Can we identify the aerosol chemical composition with spectral optical properties at the MCOH site in the northern Indian Ocean?

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Several studies of wavelength dependent optical properties and their relation to the aerosol composition have been conducted recently (e.g. Bahadur et al., 2012; Cazorla et al., 2013). The wavelength dependence of particle absorption can be used to identify the absorbing compounds in atmospheric particles, which are mainly black carbon (BC), organic carbon (OC) and dust. Information on the particle size can be determined from the wavelength dependent scattering and single scattering albedo (SSA) (Costabile et al., 2013).

Various methods have been proposed for aerosol classification based on the combined analysis of the absorption Ångström exponent (AAE) with the scattering or extinction Ångström exponent (SAE, EAE) and the SSA, optionally. Matrices have been established in which the aerosol can be grouped e.g. into EC, OC and dust dominated regimes (Cazorla et al., 2012). The key component of the aerosol population has been mainly estimated by the location of the station or the source region. Cazorla et al. (2013) also linked the theoretical schemes to ambient chemical measurements.

We will present long term in-situ data from the Maldives Climate Observatory in Hanimaadhoo (MCOH) from 2005 until the present. Measurements at the receptor site MCOH capture highly polluted air masses from Southern Asia, mineral dust aerosol from Africa and the Middle East as well as pristine marine air masses within an annual cycle due to the monsoon seasons.

The multi-year results are used to verify two different methods by Cazorla et al. (2012) and Costabiles et al. (2013). Using the AAE and SAE from AERONET as most of the recent studies, gave no subdivided matrices for MCOH because of low AOD values which results in poor quality of the inversion data. Instead, AAE, SAE and SSA data determined from in-situ measurements of particle absorption and scattering generate the theoretical matrices and are tested with measurements of the chemical composition. Filter probes were analyzed regarding elemental and organic carbon (EC, OC) as well as common ions. Furthermore, backward trajectories were utilized to identify the air mass source region.

Non-sea-salt calcium (nssCa) is for instance used as a tracer for mineral dust. Most of the cases with a high mass fraction of nssCa can either be seen in the dust dominated or mixture regimes (Fig. 1). However, filter measurements with a low nssCa mass fraction can also appear in the dust dominated cluster.

Furthermore, ammonium sulfate (NH_4) and nss sulfate ($nssSO_4$) are used as a tracer for biomass burning and anthropogenic aerosols, respectively.

Various methods will be tested to identify marine air masses from the chemical composition and to see if those aerosols can fit in the theoretical schemes as well.

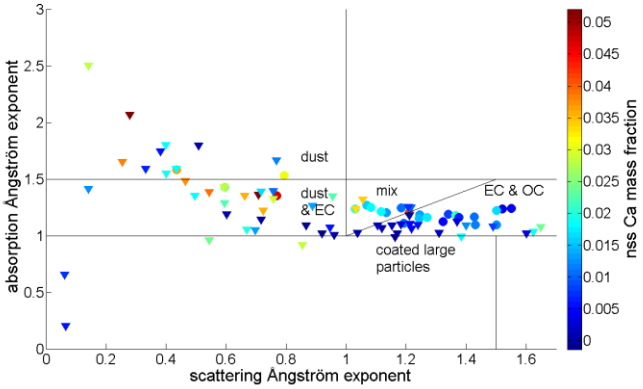

Figure 1. Scatter plot of AAE and SAE according to Cazorla et al. (2013) color coded by nssCa mass fraction for June 2005 until June 2006 and February-March 2012.

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