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3D Modelling of Halogenated Very Short-Lived Source Gas Degradation in the Tropical Troposphere

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Halogenated very short-lived species (VSLS) are known to provide an additional supply of inorganic bromine (Br_y) to the stratosphere (e.g. WMO, 2003). The magnitude of this supply is uncertain with current estimates ranging from ∼3-8 ppt. Furthermore, uncertainties exist as to the relative importance of the so-called, source gas injection (SGI) and product gas injection (PGI) pathways. This is enhanced by a lack of observational data, particularly of the degradation products (aka. product gases, e.g.CBr_2O) formed following the breakdown of source gases (e.g. $CHBr_3$) via reaction with OH or photolysis. Previous model work has not directly considered the fate of these species and thus this is omission is addressed.

A detailed chemical scheme describing the tropospheric degradation of $CHBr_3$, dibromomethane (CH_2Br_2) and other bromo/chloro-carbon source gases has been developed for use in the TOMCAT/SLIMCAT 3D chemical transport model (CTM). We present results from multi-annual simulations quantifying the contribution of these species to the stratospheric halogen budget. We also present novel estimates of the degradation products of these species in the tropical near-tropopause region. In addition, results are verified with comparison of modelled source gas profiles with observations taken during the 2007 NASA TC4 campaign. Sensitivity runs investigating the importance of convection and also the lifetime of Br_y due to washout have also been performed