WP1 (Validation) and WP2 update

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Multifractal comparison of two operational radar products

Multifractal comparison of two operational radar rainfall products

The two product used the same C band radar data but different QPE algorithm

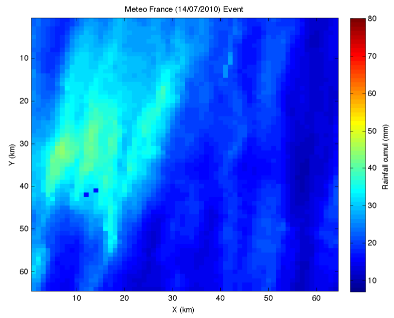
Rainfall events:
14 July 2010
15 August 2010
15 December 2011

Data
• Météo France radar data
• CALAMAR adjusted field
• CALAMAR non-adjusted field

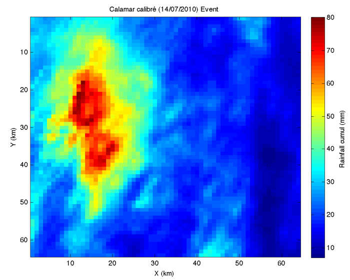
Methodology (based on Multifractal framework)
• Power spectra
• scaling function K(q)
• Multifractal parameters (Alpha and C1)

In both Spatial and Temporal analysis

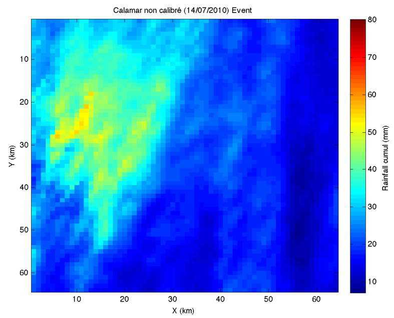
MF



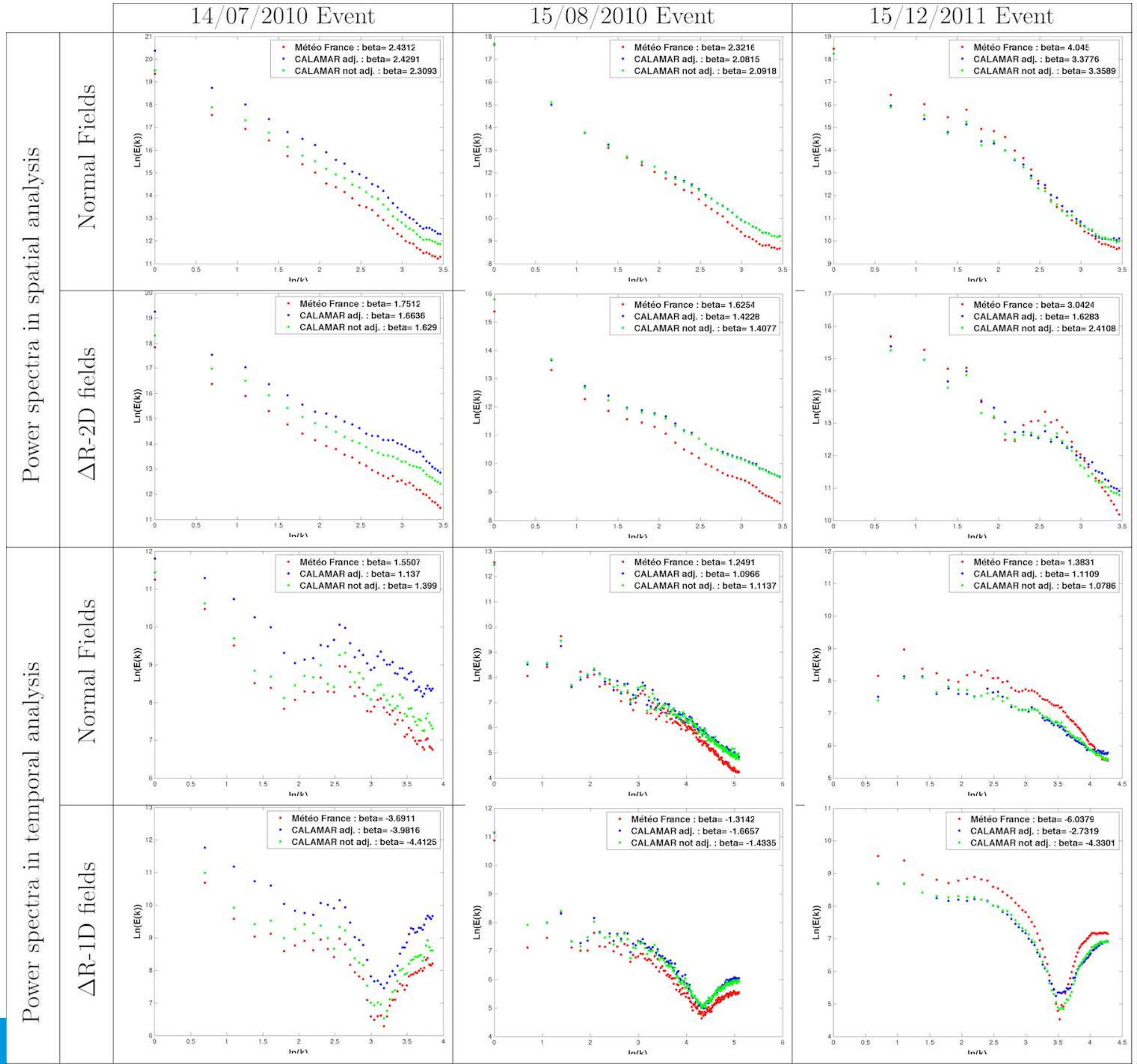
CA



CA-nc



Multifractal comparison of two operational radar rainfall products

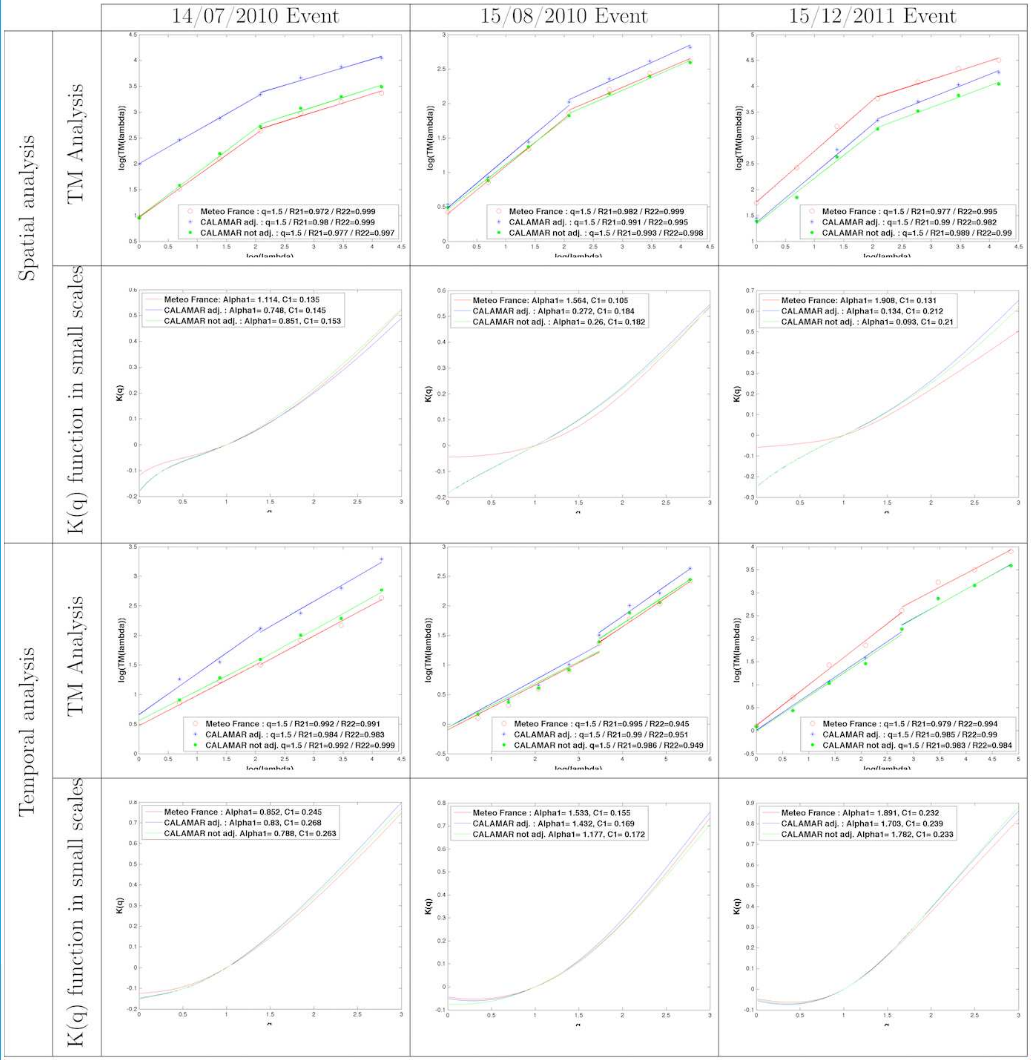


$E(f)=f^{-\beta}$

- Clear scaling behaviour
- β values greater than the dimension ==> **non-conservative field**
- Greater values of β for MF field ==> **more correlated field**

