1st EARLINET Symposium, 11-12 February 2003, Hamburg, Germany

Saharan dust outbreaks towards Europe: 3 years of systematic observations (2000-2003)

A. PAPAYANNIS

Lasers and Applications Laboratory

National Technical University of Athens, Greece

Saharan dust outbreaks to Europe:

Objectives and Methodology

Implementation of a routine monitoring scheme, mainly in the south and central European region, for the observation of specifically high aerosol loads in the lower troposphere, resulting from extreme dust events (Saharan dust outbreaks)

Forecasting scheme

Use dust forecasting models (DREAM/ICOD, SKIRON/UOA, NAAPS/NOAA/NRL models), Satellite data (EP/TOMS AI, SeaWiFS AOT, NOAA/AVHRR AOT)

Coordination

NTUA Group (Warnings: -24-48 h)

Ancillary Measurements

Spectral UV-B Measurements, Sun photometers, Meteorological observations

Validation tools

- Air-mass back-trajectory analysis

German Meteorological Service (DWD/GME Model)

- Satellite data analysis

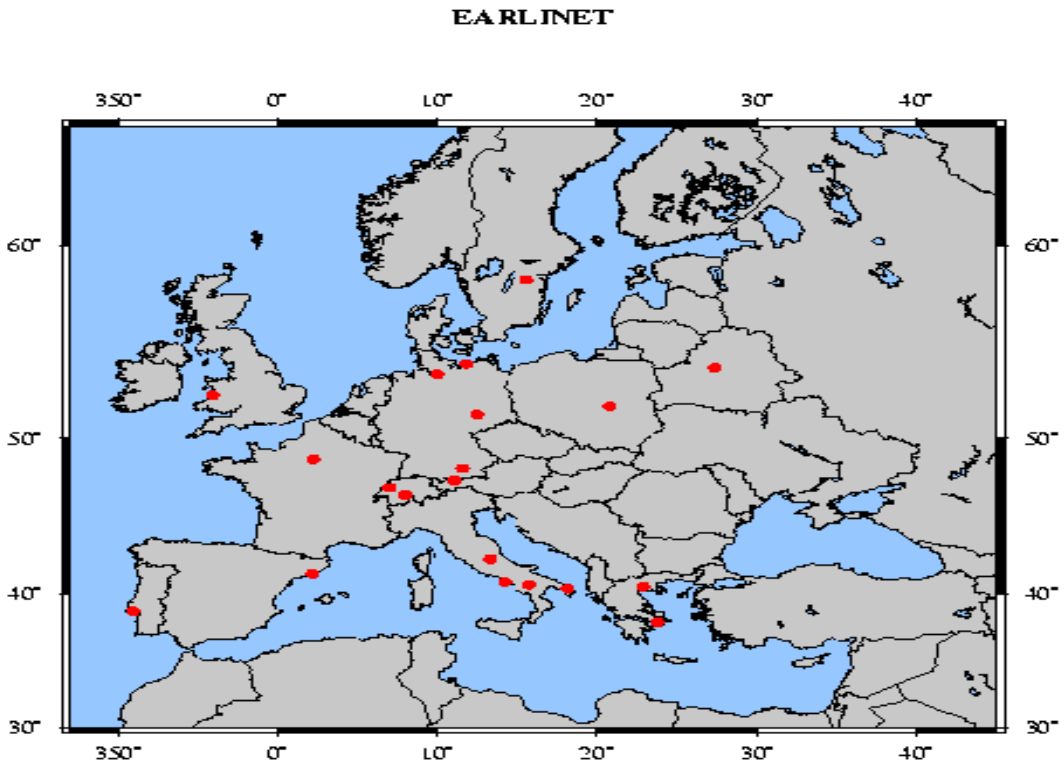
EP/TOMS & SeaWiFS data

- Sun photometer data analysis

Saharan dust events (2000-2003)

>105 cases forecasted, 85 cases followed up

EARLINET LIDAR MONITORING STATIONS



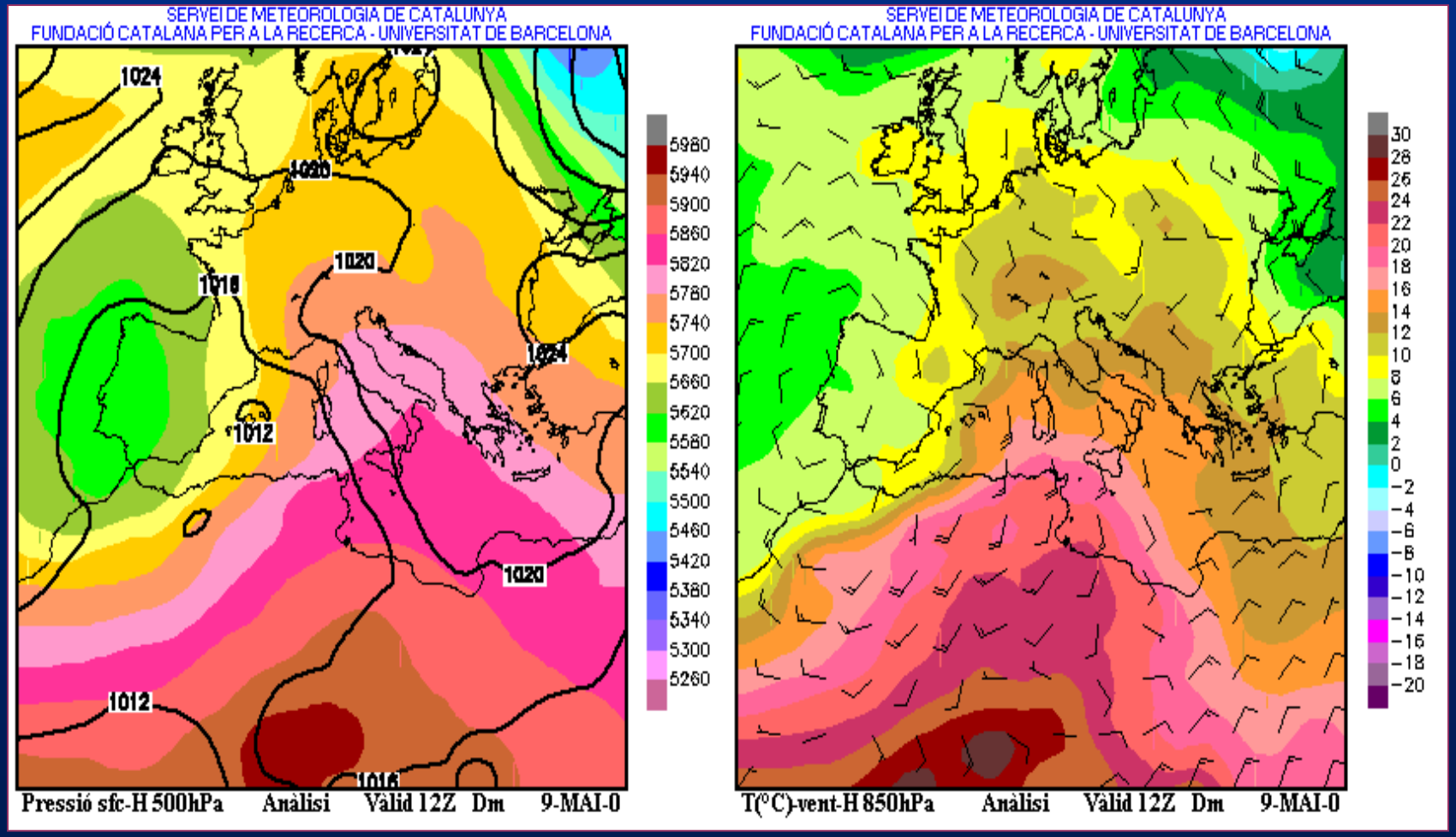
Selection of Saharan Dust Events

CASE I: SAHARAN DUST EVENT (08-11.05.00)

Typical Case

SAHARAN DUST EVENT (08-11.05.00)

METEO SPAIN 090500 12UT



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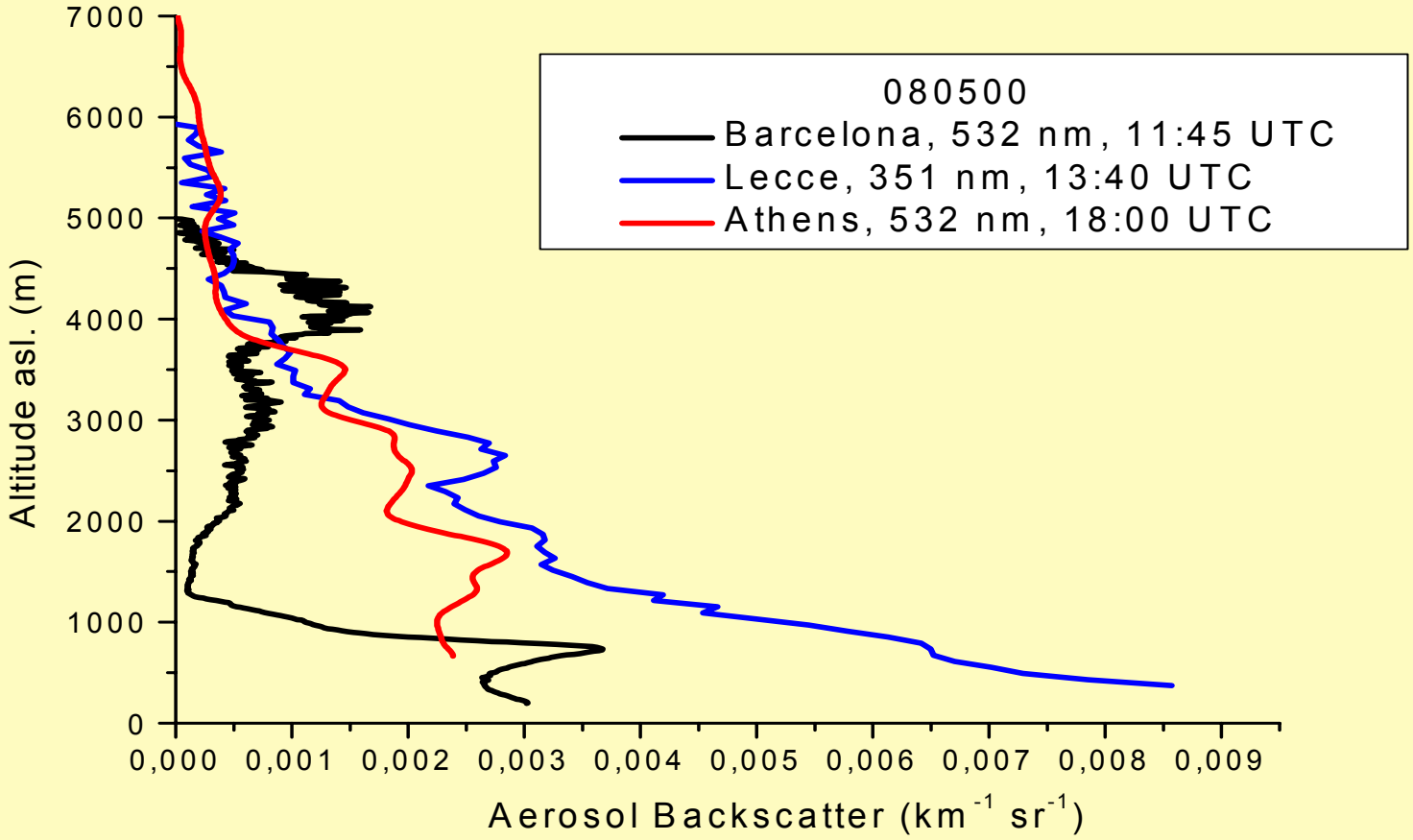
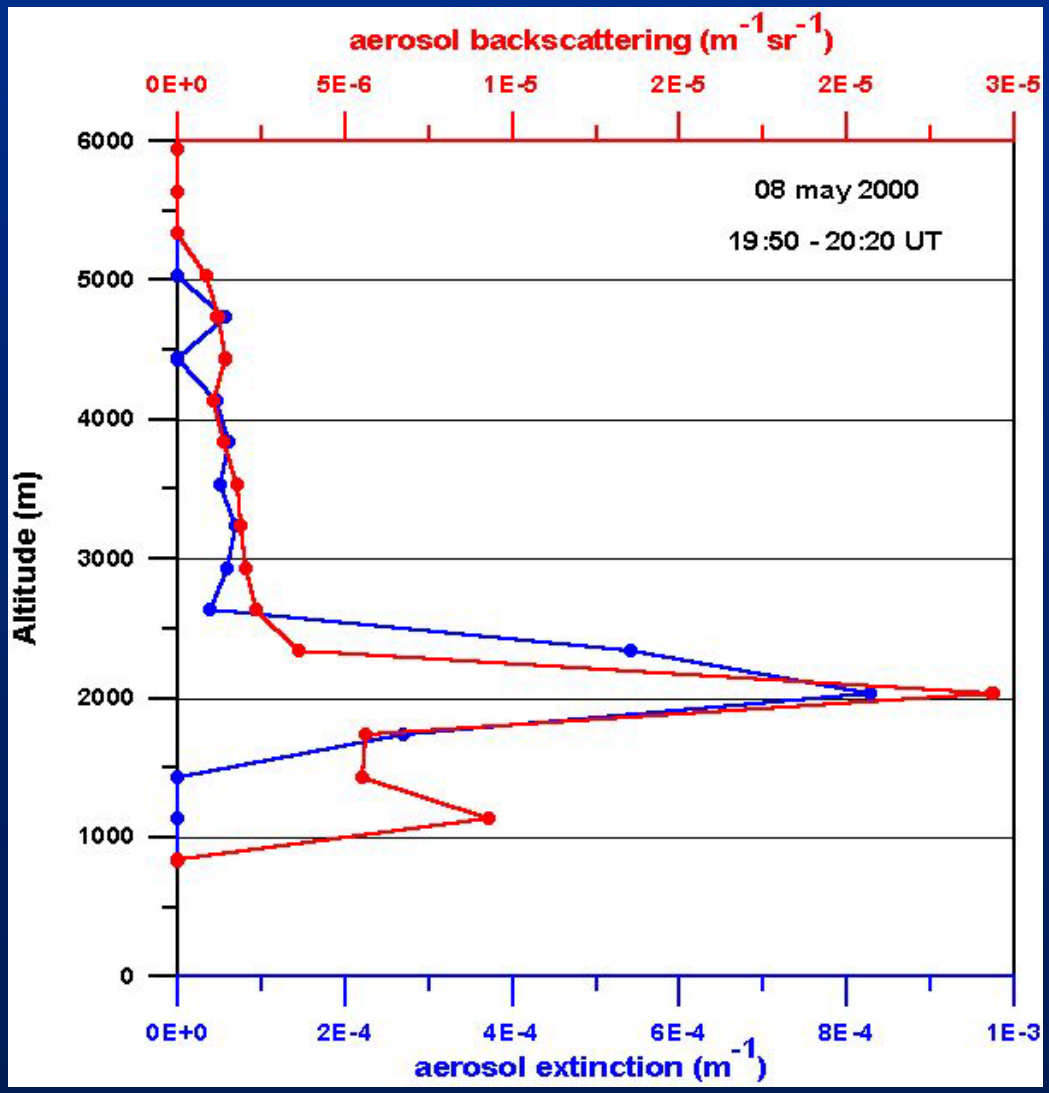


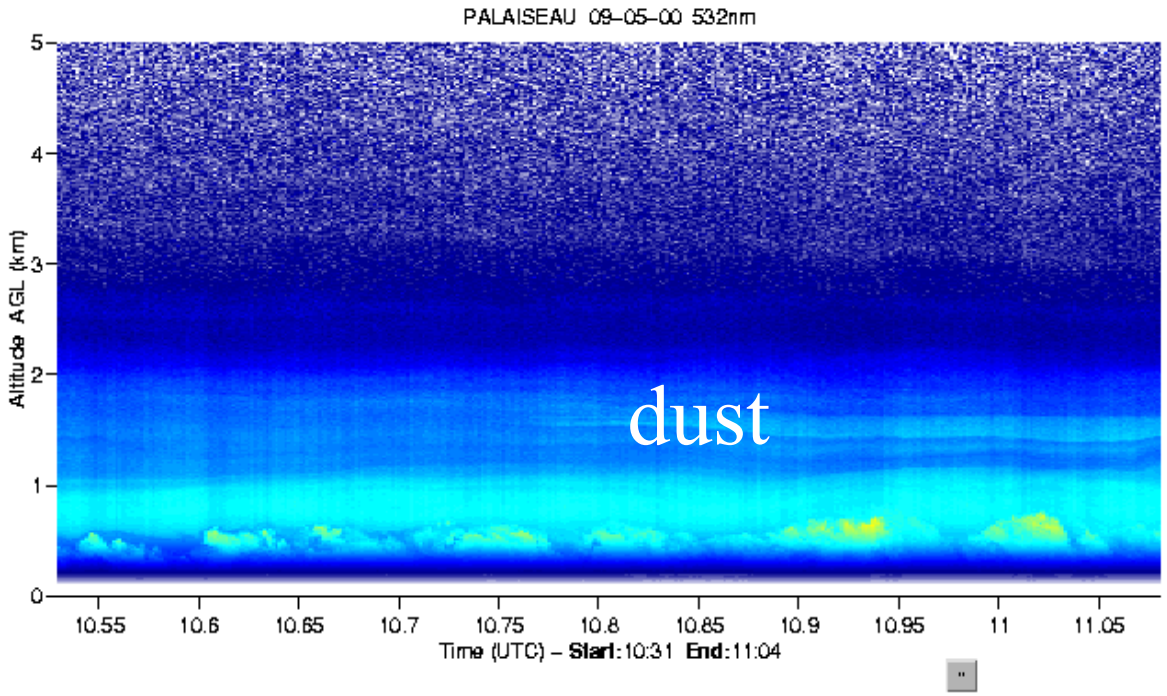
SAHARAN DUST EVENT (08-11.05.00)



Laquila, 080500

SAHARAN DUST EVENT (08-11.05.00)

