

Data Set Title:

*UW King Air Hydrometeor Size Spectra*

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Time of Interest:

2017/01/08 02:22:00 -- 2017/01/08 05:0557:00  
2017/01/09 04:16:00 -- 2017/01/09 07:38:00  
2017/01/11 02:13:00 -- 2017/01/11 05:46:00  
2017/01/18 19:59:00 -- 2017/01/18 23:13:00  
2017/01/19 15:27:00 -- 2017/01/19 18:31:00  
2017/01/19 22:29:00 -- 2017/01/20 02:04:00  
2017/01/21 22:04:00 -- 2017/01/22 01:41:00  
2017/01/22 20:56:00 -- 2017/01/23 00:32:00  
2017/01/31 20:50:00 -- 2017/01/31 22:30:00  
2017/02/03 19:44:00 -- 2017/02/03 21:48:00  
2017/02/04 21:42:00 -- 2017/02/05 01:27:00  
2017/02/07 19:49:00 -- 2017/02/07 23:24:00  
2017/02/16 23:30:00 -- 2017/02/17 00:53:00  
2017/02/18 21:30:00 -- 2017/02/19 00:48:00  
2017/02/19 17:26:00 -- 2017/02/19 20:58:00  
2017/02/20 14:31:00 -- 2017/02/20 17:42:00  
2017/02/21 14:26:00 -- 2017/02/21 18:17:00  
2017/03/04 13:15:00 -- 2017/03/04 16:55:00  
2017/03/05 12:00:00 -- 2017/03/05 15:00:00  
2017/03/07 14:00:00 -- 2017/03/07 17:50:00  
2017/03/09 13:58:00 -- 2017/03/09 16:58:00  
2017/03/09 19:56:00 -- 2017/03/09 23:46:00  
2017/03/16 00:52:00 -- 2017/03/16 04:31:00

Area of Interest:

Locations are specific to aircraft flight track for a given day/flight/file. The geographical grid that encompasses all flights is as follows: 43.5 degN, 45.0 degN, 117.0 degW, 114.5 degW.

Data Frequency:

1 Hz

Data Spatial Type:

Data were collected via aircraft. Data are time-tagged and locations can be cross-referenced from original aircraft files.

General Dataset Description:

There exists one file from each UW King Air (UWKA) research flight from SNOWIE. The files contain particle size spectra from all of the particle probes that were operational on the UWKA for that flight. No attempt has been made to combine size spectra. Detailed information on variables, naming convention, and missing data is listed below.

*Note – these data are version 1.*

File Names:

20170108.SD.cdf  
20170109.SD.cdf  
20170111.SD.cdf  
20170118.SD.cdf  
20170119a.SD.cdf  
20170119b.SD.cdf  
20170121.SD.cdf  
20170122.SD.cdf  
20170122.SD.cdf  
20170203.SD.cdf  
20170204.SD.cdf  
20170207.SD.cdf  
20170216.SD.cdf  
20170218.SD.cdf  
20170219.SD.cdf  
20170220.SD.cdf  
20170221.SD.cdf  
20170304.SD.cdf  
20170305.SD.cdf  
20170307.SD.cdf  
20170309a.SD.cdf  
20170309b.SD.cdf  
20170316a.SD.cdf

Data Restrictions:

None

File Naming Convention:

Files are named as [YYYYMMDD].SD.cdf

where YYYY is 4 number identifier for year (2017), MM is 2 number identifier for month, DD is 2 number identifier for day.

All files end in .SD.cdf (indicating size distribution, netCDF file)

If there are more than one flight for a given day, a letter is appended to the end of the 2 number day identifier.

*For Example: 2<sup>nd</sup> flight on Jan 19 --- 20170119b.SD.cdf*

Instruments/Variables:

All files contain variables for the following instruments:

2DS, CIP, 2DC, 2DP, CDP – variables for each probe contain the appropriate 3 letter identifier at the end of the variable name

2DS variables contain an additional \_V or \_H to identify whether it is from the V channel or the H channel.

For all probes, there are 4 variables that describe the binning used for data from that probe. The number of bins depends on the probe.

For each OAP probe, there are two size distributions. One provides number concentration in each bin, normalized by bin width. The second further divides the concentration into 1 of 10 area ratios, where an area ratio of 0 is perfectly linear and an area ratio of 1 is perfectly circular.

For each OAP probe, there exists a total concentration (integral of the size distribution) and a reject ratio (ratio of rejected particles to accepted particles).

For the CDP, There is one size distribution that provides number concentration in each bin, normalized by bin width and a total concentration.

