Year-round modelling study on particle formation a South African savannah

R. Gierens[1], L. Laakso[1,2,3], V. Vakkari[1], L. Zhou[1], D. Mogensen[1], J.P. Beukes[3], P.G. Van Zyl[3], and M. Boy[1]

[1]Department of Physics, Division of Atmospheric Sciences, University of Helsinki, Helsinki, 00014, Finland
[2]Finnish Meteorological Institute, Research and Development, P.O. BOX 503, FI-00101, Finland
[3]School of Physical and Chemical Sciences, North-West University, Potchefstroom, South Africa
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Presenting author email: rosa.gierens@helsinki.fi

Africa is one of the less studied continents in respect to atmospheric aerosols. In this study measurements from a savannah environment in South Africa were used to model new particle formation and growth for a full year.

The measurements utilized in this study were done at the Welgelund measurement station, a savannah site in northern South Africa, approximately 100 km west of Johannesburg. The site has very few local pollutant sources, but pollutant plumes from metropolitan and industrial areas are oberved frequently, as well as clean air advected from areas with little antropogenic sources. Measurements in the region have shown a high frequency of particle formation (Vakkari *et al*, 2013): on another savannah site 69% of days observed showed a clear nucleation event (Figure 1). The measurements include meteorological variables (temperature, relative humidity, wind speed and direction, precipitation, vertical temperature gradient, and radiation), trace gas concentrations (SO_2, NO_x, CO, and O_3), flux measurements (H_2O, CO_2, and sensible heat), soil measurements (moisture and heat at differemt dephts), aerosol number size distribution, and concentrations of volatile organic compounds (VOC). The observational data was used for input and comparisons with the simulations. More information about the station can be found at http://www.welgegund.org/.

SOSA (Model to Simulate the concentrations of Organic vapours and Sulphuric Acid) is a one-dimensional model, which includes modules for boundary layer meteorology, emissions from the canopy and chemical processes (Boy *et al,* 2011). For this work a further developed version of the model was used, which also includes aerosol dynamics simulated with UHMA (University of Helsinki Multicomponent aerosol model). UHMA focuses on new particle formation and growth (Korhonen *et al*, 2004), and thereby SOSA is well suited to study these phenomena. Boundary layer meteorology and plant-atmosphere interactions are solved by SCADIS (Scalar Distribution). The emissions of monoterpenes and other organic vapours from the canopy are calculated with MEGAN (Model of Emissions of Gases and Aerosols from Nature). The chemistry is calculated using the Kinetic PreProcessor (KPP), and chemical reaction equations are from the Master Chemical Mechanism (http://mcm.leeds.ac.uk/MCM/).

In this work we simulated a full year to be able to study the different air masses on the site as well as seasonal variations in particle formation. The period from February 2011 to February 2012 was chosen. The frequent n events and particle growth was evaluated in detail. This work will present new model results to give a better understanding on the new particle formation process in South-Africa and discuss the reasons for high frequency of nucleation episodes observed.

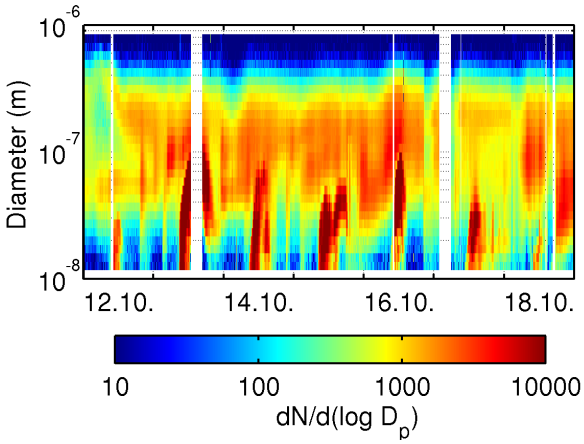

Figure 1. Observed size distribution on savannah show a high frequency of nucleation events. Measurements were done in Botsalano in October 2007.

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