Estimation and characterisation of precipitations with an X-band radar

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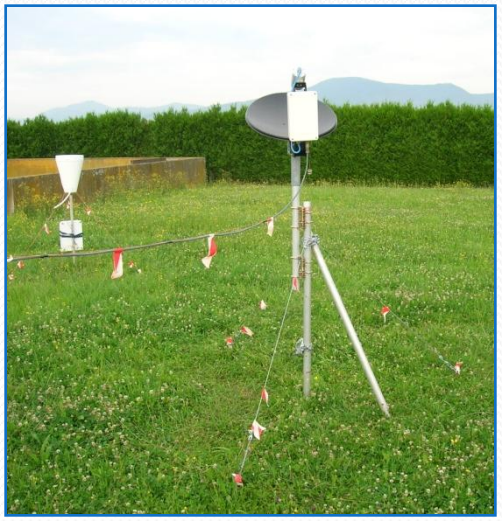
LaMP instrumentation for COPS :

X-band radar (9.41 GHz)

- 60 m in range
- 2° in azimuth
- 30 seconds

Micro Rain Radar (24.1 GHz)

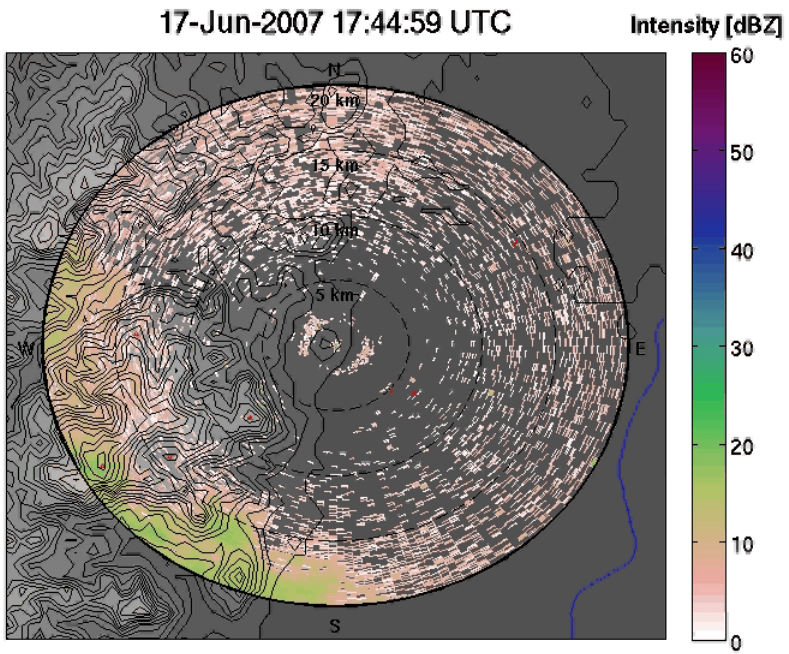
- 100 m in vertical
- 3000 m max
- 10 seconds



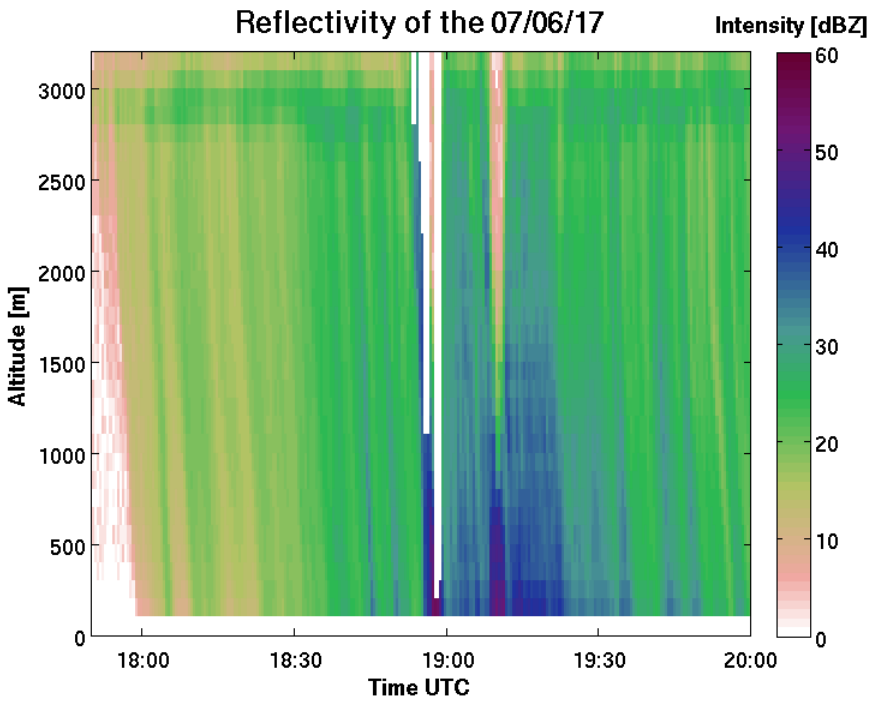
+ Raingage and JW Disdrometer

Lamp instrumentation :

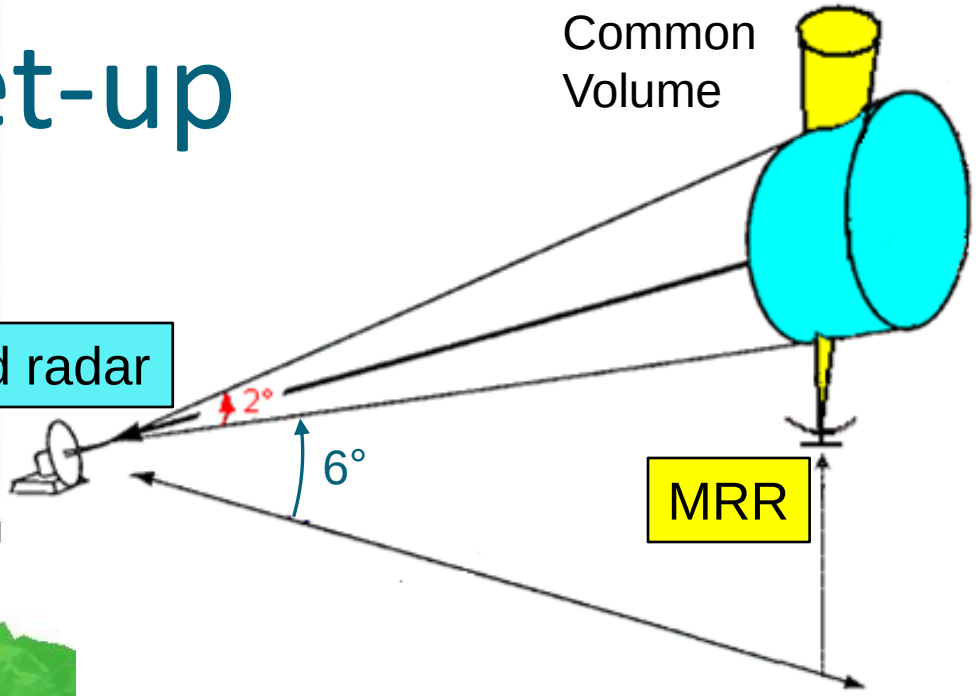
X-band radar (9.41 GHz)

