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Freeze-Induced Reactions: Formation of Iodine–Bromine Interhalogen Species from Aqueous Halide Ion Solutions

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The presence of gaseous halogens in the polar troposphere is of considerable interest to researchers as it is known that these highly reactive species can alter the oxidative capacity of the Polar atmosphere. Perhaps the most well known Polar tropospheric phenomenon to which halogens have been linked are sudden ozone depletion events (ODEs), observed to occur within the boundary layer during Polar sunrise. More recently researchers have identified other atmospherically relevant processes influenced by the presence of gaseous halogens, such as the formation of cloud condensation nuclei or the removal and deposition of gaseous elemental mercury to the snowpack. However, questions on how these halogen species are initially released to the Polar troposphere remain.

During this research, interhalide ions of the type I2Br- and IBr2- are generated by freezing dilute solutions containing components found in Polar marine environments. These interhalide species have previously been shown to be precursors of iodine monobromide, IBr, which may diffuse from solution, thus releasing reactive halogens to the gas phase. The freezing process itself is shown to stimulate interhalide formation in dilute solutions containing bromide, iodide and hydrogen peroxide, under acidic conditions. The reaction mechanisms that lead to the formation of IBr2- under freezing conditions are explored, and the chemistry subsequently modified in order to mimic naturally occurring conditions more closely. By modification of the initial ratios of bromide to iodide in solution, interhalide formation is shown to become favourable at pH˜5, an acidity comparable to that found in natural snowpack.

Please list some keywords

Halogens, Sea salt, Freeze-induced Reactions

Primary author: Mr O'SULLIVAN, Daniel (University College Cork)

Presenter: Mr O'SULLIVAN, Daniel (University College Cork)

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