Last Updated: October 31, 2011

Data Format Documentation

Instrument: PARSIVEL, MC3E Field Campaign

The Parsivel data set is contained within daily tar archives. The daily archive is named with the following convention,

parsivel_[sn]_mc3e_[latitude_longitude]_[date].tar

where [sn] = serial number of parsivel instrument (e.g., apu01)
[latitude_longitude]=geographic location of instrument (e.g., N363442.07_W0972640.90 is North 36°34'42.07" and West 97°26'40.90")
[date] = YYYYmmDD (e.g., 20110422)

and consists of ASCII encoded files containing information on the drop size distribution and integral rain parameters such as rain rate, reflectivity and mass-weighted mean diameter.

The following files are contained within the tar archive and follow a similar naming convention as above:

- *_raw.txt: Parsivel calculated parameters and unfiltered drop spectrum
  - contains the temperature, integral rain parameters and the present weather codes (see APPENDIX C) as calculated by the Parsivel firmware
  - also contains the number of particles measured within each of the 32 diameter classes and 32 velocity classes (see APPENDIX A for class definitions)
- *_dropcounts.txt: quality-controlled number of drops in each diameter class each minute hydrometeors were detected (see APPENDIX B for class definitions)
- *_dsd.txt: quality-controlled drop size distribution (based on measured fall velocities) for each diameter class each minute hydrometeors were detected (see APPENDIX B for class definitions)
- *_dsd_vT.txt: quality-controlled drop size distribution (based on terminal fall velocities) for each diameter class each minute hydrometeors were detected (see APPENDIX B for class definitions)
- *_rainParams.txt: quality-controlled integrated rainfall parameters (based on measured fall velocities) for each minute hydrometeors were detected
- *_rainParams_vT.txt: quality-controlled integrated rainfall parameters (based on terminal fall velocities) for each minute hydrometeors were detected

An additional Parsivel data set, not contained within a daily tar archive but with a similar file naming convention, provides a summary of the rainfall events for the entire campaign.

- *_raintable.txt: quality-controlled total rainfall measured for a continuous period of precipication

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Format of each file in Parsivel data set:

Level 1A: raw files (*_raw.txt)

Format: ASCII

Format of each line:
YYYYmmDDHHMMSS;[sn], sensor status, temperature (°C), number of particles detected, rain rate (mm/hr), reflectivity (dBz), MOR Visibility (m), Weather code according to SYNOP WaWa Table 4680 (see APPENDIX C), Weather Code according to SYNOP WW Table 4677 (see APPENDIX C), number of particles within each diameter and velocity class (1,024 total classifications with bin1=[D[1],v[1]],bin2=[D[1],v[2]],…bin33=[D[2],v[1]],etc.; see APPENDIX A for bin definitions)

Level 3 data processing methods:

1) Diameter bins are corrected for oblateness (see APPENDIX B).
2) Drops exceeding 50% of their terminal fall speed (Gunn and Kinzer 1949) are removed to eliminate spurious measurements (e.g., splash drops, insects, etc.). This is similar to the threshold used by Tokay et al. (2001) and Jaffrain and Berne (2011).
3) Rainy minutes with fewer than 10 drops at a rainfall rate of 0.01 mm/hr are also removed to eliminate noise.

Note: The integration period begins at the minute specified in each line

Level 3: drop count files (*_dropcounts.txt)

Format: ASCII

Format of each line:
year, day of year, hour, minute, number of drops in each of the 32 diameter bins corrected for drop shape (see APPENDIX B)

Level 3: drop size distribution (DSD) files (*_dsd.txt, *_dsd_vT.txt)

Format: ASCII

Format of each line:
year, day of year, hour, minute, drop_concentration ($m^{-3}mm^{-1}$) in each of the 32 diameter bins corrected for drop shape (see APPENDIX B)

Level 3: Integral rain parameters (*_rainParams.txt, *_rainParams_vT.txt)

Format: ASCII

Format of each line:
year, day of year, hour, minute, total number of drops, total drop concentration (m^{-3}), liquid water content ($g\ m^{-3}$), rain rate ($mm\ h^{-1}$), reflectivity in Rayleigh regime (dBZ), mean mass-weighted diameter (mm), maximum drop diameter (mm)

Level 3: raintable files

Format: ASCII

Format of each line:
year, day of year precipitation begins, beginning of precipitation (HH:MM), day of year precipitation ends, ending of precipitation (HH:MM), number of rainfall observations (minutes), event maximum rainfall rate (mm/hr), event rainfall total (mm)

APPENDIX A: Level 1A Data

Volume-equivalent diameter classification:

Class Number	Class Average (mm)	Class Spread (mm)
1	0.062	0.125
2	0.187	0.125
3	0.312	0.125
4	0.437	0.125
5	0.562	0.125
6	0.687	0.125
7	0.812	0.125
8	0.937	0.125
9	1.062	0.125
10	1.187	0.125
11	1.375	0.250
12	1.625	0.250
13	1.875	0.250
14	2.125	0.250
15	2.375	0.250
16	2.750	0.500
17	3.250	0.500
18	3.750	0.500
19	4.250	0.500
20	4.750	0.500
21	5.500	1.000
22	6.500	1.000
23	7.500	1.000
24	8.500	1.000
25	9.500	1.000
26	11.000	2.000
27	13.000	2.000
28	15.000	2.000
29	17.000	2.000
30	19.000	2.000
31	21.500	3.000
32	24.500	3.000

Velocity classification:

Class Number	Class Average (m/s)	Class Spread (m/s)
1	0.050	0.100
2	0.150	0.100
3	0.250	0.100
4	0.350	0.100
5	0.450	0.100
6	0.550	0.100
7	0.650	0.100
8	0.750	0.100
9	0.850	0.100
10	0.950	0.100
11	1.100	0.200
12	1.300	0.200
13	1.500	0.200
14	1.700	0.200
15	1.900	0.200
16	2.200	0.400
17	2.600	0.400
18	3.000	0.400
19	3.400	0.400
20	3.800	0.400
21	4.400	0.800
22	5.200	0.800
23	6.000	0.800
24	6.800	0.800
25	7.600	0.800
26	8.800	1.600
27	10.400	1.600
28	12.000	1.600
29	13.600	1.600
30	15.200	1.600
31	17.600	3.200
32	20.800	3.200

APPENDIX B: Level 3 Data

Volume-equivalent diameter classification (corrected for drop shape):

Class Number	Class Average (mm)	Class Spread (mm)
1	0.064	0.129
2	0.193	0.129
3	0.321	0.129
4	0.450	0.129
5	0.579	0.129
6	0.708	0.129
7	0.836	0.129
8	0.965	0.129
9	1.094	0.129
10	1.223	0.129
11	1.416	0.257
12	1.674	0.257
13	1.931	0.257
14	2.189	0.257
15	2.446	0.257
16	2.832	0.515
17	3.347	0.515
18	3.862	0.515
19	4.378	0.515
20	4.892	0.515
21	5.665	1.030
22	6.695	1.030
23	7.725	1.030
24	8.755	1.030
25	9.785	1.030
26	11.330	2.060
27	13.390	2.060
28	15.450	2.060
29	17.510	2.060
30	19.570	2.060
31	22.145	3.090
32	25.235	3.090

Note: Correction of diameter bins, D, for drop shape follows Beard (1976) methodology for D≤6.0mm and a linear interpolation is performed for D>6.0mm (bins 22 through 32).

APPENDIX C: SYNOP Weather Codes

Table 4680	Table 4677	Rain Rate (mm/hr)	Intensity	Precipitation Type
00	00			No precipitation
51	51	≤0.2	light	Drizzle
52	53	0.2-0.5	moderate	Drizzle
53	55	≥0.5	strong	Drizzle
57	58	≤0.2	light	Drizzle with rain
58	59	0.2-0.5	moderate	Drizzle with rain
58	59	≥0.5	strong	Drizzle with rain
61	61	≤0.2	light	Rain
62	63	0.2-4.0	moderate	Rain
63	65	≥4.0	strong	Rain
67	68	≤0.5	light	Rain, drizzle with snow
68	69	>0.5	moderate	Rain, drizzle with snow
71	71	≤0.5	light	Snow
72	73	0.5-4.0	moderate	Snow
73	75	≥4.0	strong	Snow
77	77	≤0.5	light	Snow grains
77	77	0.5-4.0	moderate	Snow grains
77	77	≥4.0	strong	Snow grains
87	87	≤0.4	light	Freezing rain
88	88	>0.4	moderate	Freezing rain
89	89	≤7.5	light	Hail
89	90	>7.5	moderate	Hail

Note: Precipitation code is determined by the Parsivel from the number of particles in the measurement range and from the precipitation rate (water amount equivalent).

References:

Beard, K. V., 1976: Terminal velocity and shape of cloud and precipitation drops aloft. *J. Atmos. Sci.*, **33**, 851–864.

Gunn, R. and G. D. Kinzer. 1949. The terminal velocity of fall for water drops in stagnant air. *J. Meteor*., **6**, 243–248.

Jaffrain, Joël, Alexis Berne, 2011: Experimental quantification of the sampling uncertainty associated with measurements from PARSIVEL Disdrometers. *J. Hydrometeor*, **12**, 352–370.

Tokay, A., A. Kruger, and W. Krajewski, 2001: Comparison of drop size distribution measurements by impact and optical disdrometers. *J. Appl. Meteor.*, **40,** 2083–2097.