Palaiseau, 090500



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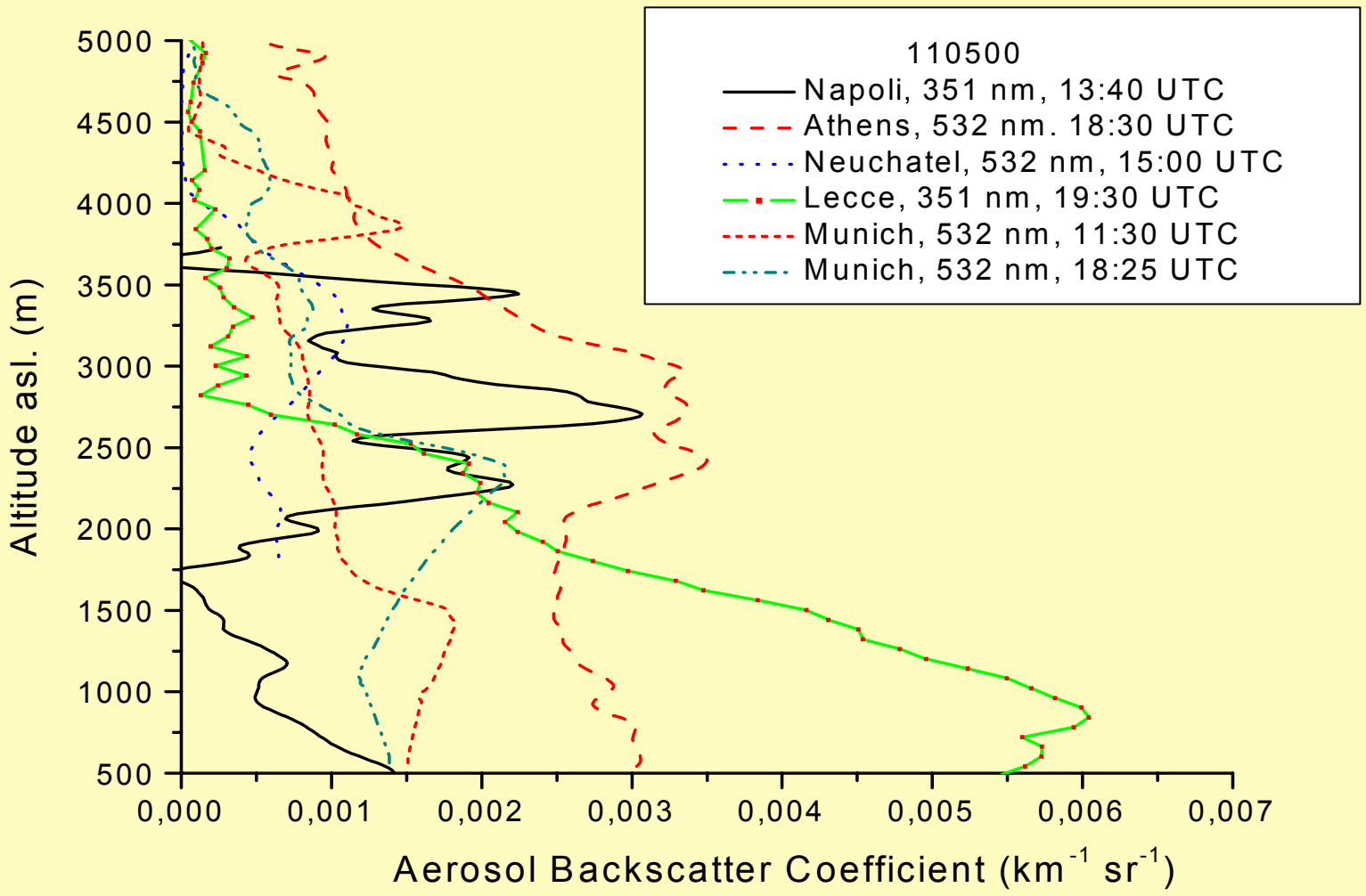
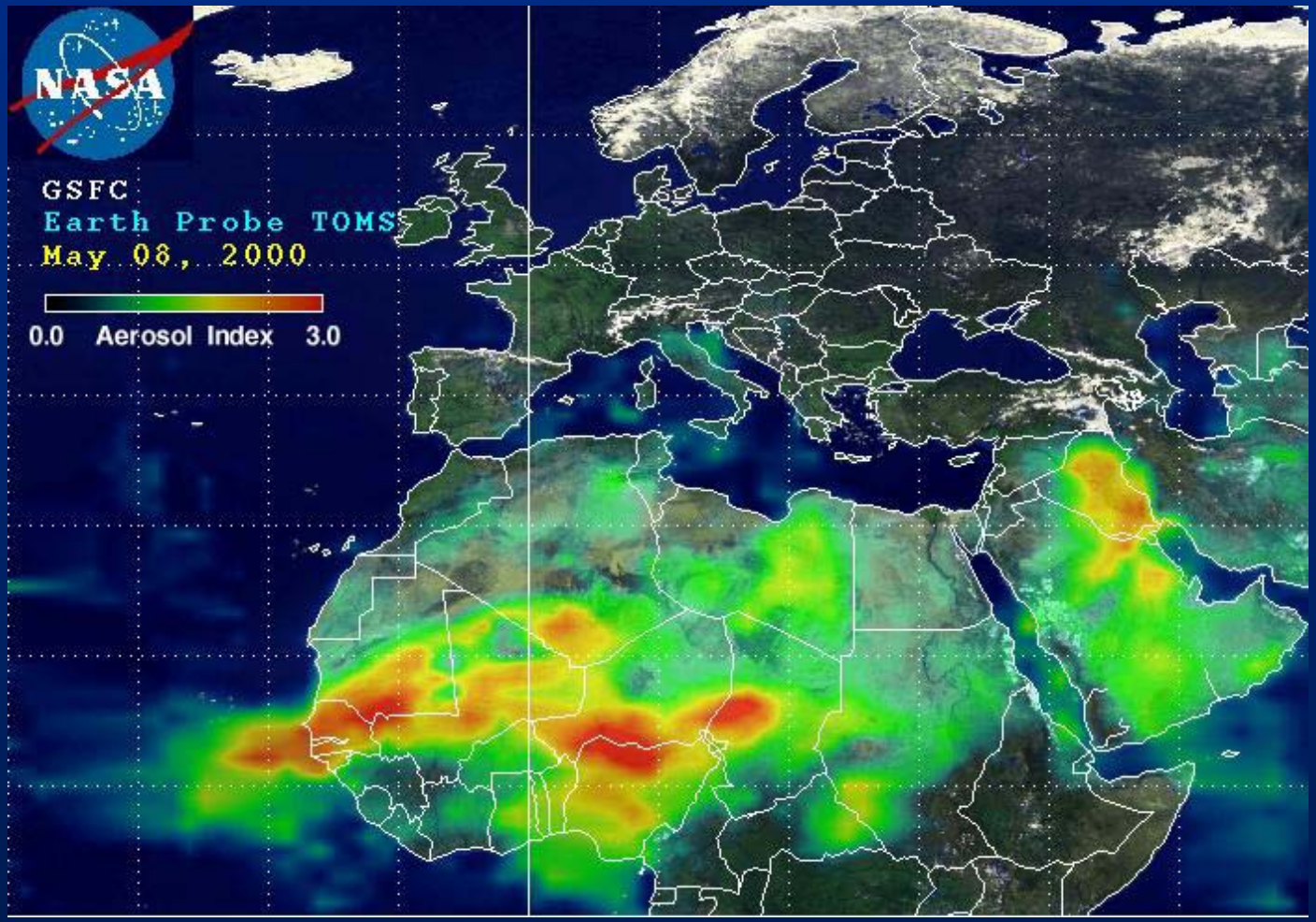


SAHARAN DUST EVENT (08-11.05.00)

NASA EP/TOMS Aerosol Index 080500



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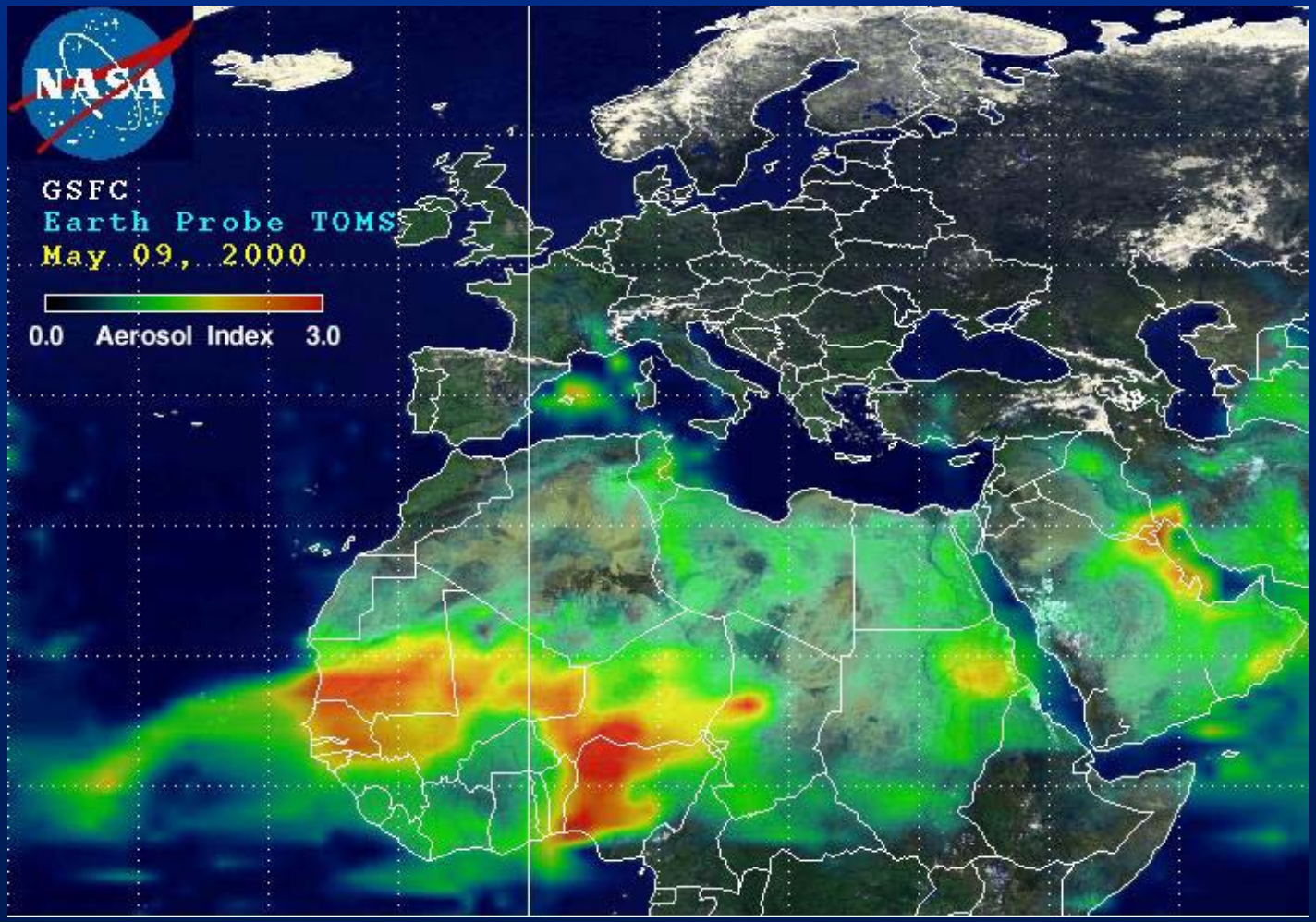
NASA EP/TOMS Aerosol Index 090500



SAHARAN DUST EVENT (08-11.05.00)

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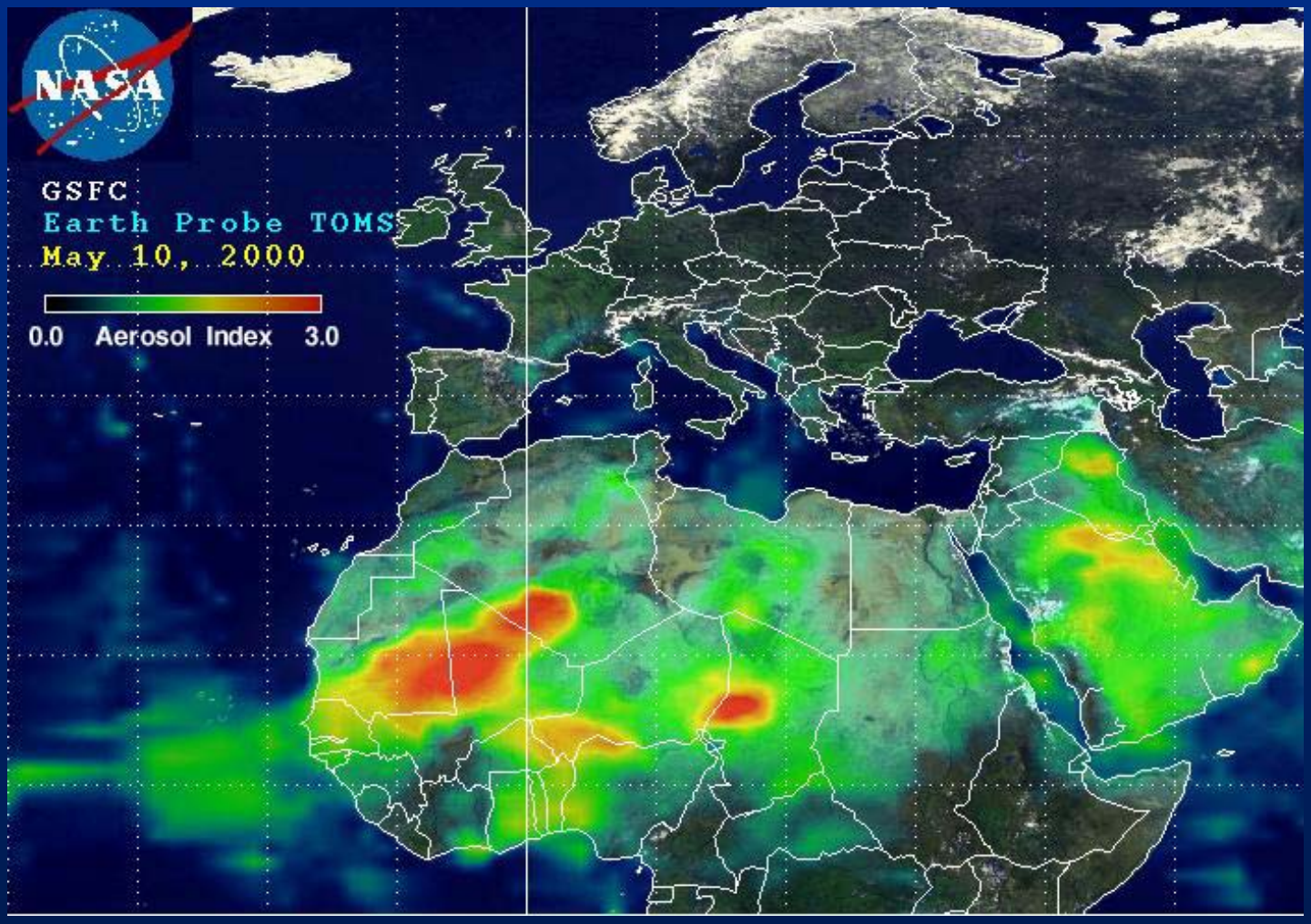

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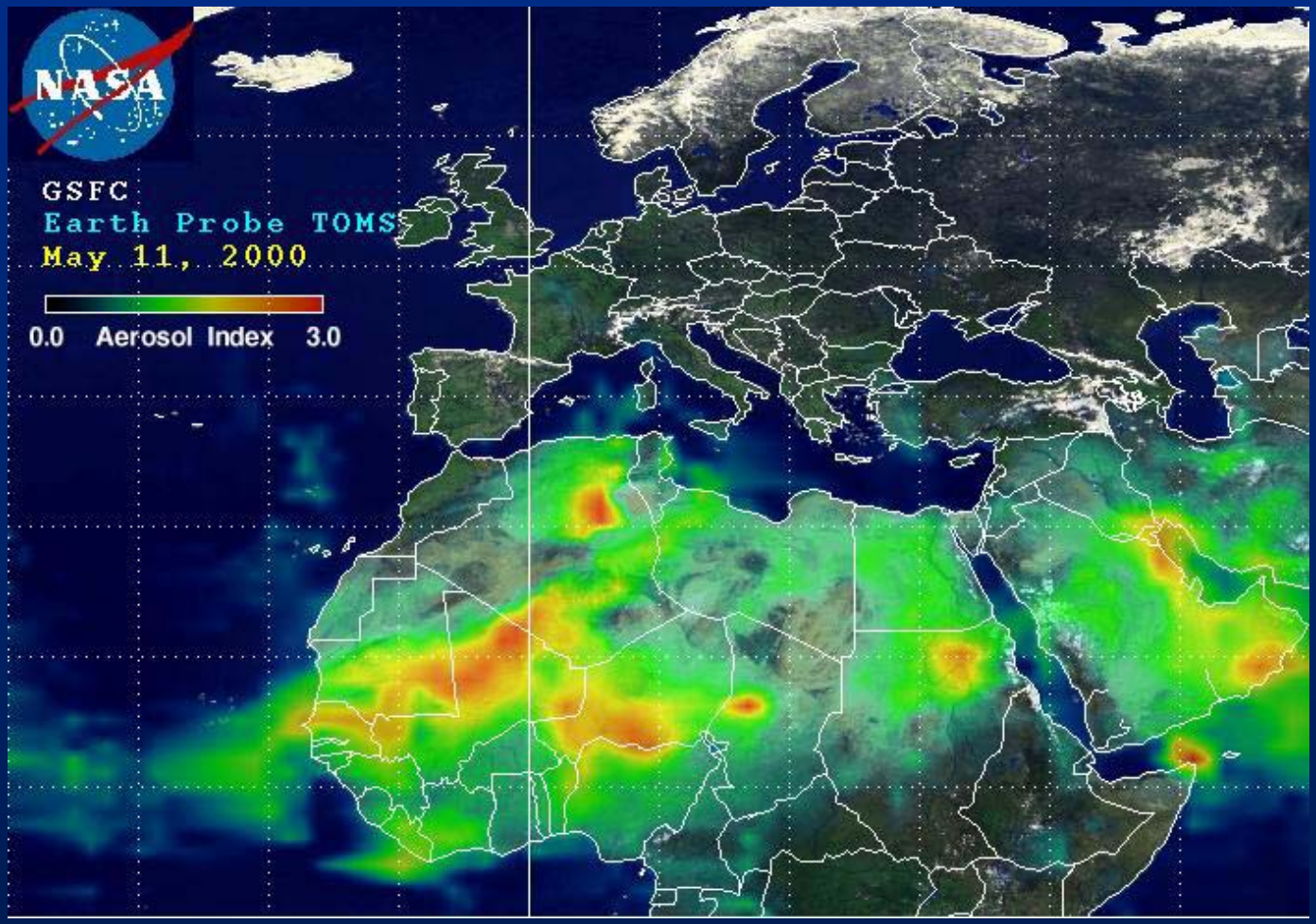
NASA EP/TOMS Aerosol Index 110500



