Dual-wavelength Raman lidar observations of the lidar ratio of Saharan dust

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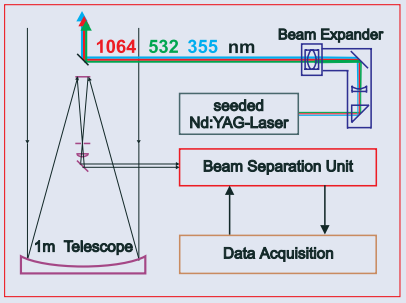
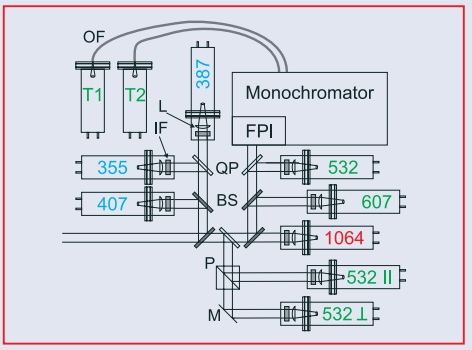
Humidity-temperature-aerosol Raman lidar



Beam separation unit



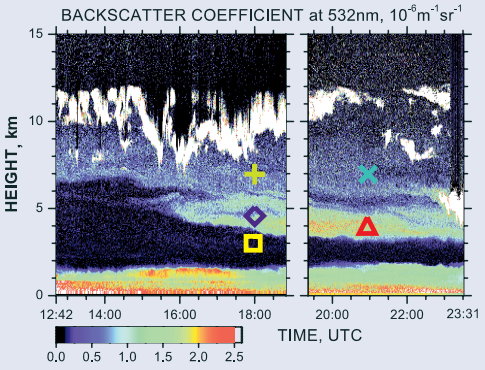
Results

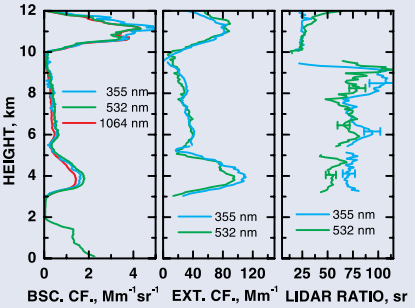
Backscatter
355 532
Extinction
355 532
Lidar ratio
355 532
Depolarization
532

H_2O Mixing ratio
Temperature
Relative humidity

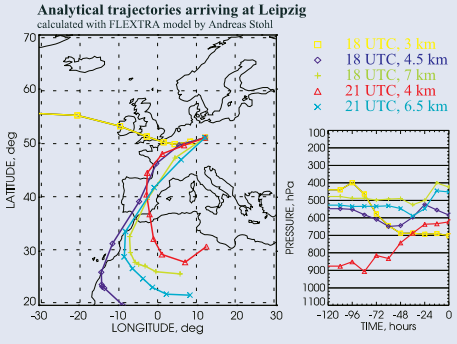
Observations

Leipzig on August 2, 2001

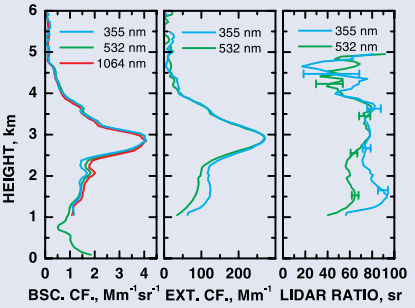




dust-layer optical depth at 532 nm: 0.26
dust-layer depolarization ratio: 0.15 - 0.17



Leipzig on October 13, 2001



dust-layer optical depth at 532 nm: 0.41
dust-layer depolarization ratio: 0.19 - 0.25

Unexpectedly large lidar ratios between 50 and 80 sr were observed in the dust layers.

Mie calculations for typical desert-dust size distributions yield lidar ratios of 15 - 30 sr.

Barnaba and Gobbi (2001) Lidar estimation of tropospheric aerosol extinction, surface area and volume: maritime and desert-dust cases. *J. Geophys.Res.*, **106**, 3005-3018

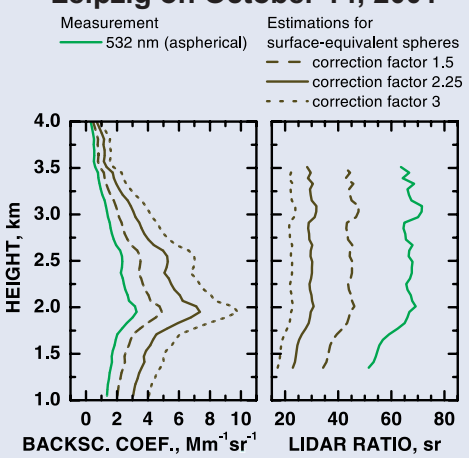
Discussion

Long-range transport:
removal of coarse mode particles (> 1 µm) by gravitational settling

Non-spherical particle shape:
reduction of backscattering efficiency compared with backscattering by surface-equivalent spheres (sphere / spheroid ratio: 1.5 - 3)

Mishchenko et al. (1997) Modeling phase functions for dustlike tropospheric aerosols using a shape mixture of randomly oriented polydisperse spheroids.
J. Geophys.Res., **102**, 16831-16847

Leipzig on October 14, 2001



Application of correction factor of 2 - 3 leads to lidar ratios of 22 - 33 sr for spheres, as predicted from Mie calculations

For details see:
Mattis, I., A. Ansmann, D. Müller, U. Wandinger, D. Althausen (2002) Dual-wavelength Raman lidar observations of the extinction-to-backscatter ratio of Saharan dust.
Geophys. Res. Lett., **29**, 10.1029/2002GL014721