README

Ultra High Sensitivity Aerosol Spectrometer – Airborne (UHSASA) GoAmazon IOP1- February 22 to March 23, 2014 GoAmazon IOP2 – September 06 to October 04, 2014

> Created by Jason Tomlinson for ARM Aerial Facility. March 27, 2015

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1 Data source

The data were recorded onboard the G1 aircraft, operated by the ARM Aerial Facility during GoAmazon IOP1 and IOP2.

1.1 Location

The research flights were conducted out of the Eduardo Gomes–Manaus International Airport in Manaus, Brazil.

1.2 Time period of collection

Flights were conducted from February 22 – March 23, 2014 and September 06 to October 04, 2014.

1.3 Instrument description

Laser based instrument that uses the measured intensity of the scatter light from particles passing through the laser beam to measure aerosol concentration and size in the 0.060 to 1.0 μ m size range. Instrument was calibrated during the field campaign using PSL.



2.1 Level R0

Level R0 data consist of raw data, housekeeping data, and particle-by-particle data collected in 30-minute intervals. The raw data is reported as a merged data file.

2.2 Level R1

Level R1 data consist of a file containing integrated number, area, and volume concentrations. Also consists of number distributions not normalized by dLogDp. All data is reported at 1HZ and contains QC flags. File name includes takeoff time for the flight. Metadata has been added to the header of each file and follows the ICARTT standard.

http://www-air.larc.nasa.gov/missions/etc/IcarttDataFormat.htm

A correction (collection efficiency – section 5.2) has been applied for undercounting of aerosols smaller than 0.100 μ m.

2.3 Level R2

Level R2 data consists of everything listed under R1. R2 corrected an error in the processing code that used the wrong bin sizes for the calculation of integrated area and volume concentration.

3 Data log

| Date | Instrument | | | Notes |
|-----------|-------------------|--------------|---------|---|
| | Instrument Status | Data Process | œ | |
| 20140222a | Ok | R2 | Ok | |
| 20140225a | Ok | R2 | Caution | Instrument started roughly 45mins into flight |
| 20140301a | Ok | R2 | Ok | |
| 20140301b | Ok | R2 | Ok | |
| 20140303a | Ok | R2 | Ok | |
| 20140307a | Ok | R2 | Ok | |
| 20140310a | Ok | R2 | Ok | |
| 20140311a | Ok | R2 | Ok | |
| 20140312a | Ok | R2 | Ok | |
| 20140313a | Ok | R2 | Ok | |
| 20140314a | Ok | R2 | Ok | |
| 20140316a | Ok | R2 | Ok | |
| 20140317a | Ok | R2 | Ok | |
| 20140319a | Ok | R2 | Caution | Data missing briefly around 16:40 UTC |
| 20140321a | Ok | R2 | Caution | Data missing from 18:15 to 18:35 UTC |
| 20140323a | Ok | R2 | Ok | |
| 20140906a | Ok | R2 | Ok | |
| 20140909a | Ok | R2 | Ok | |
| 20140911a | BAD | N/A | BAD | No Data Recorded |
| 20140912a | Ok | R2 | Ok | |
| 20140913a | Ok | R2 | Ok | |
| 20140915a | Ok | R2 | Ok | |
| 20140916a | Ok | R2 | Ok | |
| 20140918a | Ok | R2 | Ok | |
| 20140919a | Ok | R2 | Ok | |
| 20140921a | Ok | R2 | Caution | Data Missing from 15:20 to 15:50 |
| 20140922a | Ok | R2 | Ok | |
| 20140923a | Ok | R2 | Ok | |
| 20140925a | Ok | R2 | Ok | |
| 20140927a | Ok | R2 | Ok | |
| 20140928a | Ok | R2 | Ok | |
| 20140930a | Ok | R2 | Ok | |
| 20141001a | Ok | R2 | Ok | |
| 20141003a | Ok | R2 | Ok | |
| 20141004a | Ok | R2 | Ok | |

4 File Format

File naming convention: "uhsasa_g1_YYYYMMDDHHMMSS_Rx_Lygoamazon001s.ict" Where x is the revision number and y is the flight (launch) number for the day. The file is comma delimited. YYYYMMDD is the date of the flight and HHMMSS represents the takeoff time.

