CHUVA PROJECT

CHUVA International Workshop

Preparation of a filter to correct drop size distributions of Parsivel disdrometer based on the particle speed limitation

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Summary

- **Purpose**
- **Data**
- **Methodology**
- **Results**

Purpose:

- The objective is to bring similar concentration of rain drops values from different types of disdrometers.
- To reach this goal, and in the framework of the CHUVA experiment at Vale do Paraíba, the Joss-Waldvogel disdrometer is used as reference and a filter has been developed in order to eliminate inconsistent data measured by the Parsivel one.

Data

- CHUVA Experiment – Vale do Paraíba – SP (30 October 2011 - 18 March 2012)
  - Disdrometers (Joss and Parsivel)
    - Droplet Size Distribution;

Methodology

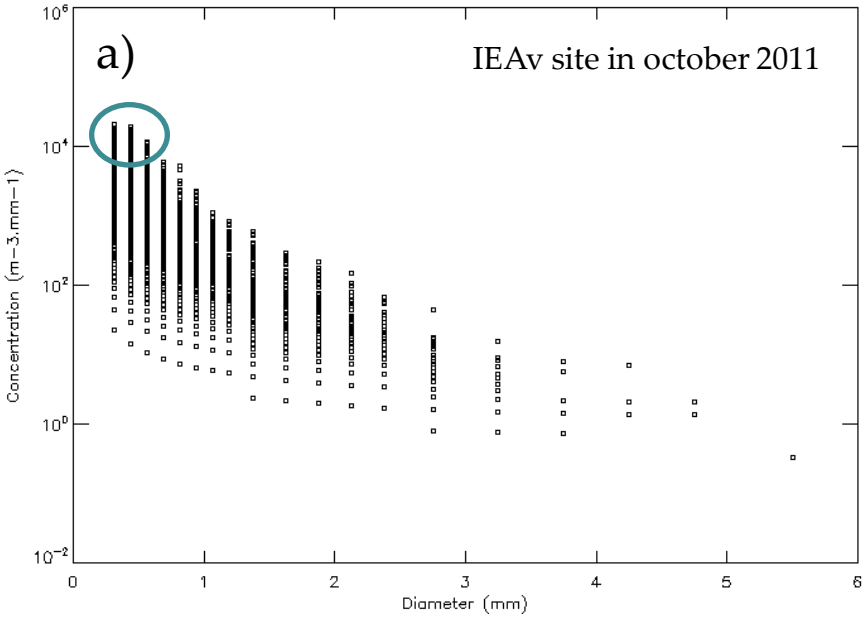
The concentration of droplets is based on the following equation:

$$N(D_i) = \frac{n_i}{F.t.v(D_i).\Delta D_i}$$

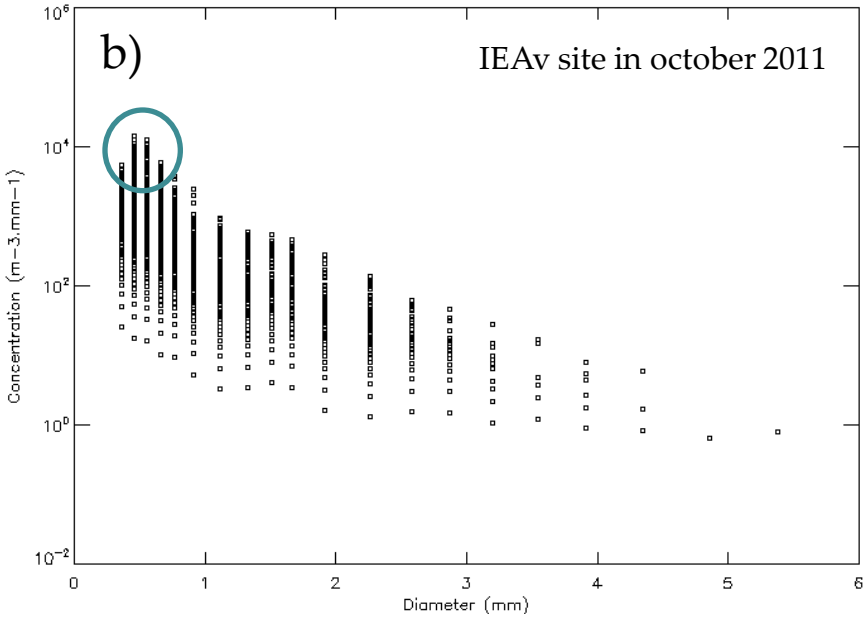
n_i	Number of drops measured in drop size class i during time interval t	---
t	Time interval	s
F	Size of the sensitive surface of the sensor	m^2 ($F=0.005\,m^2$)
D_i	Average diameter of drops in class i	mm
$v(D_i)$	Fall velocity of drop with diameter Di	m/s
ΔD_i	Diameter interval of drop size class i	mm

