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1.0 Data Set Description

NSF/NCAR GV Trace Organic Gas Analyzer with TOFWERK (Thun, Switzerland) high-resolution Time-of-Flight Mass Spectrometer (TOGA-TOF) data collected during the Asian Summer Monsoon Chemical and Climate Impact Project (ACCLIP) field campaign. The data files are in ICARTT V2.0 format.

- Data version: R0 as of April 6, 2023.
- Data Status: FINAL
- Time period covered by the data: 30 July 2022 through 31 August 2022 (UTC)
- Physical location: NSF/NCAR GV flights based from Osan Air Base, South Korea
- Additional Information:
 - ACCLIP campaign information: https://www.eol.ucar.edu/field_projects/acclip

- TOGA-TOF instrument: <https://www2.acom.ucar.edu/voc-measurements/measurement-instrumentation>

2.0 Instrument Description

The airborne TOGA-TOF instrument was developed at NCAR/ACOM to provide measurements of a large suite of C₁-C₁₀ VOCs, including non-methane hydrocarbons (NMHC; including alkanes, alkenes, and aromatic hydrocarbons), oxygenated VOCs (OVOCs) including aldehydes, ketones, alcohols, esters, and ethers, sulfur species including dimethyl sulfide (DMS), carbon disulfide (CS₂), and methanethiol (CH₃SH), nitrogen species including nitriles HCN, CH₃CN, propanenitrile, acrylonitrile, and methylacrylonitrile and alkyl nitrates, and a large number of chlorine, bromine, iodine, and fluorine halocarbons. VOCs are generally sampled for 35 seconds every 2 minutes continuously from take-off to landing. The TOGA-TOF instrument has been successfully deployed on FIREX-AQ (NASA/NOAA, 2019), TI3GER (NSF, 2022), and ACCLIP (NSF/NASA, 2022). Apart from the Time-of-Flight detector, TOGA-TOF instrument is very similar to the TOGA-Quad instrument with an Agilent quadrupole mass spectrometer detector, which has an excellent record of performance on the WE-CAN (NSF, 2018), ATom (NASA, 2016-2018), ORCAS (NSF, 2016), FRAPPÉ (NSF, 2014), CONTRAST (NSF, 2014), DC3 (NSF/NASA, 2012), and TORERO (NSF, 2012) campaigns.

- Data Frequency: 35-s samples every 2 minutes.
- Data Precision and Accuracy: VOC specific, reported in the ICARTT file header.
- Detection limits: low ppt to sub-ppt and VOC specific, reported in the ICARTT file header.

3.0 Data Collection and Processing

- Data collection computer-controlled and monitored in flight by a TOGA-TOF operator
- TOGA sampling, pre-concentration and gas chromatography processes are monitored and recorded in a 1-Hz housekeeping file.
- TOF data files are saved in HDF5 format. High-resolution mass calibration and ion trace batch fitting are performed using Tofware (Aerodyne Research, Inc.). Chromatographic peak fitting is performed using TERN in Igor (Aerodyne Research, Inc.)
- Description of quality assurance are not complete for this PRELIMINARY data set.

4.0 Data Format

- *In situ* gas-phase VOC observations are reported as dry volume mixing ratios (DVMR) in units of ppt (parts per trillion), or “arb ppt” (arbitrary ppt) for species that have not been fully calibrated, as specified in the header for each species.
- Data file structure is ASCII following the ICARTT V2.0 specifications outlined in <https://www.earthdata.nasa.gov/esdis/esco/standards-and-practices/icartt-file-format>
- Detection limits are species specific and reported in species order in the header as LLOD_VALUE.
- Data below detection limits (LLOD_FLAG) are represented by -888.
- Missing/unavailable data are represented by -999.

5.0 Data Remarks

- Data are available for all flights except for RF02 (4 Aug 2022) due to a major instrument issue.

- Due to a minor instrument issue, VOC data are unavailable during the last hour of RF03 (6 Aug 2022), the first 2.5 hours of RF04 (7 Aug 2022), the last hour of RF07 (17 Aug 2022), and the last 15 min of RF14 (30 Aug 2022).