



Salt Lakes of Western Australia – Emissions of natural volatile organic compounds

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Western Australia is a semi-arid region that is heavily influenced by global climate change and agricultural land use. The area is known for its many saline lakes with a wide range of hydrogeochemical parameters. This area has been repeatedly investigated since 2006 and consists of ephemeral saline and saline groundwater sourced lakes with a pH reaching from 2.5 to 7.1. The semi-arid region was originally covered by natural eucalyptus forests, but land-use has changed considerably after large scale deforestation from 1950 to 1970. Today the region is mostly used for growing wheat and live stock. The deforestation led to a rising groundwater table, bringing dissolved salts and minerals to the surface.

In the last decades, a concurrent alteration of rain periods has been observed. A reason could be the regional formation of ultra-fine particles that were measured with car-based and airborne instruments around the salt lakes in several campaigns between 2006 and 2011. These ultra-fine particles emitted from the lakes and acting as cloud condensation nuclei can modify cloud microphysics and thus suppress rain events [1]. New data from a campaign in 2012 accentuates the importance of these hyper saline environments for the local climate.

Ground-based particle measurements around the salt lakes in 2012 were accompanied by novel chamber experiments directly on the lakes. The 1.5 m³ cubic chamber was constructed from transparent PTFE foil permitting photochemistry within while preventing dilution of the air due to lateral wind transport. This experimental setup allows linking the measured data directly to the chemistry of and above the salt lakes. Another advantage of the PTFE chamber is the enrichment of volatile organic compounds (VOC) that are emitted from salt lakes as possible precursors for the ultra-fine particles.

Chamber air was sampled using stainless steel canisters. Sediment, crust and water samples were taken for investigation of potential VOC emissions in the laboratory using GC-MS technique.

Different VOC and halogenated volatile compounds (VOX), exceeding atmospheric background concentrations, were identified from the sampled chamber air. Their enrichment or depletion over the time in the chamber allows for postulated reaction pathways leading to the formation of ultra-fine particles.

Soil and water samples showed a variety of highly volatile and semi-volatile VOC/VOX. An abiotic formation of these VOC/VOX seems conclusive due to iron-catalysed reactions below the salt crust [2]. The salt crust is the link through which VOC/VOX pass from the soil/groundwater to the atmosphere. During desiccation salt crystals grow, trapping gases as fluid inclusions (FI). The study of FI provides qualitative emission data of VOC/VOX during desiccation which can be released upon wetting to the atmosphere.

This study includes the emission of VOC/VOX from hyper saline terrestrial environments and their role in the atmospheric formation of climate relevant ultra-fine particles.

[1] Junkermann et al., 2009, *Atmos.Chem.Phys.*, 9, 6531-6539

[2] Huber et al., 2009, *Environ.Sci.Technol.*, 43 (13), 4934-4939