

Patrick N. Gatlin<sup>1</sup>, W. A. Petersen<sup>2</sup>, L.D. Carey<sup>3</sup>, M.T. Wingo<sup>3</sup>, A. Tokay<sup>4</sup>,  
 V.N. Bringi<sup>5</sup>, M.T. Thurai<sup>5</sup>, D. B. Wolff<sup>6</sup>, and D. W. Phillips<sup>3</sup>  
<sup>1</sup>NASA-MSFC, <sup>2</sup>NASA-GSFC/WFF, <sup>3</sup>Univ. of Alabama Huntsville-ESSC,  
<sup>4</sup>NASA-GSFC/UMBC-JCET, <sup>5</sup>Colorado State Univ., <sup>6</sup>NASA-GSFC/SSAI

**Abstract.** During the Mid-latitude Convective Cloud Experiment (MC3E), NASA's GPM GV Disdrometer and Radar Observations of Precipitation (DROP) Facility deployed an array of disdrometers and rain gauges in northern Oklahoma to sample, with high resolution, the drop size distribution (DSD) for use in development of precipitation retrieval algorithms for the GPM core satellite. The DROP Facility instruments deployed during MC3E consisted of 16 autonomous Parsivel units, 5 two-dimensional video disdrometers (2DVD), a vertical pointing K-band radar and 32 tipping bucket rain gauges. There were several rainfall events during MC3E in which rain drops exceeding 5 mm in diameter were recorded. During a convective rainfall event, one of the 2DVDs measured a large rain drop of 8 mm in diameter falling from a convective cell under which several other disdrometers revealed a broad DSD spectrum across this cell and median drop diameter of 3.1 mm. The NPOL radar, which was scanning over the disdrometer array in high resolution RHI mode (every 40 sec), during a stratiform rainfall event revealed a 1 km thick bright band with locally thicker segments that produced rainfall rates of 6-10 mm/hr and indications of DSD modulations as enhanced concentrations of mid-sized rain drops (1.5-3.0 mm) descended below cloud base. These observations are key in characterizing the DSD variability within the 4 km footprint of the GPM Dual-wavelength Precipitation Radar that will provide a global map of precipitation as well as DSD.

## 1. DROP FACILITY INSTRUMENTS

Instrument	Description
APU	Solar-powered platform for measuring the DSD via laser-based sensor (PARSIVEL)
2DVD	Optical sensor that measures drop size AND velocity
MRR	Vertically-pointing FM-CW 24 GHz radar used to measure DSD profile
Tipping Bucket Rain Gauges	Direct measurement of rainfall amount
Pluivo2	Weighing type of precipitation gauge
Hot Plate	Measures snowfall and rainfall rate with high temporal resolution

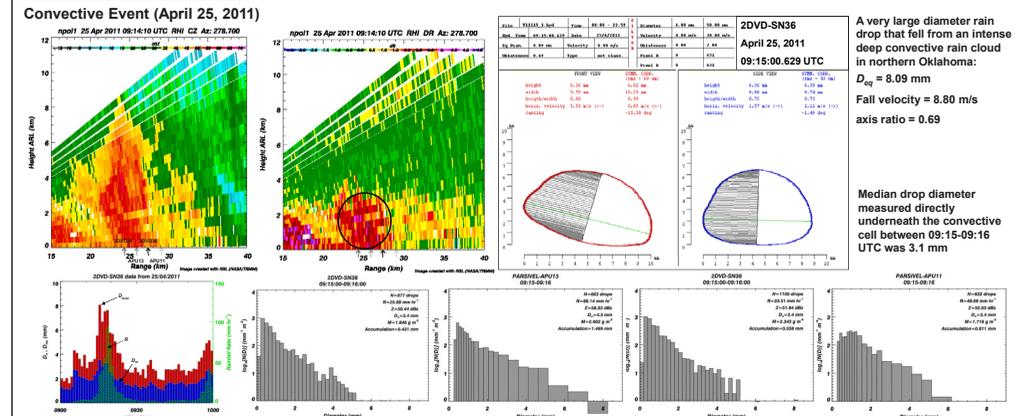
## 2. DEPLOYMENT DURING MC3E

Dates: April 22, 2011 - June 6, 2011  
 Location: North-central Oklahoma  
 See poster 172 in this session for an overview of MC3E

