Geophysical Research Abstracts
Vol. 12, EGU2010-11335, 2010
EGU General Assembly 2010

Emission of Volatile OrganoHalogens by Southern African Solar Salt Works

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Volatile organic compounds containing halogens - especially chlorine - have been considered for a long time of industrial origin only, and it was assumed that the production and emission of these compounds can easily be controlled by humans in case they will cause a threat for life on Earth. Since the middle of the 80ies of the last century it became clear that the biologically active organohalogens isolated by chemists are purposefully produced by nature as antibiotics or as antifeedant etc. To date more than 3800 organohalogens are known to be naturally produced by bio-geochemical processes.
The global budgets of many such species are poorly understood and only now with the emergence of better analytical techniques being discovered. For example the compound chloromethane nature's production (5 GT) outdates the anthropogenic production (50 KT) by a factor of 100. Thus organohalogens are an interesting recent case in point since they can influence the ozone budget of the boundary layer, play a role in the production of aerosols and the climate change discussion.
An intriguing observation is that most of the atmospheric CH3Cl and CH3Br are of terrestrial rather than of marine origin and that a number of halogenated small organic molecules are produced in soils. The high concentrations of halides in salt soils point to a possibly higher importance of natural halogenation processes as a source of volatile organohalogens. Terrestrial biota, such as fungi, plants, animals and insects, as well as marine algea, bacteria and archaea are known or suspected to be de-novo producers of volatile organohalogens.
In recent years we revealed the possibility for VOX to form actively in water and bottom sediments of hyper-saline environments in the course of studying aridization processes during climatic warming.
Due to the nature of their production process solar salt works, as to be found along-side the Southern African coast line but also upcountry, combine a variety of semi- and hyper-saline environments, rich in chloride, bromide and partly iodide. They can be seen as semi natural reactors for hypersaline microorganisms like bacteria, algae and archaea as they can be found in natural hypersaline environments as well.
To assess possible VOX emission of solar salt works the Walfishbay Salt Refiners (PTY) LTD (Namibia) were investigated and sediments of several crystallizer pans where collected. Only affected by natural temperature and radiation regime the VOX production inside the tightly closed incubation vials were determined regularly for several months by using headspace GC combined with an electron capture detector. Besides a number of non halogenated volatile hydrocarbons, detected by a self modified purge and trap GC/MS system the following VOX have been identified: CHCl3, CH3J, CH3Br, CCl4, C2HCl3, C2Cl4.
According to earlier experiments on natural salt sediments of Southern Russia a biosynthesis process involving halophilic archaea is highly probable. Although the metabolic routes entailed are not yet identified.
Obtained long term emission data are presented by focussing on possible meteorological propulsion as solar and UV radiation as well as temperature. Discussing the incubation experiments Southern African solar salt works reveal to represent interesting sources of chemically active VOX.