Sub-micrometer non-refractory aerosol composition and their sources at Welgegund in the southern African grassland region

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In this study we present the first long-term high time resolution aerosol chemical composition measurements in southern Africa.

The Welgegund measurement site, with a wide range of atmospheric aerosol and gas, as well as meteorological observations (Beukes *et al.*, 2013; www.welgegund.org) is located approximately 100 km south-west of the Johannesburg-Pretoria conurbation (population over 10 million), in South Africa (26°34'10"S, 26°56'21"E, 1480 m.asl). There are only a few local pollution sources close to the measurement site. It is frequently over-passed by air masses with pollution plumes from the highly populated megacity and major industrialized regions in the interior of South Africa. There are also clean air intrusions from a clean western sector.

The submicron chemical composition was measured by using a Aerosol Chemical Speciation Monitor (ACSM, Ng *et al.*, 2011). Positive matrix factorization (PMF) was also applied to characterize the sources and transformation of organic aerosols (OA) in the atmosphere. Air mass history was investigated using back trajectories (HYSPLIT). Our results provide an overview of the chemical composition of submicron species in southern Africa during wet and dry seasons. Insights into the sources and atmospheric processing of organics aerosols near the megacity area of Johannesburg are also obtained.

The high biomass burning organic aerosol (BBOA) and nitrate (NO_3^-) concentrations observed when air-masses over passed the megacity (MC) region (Figure 1) indicate the large amount of emissions from combustion processes in the densely populated megacity region. These emissions characterized mainly from traffic and household combustion (domestic burning of biomass for heating and cooking). However, the highest BBOA concentrations (up to 40 μg/m^3) were observed during the dry season, strongly and frequently impacted by to savannah fires and adverse meteorological conditions over the interior of South Africa (see Swap *et al.*, 2003).

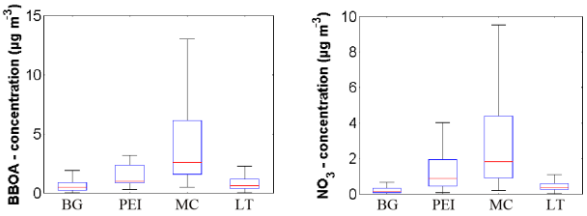

Figure 1. Average biomass burning organic aerosol (BBOA) and nitrate (NO_3^-) concentrations during the dry season calculated for four source regions, i.e background without major sources (BG), petrochemical industry (PEI), megacity (MC) and long-range transport regions (LT). The box plot indicates the 25th and 75th percentiles and the line within the box marks the median. Whiskers show 5 th and 95th percentiles.

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