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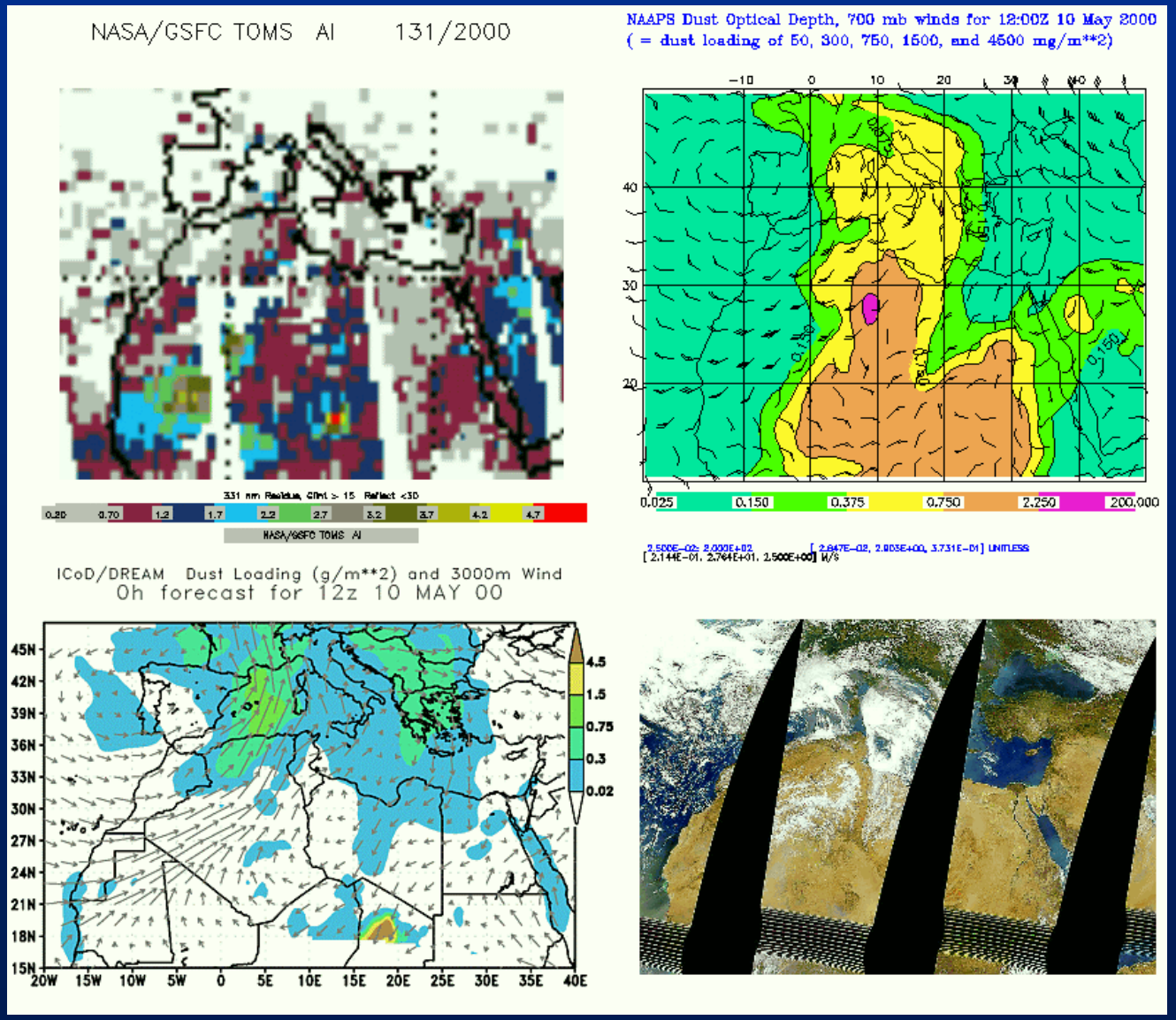

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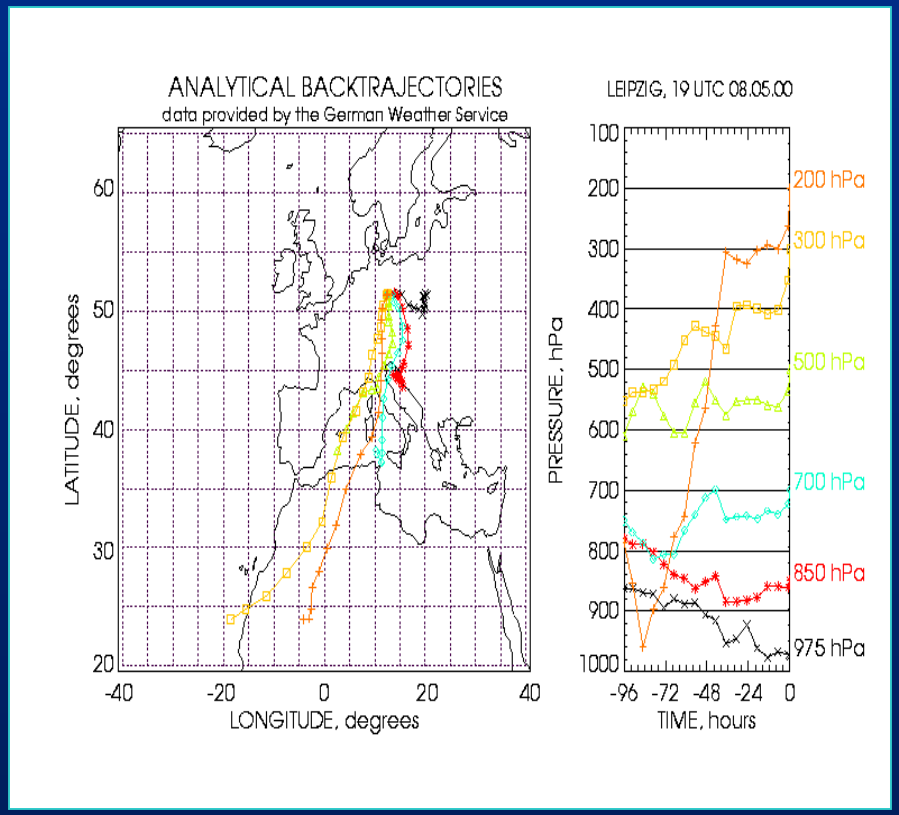
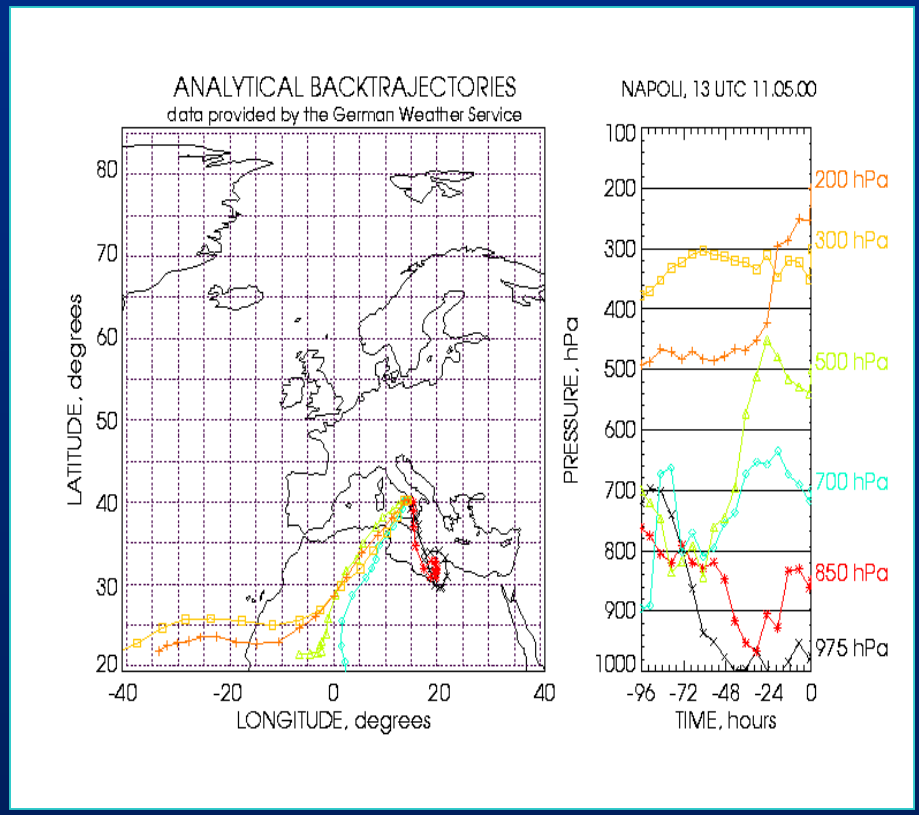
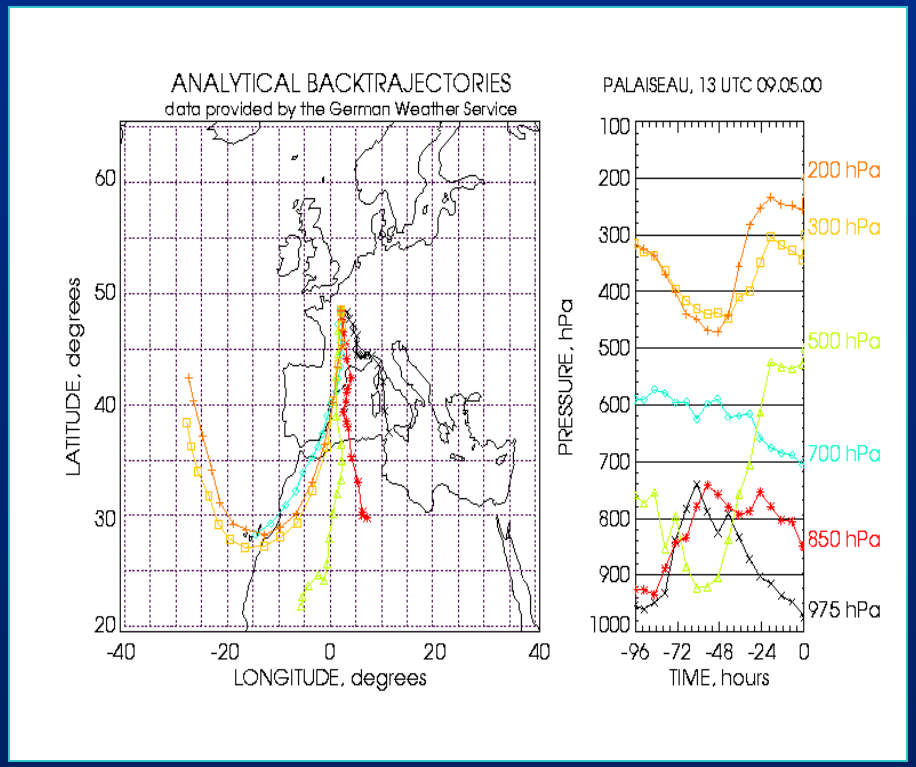


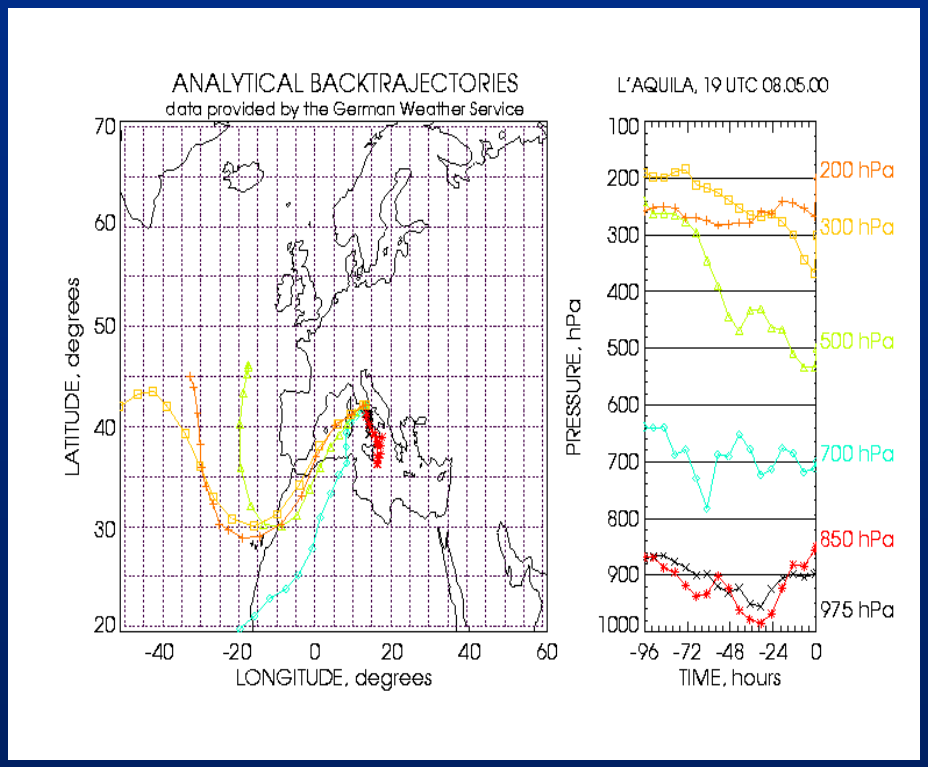
Leipzig, 19UT, 080500



Napoli, 13UT 110500

SAHARAN DUST EVENT (08-11.05.00)





Palaiseau, 13UT, 090500

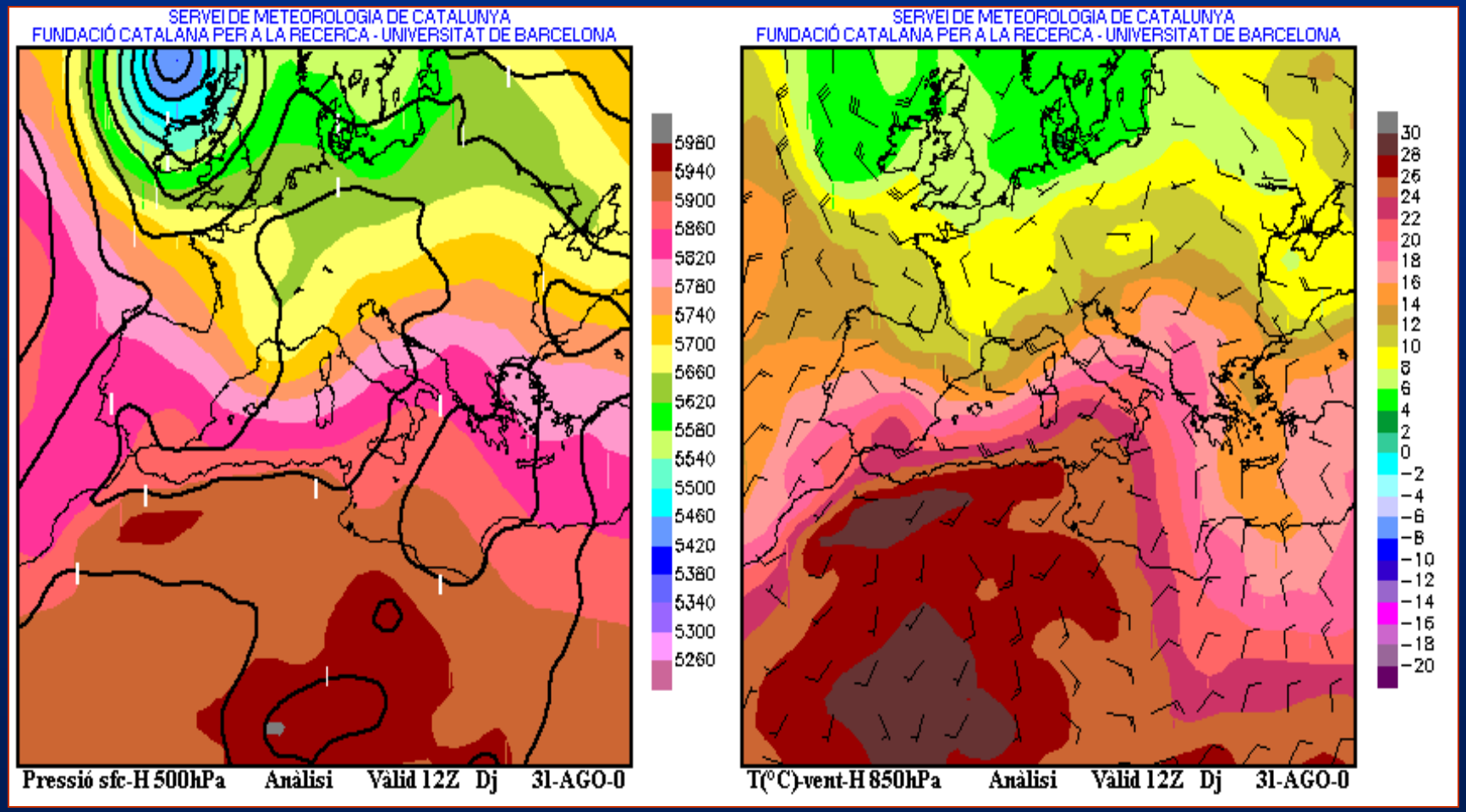
L'Aquila, 19UT 080500

CASE II: SAHARAN DUST EVENT (28-31.08.00)

