Sources and Abundance of Inorganic Bromine and Iodine in the Tropical Transition Layer: Constraints from Recent DOAS Aircraft Observations of Bromine Oxide (BrO) and Iodine Oxide (IO)

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The tropical free troposphere is a key atmospheric environment to understand chemistry-climate interactions. About 75% of the tropospheric ozone (O_3) and methane (CH_4) loss occurs at tropical latitudes. There is a particular need to understand the emissions and chemistry of tropospheric halogens in pristine remote environments, because they influence the reactive chemical removal pathways of climate active gases, and can modify aerosols that affect Earth's radiation balance.

Recently, field measurements over the remote tropical Eastern Pacific ocean have shown that tropospheric halogen chemistry has a larger capacity to destroy O_3 and oxidize atmospheric mercury than previously recognized. Halogen chemistry is currently missing in most global and climate models, and helps explain the low O_3 levels in preindustrial times (Volkamer et al., 2015; Wang et al., 2015). These aircraft measurements help resolve a long standing conundrum in the tropospheric bromine oxide (BrO) column abundance between satellites and balloon profiles, and highlight the importance of heterogeneous bromine recycling on aerosol and ice surfaces. They also provide vertical profiles of iodine oxide (IO) to evaluate models for I_y in the troposphere (Sherwen et al., 2016), and estimate iodine injections into the stratosphere (Saiz-Lopez et al., 2015). This presentation reviews the available evidence whether inorganic sources of halogens influence the composition of the tropical free troposphere, and possibly need to be considered for modeling of the Ozone layer.

Figure 1. The University of Colorado Airborne MAX-DOAS instrument telescope mounted below the wing of the NSF/NCAR GV aircraft is being serviced by CU graduate student Sunil Baidar. The instrument measured sub-pptv concentrations of BrO and IO radicals directly in the open atmosphere, spanning altitudes from the tropical Marine Boundary Layer (MBL) into the tropical transition layer (TTL), and the sub-tropical lower stratosphere (LS) during the TORERO and CONTRAST field campaigns.