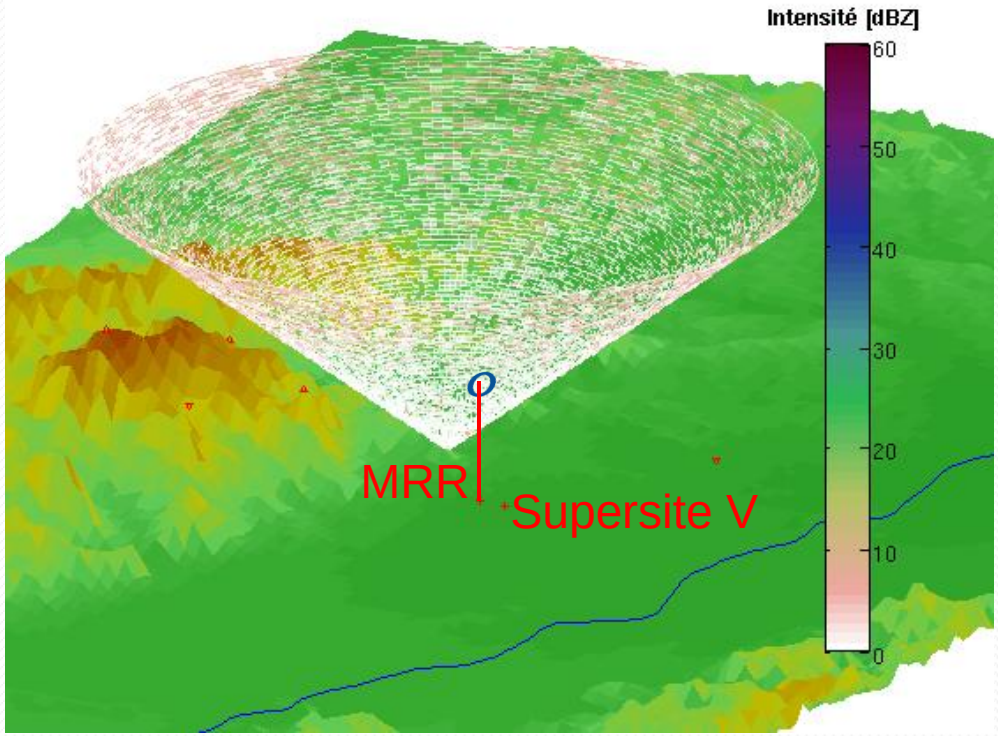


Micro Rain Radar (24.1 GHz)



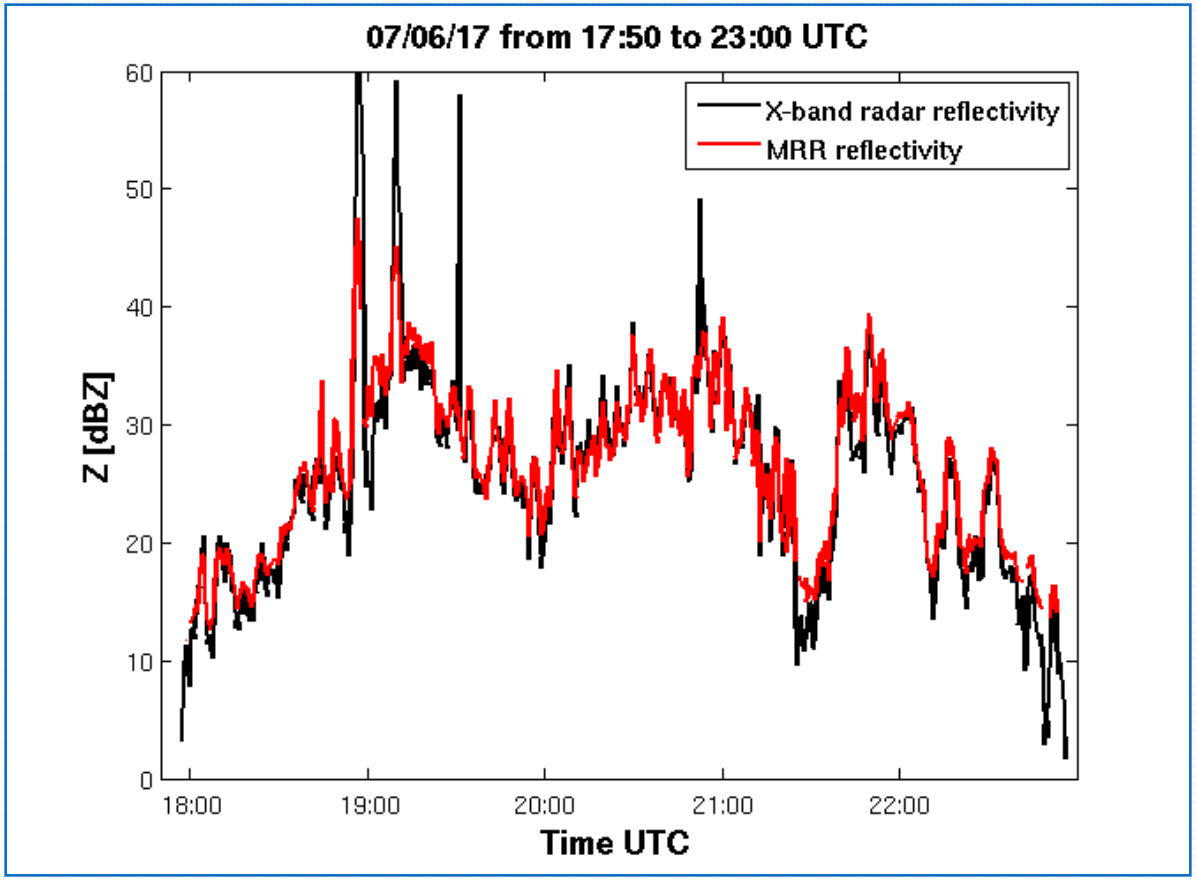
Experimental set-up at supersite V





Correlation in the common volume

- **Attenuation calculation (Hitschfeld and Bordan, 1954)**
- **Intercalibration over the whole data set (75 mm of precipitation)**