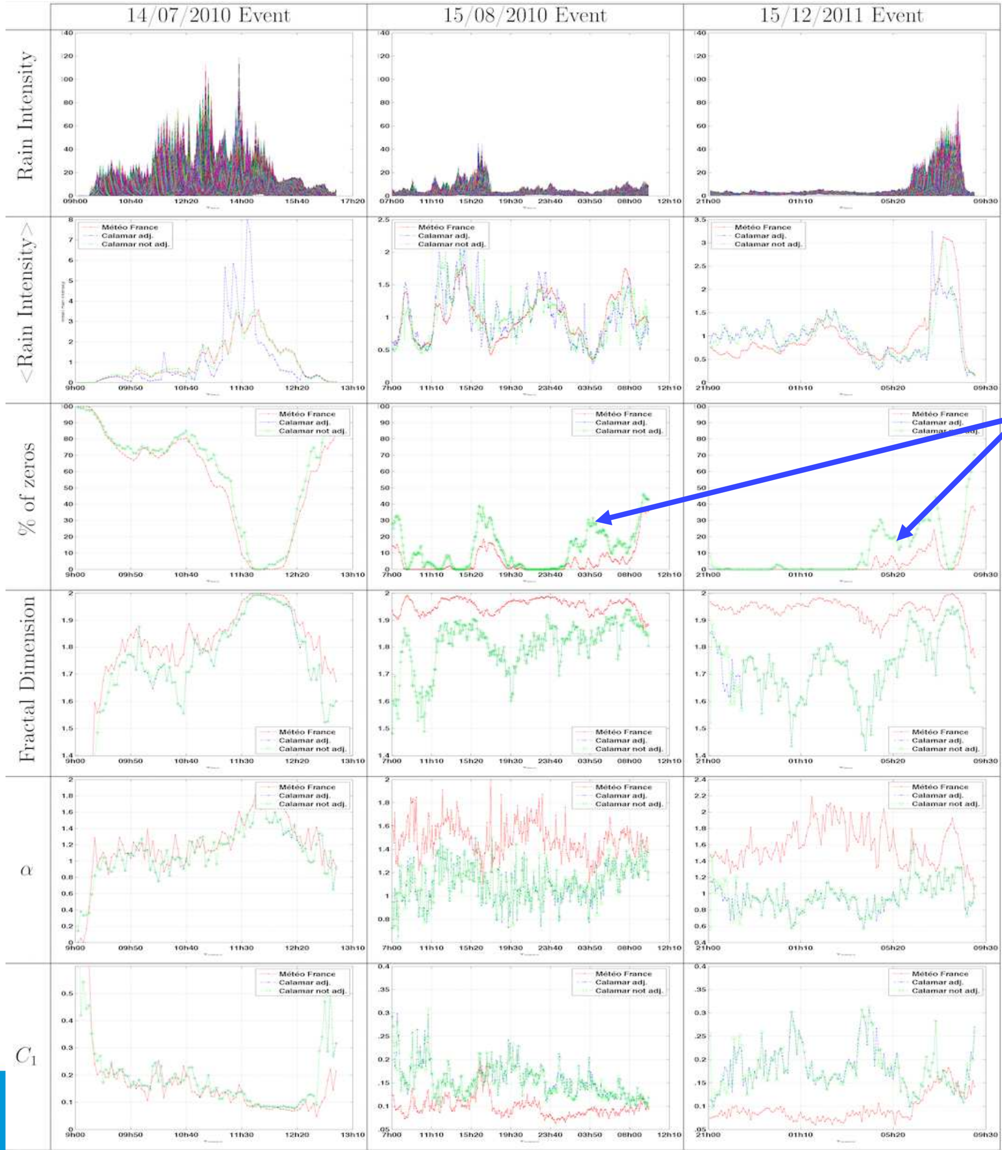
- sign change of the non-conservativeness parameter H

Multifractal comparison of two operational radar rainfall products



- The curvature of the *K(q)* functions reflects the multifractal nature of the studied field
- *K(q)* for the CALAMAR fields is almost linear and α=0 in space ==> fractal behaviour in space while remain multifractal in time
- MF field remains multifractal in both space and time (1.1< α<1.9)

