Z and Z_{DR} calibration using self consistency method

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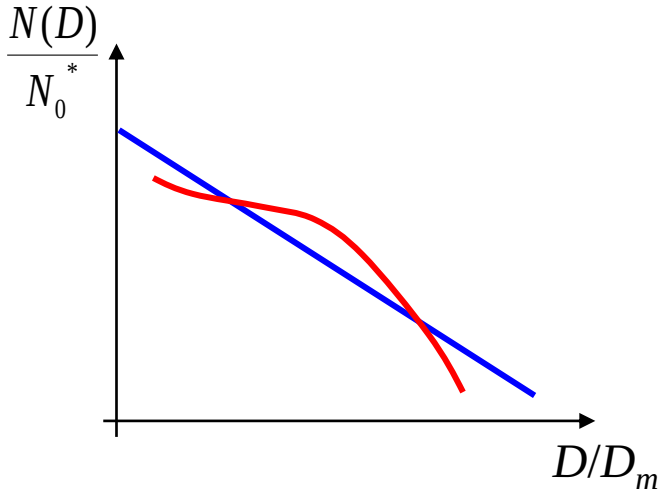
The concept of Normalized Drop Size Distribution

- DSD is characterized by:
  - Mean volume diameter D_m
  - "Normalized intercept parameter" N_0*
  - Intrinsic shape of the DSD



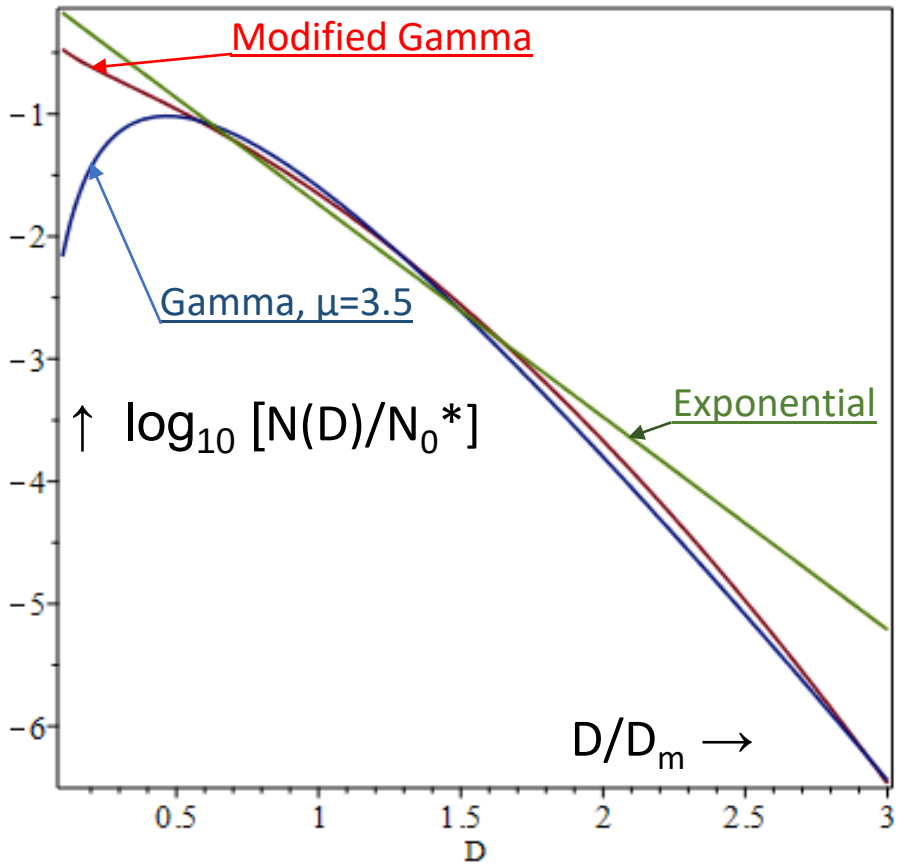
$$N_0^* = \frac{4^4}{\pi \rho_w} \frac{LWC}{D_m^4}$$

- Intrinsic shape of the DSD is stable
- N_0* and D_m are highly variable

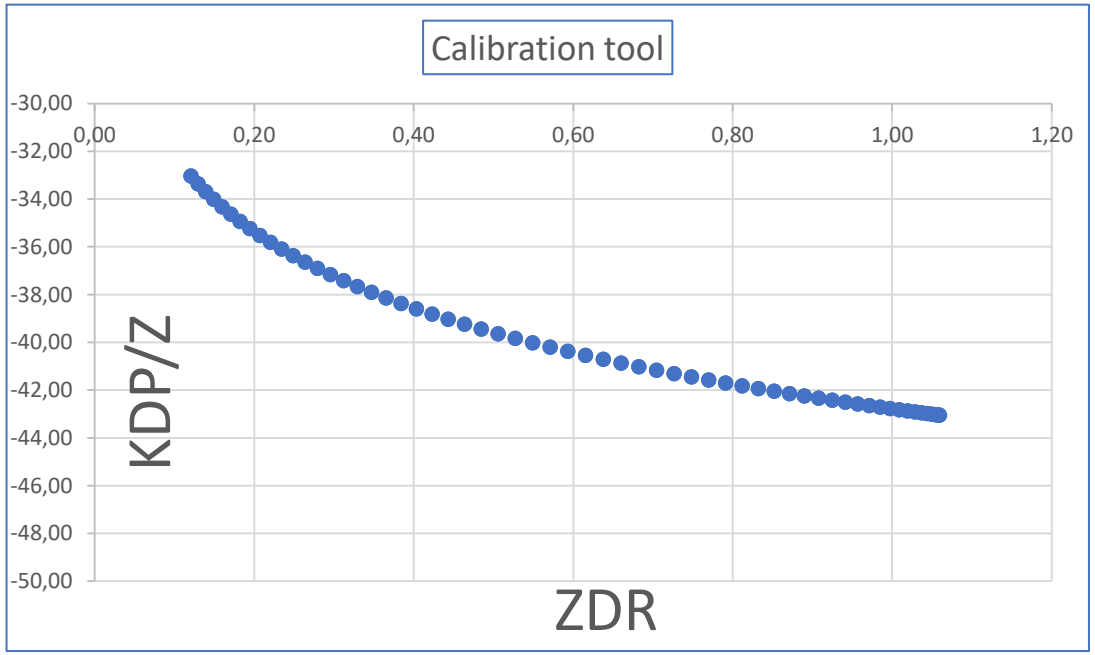
N_0* is the intercept parameter of an exponential DSD with same liquid water content *LWC* and D_m