Correlation : 0.94

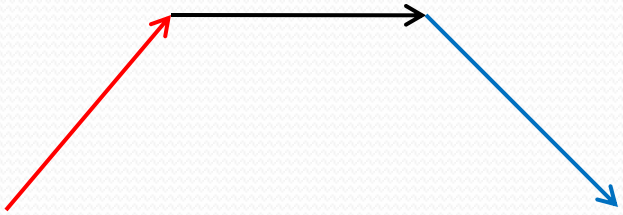
Improving the rainrate estimation

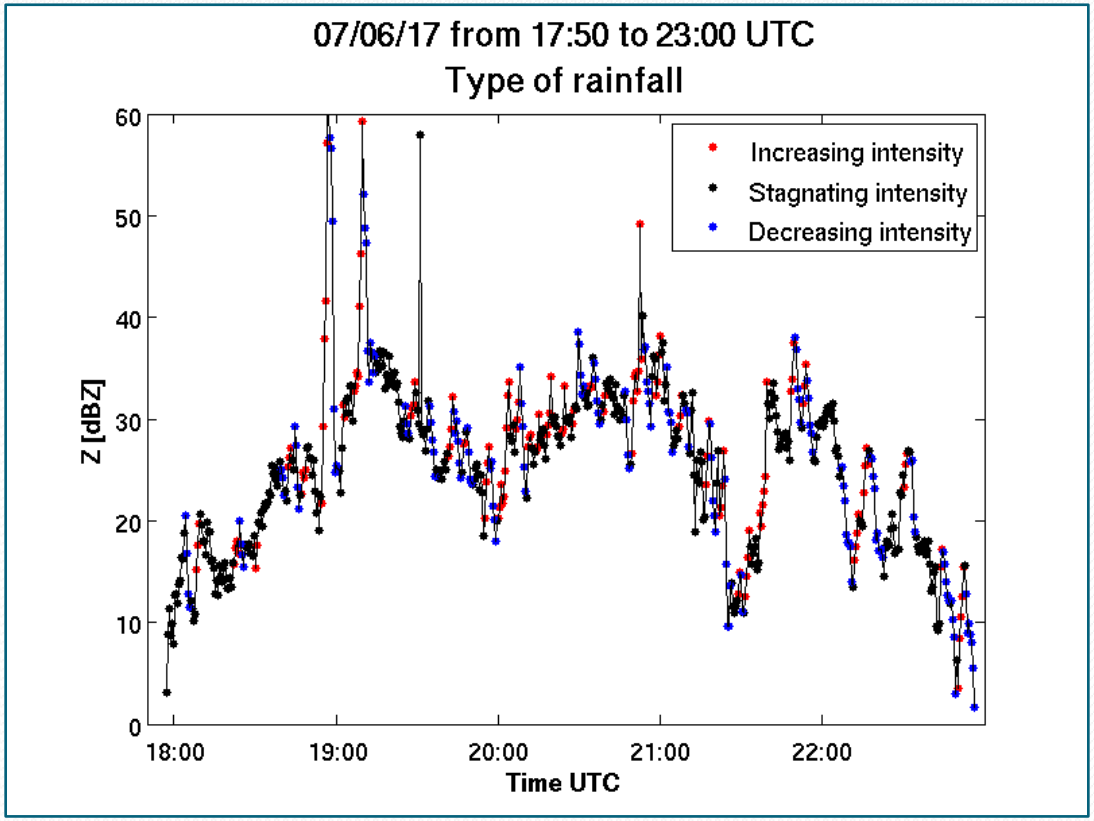
Methodology

- Use the MRR to estimate
  - the reflectivity **Z**,
  - the rainrate **R**
  - the Drop Size Distribution **DSD**
- Characterise different types of precipitation with different methods
- Use the MRR to determine the corresponding **Z-R** relationships then apply them to the X-band radar reflectivity
- Comparison of the different R obtained

Defining regimes of increasing, stagnating or decreasing intensity

17 june 2007
17:50 to 23:00

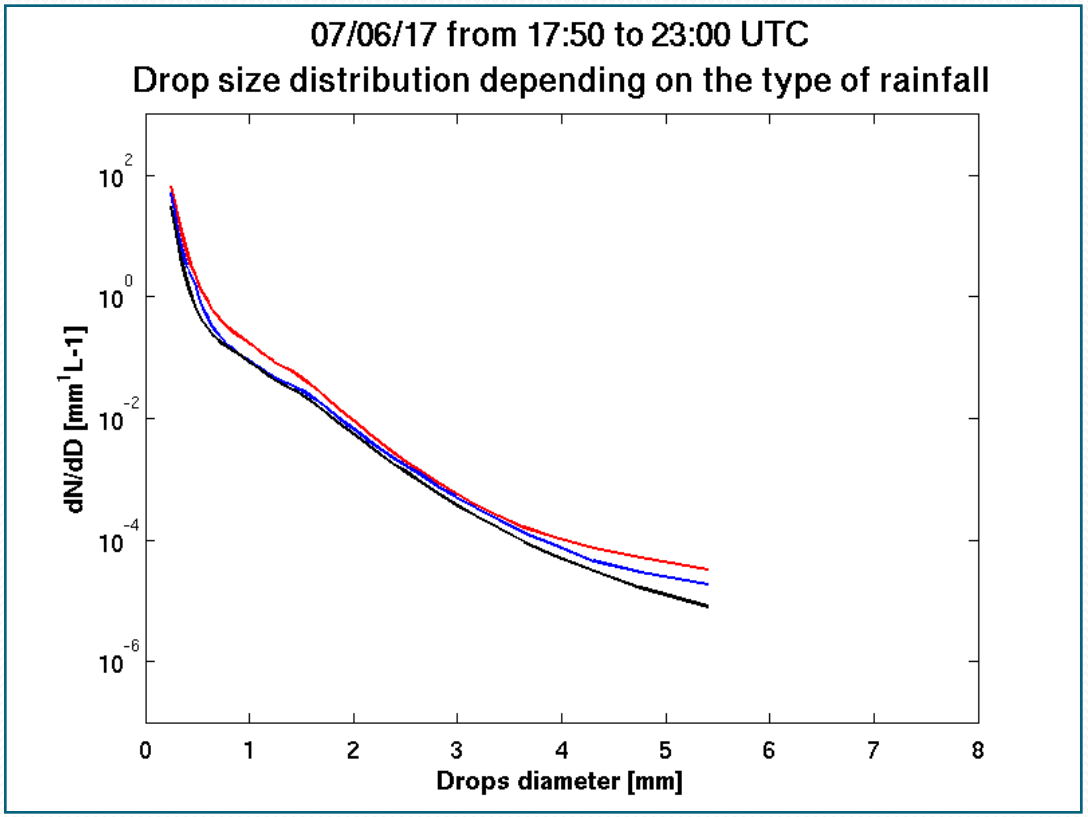




Defining regimes of increasing, stagnating or decreasing intensity

17 june 2007
17:50 to 23:00

Corresponding **DSD**



Defining regimes of increasing, stagnating or decreasing intensity

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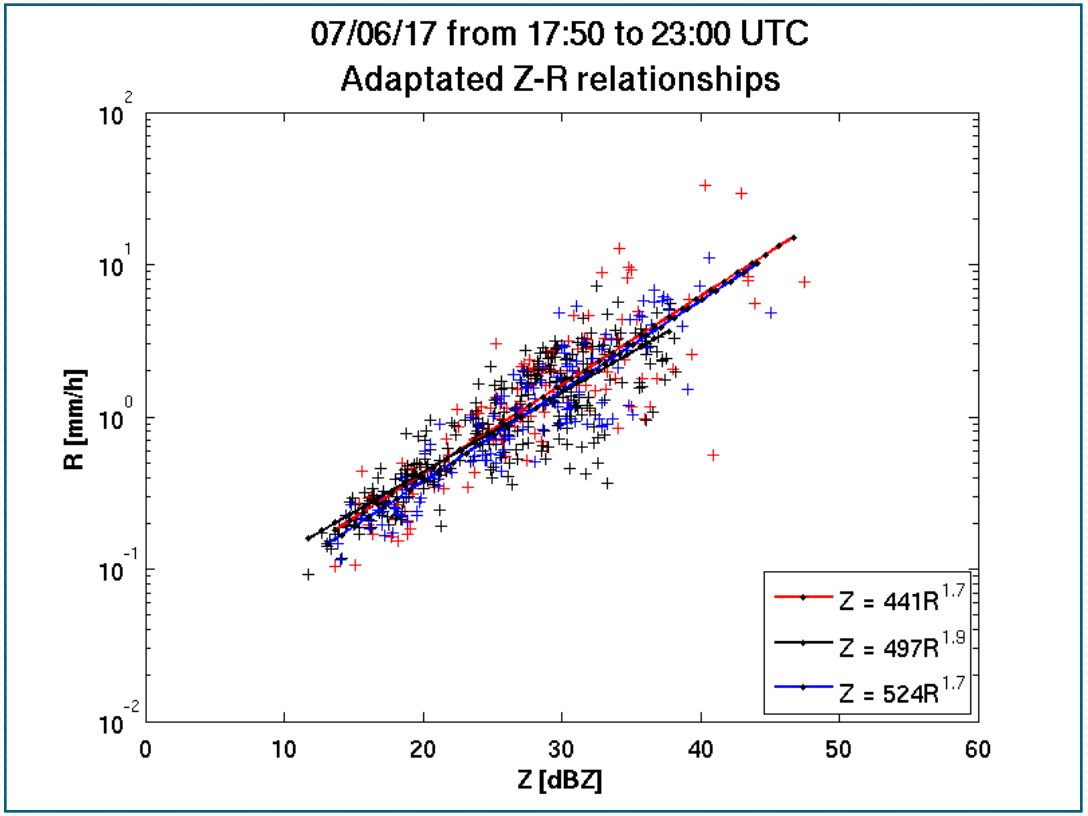
17:50 to 23:00

