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Evaluation and improvement of the French fuzzy logic polarimetric hydrometeor classifier

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RHYTMME

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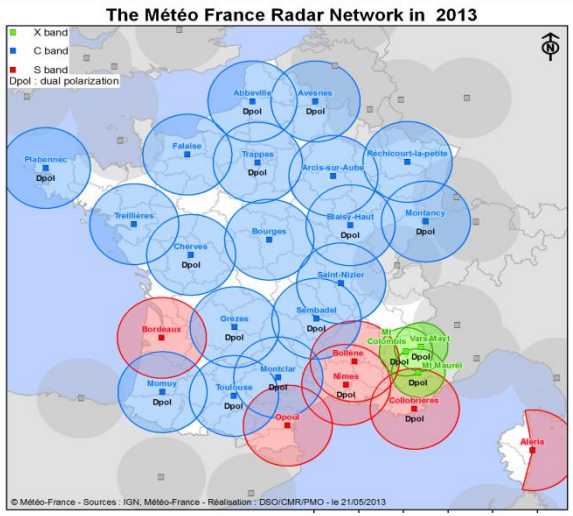
Plan

1. Overview of the Hydrometeor Classification Algorithm
2. Evaluation Method
3. Conclusion and Future work

Overview of the Hydrometeor Classification Algorithm



Hydrometeor Classification Algorithm *

Measurement conditions (Φ_{DP}, SCR*, SNR, PBB, distance, …)**
***: Signal to Clutter Ratio**
****: Partial Beam Blocking**

X, C and S-Band

Z_H
Z_{DR}
K_{DP}
ρ_{HV}

Fuzzy Logic Algorithm

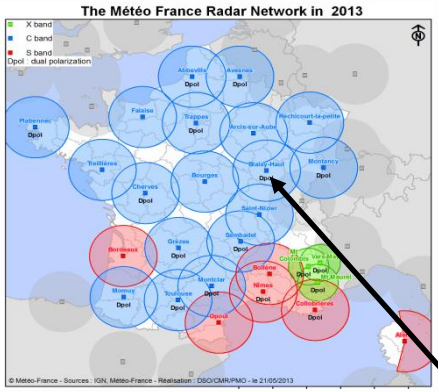
Hydrometeor Types :
RAIN
WETSNOW
DRYSNOW
ICE
small HAIL
medium HAIL
large HAIL

NWP Model (AROME)

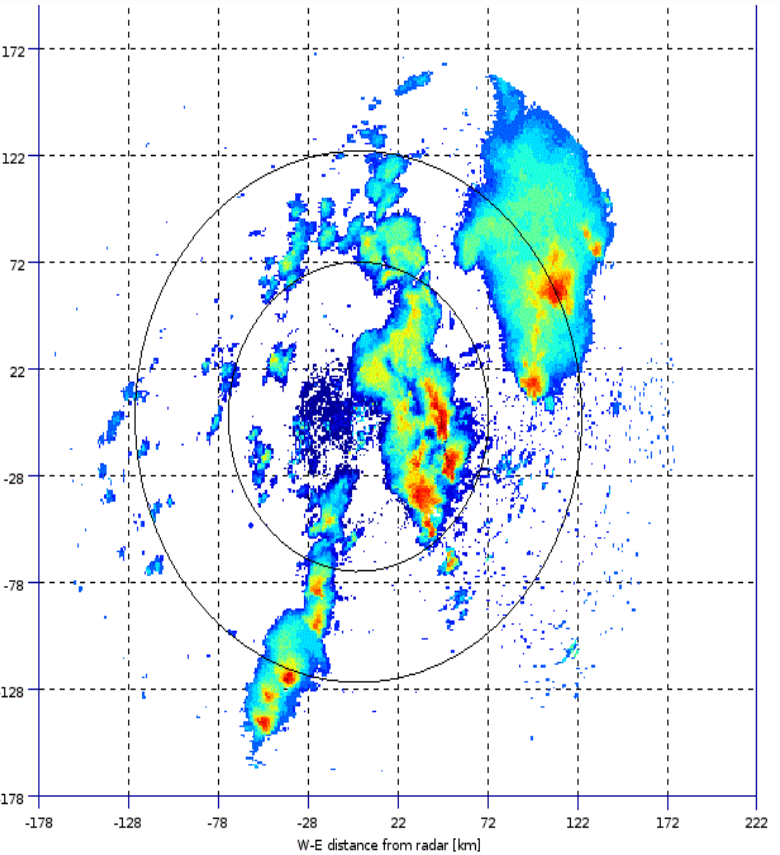
3D Temperature

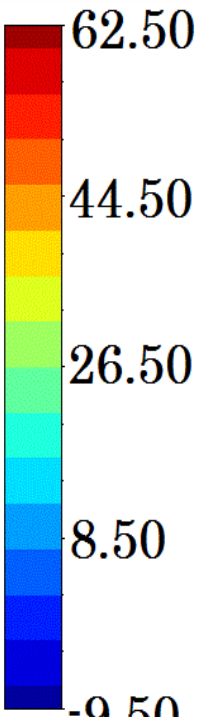
** : Al-Sakka, H., A.-A. Boumahmoud, B. Fradon, S. J. Frasier, and P. Tabary, 2013: A new fuzzy logic hydrometeor classification scheme applied to the french x, c and s-band polarimetric radars. Journal of Applied Meteorology and Climatology.*

