**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "A comparison of rainfall measurements by multiple instruments" *by* X. C. Liu et al.

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This paper compares rainfall measurements from three different types of rain gages, a weather detector, and two different disdrometers. Many events over a period of ten months have been used in this study. DSD parameters are also compared between the two disdrometers, i.e. JWD and 2DVD.

This is a very useful paper, well written and well presented, well structured, concise, and is certainly suitable for publication in AMTD. There are just a few comments/questions which need further clarification, as given below:

Response: Thanks for your positive comments of our work.

1) Page 3, line 4: Please add the proper reference for JWD.

Response: Thank you for your comment. We have added reference for JWD (Joss and Waldvogel, 1967).

2) Page 3, line 15: no space between TRMM

Response: Thank you for your comment. We have corrected it.

3) Page 7, line 15: 'where' should be 'whereas'General Comments

Response: Thank you for your comment. We have corrected it.

4) Fig. 2 and Table 1: How is an 'event' defined when (what the authors call) rain amount is determined?

Response: A rain event in this paper is defined as the rainfall lasts more than 3 minutes and rain amount greater than 1 mm during 24 hours a day, then the rain accumulation of each rain event is determined by the summation of rain amount with 1-minute resolution. It should be noted that 'rain amount' in Legend of Fig. 2 was replaced by 'rainfall accumulations'.

5) Fig. 4(a) and (b): The plots are difficult to interpret; can they be replotted in color to make the curves clearer?

Response: Thank you for your suggestions. We have replotted Fig. 4(a) and (b) in color.

6) Page 9, lines 12-15: This sentence is not at all clear, and needs to be rewritten.

Response: Thank you for your comment. We have rewritten this sentence.

7) Fig. 4 and 5: Are these 1-minute rainfall rates – please specify.

Response: Yes, Fig.4 and 5 are all 1-minute rainfall rates.

8) Fig. 6: Again, were these determined from 1-minute DSDs – please specify.

Response: Yes, Fig.6 are determined from 1-minute DSDs.

9) Fig. 7a-d: it's not clear how many DSDs are used in each R interval case; do they represent the 'averaged' DSDs for a given R interval?

Response: There are 91, 9, 9, and 6 1-minute DSDs used in R < 5 mm h-1, 5 mm h-1< R <15 mm h-1, 15 mm h-1 < R <30 mm h-1, and R > 30 mm h-1 respectively, the DSDs in each R interval case have been averaged, therefore we believe that they can represent the average DSDs for a given R interval.

10) Also, regarding the JWD measurements, was dead-time correction applied (because this can alter the estimated DSD parameters)?

Response: We are sorry that the dead-time correction was not applied, we have applied the dead-time correction to the JWD measurements in the revised manuscript, and the correction is based on the technique discussed in Sheppard and Joe, 1994. Table 4, Figure 6 and 7 are revised accordingly; relative discussions are modified, which can be found in the revised manuscript.

11) Rain rate comparisons: much depends on the weighting function used in the comparisons, so justification for equation (3) needs to be elaborated upon. For example, why use dynamic weighting function – what are advantages, etc.

Response: Because there's no standard instrument that can obtain the true rain rate, a reference rain rate is needed for the comparisons, but different instruments have different performances for different rainfall intensity, the simple averaging method might be not suitable for the different rainfall intensity, some subtle changes and features might be neglected by this method. while the dynamic weighting function proposed in this paper are more sensitive to the rain rate by different instruments, it can provide a more standard reference for rain rate, which is suitable for the different rainfall events.

12) For rain rate and DSD parameters comparison, would there be improvements if a running average over 3 minutes is used? If so, by how much.

Response: We have reran our comparisons with an average over 3 minutes, it is found

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that 1) the evolution curve of rain rate are smoothed by the average over 3 minutes; 2) there is a slight improvement for rain rate comparisons, the rain rate by individual instrument and reference rain rate have a better correlation coefficient and a small standard deviation, shown as figure bellows, for example, correlation coefficient between the TBRG and reference changes from 0.9259 to 0.9760, and std changes from 5.77 mm h-1 to 3.37 mm h-1; 3) but because the DSD parameters are already averaged in each R interval case, there are not improvement for DSD parameters comparisons.
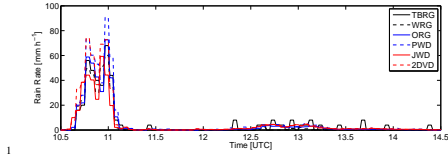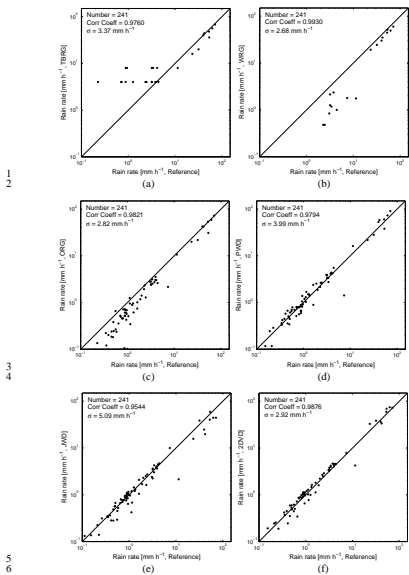
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2   Figure 1. Evolution of the rain rate recorded by six instruments averaged over 3 minutes

3   (January 13th 2012)

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Fig. 1.

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7   Figure 2. Comparison of individual instruments against the reference rain rate averaged over 3

8   minutes (January 13th 2012)

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Fig. 2.