Marine ARM GPCI Investigations of Clouds (MAGIC):
Parsivel Disdrometer IOP

BACKGROUND
-- Accurate measurements of rainfall and cloud properties important for MAGIC goals

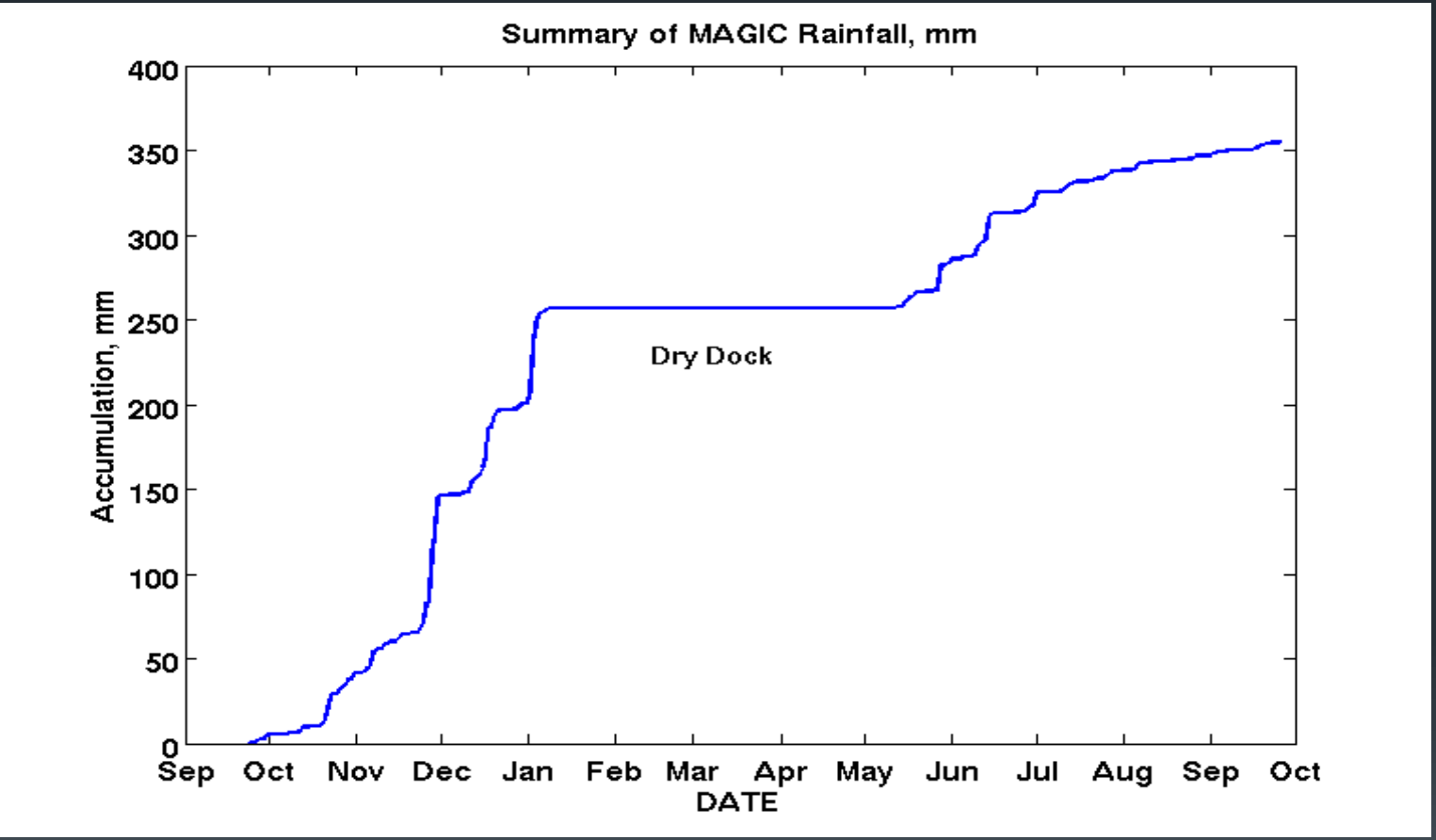
HOWEVER
-- ship distortions of the wind flow make rainfall difficult to measure
--- retrievals of cloud and precipitation rely critically on the **calibration of the AMF2 radar systems**