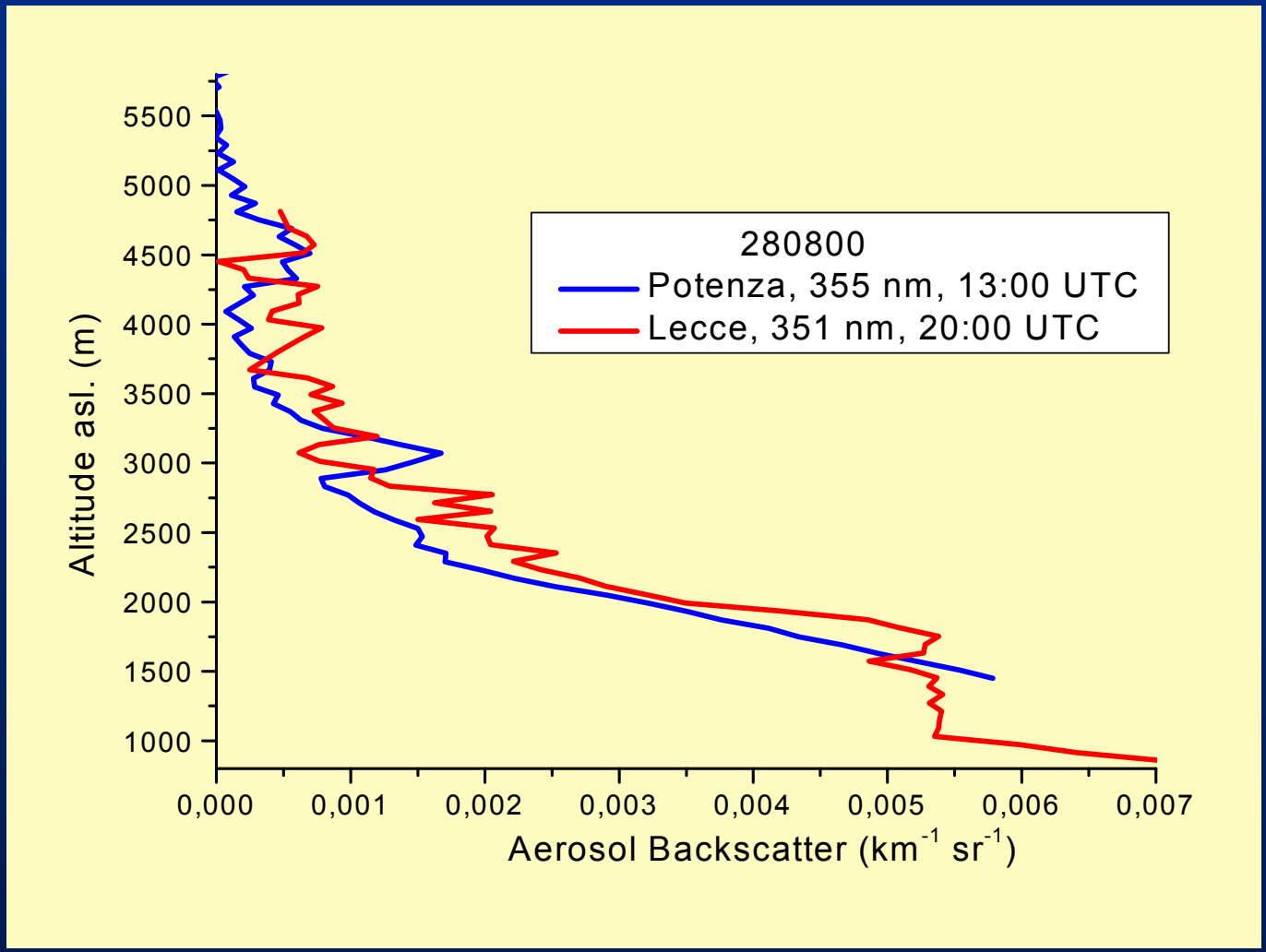
Intense Case

SAHARAN DUST EVENT (28-31.08.00)

METEO SPAIN 310800 12UT

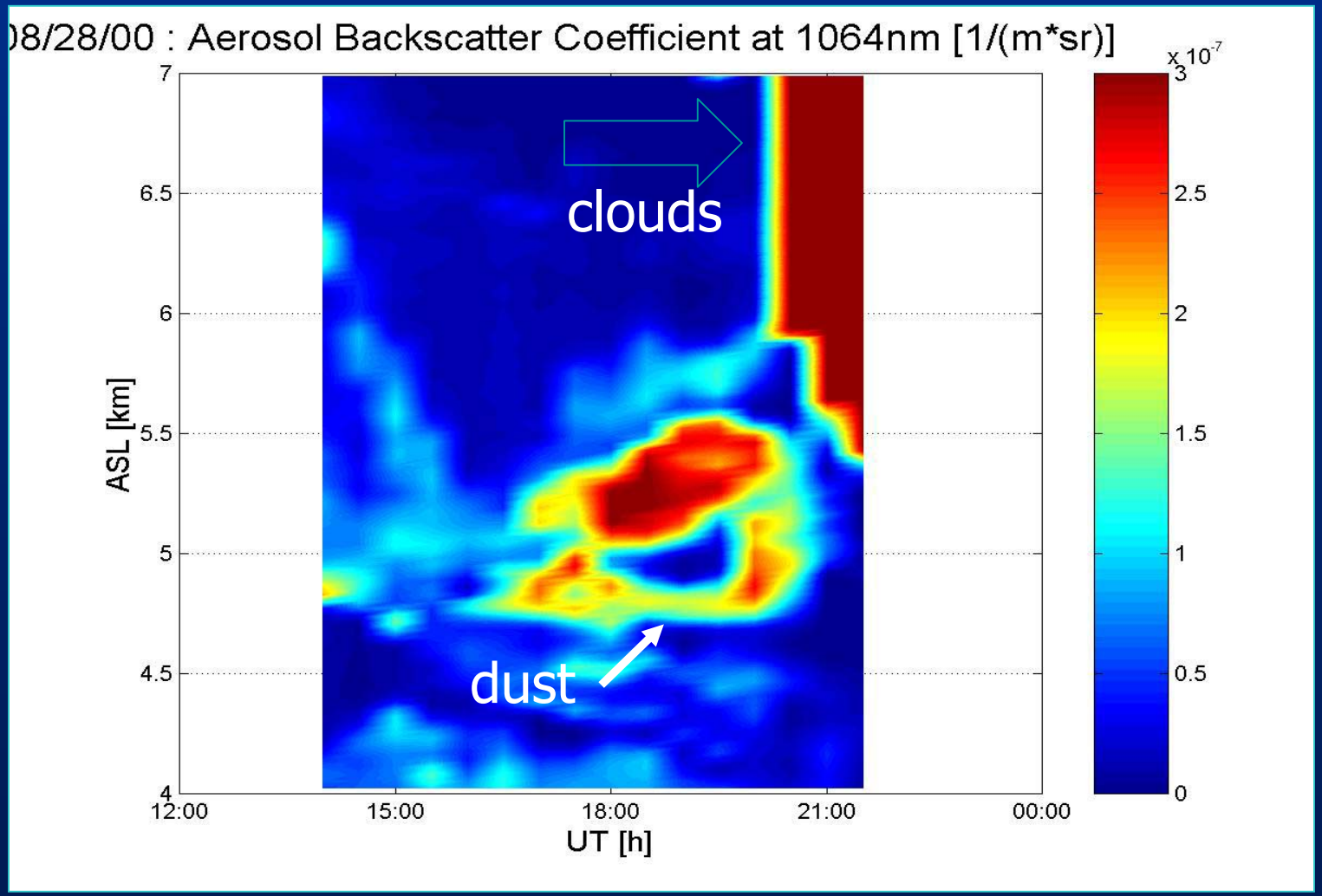


SAHARAN DUST EVENT (28-31.08.00)



SAHARAN DUST EVENT (28-31.08.00)

Lidar Profiles (1064 nm) Jungfraujoch 280800



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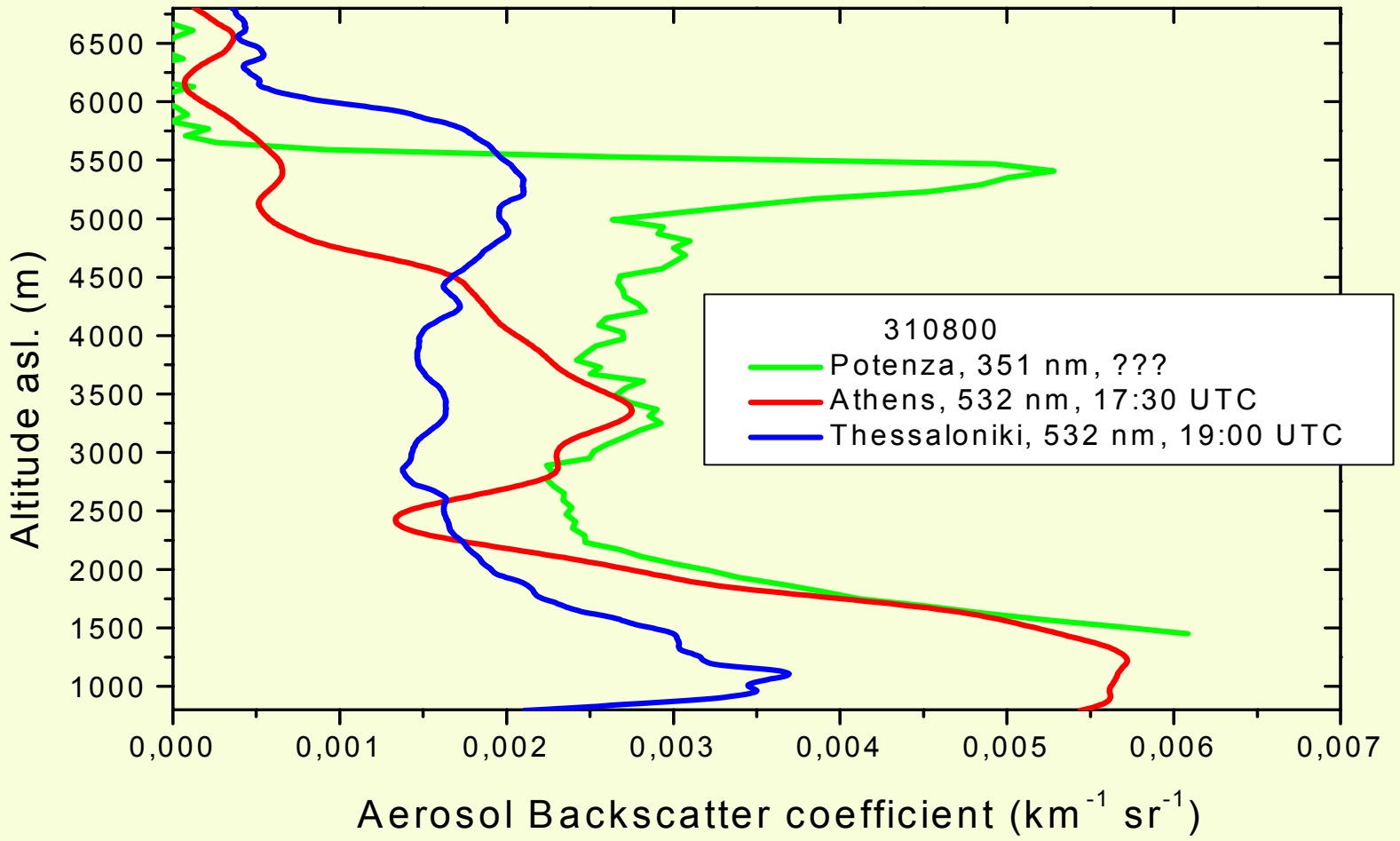
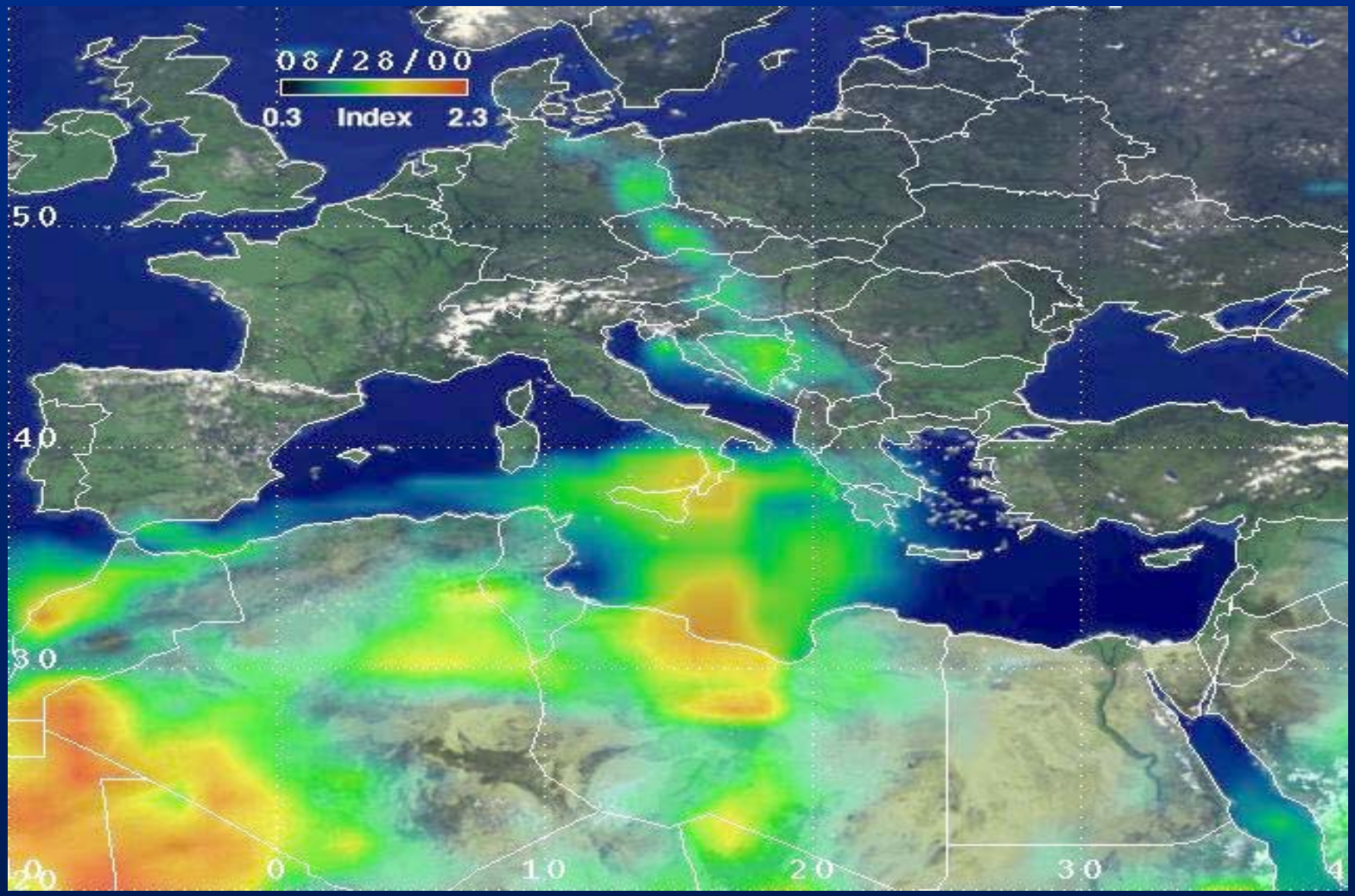


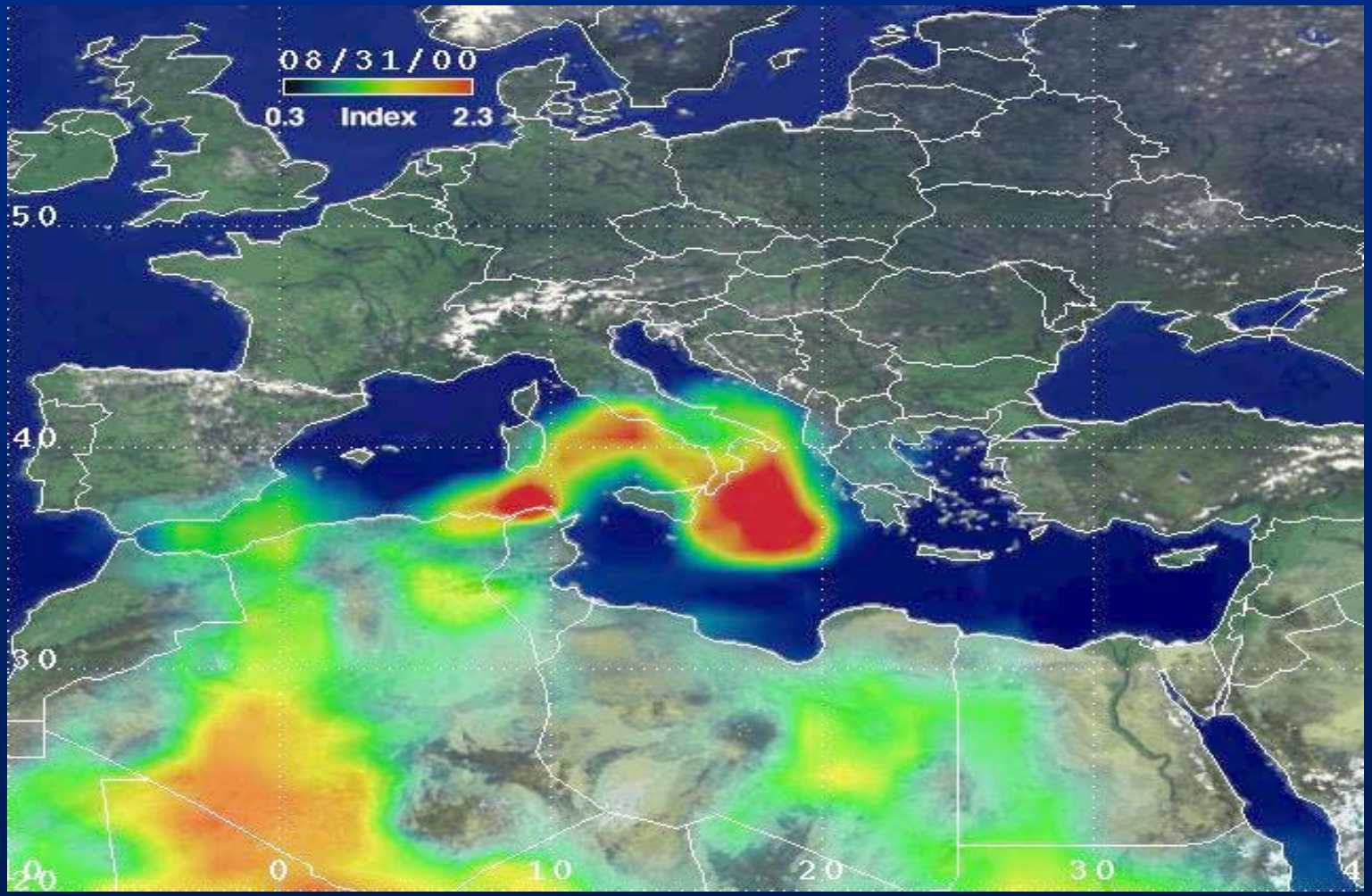
SAHARAN DUST EVENT (28-31.08.00)

