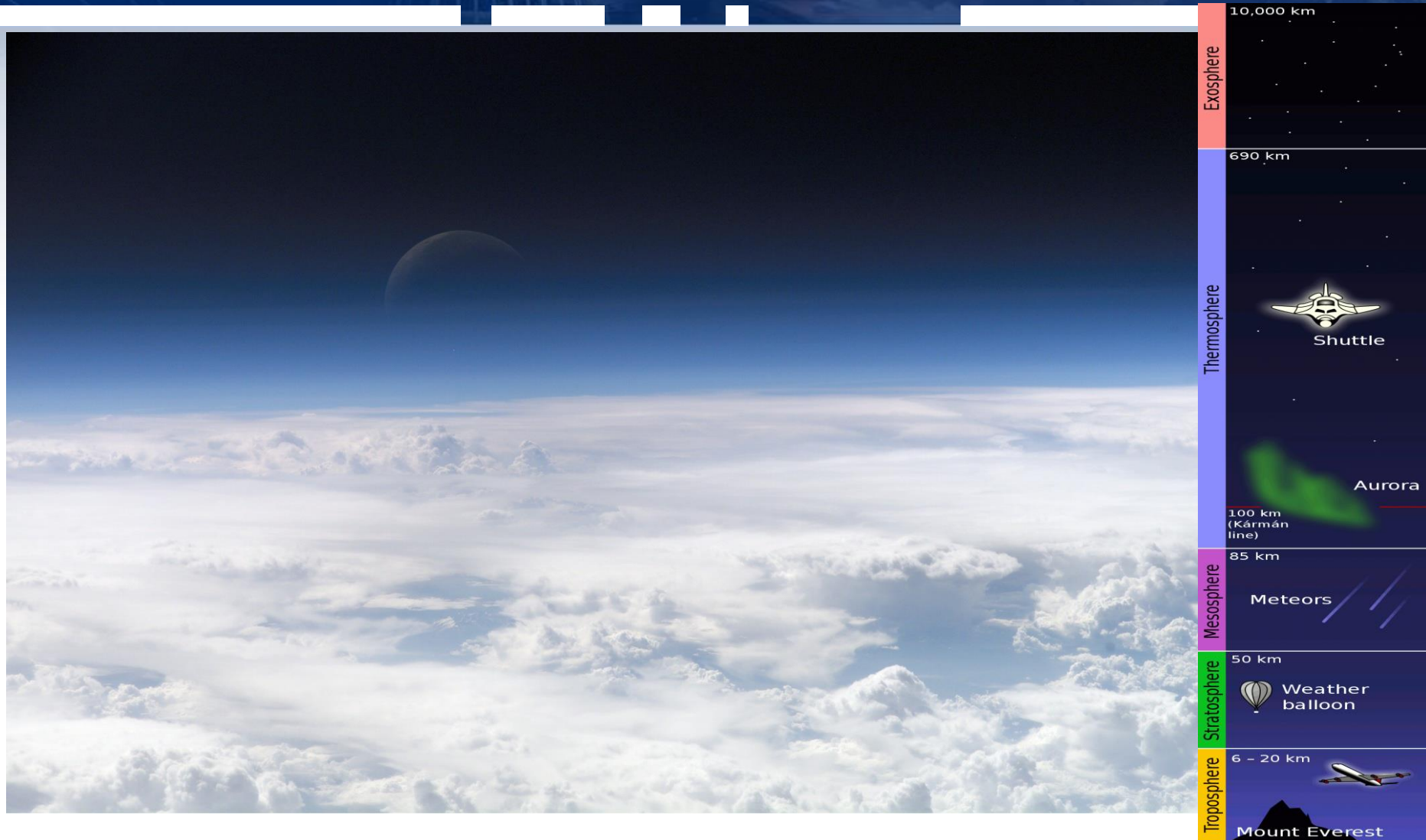
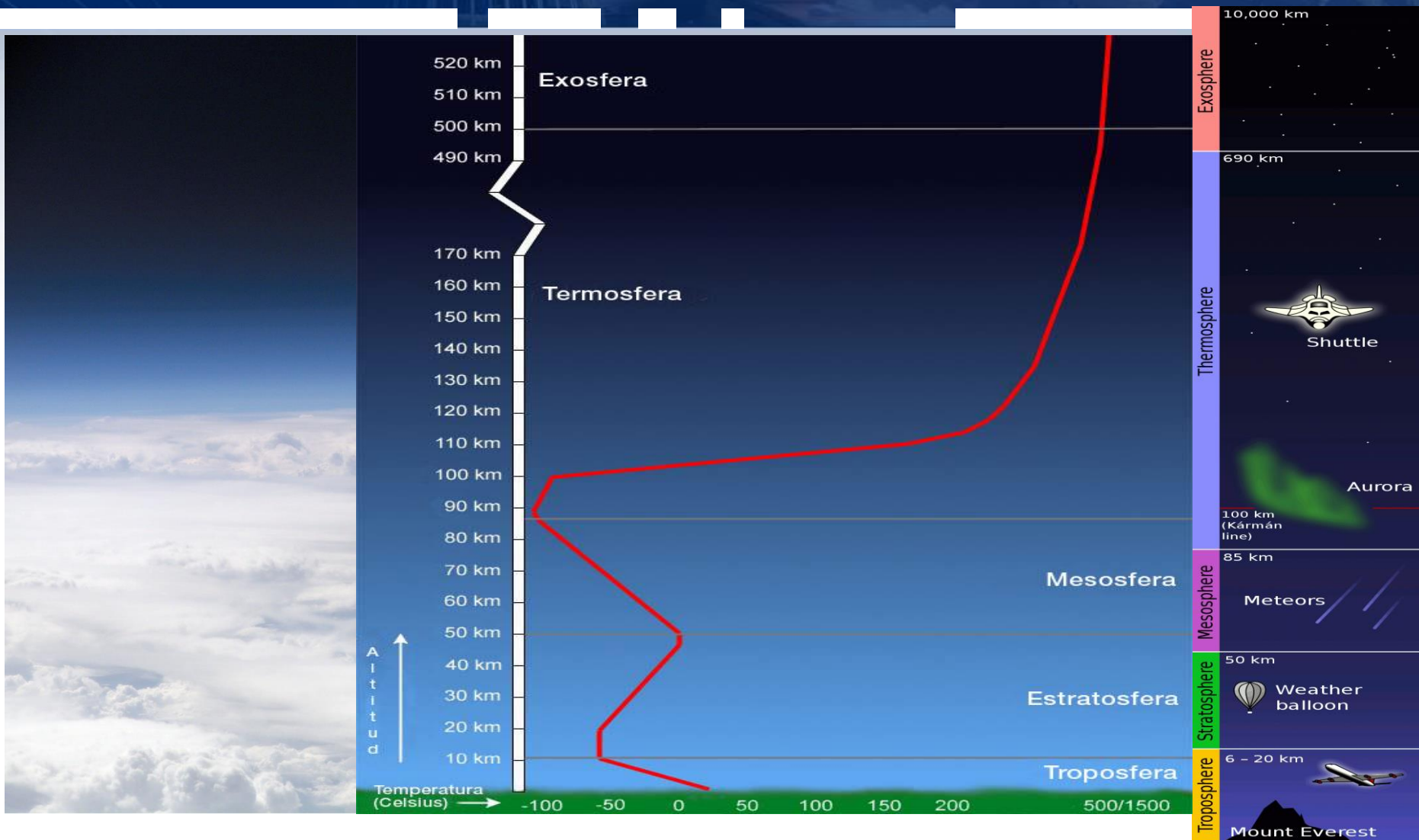


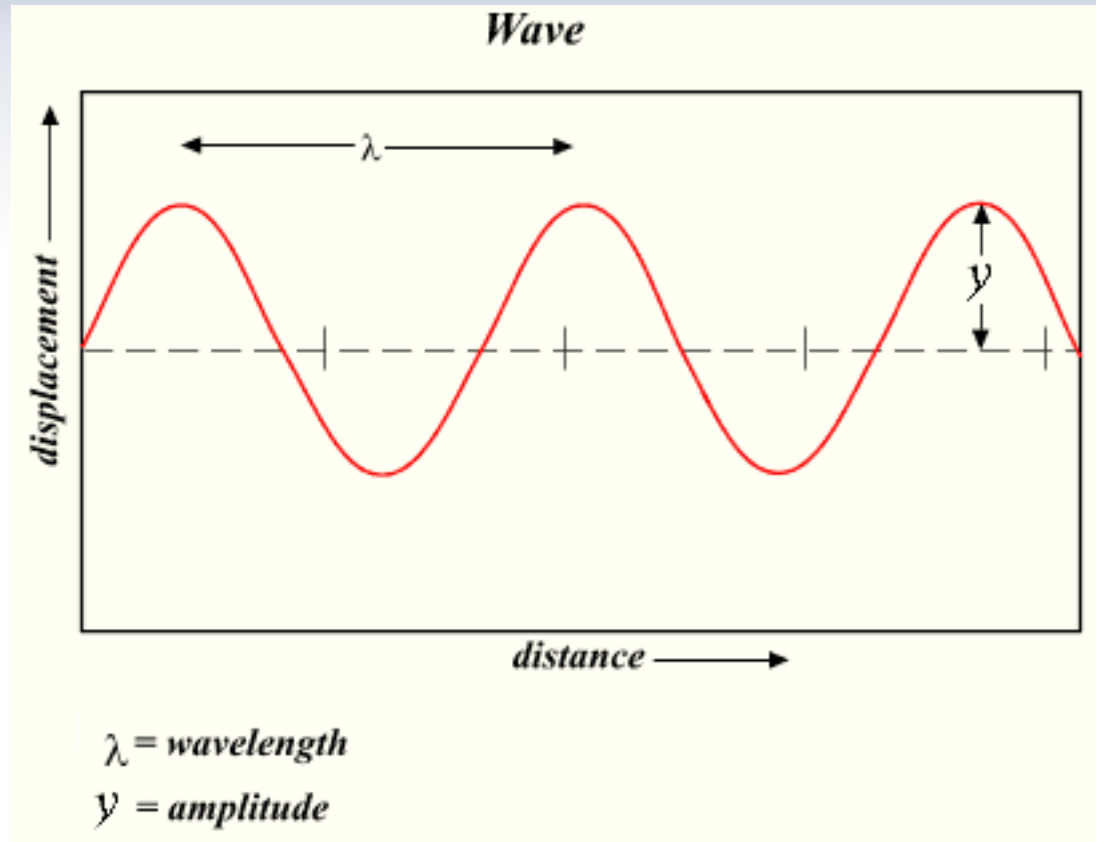
Basic Physical Principles: The Atmosphere



