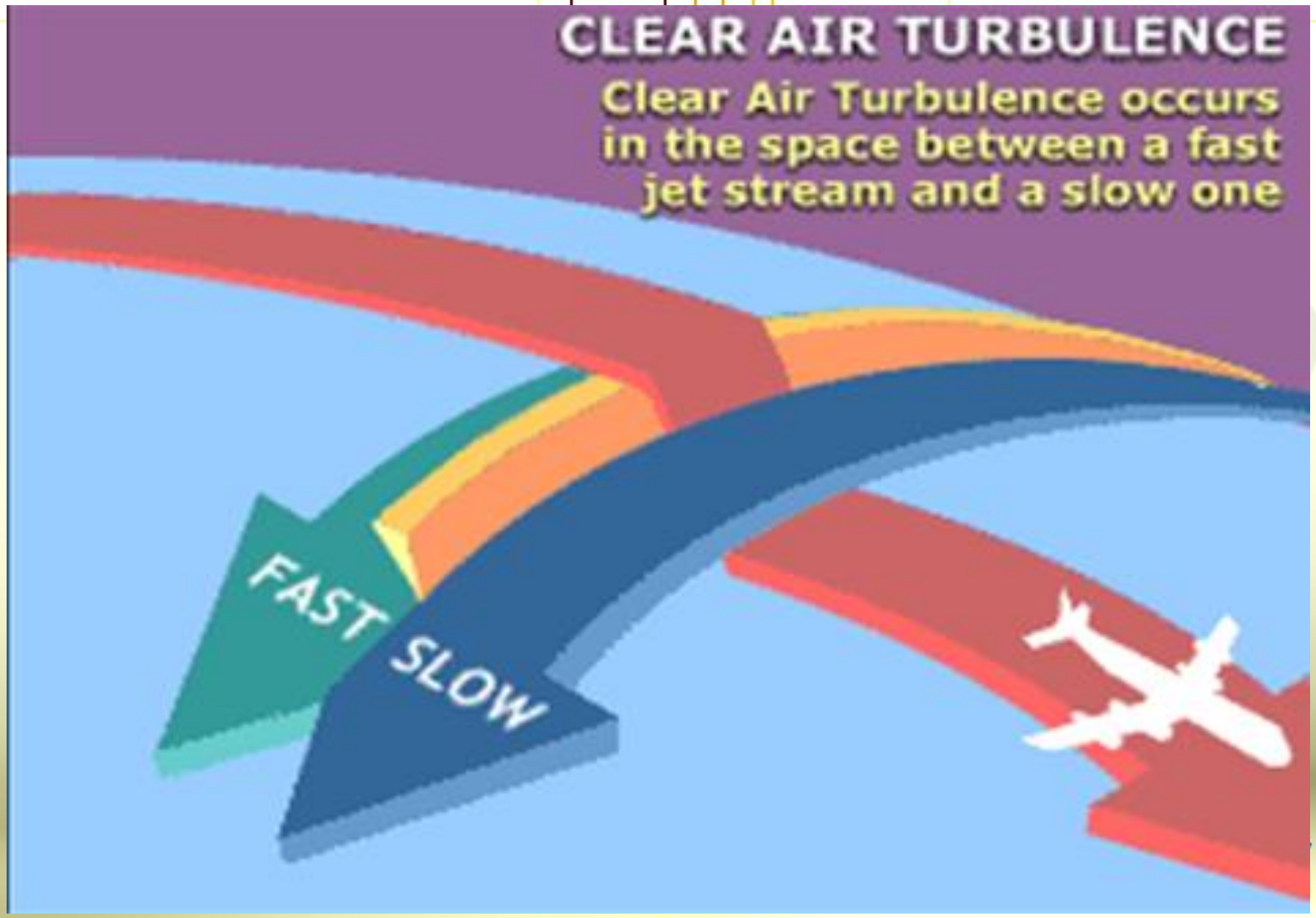
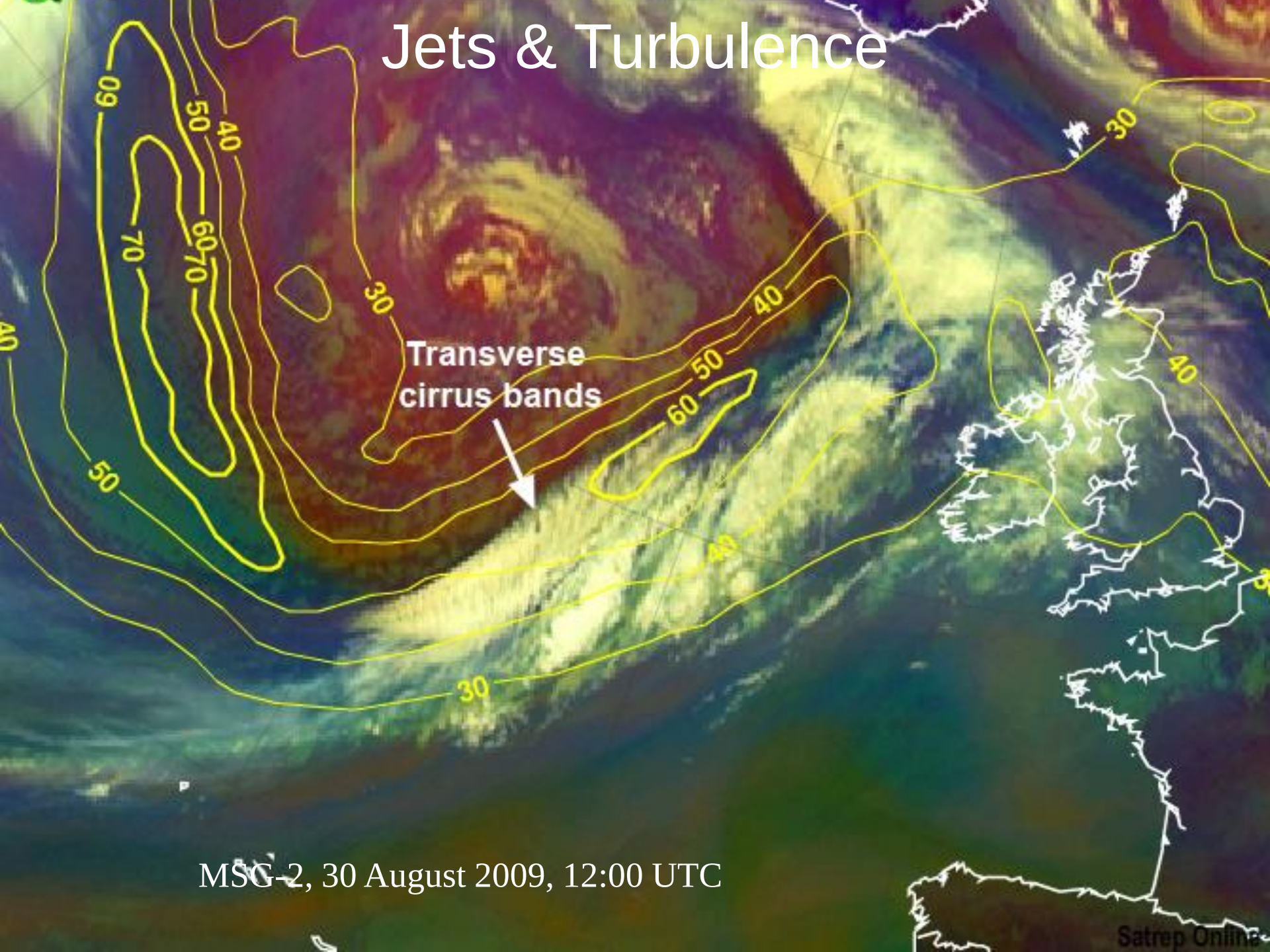
Jets & Turbulence