Multifractal comparison of two operational radar rainfall products



Calamar non adjusted

Calamar adjusted

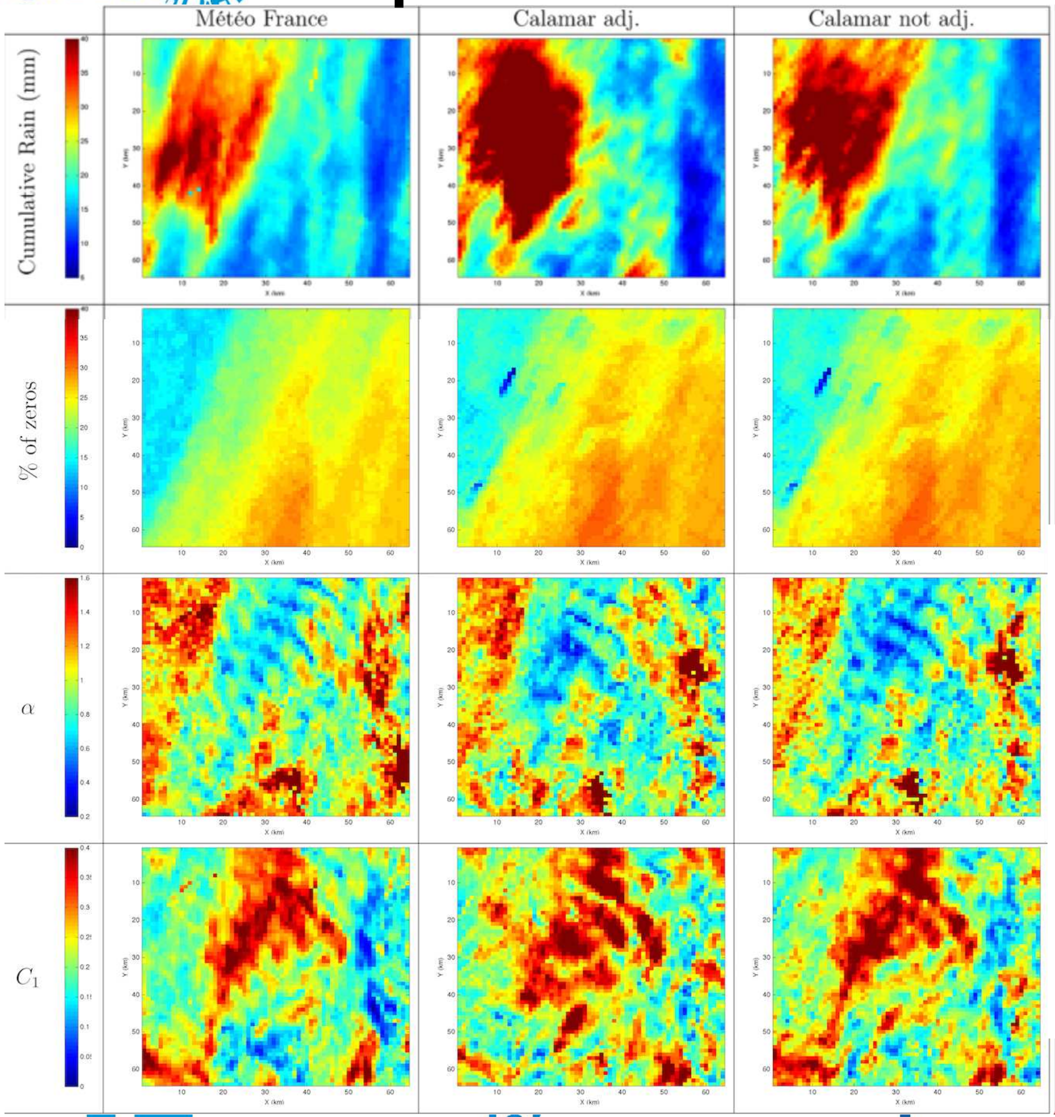
Météo France

In spatial analysis:

- **High % of zeros observed on CALAMAR fields related to the static method of ground clutters treatment**

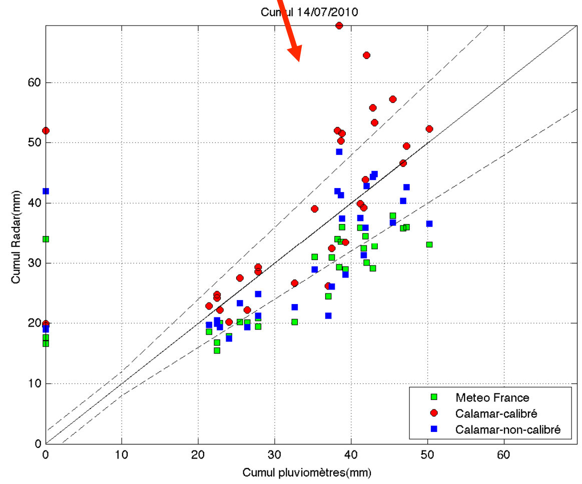
- **Huge differences between the two products:**
- **MF field exhibit the greater values of alpha and smaller values of C1.**

Multifractal comparison of two operational radar rainfall products



In Temporal analysis

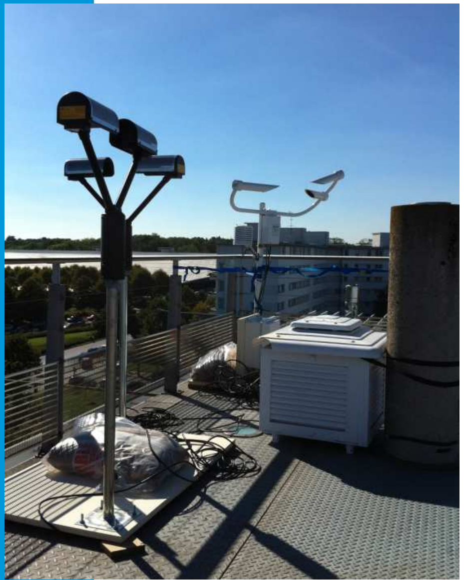
- the morphology of the MF and CA-nc fields is very similar.
- The adjustment process changes slightly the structure of the field.