Z-R relationships



Defining regimes of increasing, stagnating or decreasing intensity

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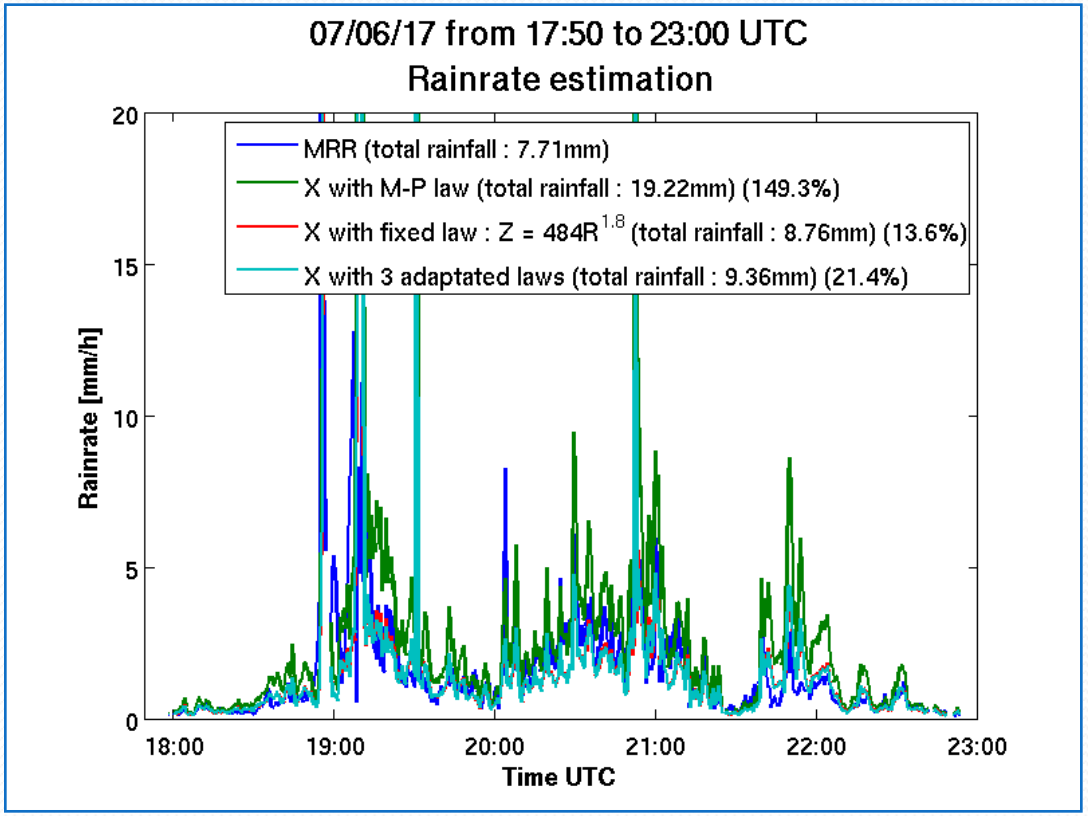
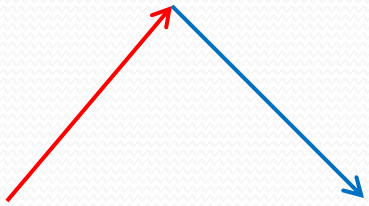
17:50 to 23:00

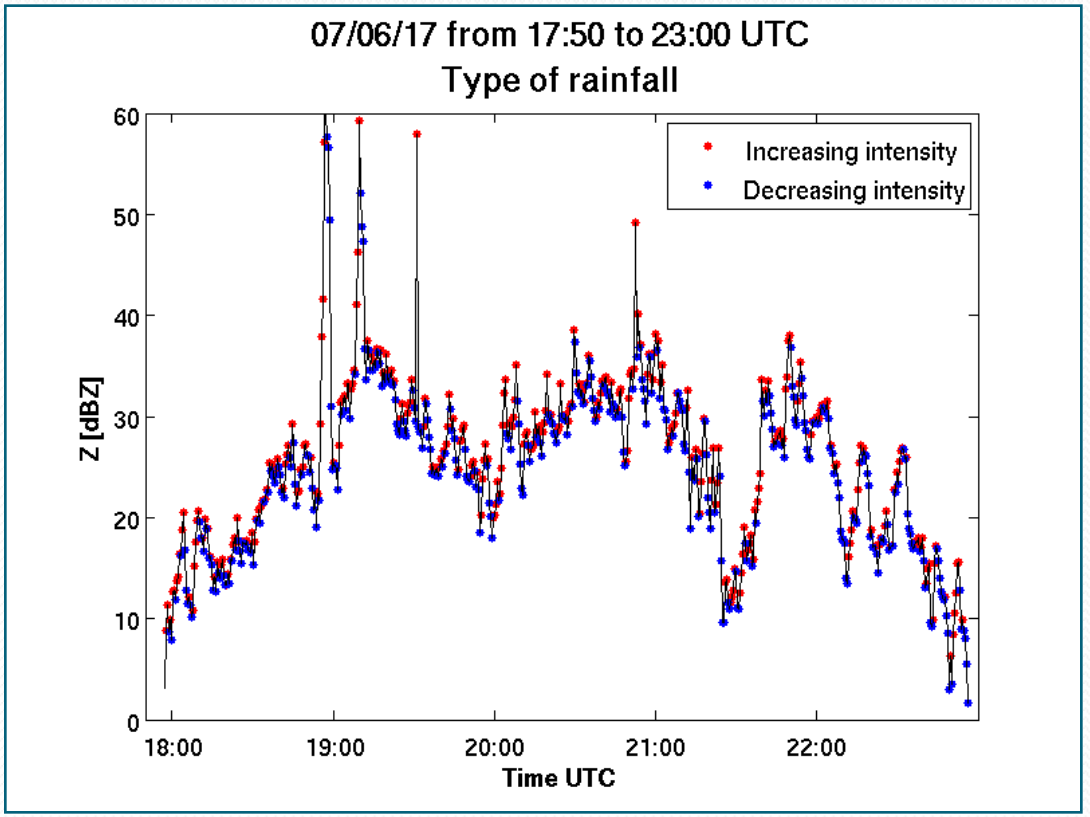
Rainrate and total rainfall



Using the sign of the derivative

17 june 2007
17:50 to 23:00





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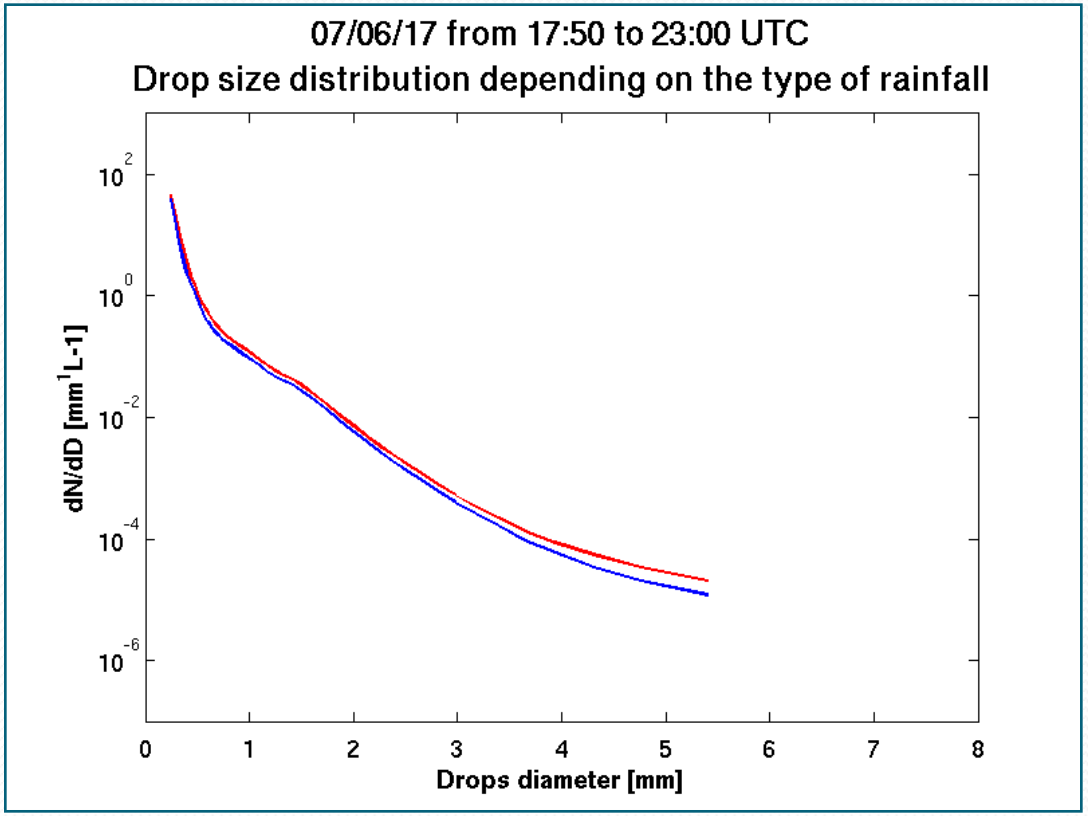

