A summary of large raindrop observations from GPM GV Field Efforts

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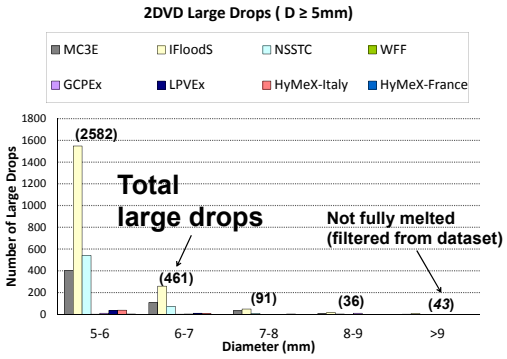
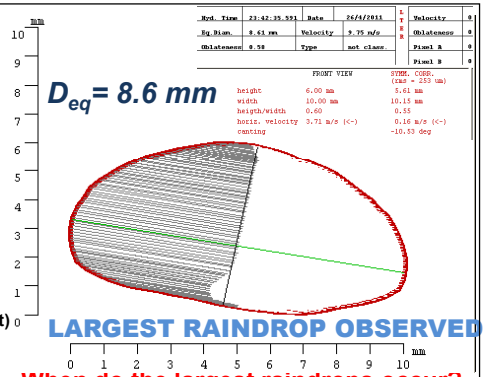
Abstract. NASA's Global Precipitation Measurement Mission (GPM) has conducted a series of Ground Validation (GV) studies to assist algorithm development for the GPM core satellite. Characterizing the drop size distribution (DSD) for different types of precipitation systems is critical in order to accurately estimate precipitation across the majority of the planet. Thus far, GV efforts have sampled DSDs in a variety of precipitation systems from Finland to Oklahoma. The two-dimensional video disdrometers (2DVDs) operated by GPM GV Disdrometer and Radar Observations of Precipitation (DROP) Facility provide information on individual hydrometeors. This dataset, which was filtered to remove large, non-oblate particles, consists of over 27 million raindrops sampled by GPM GV's two-dimensional video disdrometers (2DVD) and includes RSD observations from the LPVEx, MC3E, GCPEx, HyMEx and IFloodS campaigns as well as from GV sites in Huntsville, AL and Wallops Island, VA. This study focuses on the larger end of the raindrop size spectrum, which greatly influences radar reflectivity and has implications for moment estimation. Thus knowledge of the maximum diameter is critical to GPM algorithm development. There are 3,177 raindrops exceeding 5 mm in diameter contained within the filtered disdrometer dataset. The largest raindrops in the 2DVD dataset (>7-8 mm in diameter) are found within intense convective thunderstorms and mostly during the Spring months. Comparing the 2DVD large raindrop dataset with the NPOL radar's retrieval of hydrometeor type indicates large hail that falls during deep convective precipitation is the source for the largest raindrops.

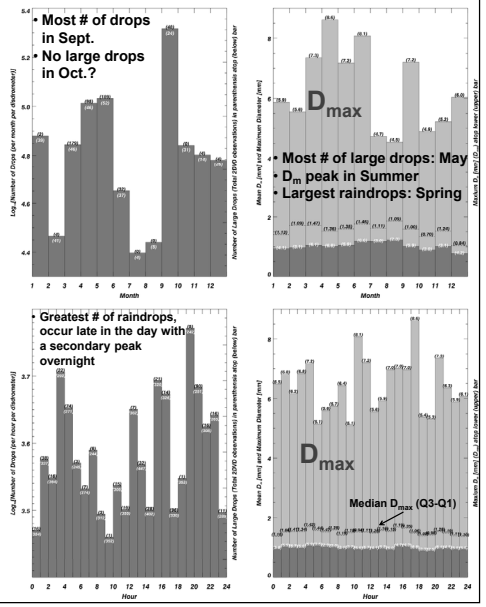
STATISTICS OF LARGE RAINDROPS

Large: Diameter ≥ 5mm

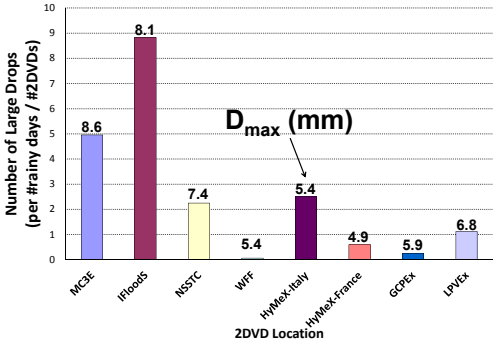




When do the largest raindrops occur?



Where are the largest raindrops?



