Geophysical Research Abstracts,
Vol. 11, EGU2009-4421, 2009
EGU General Assembly 2009

Halogen chemistry in the marine boundary layer

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Important atmospheric sources of iodine include the air-sea exchange of biogenic iodocarbons, and the emission of I2 from macro-algae. The major source of bromine is the release of bromide ions from sea-salt aerosol. The subsequent atmospheric chemistry of these halogens (1), changes the oxidizing capacity of the marine boundary layer by destroying ozone and changing the hydroxyl radical concentration; (2), reacts efficiently with dimethyl sulphide and mercury (in the polar regions); and (3), leads to the formation of ultra-fine particles which may contribute to cloud condensation nuclei (CCN) and hence affect climate.

This paper will report observations of IO, BrO, OIO and I2 made by the technique of differential optical absorption spectroscopy, in several contrasting marine environments: the equatorial mid-Atlantic (Cape Verde); mid-latitude clean coastal (Mace Head, Ireland); polluted coastal (Roscoff, France); and the polar marine boundary layer (Hudson Bay, Canada). Both IO and BrO are observed in all these locations at significant concentrations (> 1 pptv), and so have a major impact on (1) and (2) above.

To complement the field campaigns we have also carried out wide-ranging laboratory investigation. A new study of OIO photochemistry shows that absorption in the visible bands between 490 and 630 nm leads to I atom production with a quantum yield of unity, which now means that iodine is a particularly powerful ozone-depleting agent. We have also studied the formation and growth kinetics of iodine oxide nano-particles, and their uptake of water, sulphuric acid and di-carboxylic organic acids, in order to model their growth to a size where they can act as CCN. Their ice-nucleating properties will also be reported.