Basic Physical Principles: The Atmosphere

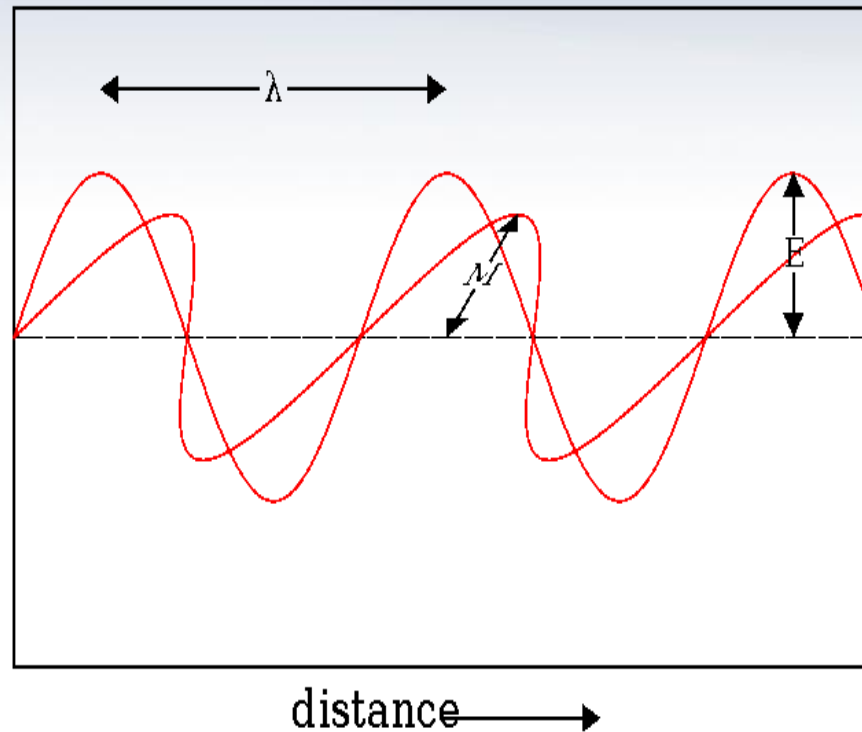


Basic Physical Principles: Light: A Wave



Basic Physical Principles: Light: An Electromagnetic Wave

Light wave

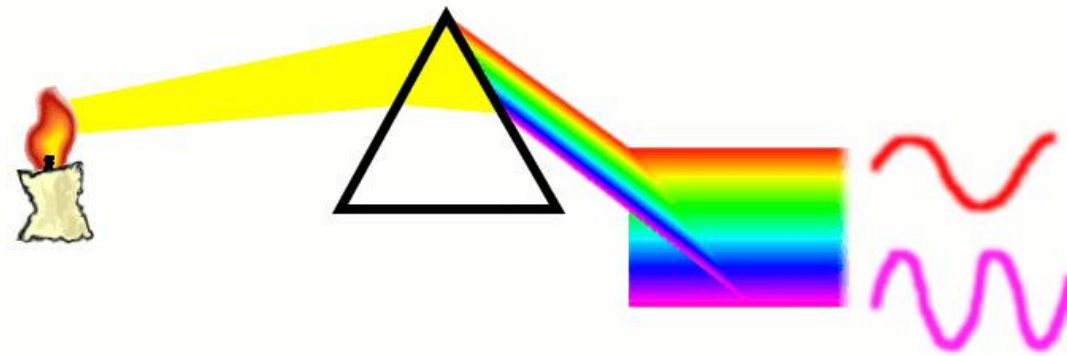


λ = wave length

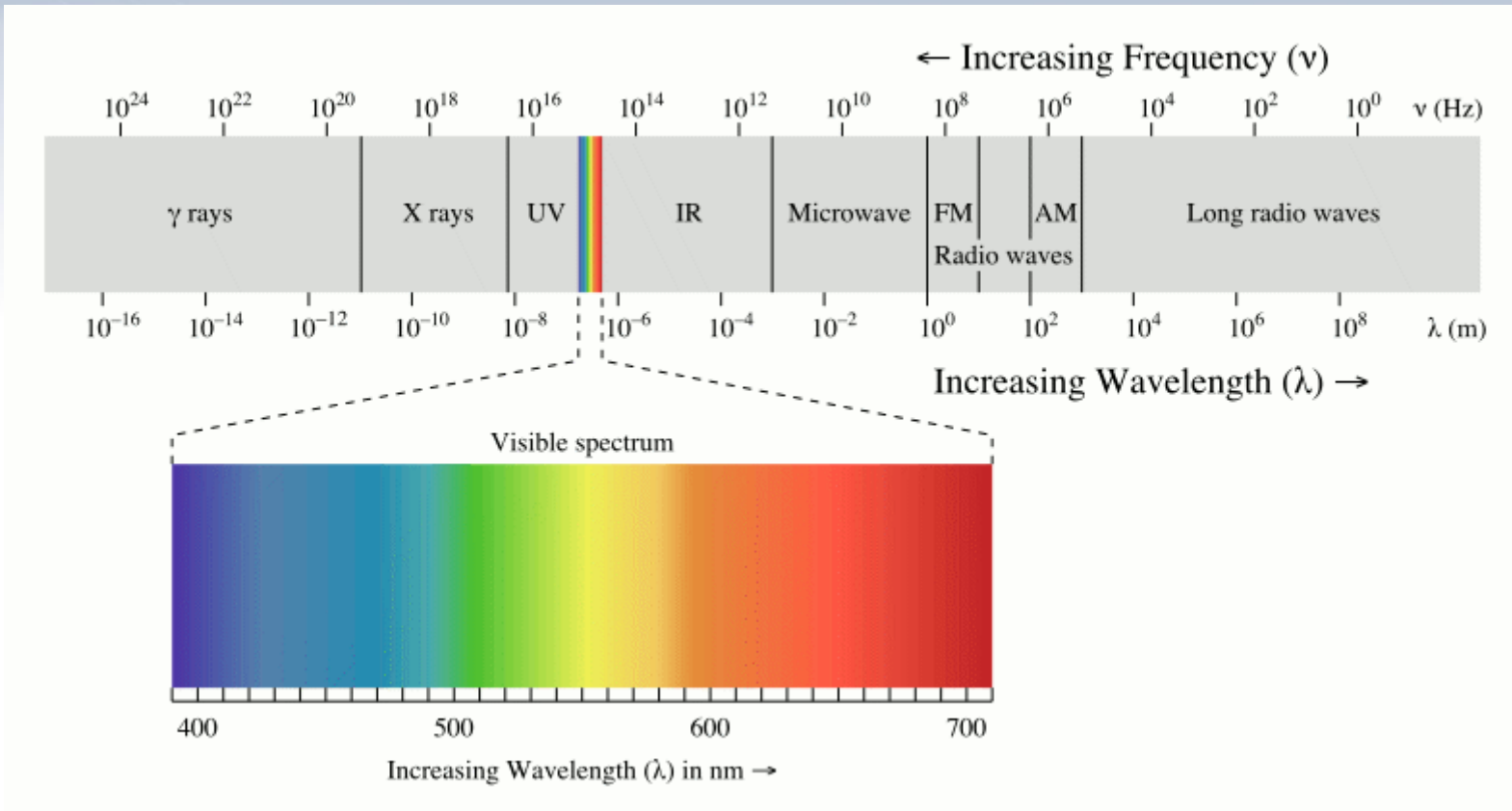
E = amplitude of
electric field

M = amplitude of
magnetic fie

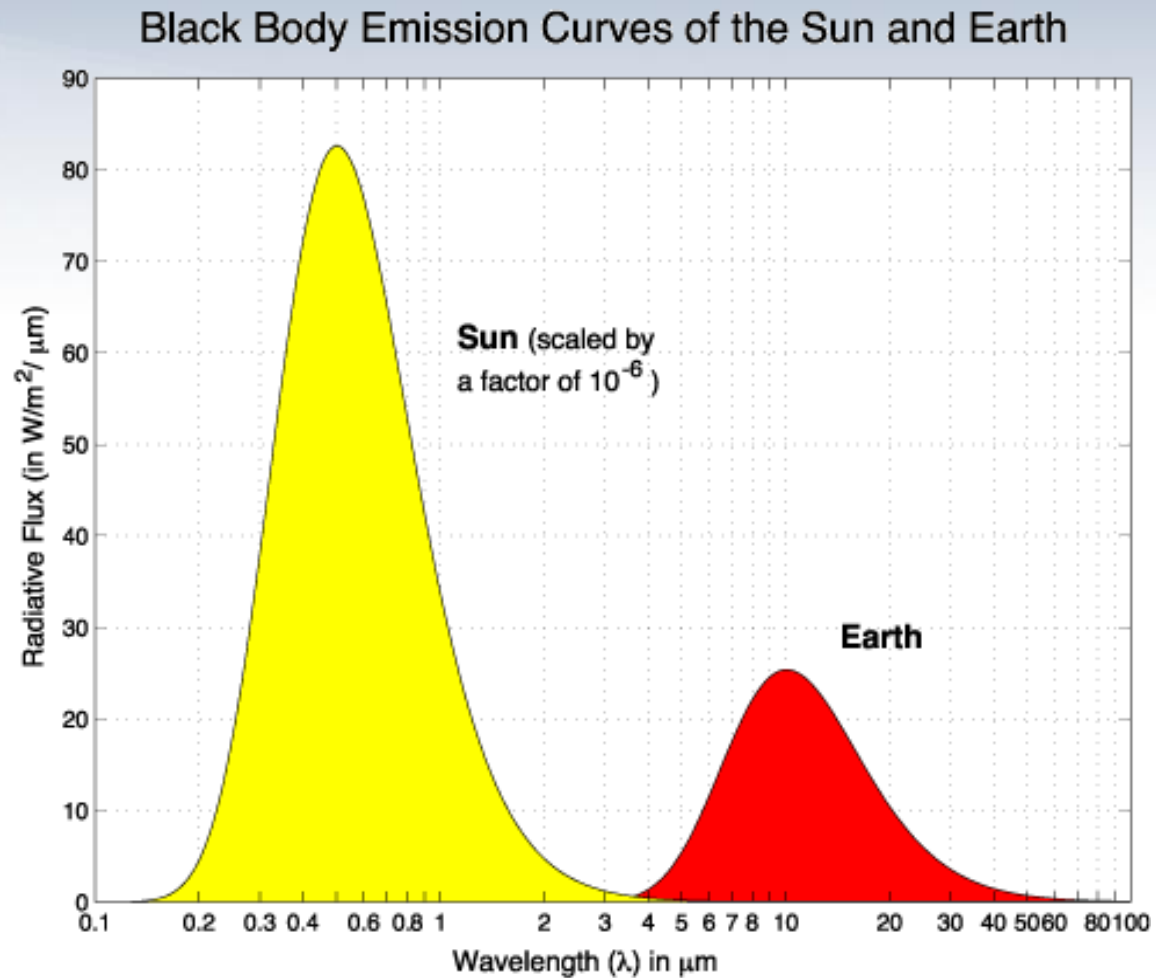
Basic Physical Principles: Light: Its Decomposition



Basic Physical Principles: Light: Spectrum



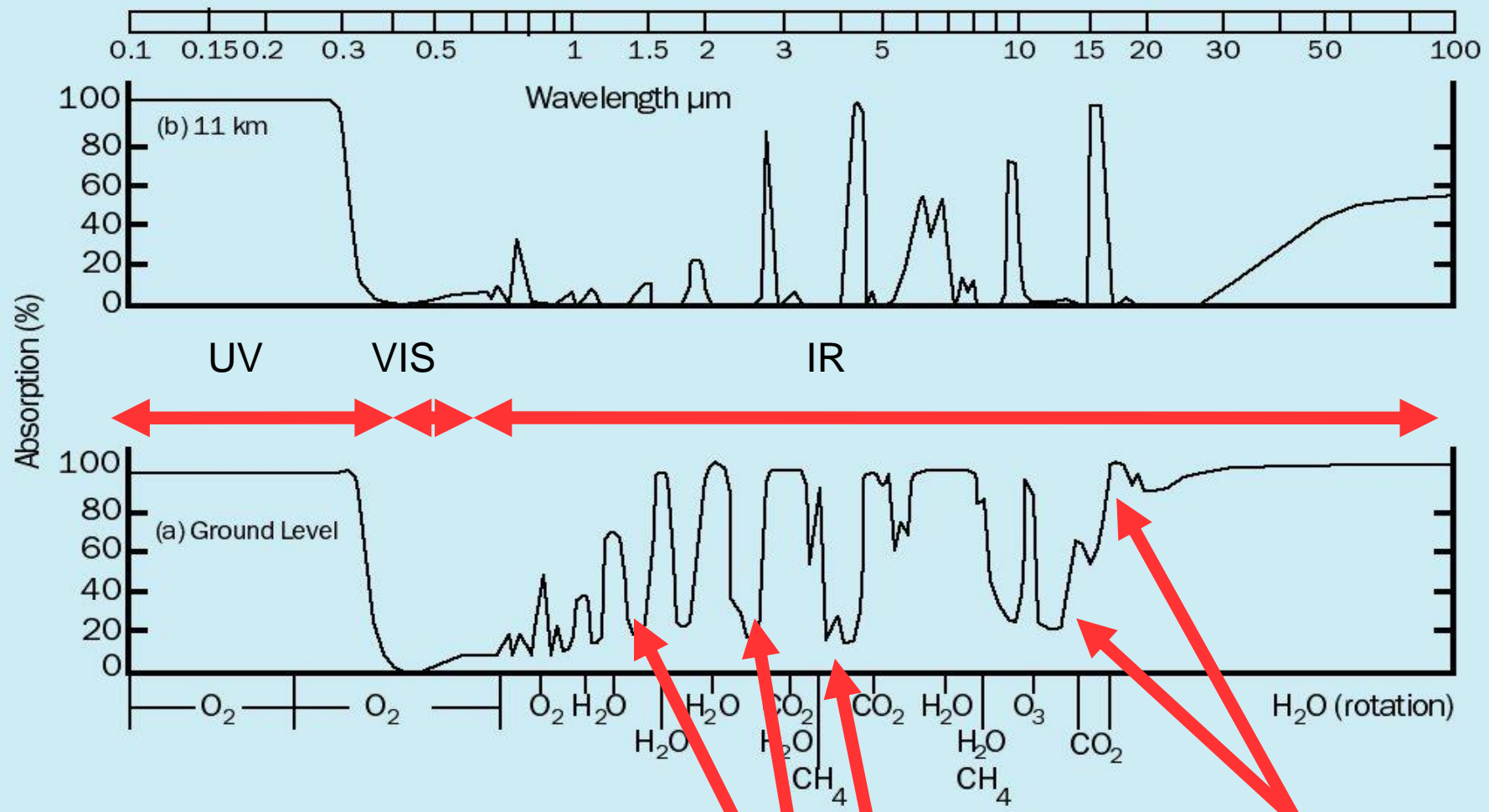
Basic Physical Principles: Light: Sun and Earth as Black Bodies



