NCAR/EOL Parsivel Disdrometer Data From the Plains Elevated Convection At Night (PECAN) Experiment

Contacts/PIs:

David Bodine
dbodine@ucar.edu

Kristen Rasmussen
kristenr@ucar.edu

Mailing address:
NCAR Foothills Laboratory
3450 Mitchell Lane
Boulder, CO 80301

Please contact us with any questions or comments on the data set, or about collaboration opportunities.

1. Parsivel Disdrometer Dataset Overview

During the Plains Elevated Convection At Night (PECAN) experiment, mobile disdrometers were deployed to obtain drop-size distribution measurements in mesoscale convective systems (MCSs) and other nocturnal convection events. Three optical disdrometers (PARSIVEL, or PARticle SIze and VELocity; Löffler-Mang and Joss 2000) were deployed during many PECAN IOPs (see list in Section 3). Disdrometers were typically sited within the dual-Doppler coverage of the radar network and close to mobile radars with dual-polarization capability. For several cases, the disdrometers were also frequently collocated with surface pods from the Center for Severe Weather Research (CSWR).

This dataset contains data from two of the mobile Parsivel disdrometers, and data from the third disdrometer is found with the CSWR surface data. In addition to these measurements, Parsivel disdrometer data were collected at FP3 (Ellis, Kansas), and MP2.

2. Data Format and Quality Control information

a. Data Format

The Parsivel data format is a comma-delimited text file, and contains the standard output of the instrument as well as a header with IOP-specific information. Headers are included for each file with the data type, instrument number, IOP number, GPS coordinates, and collocated instrumentation (when applicable). After the header, each line of Parsivel data is preceded by a description followed by the data. The times of each file are UTC, and the data time interval is 10 s.

The primary output of interest from the Parsivel disdrometer is the particle size distribution data. The Parsivel disdrometer outputs particle counts into 32 classes for both particle diameter and fall speed (Tables 1 and 2). This output creates a 32-by-32 matrix of particle counts sorted by diameter and fall speeds. In these files, the particle counts are between <SPECTRUM> and </

SPECTRUM>. When no particles are detected, it simply listed as ZERO. When particles are detected, the particle size distribution counts are delimited by semicolons. To sort into a two-dimensional matrix, divide the data into groups of 32. Each group of 32 represents the diameter size ranges, and the groups of 32 will be arranged from smallest to largest fall speed. In other words, the first group of 32 represent counts for all diameters from the first fall speed class (0.05 m/s), the second group of 32 represents counts for all diameters from the second fall speed class (0.15 m/s), etc.

Example:

Date,Time,Intensity (mm/h),Precipitation since start (mm),Weather code SYNOP WaWa,Weather code METAR/SPECI,Weather code NWS,Radar reflectivity (dBz),MOR Visibility (m),Signal amplitude of Laserband,Number of detected particles,Temperature in sensor (∞C),Heating current (A),Sensor voltage (V),Spectrum

06.07.2015,01:43:40,0.000,0.00,0,NP,C,-9.999,9999,9740,0,24,0.06,24.5,<SPECTRUM>ZERO </SPECTRUM>

Date (dd.mm.yyyy): July 6, 2015
Time (UTC): 01:43:40
Rainfall rate (mm/hr): 0.000
Radar reflectivity (dBZ): -9.999
Number of detected particles: 0

b. Quality Control

Parsivel disdrometers are susceptible to several sources of error in convective storms, particularly during strong winds. To address these errors, we recommend implementing quality control methods developed by Friedrich et al. (2013a,b) for Parsivel disdrometer data in convective storms. These methods address errors caused by strong winds, splashing effects, and particles passing along the edge of the laser. Since these methods are subjective, we have not implemented these quality control methods on the data provided here. However, we can provide quality controlled data based on these methods upon request. In addition to the Friedrich et al. quality control, surface pod data from CSWR or dual-Doppler analyses may help identify times when strong winds are present.

c. Postprocessed Data Products

We are planning on creating data products for microphysical and radar analysis. These products include drop-size distribution moments and simulated dual-polarization radar quantities at different wavelengths. When available, these products will be available upon request.

3. Disdrometer Cases and Data Quality Notes

Disdrometer data were collected on the dates listed below. Known data quality issues are listed and will be updated if additional issues become evident.