NASA-EP/TOMS Aerosol Index 28.08.00



SAHARAN DUST EVENT (28-31.08.00)

NASA-EP/TOMS Aerosol Index 31.08.00



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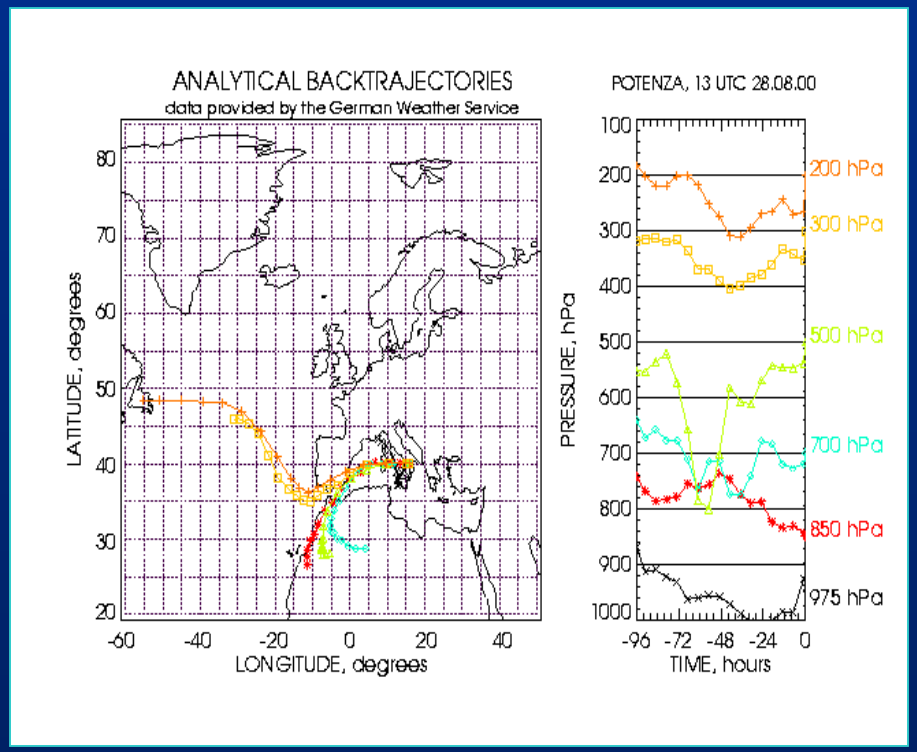
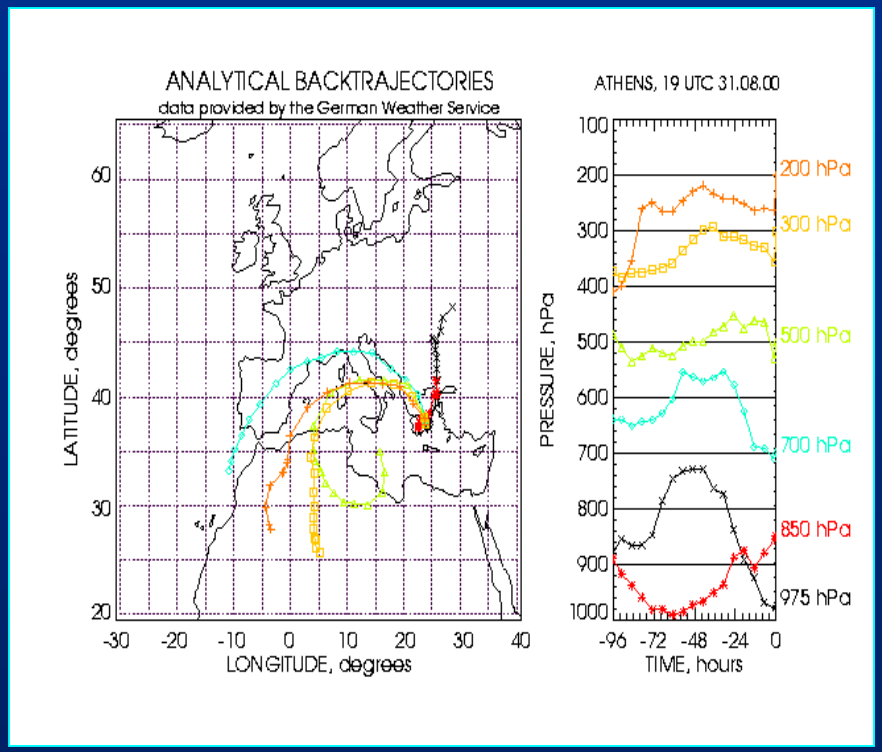


Potenza, 13UT, 280800



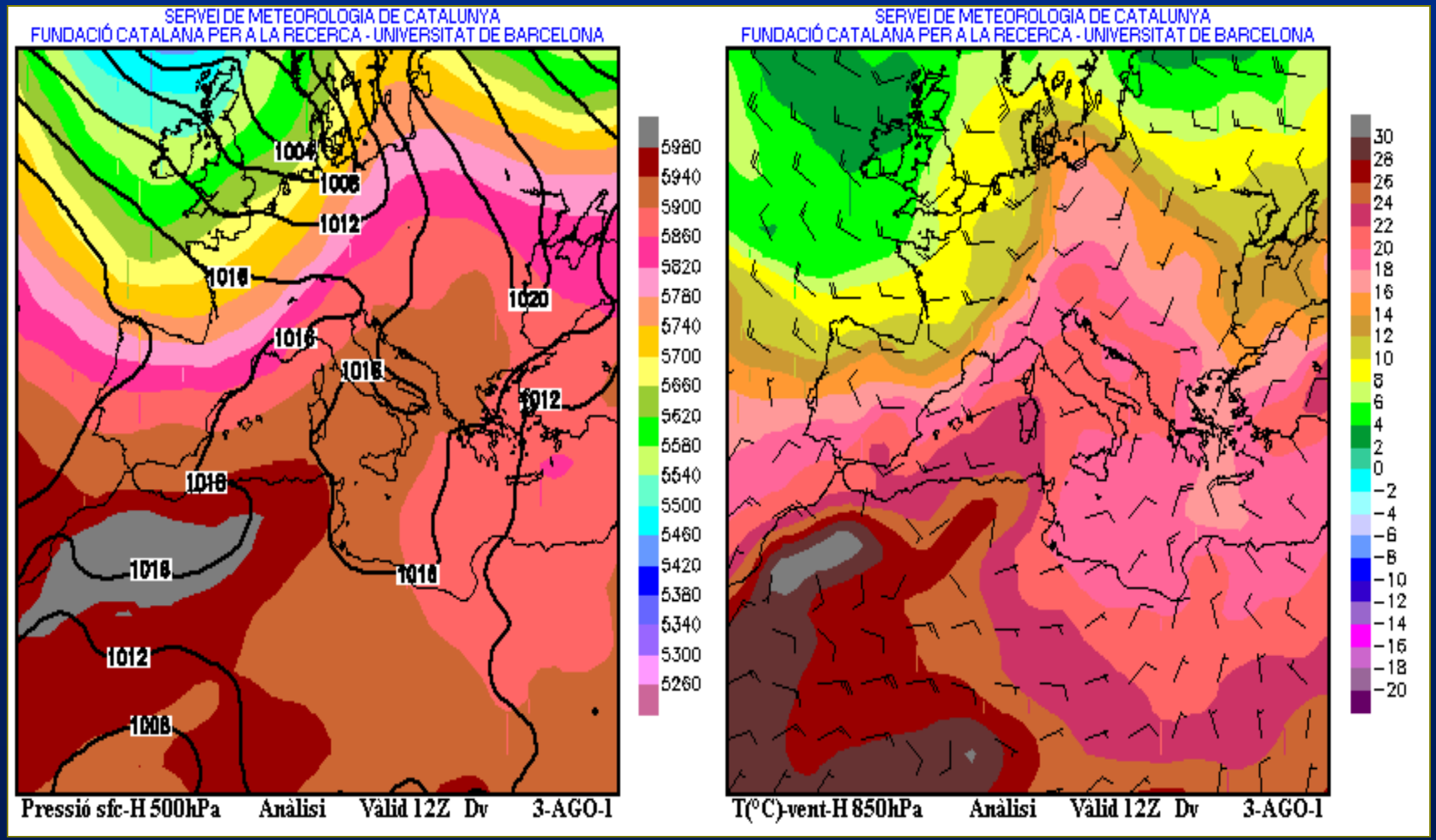
Athens, 19UT, 310800

CASE III: SAHARAN DUST EVENT (02-10.08.01)

Intense Case

SAHARAN DUST EVENT (02-10.08.01)

METEO SPAIN 030801 12UT



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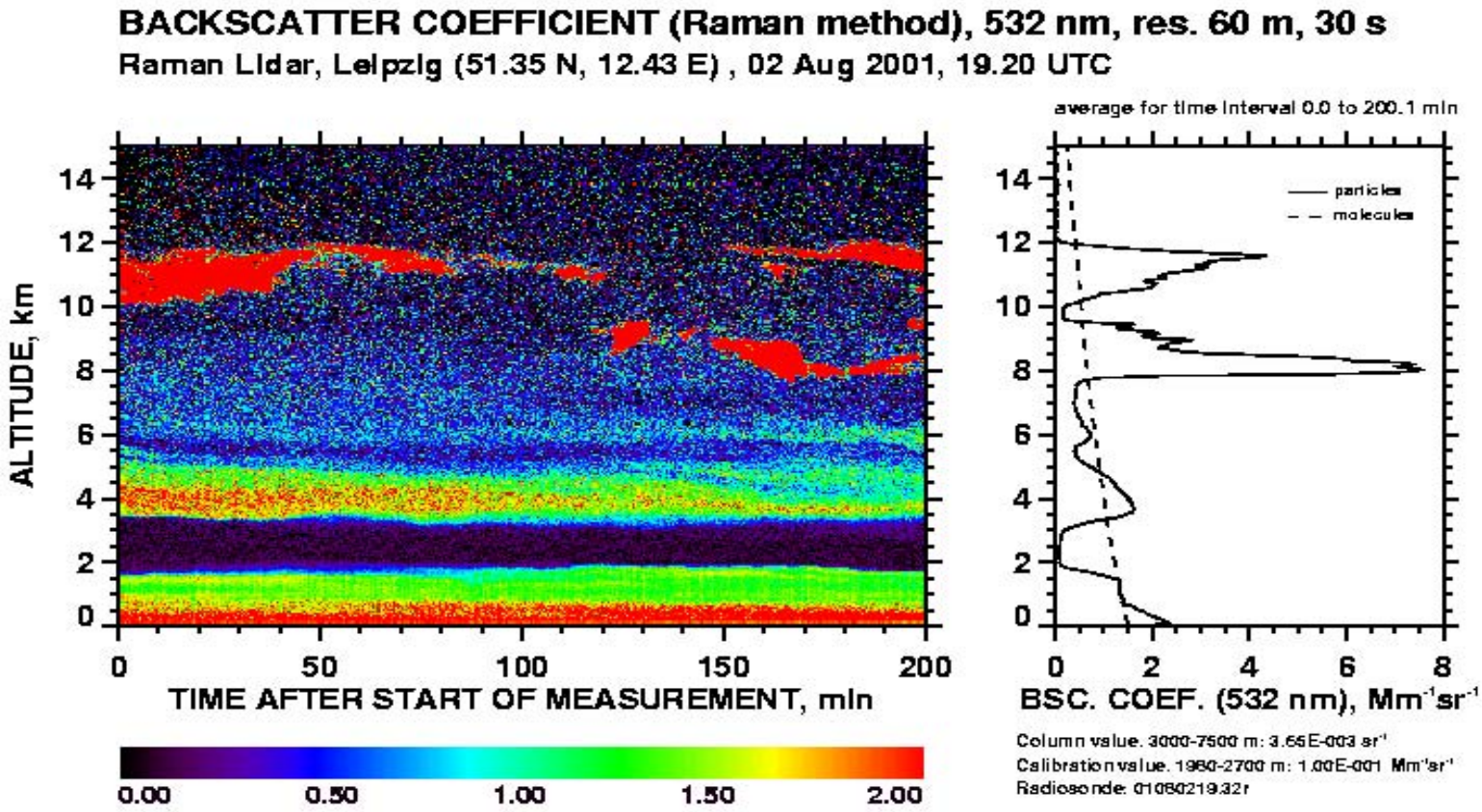

Mattis et al., *Geophys. Res. Lett.*, **29**, No 9, 10.1029/2002GL014721, 2002.

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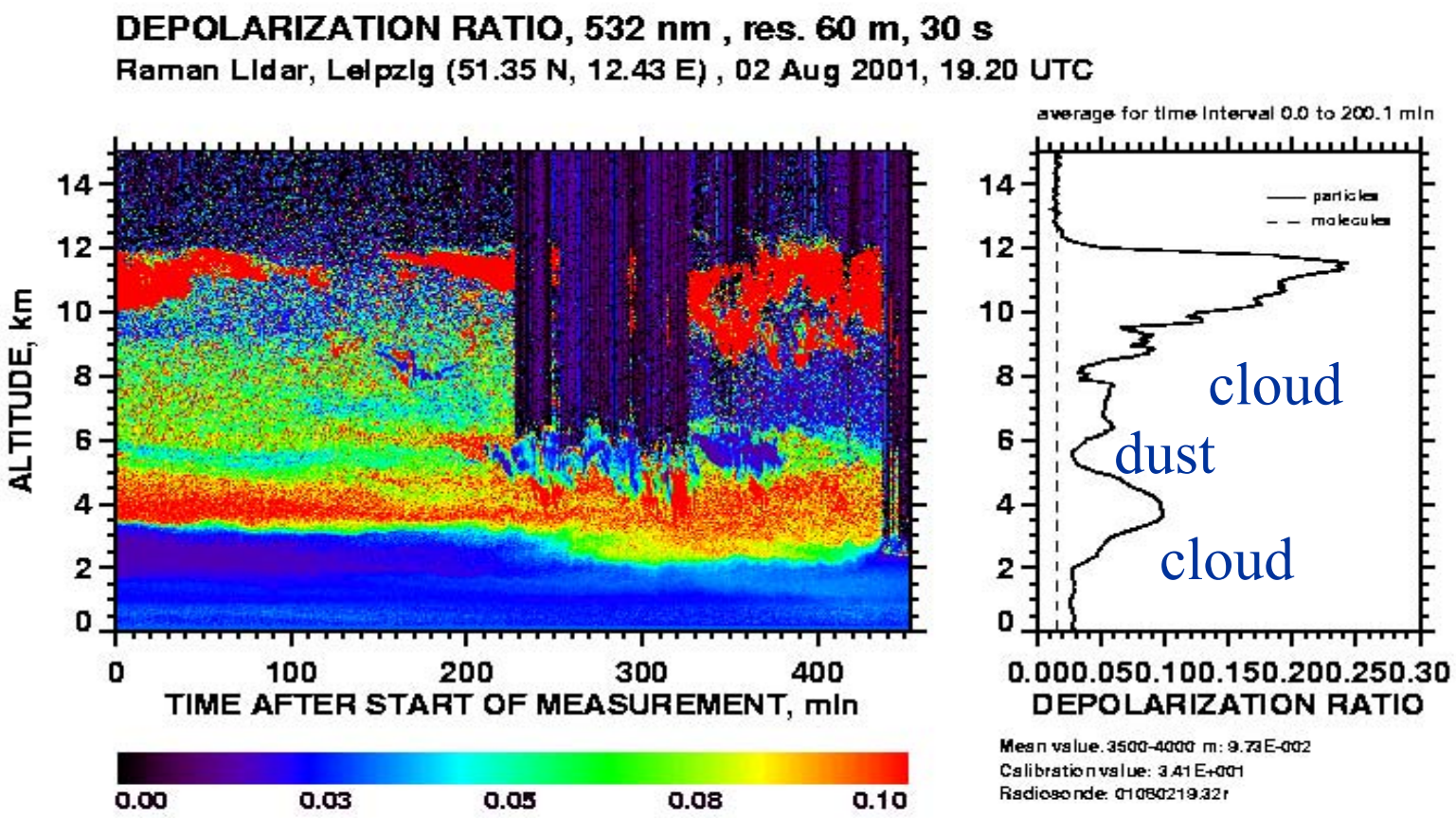

Mattis et al., *Geophys. Res. Lett.*, **29**, No 9, 10.1029/2002GL014721, 2002.