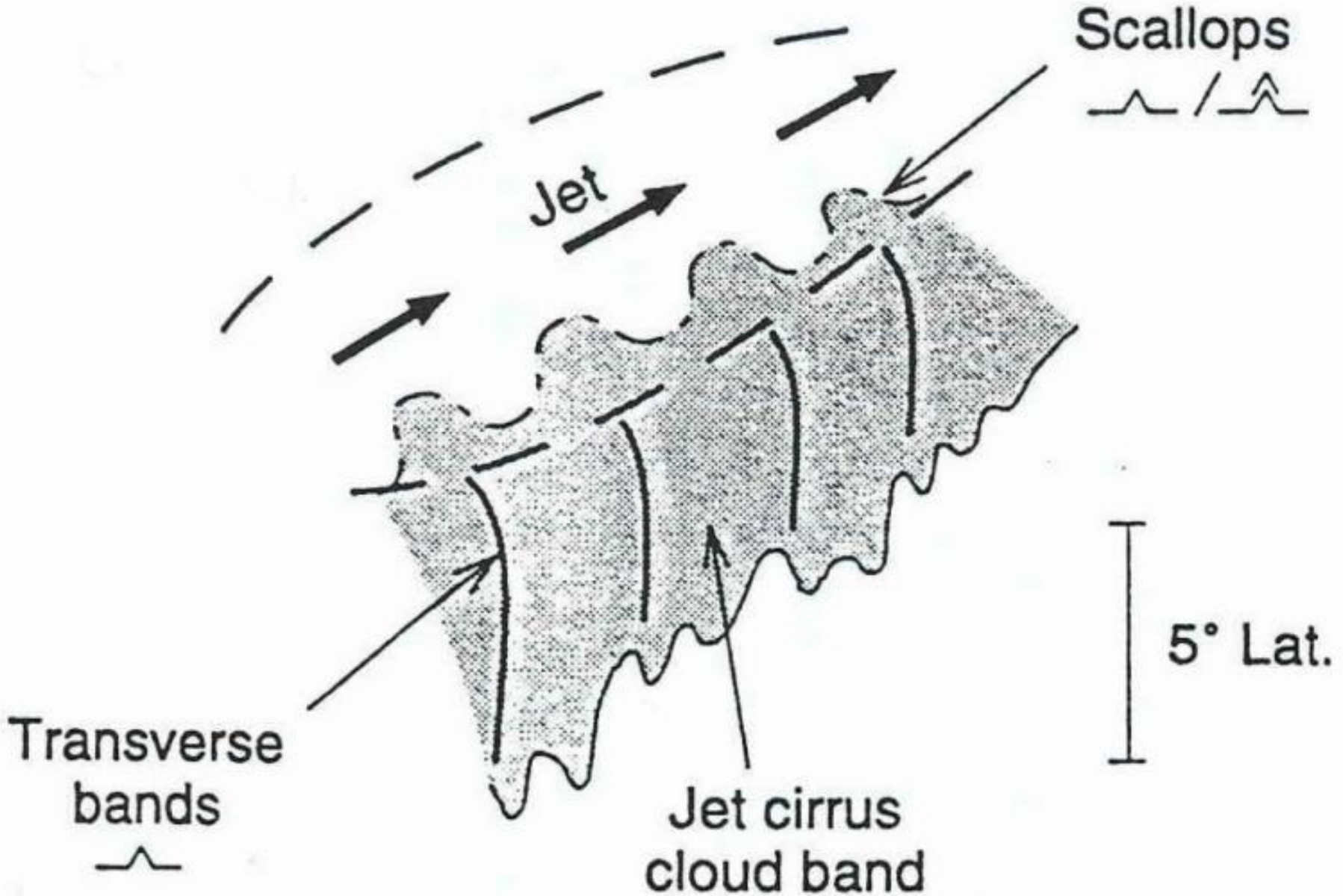


Jets & Turbulence

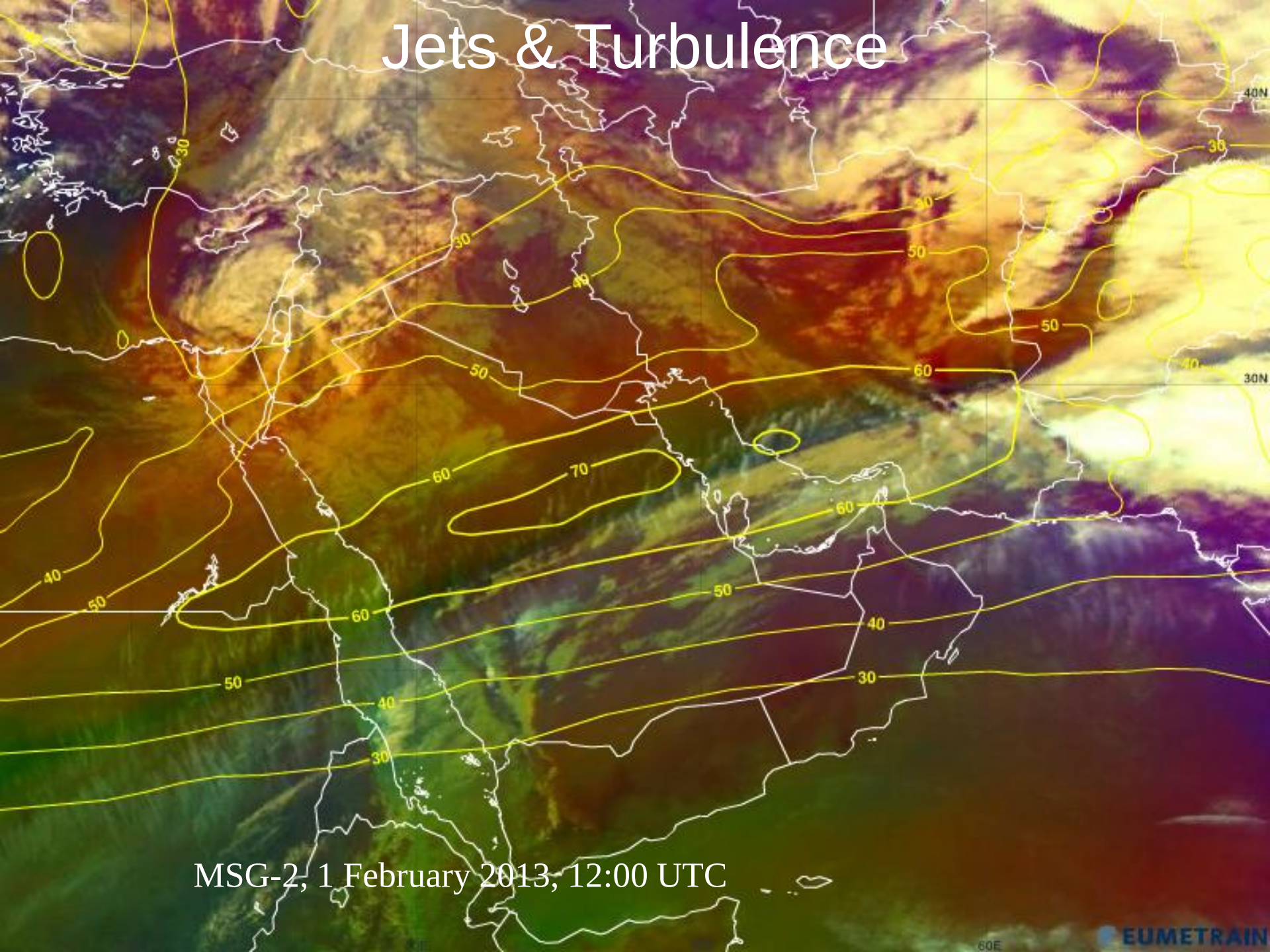


MSG-2, 30 August 2009, 12:00 UTC

Jets & Turbulence

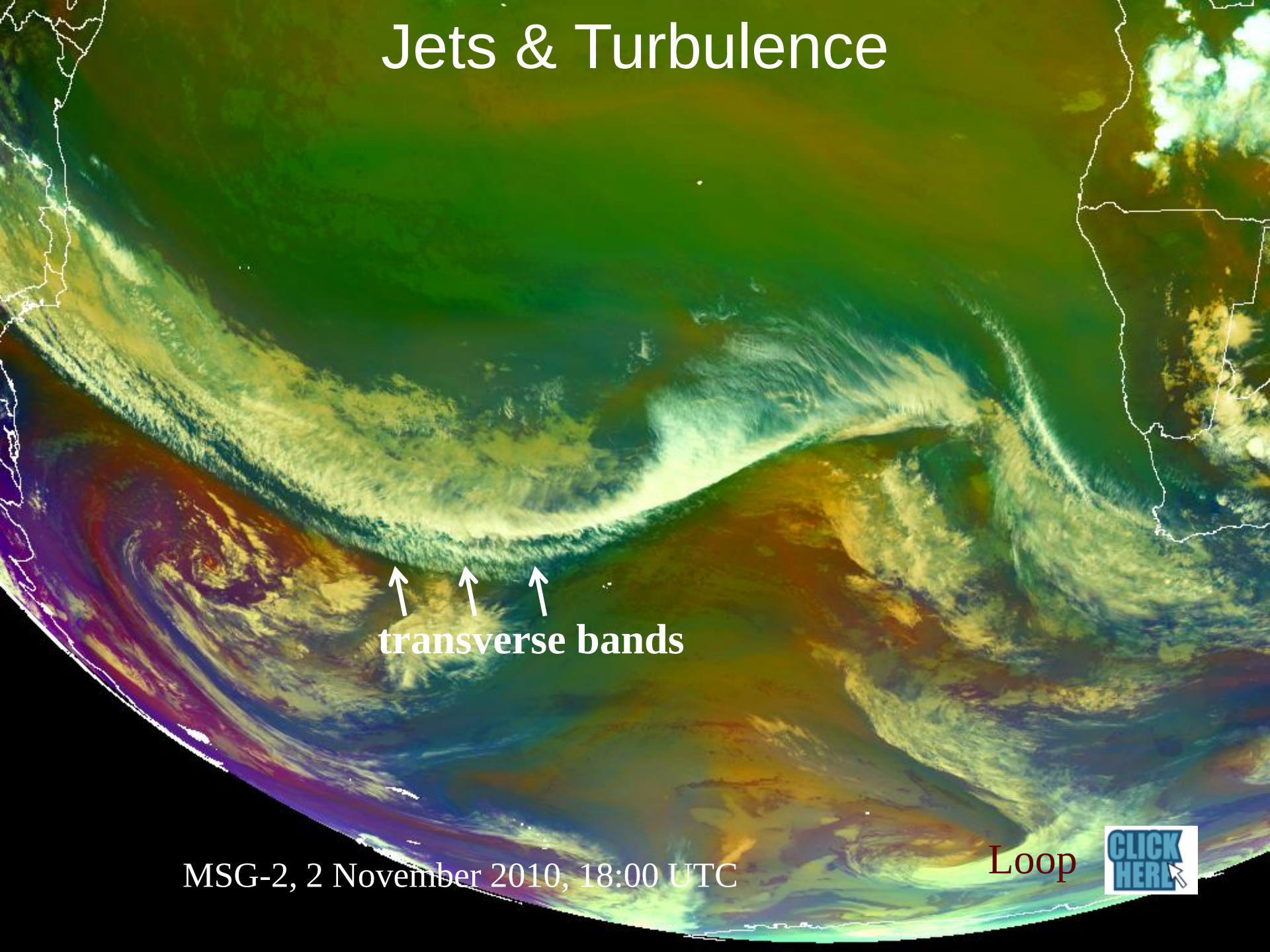


Jets & Turbulence



MSG-2, 1 February 2013, 12:00 UTC