Universal Relationships parameterized by N_0*

- Normalized DSD:
  - $N(D) = N_0^*.f(\mathrm{D/Dm})$
  - Typical variation of N_0^*: 10^6 to 10^8 m^{-4}
- Between extensive variables
  - $\frac{R}{N_0^*} = a\left(\frac{Z}{N_0^*}\right)^b ; \frac{R}{N_0^*} = c\left(\frac{K_{DP}}{N_0^*}\right)^d$
- Between intensive variables
  - $\frac{R}{Z} = e(Z_{DR})^g \; ; \frac{K_{DP}}{Z} = f(Z_{DR})$



Exploiting the universal rel. $\frac{K_{DP}}{Z} = f(Z_{DR})$

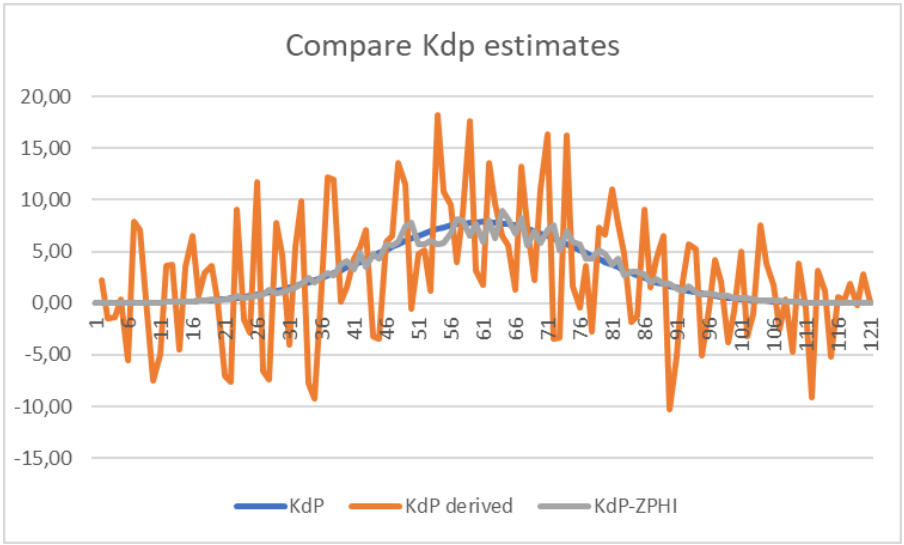


The difficulty is in the K_{DP} estimate:

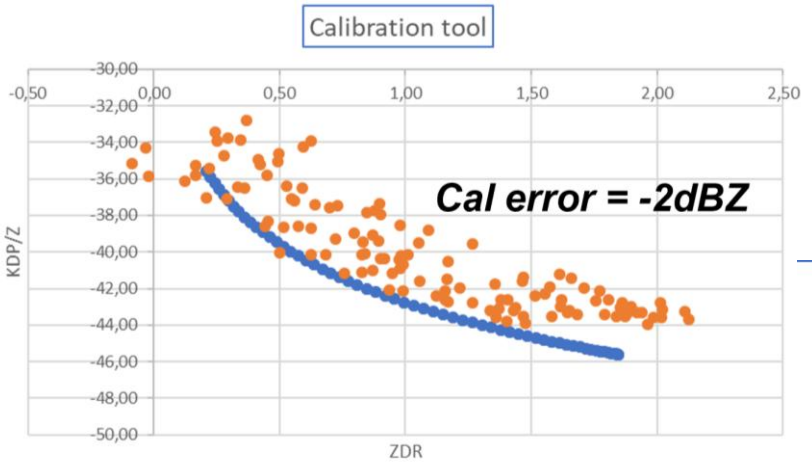
- Direct derivative of Φ_{DP} is awfully noisy
- ZPHI (integral algorithm offers an estimate with moderate noise

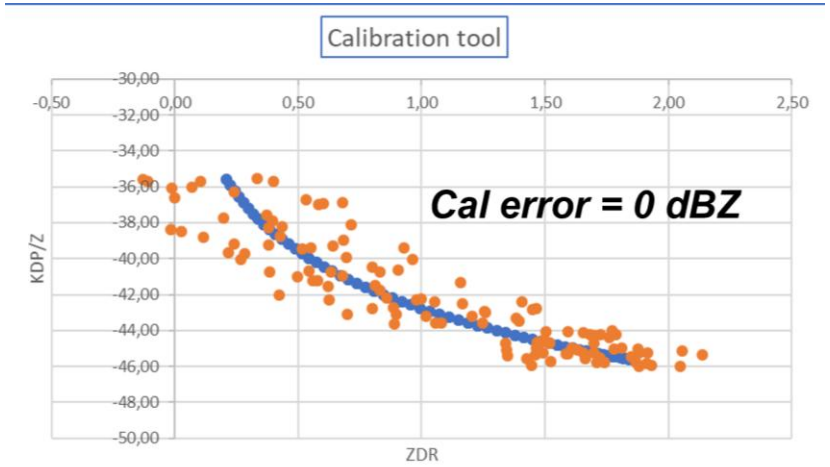
To exploit this relation in order to calibrate *Z:*