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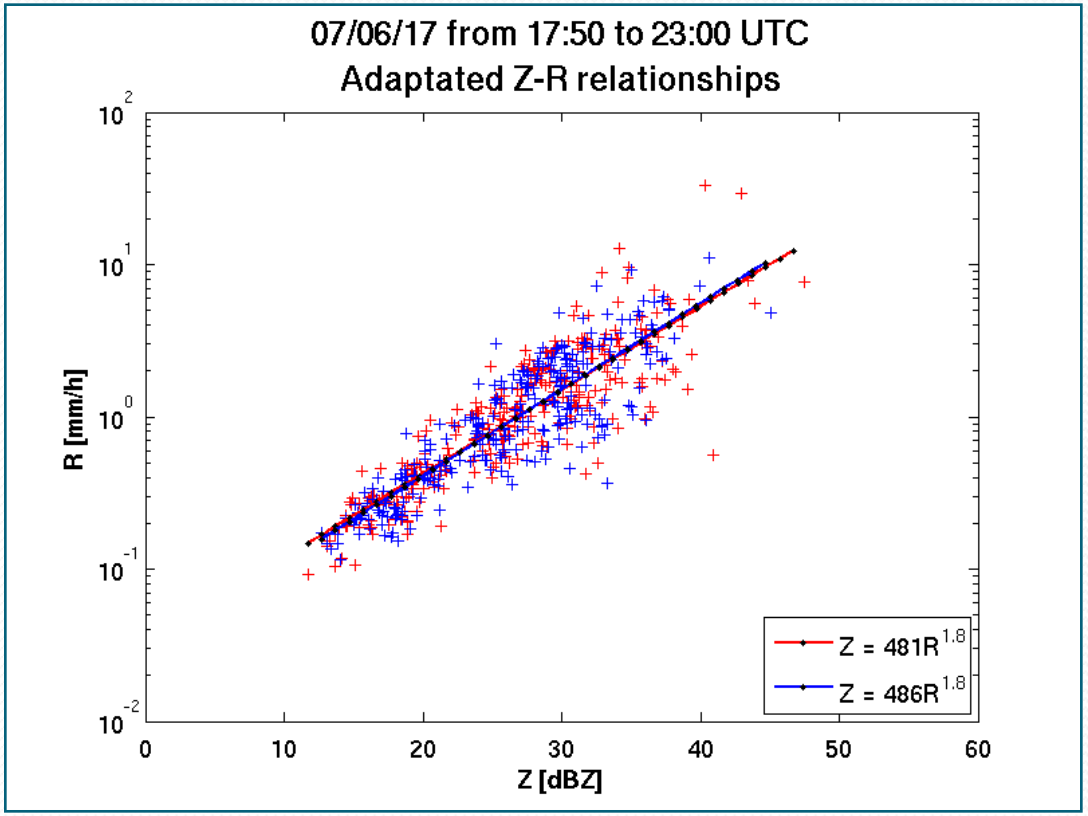
Z-R relationships



Using the sign of the derivative

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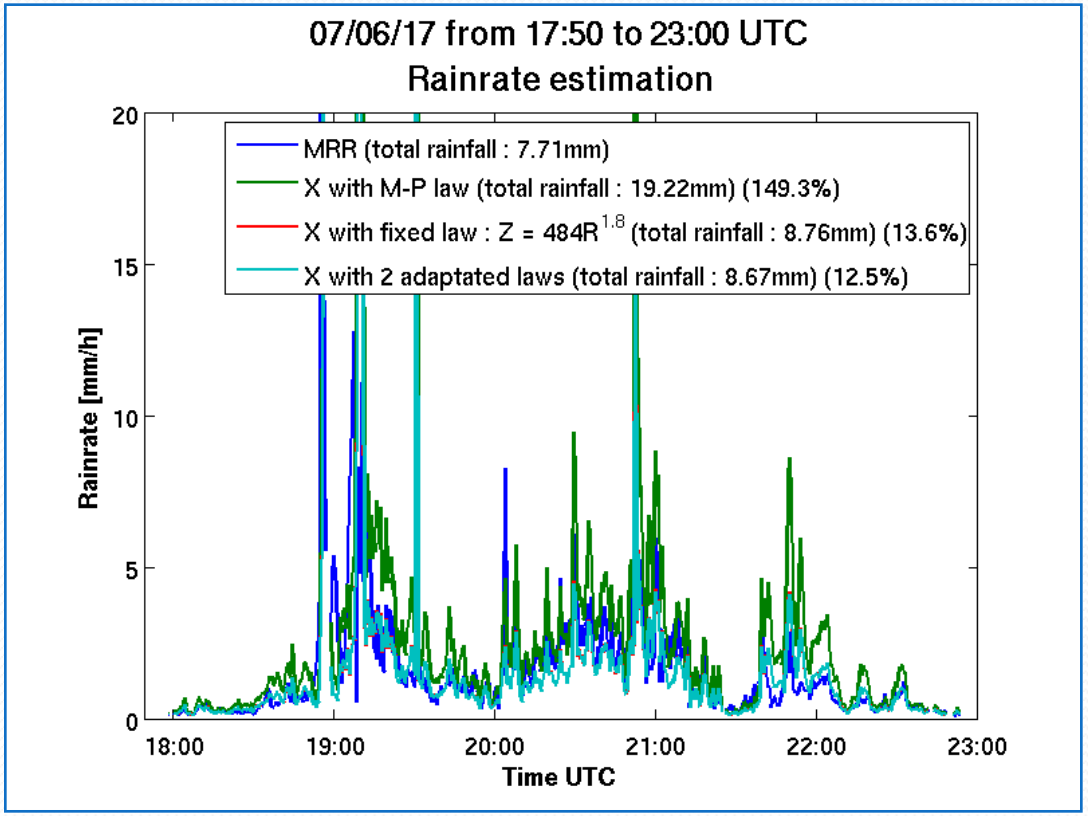
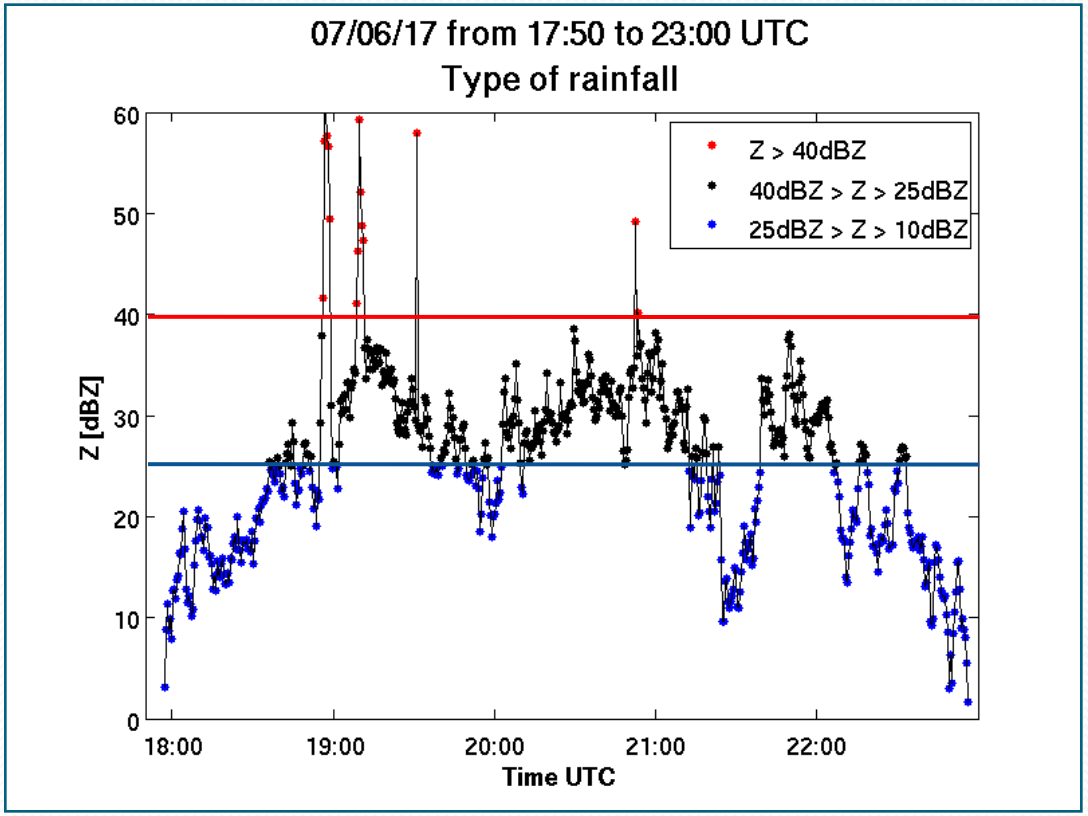
Rainrate and total rainfall