Jets & Turbulence

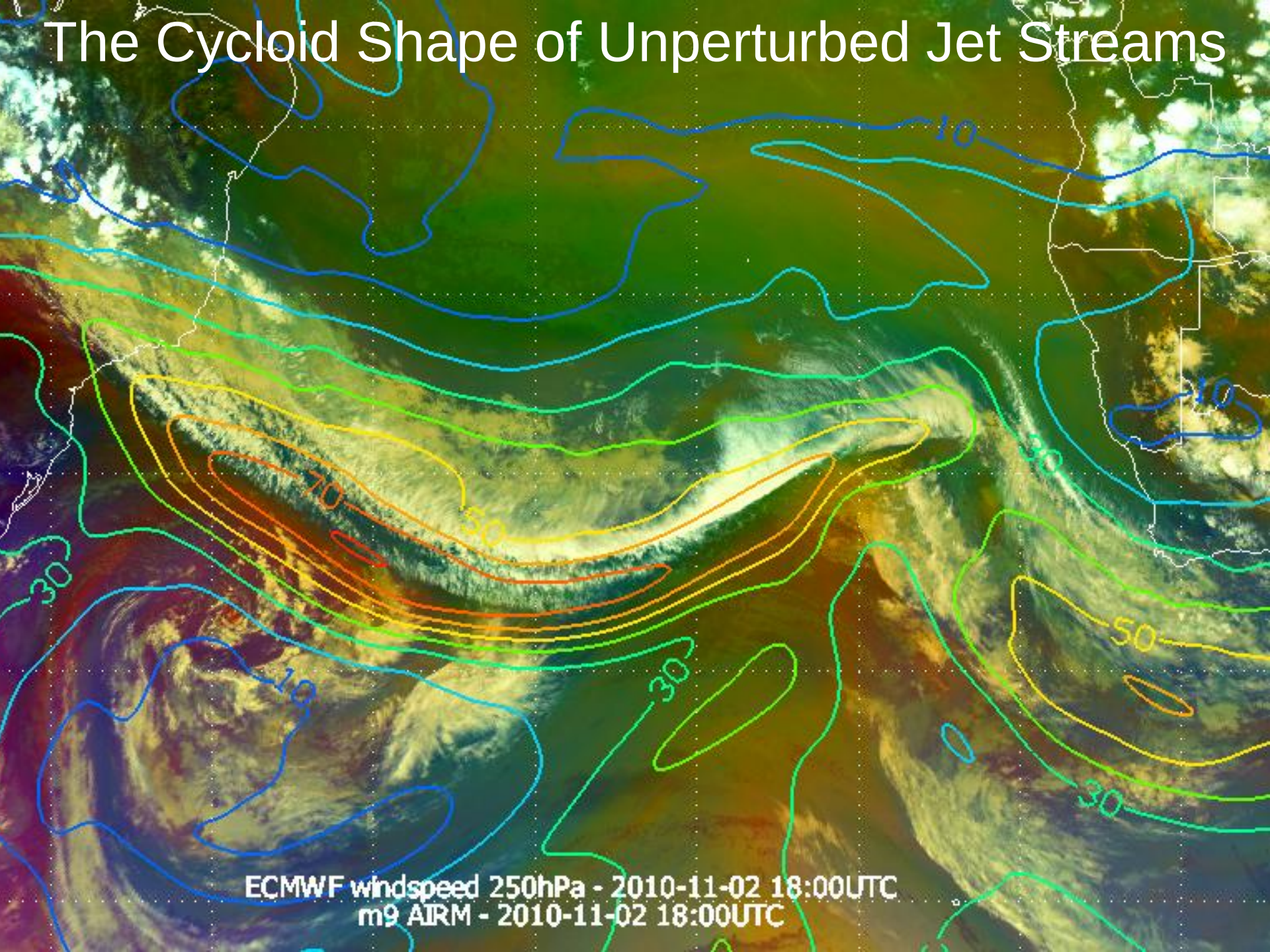


MSG-2, 2 November 2010, 18:00 UTC

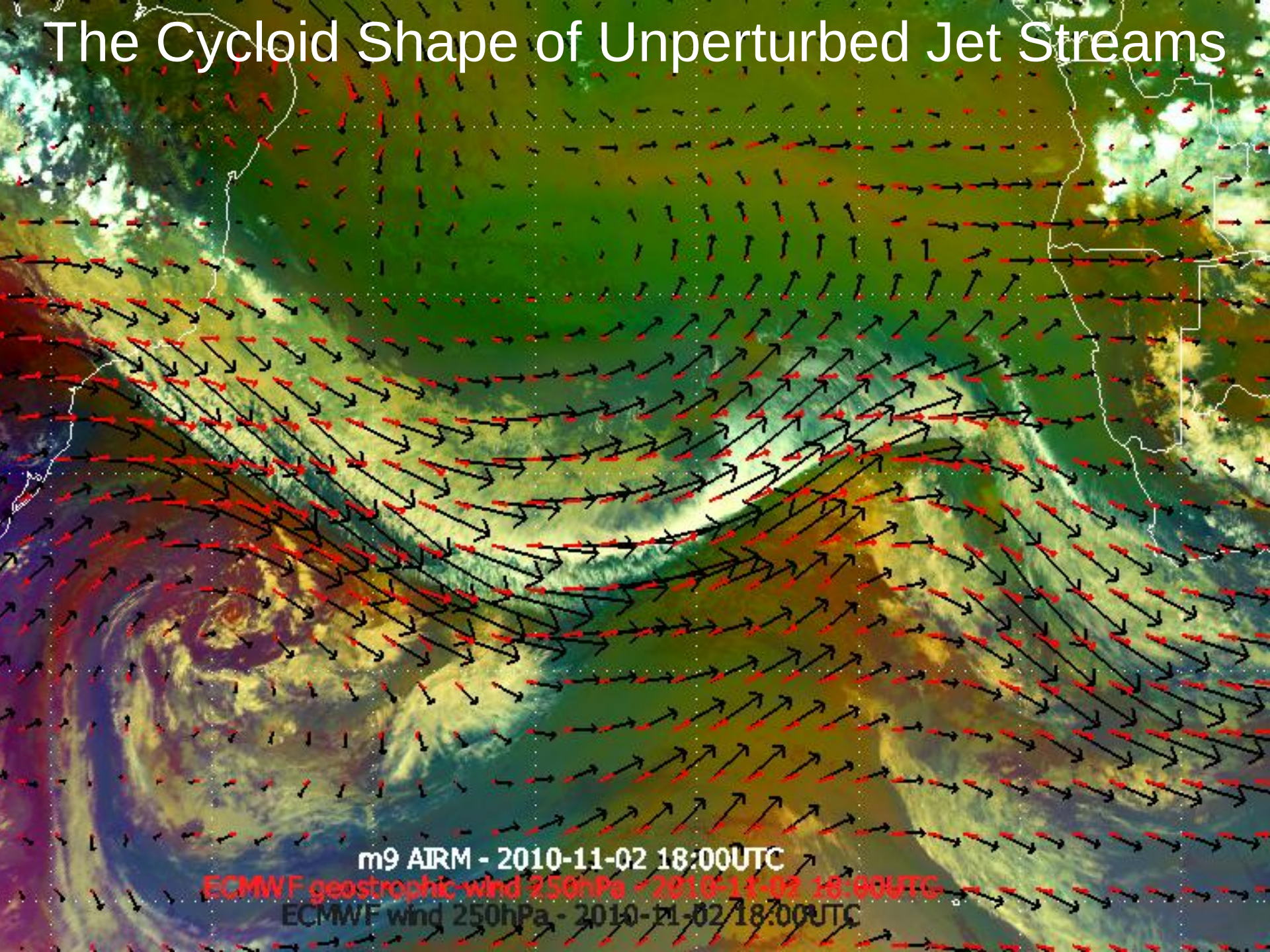
Loop

CLICK HERE

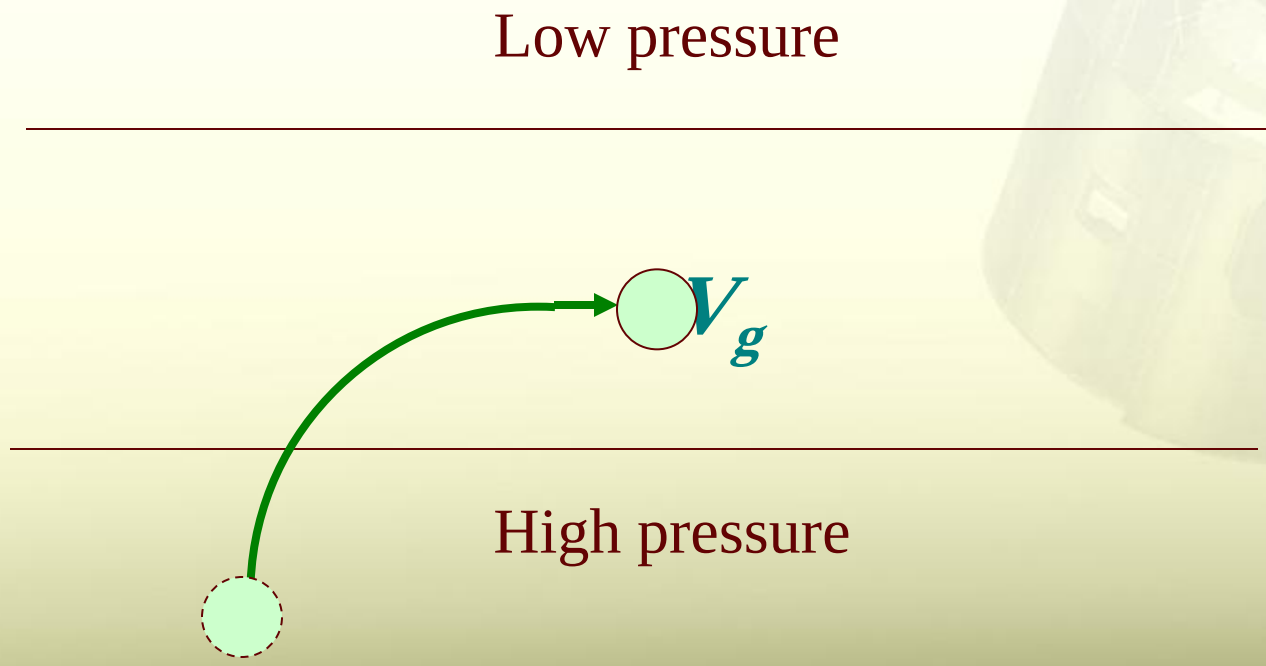
The Cycloid Shape of Unperturbed Jet Streams