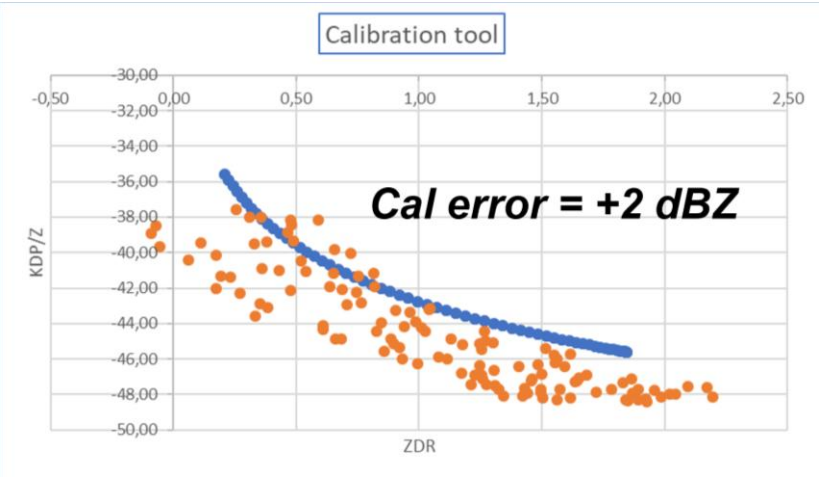
Z_{DR} must first be calibrated



This realistic simulation shows that this technique may calibrate *Z* within ±0.5dB



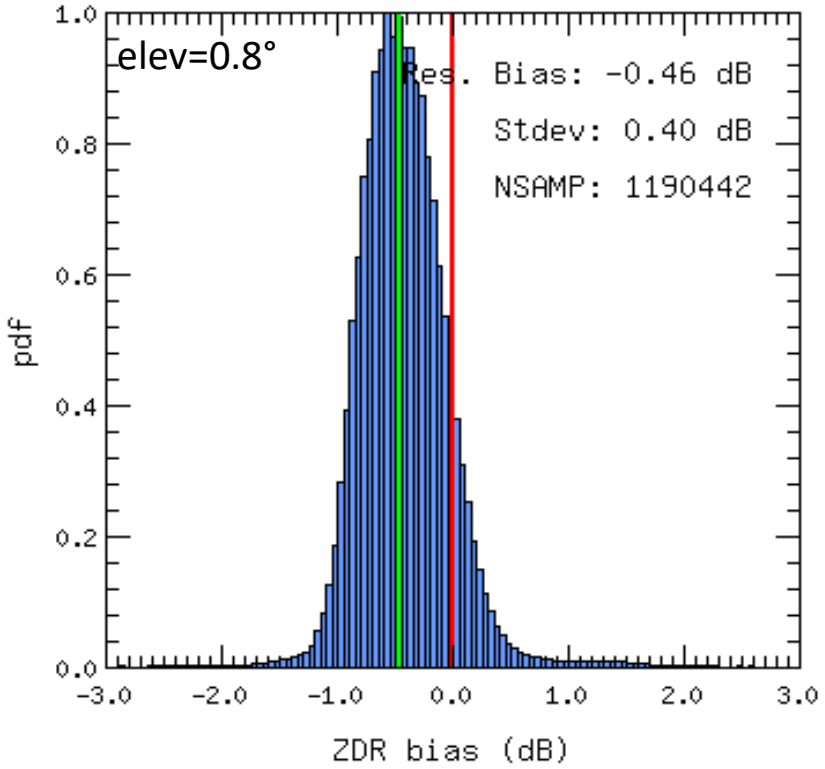




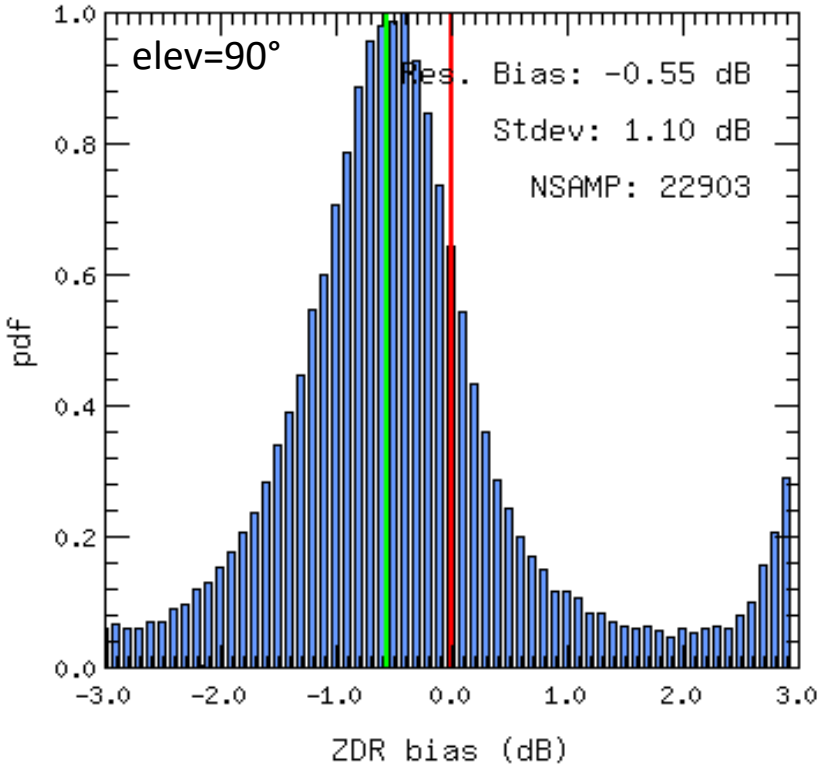
Calibrating ZDR:

- Vertical incidence sounding?
- Observation of weak rain at low elevation?

Météo France
Trappes radar
21/10/2021



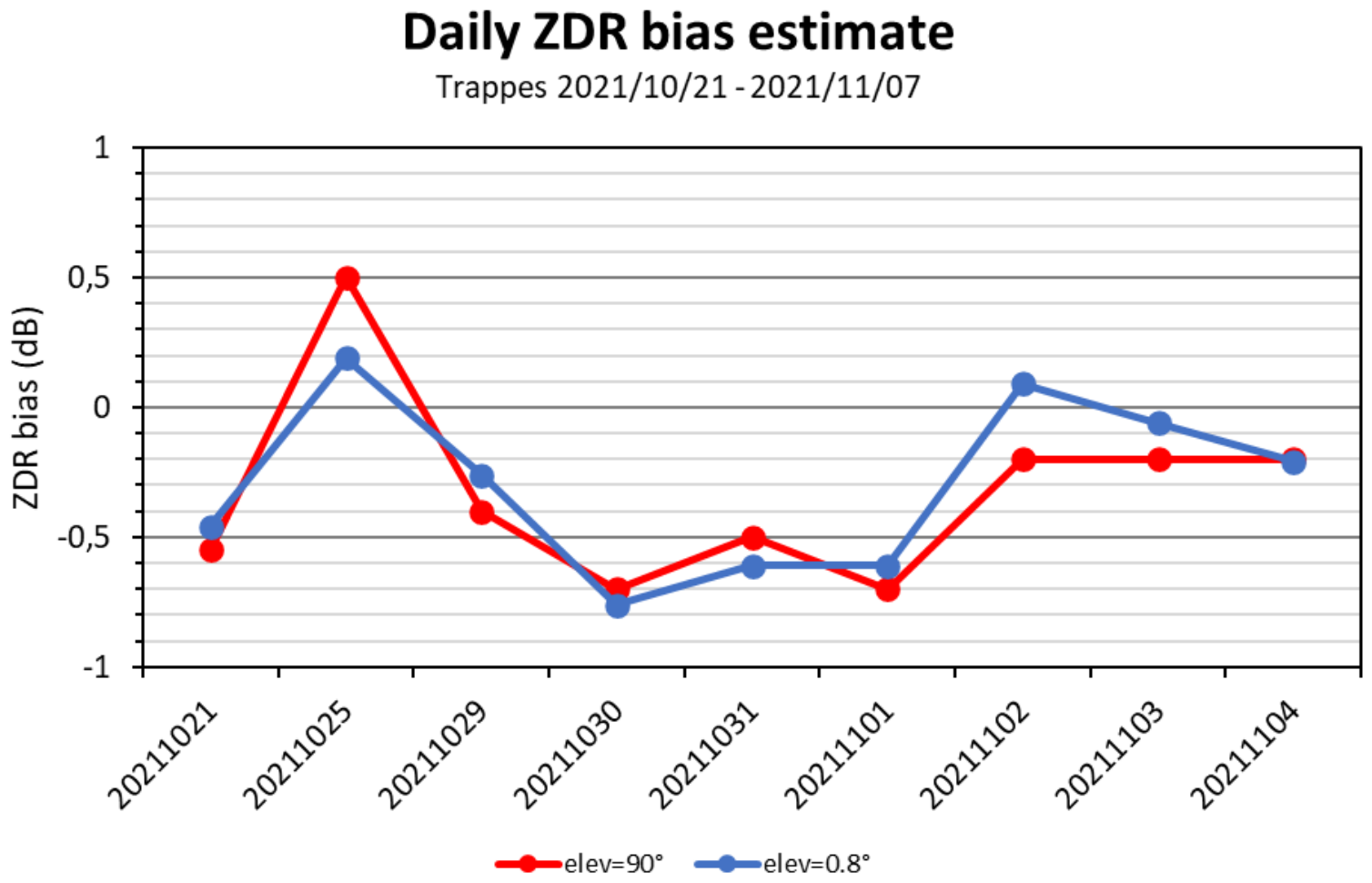
0,8° Elevation



90° Elevation

Compare ZDR Cal from vertical and low elevation sounding

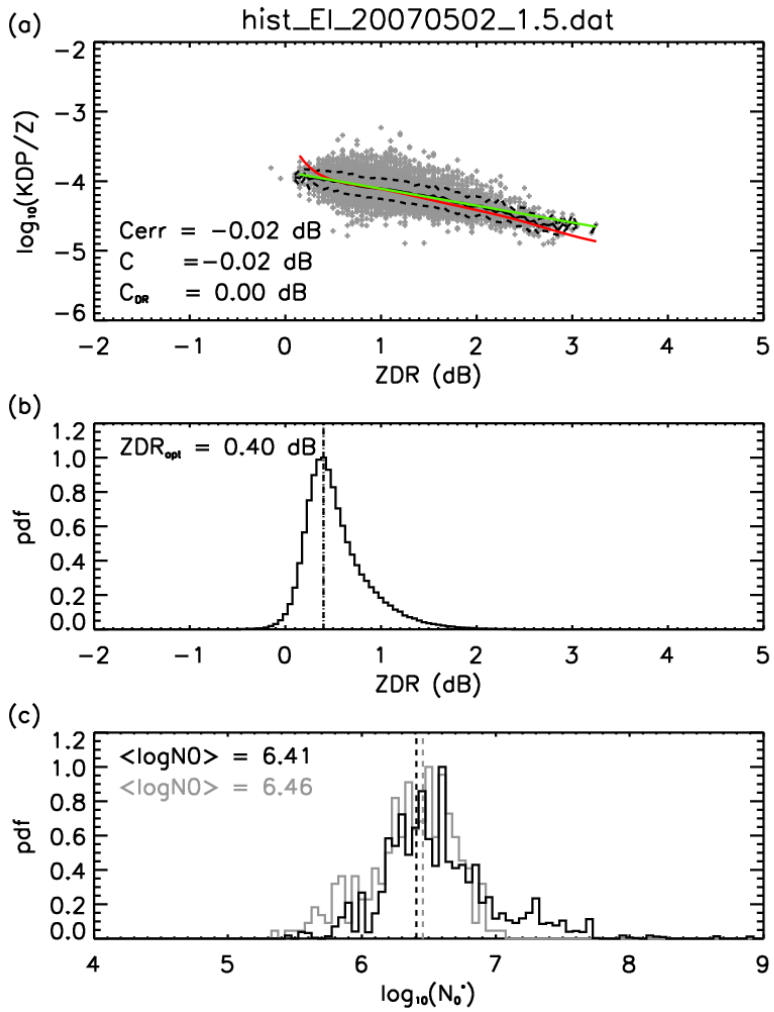
Météo France
Trappes radar
21/10/2021
To
04/11/2021



Calibration tool

- After calibration

ZPHI® internal calibration uses the functional relation existing between K_{DP}/Z and Z_{DR}