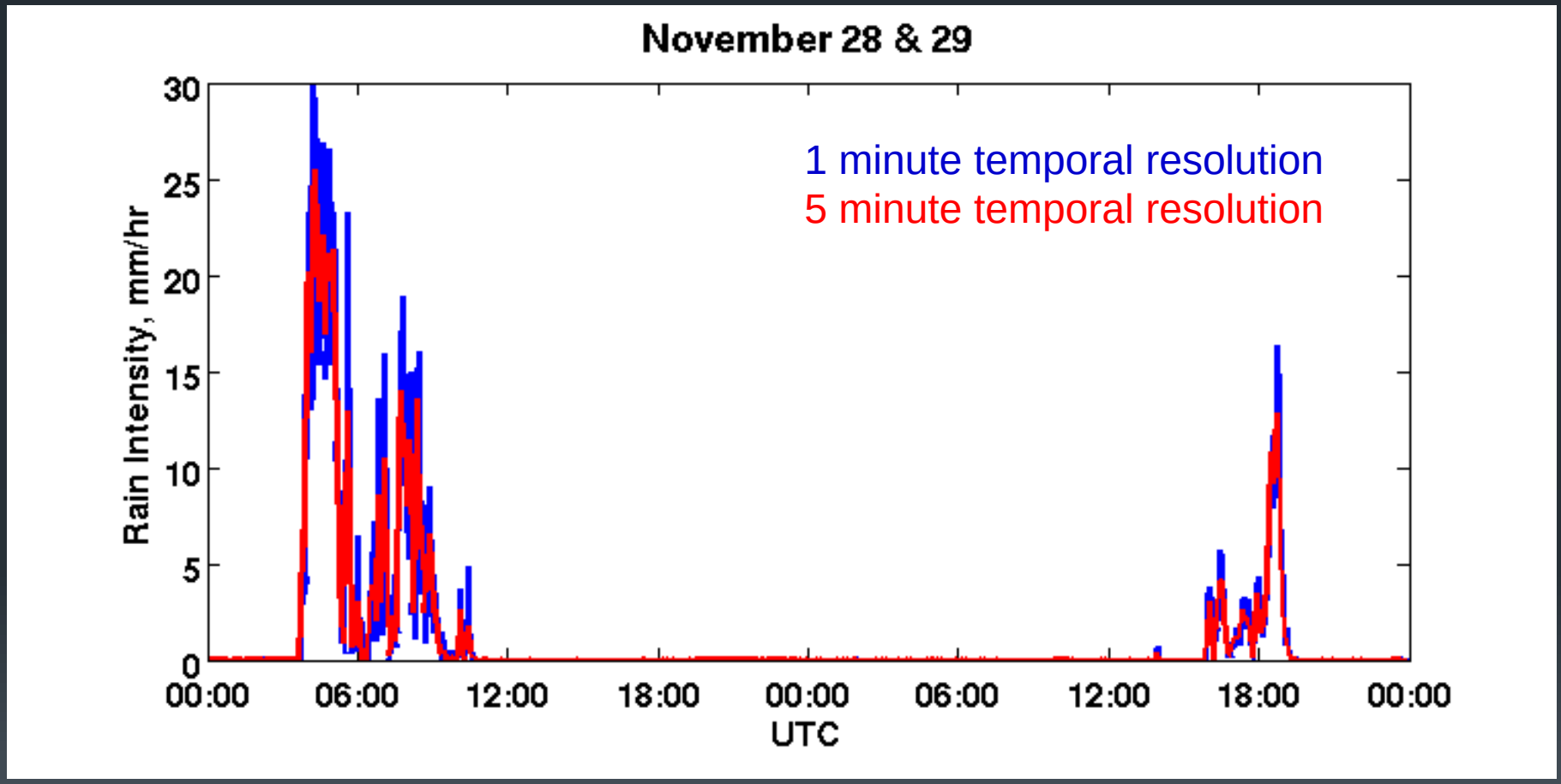
-- deployment of disdrometers can help with both issues