Methodology

Concentration of the Parsivel disdrometer



Concentration of the Joss disdrometer



The parsivel disdrometer overestimates the first diameter classes, on the contrary to the results issued from the Joss-Waldvogel disdrometer.

→ For this reason that a filter has been developed.

Methodology

❑ Based on these observations, we have computed the average speeds and standard deviations for each diameter class of the Parsivel disdrometer.

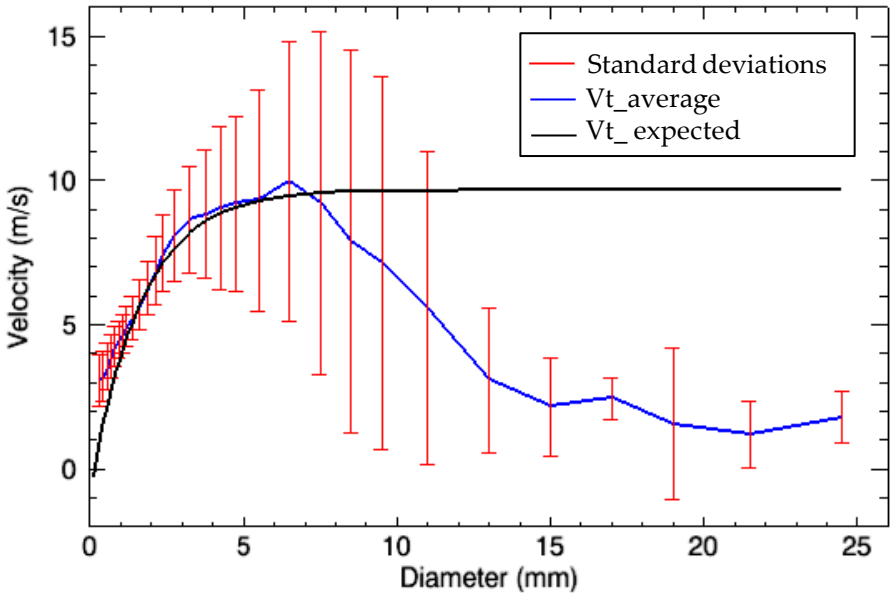


Figure 2 – Average speeds and standard deviations for each class of diameter.

$$V(D) = 9.65 - 10.3exp^{-6.D}$$

Atlas et al. (1973)