Improvement of disdrometer rainfall measurements

Implementation of three disdrometers

On the roof of the ENPC building :

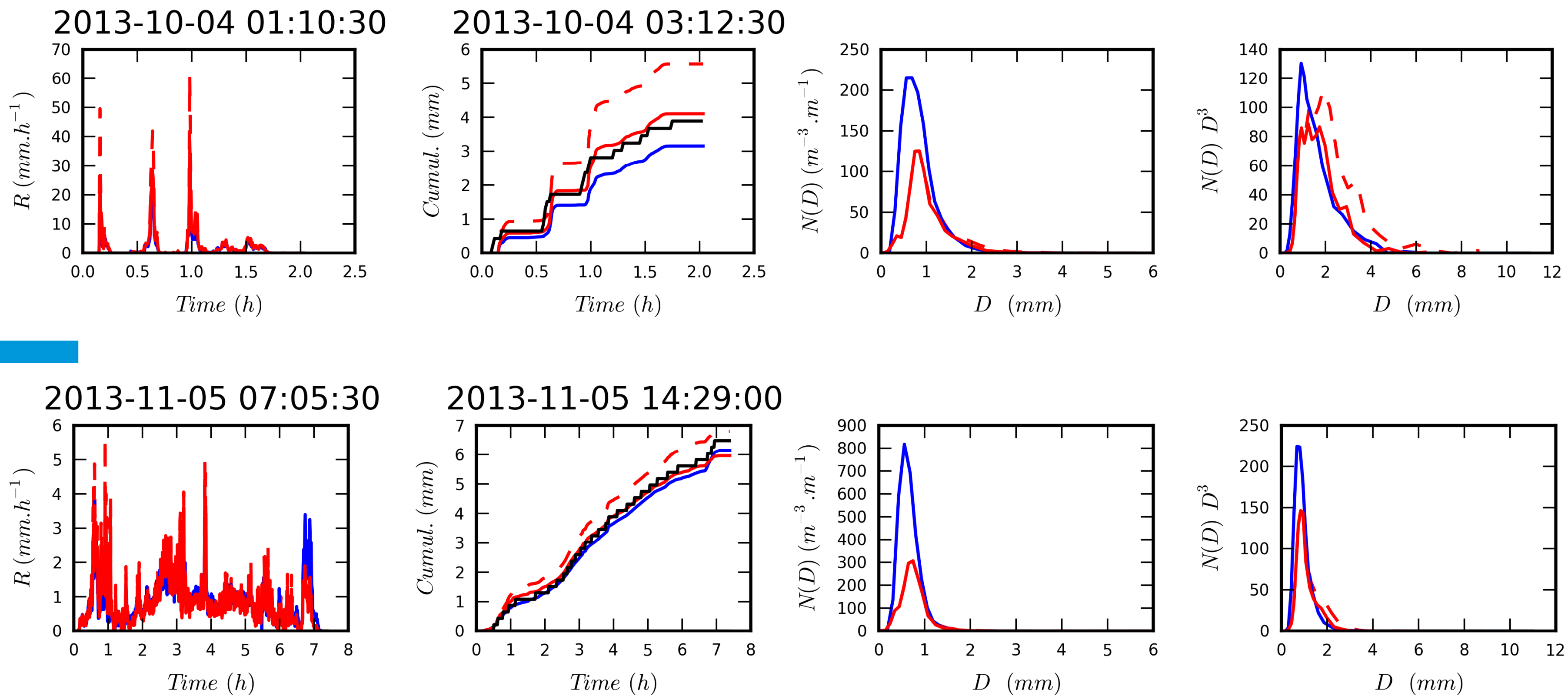


OTT Parsivel^2
(occulted light)
(Available since October 2013)

Campbell Scientific PWS100
(scattered light)
(Available since March 2013)

With the help of S. Botton team (ENSG)

