DUST
Detection

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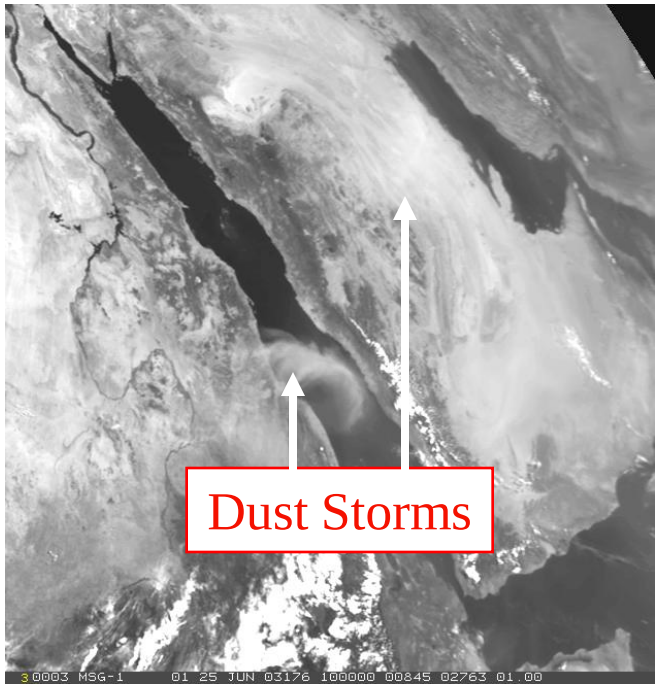
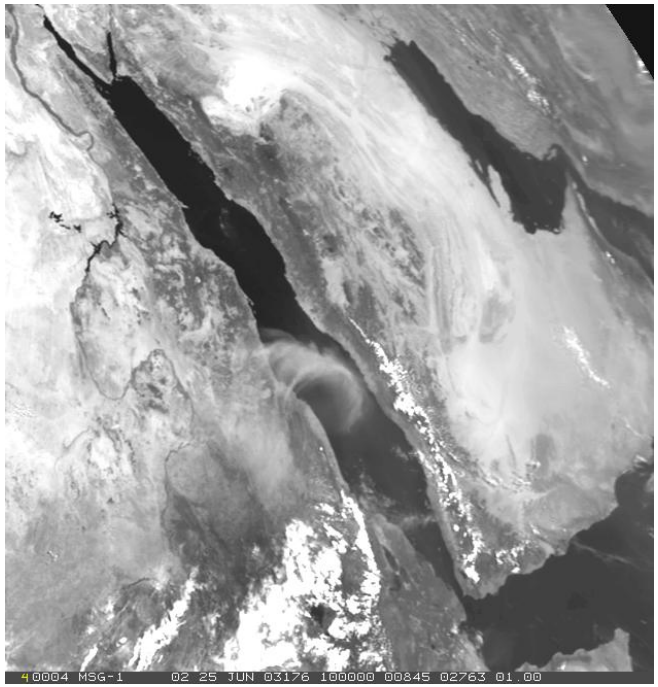
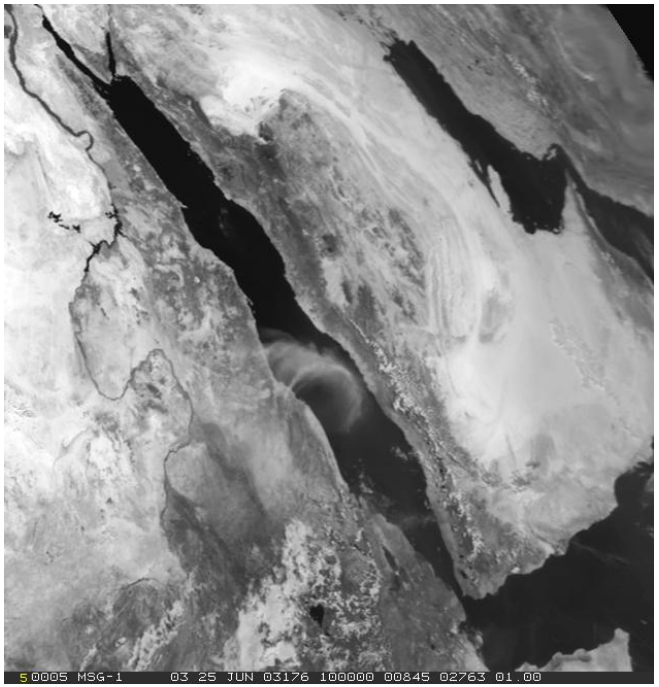
Remote Sensing of Dust Clouds



Channel 01 (0.6 μm)



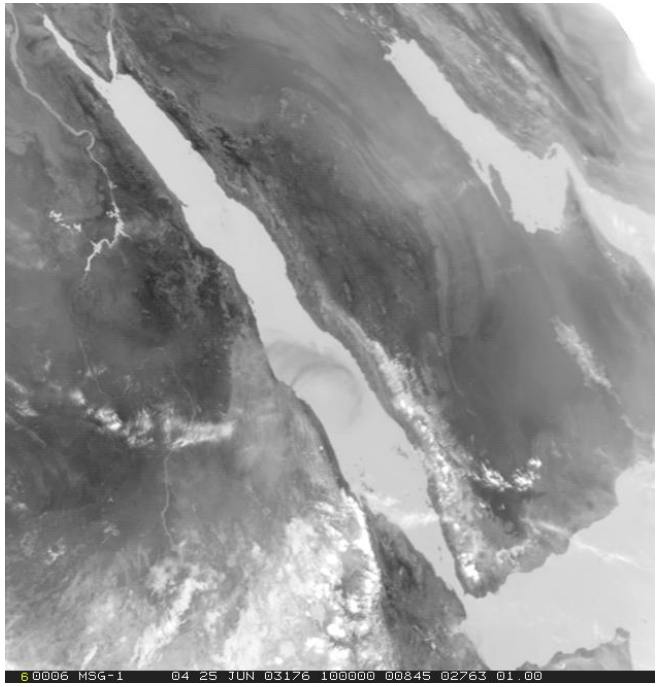
Channel 02 (0.8 μm)



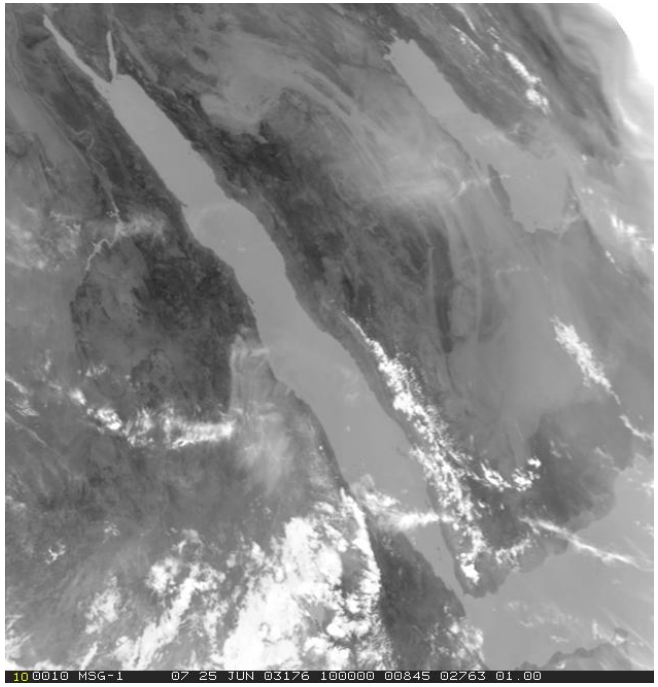
Channel 03 (1.6 μm)

MSG **VIS** imagery on 25 June 2003 at 10:00 UTC showing a major **dust storm** over the Red Sea. The dust storm over the Arabian Peninsula is not visible in VIS imagery.