Example : Convective case with the presence of Large Hail at C-Band

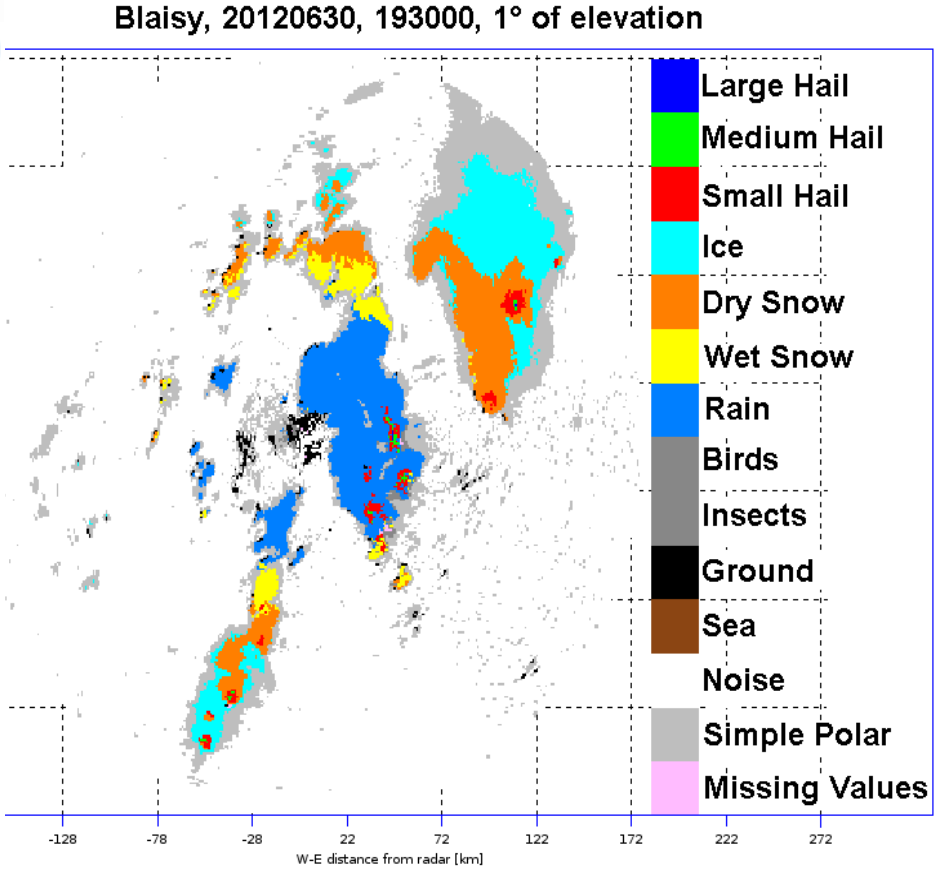


Z_H (dBZ)





Blaisy, 20120630, 193000, 1° of elevation



Evaluation Method: Radar Volume Intercomparison

Each 5 min

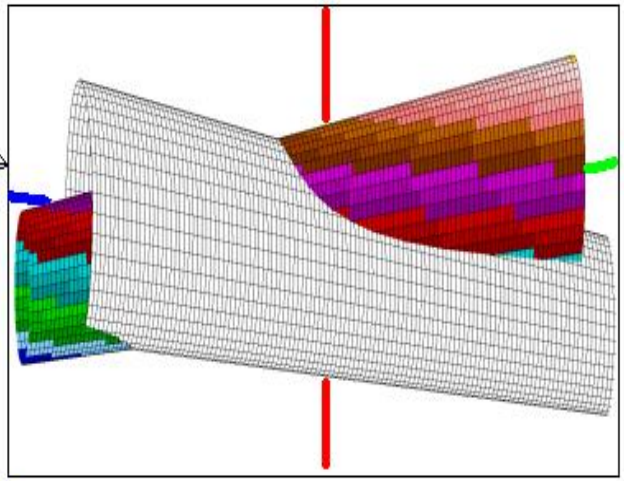
% HT

$\langle Z_H \rangle$

$\langle Z_{DR} \rangle$

$\langle K_{DP} \rangle$

$\langle \rho_{HV} \rangle$



Φ_{DP}

R

Radar 1

(lon/lat, alt)