Basic Physical Principles: Light: Emission and Absorption



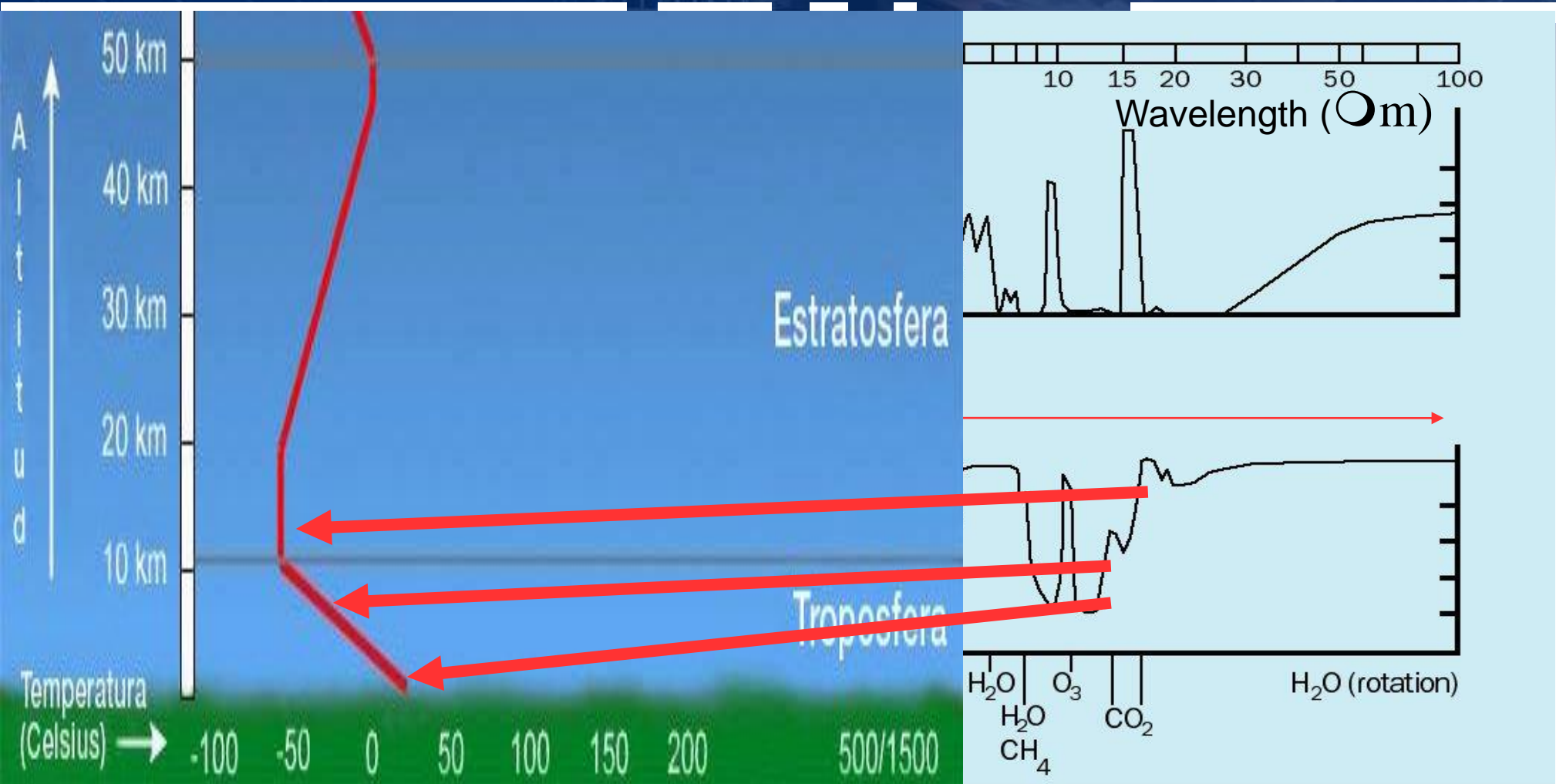
Basic Atmospheric Principles: Light: Atmospheric Absorption



**Atmospheric
Windows**

Absorption bands

Basic Atmospheric Principles: Light: Atmospheric Absorption



Basic Physical Principles: Light: Summary

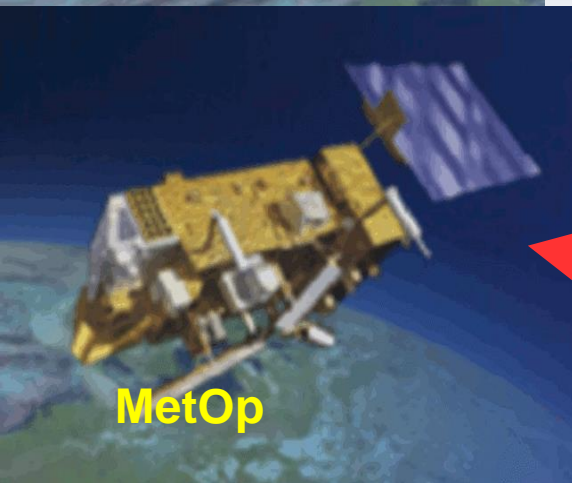
- Different Absorption depending on wavelength \Leftrightarrow Height (windows and absorption bands)
- Sun and Earth emission (border at 4 micra)



IASI on Metop: Polar Low Earth Orbit (LEO)



Meteosat



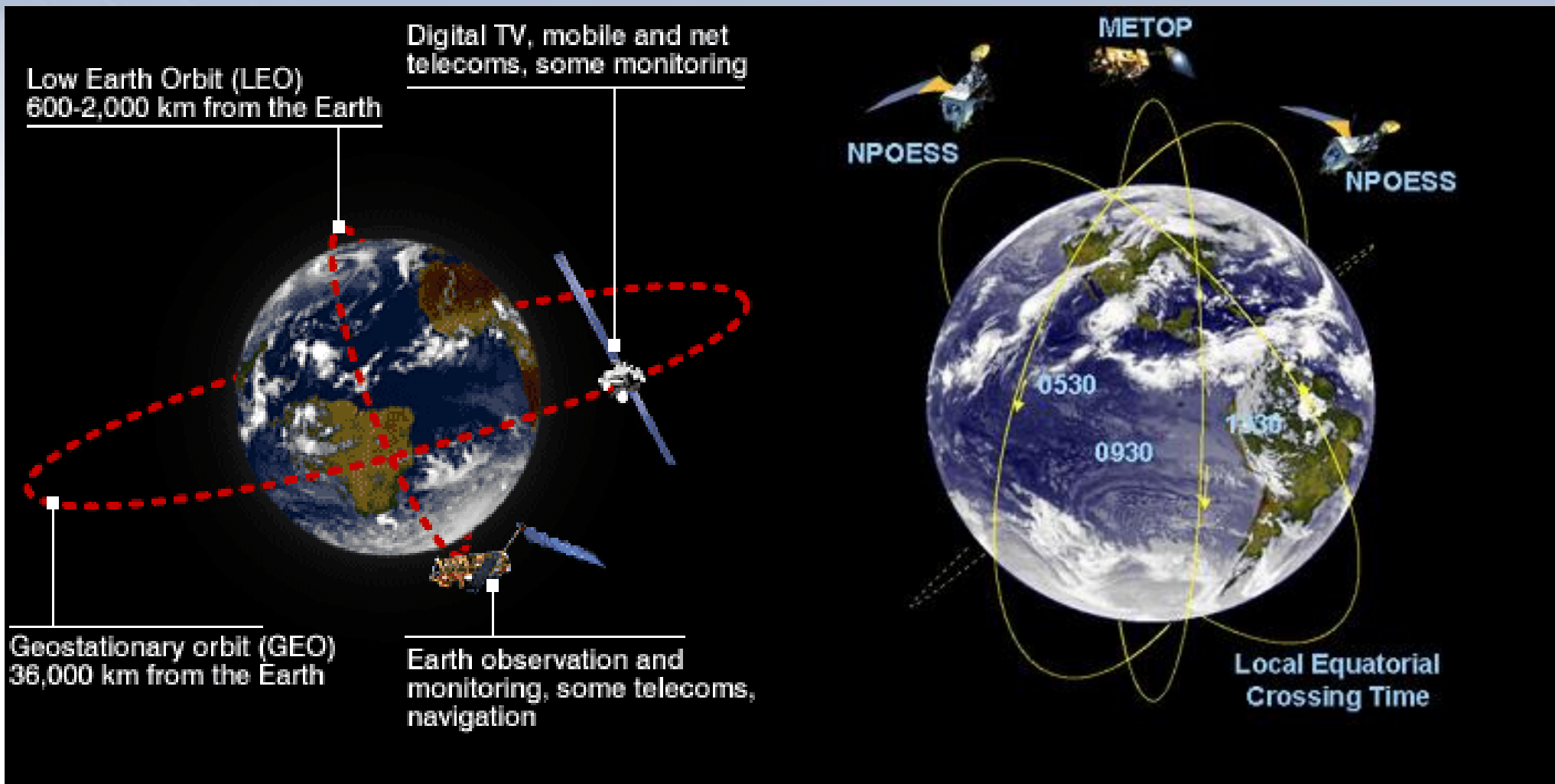
MetOp



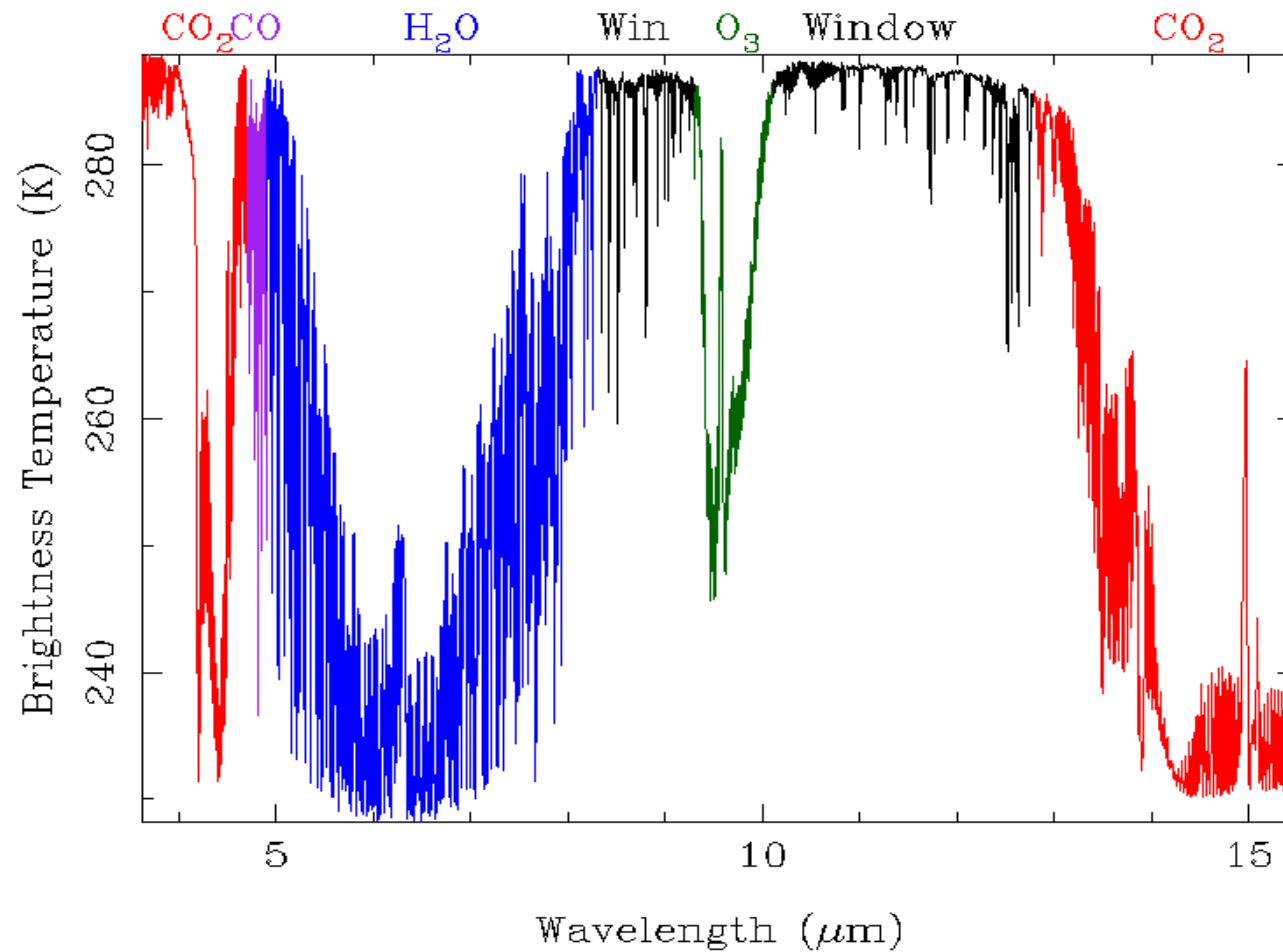
Jason

SERIES	ORBIT	HEIGHT (km)	OBJECTIVE
Meteosat	Geostationary	35786	Atmosphere
MetOp	LEO Polar	800	Atmosphere and Oceans
Jason	LEO	1600	Oceans