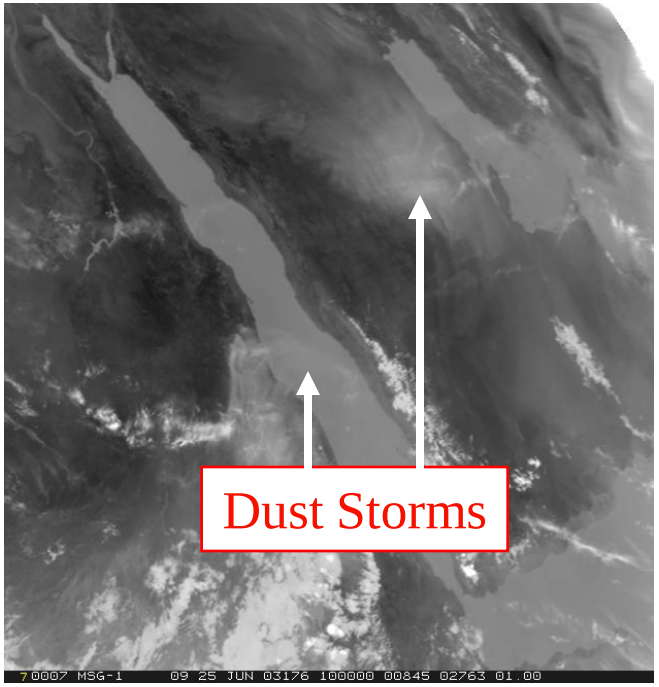
Remote Sensing of Dust Clouds



Channel 04 (3.9 μm)



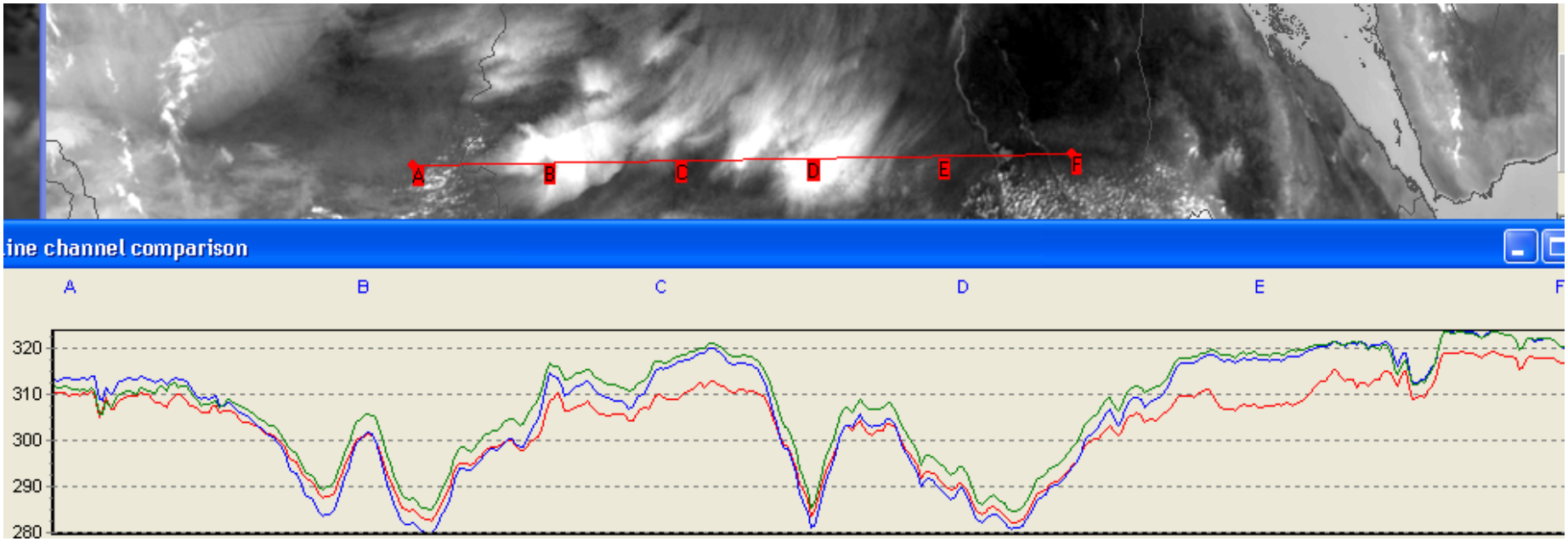
Channel 07 (8.7 μm)



Channel 09 (10.8 μm)

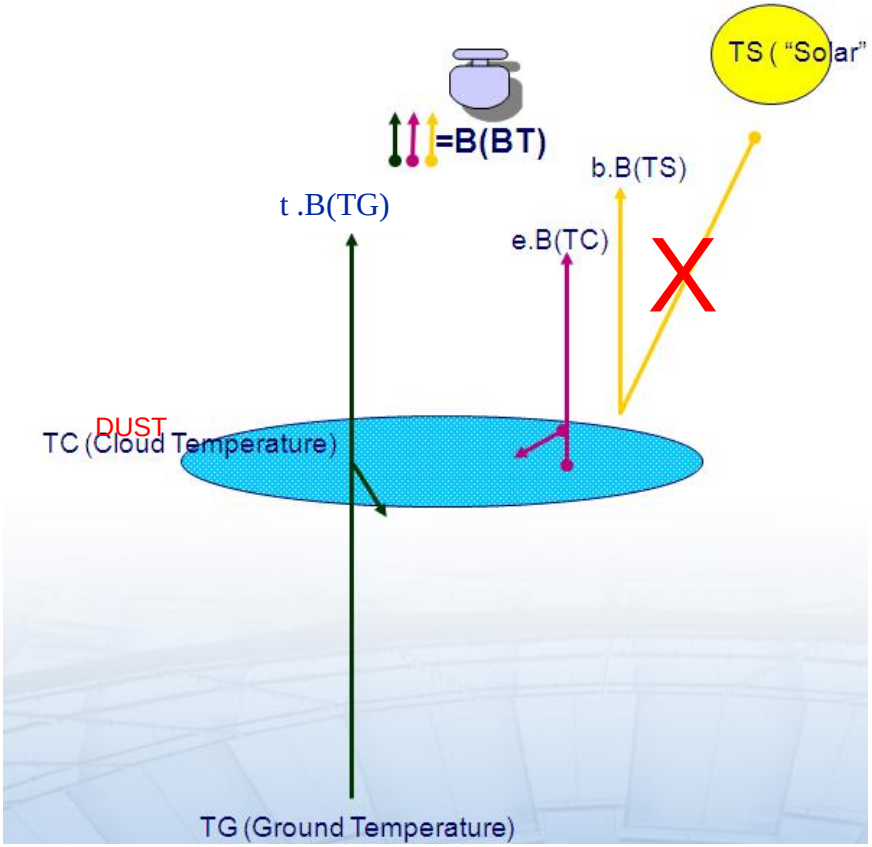
MSG **IR** imagery on 25 June 2003 at 10:00 UTC
showing a **dust storm** over the Arabian Peninsula.

