Readme document

ESCAPE OAP microphysics dataset ver. 1 (Preliminary)

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Note: Collaborative use of this dataset and contacting PI for additional details/caveats is strongly encouraged.

1.0 Data Set Description

Airborne measurements during the Experiment of Sea Breeze, Convection, Aerosol, Precipitation and Environment (ESCAPE) field campaign were conducted near Houston, Texas between 31 May and 17 June 2022. This preliminary dataset contains 1 Hz derived quantities from the 2D-S and HVPS-3 instruments onboard the National Research Council of Canada (NRC) Convair-580 aircraft. The binary dataset was processed using the University of Illinois-Oklahoma Optical array probe Processing Software (UIOOPS) v3.3.6 software (McFarquhar et al. 2020) and the size distributions were derived as a function of the diameter of the minimum enclosing circle of all center-in particle images acquired. Additional details about data processing can be found in McFarquhar et al. (2017).

2.0 Instruments Description

The 2D-S and HVPS-3 probes, also known as Optical Array Probes (OAP), records the 2-dimensional shadow images of the hydrometeors entering the sample volume of the instrument. The 2D-S probe has two channels namely horizontal (H) and vertical (V) that are perpendicular to each other whereas HVPS-3 has only vertical (V) channel. Table 1 shows the measurement range and the accuracy of the instruments. Table 2 and 3 shows bin widths used to derive size distributions from 2D-S and HVPS-3 measurements respectively. For detailed information about the 2D-S, refer to Lawson et al. (2006). For technical information about OAPs, refer to links in the references.

Table 1: List of Instruments.

Instrument	Manufacturer	Nominal Range	Accuracy
2-Dimensional Stereo Probe (**2D-S**)	SPEC*	10 μm to 1.28 mm	10 μm
High Volume Precipitation Spectrometer ver. 3 (**HVPS-3**)	SPEC*	150 μm to 1.92 cm	150 μm

*Stratton Park Engineering Company (SPEC) inc.

Table 2: 2D-S Bin Widths Used for Derived Size Distributions.

Bins (from) [mm]	Bins (up to) [mm]	Bin Width [mm]
0.005	0.205	0.01
0.205	0.505	0.02
0.505	1.005	0.05
1.005	2.005	0.1
2.005	3.005	0.2

Table 3: HVPS-3 Bin Widths Used for derived Size Distributions.

Bins (from) [mm]	Bins (up to) [mm]	Bin Width [mm]
0.075	3.075	0.15
3.075	7.575	0.3
7.575	15.075	0.75
15.075	30.075	1.5
30.075	45.075	3.0

3.0 Data Format

Filename: flight_yyyymmdd.instrument.channel.nc

Dimensions:

Time, Bins.

Variables (Units):

time: (HHMMSS)
bin_min (millimeter)
bin_mid (millimeter)
bin_max (millimeter)
bin_dD (millimeter)
conc_minR (cm^{-4}), number distribution function (size distribution) as function of time and particle size.
n (cm^{-3}), total concentration as function of time.
count (1), # of particles detected in bin as function of time and particle size.
sample_vol (cm^3), sample volume of probe as function of time and particle size.

4.0 Data Remarks

Date (M/DD)	5/31	6/02	6/02	6/04	6/08	6/09	6/10	6/11	6/12	6/14	6/16	6/16	6/17
CRF #	01	02	03	04	05	06	07	08	09	10	11	12	13
2D-S (H & V)													
HVPS (V)													

Note that there were total of 13 Convair Research Flights (CRF) during ESCAPE campaign and no data was recorded by the HVPS-3 probe on CRF09 (20220612) and CRF10 (20220614) flights. Particle images from 2D-S, HVPS-3 probes for selected times are available on request, please contact PI for additional information.

5.0 References

Lawson, RP, D O'Connor, P Zmarzly, K Weaver, B Baker, Q Mo, and H Jonsson, 2006. "The 2D-S (Stereo) Probe: Design and Preliminary Tests of a New Airborne, High-Speed, High-Resolution Particle Imaging Probe." Journal of Atmospheric and Oceanic Technology 23(11): 1462–1477, https://doi.org/10.1175/JTECH1927.1

McFarquhar, GM, D Baumgardner, A Bansemer, SJ Abel, J Crosier, J French, P Rosenberg, A Korolev, A Schwarzoenboeck, D Leroy, J Um, W Wu, AJ Heymsfield, C Twohy, A Detwiler, P Field, A Neumann, R Cotton, D Axisa, and J Dong. 2017. "Processing of ice cloud in situ data collected by bulk water, scattering, and imaging probes: fundamentals, uncertainties, and efforts toward consistency." In Ice Formation and Evolution in Clouds and Precipitation: Measurement and Modeling Challenges, American Meteorological Society Monographs 58: 11.1−11.33, https://doi.org/10.1175/AMSMONOGRAPHS-D-16-0007.1.

McFarquhar, G.M., J.A. Finlon, D.M. Stechman, W. Wu, R. Jackson, and M. Freer, 2020: University of Illinois/Oklahoma Optical Array Probe (OAP) processing software. Version 3.3.6 (Dataset). Zenodo, doi:10.5281/zenodo.3976291.

SPEC 2DS Technical Manual, rev 3.1, 2011 http://www.specinc.com/downloads

SPEC HVPS Technical Manual, rev 1.2, 2013 http://www.specinc.com/downloads