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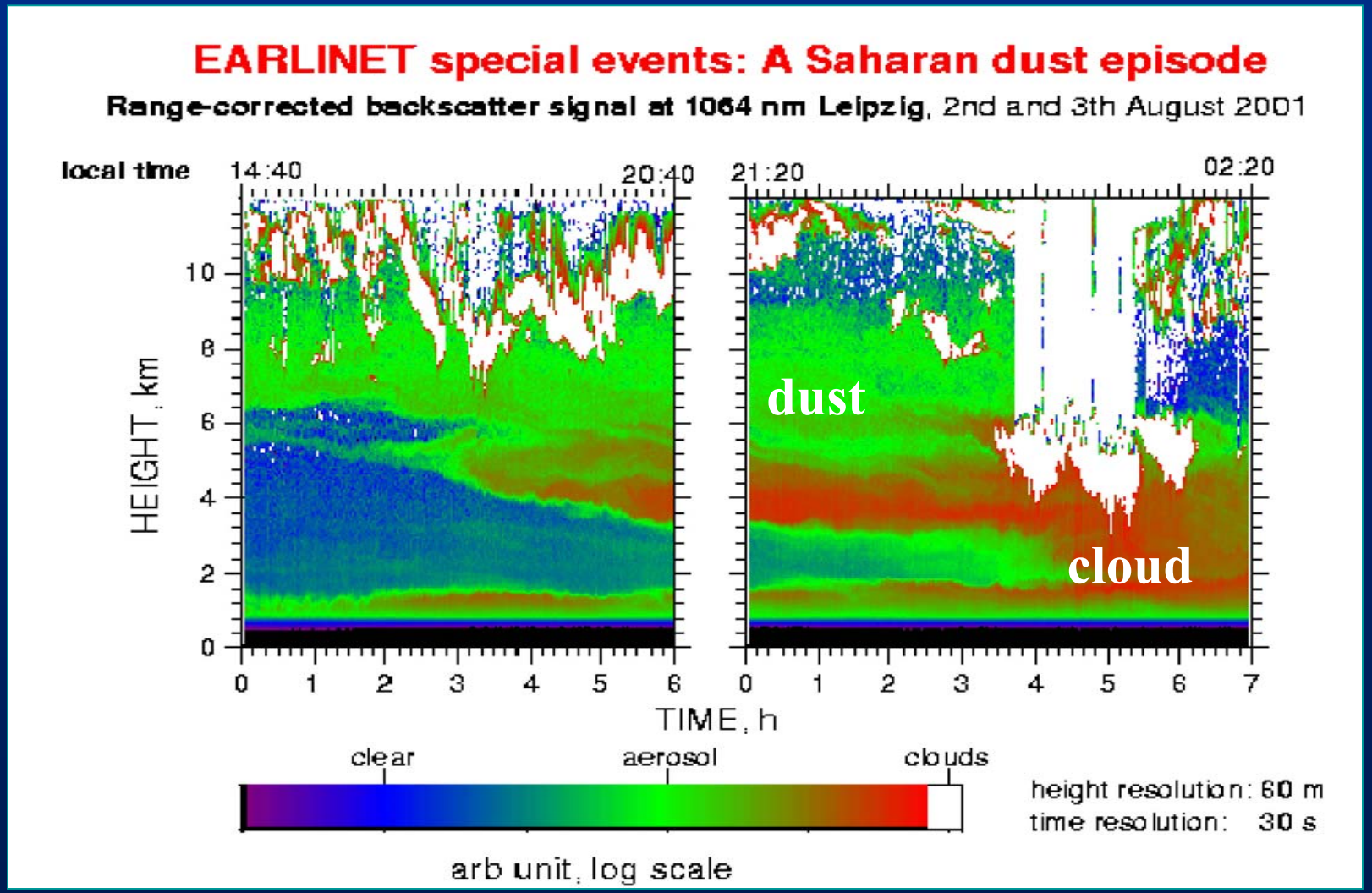

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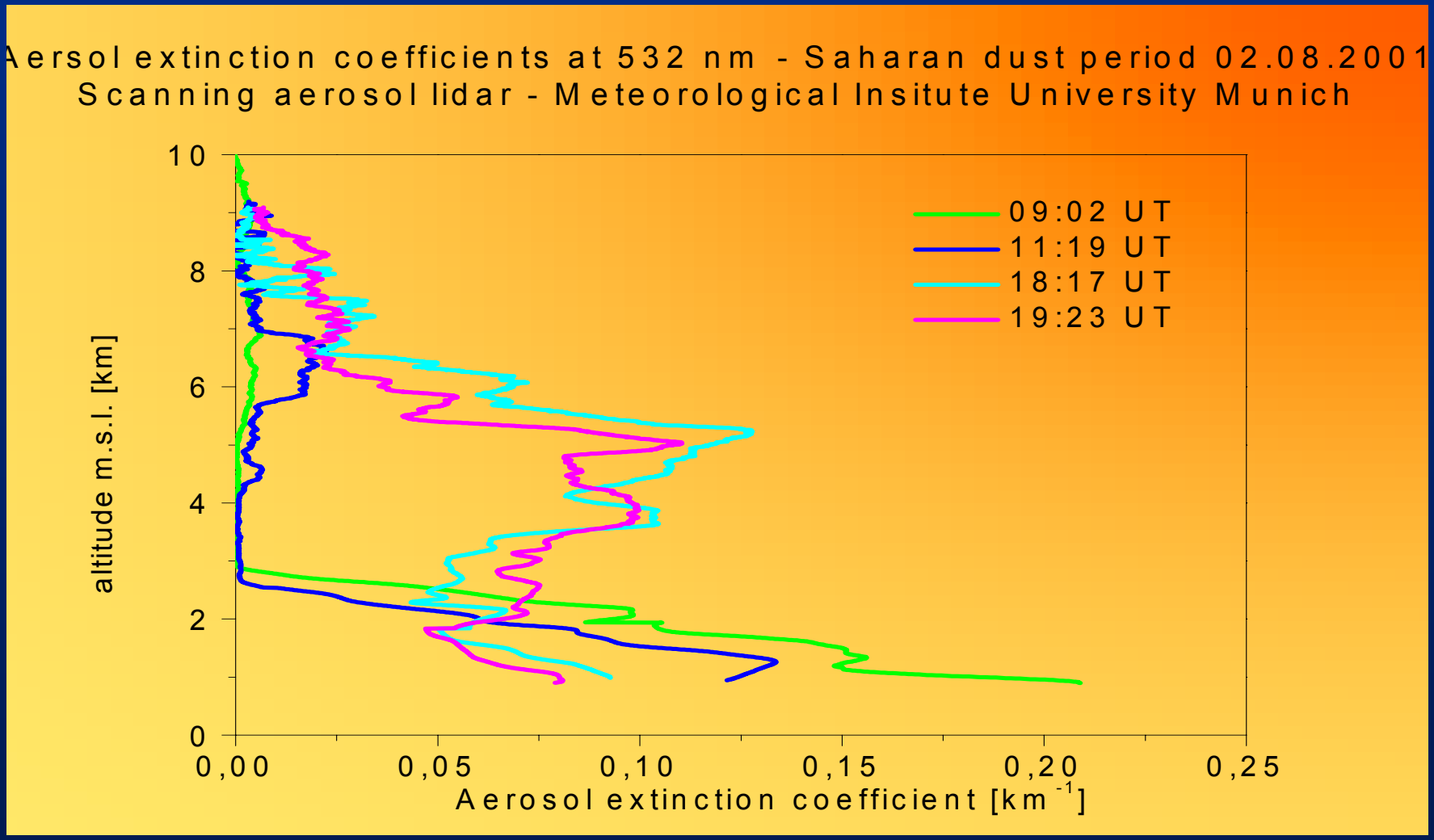

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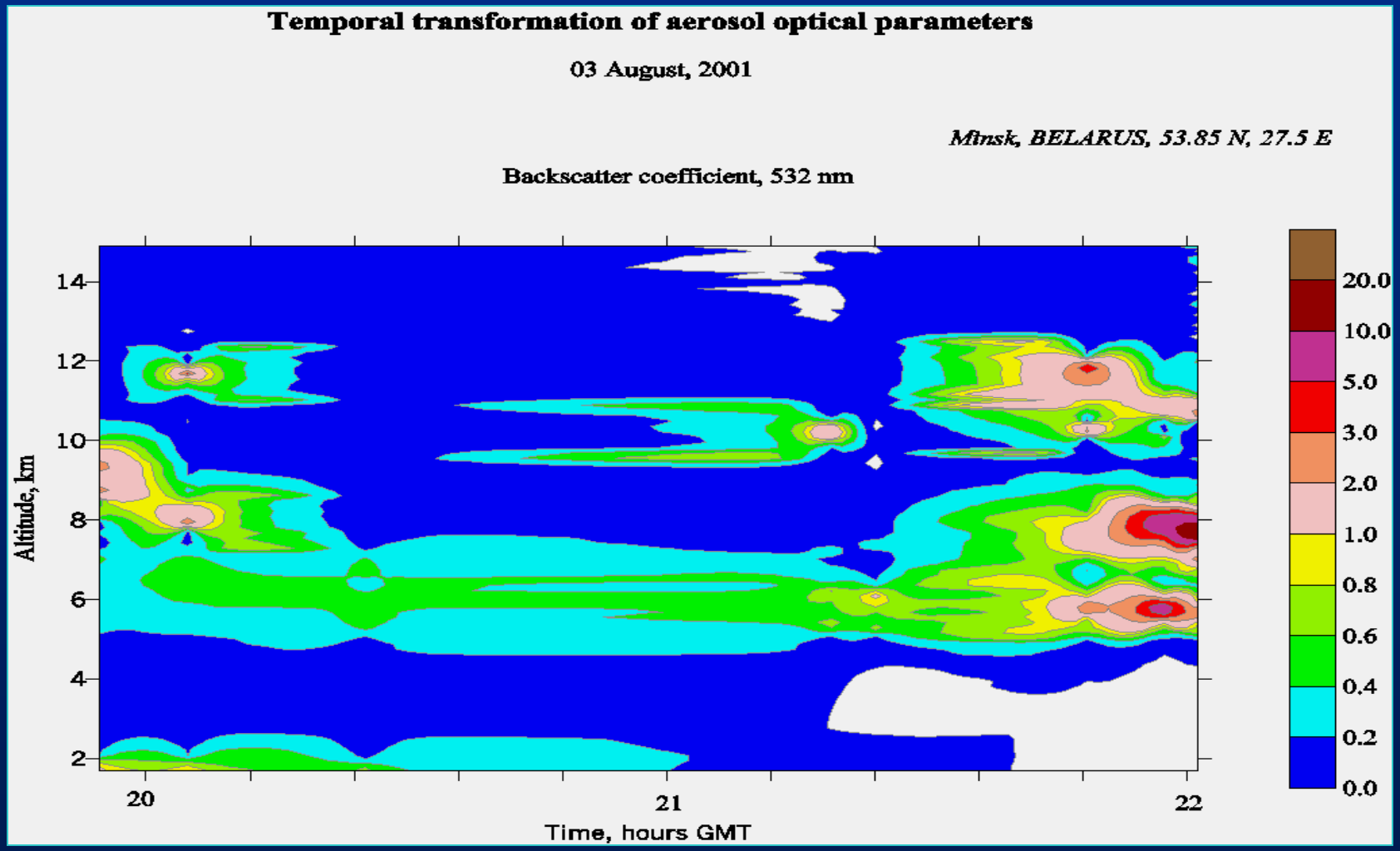

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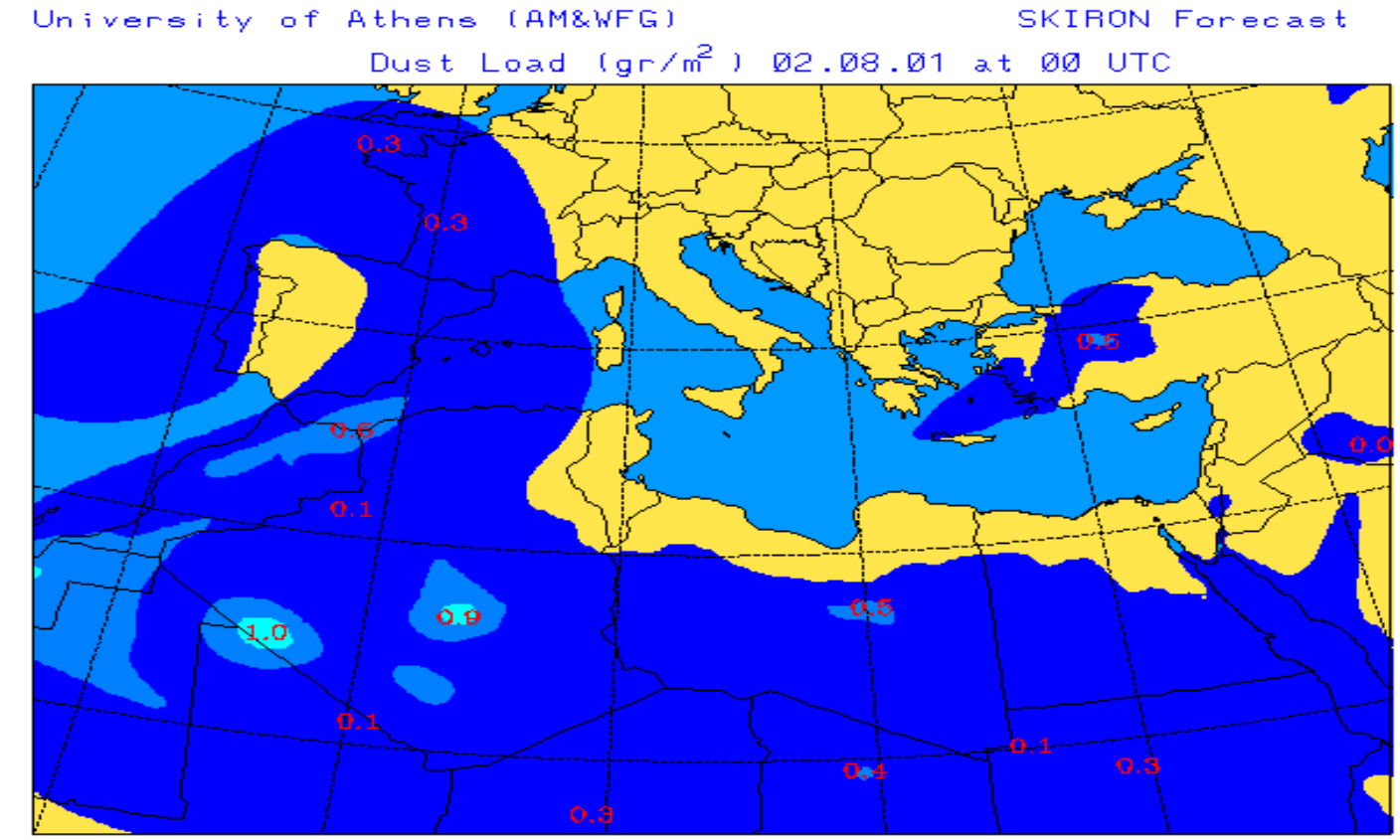

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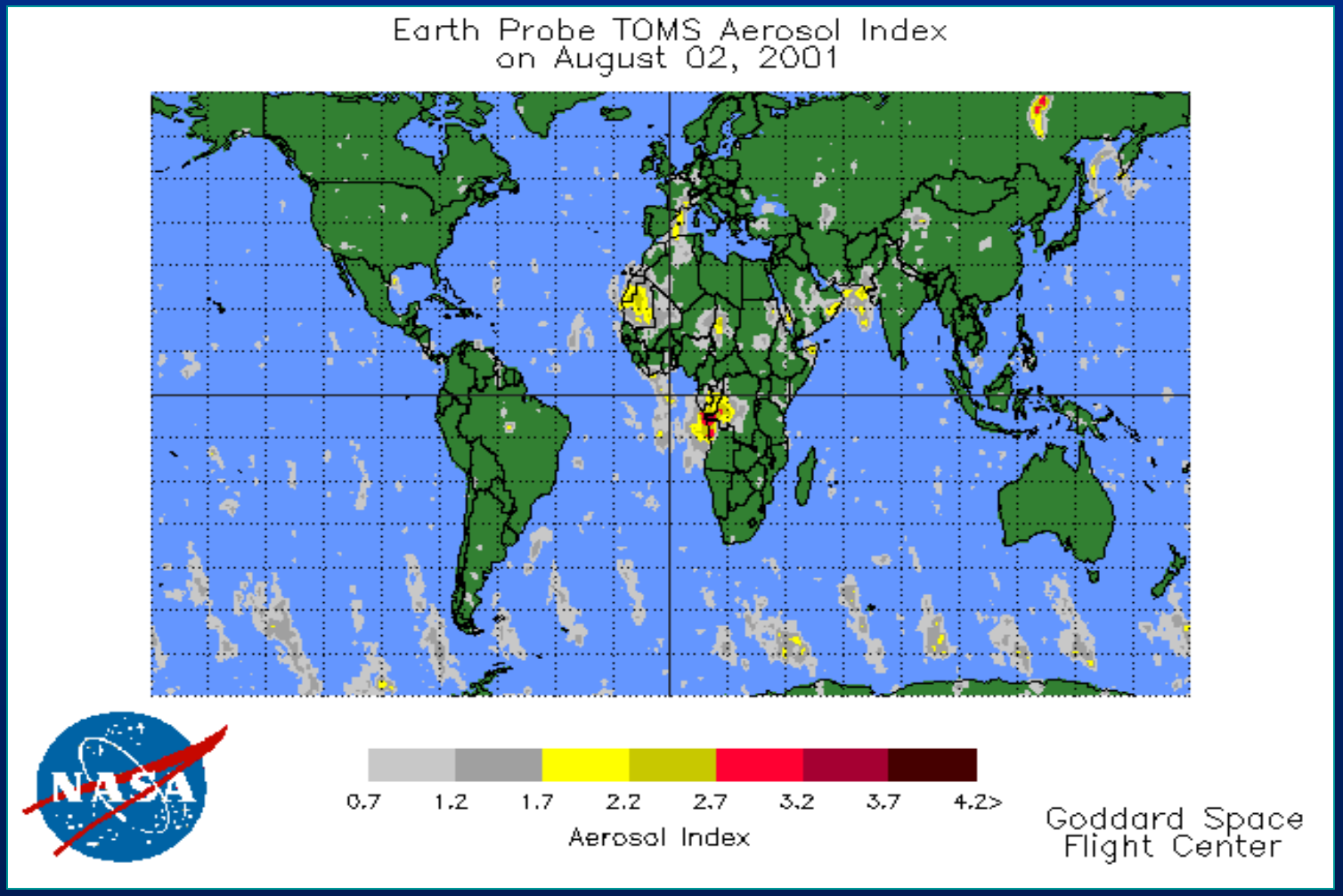

