Insights into the roles of sulphuric acid and organic compounds in new particle formation in southern Africa

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Formation and growth of new aerosol particles (new particle formation, NPF) has been shown to contribute significantly to the global cloud condensation nuclei (CCN) budget (e.g. Kerminen *et al.*, 2012). Consequently better understanding of atmospheric NPF can help decrease the large uncertainty that aerosol-cloud interactions pose on the Earth's radiative forcing budget (Boucher *et al.*, 2013). The survival probability of newly formed particles into CCN size range depends strongly on their growth after nucleation (e.g. Kerminen *et al.*, 2012). However, the composition of the chemical compounds responsible for the growth is not yet well known.

We utilised one year of simultaneous measurements of aerosol particle size distributions with a differential mobility particle sizer (DMPS) and on-line PM1 chemical composition with an aerosol chemical speciation monitor (ACSM) at the Welgegund measurement station in South Africa, 100 km west of Johannesburg (e.g. Tiitta *et al.*, 2014). The measurement period was September 2010 to August 2011. We used the ACSM mass increase rate during NPF to study the chemical composition of the growth, similar to e.g. Setyan *et al.* (2014).

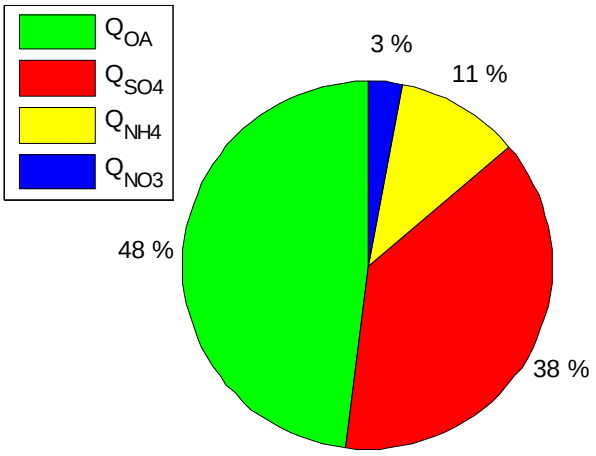

Figure 1. Average contribution of organic aerosol (OA), sulphate (SO_4^{2-}), ammonium (NH_4^+) and nitrate (NO_3^-) to the growth in NPF events at Welgegund.

During the study period the frequency of regional scale NPF events was very high, 75 %, and the chemical composition of the growth could be analysed for 88 NPF events. The median aerosol particle growth rate in the 12 to 30 nm size range was 9 nm h^{-1} (mean 11 nm h^{-1}). The highest growth rates were observed during the spring and summer; during winter the growth was slower.

The composition of the growth in regional scale NPF events was dominated by organic compounds and sulphate accompanied by ammonium, as indicated in Figure 1. Depending on the air mass origin, the contribution of organic compounds varied from approximately 25 % to more than 90 %. The highest organic aerosol formation rates were observed during the spring.

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