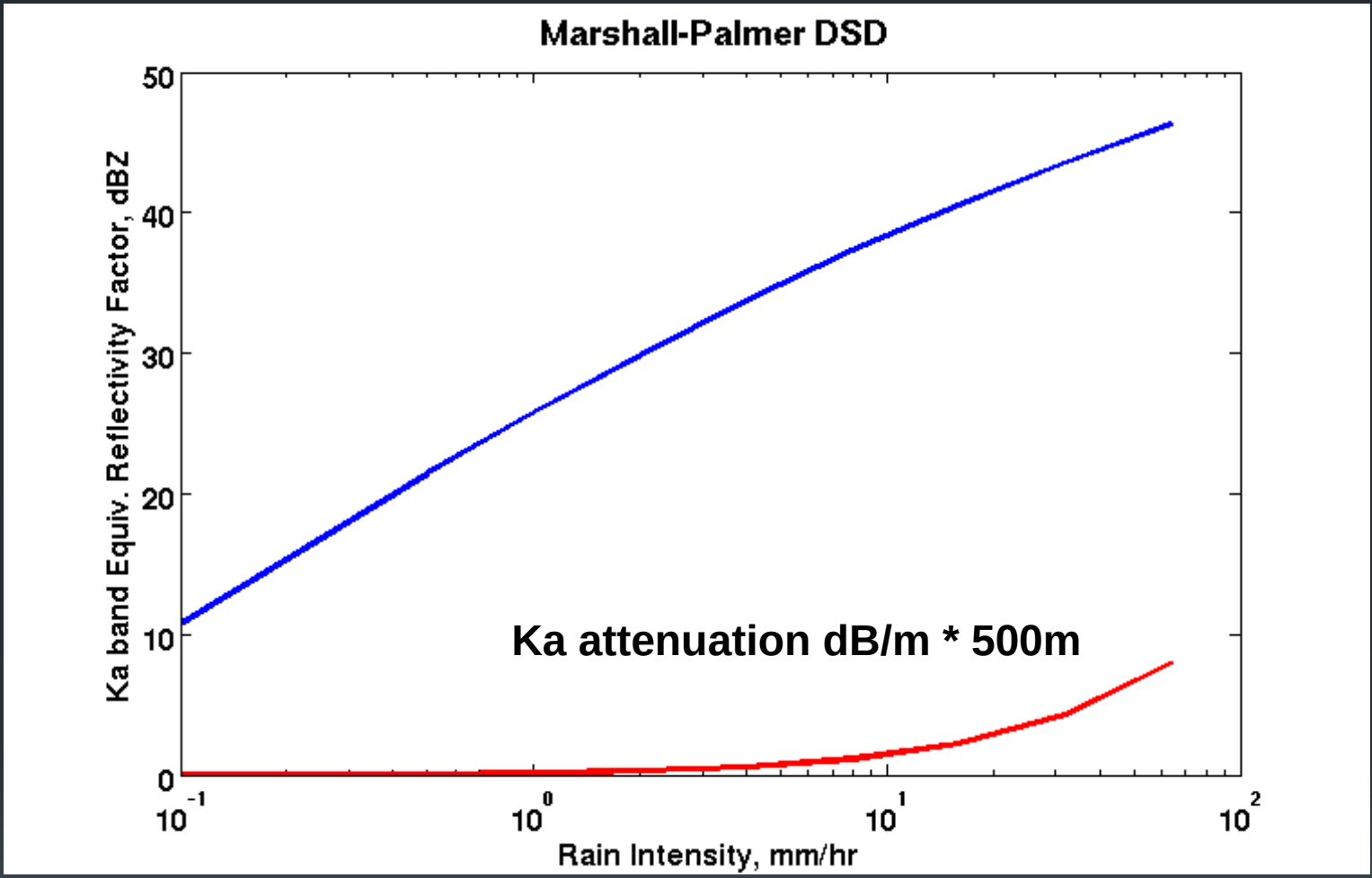
Mary Jane Bartholomew ASR Meeting 2015
bartholomew@bnl.gov

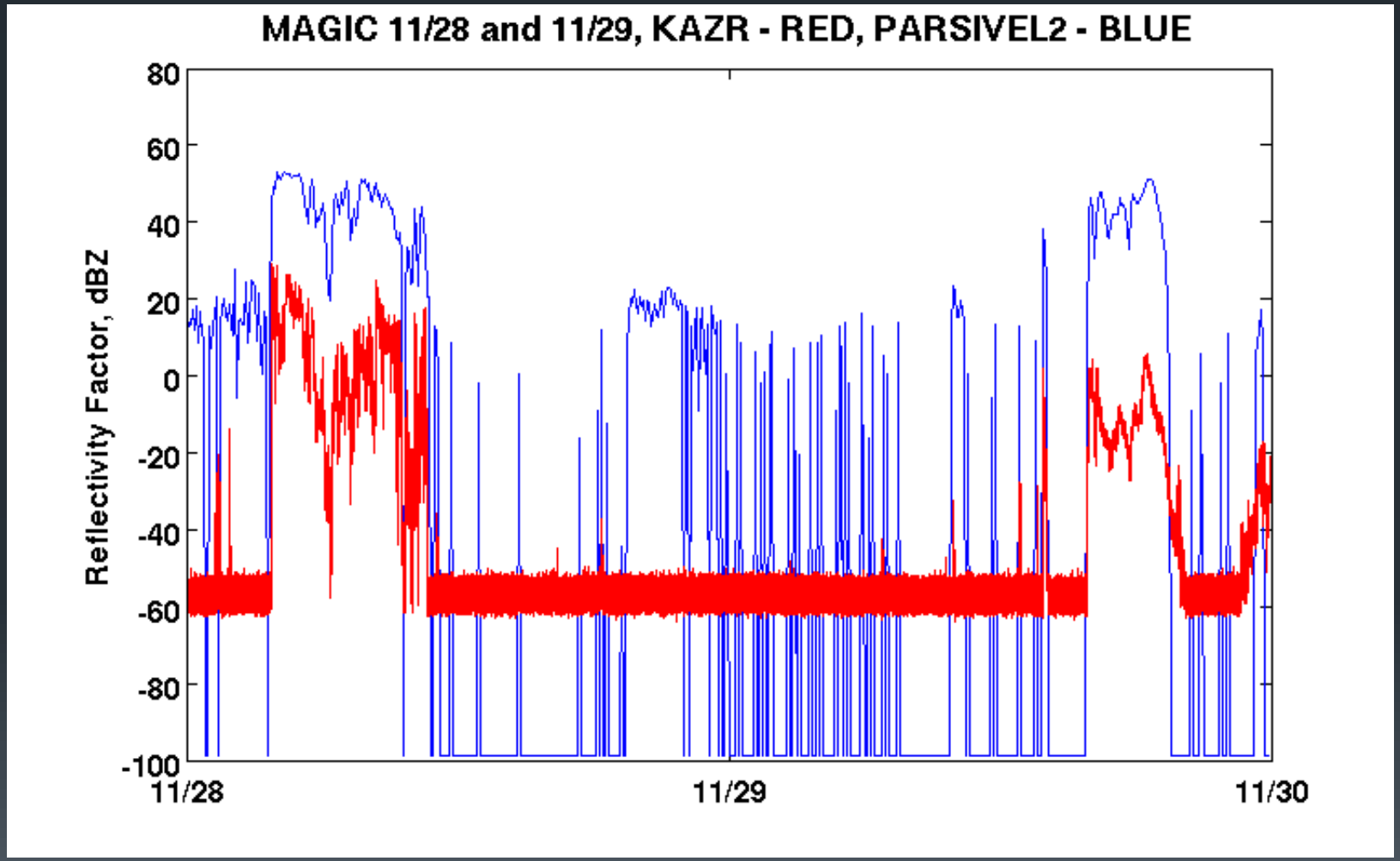
Parsivel2 disdrometer is a more sophisticated version of an optical rain gauge