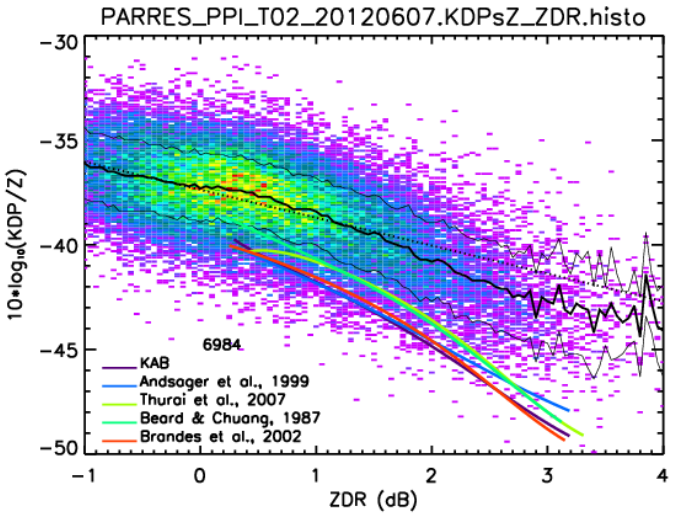
theoretical

fitted

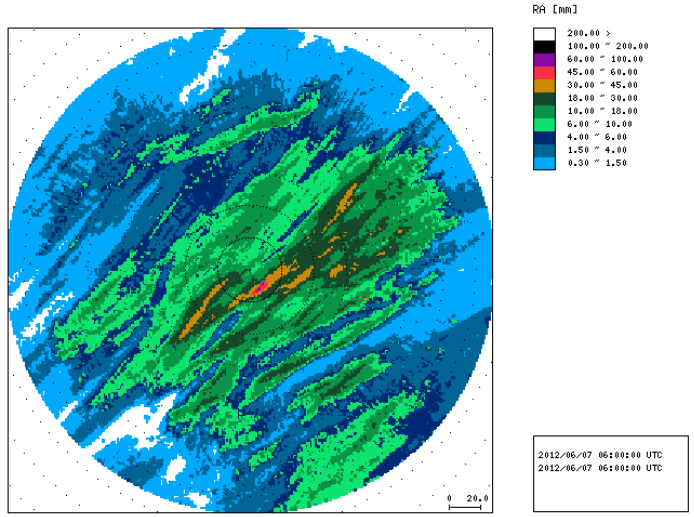
disdrometer

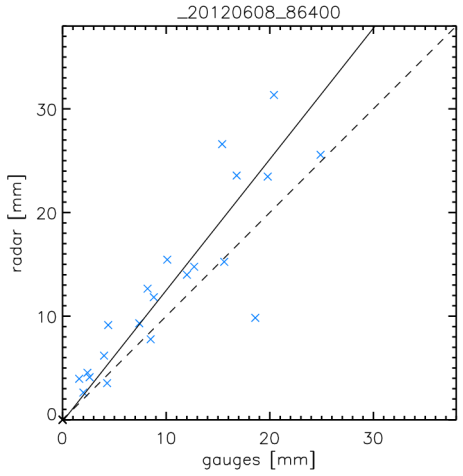
radar

Calibration adjustment example



Outil d'étalonnage

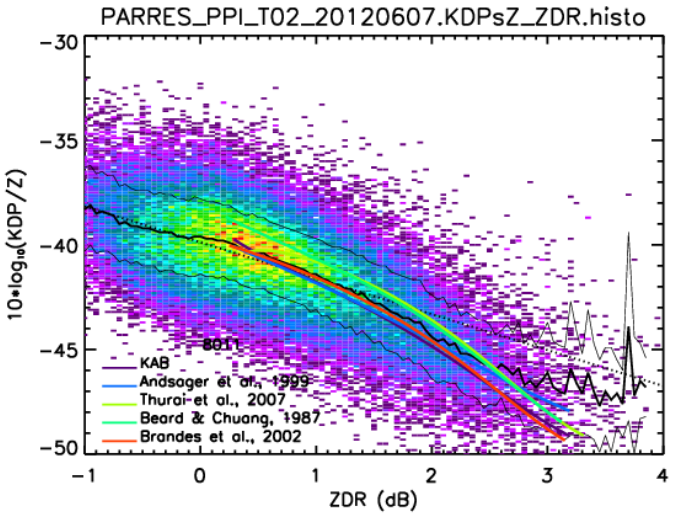




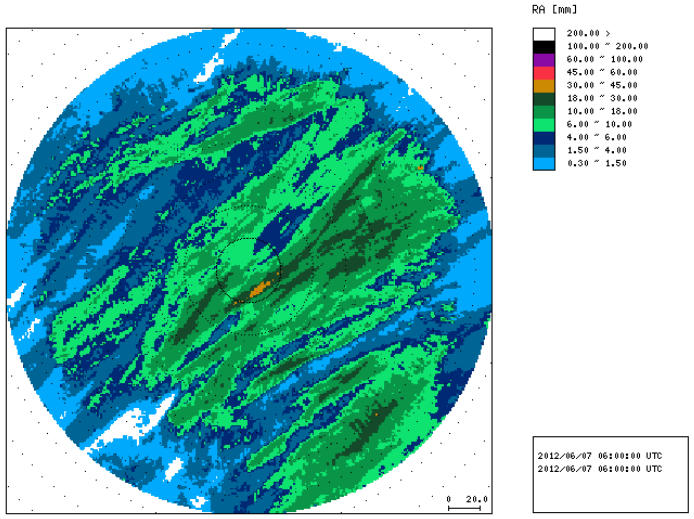
Comparaison avec les pluviomètres /24heures

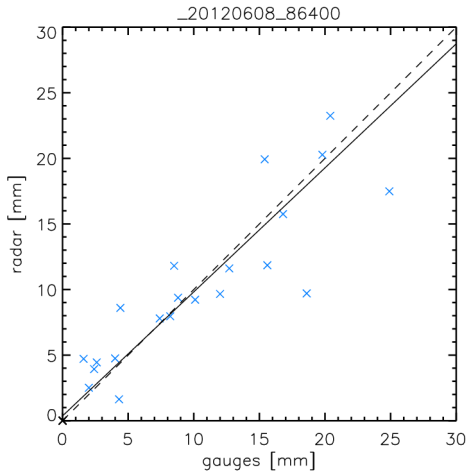
Pluie accumulée /24heures (Saint Parres-lès-Vaudes, 7 Juin 2012)

Calibration adjustment example



Outil d'étalonnage





Comparaison avec les pluviomètres /24heures

Pluie accumulée /24heures (Saint Parres-lès-Vaudes, 7 Juin 2012)

ZPHI calibration

Language selection:

2020/02/06 10:14:14 UTC

No file being processed.

Radar mode selection

ningbo3 ▼ Apply

Logout

- Realtime data viewer
- Archive data viewer
- Primary input settings
- ZPHI configuration
- Projection configuration
- Acc. and Nowcast settings
- ZPHI calibration
- Statistical profiles
- Cormap processing
- Ground level map
- Radar Mode Management
- INZPHI Conversion
- Export Settings
- About ZPHI