2004 May 13th 13:00 Meteosat **10.8µm**
gray-enhanced

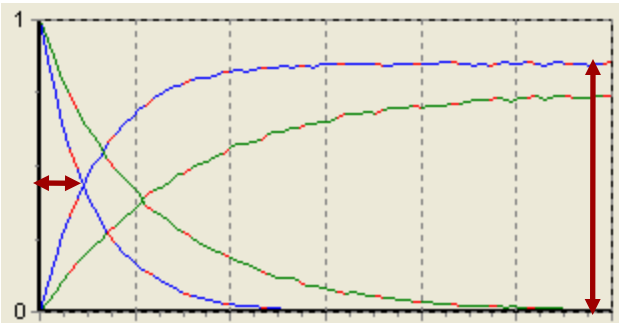


8.7 µm
10.8 µm
12.0 µm

Difference 7-9 depends on dust concentration, humidity and ground emissivity
Difference 9-10 depends on dust concentration and humidity



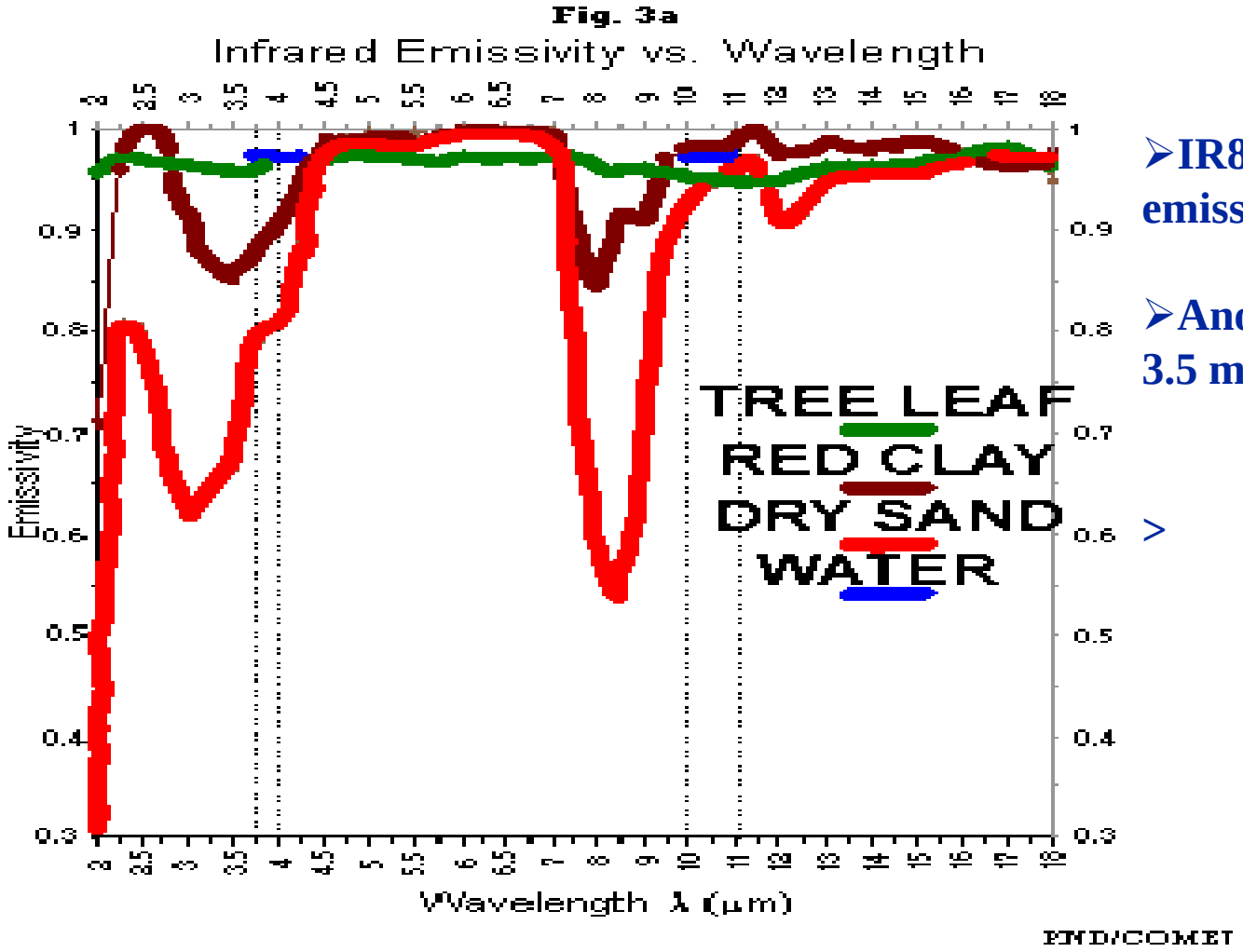
- No solar contribution in the spectral range above 8µm
- But **scattering** !
- Signal= t + e
- For thick dust layers f ≈ 0
- **Thick layer emissivity** dependent on absorption/scattering efficiencies **ratio**
- **Contributing layer** inversely to absorption+scattering (extinction) **sum**