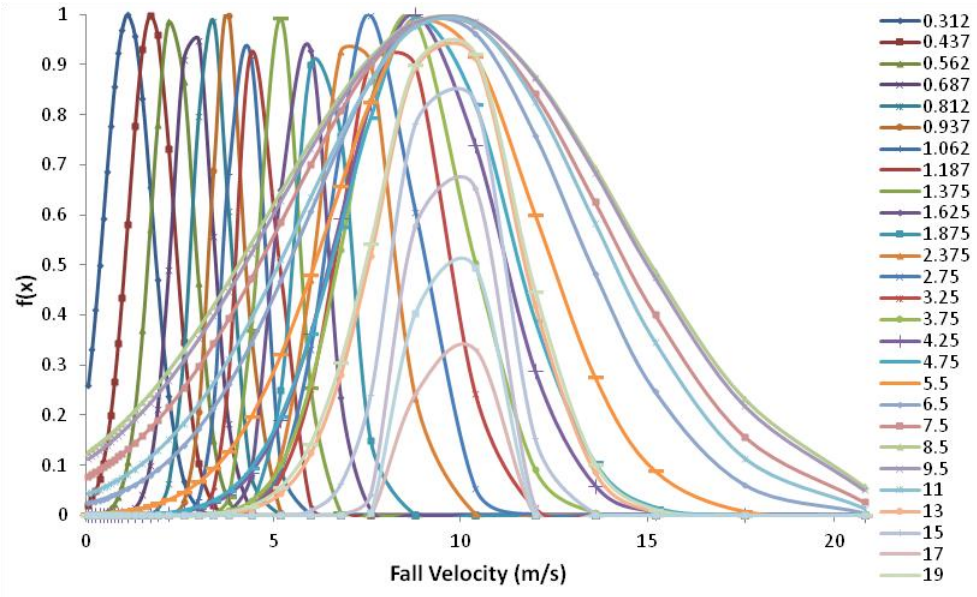
- The results show that for classes up to 7mm the results seem to be similar.

- we use the expected fall velocity and standard deviations for the preparation of the filter.

Methodology

- For each diameter class has been calculated the Gaussian curves using the expected fall velocity and the standard deviation.
- Based on that curves, for each class of diameter. It is possible to determinate the minimum and the maximum of the fall velocity.

Figure 3 – Gaussian curves for each class of diameter.



Results

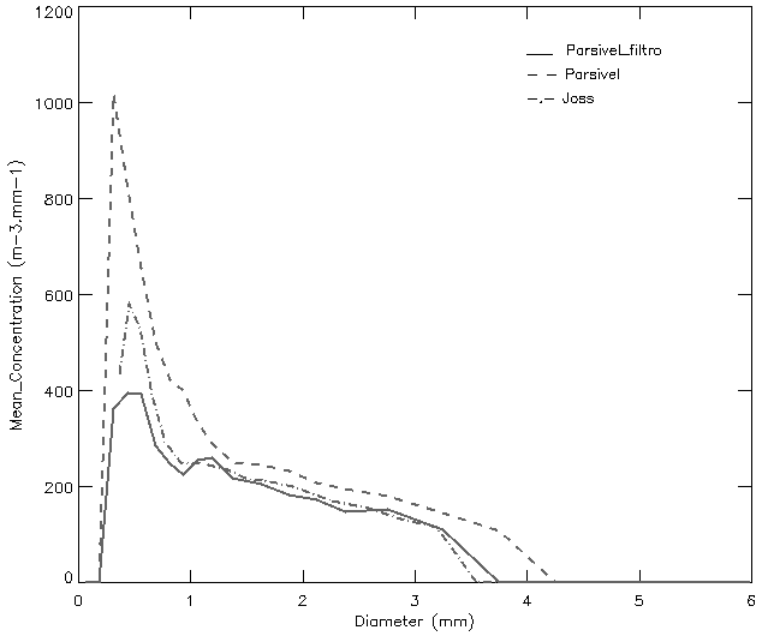


Figure 4 – Average concentration for each class of diameter.

Differences observed between the two instruments, in particular for diameters < 1 mm.

The average concentration from the filtered-Parsivel configuration is more similar to the concentration from the Joss instrument.