Φ_{DP}

Res = 250m

10km

10km

R

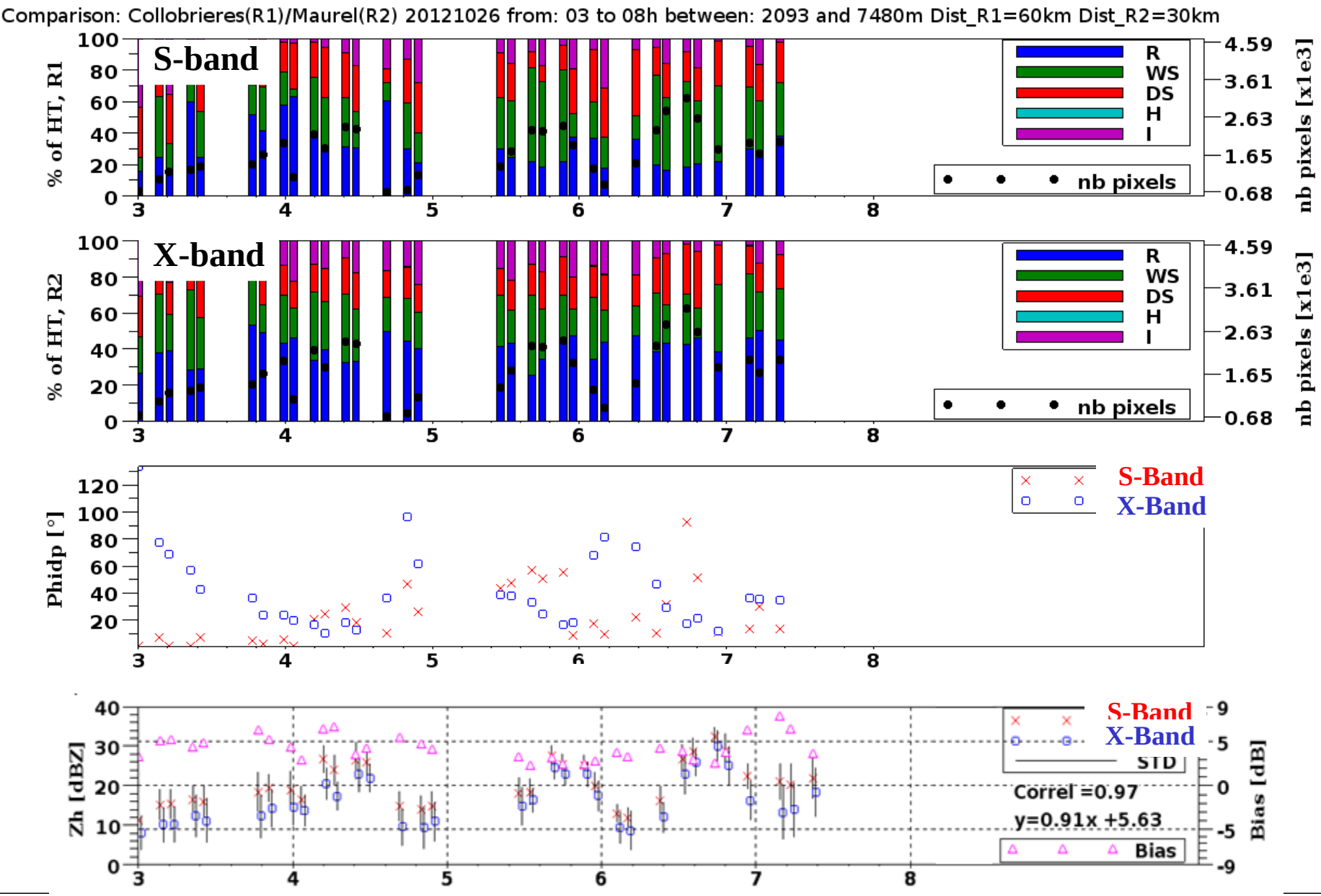
Radar 2

(lon/lat, alt)

Taking into account :

- SNR
- Partial beam blocking
- Volume ratio
- Bright Band

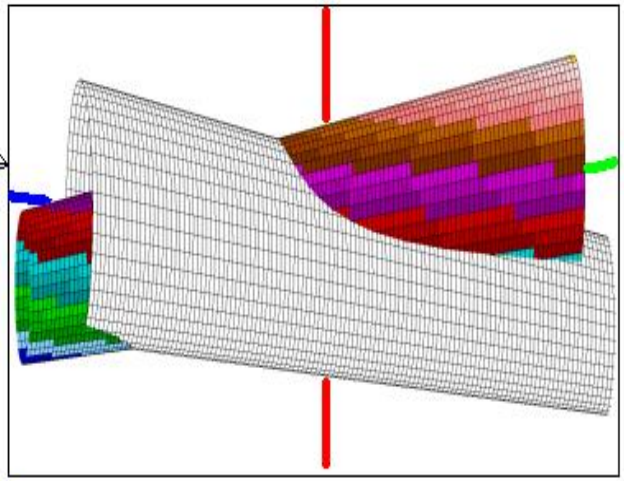
Radar Volume Intercomparison: S-Band (Collobrieres R1) vs X-Band (Maurel R2)



Radar Volume Intercomparison : Estimation of the γ_H and γ_{DP} constants used in the PIA and PIDA calculation

Z_H (no attenuation correction)

Z_{DR} (no attenuation correction)



