

# Particle formation above natural and simulated salt lakes

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Western Australia was originally covered by natural eucalyptus forests, but land-use has changed considerably after large scale deforestation from 1950 to 1970. Thus, the ground-water level rose and brought dissolved salts and minerals to the surface. Nowadays, Western Australia is known for a great plenty of salt lakes with pH levels reaching from 2.5 to 7.1. The land is mainly used for wheat farming and livestock and becomes drier due to the lack of rain periods. One possible reason could be the formation of ultrafine particles from salt lakes, which increases the number of cloud condensation nuclei and thus potentially suppresses precipitation.

Several field campaigns have been conducted between 2006 and 2011 with car-based and airborne measurements, where new particle formation has been observed and has been related to the Western Australian salt lakes (Junkermann et al., 2009). To identify particle formation directly above the salt lakes, a 2.35 m<sup>3</sup> PTFE chamber was set up above several lakes in 2012. Inside the chamber, photochemistry may take place whereas mixing through wind or advection of already existing particles is prevented. Salt lakes with a low pH level lead to strongly increased aerosol formation. In two chamber experiments also aerosol filter samples have been taken. The chemical analysis of the anions by ion chromatography showed a 8 to 17 times higher concentration of Cl<sup>-</sup> than SO<sub>4</sub><sup>2-</sup>. Thus, the particle formation seems to be influenced by halogens.

As salt lakes have been identified as a source for reactive halogen species (RHS; Buxmann et al., 2012) and RHS seem to interact with precursors of secondary organic aerosol (SOA), they could be producers of halogen induced secondary organic aerosol (XOA) (Ofner et al., 2012).

As reference experiments, laboratory based aerosol smog-chamber runs were performed to examine XOA formation under atmospheric conditions using simulated sunlight and the simplified chemical composition of a salt lake. The mixture included FeSO<sub>4</sub>, NaCl and Na<sub>2</sub>SO<sub>4</sub>. After adding  $\alpha$ -pinene to the simulated salt lake, a strong nucleation event began (Figure 1) in the absence of ozone comparable to the observed events in Western Australia in 2012. First results from the laboratory based aerosol smog-chamber experiments indicate a halogen-induced aerosol formation above Australian salt lakes. To validate this hypothesis, additional measurements above several salt lakes of Western Australia will be conducted in spring

2013 with combined physical and chemical investigations. The particle number size distribution will be recorded by a mobile DMPS system and for further chemical analysis filter and impactor samples will be taken.

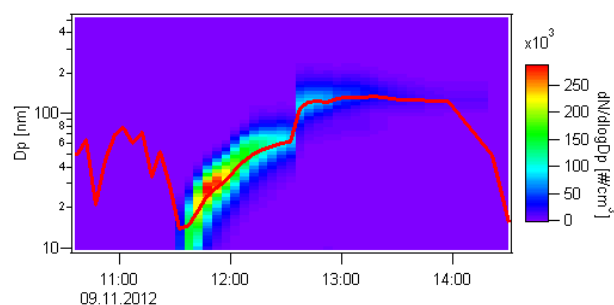


Figure 1. Contour plot with the geometric mean diameter (red) for an aerosol formation event above a simulated salt lake in a smog chamber experiment with simulated sunlight.

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Buxmann, J., Balzer, N., Bleicher, S., Platt, U., and Zetzsch, C.: Observations of bromine explosions in smog chamber experiments above a model salt pan, *Int. J. Chem. Kinet.*, 44, 312-326, 2012.

Junkermann, W., Hacker, J., Lyons, T., and Nair, U.: Land use change suppresses precipitation, *Atmos. Chem. Phys.*, 9, 6531–6539, 2009.

Ofner, J., Balzer, N., Buxmann, J., Grothe, H., Schmitt-Kopplin, Ph., Platt, U., and Zetzsch, C.: Halogenation processes of secondary organic aerosol and implications on halogen release mechanisms, *Atmos. Chem. Phys.*, 12, 5787-5806, 2012.