Using rain intensity classification

17 june 2007
17:50 to 23:00



Using rain intensity classification

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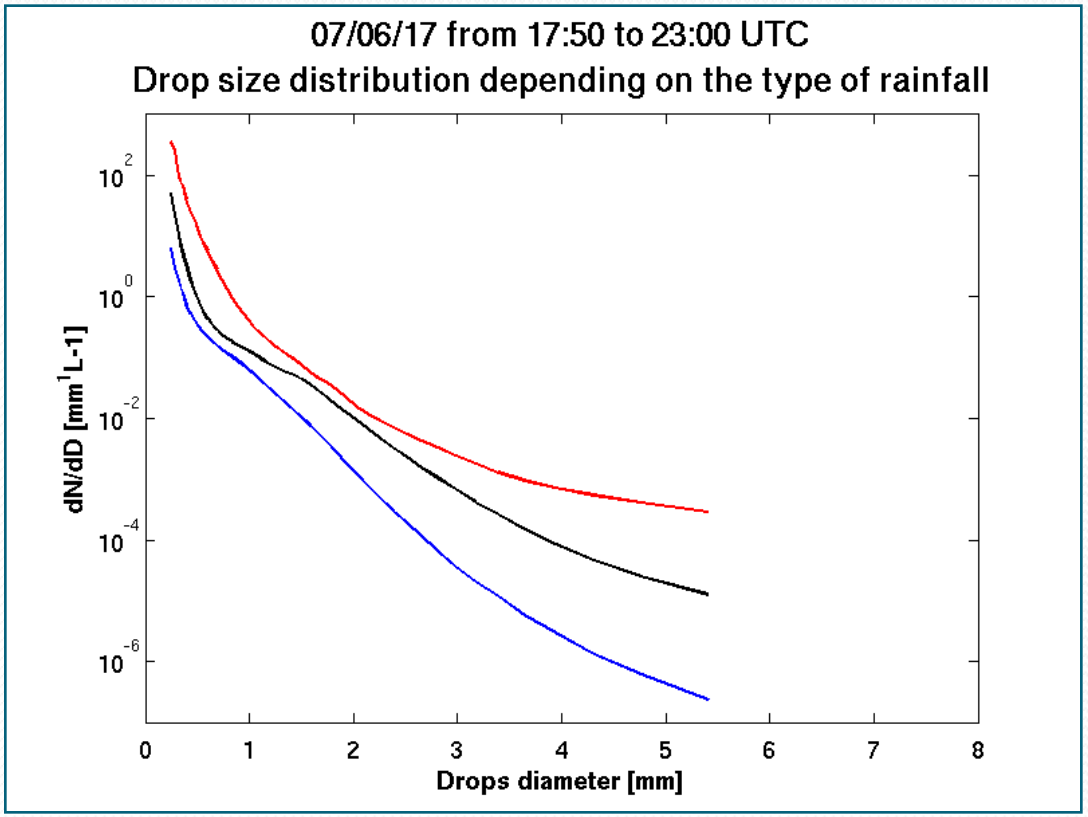

Using rain intensity classification

Z-R relationships

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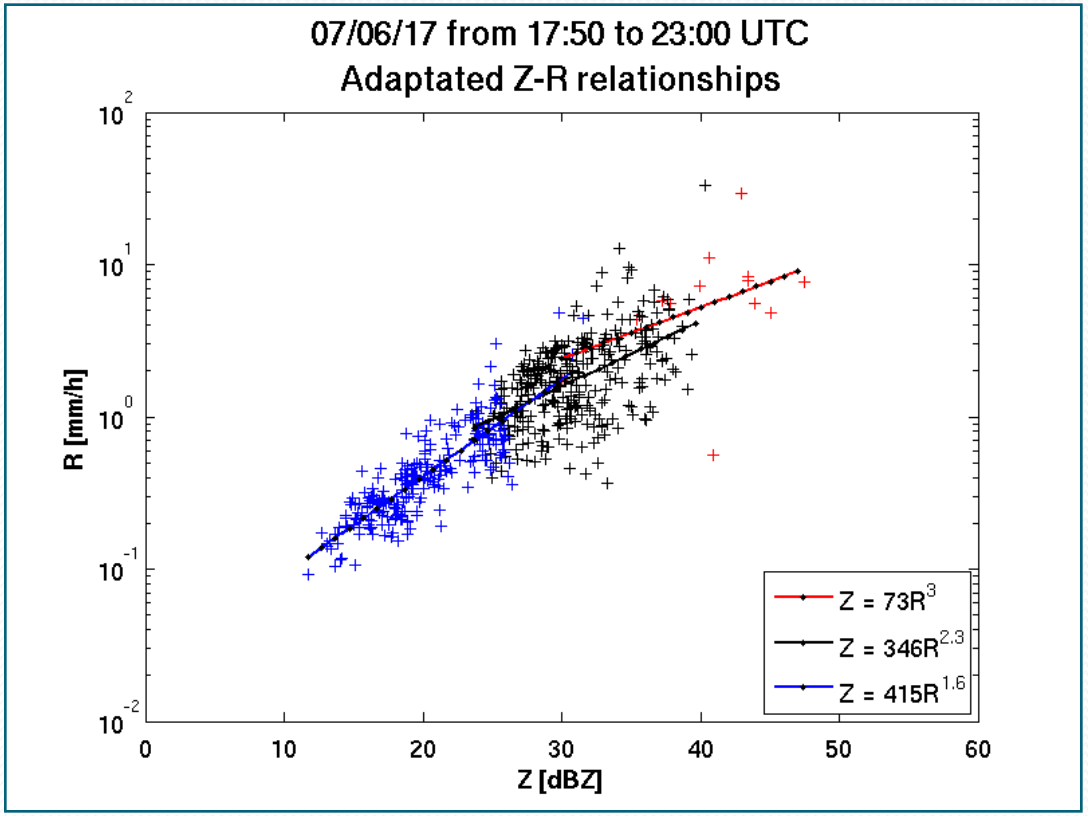

