ACTIVATE HSRL-2 ReadMe
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Organization: NASA Langley Research Center
Instrument Name: HSRL-2
Mission: ACTIVATE
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Platform: NASA UC12, N528NA
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 MERRA2 (see http://gmao.gsfc.nasa.gov/)

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.
Instrument Info: High Spectral Resolution Lidar (HSRL-2), 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: richard.a.ferrare@nasa.gov, sharon.p.burton@nasa.gov, marta.a.fenn@nasa.gov, amy.jo.scarino@nasa.gov
Stipulations on Use: This is Final data. Users are strongly encouraged to consult the PI and/or DM prior to use.
Revision: R0

Comments on Data:
Within each full data file (ACTIVATE-HSRL2_UC12_yyyymmdd_RX.h5) there is '000_Readme', but additionally the following should be considered.

Aerosol_ID classification of Ice is highly suspect on all flights.

20200214 - An unidentified oscillation at 2.3-minute frequency exists in the backscatter and depolarization products at all wavelengths.

20200215 through 20200311 - An unidentified oscillation exists in the 355 nm backscatter product.

20200217 - An unidentified oscillation at 2.3-minute frequency exists in the 532 nm backscatter, and depolarization products and the 1064 nm depolarization product.

20200228_F2 -An unidentified oscillation exists in the 1064 nm depolarization product.

20200229_F1 -An unidentified oscillation at 2.3-minute frequency exists in the 532 nm backscatter product and the 1064 nm depolarization product.

20200306_F1 -An unidentified oscillation exists in the 1064 nm depolarization product.

2021052_F2 through 20210526_F2 – The 355 nm aerosol depolarization ratio product is anomalously low just above a bright cloud deck. The cause partly understood, but no remedy applied.

ICARTT format files are provided that include:

Aerosol Optical Thickness (AOT); Revision R0 at both 355nm and 532nm. Both clear-sky AOT and above cloud AOT are included. Cloud top height is available in these files.

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).
DEM altitude is provided in this file, which is the ground altitude above mean sea level based on the 1km GLOBE Digital Elevation Map dataset based on the GPS latitude and longitude. Also included in this file are mean 532 nm backscatter and extinction at three different layers: lowest 300m, within the MLH, and a 500m above MLH.

A quality assurance flag is included for the detection of the mixed layer heights, based on the index referenced by de Haij, Wauben & Baltink (2006). The magnitude in jump in backscatter, centered on the MLH is used as a quality of detection. A difference between the averaged backscatter from 360m below MLH (B_d) and the average backscatter from 360m above MLH (B_u) is used as a quantity for the quality index (see table below). The de Haij group used 150m above/below the MLH and slightly different threshold values for the quality index. The threshold values for the different quality index classes have been estimated by assessing cases from the initial MLH processing.

Color Code/QA Flag Value	**Threshold**	**Description**
White – 2	$B_d - B_u < 0.000025$	Poor MLH Detection
Blue – 1	$0.000025 < B_d - B_u < 0.0002$	Weak MLH Detection
Pink – 0	$B_d - B_u > 0.0002$	Good MLH Detection

Compressed folder ('**ACTIVATE-HSRL2- images_UC12_2020_R0_MLH.zip**') contains MLH plots for all flights. There are three plots for each flight – backscatter curtain with MLH, backscatter curtain with MLH colored by QA flag, and flight track colored by MLH.

References

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.

Marijn de Haij, Wiel Wauben, Henk Klein Baltink, "Determination of mixing layer height from ceilometer backscatter profiles," Proc. SPIE 6362, Remote Sensing of Clouds and the Atmosphere XI, 63620R (11 October 2006); https://doi.org/10.1117/12.691050