→ Still have differences for diameters < 1 mm

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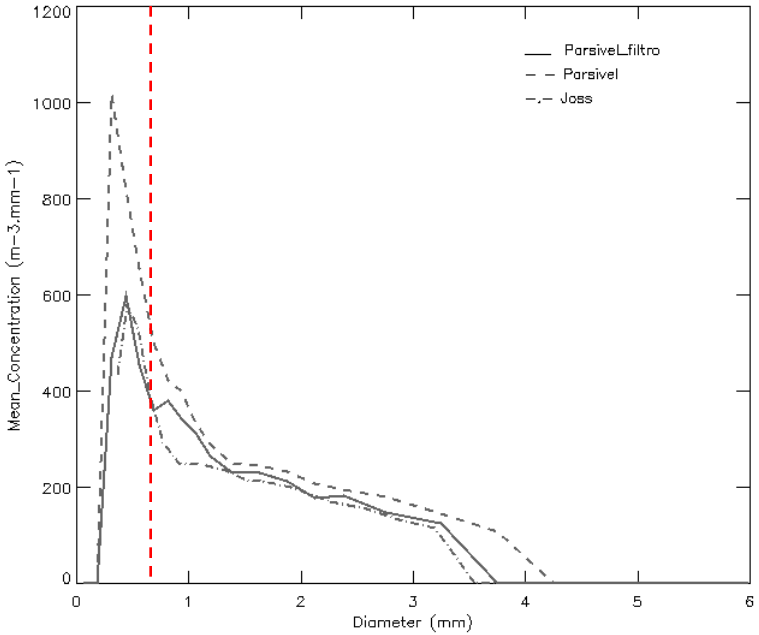
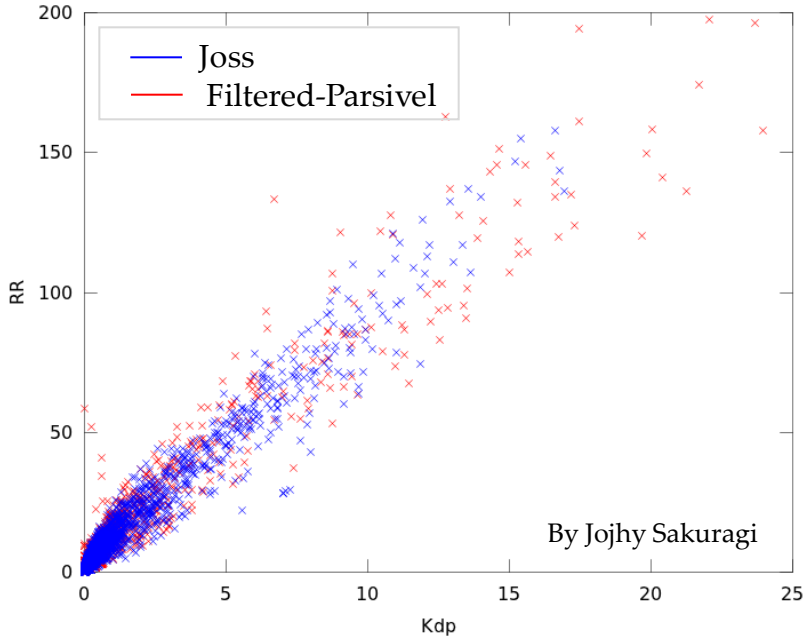
Results