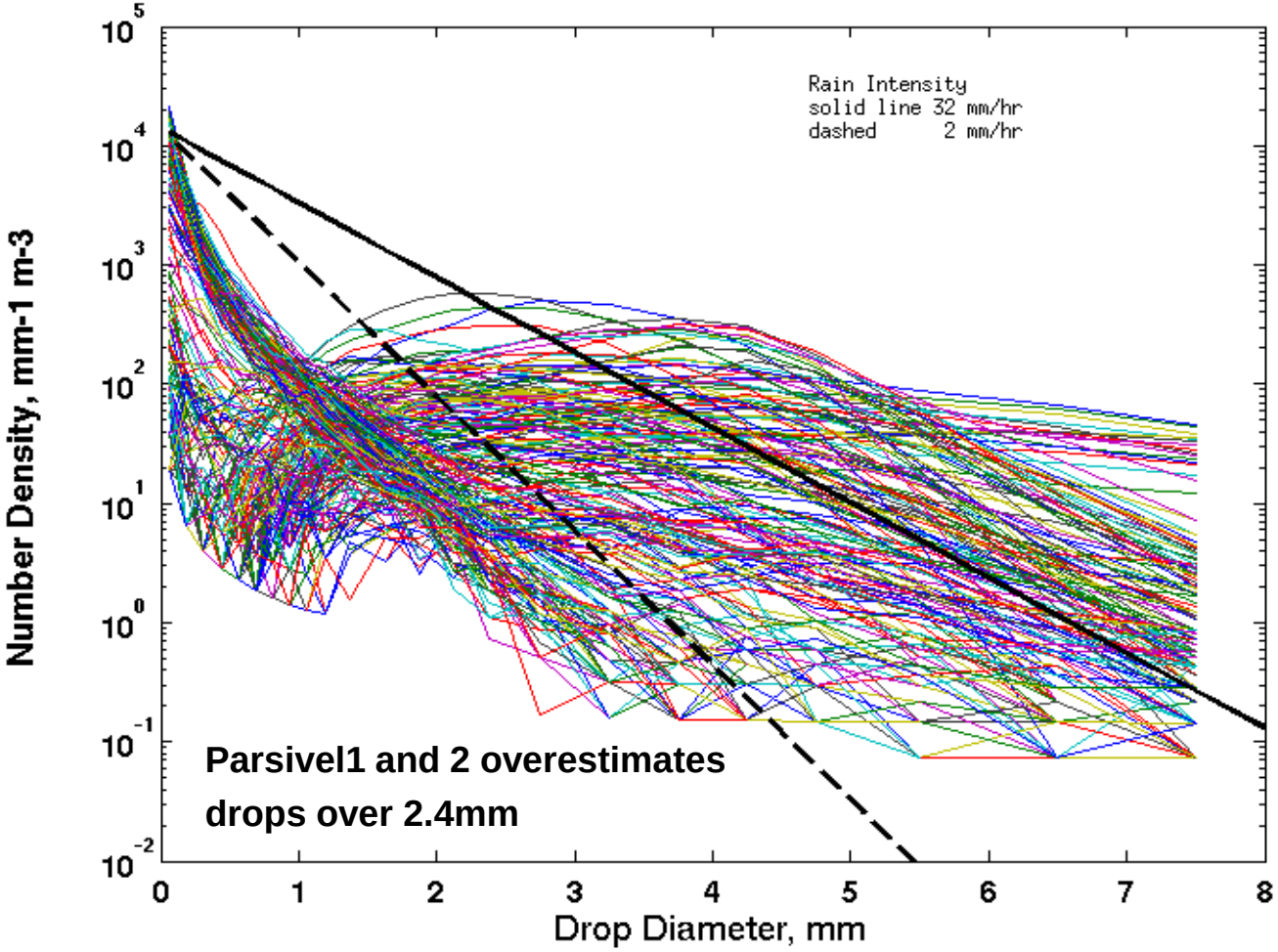
- measures particle size and fall velocity
- characterizes precipitation type

