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Emission, transport and degradation of the major bromine-containing VSLS in the troposphere: an inter-comparison study

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Due to their high reactivity and consequently their very short lifetime, bromine-containing VSLS contribute to the atmospheric inorganic bromine (Bry) budget and play an important role in the chemistry of the free troposphere and the stratosphere. However, the contribution of these species to the Bry budget and in particular the delivery to the stratosphere can vary significantly between atmospheric models and the emission scenarios used by the model. Here we test emissions of brominated VSLS from four different emission scenarios with VSLS observations in the troposphere, using two different models.

This study is part of the TRANSCOM-VSLS project aimed to examine intermodel variability on the abundance of several VSLS in the atmosphere. We performed simulations of the transport and degradation of the most abundant brominated VSLS in the troposphere, CHBr3 and CH2Br2, using three top-down emission inventories (Warwick et al., 2006; Liang et al., 2010 and Ordonez et al., 2012) and one bottom-up emission inventory (Ziska et al., 2013) as input to the chemistry climate model EMAC and the chemical transport model TOMCAT/SLIMCAT.

The modeled VSLS are compared to in-situ aircraft and long-term ground based observations of CHBr3 and CH2Br2 by the GhOST-MS instrument in the South China Sea during the SHIVA campaign and at the NOAA stations, respectively.

From our model simulations, we find that observed VSLS profiles in the tropical troposphere are consistent with the bottom-up emission scenario, indicating that we now approach an adequate understanding of the large scale sources and sinks of brominated VSLS in the tropical troposphere.