Surface Aerosol Monitoring at Hada Al Sham, Western Saudi-Arabia

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The Arabian Peninsula has one of the largest aerosol particle burdens in the world because of the frequent presence of dust storms, smoke advection from South Asia, and its own pollution emissions from road traffic, the petroleum industry and local construction. In addition, the Arabian Peninsula exhibits extremely complicated meteorology with variable sea surface temperatures, enormous latent heat fluxes, abrupt topography, and strong mesoscale circulation, making both modeling and remote sensing of aerosols extremely difficult in this region.

The object of this study is to establish an aerosol measurement station in the Western Saudi Arabia to evaluate the quantities and properties of both natural and anthropogenic aerosols in the area, and their effect on climate change and air quality. The measurements were begun October 2012 with a projected length of three years.

The Hada Al Sham site (21.802° North, 39.729° East, 254 m a.s.l.) is situated about 60 km east of the coastal city of Jeddah. The surroundings represent a rural area. The following in situ measurements are conducted at the station: $PM_{2.5}$ and PM_{10} mass concentrations, total particle number concentration, particle number size distribution from 7 nm to 10 µm, aerosol black carbon concentration (absorption coefficient) and aerosol scattering coefficient. Cimel sunphotometer is used for measuring the columnar properties of the atmosphere. In addition, weather parameters are measured.

The early results from Hada Al Sham show a wide diversity of different aerosol sources. In December 2012, 85 % of the recorded days exhibited a new particle formation event (Fig 1.). This can be related to sulphate emissions from heavy oil combustion occurring in the Western Saudi Arabia, such as oil refining (Khodeir et al. 2012).

The scattering and absorption coefficients measured during December 2012 showed a clear diurnal variation (Fig 2.). While the scattering coefficient showed two daily maxima, occurring at 7 am and 5 pm, the absorption coefficient was elevated from 12 am to 7 am. This illustrates that the absorbing aerosols related to anthropogenic activities have different sources than scattering aerosols, which also have natural sources, such as mineral dust.

In the future, the seasonal variation of aerosols in Hada Al Sham, together with their spatial sources will be investigated.

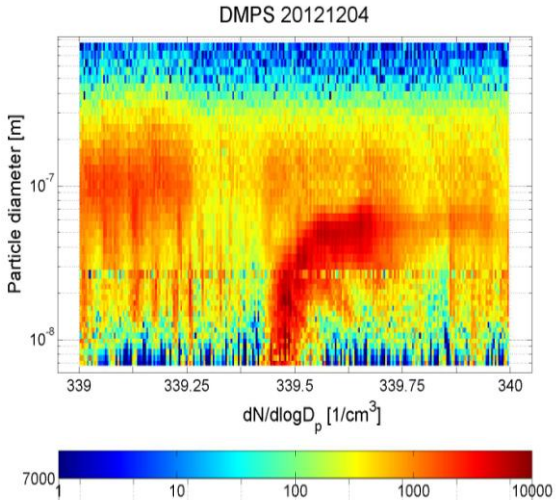

Figure 1. Example particle size distribution as a function of time on 4.12.2012.

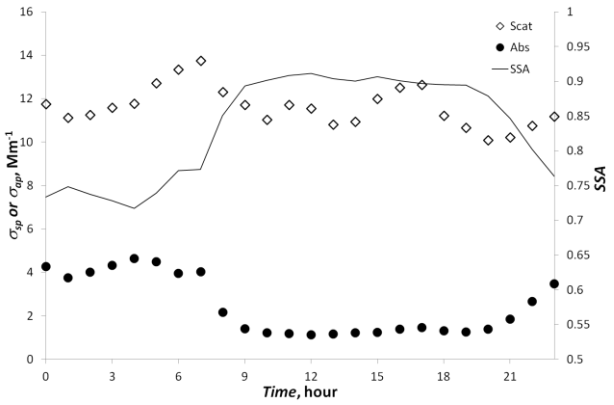

Figure 2. Diurnal variation of scattering coefficient (σ_{sp}), absorption coefficient (σ_{ap}), and single scattering albedo (*SSA*) at 525 nm on December 2012.

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