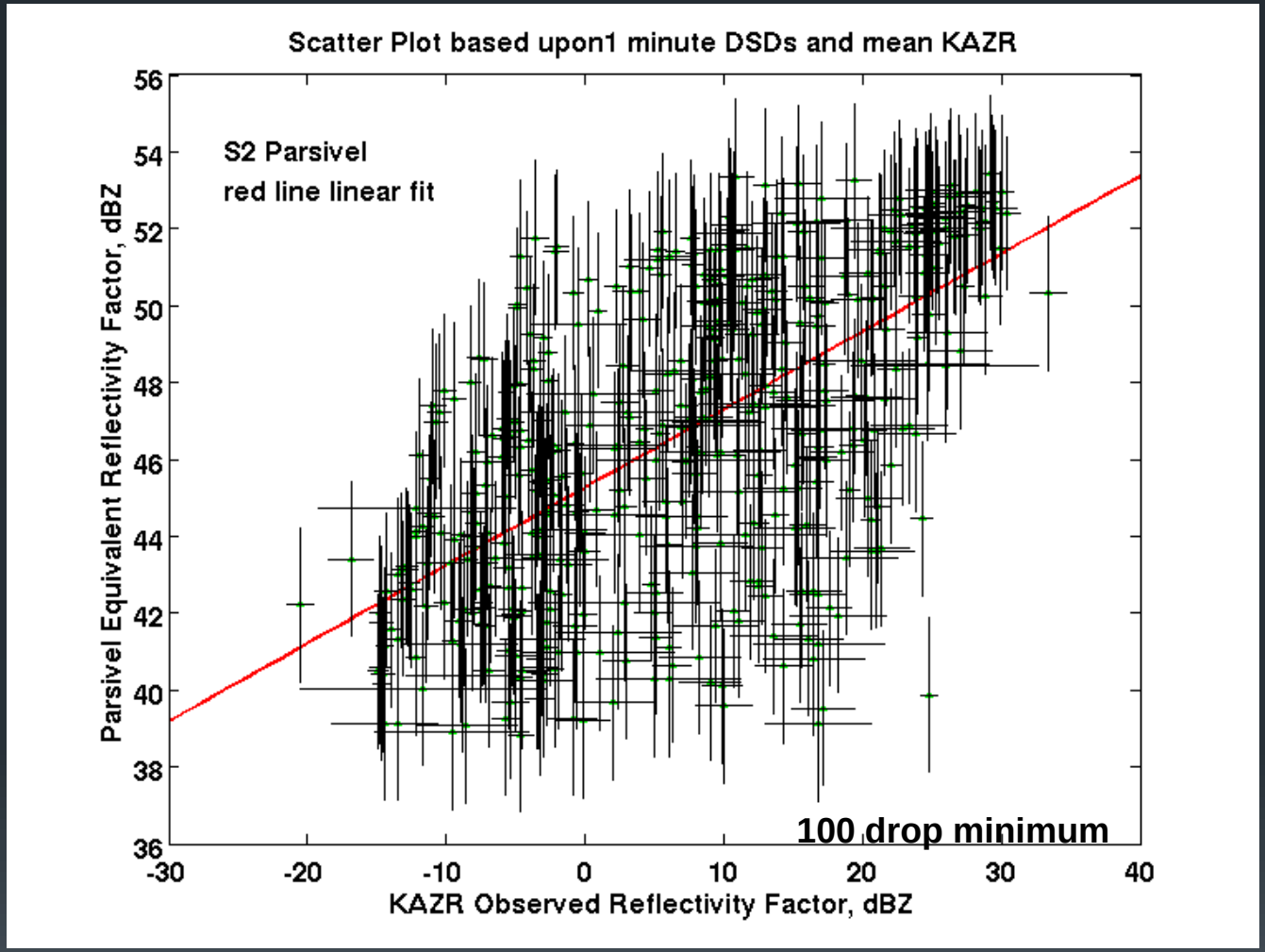

Summary of MAGIC Rainfall, mm
Accumulation, mm
400
350
300
250
200
150
100
50
0
Dry Dock
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
DATE