Φ_{DP}

R = 0

X-Band

Φ_{DP} <10°

- SNR >10 dB
- PBB < 5%
- Volume ratio < 1/2

Res = 250m

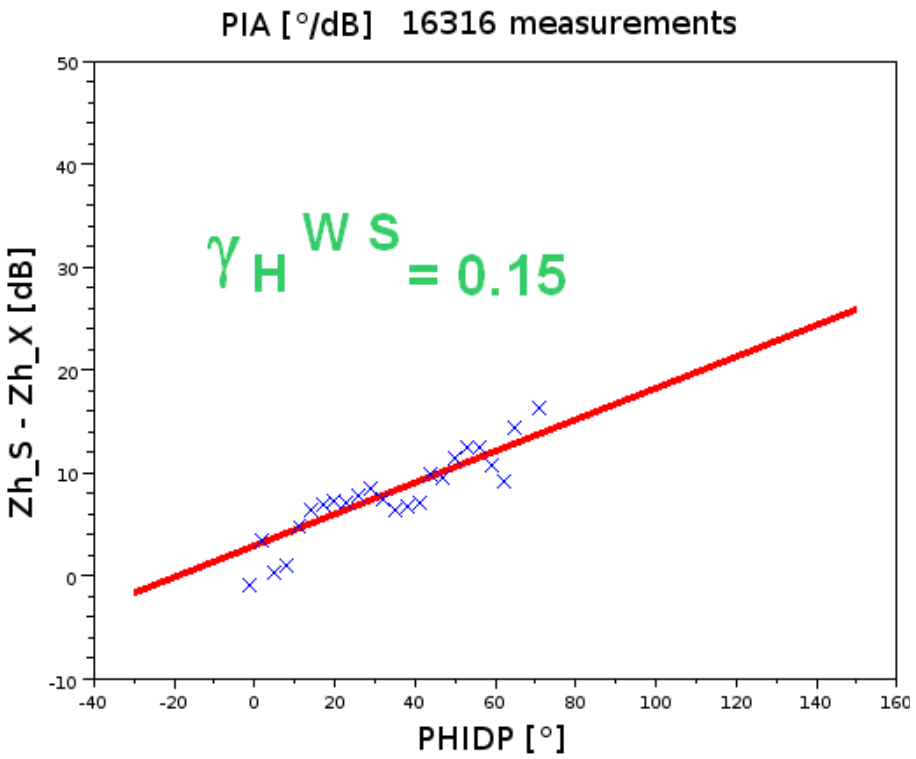
10km

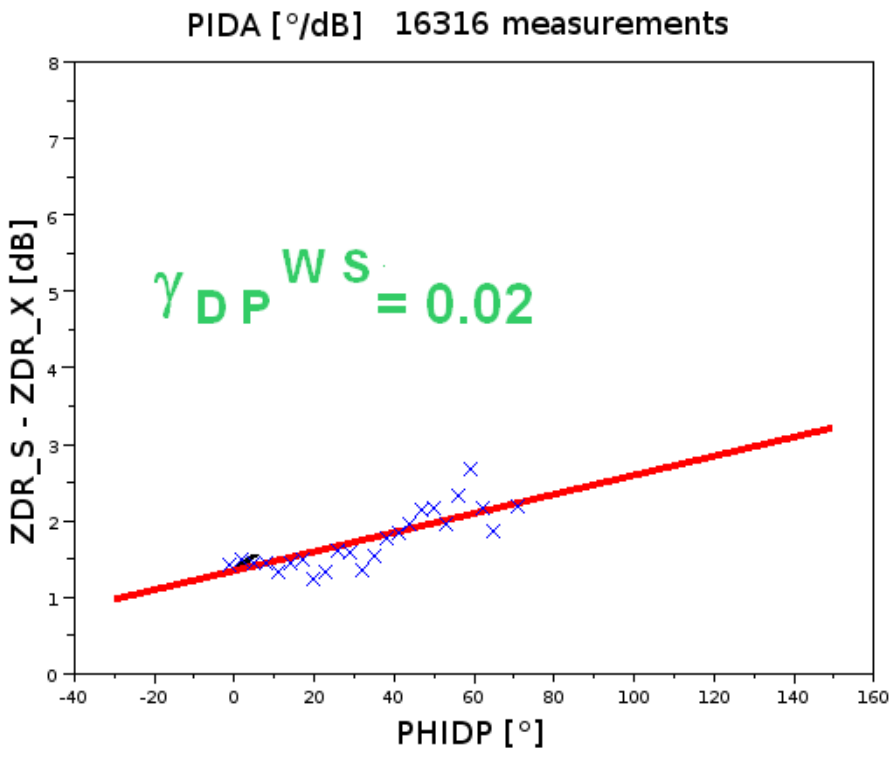
10km

R

S-Band
(Reference)