Reset

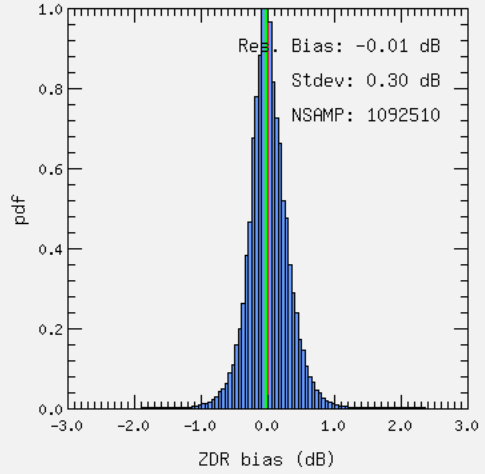
Date: 20190620 ▼ : A ▼ Elevation: 1.5 ▼

ZDRcal

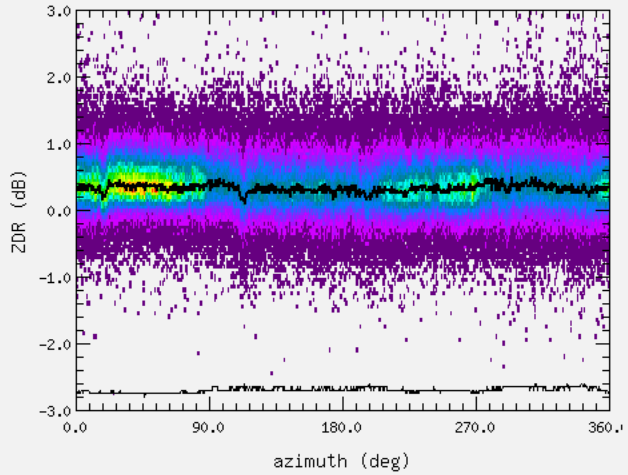
Operational value: 0,67

Suggested value: 0,68 Select

ZDRcal: 0,67 Check Apply



☑ View detail

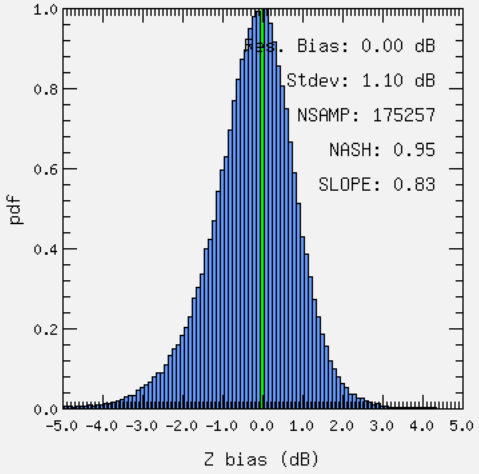


Zcal

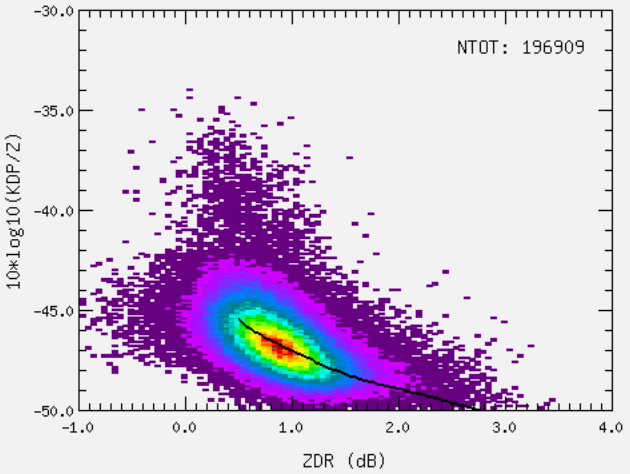