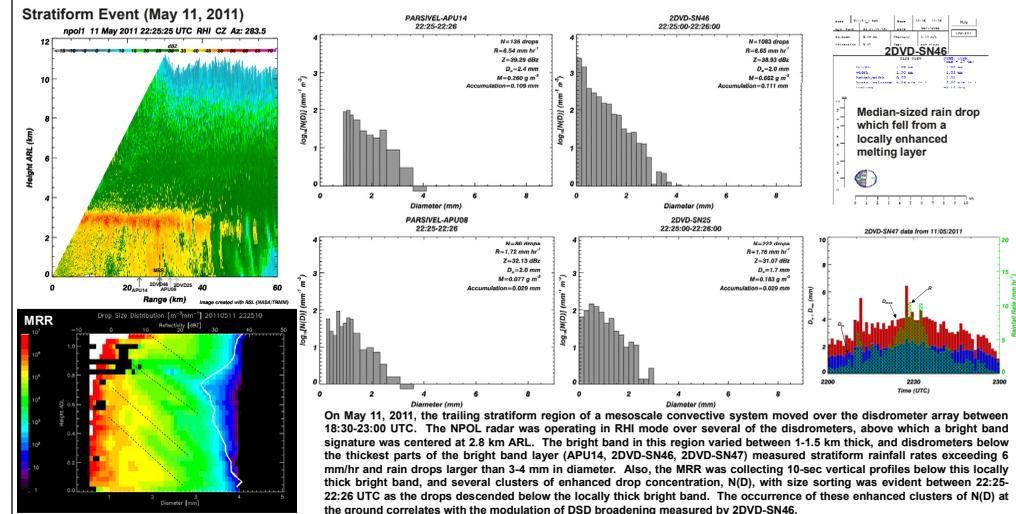
Summary of instruments deployed:

- 16 APUs (PARSIVEL + 2 tipping bucket rain gauges)
- Compact two-dimensional video disdrometers (2DVD): 5 NASA + 2 DOE
- vertically pointing 24 GHz FM-CW radar (MRR)
- Joss-Waldvogel impact type disdrometer (near 2DVD-SN47)
- NASA's S-band dual-polarimetric radar (NPOL)

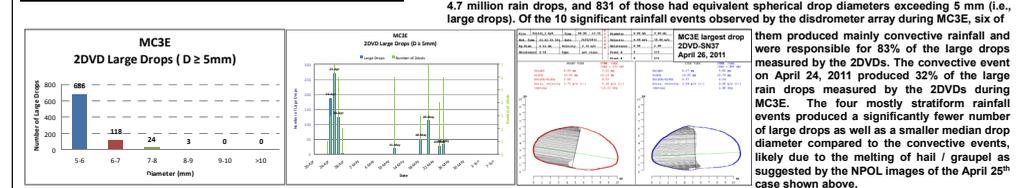
## 3. DSD VARIABILITY



On April 25, 2011, deep, multi-cellular convection moved over the disdrometer array between 09:00-09:40 UTC and produced peak 1-min rainfall rates exceeding 70 mm/hr. A vertical cross section from NASA's S-band dual-polarimetric radar (NPOL; top left panels) shows an intense 9-10 km tall storm that occurred over two 2DVDs and two APUs, which all measured a broad DSD spectrum across the cell's core. The large values of differential reflectivity measured by NPOL (top middle) suggests large oblate drops were falling from the storm. Consequently between 09:15-09:16 UTC, the most intense rainfall and largest drops were occurring at APU13 and 2DVD-SN36, where an 8.09 mm rain drop fell to the ground, the second largest drop recorded by any of the 2dvds during MC3E (top right); the largest drop recorded was 8.59 mm from a weaker convective storm on April 26, 2011).



## 4. FREQUENCY OF LARGE DROPS



## 5. FUTURE WORK

The large drops observed with the 2DVDs will be used to validate the large drops identified by CSU's hydrometeor identification algorithm that is being applied to the NPOL dataset collected during MC3E. Furthermore, to improve the DSD retrievals with dual-polarimetric radars participating in MC3E, scattering simulations will be conducted with the 2DVD observations. In order to increase the sampling of large drops during a rainfall event, several 2DVDs will be deployed closely together at NASA's Wallops Flight Facility beginning this spring and summer.

**Acknowledgments:** We would like to thank Dr. Ramesh Kakar at NASA HQ and Drs. Arthur Hou and Matt Schwaller of NASA's GPM Program office for funding our GPM Ground Validation research. We also want to thank Dr. Scott Giangrande and Mary Jane Bartholomew at Brookhaven National Laboratory for providing the two DOE 2DVD datasets collected during MC3E.