γ_H and γ_{DP}





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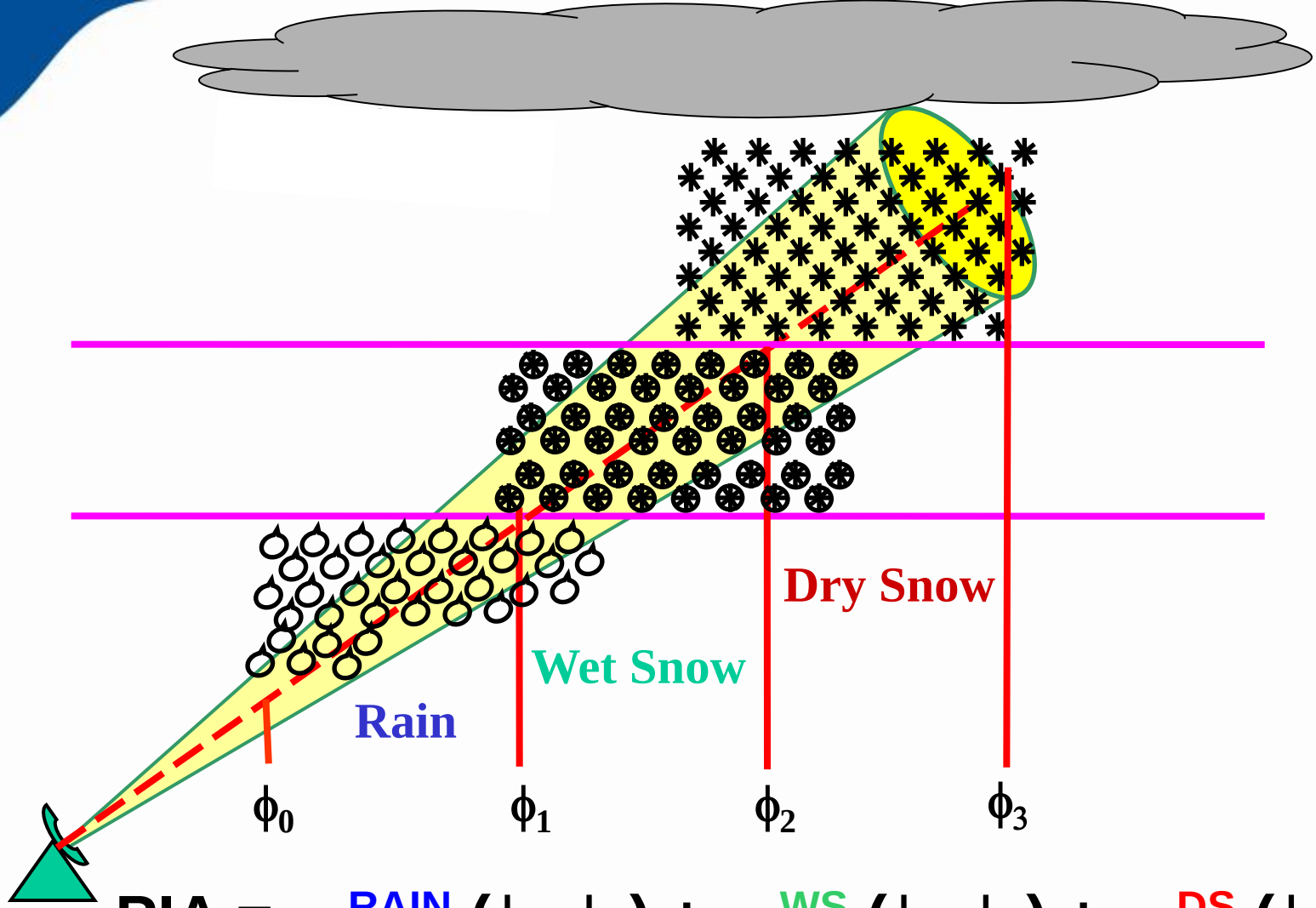


$$PIA = \gamma_H^{RAIN}.(\phi_1 - \phi_0) + \gamma_H^{WS}.(\phi_2 - \phi_1) + \gamma_H^{DS}.(\phi_3 - \phi_2)$$

$$PIDA = \gamma_{DP}^{RAIN}.(\phi_1 - \phi_0) + \gamma_{DP}^{WS}.(\phi_2 - \phi_1) + \gamma_{DP}^{DS}.(\phi_3 - \phi_2)$$

Parameterization

3 parameterizations were tested :

Param. 1 : attenuation correction ALL ALONG the path using γ_H^{RAIN} and γ_{DP}^{RAIN}

Param. 2 : attenuation correction ONLY in Rain.

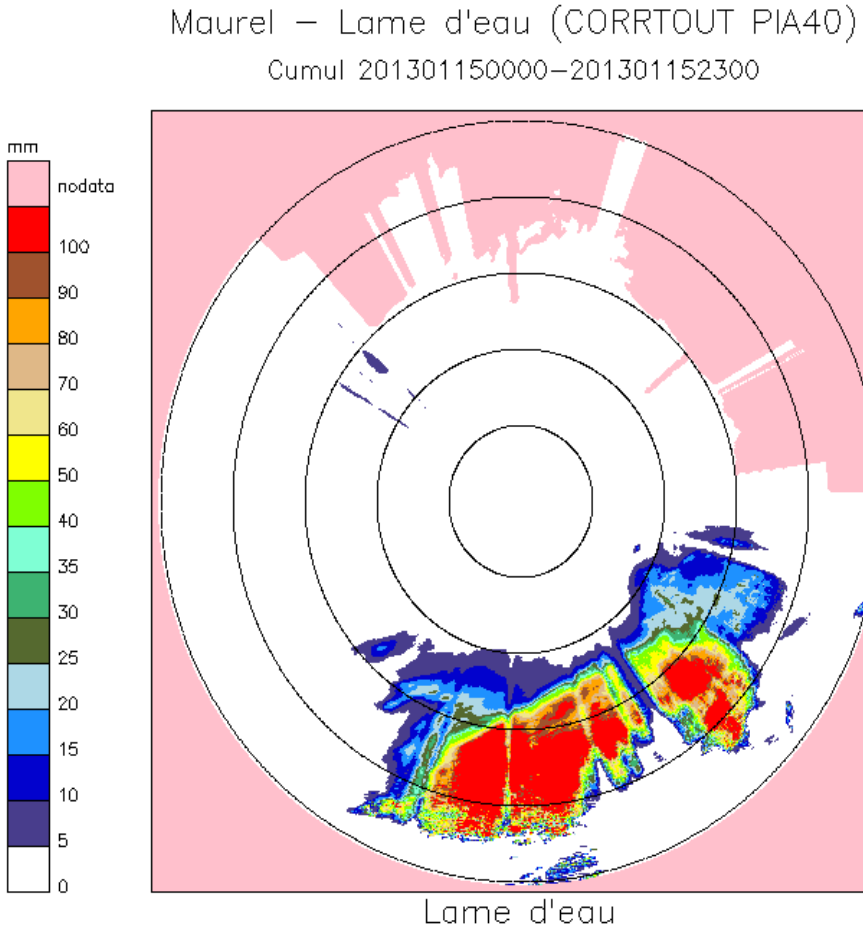
Param. 3 : attenuation correction using γ_H^{RAIN} and γ_{DP}^{RAIN} in Rain and γ_H^{WS} and γ_{DP}^{WS} in WetSnow.