First comparison of the two disdrometers

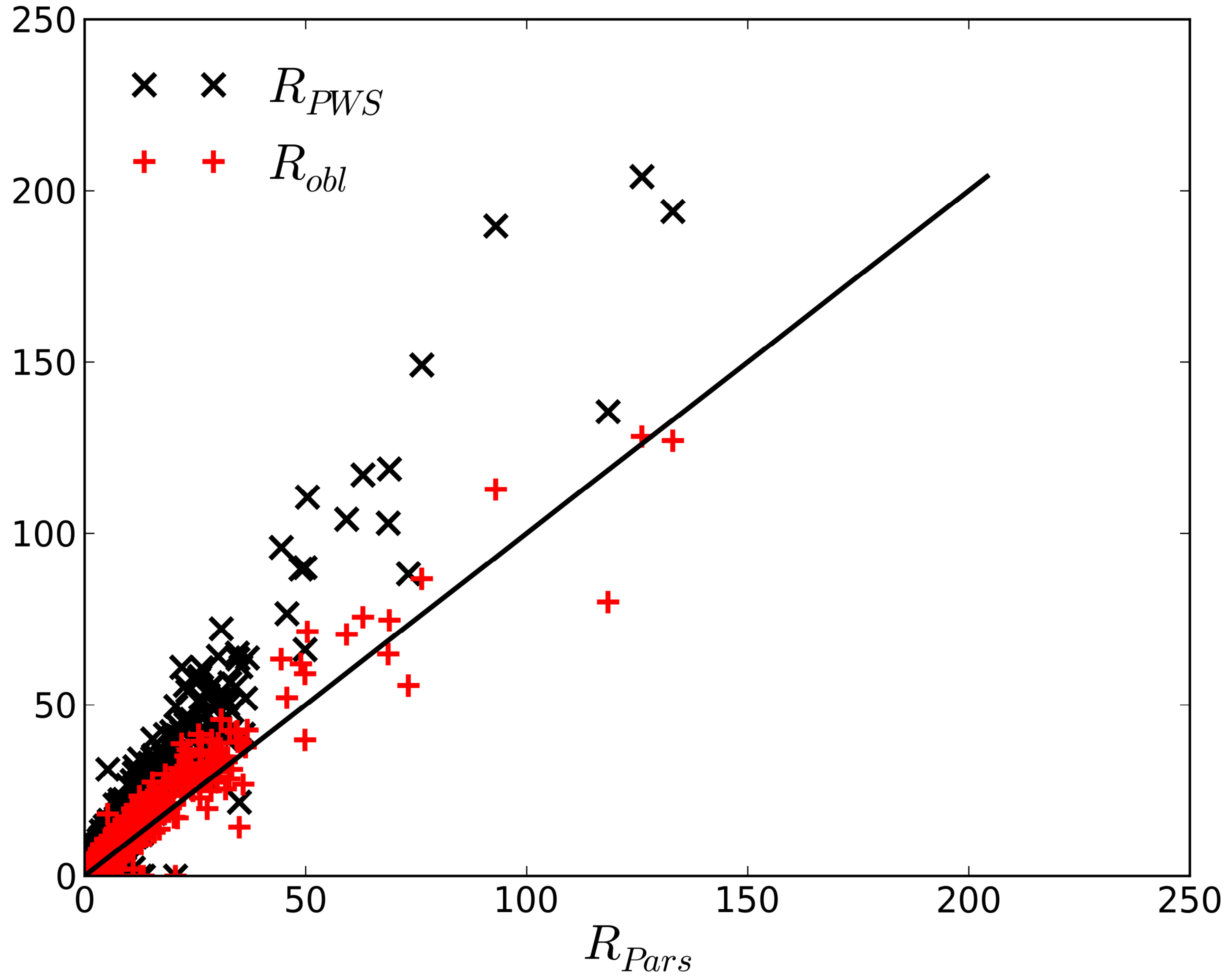


Parsivel measures much more small drops and less large ones which have a stronger influence on rain rate (much more data is need to confirm this).

Correction for drop oblatness

Drop oblateness poorly taken into account in the PWS100 software

→ Suggestion of a correction (initial tests) :