Operational value: 2,1

Suggested value: 2,1 Select

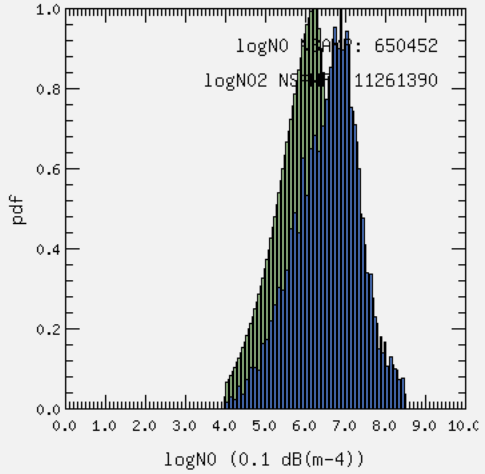
Zcal: 2,1 Check Apply



☑ View detail ☐ View more detail



logN0



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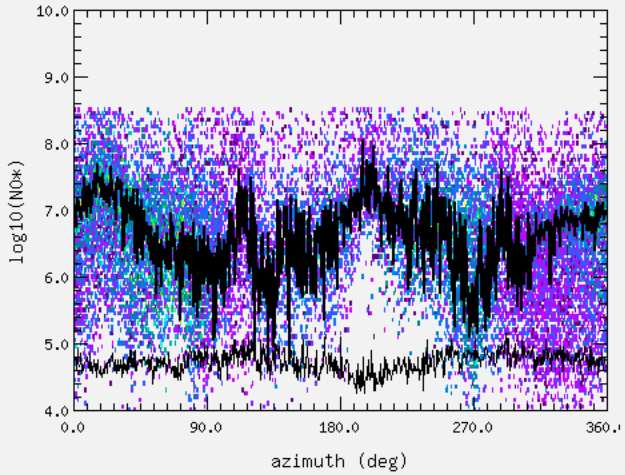
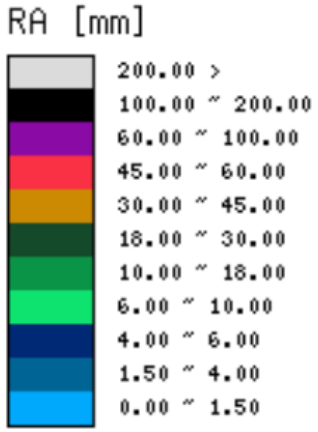
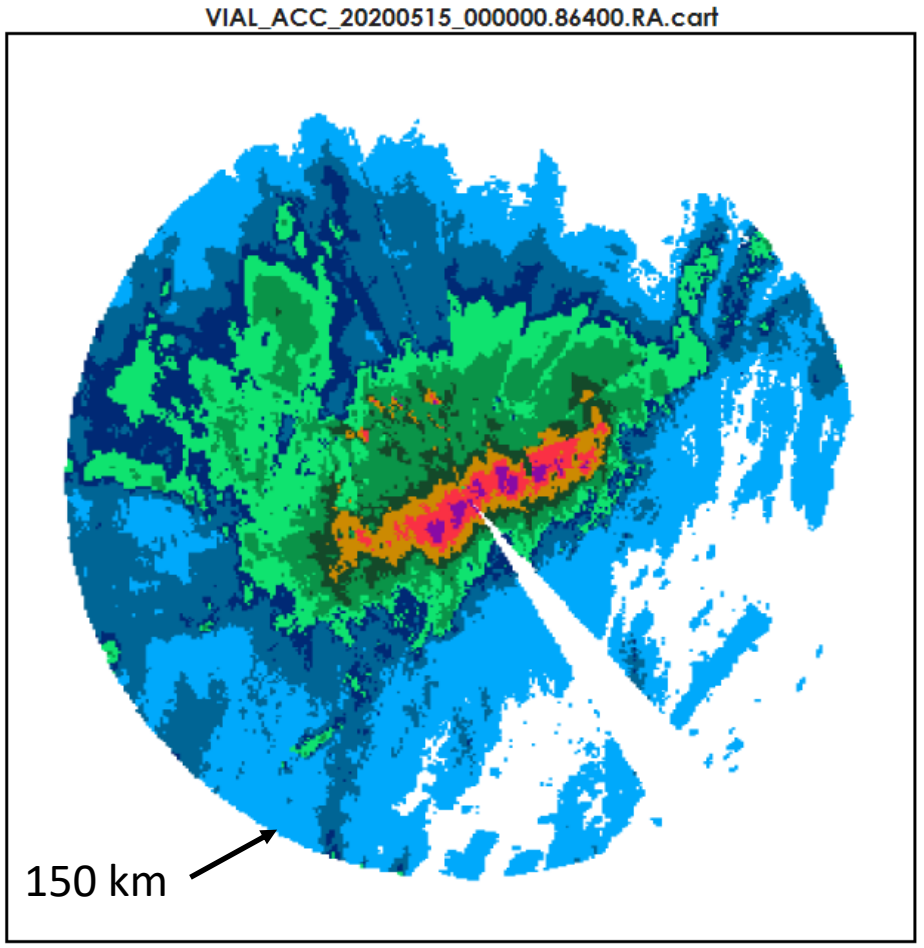