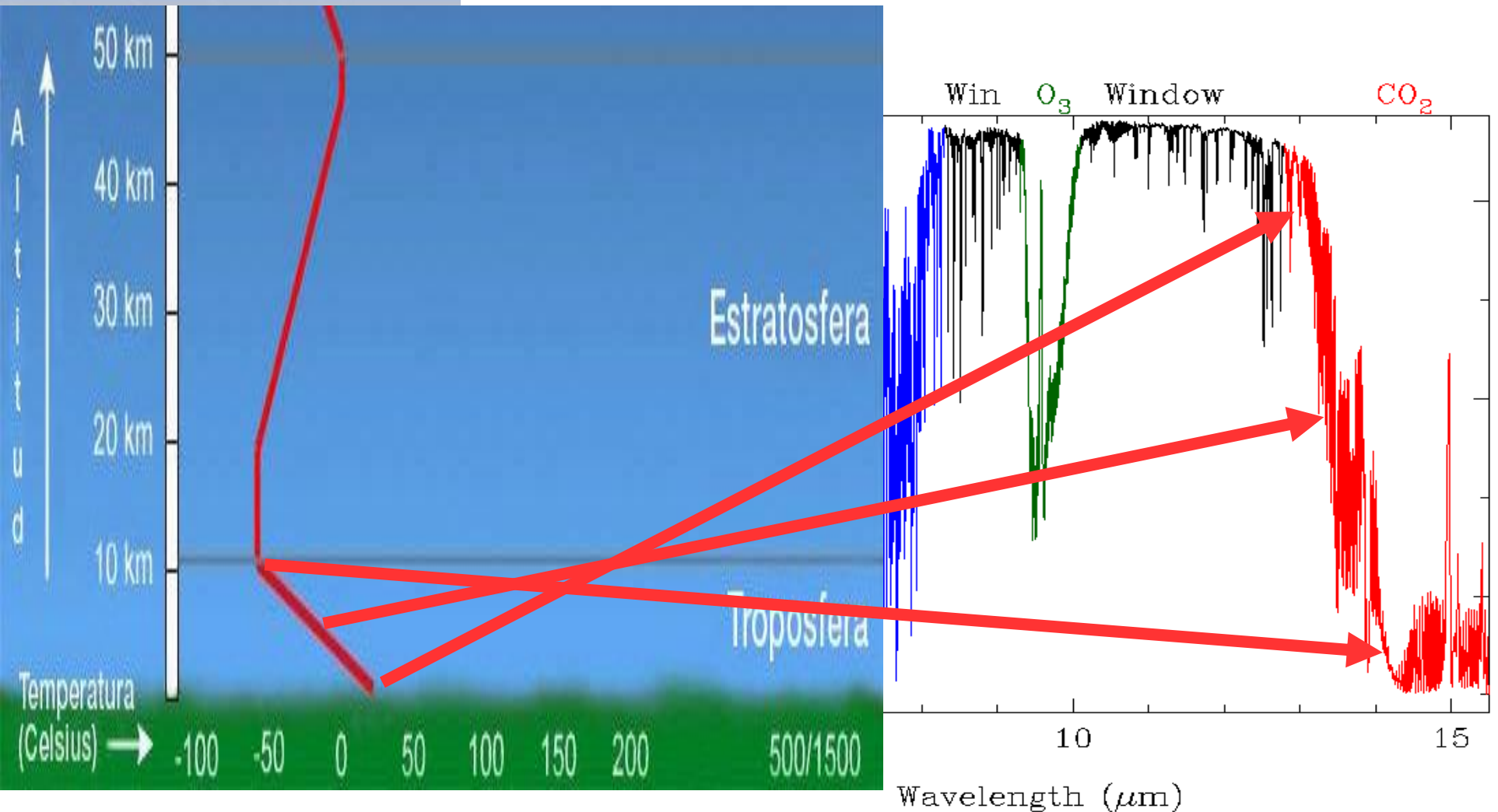
IASI on Metop: GEO versus Polar LEO orbit



IASI: Espectrum



IASI: Physical Principles of Light





All MSG channels: CO2 channel

Channel 01:	VIS 0.6 μ
Channel 02:	VIS 0.8 μ
Channel 03:	NIR 1.6 μ
Channel 04:	MIR 3.9 μ
Channel 05:	WV 6.2 μ
Channel 06:	WV 7.3 μ
Channel 07:	IR 8.7 μ
Channel 08:	IR 9.7 μ („Ozone“)
Channel 09:	IR 10.8 μ
Channel 10:	IR 12.0 μ
•Channel 11:	IR 13.4 μ („CO ₂ “)
Chanell 12:	HRV (High Resolution Visible)

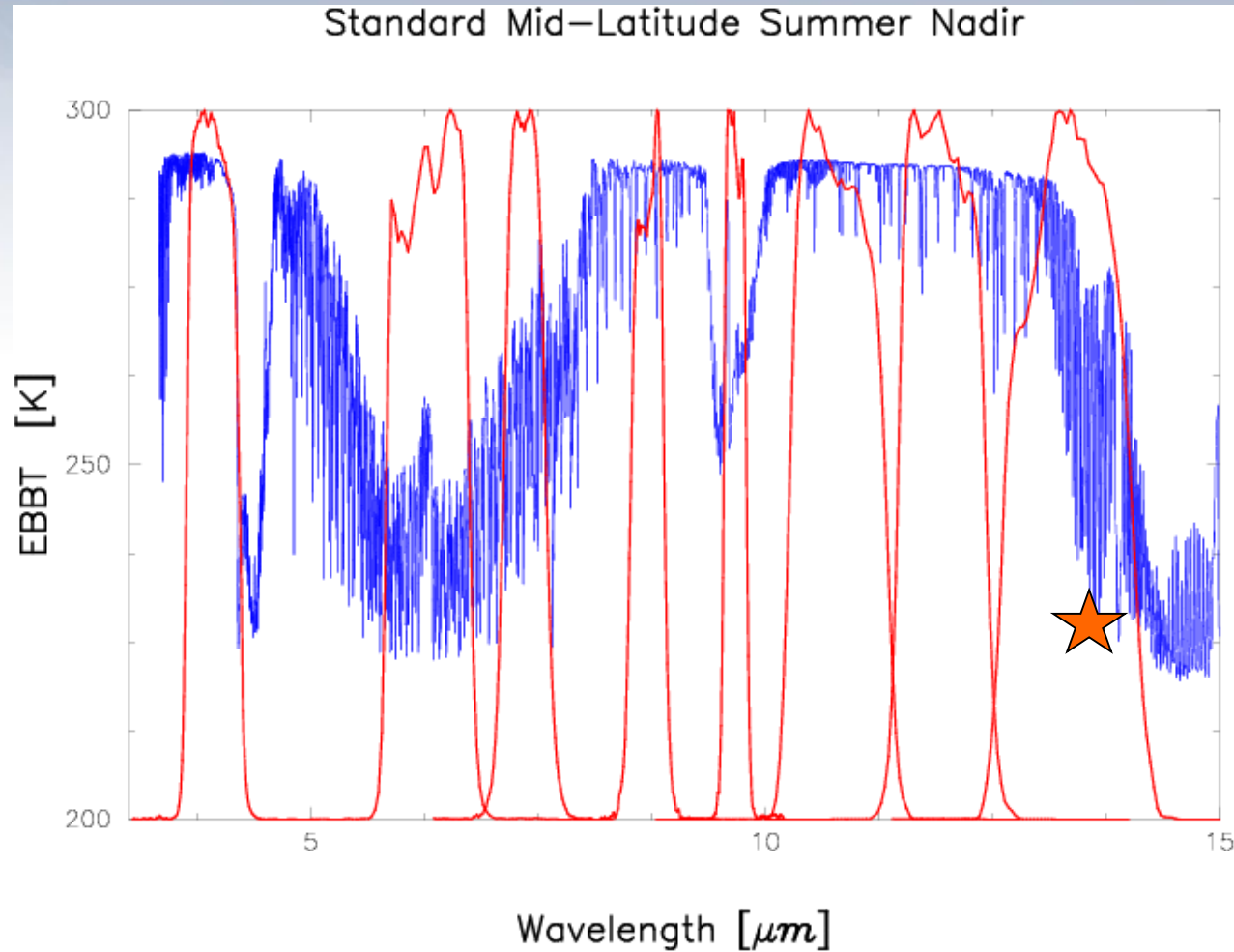


CO2 channel

„CO2 channel“
Ch11: 13.4 μm

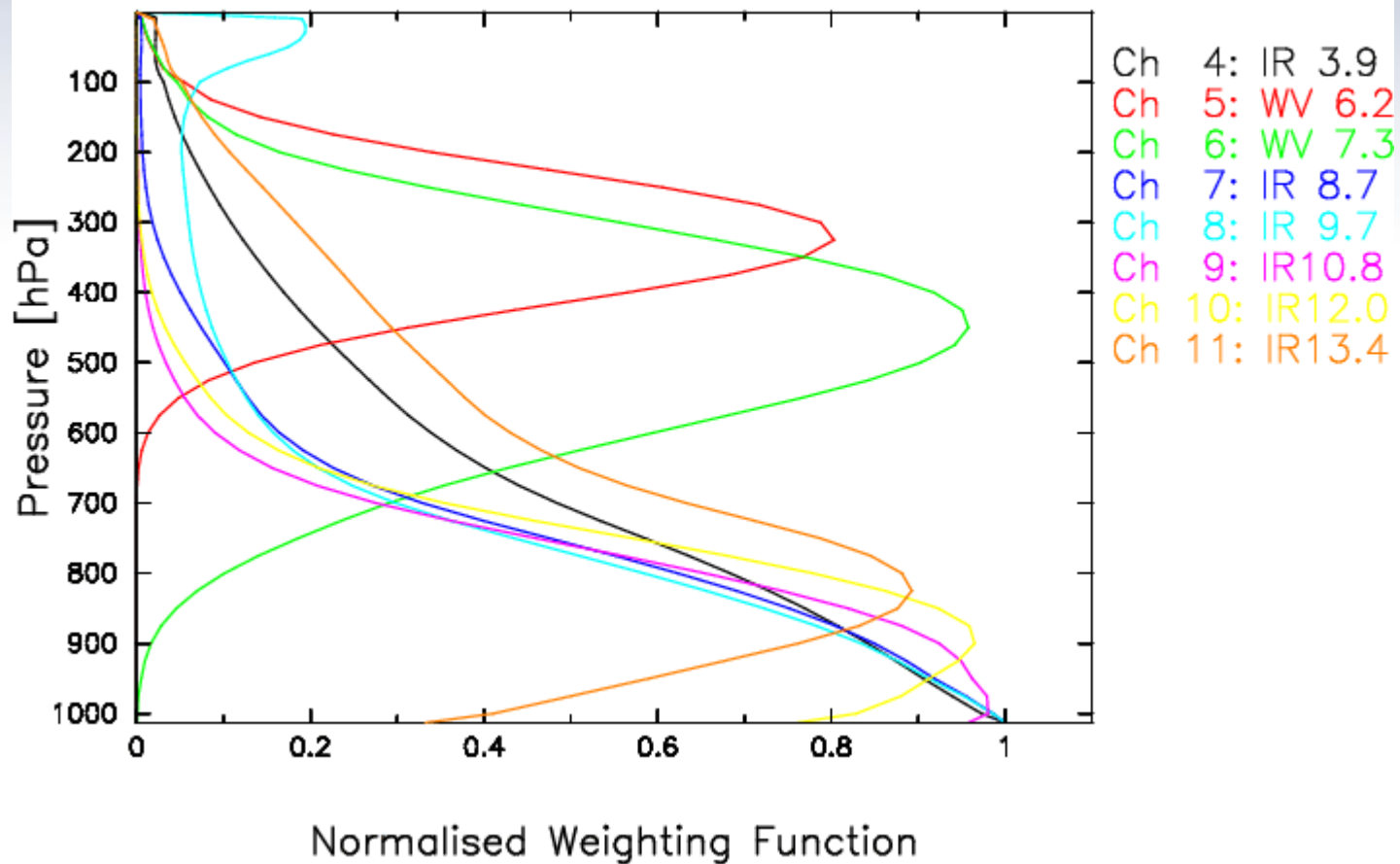
CO2 channel

Ch11 is in the centre of the CO2 absorption band around 15 μm



CO2 channel

Standard Mid-Latitude Summer 60 °



Maximal
Signal from
around
820 hPa



Application Areas for the CO₂ channel

Qualitative application of images:

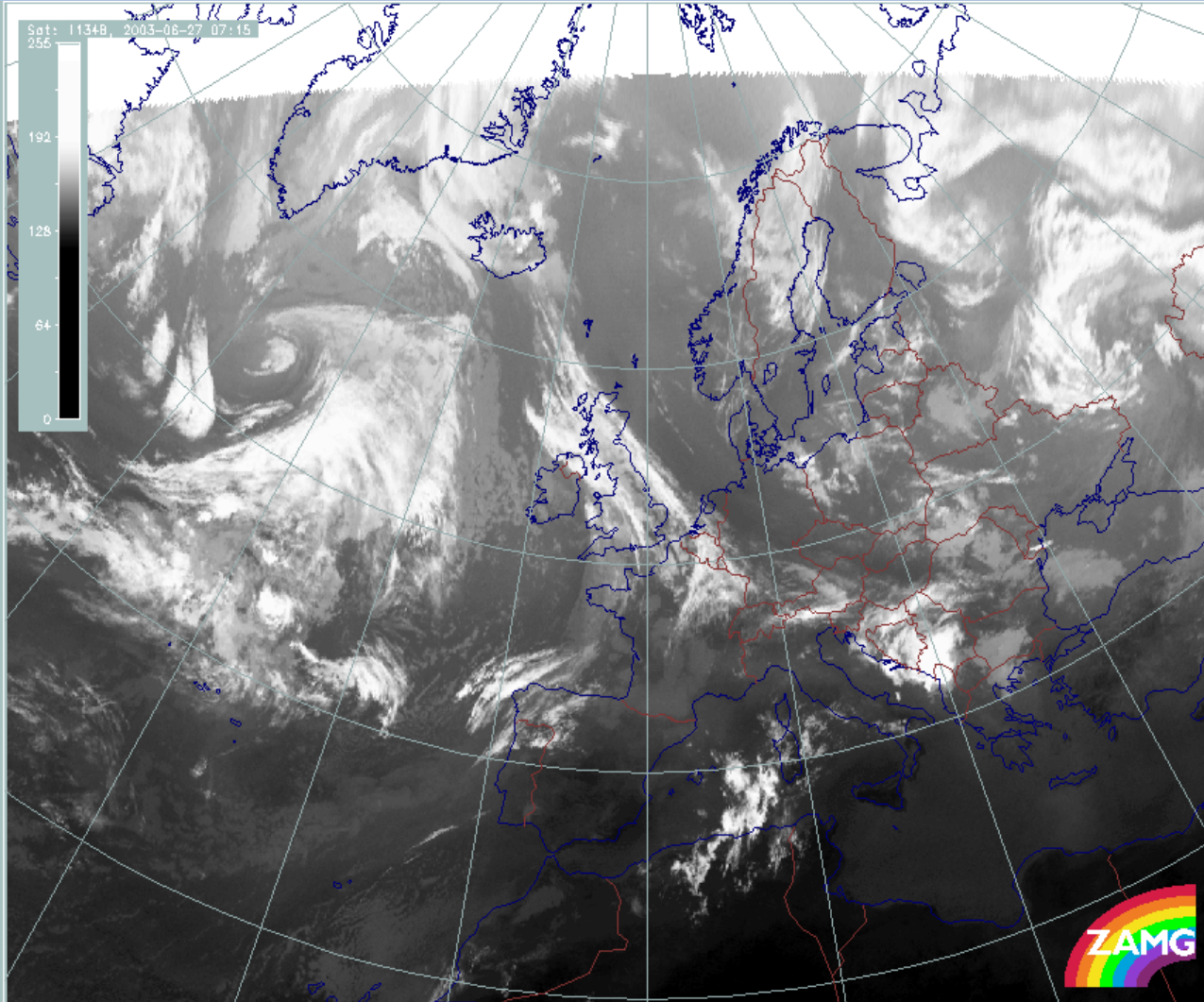
- No additional features compared to the IR window channels
- No special application for qualitative image interpretation (at the time being)

Quantitative applications:

- temperature profiles
- instability
- winds



CO2 channel Image



Sat: 11348, 2005-06-27 07:15



Ch11:13.4 μ m



All MSG channels: Ozone channel

Channel 01:	VIS 0.6 μ
Channel 02:	VIS 0.8 μ
Channel 03:	NIR 1.6 μ
Channel 04:	MIR 3.9 μ
Channel 05:	WV 6.2 μ
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Channel 10:	IR 12.0 μ
Channel 11:	IR 13.4 μ („CO ₂ “)
Chanell 12:	HRV (High Resolution Visible)

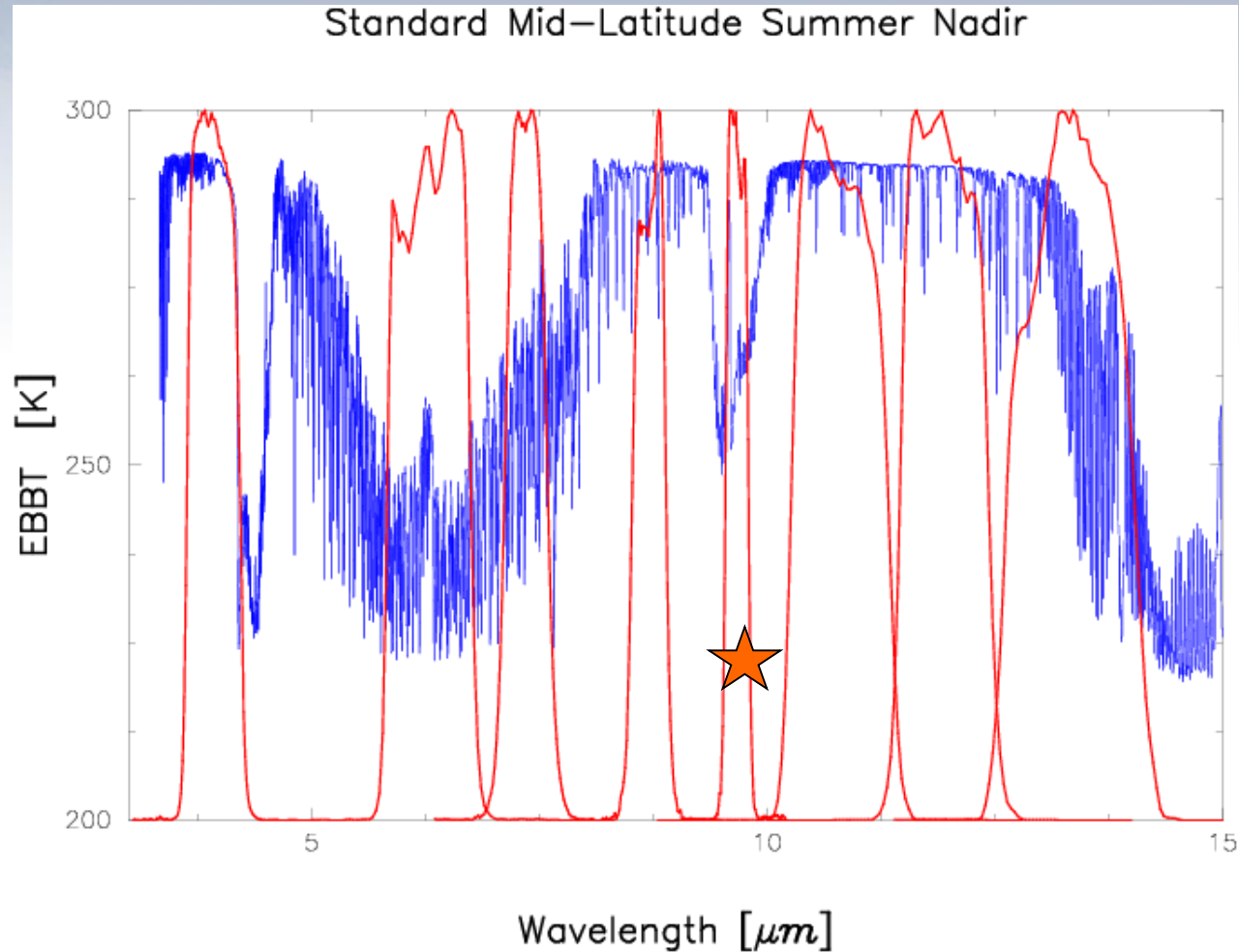


O3 channel

„Ozone channel“
Ch08: 9.7 μm

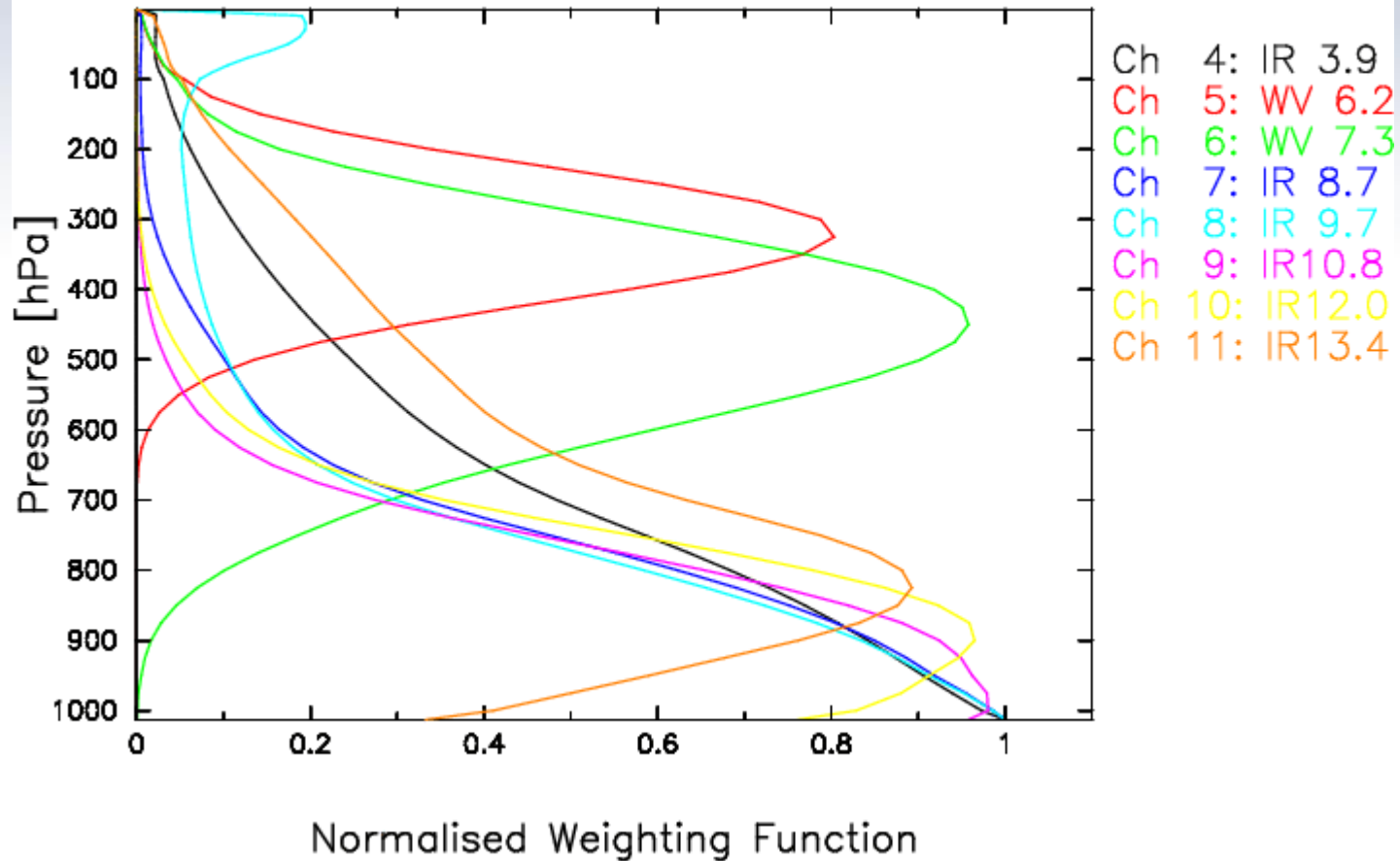
O3 channel

Ch08 is in the centre of the O3 absorption band around 9 μm



O3 channel

Standard Mid-Latitude Summer 60 °



Signals from lower parts of troposphere; But: Secondary maximum from higher than 100 hPa



Application Areas for the O3 channel

Ozone concentration in the lower stratosphere is not regarded as a channel with optically applicable structures

- But: there are in some situations white stripes in the areas of the black stripes in WV
- Further: there are structures in the cloud free sea, best seen in this channel



O3 channel: White Stripes

White stripes can only be seen in Ch08, not in Chs 09, 10
They appear in areas of dark stripes in WV (Ch05 and 06)
They are accompanied by NWP parameters typical for low tropopause (tropopause folding):

- PV low down (for instance 500 hpa)
- Maximum of shear vorticity at 300 hpa
- on the cyclonic side of a jet streak

Physical meaning of white stripes:

- high content of Ozone which absorbs the radiation from below and emits radiation according to 2nd law of Kirchhoff

There are many more situations with low tropopause (tropopause folding) without the white stripe; consequently: White stripes are an optical indication of high stratospheric Ozone in upper tropospheric heights