Factor 1.6



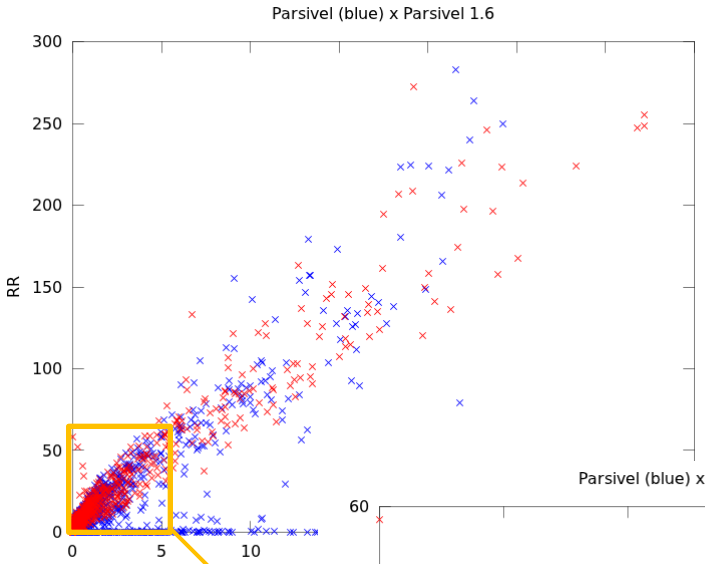


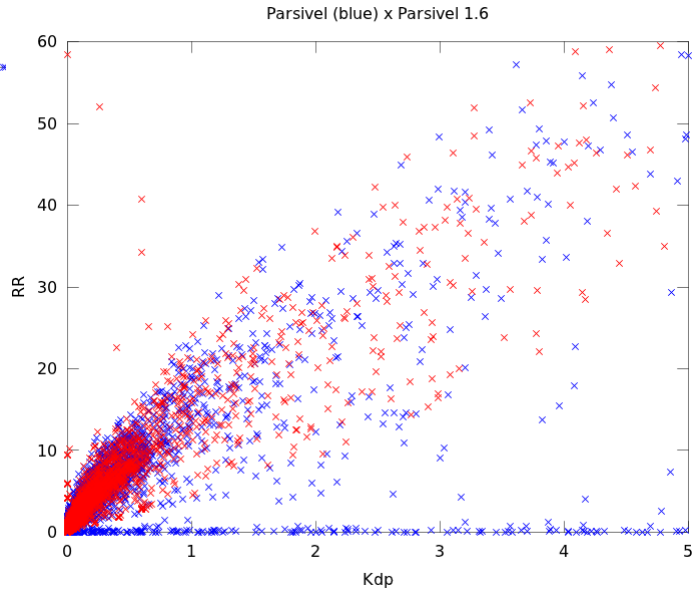
→A factor of 1.6 allows to improve the average concentration of Parsivel, for most of the classes in comparison with the Joss concentrations.

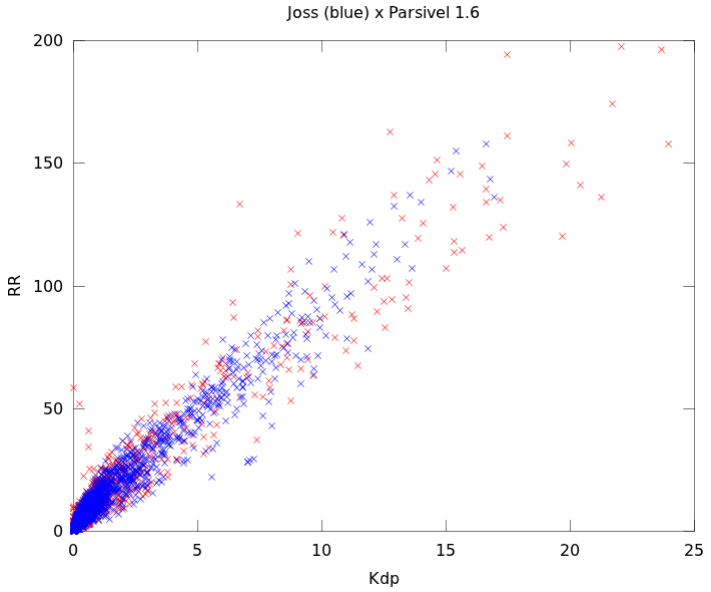
→ There is still a weak difference around 1mm.

→ We can observe that the 2 distributions seem to be similar.

Thank you!


Parsivel (blue) x Parsivel 1.6
RR
300
250
200
150
100
50
0
0
5
10


Parsivel (blue) x Parsivel 1.6
RR
60
50
40
30
20
10
0
0
1
2
3
4
5
Kdp


Joss (blue) x Parsivel 1.6
RR
200
150
100
50
0
0
5
10
15
20
25
Kdp