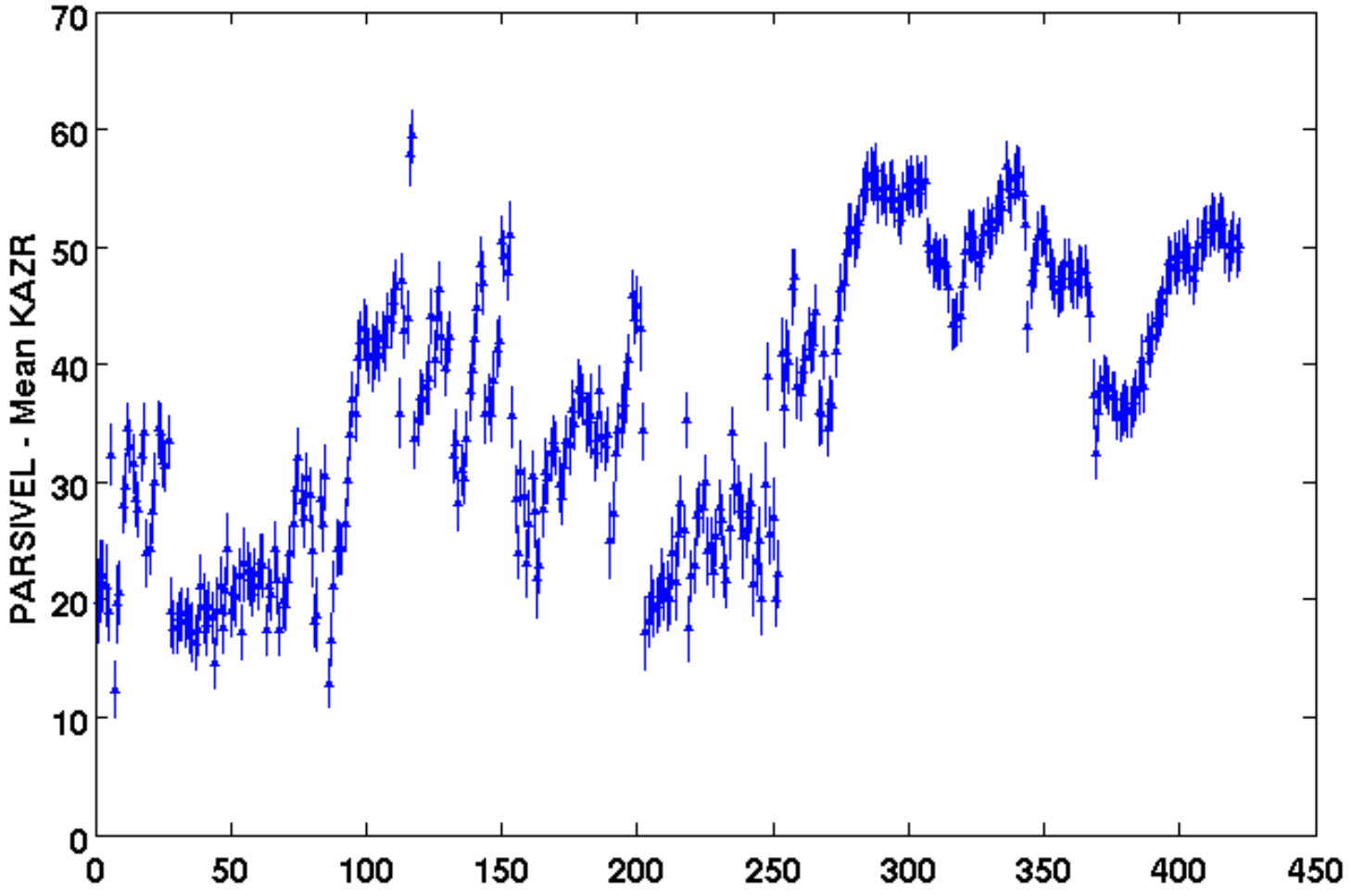

November 28 & 29
Rain Intensity, mm/hr
30
25
20
15
10
5
0
00:00
06:00
12:00
18:00
00:00
06:00
12:00
18:00
00:00
UTC
1 minute temporal resolution
5 minute temporal resolution


Marshall-Palmer DSD
Ka band Equiv. Reflectivity Factor, dBZ
50
40
30
20
10
0
Ka attenuation dB/m * 500m
10^{-1}
10^{0}
10^{1}
10^{2}
Rain Intensity, mm/hr


MAGIC 11/28 and 11/29, KAZR - RED, PARSIVEL2 - BLUE
Reflectivity Factor, dBZ
80
60
40
20
0
-20
-40
-60
-80
-100
11/28
11/29
11/30