The Cycloid Shape of Unperturbed Jet Streams



The school book image of geostrophic adjustment in a constant pressure field

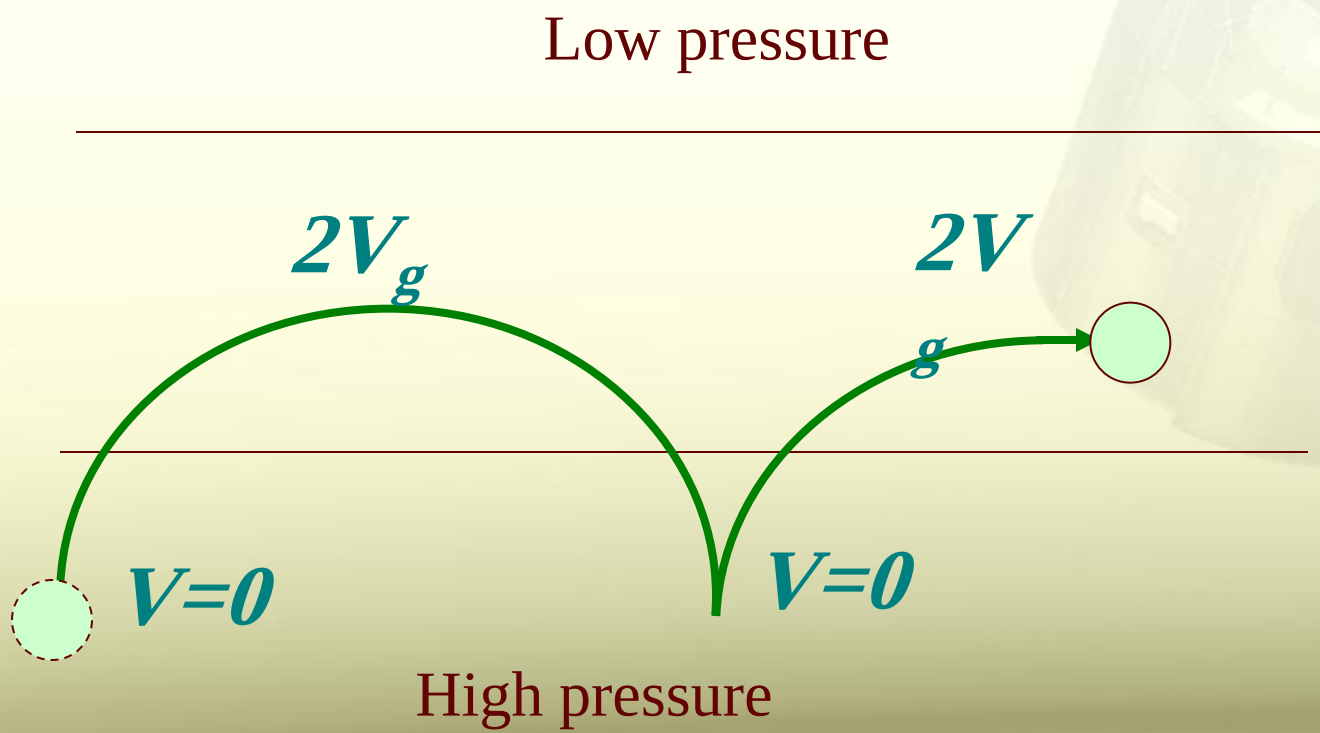


-Not wrong, but misleading!

Source: Anders Persson

This is what happens!

The real image of motion of an air parcel in a constant pressure field



Source: Anders Persson

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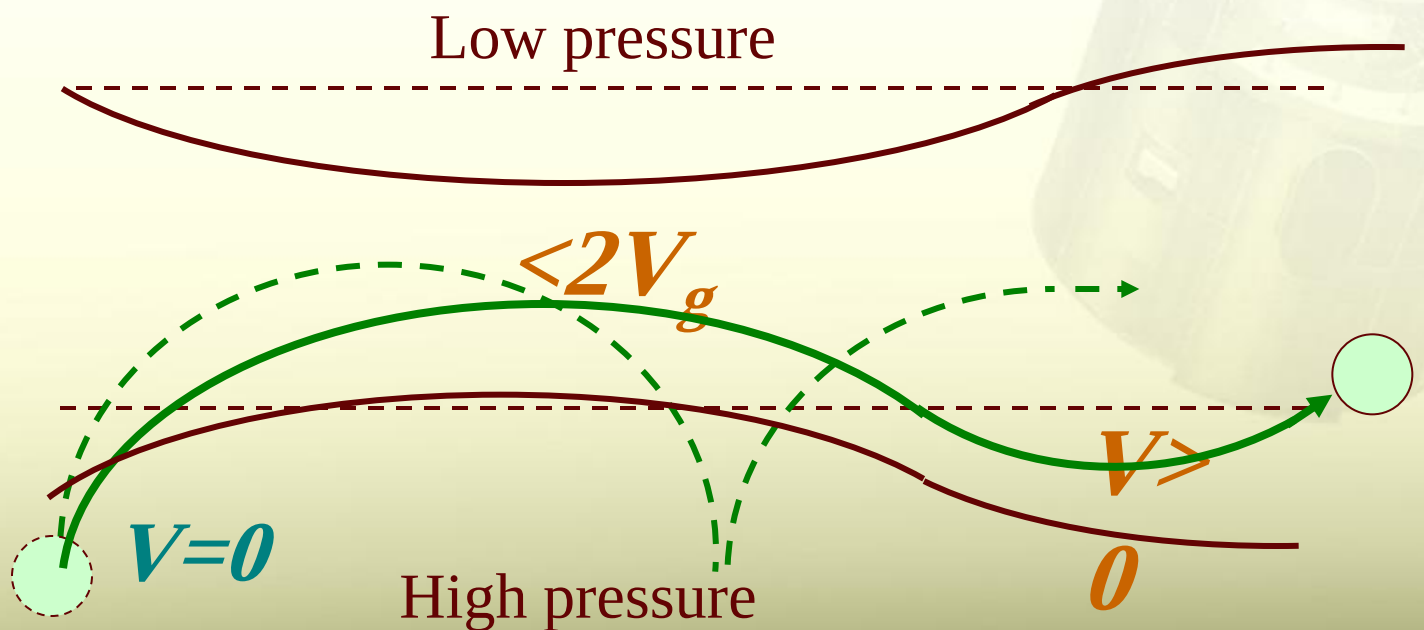
The pressure field and the winds will mutually adjust to each other and stretch the cycloid