Using rain intensity classification

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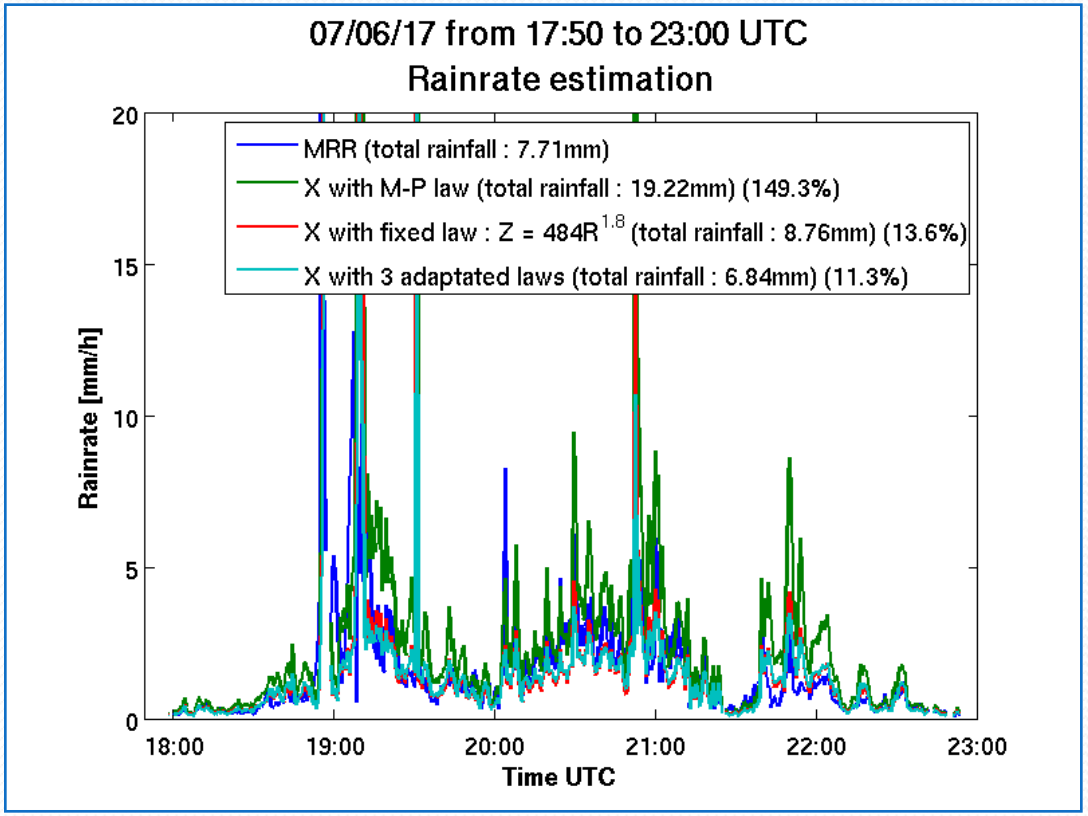
Rainrate and total rainfall



Statistical method (Clemens et al., submited)

- **Study of the time serie of the mean correlation coefficient between Z and R deduced from the measure of MRR over 15 min. periods**

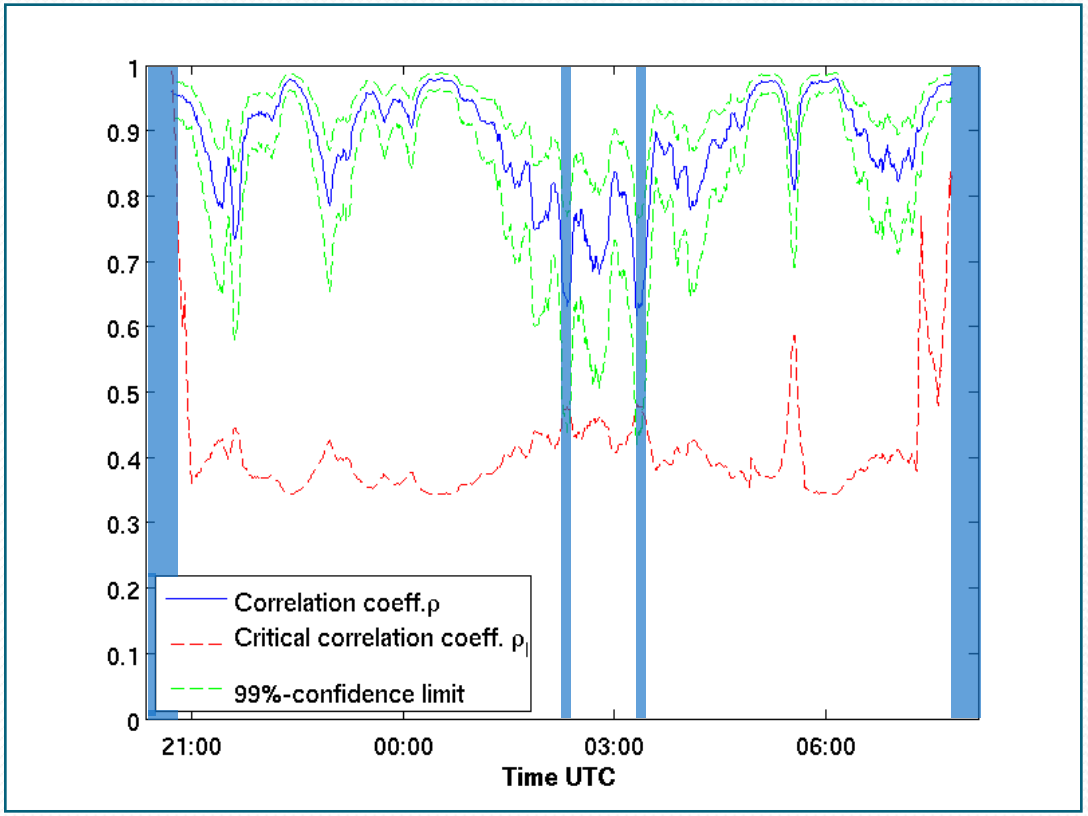
- **Determination of periods (minimum 15 min.) with constant high correlation by the use of a critical correlation coefficient (function of the significance level and number of measurements)**

- **Same as before (Use of the MRR to determine the corresponding Z-R relationship then to apply them on the X-band radar reflectivity)**