optical depth →

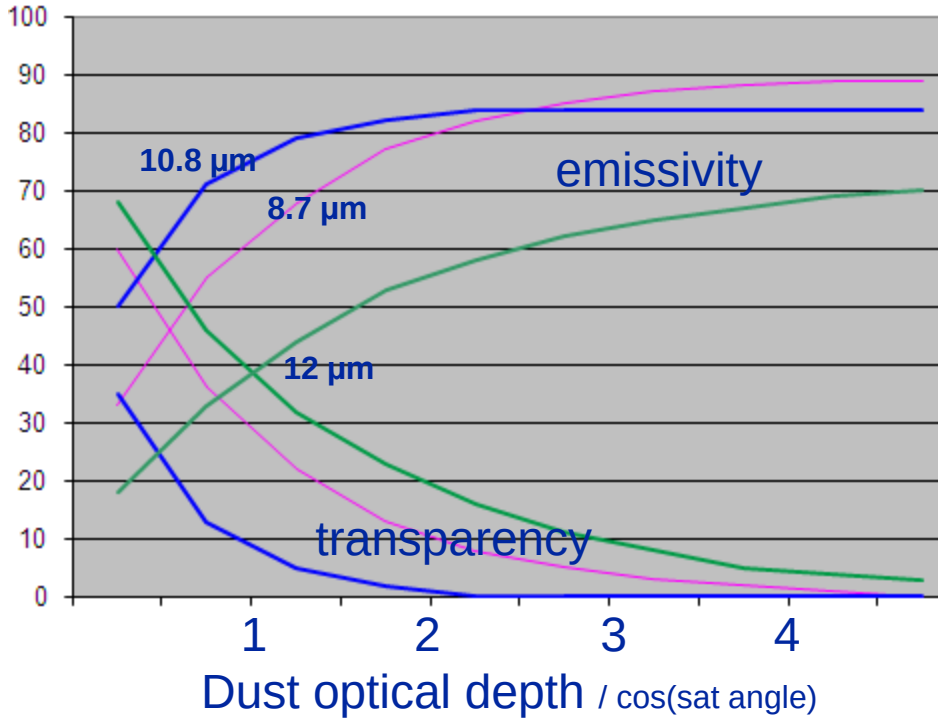
Remote Sensing of Dust Clouds

Ground Emissivity



- **IR8.7: sand has much less emissivity than at IR10.8**
- **Another minimum around 3.5 microns**
- >

10.8 suffer more by dust cloud scattering

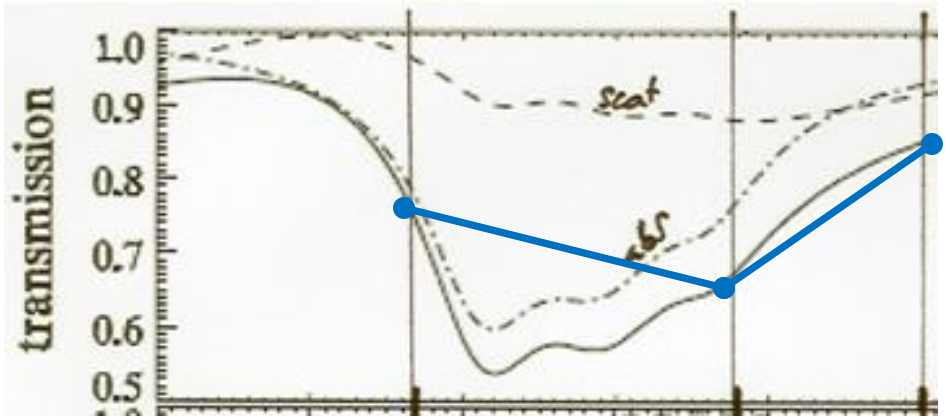


➢EMISSIVITY: The emissivity of the dust layer grows with the dust optical depth up to a saturation value. It is higher for 10.8µm than for 12.0µm.

➢TRANSPARENCY: The transparency supplies warm signal from the ground, making the signal stronger at 12.0µm than at 10.8µm (opposite to warm bias)

➢CONTRIBUTION LAYER: For deep dust (no ground contribution) the upper layer (supplying the signal) is thicker (and a few K warmer) at 12.0µm

Signal reduction (K) at chan	*8.7µm*	*10.8 µm*	*12.0 µm*
Water vapour absorption	-2	0	-1
Dust absorption	-5	-6	-2
Dust scattering	-2	-4	-3
Dust extinction (abs + scat)	-7	-10	-5
Desert/clay emissivity	-10	-1	0
Ocean emissivity	0	0	0