| X T Variable Name | | Unite | Range or | From | Description Definition | |
|----------------------|-----------------------|-------------|-----------|-----------------------------|--|--|
| Inc | Valiable Name | Units | Frequency | Instrument: | Description Definition | |
| 1 | Start Time | UTC | 1 s | UHSAS | Seconds since midnight | |
| | | | | | Synchronized with M300 | |
| 2 to 100 | Num_Conc | (#/cm^3) | 1s | UHSAS | Number Concentration at specified mean diameters | |
| 101 | Num_Conc | (#/cm^3) | 1s | UHSAS | Integrated Number | |
| | | | | | Concentration | |
| 102 | Area_Conc | (□m^2/cm^3) | 1s | UHSAS | Integrated Area Concentration | |
| 103 Vol Conc | | (□m^3/cm^3) | 15 | UHSAS | Integrated Volume | |
| 105 | Vol_done | | 15 | 0115/15 | Concentration | |
| 104 | 4 Counts 0 to 2 LIHSA | | UHSAS | 0: Good 1: =>3000 counts 2: | | |
| 101 | counto | | 0 10 2 | 0110110 | =>4000 counts | |
| 105 | Noise | | 0 to 2 | UHSAS | 0: Good 1:Possible Noise | |
| 100 | | | 0 10 2 | 0110110 | 2:Noise observed | |
| | | | | | 0: Good 1:Num_conc exceeds | |
| 106 | CPC | | 0 to 2 | UHSAS | 3010 2:Num_conc exceeds 3010 | |
| | | | | by 25% | | |
| 107 | Total | | n | UHSAS | Sum of QC flags 104-106 | |
| 108 | Max Flag | | 0 to 2 | UHSAS | Max value of QC flags 104-106 | |
| 109 | Cloud Flag | | 0 to 2 | IWG1 | 0: Good 1:Clouds may be present 2:Definite clouds | |

4.1 Data description

Definition and diagrams

| QC | Description |
|--------|--|
| Counts | Sums up total UHSAS counts over a 1s period. If its greater than 3000 an QC flag is triggered |
| Noise | In pre-processing an index for a possible noisy bin size is determined. If the number of counts for that bin size is 4x larger than the surrounding values than its determined noise is present (1). If it's 8x larger noise is definitely present (2) |
| СРС | Compares number concentration of UHSAS to CPC3010. If UHSAS is greater than the CPC a QC flag is triggered (1). If its greater by 25% than a data flag of 2 is triggered. |