	Param. 1	Param. 2	Param. 3
γ_H^{RAIN}	0.28	0.28	0.28
γ_H^{WS}	0.28	0	0.15
γ_H^{DS}	0.28	0	0

	Param. 1	Param. 2	Param. 3
γ_{DP}^{RAIN}	0.04	0.04	0.04
γ_{DP}^{WS}	0.04	0	0.02
γ_{DP}^{DS}	0.04	0	0

Maurel (X-Band) : QPE(24h)

Param. 1 : attenuation correction ALL ALONG the path using γ_H^{RAIN} and γ_{DP}^{RAIN}



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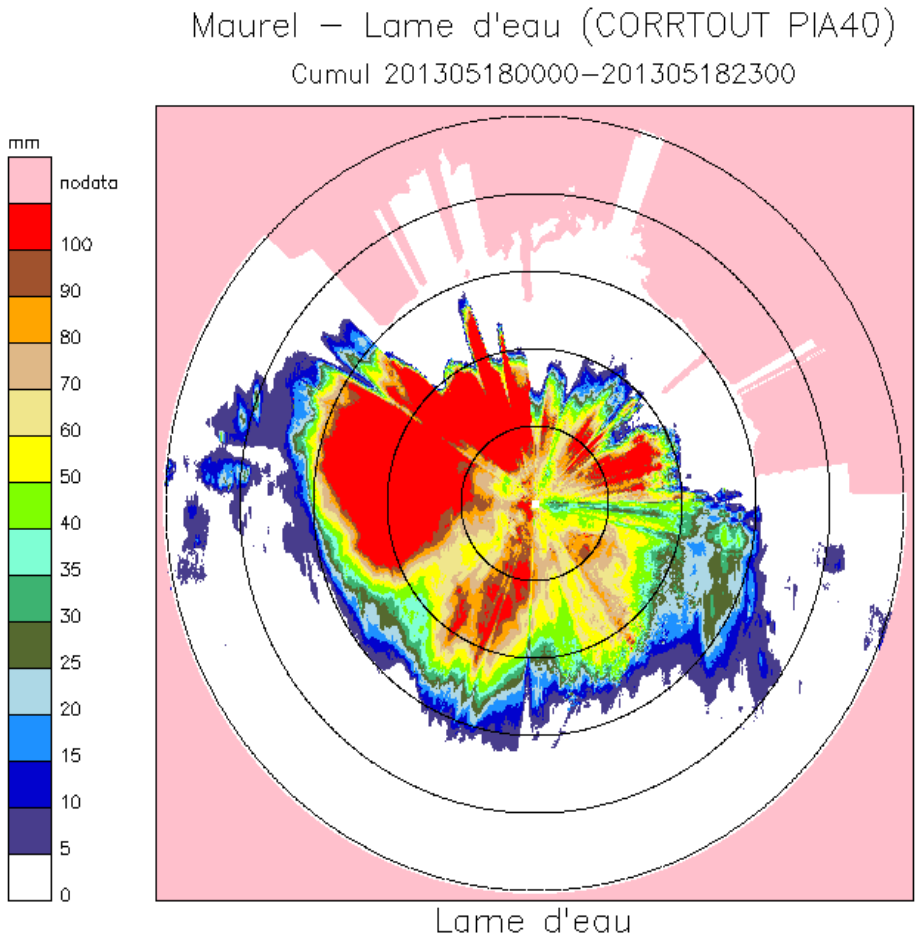

