

# SAMUM Project #4 - Leipzig Group: Vertically Resolved Characterization of Saharan Dust With (Three) Lidars



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TROPOSPHÄRENFORSCHUNG

## 6- $\lambda$ Aerosol Lidar + Sun Photometer

### Lidar (BERTHA)

- backscatter coefficients: 355, 400, 532, 710, 800, 1064 nm
- extinction coefficients: 355, 532 nm
- lidar ratio: 355, 532 nm
- depolarization ratio: 710 nm
- water vapor

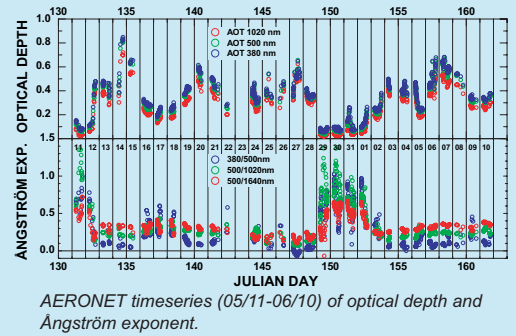
### AERONET Sun Photometer (SPM)

- optical depth at 7  $\lambda$  (340-1600nm)
- Angström exponents
- phase function (340, 670, 870, 1020nm)

- continuous measurements twice a day (if possible)
- observation of the atmospheric column with three lidars 1 x IFT (BERTHA); 2 x MIM (MULIS, POLIS)
- system intercomparison for quality assurance
- more than 150h of lidar measurements
- 30 days of high-quality SPM-measurements

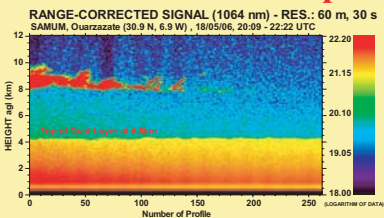


Field site at Ouarzazate airport.

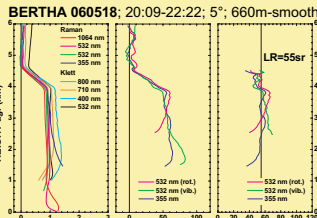


AERONET timeseries (05/11-06/10) of optical depth and Angström exponent.

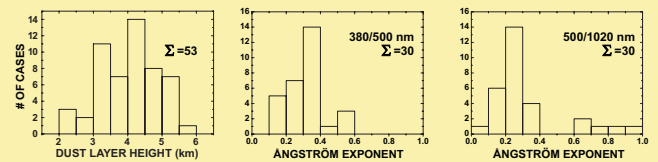
## Measurement Example



The nighttime measurement of 18/05/2006 was used for calibration in cirrus.

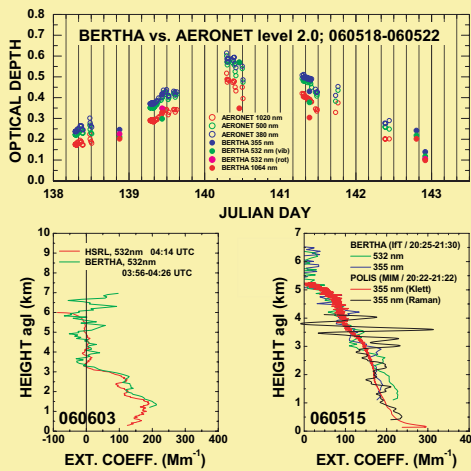
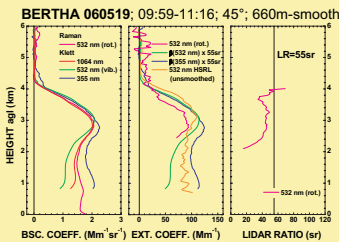
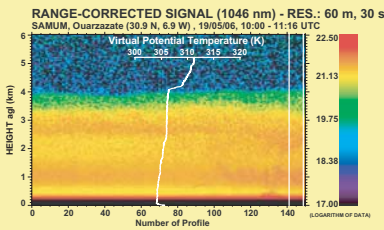


## Frequency Distributions



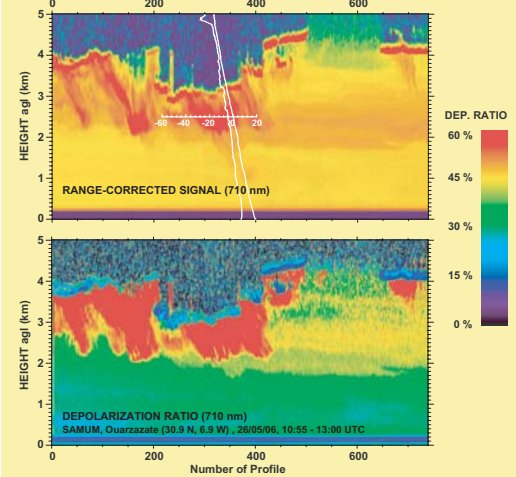
Frequency distribution of dust layer height (derived from lidar measurements) and Angström exponent (from AERONET optical depth).

## Optical Closure of Lidars / Lidar and Sun Photometer



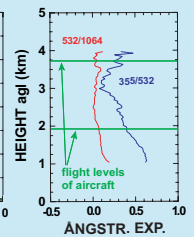
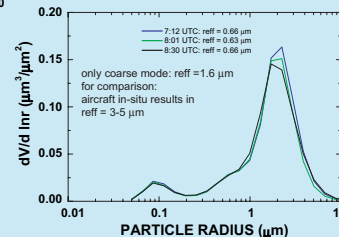
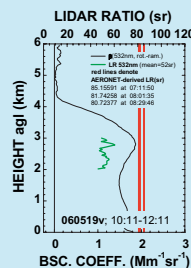
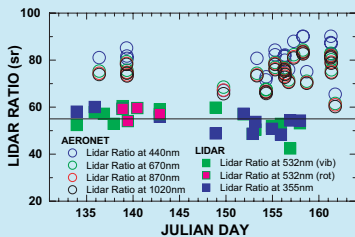
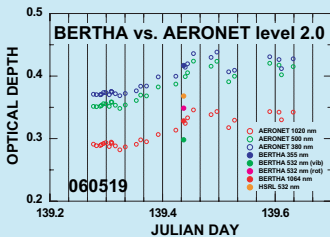
Intercomparison of BERTHA-derived profiles of extinction coefficient and optical depth show good agreement with other lidar system and AERONET optical depth, respectively.

## Ice Formation in Desert Dust



Heterogeneous ice formation from slightly supercooled water droplets after contact with dust particles.

## Test of Optical Particle Model



Comparison of AERONET-derived lidar ratios to measurement results; despite similar optical depth, poor agreement is achieved.

Discrepancy of particle effective radius derived from inversion of Sun photometer data to in-situ observations with aircraft.

- First closure studies reveal inconsistencies regarding particle properties derived from SPM compared to the same particle properties derived from lidar and aircraft in-situ measurements.
- Further closure studies have to resolve the question how the particle model that is used for the analysis of the AERONET data must be modified.
- Theoretical studies on the basis of databank (PROJECT # 8 of SAMUM II) for modified particle model.