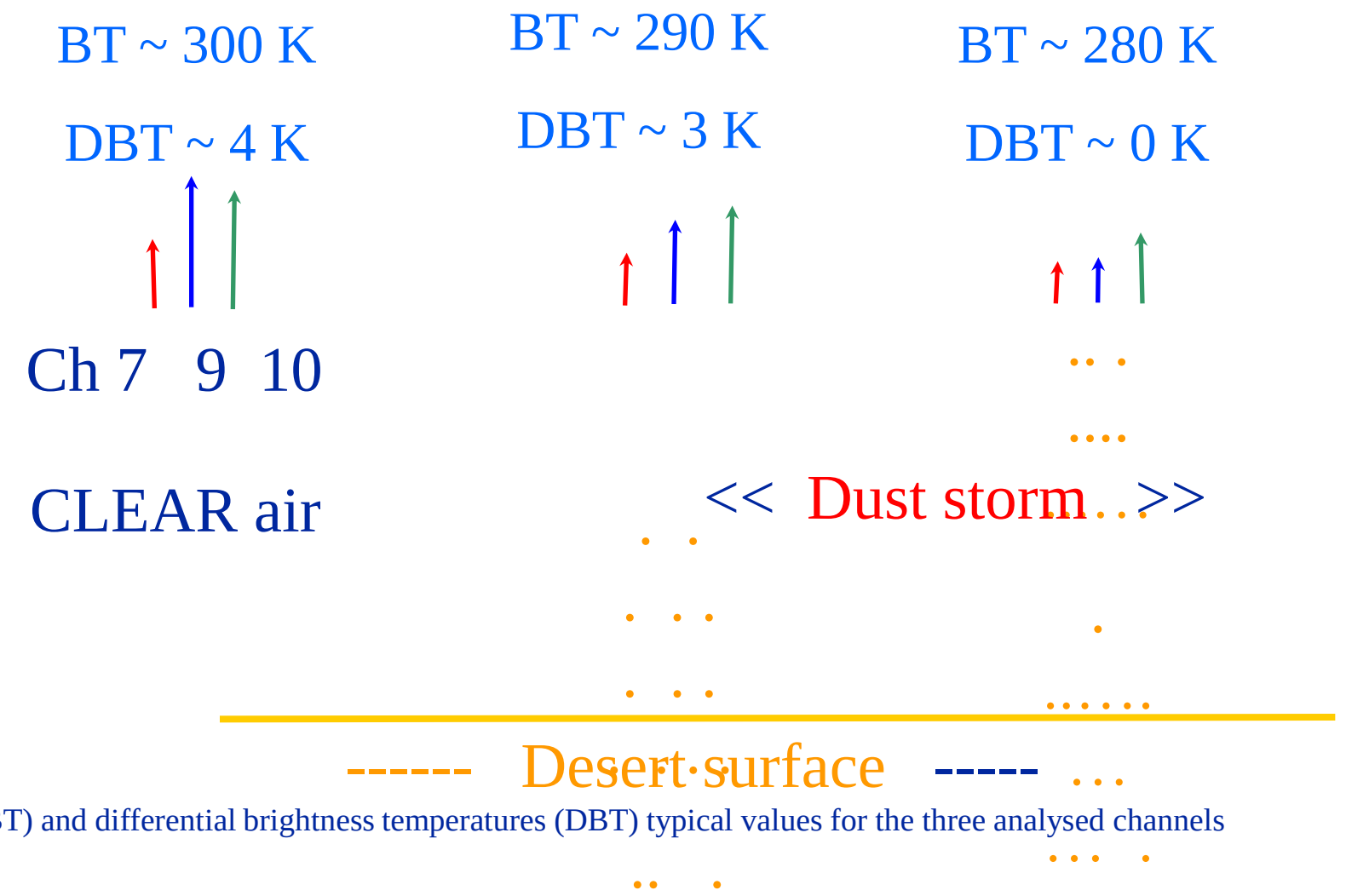


8.7µm 10.8µm 12 µm

Transmission through 3µm-ash
for wavelengths in the atmospheric window

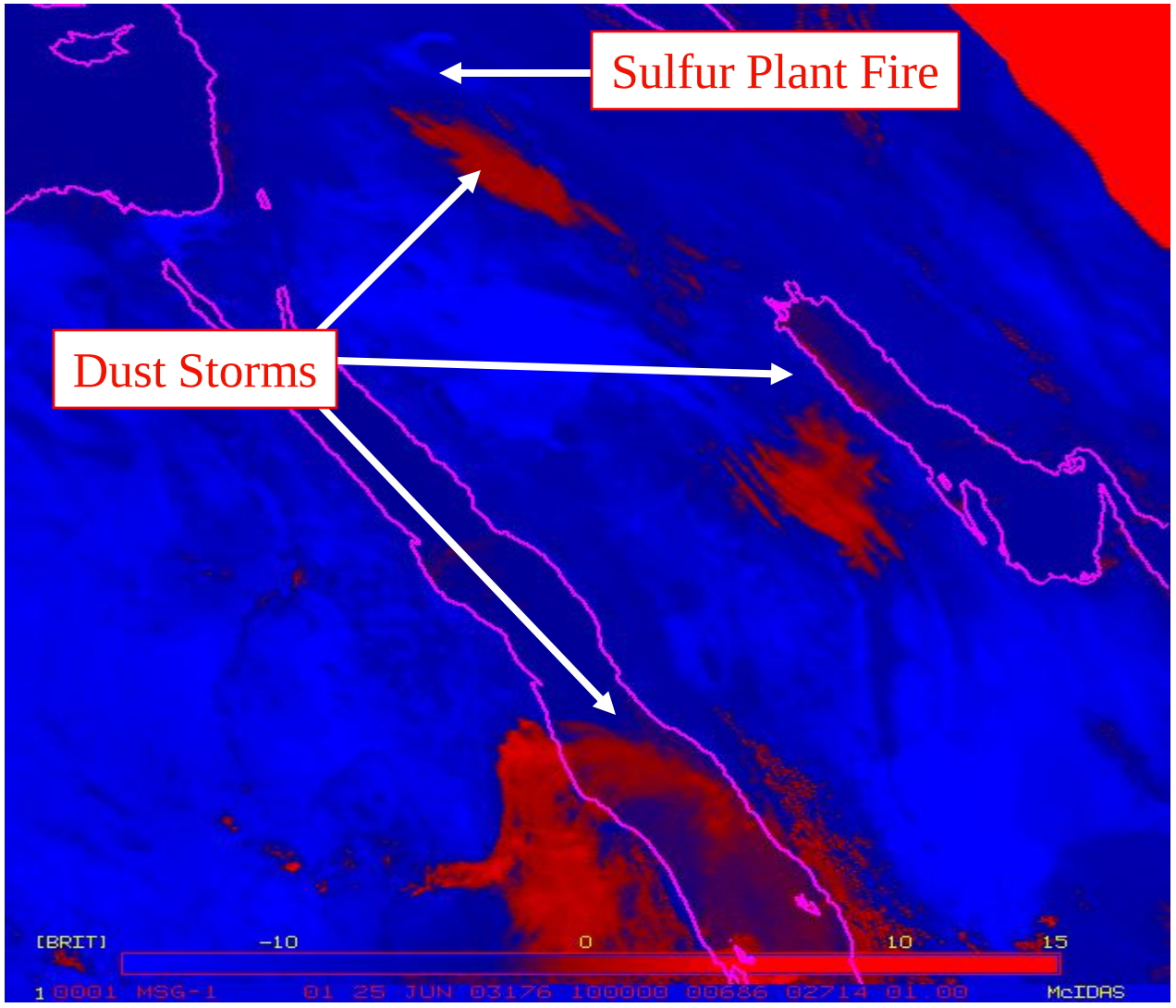
Differences for Dust storms

- Dust Emit less at 8.7 μm
- the strong difference Ch7-Ch9 gets blurred by *dust* (scattering more on 10.8 μm)



Brigthness (BT) and differential brightness temperatures (DBT) typical values for the three analysed channels

Remote Sensing of Dust Clouds



Meteosat-8
25 June 2003
10:00 UTC
Difference Image
Channels IR8.7 - IR10.8

Monitoring of thin Cirrus clouds, but also useful for detecting dust storms over deserts (day and night).

