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Global modelling of atmospheric bromoform sources and sinks

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Brominated organic compounds carry bromine atoms to the atmosphere which, once released via photolysis or reaction with OH, catalytically destroy ozone, influencing atmospheric oxidation and composition. While previously it was assumed that bromine in the stratosphere was predominantly due to the transport of methyl bromide and long-lived halons emitted from the Earth's surface, observations now suggest that between $\sim$3-8 ppt bromine in the stratosphere is from short-lived bromocarbons. Determining the magnitude of the surface emissions of short-lived bromocarbons and the potential quantites transported to the free troposphere and lower stratosphere is therefore of interest.

A global three-dimensional chemical transport model has been used to simulate atmospheric bromoform and other short-lived bromocarbons, using a variety of prescribed surface emission scenarios and a simple atmospheric chemistry scheme. Model simulations indicate that global emissions of bromoform calculated previously using top-down methods are too low, and emissions are likely to be significantly larger than suggested in the World Meteorological Organization's reports on the Scientific Assessment of Ozone Depletion of 1998 and 2002. In addition, simulations suggest that a large proportion of bromoform emissions are situated in tropical regions. Both these factors are likely to have an important influence on estimates of the quantity of bromine transported from the surface to the lower stratosphere by short-lived bromocarbon species, and its subsequent impact on ozone in this region.

Further simulations including methyl bromide, bromoform and the other major short-lived bromocarbons emitted from the ocean provide estimates on the amount of reactive bromine in the troposphere and lower stratosphere derived from these compounds.