4.2 Bins (μm)

| Bin # | Lower | Upper | Avg. | Bin # | Lower | Upper | Mid | Bin # | Lower | Upper | Mid |
|----------|-------|-------|-------|----------|-------|-------|-------|----------|-------|-------|-------|
| 1 | 0.067 | 0.069 | 0.068 | 34 | 0.170 | 0.175 | 0.173 | 67 | 0.435 | 0.448 | 0.441 |
| 2 | 0.069 | 0.071 | 0.070 | 35 | 0.175 | 0.180 | 0.178 | 68 | 0.448 | 0.460 | 0.454 |
| 3 | 0.071 | 0.073 | 0.072 | 36 | 0.180 | 0.185 | 0.183 | 69 | 0.460 | 0.474 | 0.467 |
| 4 | 0.073 | 0.075 | 0.074 | 37 | 0.185 | 0.191 | 0.188 | 70 | 0.474 | 0.487 | 0.481 |
| 5 | 0.075 | 0.077 | 0.076 | 38 | 0.191 | 0.196 | 0.194 | 71 | 0.487 | 0.501 | 0.494 |
| 6 | 0.077 | 0.079 | 0.078 | 39 | 0.196 | 0.202 | 0.199 | 72 | 0.501 | 0.516 | 0.509 |
| 7 | 0.079 | 0.081 | 0.080 | 40 | 0.202 | 0.208 | 0.205 | 73 | 0.516 | 0.531 | 0.523 |
| 8 | 0.081 | 0.084 | 0.083 | 41 | 0.208 | 0.214 | 0.211 | 74 | 0.531 | 0.546 | 0.538 |
| 9 | 0.084 | 0.086 | 0.085 | 42 | 0.214 | 0.220 | 0.217 | 75 | 0.546 | 0.562 | 0.554 |
| 10 | 0.086 | 0.089 | 0.087 | 43 | 0.220 | 0.226 | 0.223 | 76 | 0.562 | 0.578 | 0.570 |
| 11 | 0.089 | 0.091 | 0.090 | 44 | 0.226 | 0.233 | 0.230 | 77 | 0.578 | 0.595 | 0.586 |
| 12 | 0.091 | 0.094 | 0.092 | 45 | 0.233 | 0.239 | 0.236 | 78 | 0.595 | 0.612 | 0.603 |
| 13 | 0.094 | 0.096 | 0.095 | 46 | 0.239 | 0.246 | 0.243 | 79 | 0.612 | 0.629 | 0.621 |
| 14 | 0.096 | 0.099 | 0.098 | 47 | 0.246 | 0.254 | 0.250 | 80 | 0.629 | 0.648 | 0.638 |
| 15 | 0.099 | 0.102 | 0.101 | 48 | 0.254 | 0.261 | 0.257 | 81 | 0.648 | 0.666 | 0.657 |
| 16 | 0.102 | 0.105 | 0.104 | 49 | 0.261 | 0.268 | 0.265 | 82 | 0.666 | 0.685 | 0.676 |
| 17 | 0.105 | 0.108 | 0.107 | 50 | 0.268 | 0.276 | 0.272 | 83 | 0.685 | 0.705 | 0.695 |
| 18 | 0.108 | 0.111 | 0.110 | 51 | 0.276 | 0.284 | 0.280 | 84 | 0.705 | 0.725 | 0.715 |
| 19 | 0.111 | 0.114 | 0.113 | 52 | 0.284 | 0.292 | 0.288 | 85 | 0.725 | 0.746 | 0.736 |
| 20 | 0.114 | 0.118 | 0.116 | 53 | 0.292 | 0.301 | 0.296 | 86 | 0.746 | 0.768 | 0.757 |
| 21 | 0.118 | 0.121 | 0.119 | 54 | 0.301 | 0.309 | 0.305 | 87 | 0.768 | 0.790 | 0.779 |
| 22 | 0.121 | 0.125 | 0.123 | 55 | 0.309 | 0.318 | 0.314 | 88 | 0.790 | 0.813 | 0.801 |
| 23 | 0.125 | 0.128 | 0.126 | 56 | 0.318 | 0.327 | 0.323 | 89 | 0.813 | 0.836 | 0.825 |
| 24 | 0.128 | 0.132 | 0.130 | 57 | 0.327 | 0.337 | 0.332 | 90 | 0.836 | 0.860 | 0.848 |
| 25 | 0.132 | 0.136 | 0.134 | 58 | 0.337 | 0.347 | 0.342 | 91 | 0.860 | 0.885 | 0.873 |
| 26 | 0.136 | 0.140 | 0.138 | 59 | 0.347 | 0.357 | 0.352 | 92 | 0.885 | 0.911 | 0.898 |
| 27 | 0.140 | 0.144 | 0.142 | 60 | 0.357 | 0.367 | 0.362 | 93 | 0.911 | 0.937 | 0.924 |
| 28 | 0.144 | 0.148 | 0.146 | 61 | 0.367 | 0.377 | 0.372 | 94 | 0.937 | 0.964 | 0.950 |
| 29 | 0.148 | 0.152 | 0.150 | 62 | 0.377 | 0.388 | 0.383 | 95 | 0.964 | 0.992 | 0.978 |
| 30 | 0.152 | 0.156 | 0.154 | 63 | 0.388 | 0.399 | 0.394 | 96 | 0.992 | 1.020 | 1.006 |
| 31 | 0.156 | 0.161 | 0.159 | 64 | 0.399 | 0.411 | 0.405 | 97 | 1.020 | 1.050 | 1.035 |
| 32 | 0.161 | 0.166 | 0.163 | 65 | 0.411 | 0.423 | 0.417 | 98 | 1.050 | 1.080 | 1.065 |
| 33 | 0.166 | 0.170 | 0.168 | 66 | 0.423 | 0.435 | 0.429 | 99 | 1.080 | 1.111 | 1.096 |

5 Calibration

5.1 PSL

PSL calibration shows a consistent under sizing of the PSL by the UHSAS. For that reason, the bins were shifted by a factor of 1.11 (1/0.9).



5.2 Collection Efficiency (CE)

The values in the table below were used to correct for the undercounting. This is a well know issue with the UHSAS. The values below were measured by comparing the UHSAS size distribution with an SMPS size distribution in a lab environment. To use the CE, take the measured counts in specific bin and dive by the CE for the same bin to calculate the actual counts.

| Bin # | Lower | Upper | Avg | CE |
|-------|-------|-------|-------|------|
| 1 | 0.067 | 0.069 | 0.068 | 0.45 |
| 2 | 0.069 | 0.071 | 0.070 | 0.50 |
| 3 | 0.071 | 0.073 | 0.072 | 0.55 |
| 4 | 0.073 | 0.075 | 0.074 | 0.60 |
| 5 | 0.075 | 0.077 | 0.076 | 0.65 |
| 6 | 0.077 | 0.079 | 0.078 | 0.69 |
| 7 | 0.079 | 0.081 | 0.080 | 0.74 |
| 8 | 0.081 | 0.084 | 0.083 | 0.78 |
| 9 | 0.084 | 0.086 | 0.085 | 0.82 |
| 10 | 0.086 | 0.089 | 0.087 | 0.86 |
| 11 | 0.089 | 0.091 | 0.090 | 0.89 |
| 12 | 0.091 | 0.094 | 0.092 | 0.92 |
| 13 | 0.094 | 0.096 | 0.095 | 0.95 |
| 14 | 0.096 | 0.099 | 0.098 | 0.97 |
| 15 | 0.099 | 0.102 | 0.101 | 0.99 |
| 16 | 0.102 | 0.105 | 0.104 | 1.00 |