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Biogenic halocarbons in the tropical East Pacific during different seasons and ENSO-conditions

Birgit Quack (1), Steffen Fuhlbrügge (2), Elliot Atlas (3), Astrid Bracher (4), Sarah Gjermo (2), Helmke Hepach (1), Alina Fiehn (5), Irene Stemmler (6), and Kirstin Krüger (2)

(1) GEOMAR | Helmholtz-Zentrum für Ozeanforschung Kiel, Marine Biogeochemistry - Chemical Oceanography, Kiel, Germany (bquack@geomar.de), (2) University of Oslo, Norway, (3) RSMAS, Miami, USA, (4) AWI Bremerhaven, Germany, (5) DLR Oberpfaffenhofen, Germany, (6) MPI for Meteorology, Hamburg, Germany

Marine emissions of volatile, short-lived halogenated compounds (halocarbons) influence the oxidative capacity of the troposphere and are involved in aerosol formation. In regions of strong tropical deep convection they can be transported into the upper troposphere/ lower stratosphere (UTLS), where the released halogens take part in ozone destruction. Oceanic upwelling systems, where cold, nutrient rich deep waters foster enhanced biological activity in the surface, are important source regions for brominated compounds such as bromoform (CHBr3) and dibromomethane (CH2Br2), as well as iodinated methyl iodide (CH3I).
The tropical East Pacific is subject to strong interannual changes in atmospheric and oceanographic conditions known as the El Niño Southern Oscillation (ENSO). During normal conditions, a strong upwelling can be observed at the western coast of South America especially close to Peru, called the “Peruvian Upwelling”. During anomalous warm phases, called El Niño, the upwelling ceases with severe consequences for biogeochemical cycles in the tropical East Pacific. Here, we report halocarbon measurements from three different cruises crossing surface waters of the Peruvian Upwelling during December 2012 (M91 cruise), October 2015 (ASTRA-OMZ), and June 2017 (M138 cruise) during neutral ENSO and El Niño conditions. During neutral ENSO in December 2012, the upwelling was identified as a strong source of iodocarbons, which contributed significantly to the tropospheric iodine loading. During the onset of an El Niño in October 2015, the emissions and atmospheric loading of brominated halocarbons were higher, while the atmosphere was more convective than during the previous cruise. In June 2017 ENSO neutral conditions prevailed, where the collected measurements are currently analyzed. Preliminary results reveal high variability of halocarbons surface water concentrations and emissions which may be related to the seasonality of the “coastal El Nino” affecting the marine biology or to other factors such as anthropogenic impacts from coastal urbanization.