STAQS HSRL-2 ReadMe
February 9, 2024

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Organization: NASA Langley Research Center
Instrument Name: NASA HSRL-2
Mission: STAQS (Synergistic TEMPO Air Quality Science)
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Platform: NASA JSC GV
Location: GPS Lat, Lon, and Alt included in the Nav_Data records
Associated Data: Additional folders provide information used to process and locate the HSRL-2 data products

/State: parameters interpolated to HSRL-2 curtains from The High-Resolution Rapid Refresh (HRRR) (see rapidrefresh.noaa.gov/hrrr/)

Temperature, K, atmospheric temperature
Pressure, atm, atmospheric pressure
Number_Density, per cubic meter, molecular number density

/Nav_Data: other navigational data is also included besides what is listed below

gps_time, time of the data products from 0 UT on the flight day
gps_alt, m, aircraft altitude from GPS
gps_lat, degrees, latitude N from GPS
gps_lon, degrees, longitude E from GPS

Data Info: 10 second profiles, higher resolution files are available upon request. All data products have been interpolated to the same uniform altitude grid (DataProducts/Altitude) and horizontally averaged or interpolated to the GPS times (Nav_Data/gps_time). Horizontal and vertical resolutions of the data products are found in the attributes of each scientific data set. https://www-air.larc.nasa.gov/missions/staqs/index.html
Instrument Info: Multiwavelength High Spectral Resolution Lidar (HSRL-2) aerosol/cloud measurements with Differential Absorption Lidar (DIAL) Ozone measurement capability, see https://science-data.larc.nasa.gov/lidar/instruments.html
Uncertainty: Uncertainty values are not included in this release, they will be provided in the next release
DM Contact Info: marta.a.fenn@nasa.gov, amy.jo.scarino@nasa.gov
Project Info: https://espo.nasa.gov/staqs
Stipulations on Use: Although not required for publicly archived data, users are STRONGLY ENCOURAGED to contact the HSRL team before using the data, for advice specific to the desired application.
Revision: R0, Final Data
Similar information is found within the Global Attributes of the HDF5 file.

Comments on Data:
Revision: R0: Final Data - RF08 from Toronto was largely flown with the transmitted signals attenuating due to Canada restrictions, so this flight has lower signal to noise ratio than the other flights. The images that are made for a specific raster have L1, L2, and possibly L3 in their file names. L1 refers to the first raster, L2 to the second raster, and L3 to the third raster, if indeed three raster's were flown. One exception to this is RF02. Due to operational considerations, both L1 and L2 refer to the first raster. Raster 2 plots are labeled L3, and raster 3 plots are labeled L4.

New NearSurface Data Products H5 Files Available: Revision R0 – staqs-HSRL2-NearSurface_JSC-GV_yyyymmdd_R#.h5
Nav_Data included: Latitude, Longitude, Time_mid (UTC)
HSRL-2 data products calculated near the surface over different geometric altitude intervals. The products are calculated from near the surface to the altitude and if there is terrain the vertical average is adjusted by the Globe Digital Elevation Model altitude. Data products are provided at the fundamental acquisition resolution of 0.5 seconds, but are averaged over the time interval specified. Precise RangeAverage and TimeAverage information for each set is given within the specific set folder: 765meters_20seconds, 315meters_60seconds, 1005meters_10seconds, 1515meters_10seconds, 1995meters_10seconds. See 000_Readme within H5 file for more information.

Mixed Layer Heights (MLH); Revision R0 derived from 532nm cloud screened aerosol backscatter profiles when the aircraft is higher than 2km. MLH is reported in meters, above ground level. Given the variety of ways to define, retrieve, and use MLH, as well as the difficulty in determining MLH in complex atmospheric conditions, the MLH provided in these files may or may not be useful for a given application. We strongly recommend that users consult the introduction and methodology found in Scarino, A. J. et al. (2014) when using this dataset. The MLH values can be found in the archived hdf5 files (staqs-HSRL2_JSC-GV_yyyymmdd_R#.h5) under '/DataProducts/MixedLayerHeight.'

For STAQS, a different approach was used for the final MLH product. Manual heights were determined and incorporated into use if criteria from a normalized percent difference was met. If the normalized percent difference of the automated algorithm MLH and the manual determined MLH is less than 10% (or 30m), the automated MLH value will be used. Otherwise, the manual determined MLH will be used. If no manual determined MLH, it was decided that there is high uncertainty on where the MLH is located and the MLH value is blanked. A QA flag has been provided to give context to the MLH product, found in '/DataProducts/MixedLayerHeight_QAflag.'

Column 1:

(0) automated algorithm MLH used
(1) manual heights used
(2) no manual heights used, but automated algorithm MLH value is blanked

Column 2:

(1) auto and manual algorithm MLH within 10% or 30m
(2) auto and manual algorithm MLH within 20%, or within 30m and 60m
(3) auto and manual algorithm MLH within 30%, or within 60m and 120m
(4) auto and manual algorithm MLH within 40%, or within 120m and 240m
(5) auto and manual algorithm MLH greater than 50%, or greater than 240m
(-999) if Column 1 value is 2

MLH was not provided for the transit flights (20230624 and 20230629).

Compressed folder ('**staqs-HSRL2-images_JSC-GV_20230624_R0_MLH.zip**') contains MLH plots for all flights. There are two* plots for each flight – backscatter curtain with MLH and flight track (*dependent on number of raster's) colored by MLH.

References

Hair, J. W. et al.: Airborne High Spectral Resolution Lidar for profiling aerosol optical properties. Appl. Opt. 47, 6734-6752, doi:10.1364/AO.47.006734, 2008.

Scarino, A. J. et al.: Comparison of Mixed Layer Heights from Airborne High Spectral Resolution Lidar, Ground-based Measurements, and the WRF-Chem Model during CalNex and CARES, Atmos. Chem. Phys., 14, 5547-5560, https://doi.org/10.5194/acp-14-5547-2014, 2014.