Title: HIAPER Airborne Radiation Package (HARP) – Actinic Flux

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1.0 Data Set Description

NSF/NCAR G-V HARP (HIAPER Airborne Radiation Package) – Actinic Flux data collected during the Asian Summer Monsoon Chemical and Climate Impact Project (ACCLIP) field project. The data set is in ICARTT format. Please see the data file headers for additional details on instruments, parameters, quality assurance, quality control, contact information, and data set comments.

- Data version: R0 as of 21 April 2023
- Data Status: FINAL
- Time period: 28 July through 1 September 2022
- Location: NSF/NCAR G-V flights based from Osan Air Base, South Korea
- Additional information at the following websites:
  - https://www.eol.ucar.edu/instruments/hiaper-airborne-radiation-package
  - https://www2.acom.ucar.edu/sections/arim-instrumentation

2.0 Instrument Description

HARP actinic flux instruments were developed in the NCAR/ACOM Atmospheric Radiation Investigations and Measurements (ARIM) laboratory to provide down- and up-welling spectra from 280 to 640 nm. Photolysis frequencies are calculated from the actinic flux for over 40 atmospherically relevant trace gases. The instruments have an excellent record of performance on the WE-CAN, WINTER, FRAPPE, CONTRAST, NOMADSS, DC3 and TORERO campaigns.

- Data Frequency: 1 Hz
- Actinic flux precision: 1%
- Actinic flux uncertainty: 4-6% (wavelength dependent)
- Typical photolysis frequency uncertainty at high sun: 12-25% (molecule dependent). Degredation of the zenith (downwelling optic) during ACCLIP adds an additional 5-25% uncertainty.

3.0 Data Collection and Processing

- Data collected autonomously during each G-V aircraft flight

- Photolysis frequencies calculated from the molecular code of the NCAR/ACOM Tropospheric Ultraviolet and Visible (TUV) radiative transfer model (version 5.4)
- Quality assurance and control procedures are complete

4.0 Data Format

- Calculated photolysis frequencies are reported as column delimited ASCII in the ICARTT format
- Filenames are in the format: ACCLIP-HARP-JV_GV_yyyymmdd_R0.ICT

5.0 Data Remarks

- Modifications were completed after final calibrations, data assessments and optical corrections for this data set
- The TUV model was used to assess clear-sky downwelling photolysis frequencies during high altitude flight legs and solar zenith angle dependencies of the degrading optic.

6.0 References

- Hall, S. R., et al.: Cloud impacts on photochemistry: building a climatology of photolysis rates from the Atmospheric Tomography mission, Atmos. Chem. Phys., 18, 16809-16828, https://doi.org/10.5194/acp-18-16809-2018, 2018.
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- Madronich, S. and Flocke, S.: The Role of Solar Radiation in Atmospheric Chemistry, in: Environmental Photochemistry, The Handbook of Environmental Chemistry (Reactions and Processes), edited by: Boule, P., vol. 2/2L, Springer, Berlin, Heidelberg, 1999.

7.0 Appendix

- Keywords: Actinic flux, photolysis rates, photochemistry, atmospheric radiation