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Halogenated trace gases in stratospheric air samples: Implications for atmospheric lifetimes

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Halogenated trace gases are large contributors to the anthropogenic greenhouse effect with chlorine- and bromine-containing species also catalysing ozone-depletion in the stratosphere. In order to quantify these impacts knowledge of the respective atmospheric lifetimes is crucial. For many of these compounds the stratospheric lifetime is very influential, in the case of chlorofluorocarbons (CFCs) it is even equivalent to the total atmospheric lifetime as CFCs have only negligible sink reactions in the troposphere. Published lifetime estimates based on various experimental and modelling-based approaches show considerable spread which results in significant uncertainty ranges. We here present an analysis of a data set based on mass spectrometric measurements of stratospheric whole-air samples. These samples originate from the tropical, mid-latitudinal, and polar stratosphere from aircraft and balloon campaigns in 2005, 2006, 2008, 2009, 2010, and 2011. Implications for the stratospheric lifetimes of a variety of halocarbons including CFCs, halons, hydrochlorofluorocarbons, and hydrofluorocarbons (HFCs) are being derived and discussed.