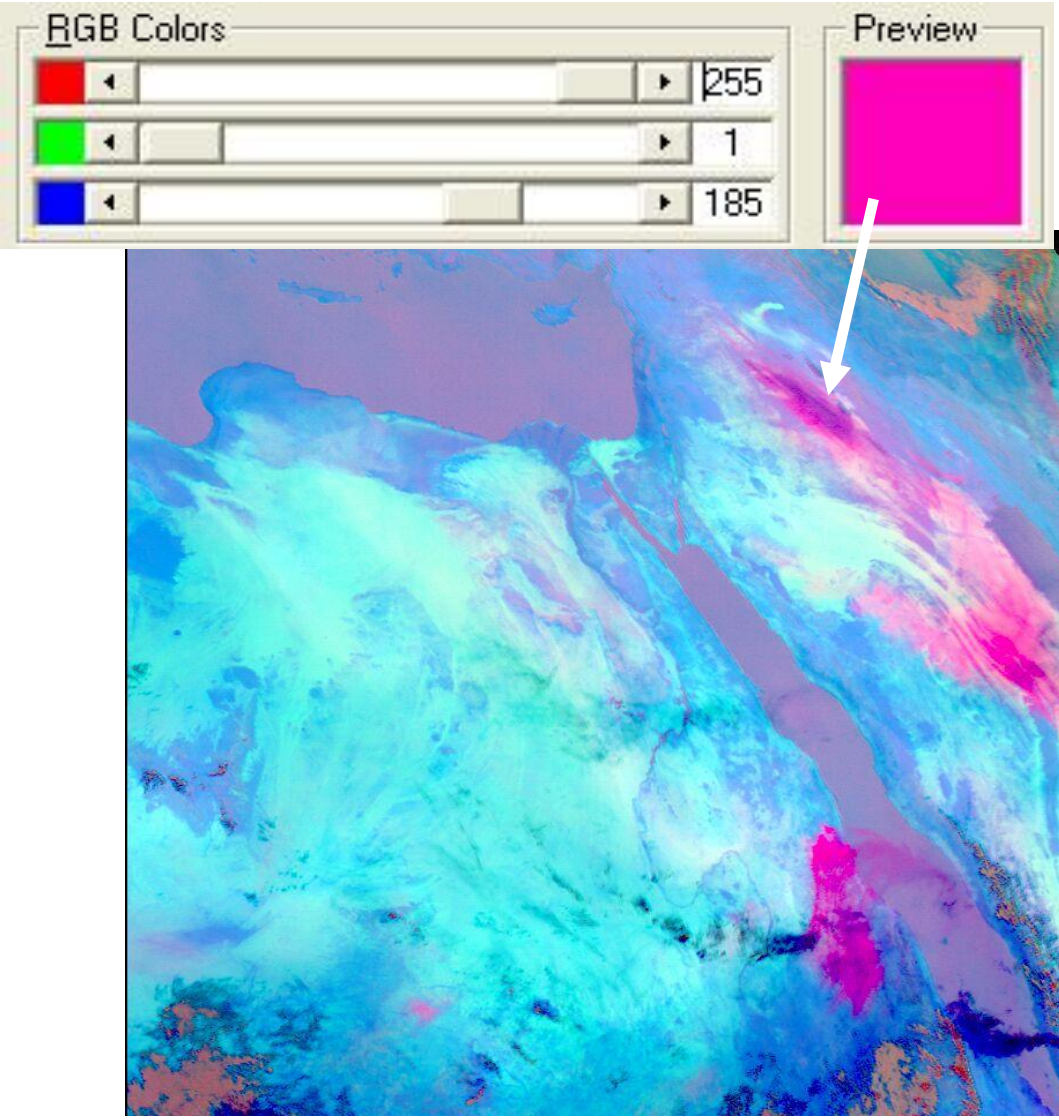
Remote Sensing of Dust Clouds

Recommended Ranges and Enhancements to show dust in RGB

	Temperature Range	Gamma
• Red IR12.0 - IR10.8	-4 K … +2 K	1.0
• Green IR10.8 - IR8.7	0 K … +15 K	2.5
• Blue IR10.8	261 K … 289 K	1.0

Remote Sensing of Dust Clouds

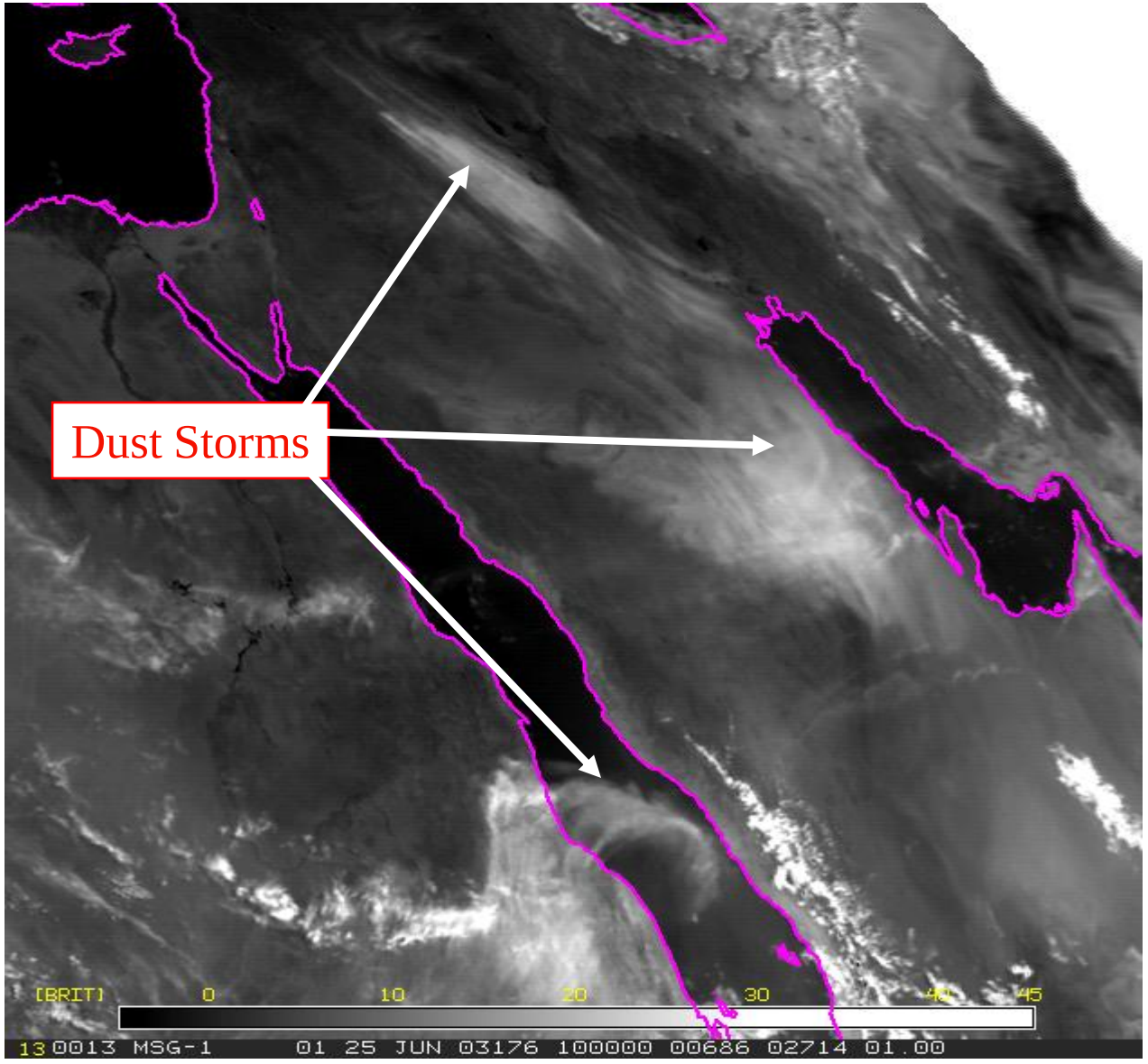
Recommended RGB for Monitoring of Dust Storms



