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Particle size distributions of dust during the Mineral Dust Campaign 2008 at the AIDA facility Karslruhe – How well compare different sizing methods?

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Dust particle size distributions and information on dust refractive index and particle shape are key input parameters for the determination of optical and radiative properties of airborne dust. Climate models require this data together with information on the vertical distribution of desert dust. During the Mineral Dust Campaign 2008 at the AIDA facility, special emphasis was put on the measurement of dust size distributions and mass with different methods in order to assess the uncertainties in dust size distribution measurement.

Measuring particle size distributions of airborne dust is still a challenge. The main reasons for the existing measurement uncertainties are

1. the wide size ranged of mineral dust particles extending from the sub-µm accumulation mode to giant dust particles larger than 100 µm,
2. the irregular shape of dust particles, and
3. the limited number of measurement methods available for this application.

Airborne dust particles can be sized by optical methods such as light scattering techniques, and by aerodynamic sizing methods such as Aerodynamic Particle Sizers or Impactors. Sizing by morphological methods using microscopy analyses of particles collected on appropriate matrices is only of limited applicability to airborne measurements due to detection limit issues. The available methods measure different properties such as aerodynamic equivalent diameters, optical equivalent diameters, or geometric diameters. Table 1 summarises the methods used during our studies.

Table 1. Methods for measuring particle size and mass during the Mineral Dust Campaign 2008.

Instrument	Property
Optical Particle Counter GRIMM 1.109	Light scattering, optical equivalent diameter
SMPS	Electrical mobility, mobility diameter
APS	Aerodynamic sizing, aerodynamic equivalent diameter
Filter sampling	Total mass, morphology

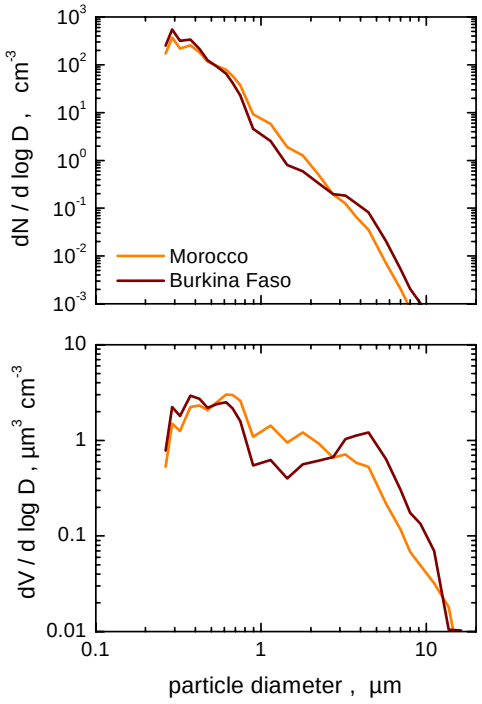

Figure 1. Size distribution of dust from Morocco and Burkina, re-suspended in the aerosol chamber of AIDA and measured downstream a cyclone.

As is shown in Figure 1, the dust re-suspended from bulk samples shows different number (top) and volume (bottom) size distributions depending on its origin, which will be compared to measurements in Morocco with airborne dust of similar origin (Petzold et al., 2009; Weinzierl et al., 2009). The results from closure studies on the methods applied at AIDA (Table 1) will be used to quantify uncertainties of dust size measurements in airborne field studies.

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Petzold, A., et al. (2009). *Tellus* 61B, 118-130.

Weinzierl, B., et al. (2009). *Tellus* 61B, 96-117.