→ **Large raindrops mostly observed to occur in the central U.S. during the Spring**

SUMMARY OF GPM GV RAINFALL OBSERVATIONS WITH THE 2DVD

Helsinki, Finland
Sept. 2010 – Dec. 2010
Number of 2DVDs: 3 [sn35,sn36,sn37]
Total Rainy Days: [14,9,7]
Accumulation: [31,26,7] mm
Number of Raindrops: 1.9x10⁶
Raindrops (D≥5mm): 28

Southern Ontario
Oct. 2011 – Mar. 2012
Number of 2DVDs: 5
Total Rainy Days: 11
Accumulation: 17 mm (8-22mm)
Number of Raindrops: 2.5x10⁶
Raindrops (D≥5mm): 385

Northern Oklahoma
Apr. 2011 – June 2011
Number of 2DVDs: 7
Total Rainy Days: 16
Accumulation: 29 mm (14-41mm)
Number of Raindrops: 2.1x10⁶
Raindrops (D≥5mm): 150

Eastern Iowa
April 2013 – June 2013
Number of 2DVDs: 6
Total Rainy Days: 36
Accumulation: 85 mm (42-109 mm)
Number of Raindrops: 9.5x10⁶
Raindrops (D≥5mm): 164

Huntsville, AL (NSSTC)
Dec. 2009 – Oct 2011
Number of 2DVDs: 3
Total Rainy Days: 93
Accumulation: 254 mm
Number of Raindrops: 10x10⁶
Raindrops (D≥5mm): 205

Wallops Flight Facility, VA
May. 2012 – Mar. 2013
Number of 2DVDs: [5]
Total Rainy Days: 5
Accumulation: 3 mm
Number of Raindrops: 0.3x10⁶
Raindrops (D≥5mm): 6

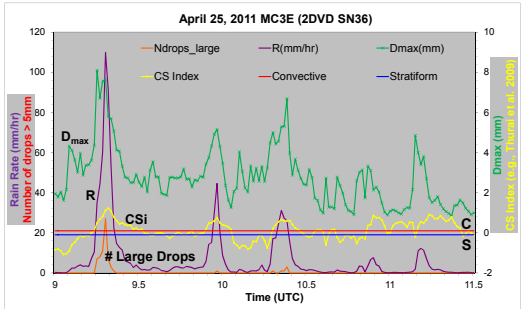
Rome, Italy (HyMeX)
Sept. 2012 – Oct. 2012
Number of 2DVDs: 1
Total Rainy Days: 20
Accumulation: 32 mm
Number of Raindrops: 0.4x10⁶
Raindrops (D≥5mm): 2

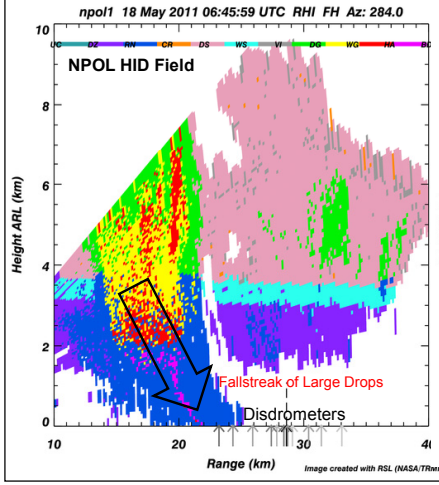
Ales, France (HyMeX)
Sept. 2012 – Oct. 2012
Number of 2DVDs: 1
Total Rainy Days: 5
Accumulation: 25 mm
Number of Raindrops: 0.3x10⁶
Raindrops (D≥5mm): 0

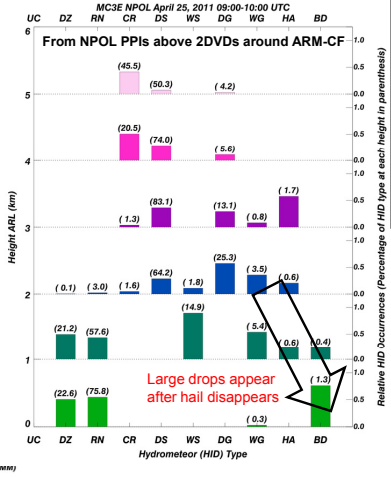
ORIGIN OF LARGE DROPS

→ **Large raindrops tend to occur within deep convective precipitation cores**

→ **The largest raindrops (i.e., D>7mm) can be traced to large hail which melts before reaching the ground**







HID KEY
UC: Unclassified
DZ: Drizzle
RN: Rain
CR: Ice Crystals
DS: Dry Snow
WS: Wet Snow
DG: Dry Graupel
WG Wet Graupel
HA: Hail
BD: Big Drops

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All NASA 2DVD datasets presented here are available at:
http://gpm.nsstc.nasa.gov (IFloodS datasets will be available in Dec 2013)

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