Meteosat -8
25 June 2003
10:00 UTC
RGB Composite

R = IR12.0 - IR10.8
G = IR10.8 - IR8.7
B = IR10.8

Remote Sensing of Dust Clouds

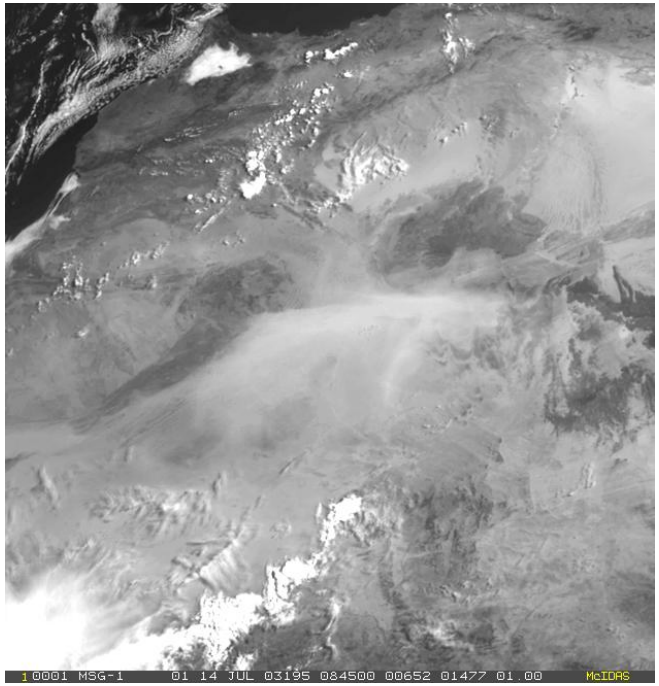


MSG-1
25 June 2003
10:00 UTC
Difference Image
Channels IR3.9 - IR10.8

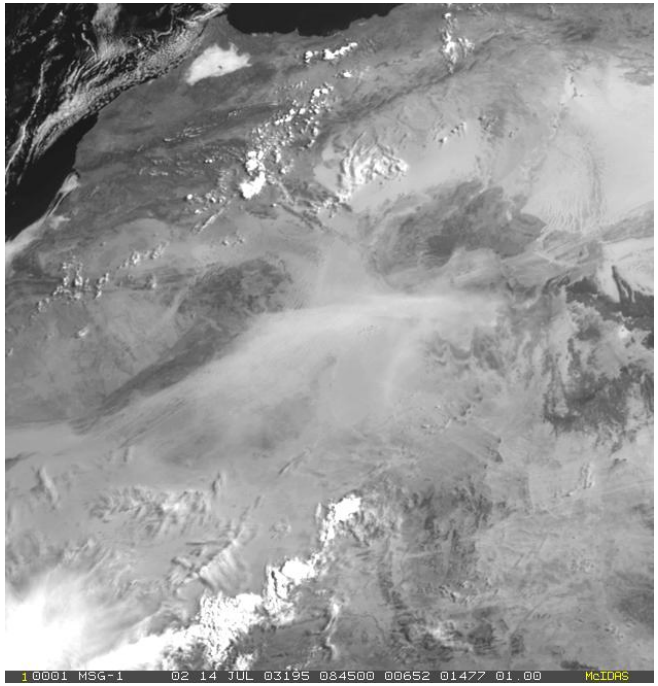
Monitoring of fires and fog, but also useful for the detection of dust storms over deserts.

Remote Sensing of Dust Clouds

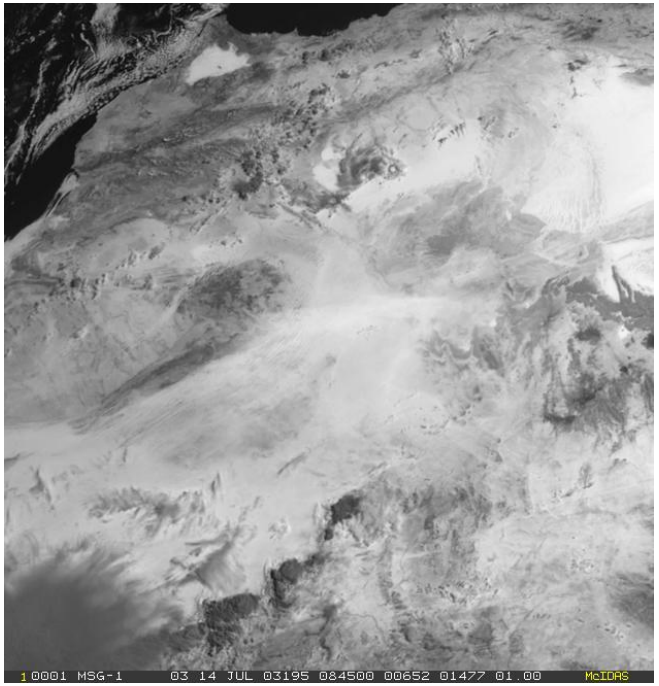
Recommended RGB for Monitoring of Dust Storms



Channel 01 (0.6 μm)



Channel 02 (0.8 μm)

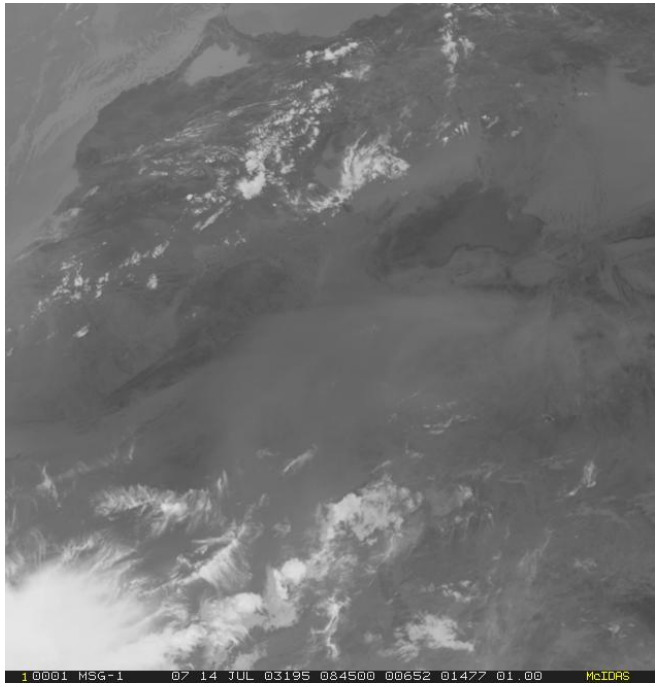


Channel 03 (1.6 μm)