O3 channel: White Stripes

Case July 03/0600 UTC

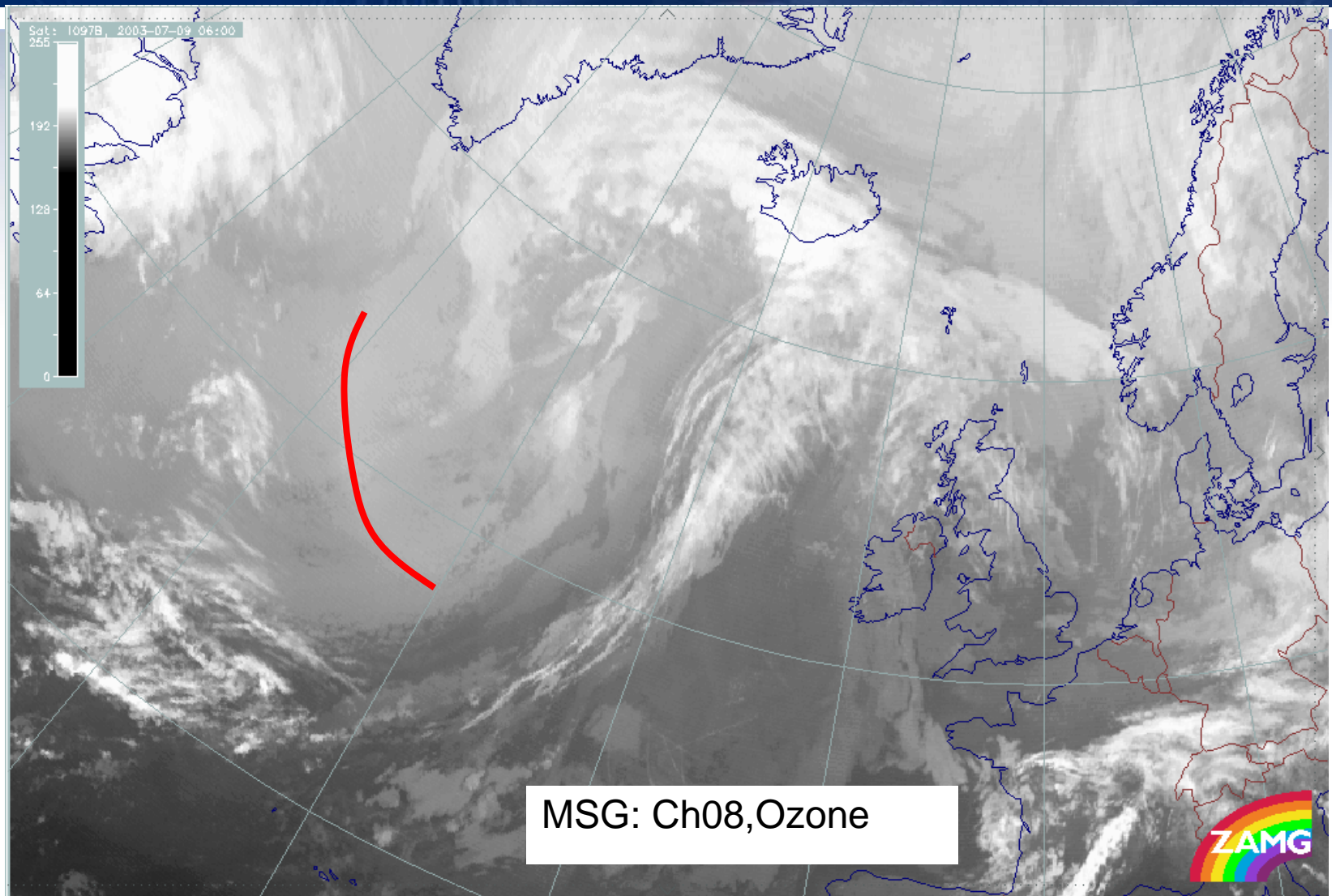
Black stripe in WV: Atlantic; huge low system
Same area shows white stripe in Ch08
white stripe not seen in the other IR channels

Model parameters:

- close to jet axis (zeroline of shear vorticity) on cyclonic side
- maxima of cyclonic shear vorticity
- PV = 1 lower than 450
- in vertical cross section convergence at these levels