Source: Anders Persson

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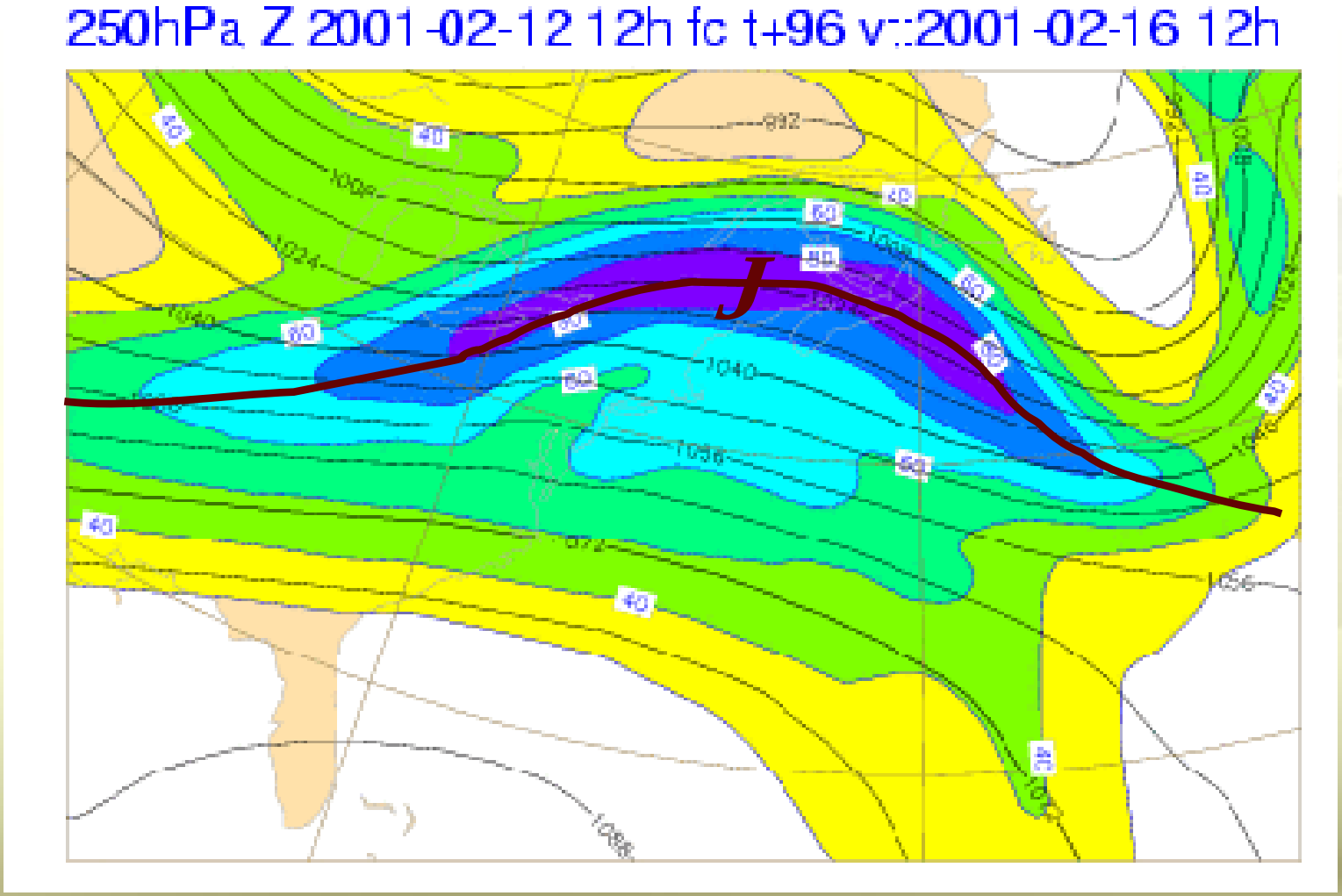
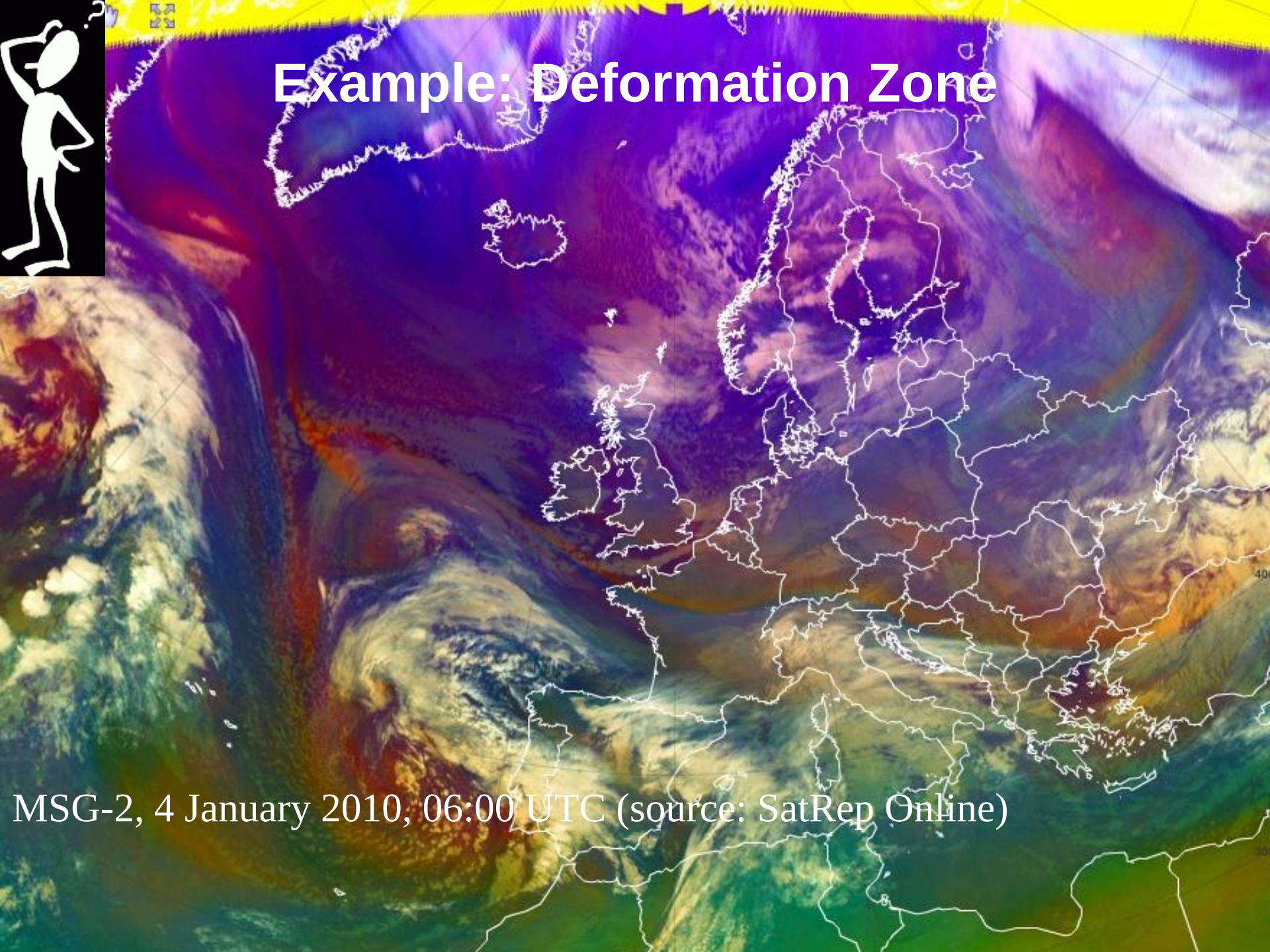
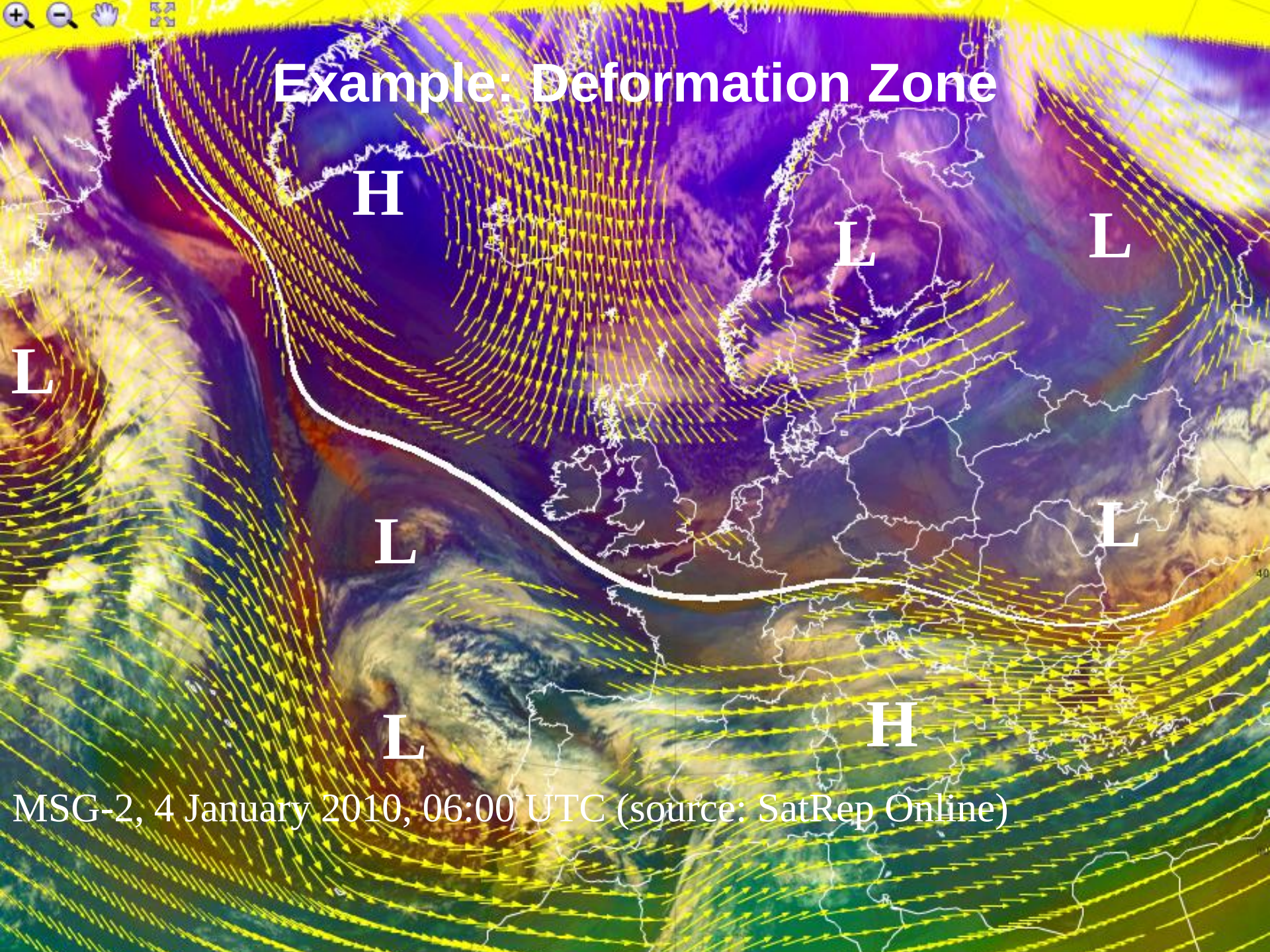
The cycloid shape of unperturbed jet streams