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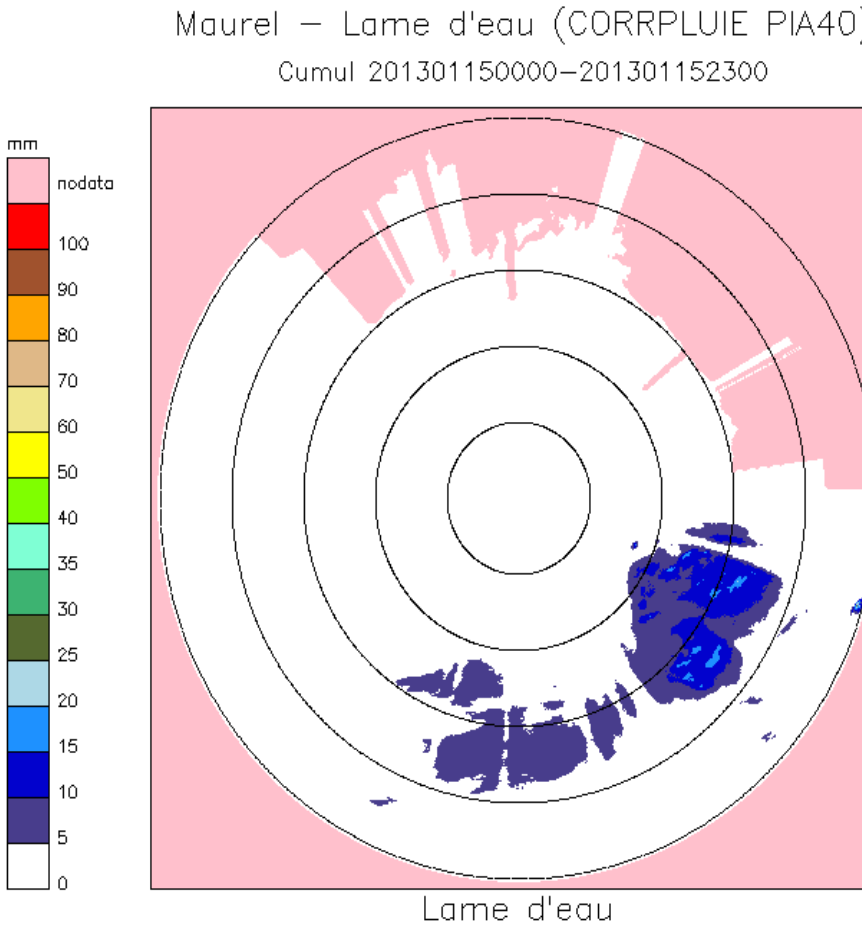
Maurel (X-Band) : QPE(24h)

Param. 2 : attenuation correction ONLY in Rain.



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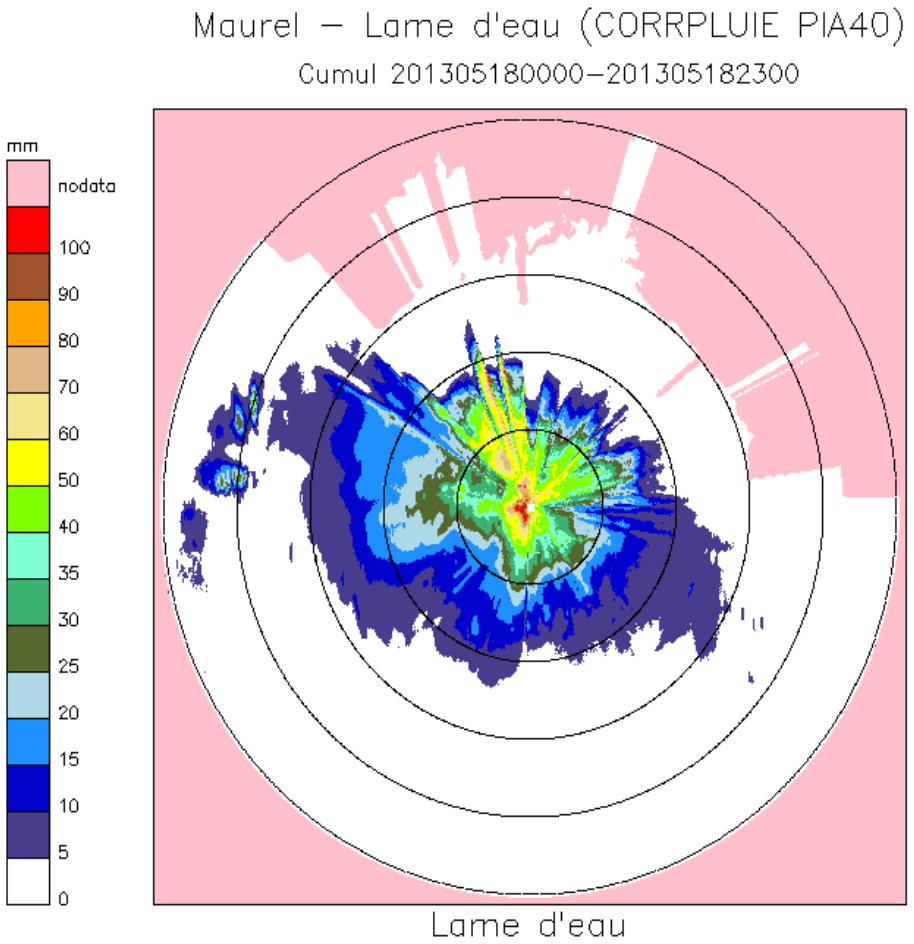