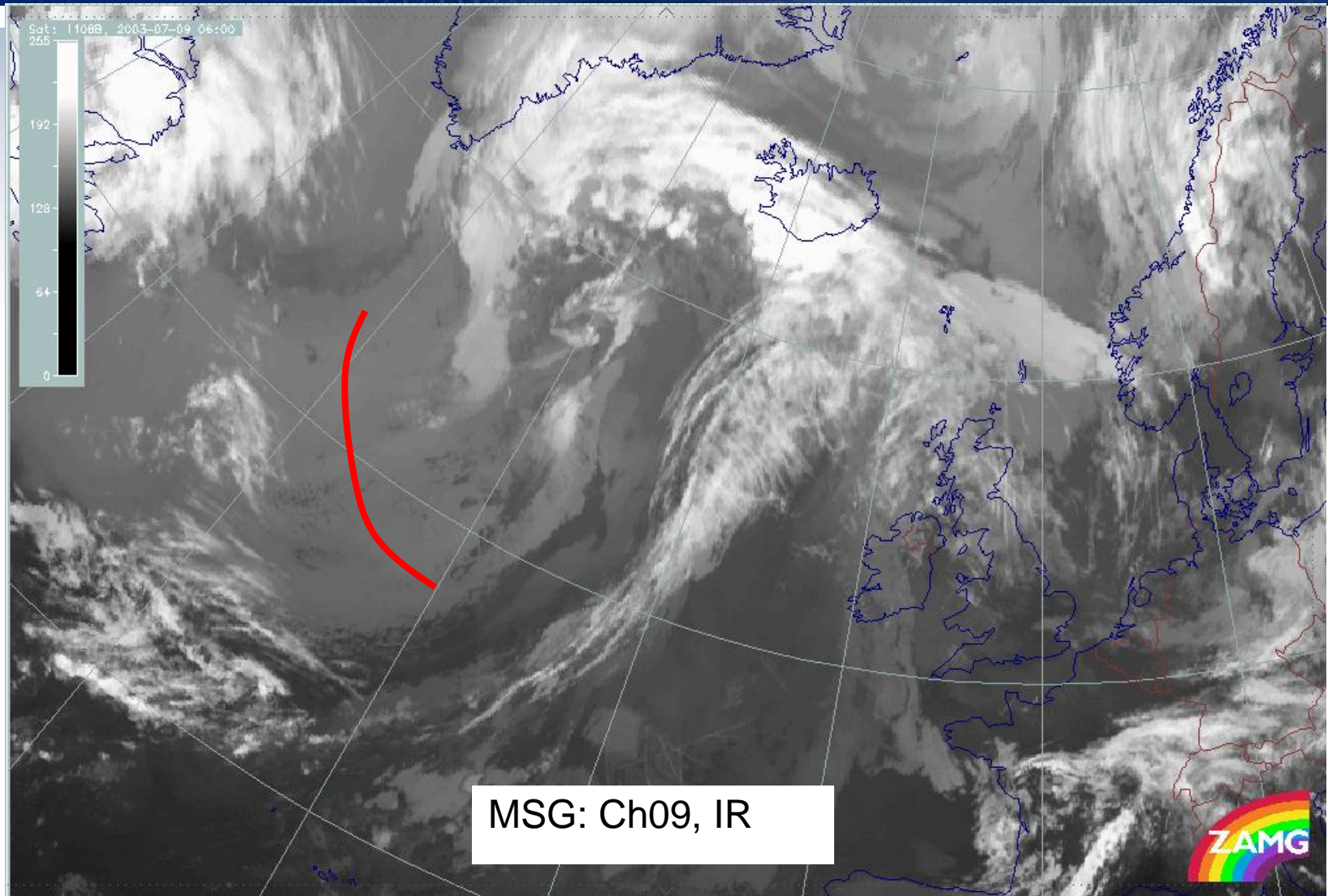


O3 channel: White Stripes



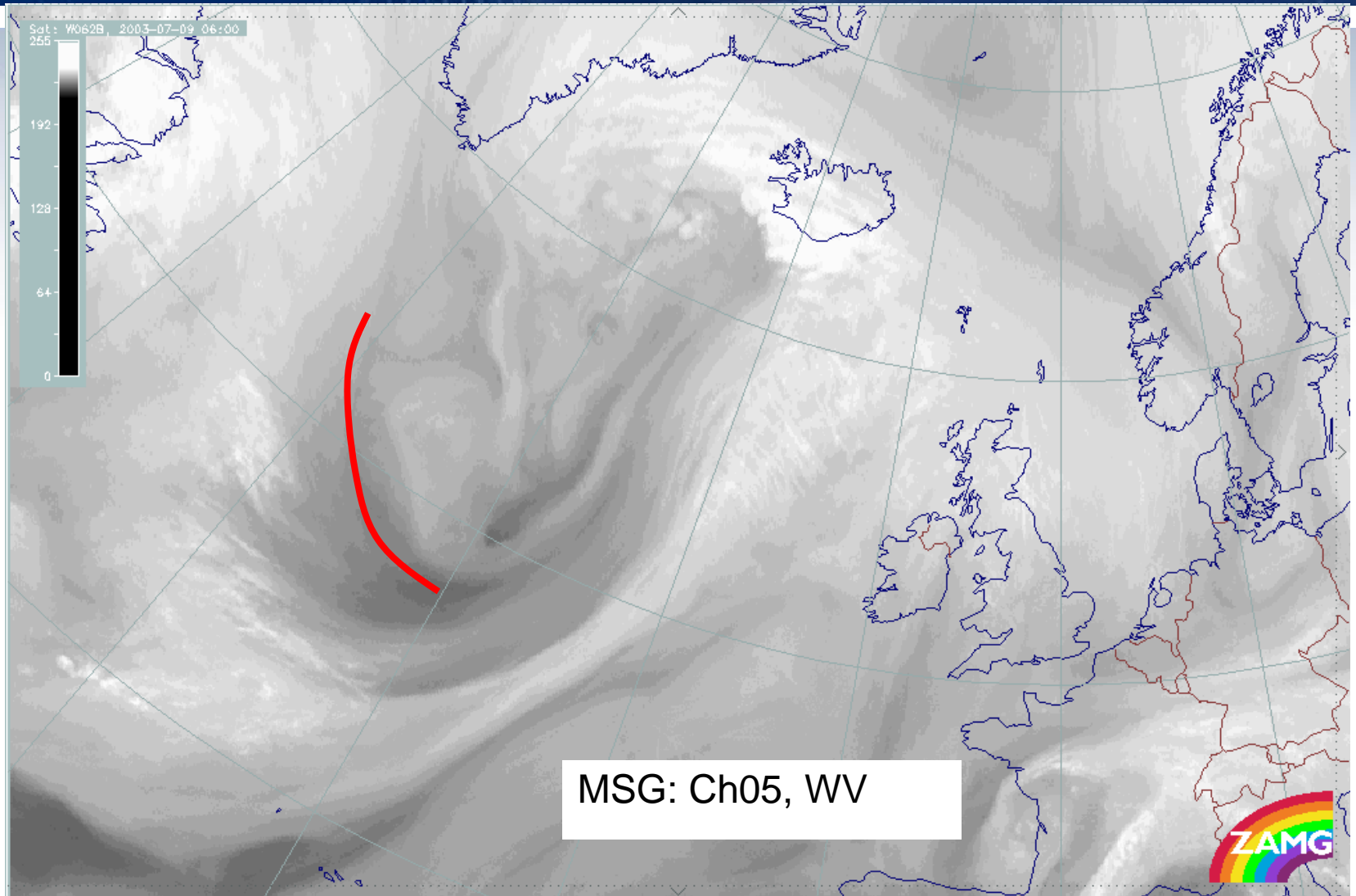


O3 channel: White Stripes

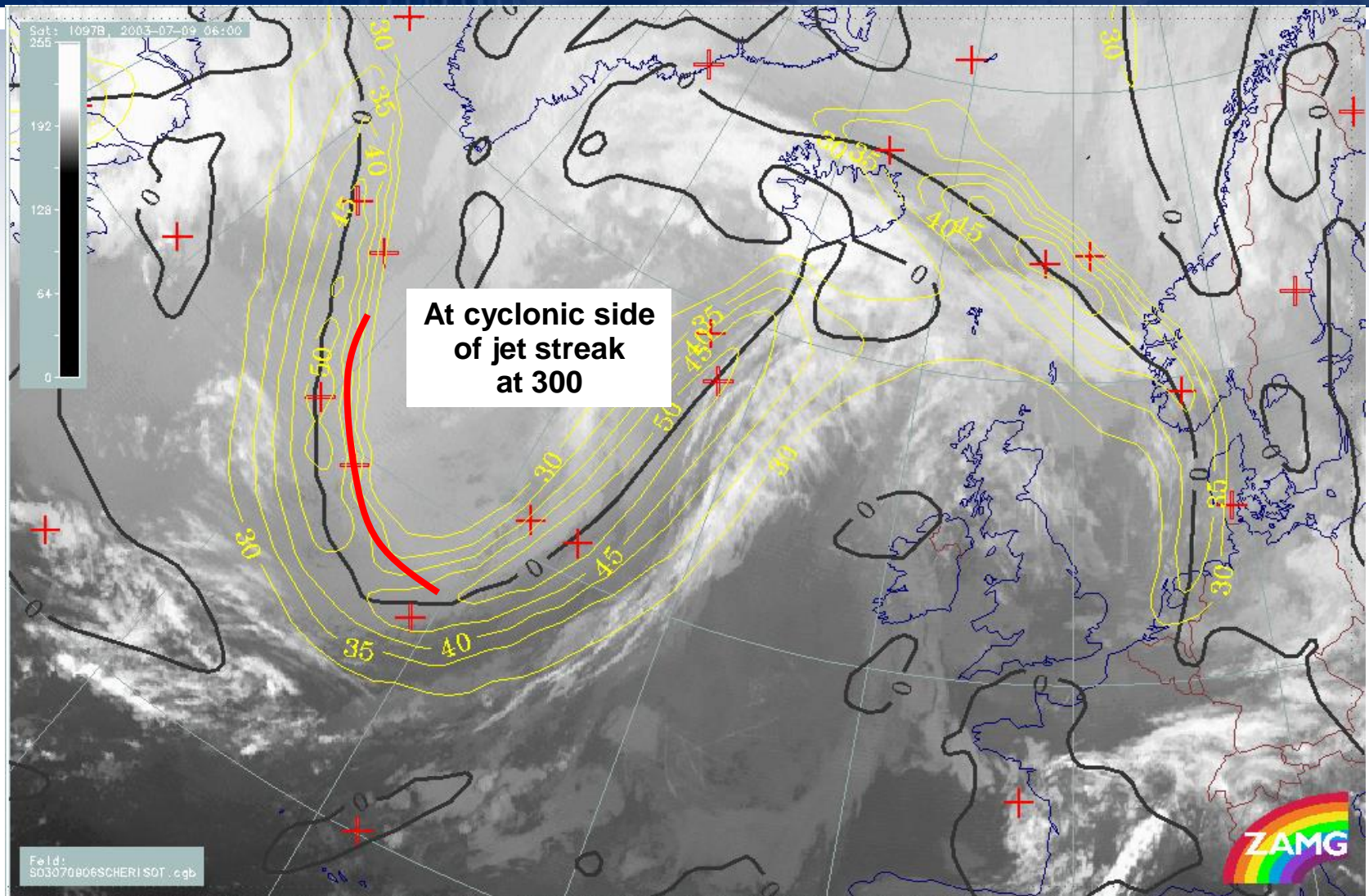




O3 channel: White Stripes



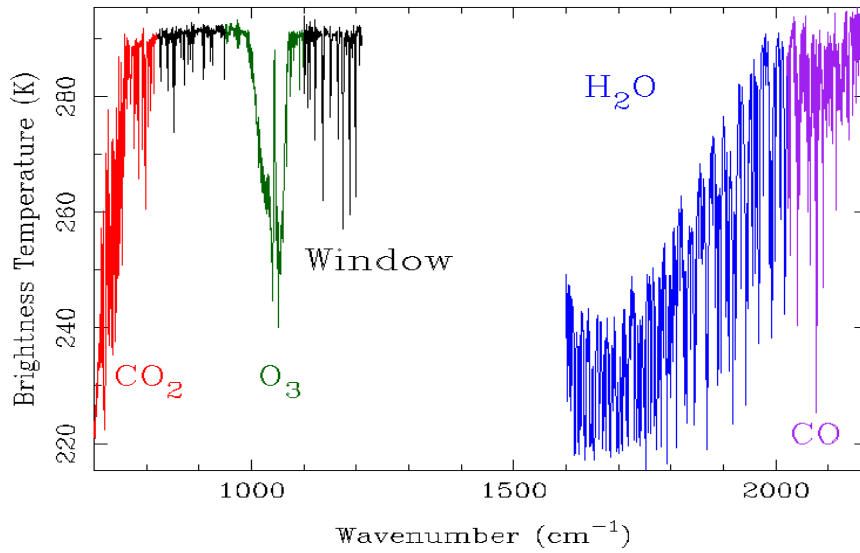
O3 channel: White Stripes





IASI: Its use

Typical MTG-IRS Spectrum

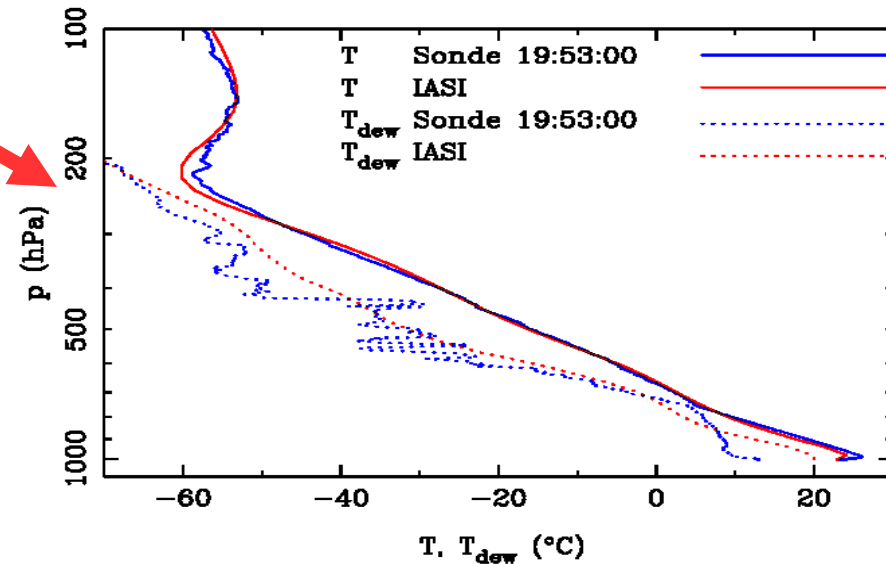


Radiances = Level 1 (L1)

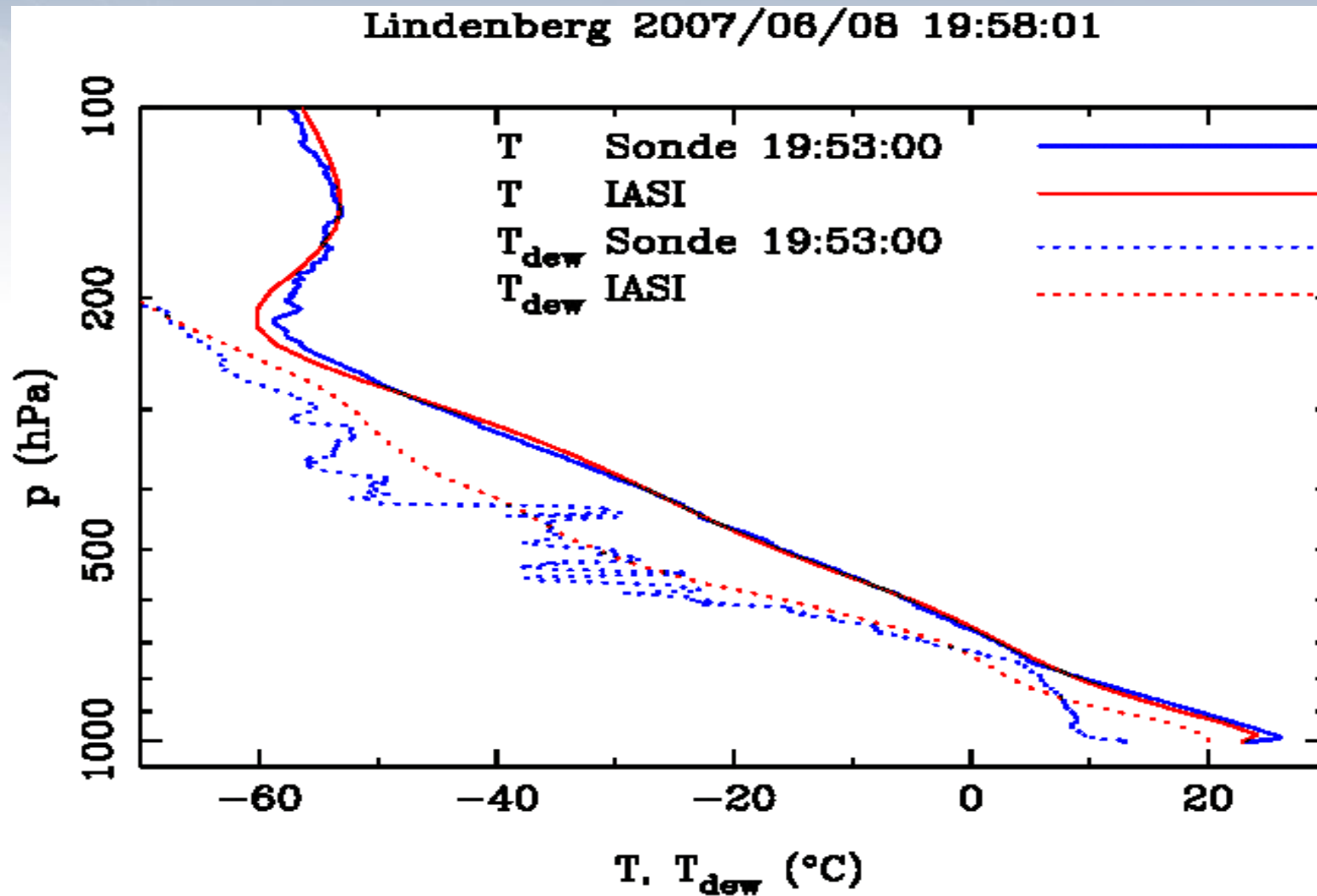
Level 2 Processor

Profiles = Level 2 (L2)