Source: Anders Persson

EUMETSAT

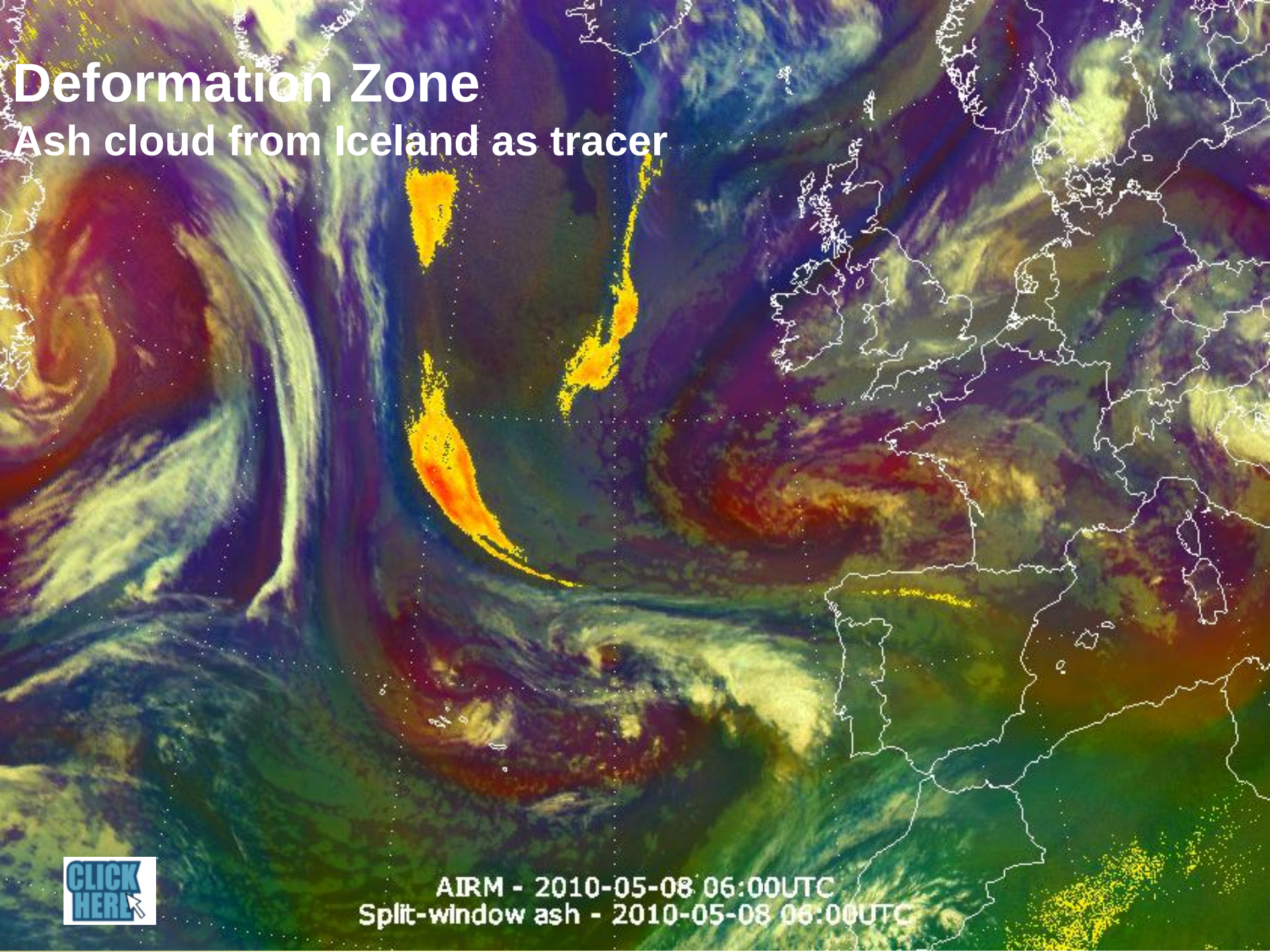

Example: Deformation Zone
MSG-2, 4 January 2010, 06:00 UTC (source: SatRep Online)



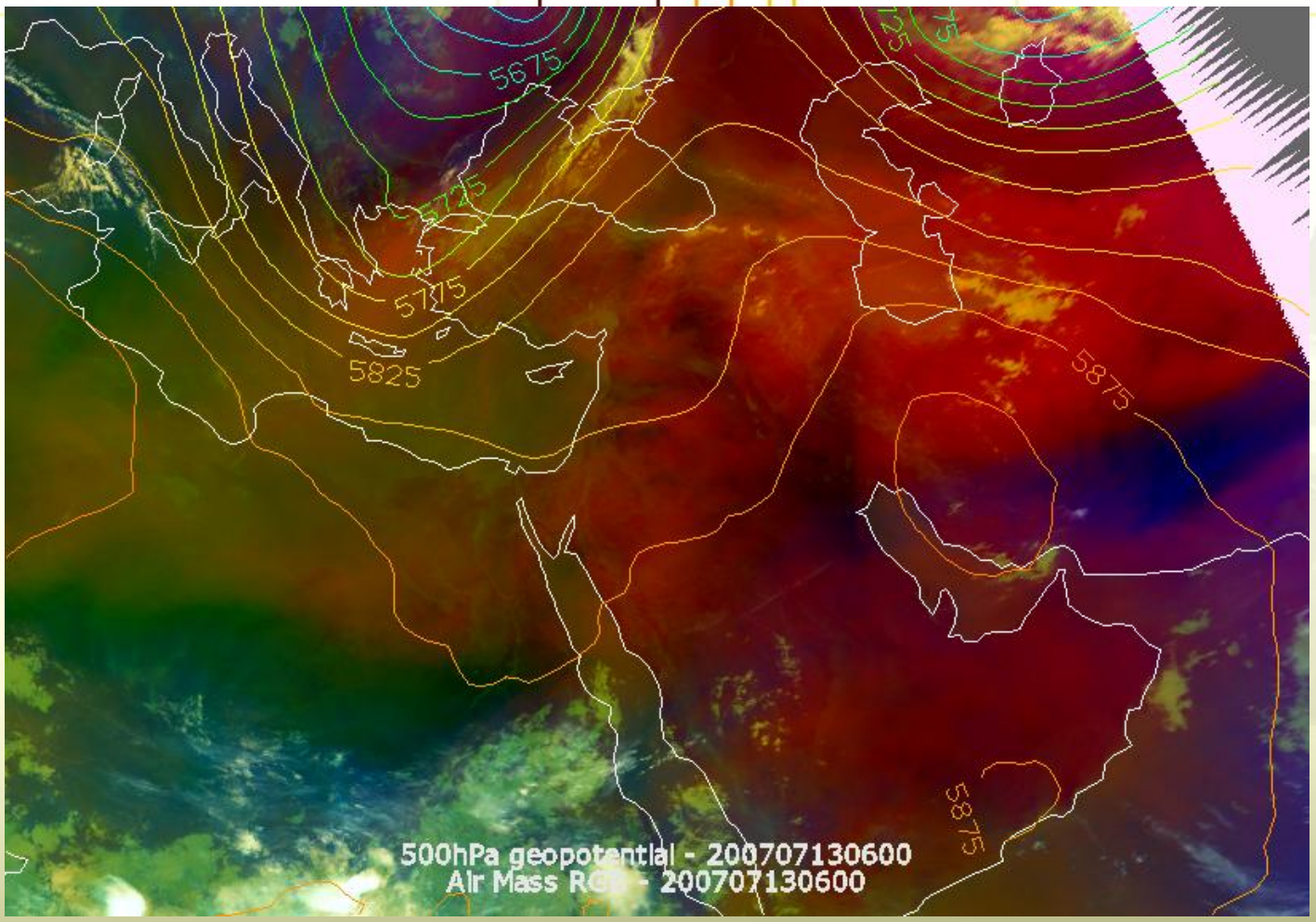
MSG-2, 4 January 2010, 06:00 UTC (source: SatRep Online)