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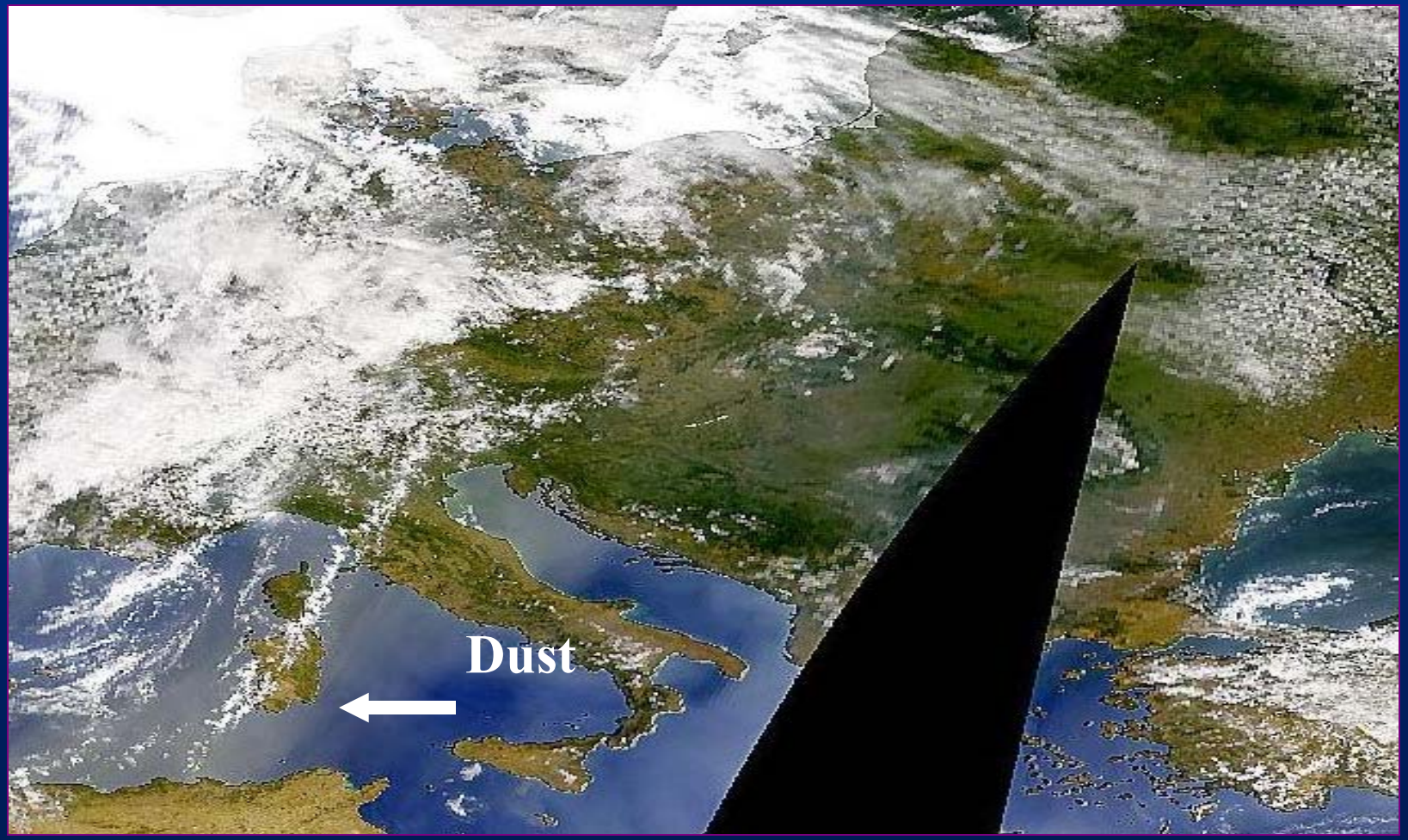

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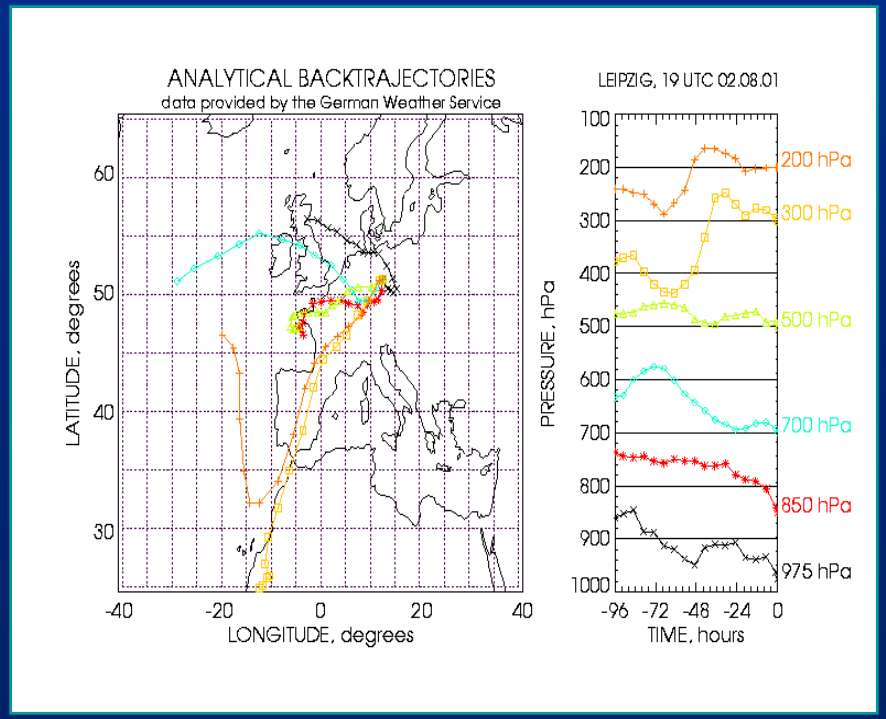
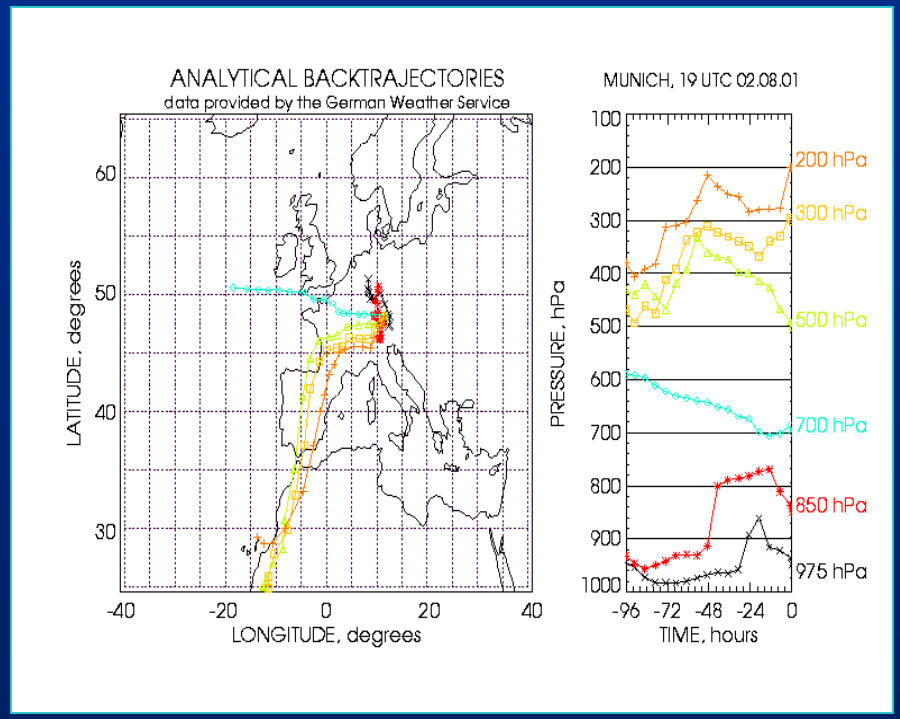


Leipzig, 19UT, 020801



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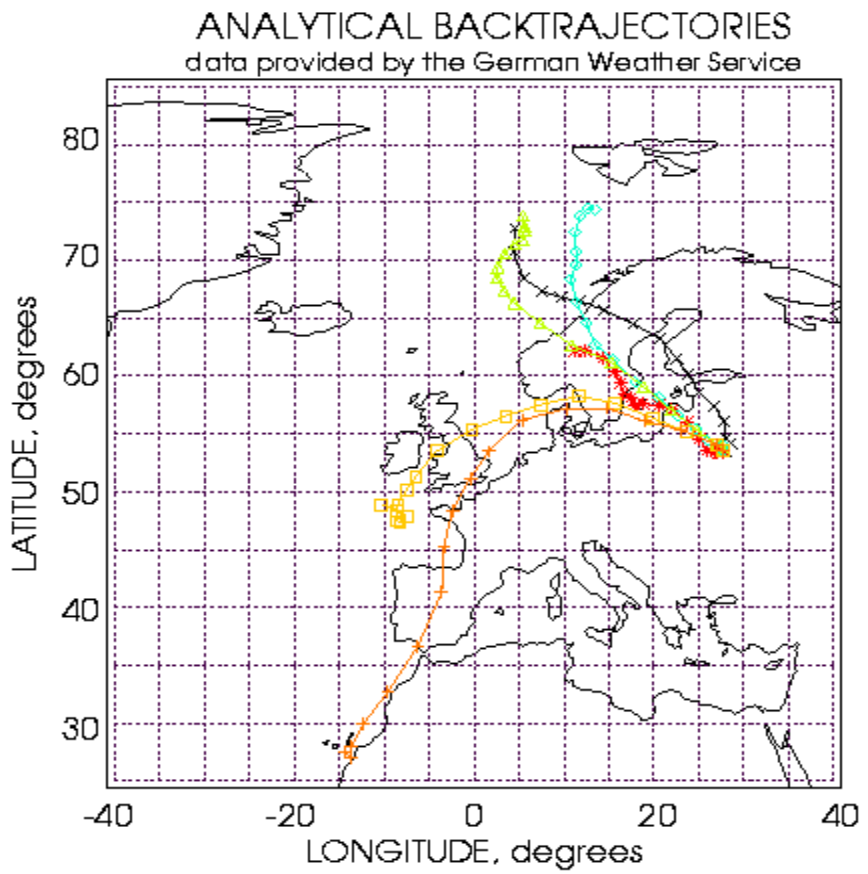
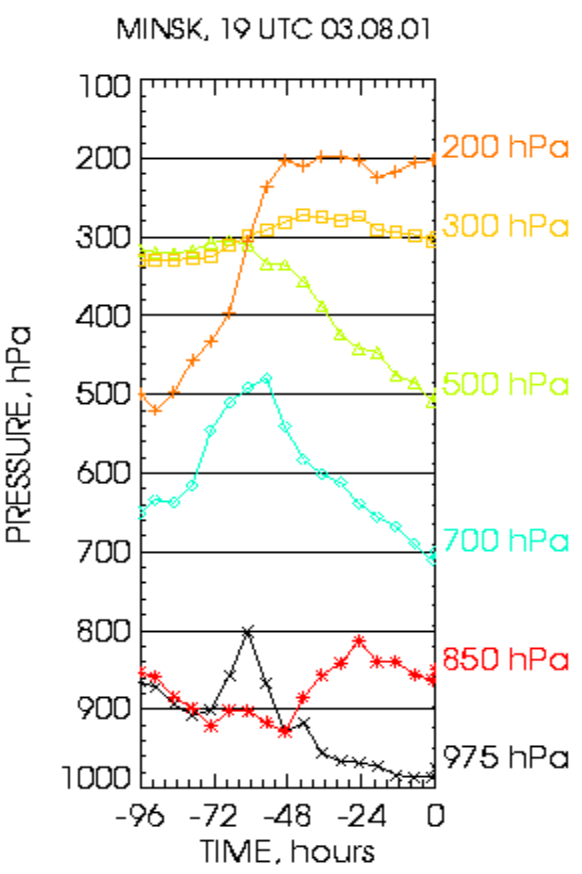
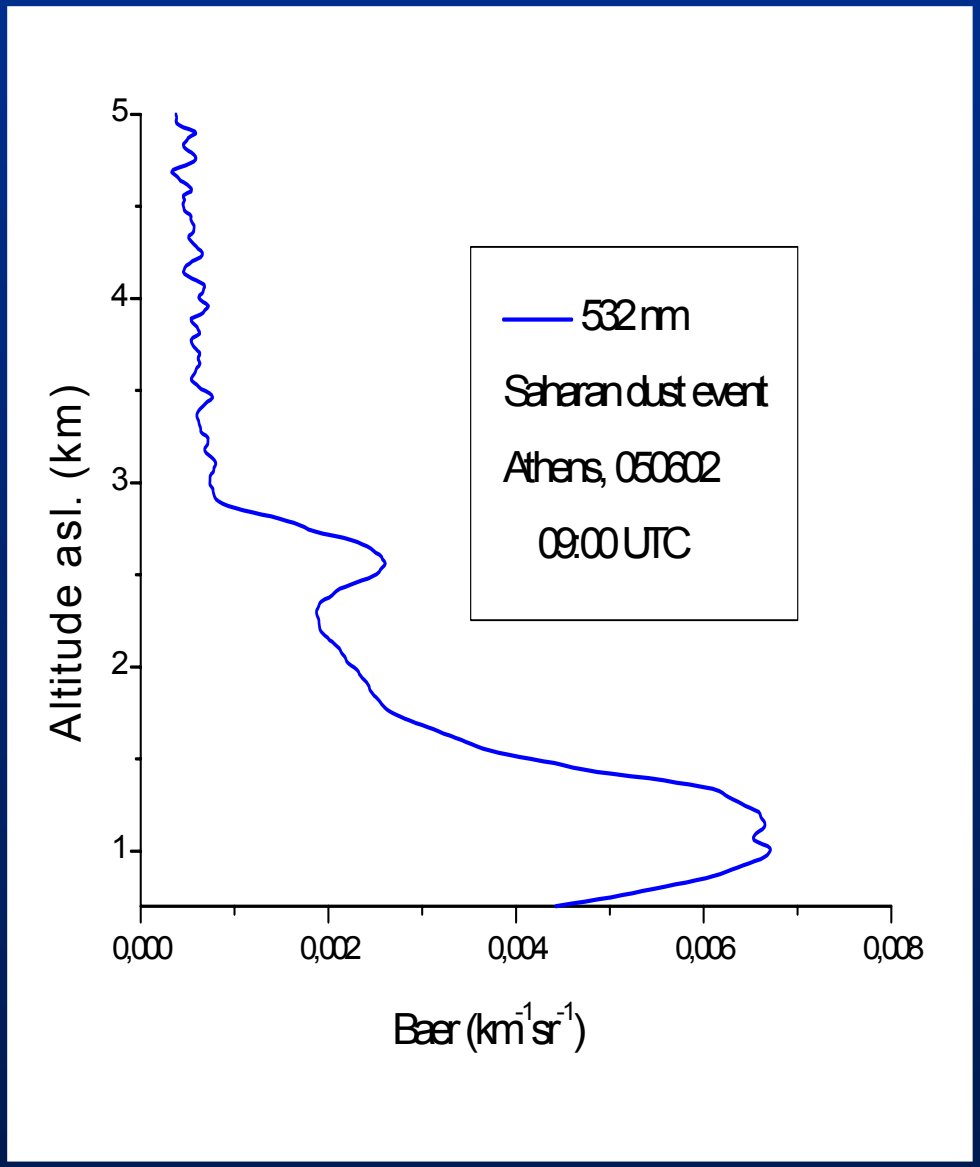
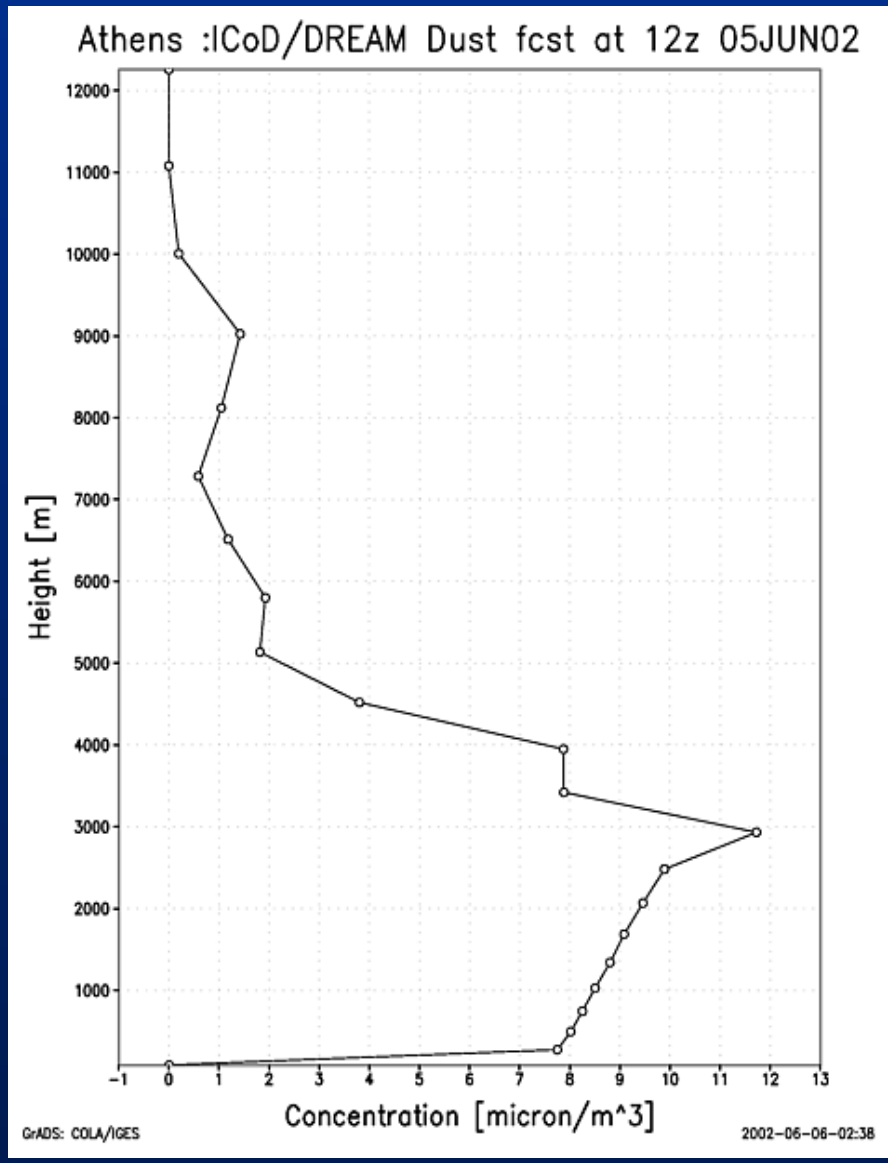




