Hygroscopicity and Optical Properties of Dust Particles: Measurements from the SAMUM Field Campaign Project #5

LEIBNIZ-INSTITUT FÜR TROPOSPHÄRENFORSCHUNG

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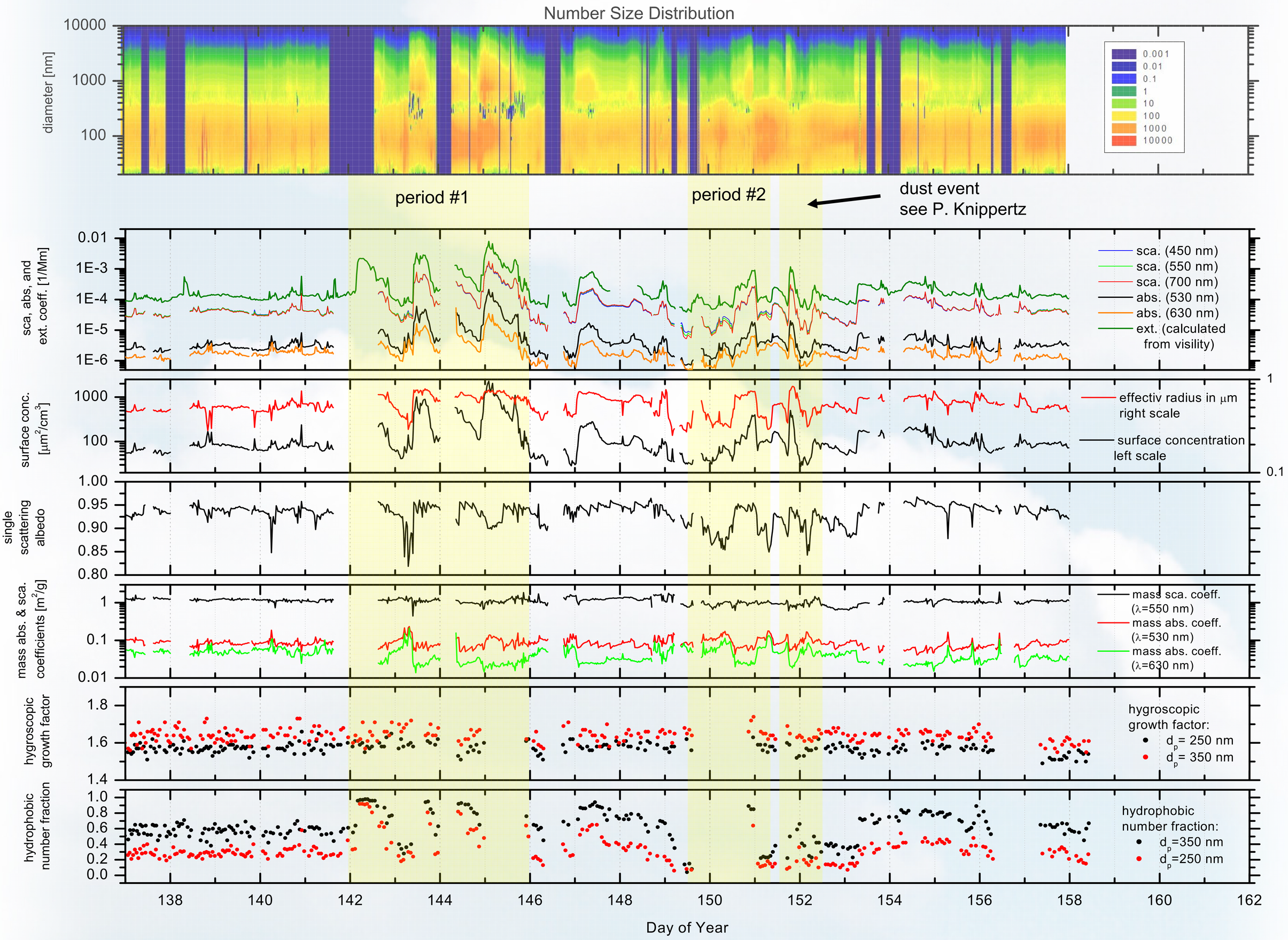
Objective

- Optical and hygroscopic properties of dust particles were measured in a source region of mineral dust in southern Morocco
- The physical and optical properties will be compared with results from optical and electron microscopy and elemental analysis (K. Kandler and S. Weinbruch ,Technische Universität Darmstadt ; L. Schütz, Universität Mainz)
- A set of optical constants, the complex refractive indices, mass absorption and mass scattering coefficients, will be calculated for accumulation- and dust-mode particles
- The optical depth measured using a sun-photometer (W. von Hoyningen Huene and T. Dinter, Universität Bremen) will help to estimate a scale height
- Vertical distribution of dust particles was measured onboard of two Aeroplanes (A. Petzold and M. Fiebig DLR; M. Wendisch and E. Bierwirth, IfT) within several flights and in a case study of two days by a mobile LIDAR (B. Heese and M. Garhammer, Universität München)

System	Parameter	RH	Inlet
DMPS and APS	Particle number size distribution	dry	PM 10
H-TDMA	Hygroscopic growth factors and number fractions of more and less hygroscopic particles (d_p= 30, 50, 80, 150, 250, 350 nm)	85 %	PM 10
H-DMA-APS	Hygroscopic growth factors and number fractions of more and less hygroscopic particles (d_{aero}= 800, 1000, 1200 nm)	85 %	PM 10
Nephelometer	Total- and backscattering coefficient at λ=450, 550 and 700 nm	dry	PM 10
PSAP	Absorption coefficient at λ= 530 nm	dry	PM 10
CARUSSO	Absorption coefficient at λ= 630 nm	dry	PM 10
Spectral photometer	Absorption Coefficient from 250 to 800 nm with 25 nm resolution	dry	PM 10
VPF 710	Visibility, ambient extinction	ambient	no inlet

Overview of measured optical and hygroscopic parameters



A case study

- **During period #1 there was a significantly larger dust mode compared to period #2**
- **The higher relative particle number concentration of dust particles during period #1 causes a higher number fraction of hydrophobic particles The number fraction of particles with diameters larger than 700 nm is always about 1.0**
- **During both periods the optical properties are dominated by the coarse mode represented here by dust particles**
- **In general, no hygroscopic particles (e.g. sea salt aerosol) were observed for particles larger than 800 nm in diameter**

Comparison of measured scattering coefficients with Mie calculations

$$\text{rel. deviation} = \frac{\sigma_{Mie} - \sigma_{measured}}{\sigma_{Mie}}$$

- **For larger particles σ_{Mie} and $\sigma_{measured}$ have higher relative deviations**
- **Larger particles are assumed to have a more complex shape**
- **Relative deviations are in agreement with model calculations for non-spherical particles (Kalashnikova & Sokolik 2002)**