→ Measurements are comparable

→ Better agreement of PWS100 with rain gauges

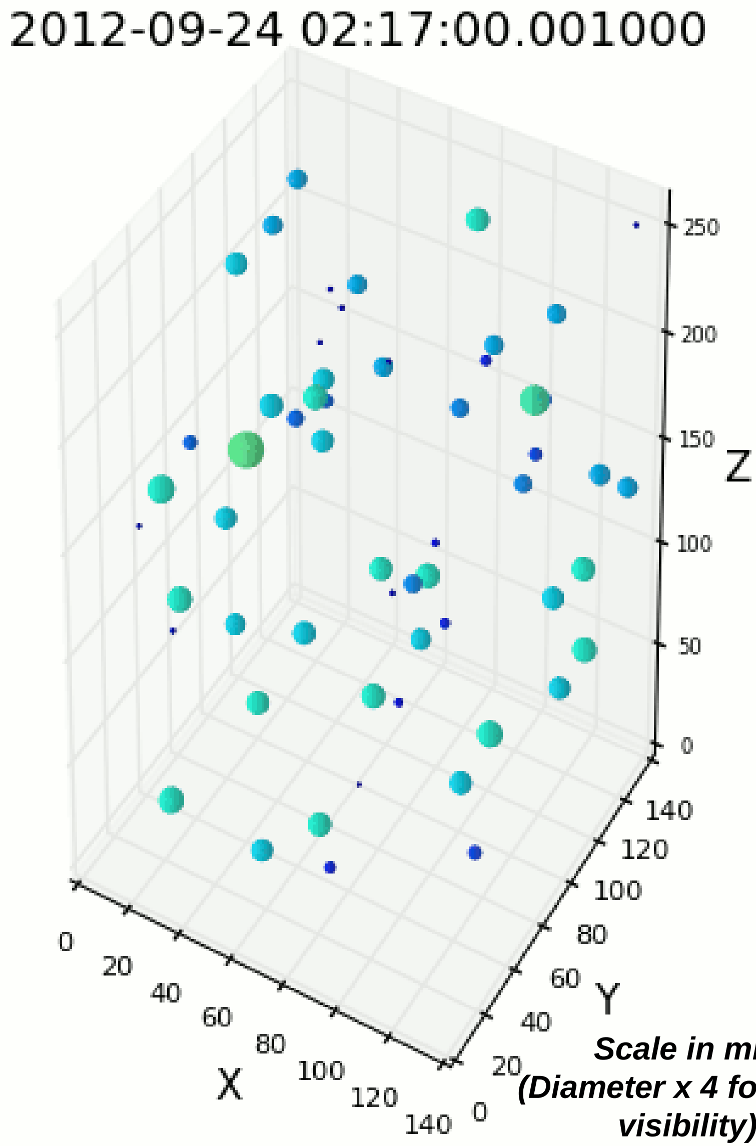
→ PWS100 (less noisy than Parsivel) can now be used for ground validation

Patent to be submitted with Véolia (hence no details…)

Insight into the 3+1D structure of the rainfall field

2D Video disdrometer

Data from LTE (Alexis Berne)

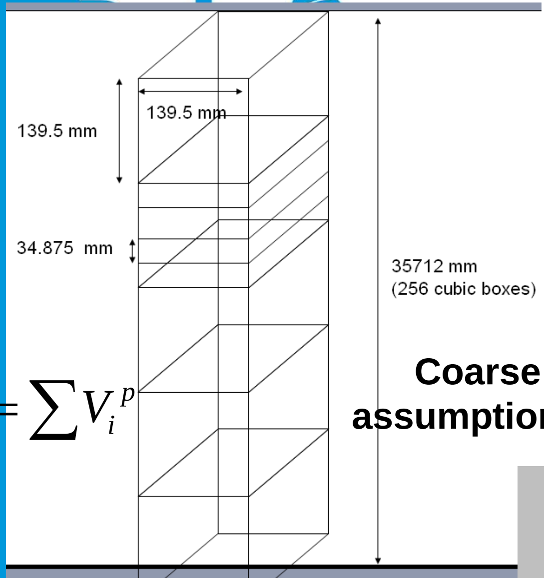


Scale in mm (Diameter x 4 for more visibility)

For each drop :

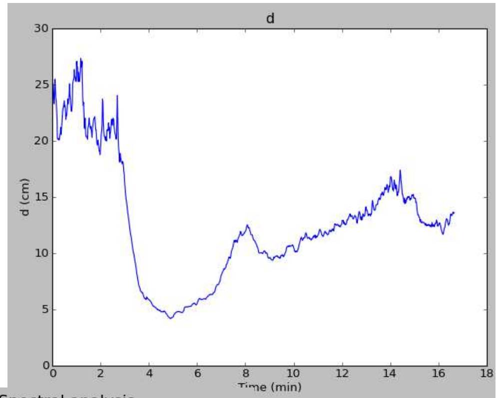
- Date
- Position (within a 14 cm x 14 cm sampling area)
- Diameter (Equivolumic sphere)
- Oblateness
- Velocicty

