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Exchange of VSLS in the marine boundary layer with the free troposphere during SHIVA-SONNE

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Significant contributions from short lived brominated and iodinated compounds to the stratospheric ozone budget are suspected especially from the tropical oceans particularly from coastal regions, where strong VSLS emissions are observed, caused by local biology (phytoplankton and macro algae). Due to the fast uplift of surface air by deep convection in the tropics, the ocean derived substances are expected to be transported to the stratosphere.

Results from the SHIVA-SONNE ship campaign in the tropical West Pacific during 15 to 29 November 2011 revealed that the South China and Sulu seas comprise strong source regions of halocarbons for the atmosphere. Especially the bromoform fluxes were very high along the whole cruise and were in agreement with coastal fluxes from previous campaigns. Measurements of low air and high water concentrations of CH_3I, CH_2Br_2, and $CHBr_3$ support the derived air sea fluxes together with the high surface water temperatures and elevated wind speeds. The three airborne VSLS showed correlations and anti-correlations with some meteorological parameters (i.e. wind speed), while the mixing ratios of all compounds generally increased from the South China Sea towards the Sulu Sea region. A comparison of collocated VSLS measurements in the marine atmospheric boundary layer (MABL) between the research vessel SONNE and the aircraft FALCON revealed a good agreement. With a simple box-model we calculated the importance of the compounds sea-air flux related to their MABL-concentrations and lifetimes assuming a mean loss of 20% per day due to transport out of boundary layer into the free troposphere during the campaign. While the CH_3I–flux approximately equaled its chemical loss, the fluxes of the brominated compounds were roughly ten times larger than needed to maintain the MABL mixing ratio, suggesting this region to be a very important oceanic source region for the atmosphere. Finally, we will compare the box-model loss from the MABL to the free troposphere with calculations from the trajectory model FLEXPART and with in situ aircraft measurements from the FALCON to validate and inter compare different VSLS emission estimates.