An example of intense squall line observed by the Mont Vial HYDRIX radar with intense rainfall over head

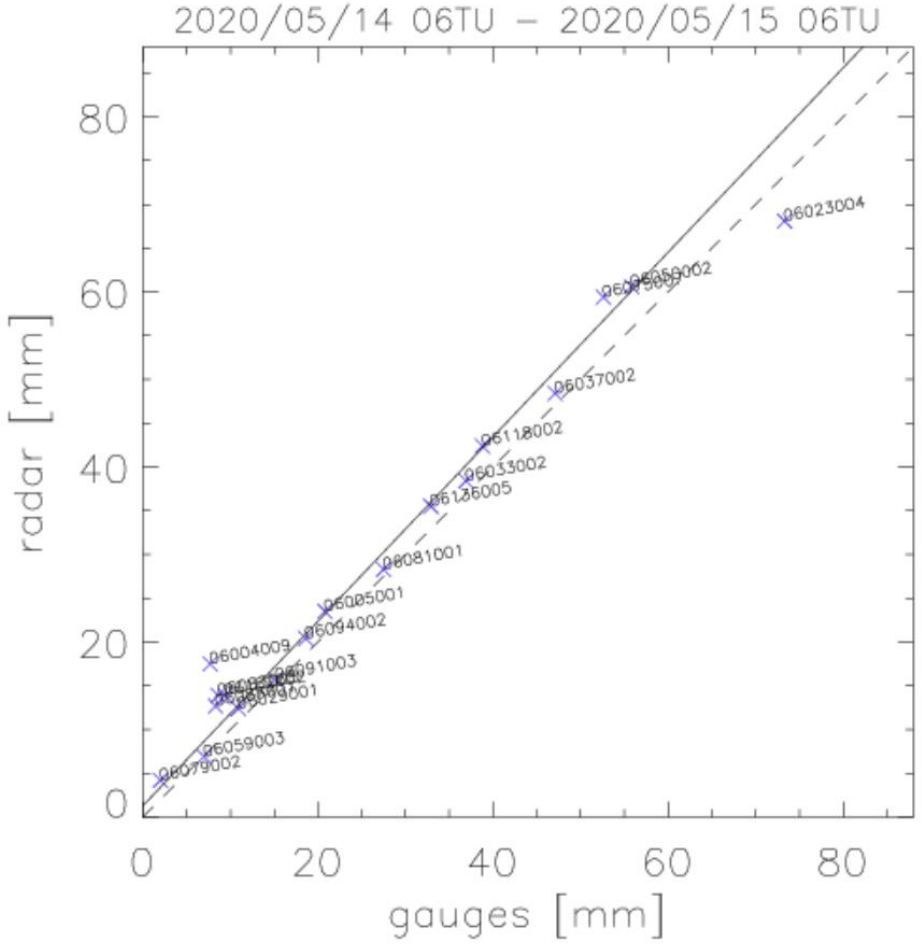
Last 24h accumulation file (from 2020-05-14 00:00:00 to 2020-05-15 00:00:00 UTC) :





Extract of the daily automatic report of the RAINPOL platform

At X-band, only the radome less solution associated with ZPHI® makes it possible to obtain this result



Scores of the comparison

N :	18		
NASH:	0.96	Mean X:	26.30
CORR:	0.99	Var X:	423.47
Slope:	1.05	Mean Y:	29.01
Offset:	1.29	Var Y:	391.33
RMSE:	4.10		
Norm. bias:	10.31		

lean X: 26.30
ar X: 423.47
lean Y: 29.01
ar Y: 391.33

Norm. bias: 10.31

Comparison between the 24-hr accumulated rain map with the Météo France rain gauge network (within 60km from the radar) used for verification

Thank you for your attention

Z_{DR} speckle as a function of ρ_{HV} and N_i