Deformation Zone

Ash cloud from Iceland as tracer

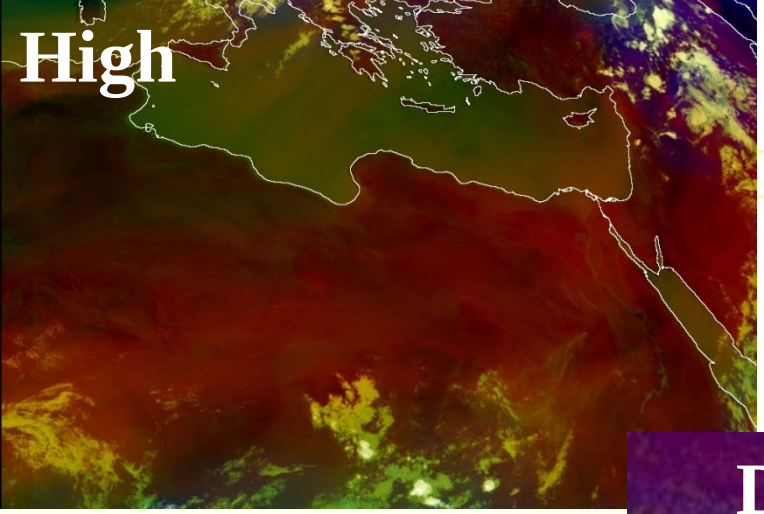


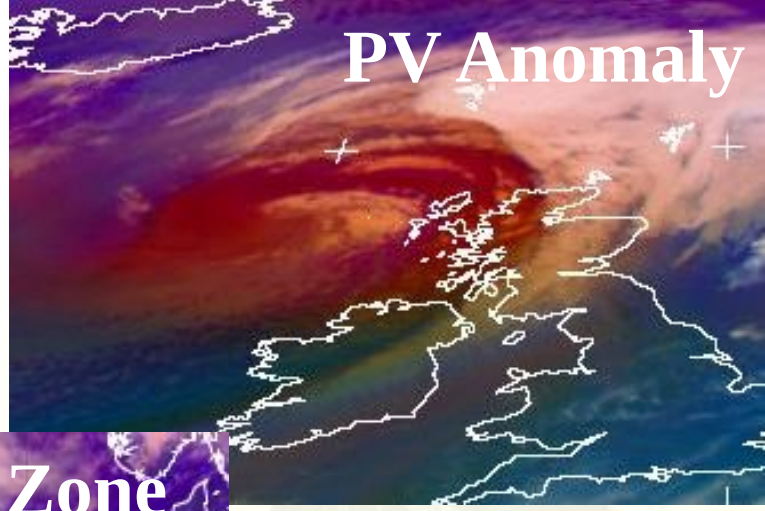
Subtropical High Pressure Belt NH



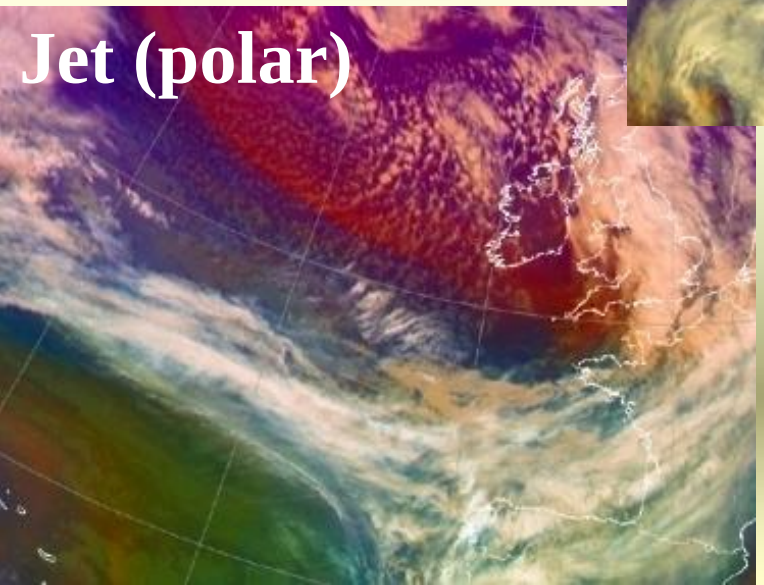
MSG-2, 13 July 2007, 06:00 UTC

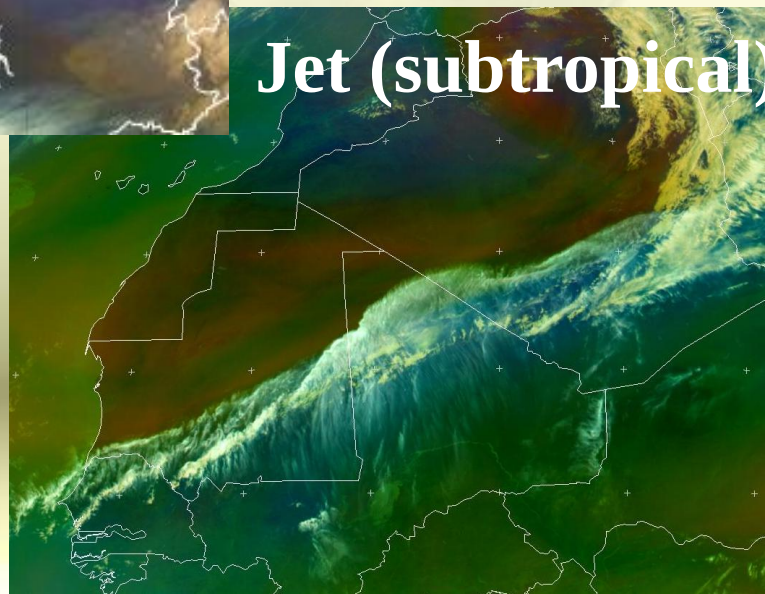
EUMETSAT


High


PV Anomaly

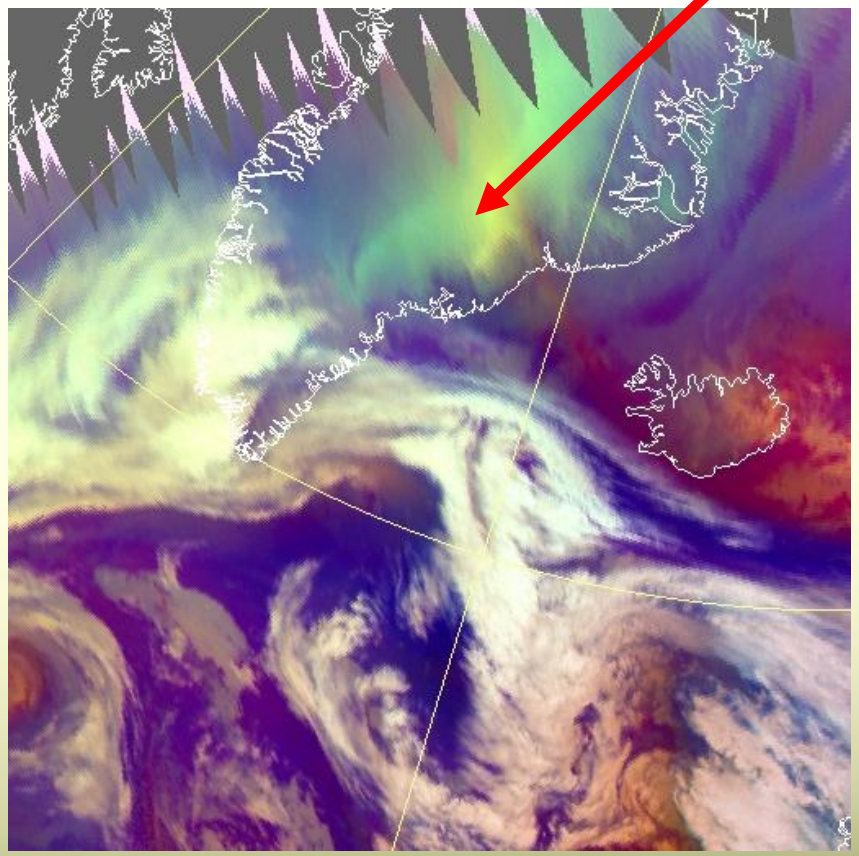

Deformation Zone


Jet (polar)

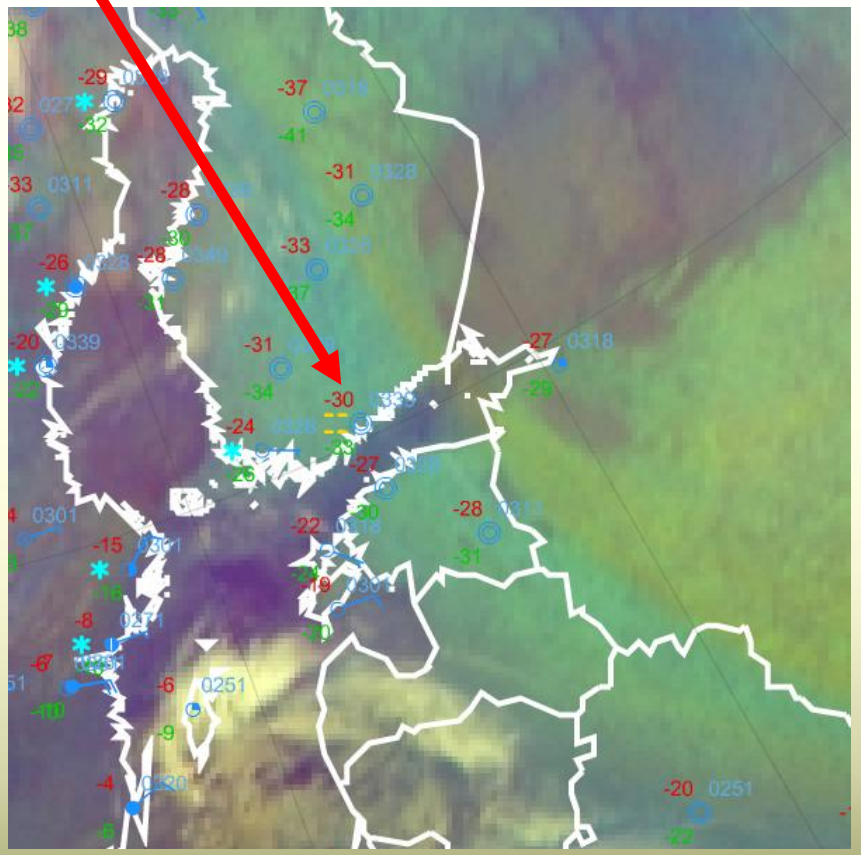

Jet (subtropical)

Unusual colours because of:

very low surf. temperatures



28 February 2007, 04:00 UTC

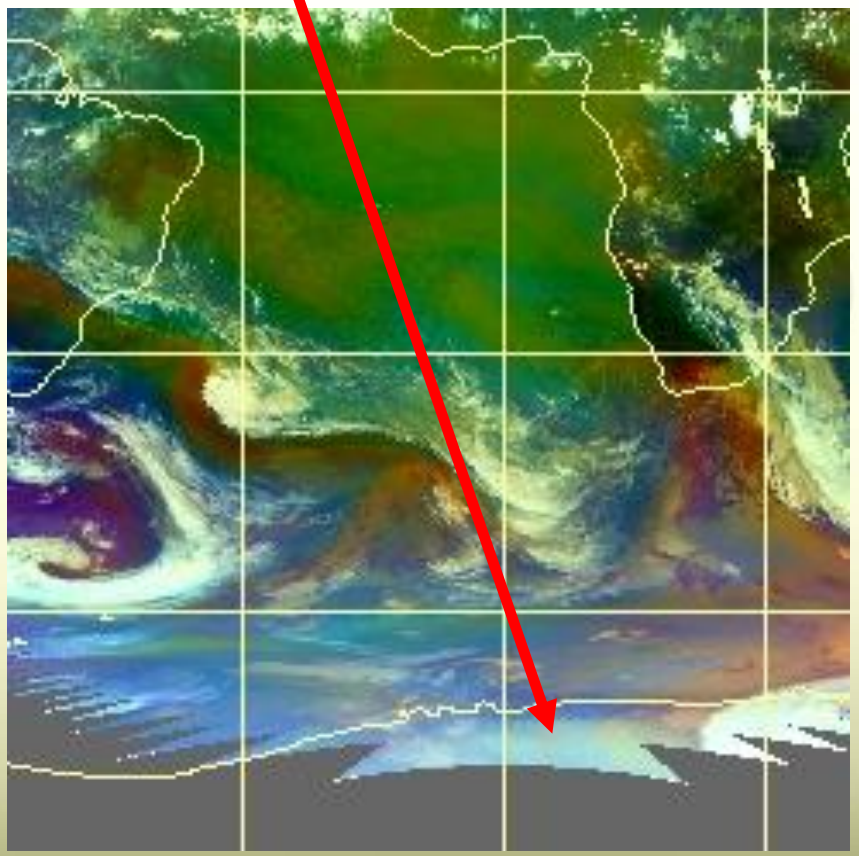


18 February 2010, 06:00 UTC

EUMETSAT

Unusual colours because of:

very low Ozone content

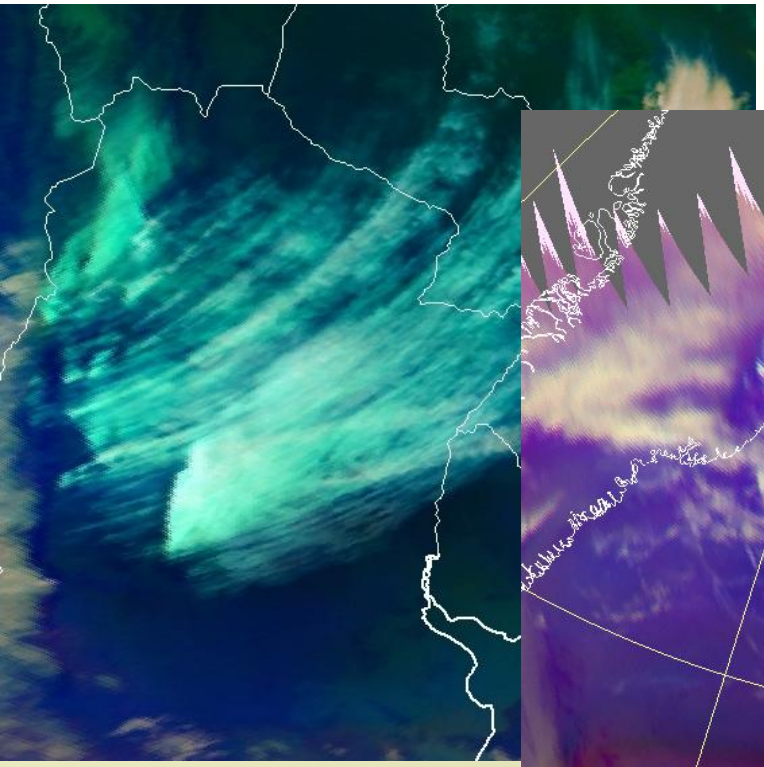


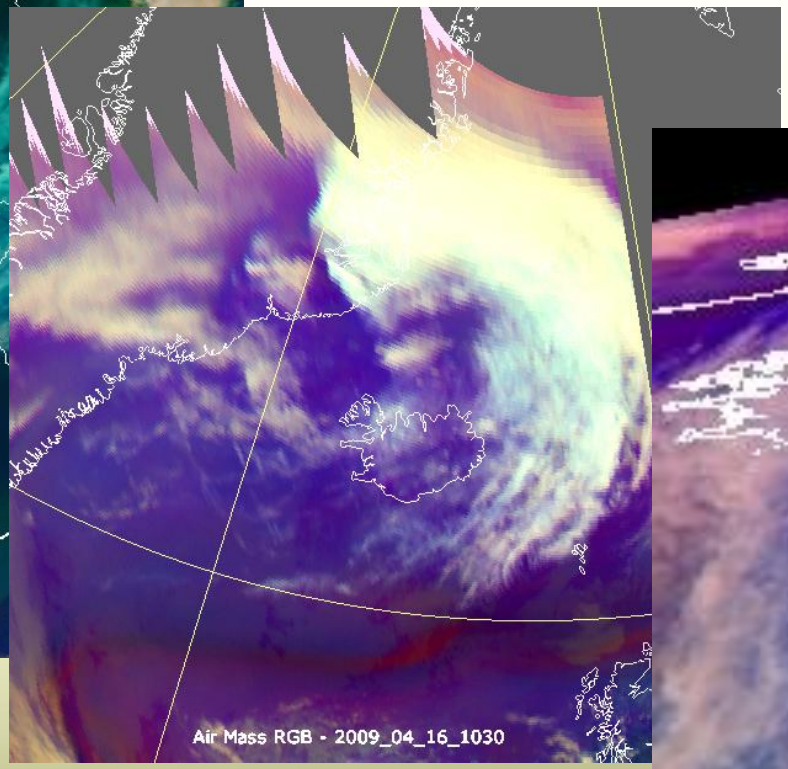
9 October 2006, 12:00 UTC

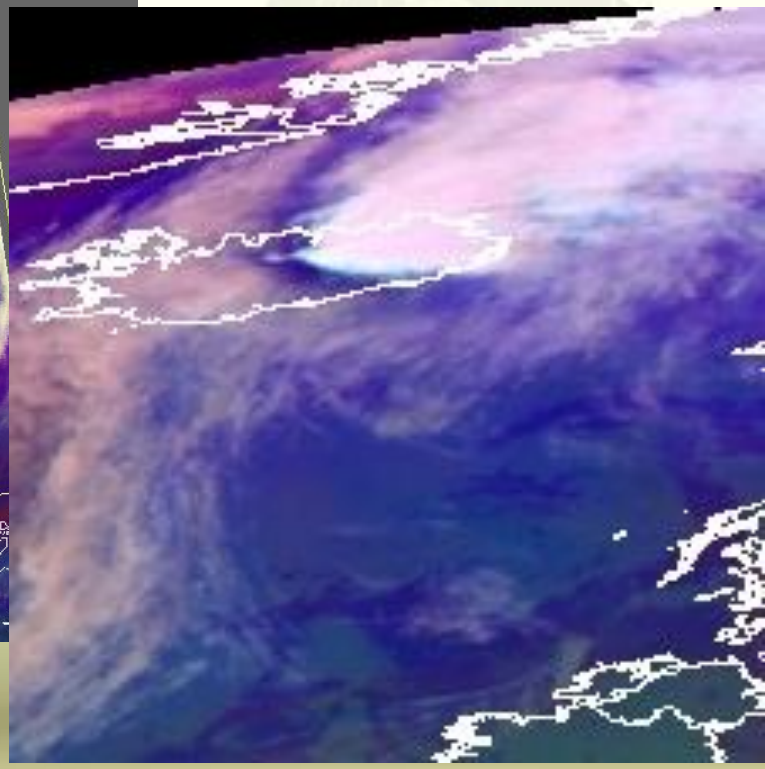
EUMETSAT

Unusual colours because of:

very high wave clouds with small ice particles

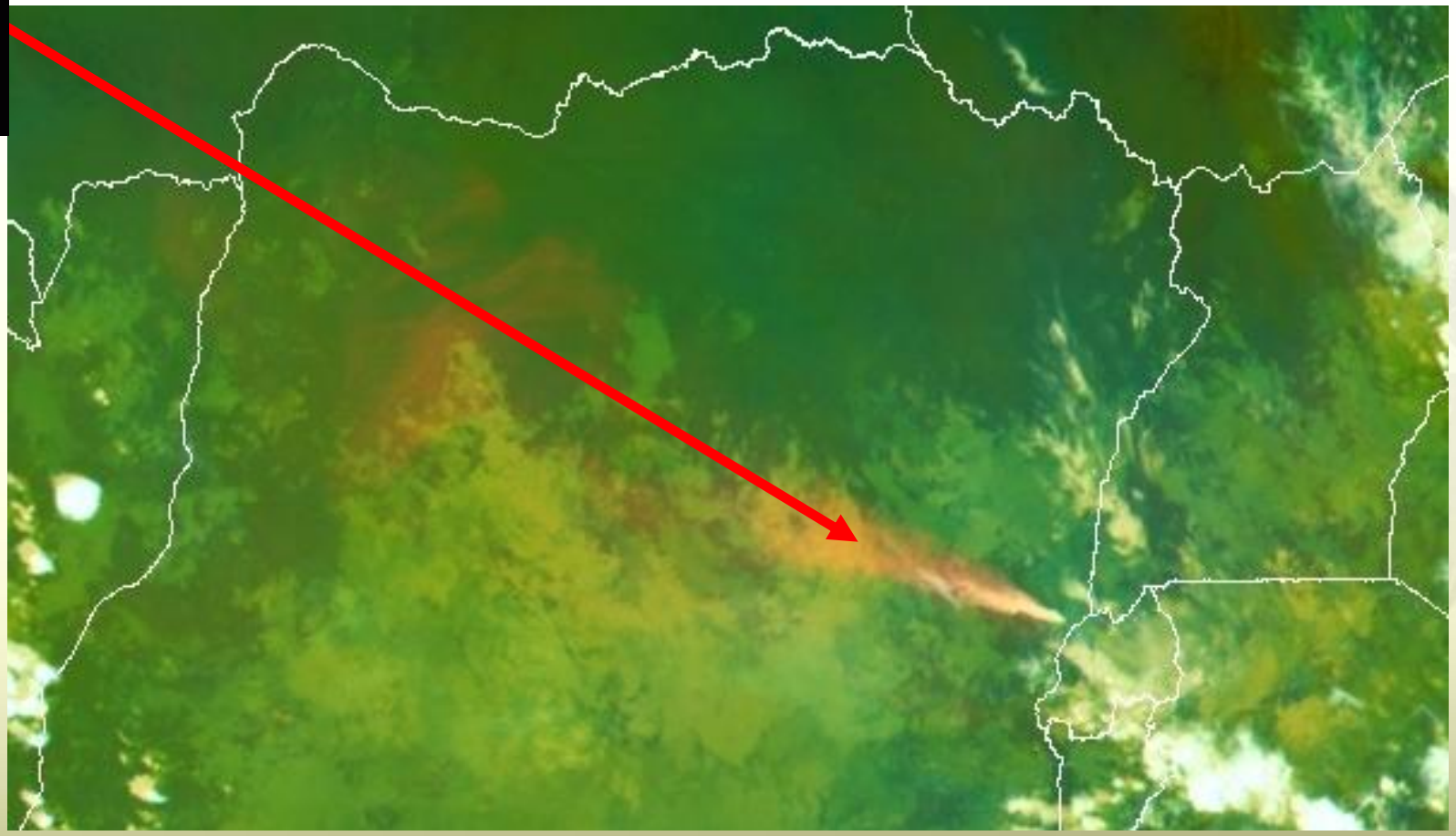






EUMETSAT

Unusual colours because of ?



MSG-1, 29 November 2006, 11:00 UTC

EUMETSAT