1) 12 June 2015 (Western Kansas)
2) 24 June 2015 (Eastern Nebraska)

3) 25 June 2015 (Southeast Iowa)
4) 26 June 2015 (Northeast Kansas)
-Disdrometer 1 had a laser signal amplitude below the typical value during PECAN, and poor agreement was seen with radar comparisons
5) 01 July 2015 (Northwest Missouri)
6) 02 July 2015 (Southern Missouri)
7) 06 July 2015 (Southeast South Dakota)
8) 09 July 2015 (Texas Panhandle)
9) 11 July 2015 (North central Kansas/South central Nebraska)
10) 13 July 2015 (Southeast Minnesota)
11) 15 July 2015 (Western Kansas)

4. References

Katja Friedrich, Stephanie Higgins, Forrest J. Masters, and Carlos R. Lopez, 2013a: Articulating and Stationary PARSIVEL Disdrometer Measurements in Conditions with Strong Winds and Heavy Rainfall. J. Atmos. Oceanic Technol., 30, 2063–2080.

Katja Friedrich, Evan A. Kalina, Forrest J. Masters, and Carlos R. Lopez, 2013b: Drop-Size Distributions in Thunderstorms Measured by Optical Disdrometers during VORTEX2. Mon. Wea. Rev., 141, 1182–1203.

Martin Löffler-Mang and Jürg Joss, 2000: An Optical Disdrometer for Measuring Size and Velocity of Hydrometeors. J. Atmos. Oceanic Technol., 17, 130–139.

5. Acknowledgments

The mobile disdrometer project was funded through support from the Advanced Study Program and the Significant Opportunities in Atmospheric Research and Science at the National Center for Atmospheric Research (NCAR). Katja Friedrich (University of Colorado Boulder) and Paul Kucera (Research Applications Laboratory; NCAR) are thanked for providing Parsivel disdrometers for this data set. We also thank Karen Kosiba, Joshua Wurman, and the Center for Severe Weather Research for providing a mobile mesonet to facilitate our deployments, as well as a surface pod and disdrometer. Finally, Erin Dougherty and Anthony Torres helped deploy disdrometers during PECAN, and Jim Kurdzo (University of Oklahoma) and Tammy Weckwerth (NCAR) coordinated RHI scans over the disdrometers.

Table 1: Parsivel disdrometer diameter size classes and class diameter widths.

Particle Class Number	Mean Class Diameter (mm)	Class Diameter Width (mm)
1	0.0620	0.1250
2	0.1870	0.1250
3	0.3120	0.1250
4	0.4370	0.1250
5	0.5620	0.1250
6	0.6870	0.1250
7	0.8120	0.1250
8	0.9370	0.1250
9	1.0620	0.1250
10	1.1870	0.1250
11	1.3750	0.2500
12	1.6250	0.2500
13	1.8750	0.2500
14	2.1250	0.2500
15	2.3750	0.2500
16	2.7500	0.5000
17	3.2500	0.5000
18	3.7500	0.5000
19	4.2500	0.5000
20	4.7500	0.5000
21	5.5000	1.0000
22	6.5000	1.0000
23	7.5000	1.0000
24	8.5000	1.0000
25	9.5000	1.0000
26	11.0000	2.0000
27	13.0000	2.0000
28	15.0000	2.0000
29	17.0000	2.0000
30	19.0000	2.0000
31	21.5000	3.0000
32	24.5000	3.0000

Table 2: Parsivel disdrometer fall speed classes and fall speed widths.

Particle Class Number	Mean Fall Speed (m/s)	Class Fall Speed Width (m/s)
1	0.0500	0.1000
2	0.1500	0.1000
3	0.2500	0.1000
4	0.3500	0.1000
5	0.4500	0.1000
6	0.5500	0.1000
7	0.6500	0.1000
8	0.7500	0.1000
9	0.8500	0.1000
10	0.9500	0.1000
11	1.1000	0.2000
12	1.3000	0.2000
13	1.5000	0.2000
14	1.7000	0.2000
15	1.9000	0.2000
16	2.2000	0.4000
17	2.6000	0.4000
18	3.0000	0.4000
19	3.4000	0.4000
20	3.8000	0.4000
21	4.4000	0.8000
22	5.2000	0.8000
23	6.0000	0.8000
24	6.8000	0.8000
25	7.6000	0.8000
26	8.8000	1.6000
27	10.4000	1.6000
28	12.0000	1.6000
29	13.6000	1.6000
30	15.2000	1.6000
31	17.6000	3.2000
32	20.8000	3.2000