Statistical method

8 aug. 2007
20:20 to 20:10

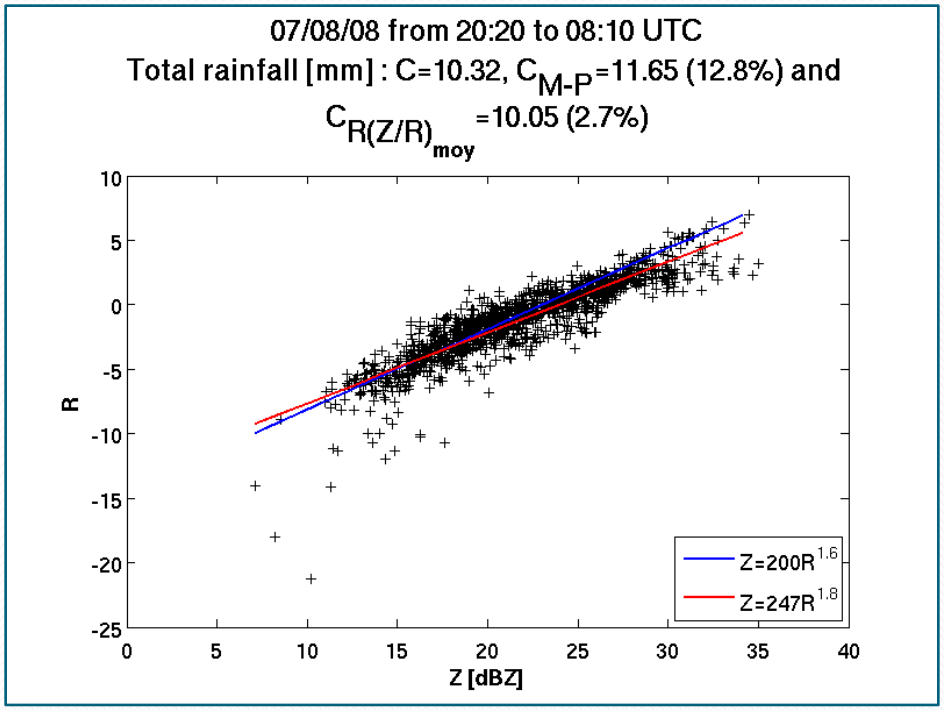
Correlation time serie

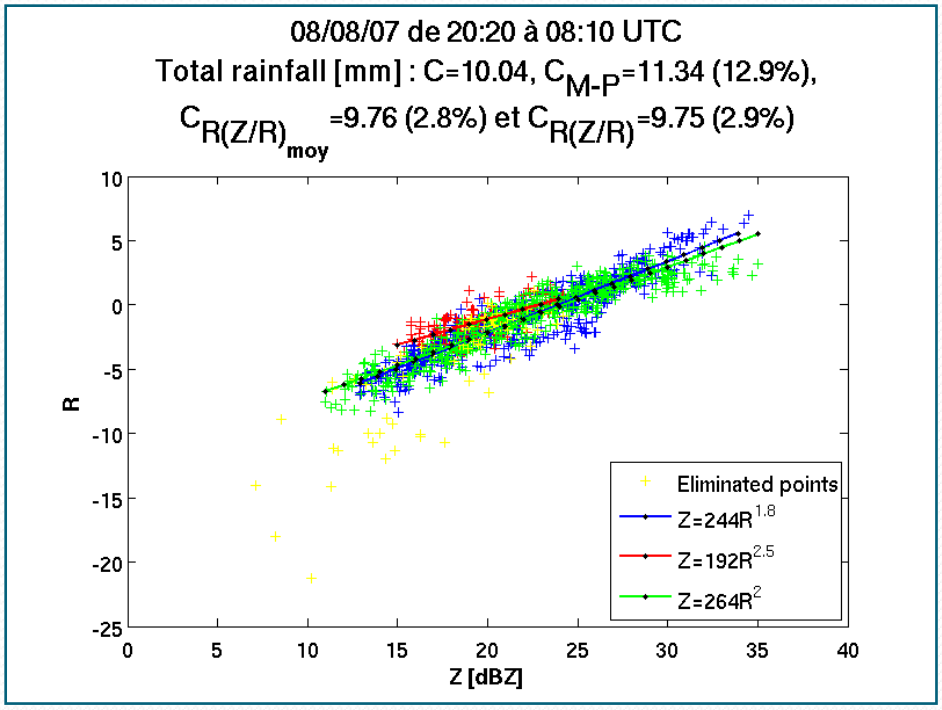


Statistical method

8 aug. 2007
20:20 to 20:10

Z-R laws and total rainfall





Overall COPS data

Total rainfall (mm)	MRR
Defining regimes of increasing, stagnating or decreasing intensity	82
Using the sign of the derivative	82
Using rain intensity classification	82
Statistical method	45

Overall COPS data

Total rainfall (mm)	MRR	Marshall-Palmer relationship
Defining regimes of increasing, stagnating or decreasing intensity	82	167 (104%)
Using the sign of the derivative	82	167 (104%)
Using rain intensity classification	82	167 (104%)
Statistical method	45	63 (38%)

Overall COPS data

Total rainfall (mm)	MRR	Marshall-Palmer relationship	Global Z-R relationship
Defining regimes of increasing, stagnating or decreasing intensity	82	167 (104%)	121 (48%)
Using the sign of the derivative	82	167 (104%)	121 (48%)
Using rain intensity classification	82	167 (104%)	121 (48%)
Statistical method	45	63 (38%)	41 (10%)

Overall COPS data

Total rainfall (mm)	MRR	Marshall-Palmer relationship	Global Z-R relationship	Adaptated Z-R relationships
Defining regimes of increasing, stagnating or decreasing intensity	82	167 (104%)	121 (48%)	181 (120%)
Using the sign of the derivative	82	167 (104%)	121 (48%)	117 (44%)
Using rain intensity classification	82	167 (104%)	121 (48%)	82 (1%)
Statistical method	45	63 (38%)	41 (10%)	42 (8%)

Outlook

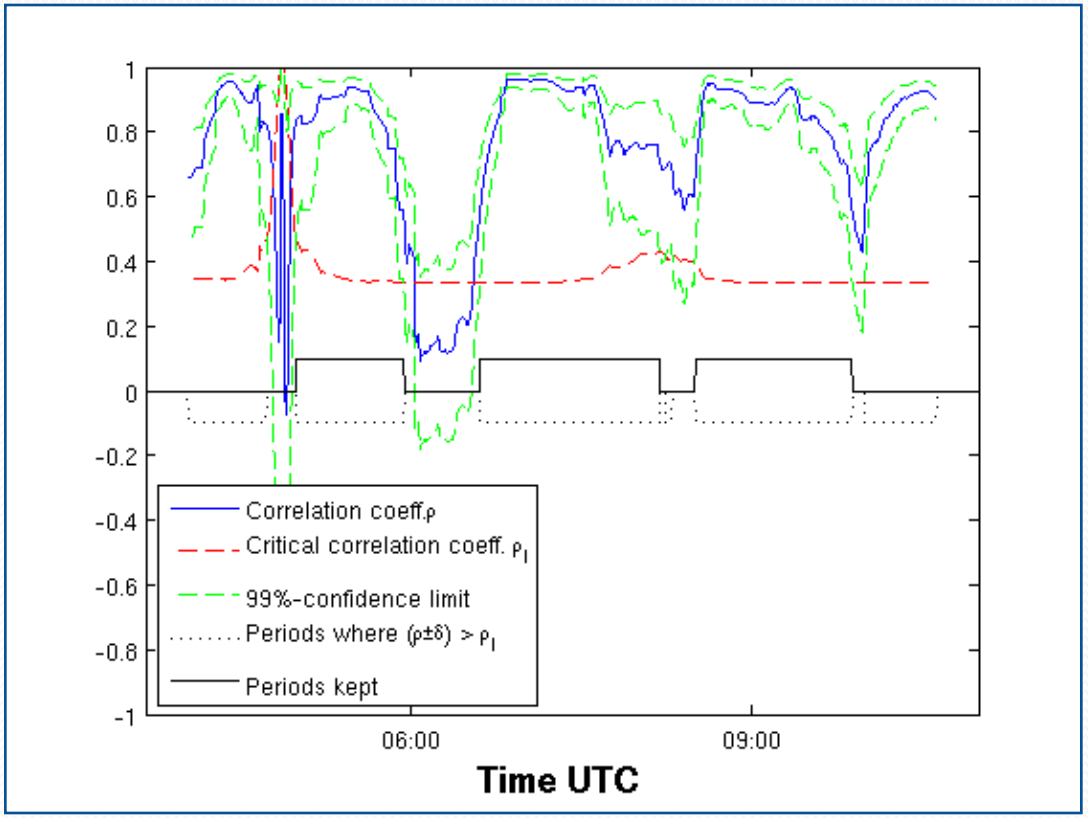
- These are preliminary results that need further analyses
- Methods proposed can be improved (selection criteria) and some of them could be combined
- Next we will study the vertical variability of DSD and rain in order to develop the best estimates of precipitation on the ground (comparisons will be done with raingages and disdrometers)
- Generalisation of the adapted Z-R relationship to the entire surface scanned by the X-band radar
- Use a cell recognition and tracking algorythm in conjunction with the rain classification criteria in order to improve rain estimates

Thank you for your attention

Statistical method

7 aug. 2007
03:40 to 11:00

Correlation time serie



Statistical method

7 aug. 2007
03:40 to 11:00

Rainrate and total rainfall