Rain Intensity
solid line 32 mm/hr
dashed 2 mm/hr
Number Density, mm-1 m-3
Drop Diameter, mm
Parsivel1 and 2 overestimates
drops over 2.4mm


Scatter Plot based upon1 minute DSDs and mean KAZR
S2 Parsivel
red line linear fit
100 drop minimum
Parsivel Equivalent Reflectivity Factor, dBZ
KAZR Observed Reflectivity Factor, dBZ
56
54
52
50
48
46
44
42
40
38
36
-30
-20
-10
0
10
20
30
40



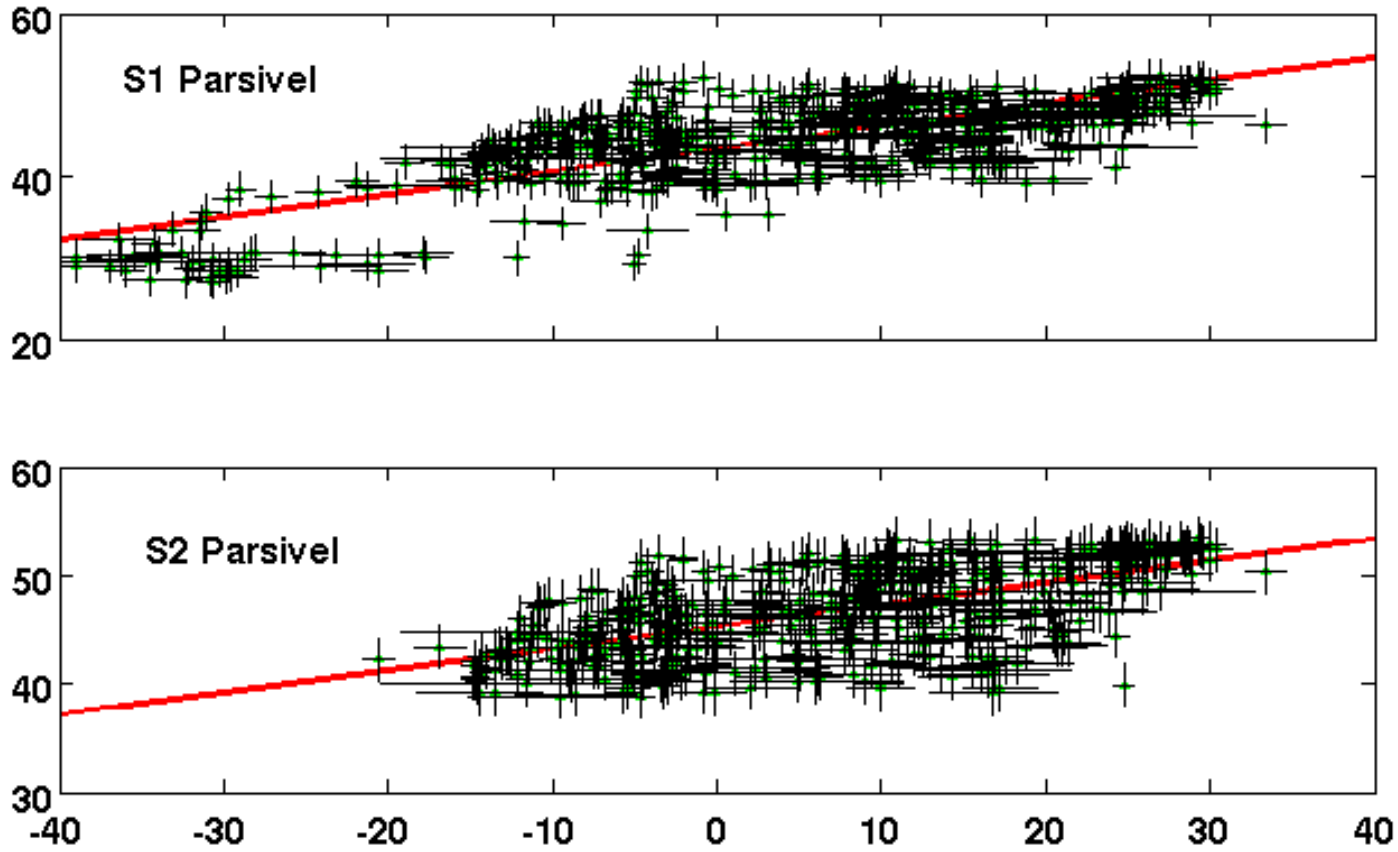
1 minute accumulations with 100 drops and low KAZR std