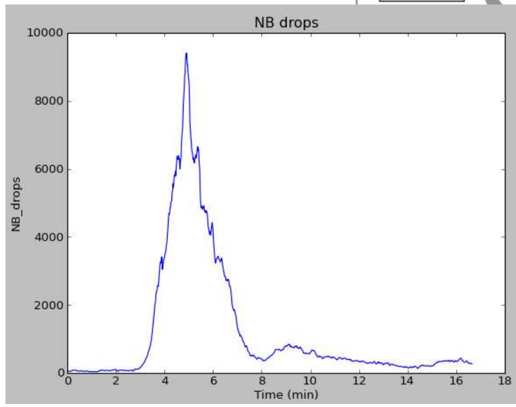
Spatial analysis on vertical columns

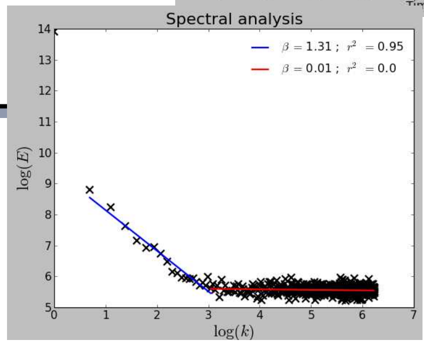


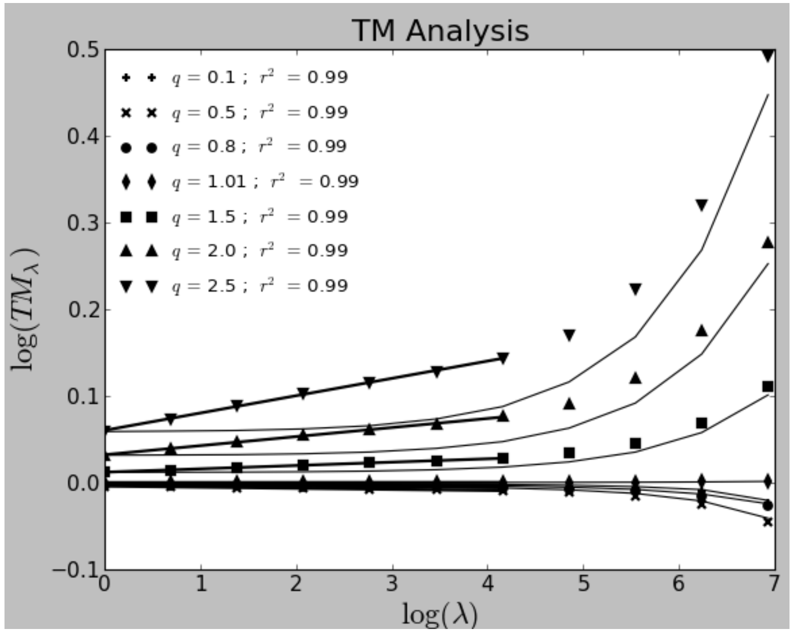
$$\chi = \sum V_i^{\,p}$$

Coarse assumptions !









- Good scaling on 35 m – 0.5 m

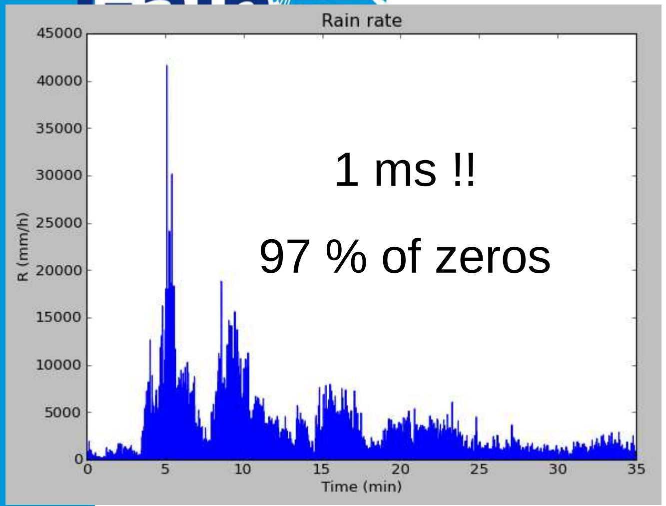
- Below homogeneous distribution

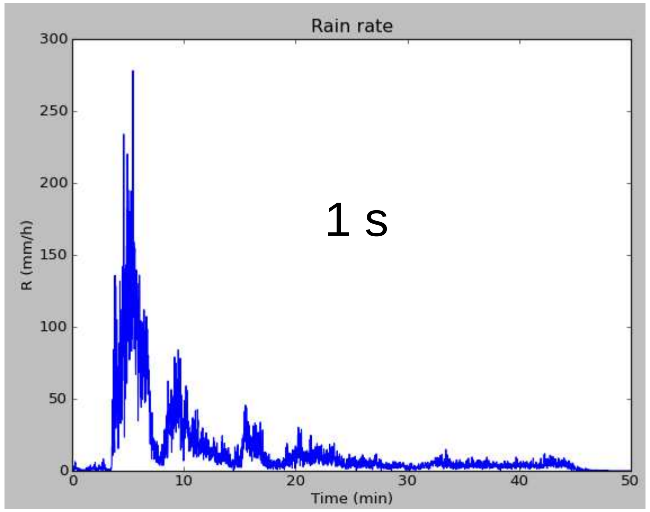
- $\alpha \sim 2$; $C_1 \sim 0.005$

- Lots of drops (>5 000) are needed to observe scaling and deviations from homogeneous distribution

Csq on remote sensing : Speckle effect, sampling issues

Temporal analysis on 1ms time step series !





24 September 2012

Cumul. Depth ~ 10 mm

On 5 events:

- Large scale (blue) : $\alpha = 1 - 2$, $C_1 = 0.2 - 0.5$ according to the event

- Small scale (red) : bad scaling, transition zone

- Extremely small scale (green) : $\alpha = 0$ and $C_1 = 0.7\text{-}0.8$ (fractal codimension of the rainfall support)