All variables, except those that describe the bin diameters, are provided at 1 Hz. The variable 'time' is given in HHMMSS for a UTC clock

Variables for the size distributions, total concentration and reject ratios have a common naming convention:

size\_dist\_{probe ID}  
size\_dist\_area\_{probe ID} *OAP Probes only*  
total\_conc\_{probe ID}  
reject\_ratio\_{probe ID} *OAP Probes only*

Variables for the bins also have a common naming convention:

bin\_max\_{probe ID} *upper diameter bin edges*  
bin\_min\_{probe ID} *lower diameter bin edges*  
bin\_mid\_{probe ID} *mid-point diameter for each bin*  
bin\_dD\_{probe ID} *bin widths*

Number of bins and approximate size range for each probe:

CDP	27 bins	1 – 50 $\mu\text{m}$
2DC	19 bins	50 – 800 $\mu\text{m}$
2DS	128 bins	10 – 1280 $\mu\text{m}$ (H and V channels)
CIP	19 bins	25 – 1600 $\mu\text{m}$
2DP	19 bins	400 – 6400 $\mu\text{m}$

#### MISSING DATA **IMPORTANT**

*Not all probes were operational on all flights. If a probe was non-operational for an entire flight (or not installed), all values will be NaN for that flight.*

*If a probe was not operational for part of a flight, then values for concentrations, size distributions, etc. will be zero for that period. **There is no way to tell directly whether a probe did not detect particles or whether it was non-operational from looking at the data.** Users are cautioned that they should consider other data (measurements from other probes, bulk measurements, WCR reflectivity) to determine if particles may have been present when concentrations are reported as zero.*

### Version 1 Size Distribution Data Availability Inventory

IOP -- File	CDP	2DS	CIPG	2DP	2DC
1 - 0108	☑	☑	✘	☑	
2 - 0109	☑	☑	☑	☑	
3 - 0111	☑			☑	
4 - 0118	☑	☑	☑	☑	
5 - 0119a	☑	☑	☑	☑	
6 - 0119b	☑	☑	✘	☑	
7 - 0121	☑	☑	✘	☑	
8 - 0122	☑	☑	✘	☑	
9 - 0131	☑	☑	✘	☑	
10 - 0203	☑	☑		☑	
11 - 0204	☑	☑		☑	
12 - 0207	☑	☑		☑	
13 - 0216	☑	☑		☑	
14 - 0218	☑	☑		☑	
15 - 0219	☑	☑		☑	
16 - 0220	☑	☑		☑	
17 - 0221	☑	☑		☑	
19 - 0304	☑			☑	
20 - 0305	☑			☑	
21 - 0307	☑	☑		☑	✘
22 - 0309a	☑	☑		☑	✘
23 - 0309b	☑	☑		☑	✘
24 - 0316a	☑	☑		☑	✘

Check mark indicates data is available and included in the final size distribution file. Green (yellow) indicates that the data doesn't (does) have outstanding issues that require more detailed analysis—yellow marks for CDP indicate severe icing at some time through the flight, yellow marks for 2DS indicate one of data channels is missing (H or V). Red X's indicate that the data is not included in the final size distribution file or is useless (i.e. all NaN or zero concentrations) for V1.0. Later releases of the data set will likely include fixes for these data. X'ed out cells indicate data is unavailable from that probe on that date or unusable in perpetuity. No research flight for IOP18.

#### **SNOWIE OAP Size Distribution Version 1.0 (V1.0) known issues:**

- No 2DC size distributions for any IOPs (affects IOPs 21-24). *Expect later releases of the data may contain 2DC for these four flights in which the 2DC was operated. However, the 2DC was only operational for roughly the second half of each flight.*
- Icing effects present in size distributions for all probes (regions have not been flagged/removed; suspect times may be identified with [UWyo WCR/WCL/in-situ data](#) for CDP/2DP, especially)

- The 2DS and 2DP show poor agreement in their overlap region. The generated png log-by-log size distributions show this disagreement (up to  $\sim 1 \text{ OM cm}^{-3} \mu\text{m}^{-1}$ ) in regions of both low ( $n_{2DP} > n_{2DS}$ ) and high ( $n_{2DP} < n_{2DS}$ ) concentrations of particles in the overlap region ( $\sim 200$ - $1000 \mu\text{m}$ ). For these plots, 4 2DS bins from the size distribution file have been combined for each plotted bin to address issues with poor sample statistics in the 2DS/2DP overlap region. The first 2DP bin includes the smallest detectable particles (1 diode images) and might be suspect, but does not explain all of the disagreement. As far as we are aware this disagreement is a processing issue, so caution must be taken in any analysis of the overlap region.
- CDP distributions frequently show an elevated mode at the large end of the spectrum (starting at  $\sim 300 \mu\text{m}$ ) in regions of ice that is not corroborated by the 2DS and likely physically unrealistic. We believe this is a result of ice shattering on probe tips in the CDP.
- V1.0 size distributions were generated using diameter of minimum enclosing circle as the size parameter and center in particle acceptance criteria
- Shattering effects were removed by utilizing probe-dependent interarrival time threshold values that remained constant for the whole project and were verified to remove shattered artifacts (but reject some good particles with short interarrival times in places)
- Threshold for diode shadowing that was used on the CIP-Grayscale was 50%
- 2DS/CIPG data were removed for any laser power issues or fogging (affects IOPs 3,5,6,19)
- CIPG data from IOPs 1,6,7,8, and 9 have data integrity issues that will be resolved for subsequent versions (removed for V1.0)