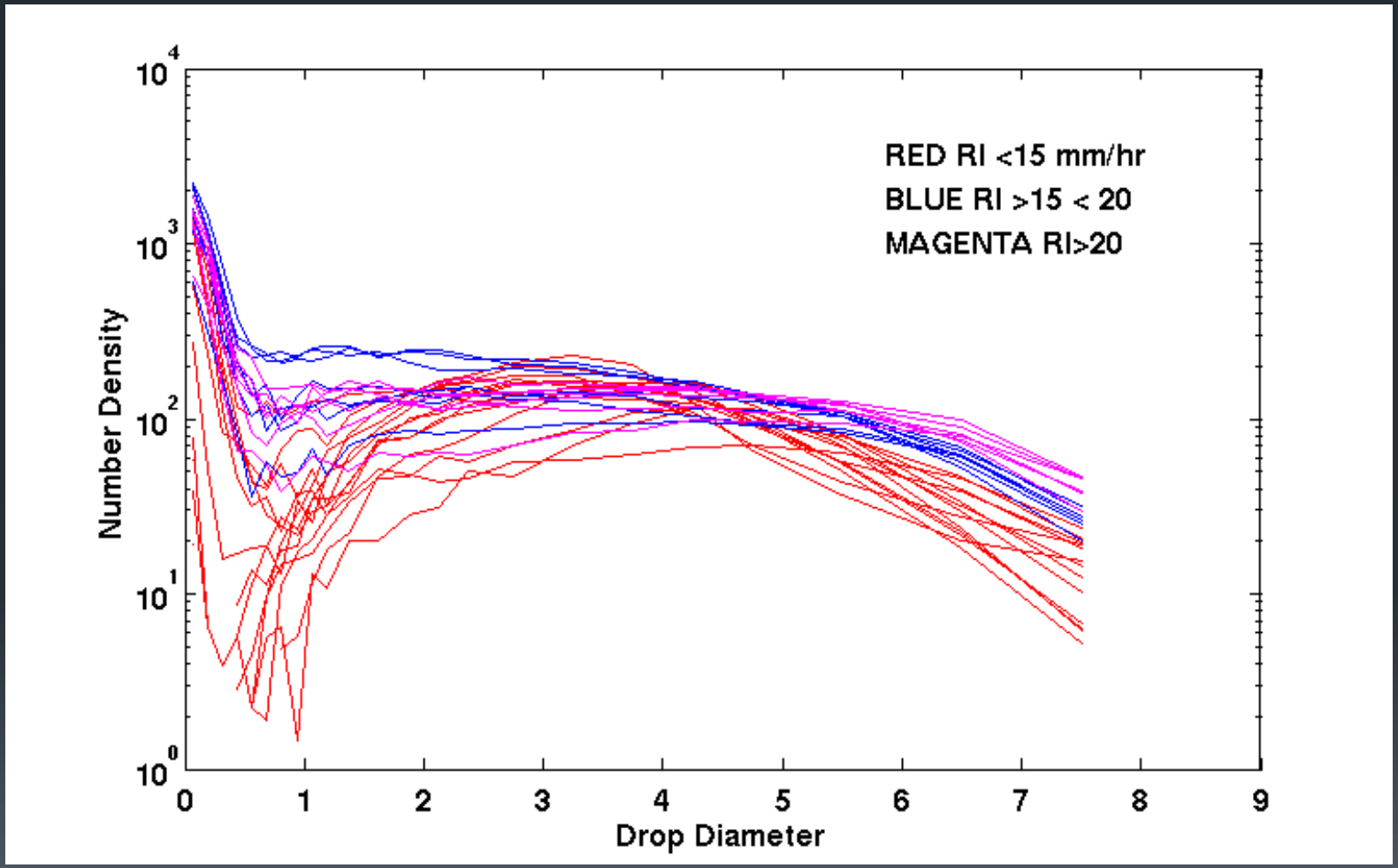
Analysis Summary

Instrument (temporal resolution)	KAZR Mean Offset dBZ (truncation)	KAZR Mean Offset, dBZ (truncation & upper limit)	Median Offset (Pars2-KAZR) (truncation)	Correlation Coefficient Rain Intensity vs (PARSIVEL – KAZR)
S1 (1 minute)	41 +- 2	39 +- 2	42	0.4
S2 (1 minute)	37 +- 2	35 +- 2	37	0.4
S1 (5 minute)	48 +- 4	44 +- 3	47	0.6
S2 (5 minute)	39 +- 3	37 +- 3	40	0.5

Final Thoughts

- This method of radar calibration is not equivalent nor as reliable as the method using a corner cube.
- This analysis does suggest, however, that the MAGIC KAZR data should only be used for tasks relying on relative reflectivity.
- More rain events would have been very useful especially if significant rain had fallen both before and after the dry dock hiatus.
- Real-time availability of the appropriate data might have been helpful in monitoring radar performance.


S1 Parsivel
S2 Parsivel
60
40
20
60
50
40
30
-40
-30
-20
-10
0
10
20
30
40


RED RI <15 mm/hr
BLUE RI >15 < 20
MAGENTA RI>20
Number Density
Drop Diameter
10^4
10^3
10^2
10^1
10^0
0
1
2
3
4
5
6
7
8
9