DREAM Model – LIDAR inter-comparison

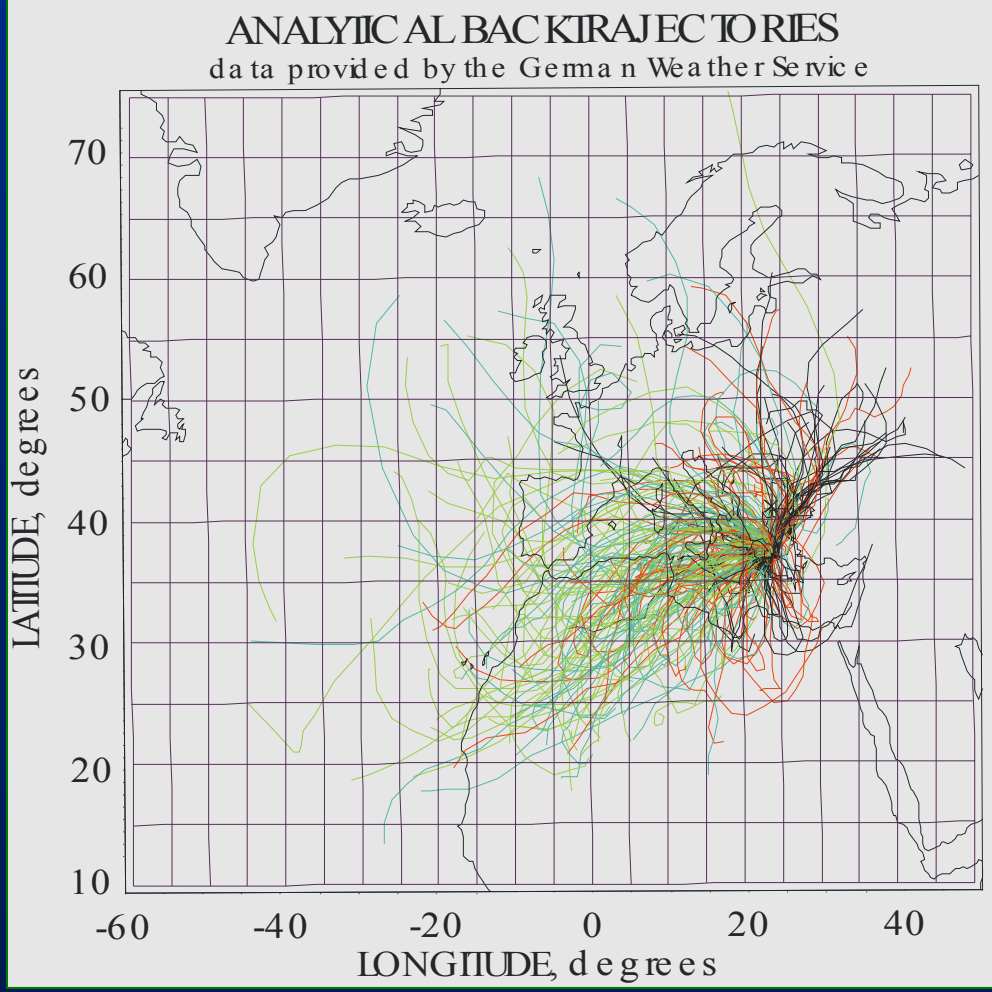
Athens, 050602

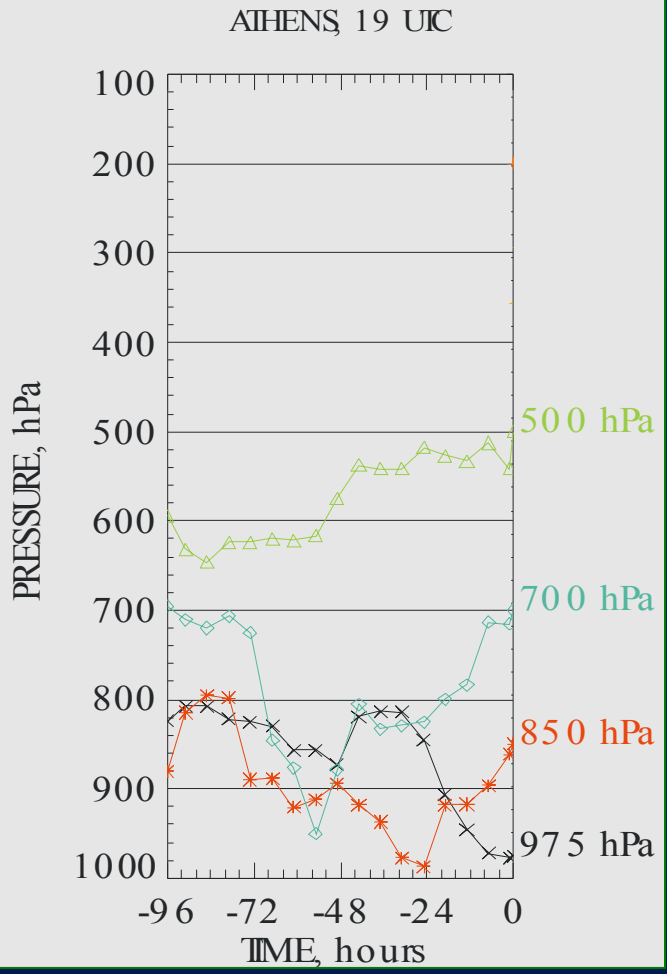




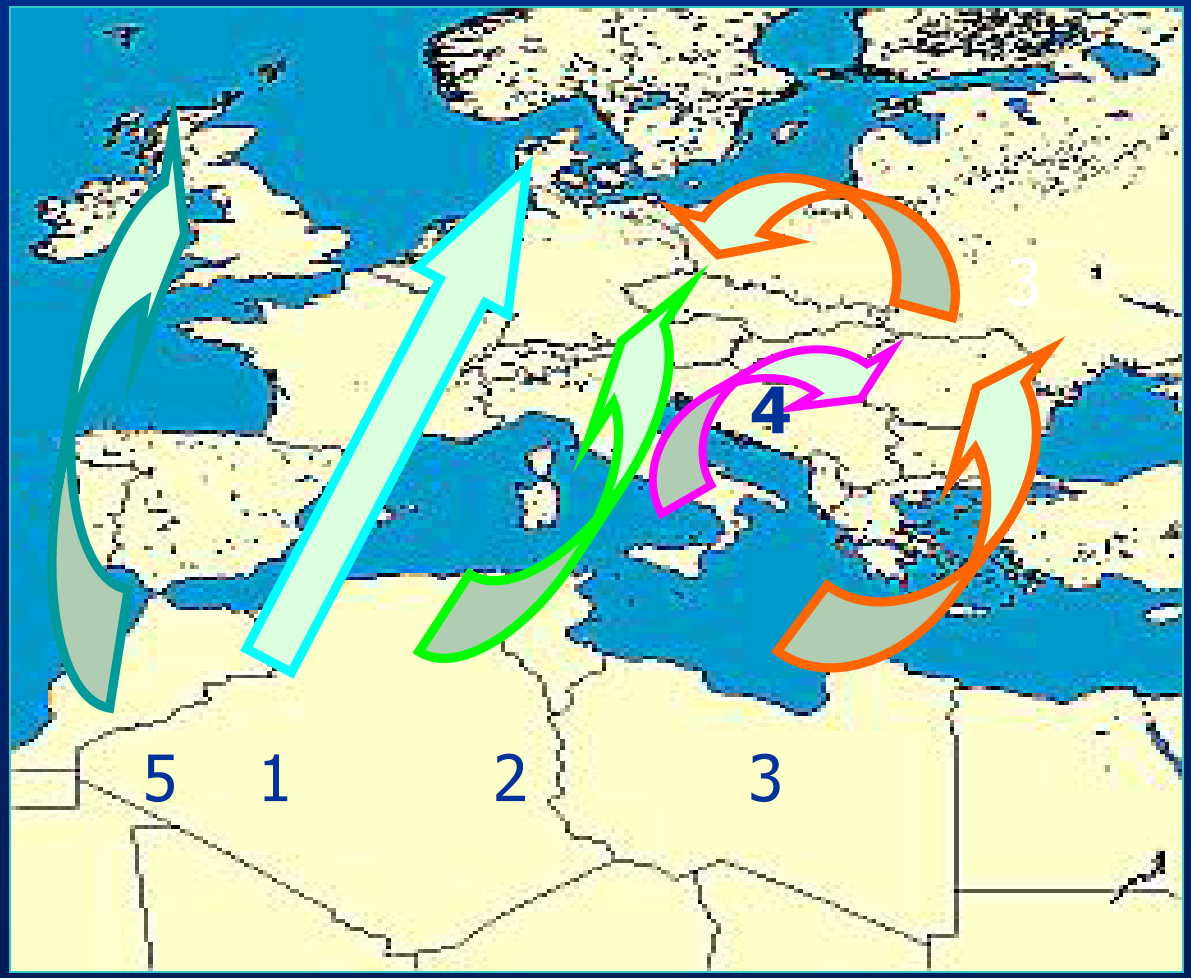
Pathways of Saharan Dust Transport to Athens

Years 2000, 2001, 2002 (67 days)





Possible Pathways of Saharan Dust Transport over Europe



1: ~20 %

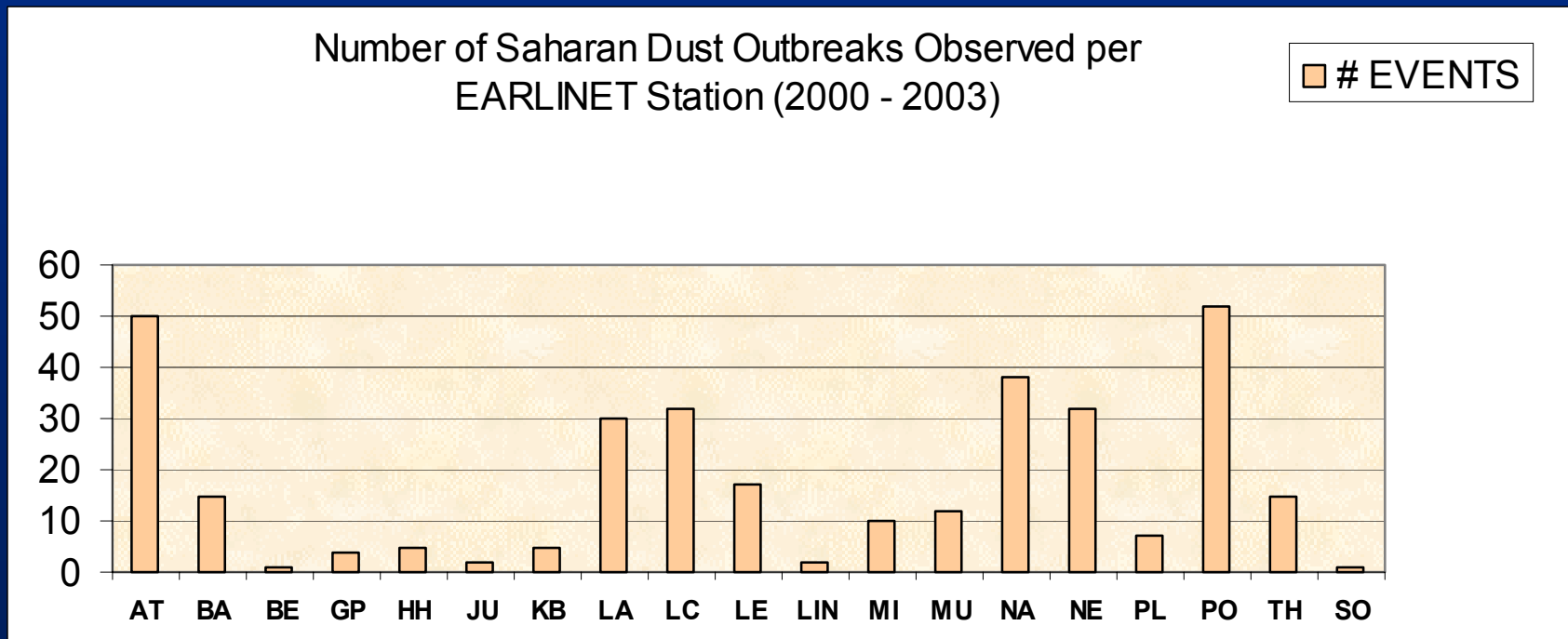
2: ~ 35 %

3: ~ 30 %

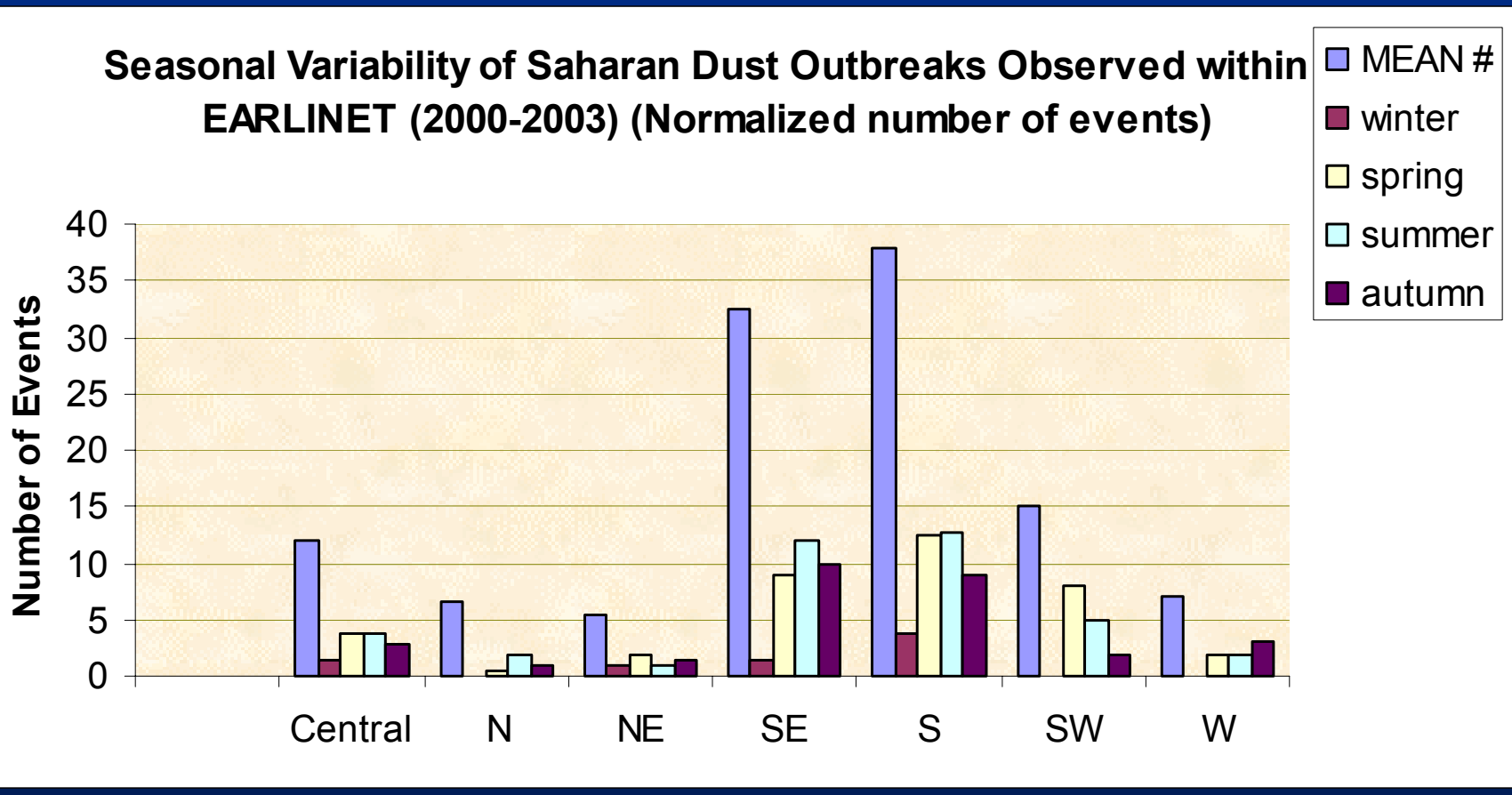
4: ~ 5 %

5: ~ 10 %

Saharan dust outbreaks observed per EARLINET station



Seasonal Variability of Saharan dust outbreaks



Conclusions

- Dust layer thickness (0.2-2.5 km), Dust layer height (1.5-6 km asl.)

- Dust Aerosols can penetrate deeply up to central Europe (up to 8-10 km height asl., where may co-exist with clouds)

-Transport time (2-5 days)

-Aerosol extinction/backscatter (lidar ratio) = 50-90 sr (355-532 nm)

-TOMS Aerosol Index (AI) values: 3-3.5 (Mediterranean Region), 1-2.5 (Central Europe)

-Max. of Dust Outbreaks: South-South-eastern Europe:

* Summer, autumn and spring period (S-SE Europe)

* Spring and summer (SW, central Europe)

Acknowledgements

- All EARLINET partners for providing their data
- NASA/GSFC (EP/TOMS Aerosol Index data)
- NASA/GSFC – ORBIMAGE (SeaWiFS data)
- NRL (NAAPS Model)
- UOA (SKIRON Model)
- German Weather Service-DWD (Air mass back-trajectory analysis)
- ENVIRONMENT EU PROGRAMS