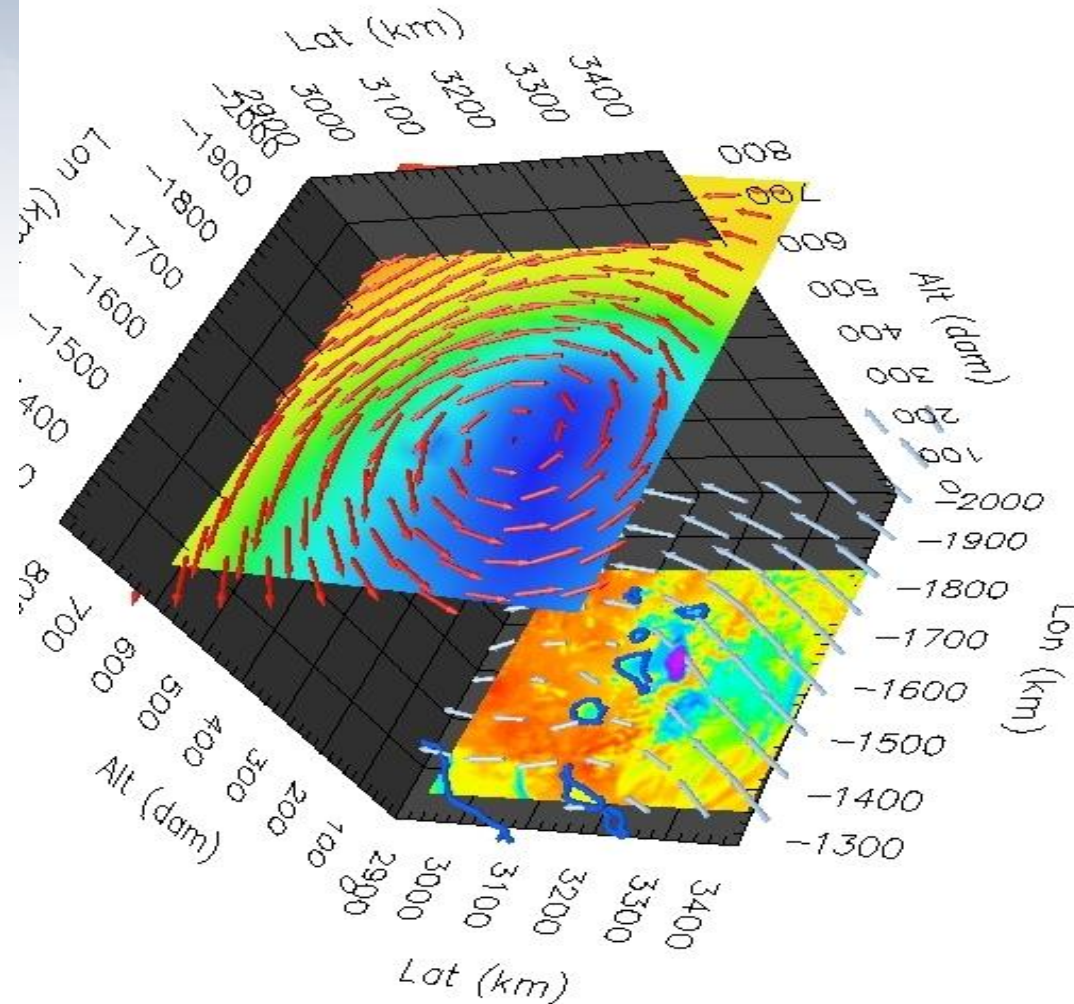
Lindenberg 2007/08/08 19:58:01



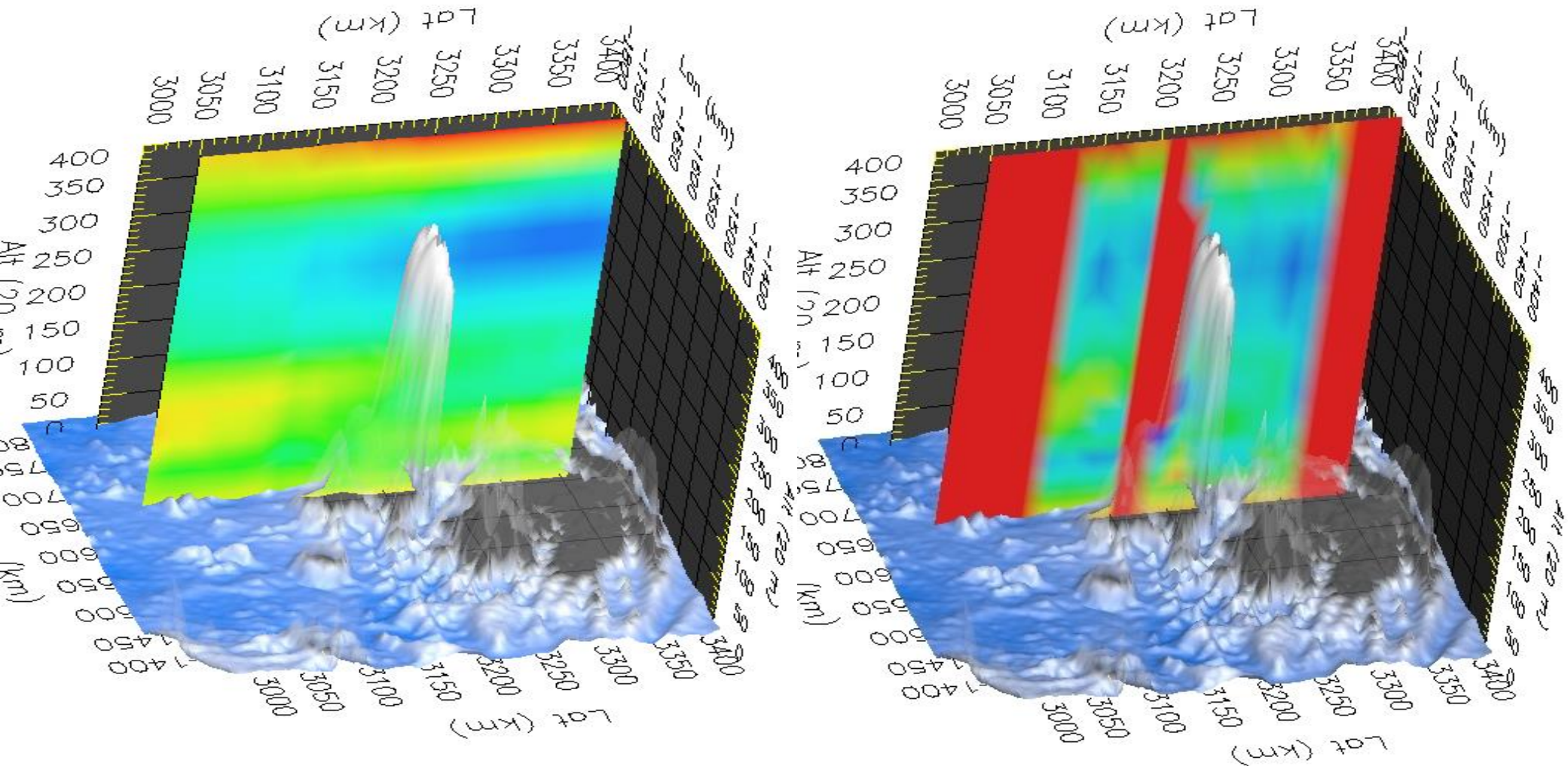
IASI Profiles of Temperature and Humidity



IASI: Case Study with AIRS profiles (1/2)

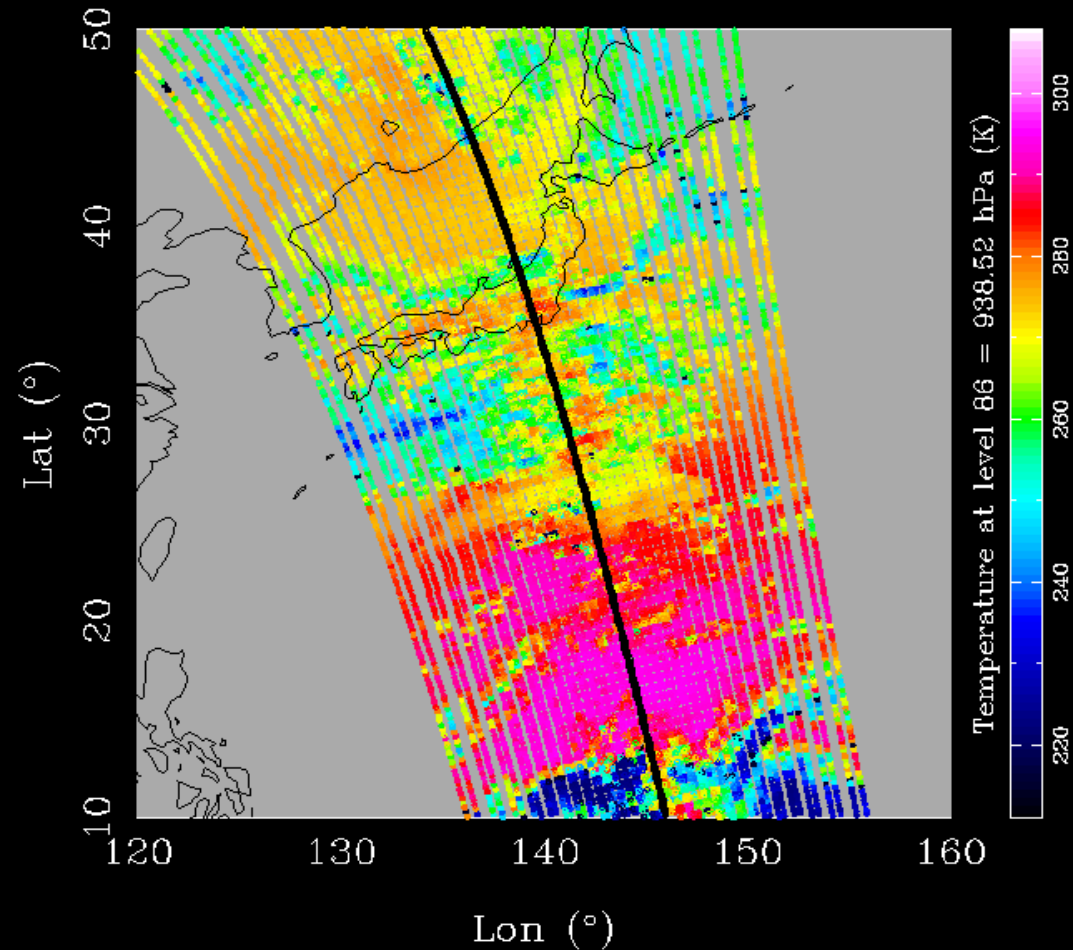


IASI: Study Case with AIRS profiles (2/2)



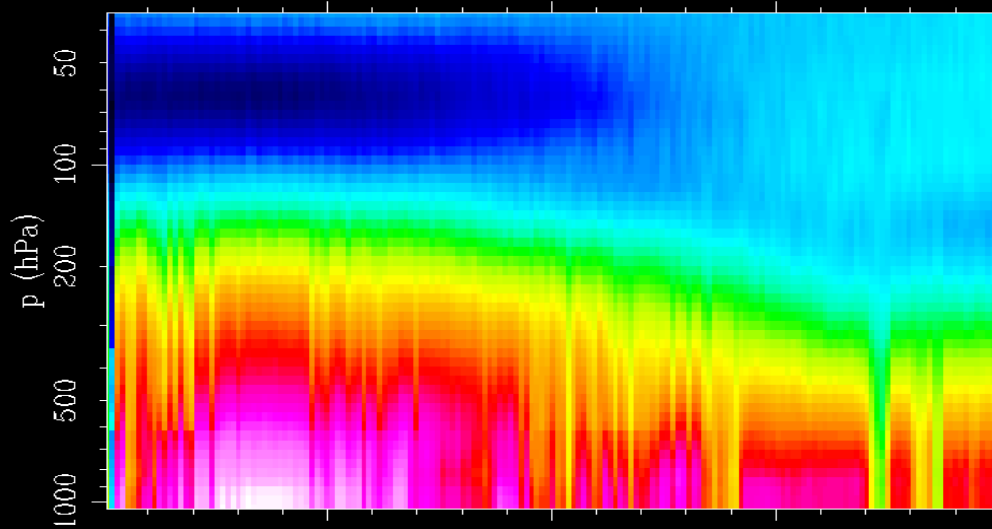
IASI Case Study (1/2)

IASI Temperature Retrieval

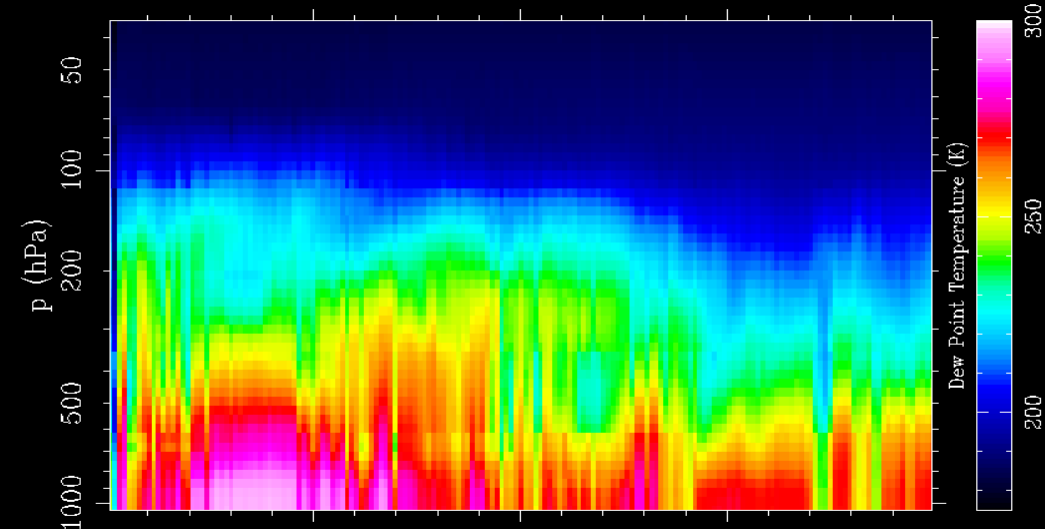


IASI Case Study (1/2)

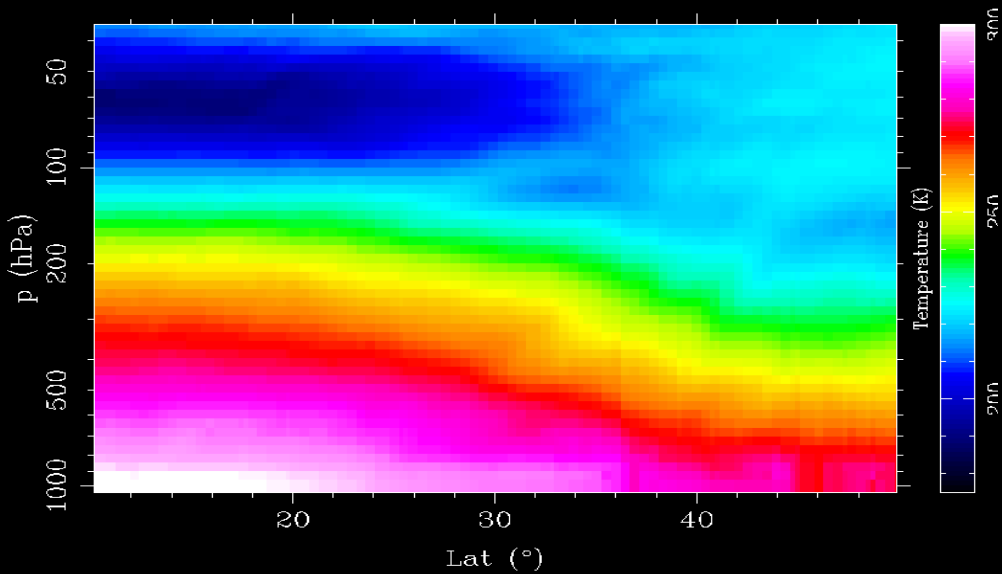
IASI NLR Temperature Retrievals



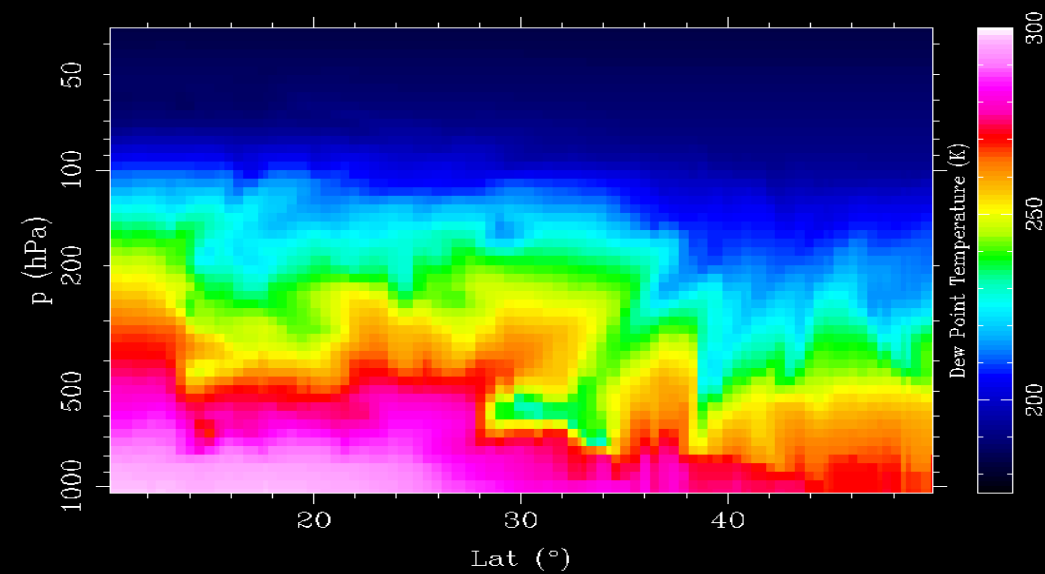
IASI NLR Dew Point Temperature Retrievals



ECMWF Temperature Profiles



ECMWF Dew Point Temperature Profiles



CO2/Ozone absorption channels And IASI

Thank You!!

21.06.2011
Xavier Calbet
EUMETSAT