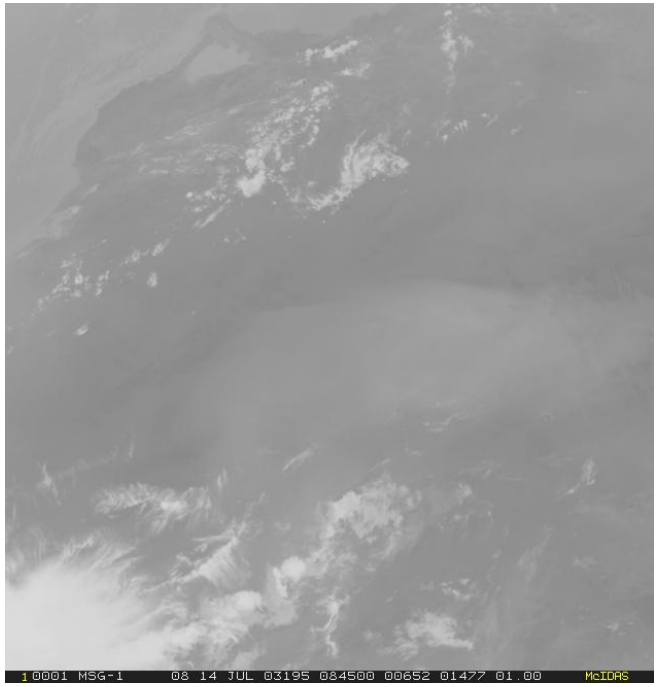
MSG **VIS** imagery on 14 July 2003 at 08:45 UTC
showing a **dust storm** over Algeria

Remote Sensing of Dust Clouds

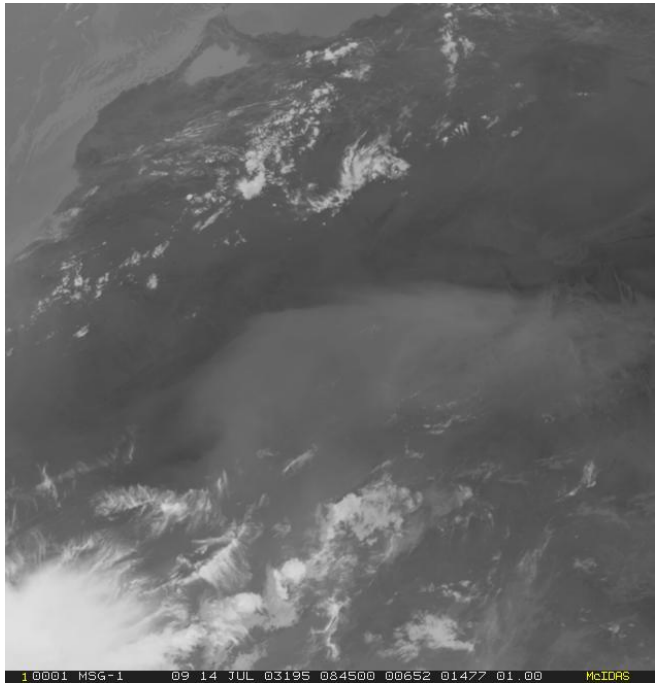
Recommended RGB for Monitoring of Dust Storms



Channel 07 (8.7 μm)



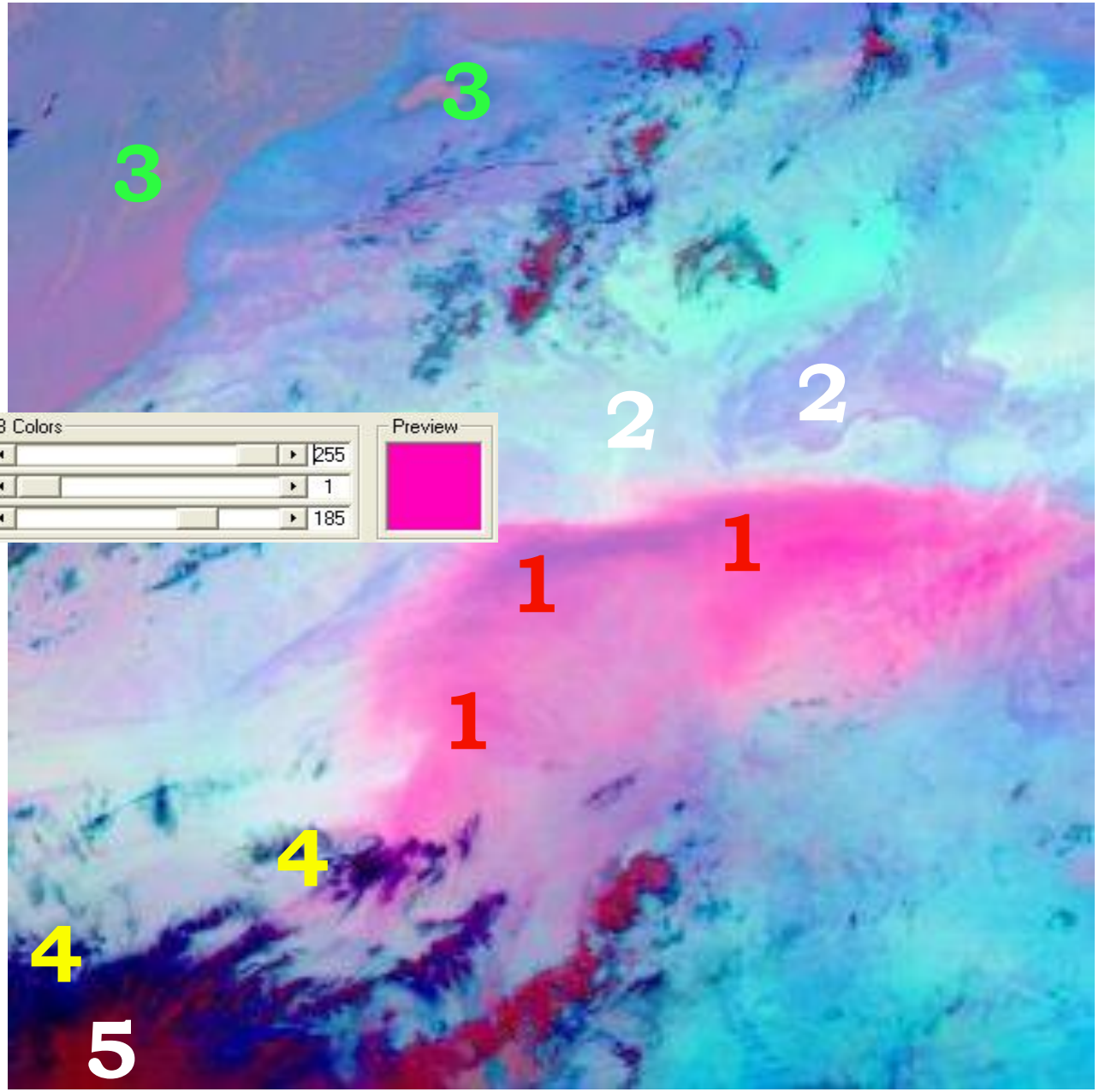
Channel 08 (9.7 μm)



Channel 09 (10.8 μm)

MSG **IR** imagery on 14 July 2003 at 08:45 UTC
showing a **dust storm** over Algeria

Recommended RGB for Monitoring of Dust Storms



1= dust storm

2= clear ground

3 = low-level clouds

4 = thin high-level clouds

5 = thick high-level clouds

MSG-1
14 July 2003
10:00 UTC
RGB Composite

R = IR12.0 - IR10.8
G = IR10.8 - IR8.7
B = IR10.8

Questions ?