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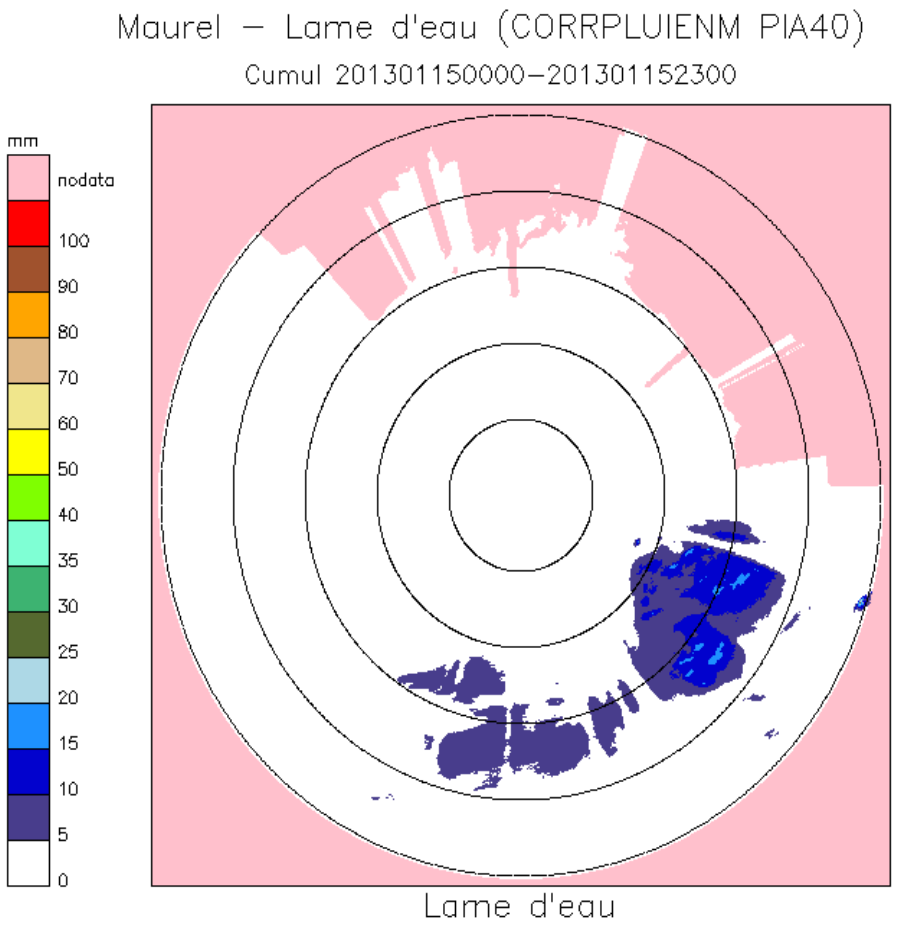
Maurel (X-Band) : QPE(24h)

Param. 3 : attenuation correction using γ_H^{RAIN} and γ_{DP}^{RAIN} in Rain and γ_H^{WS} and γ_{DP}^{WS} in WetSnow.



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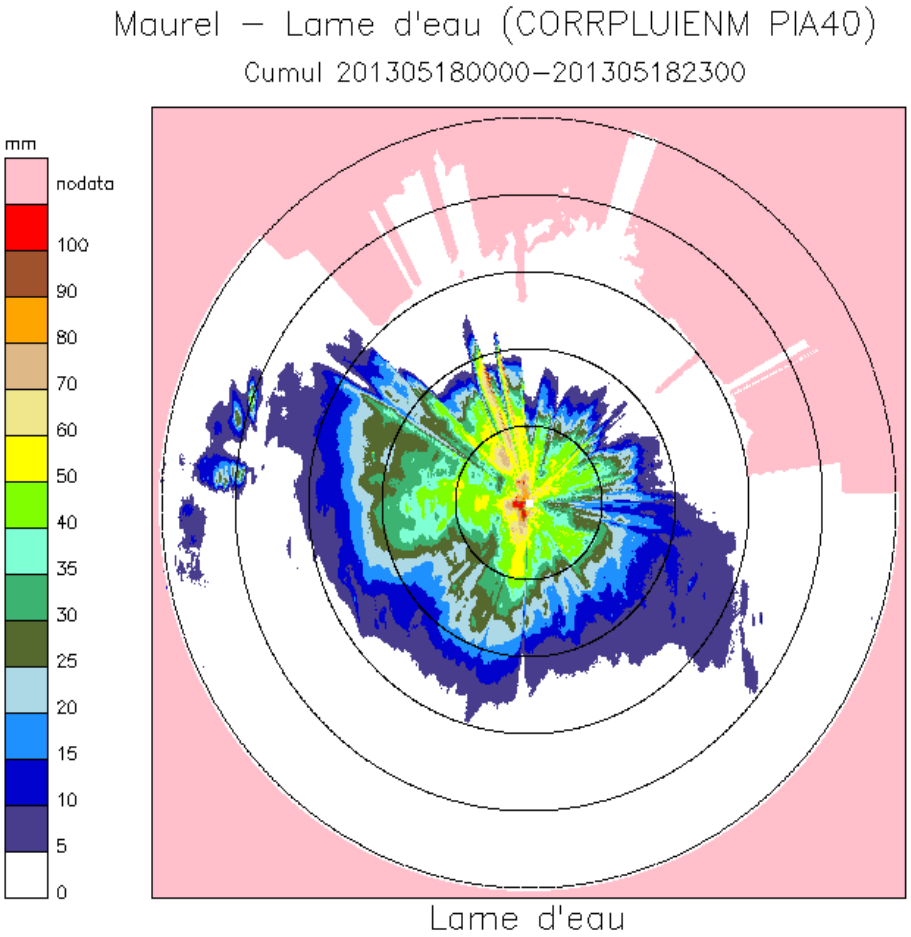

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For more information about these cases see Poster N°: 369 Boumahmoud et al.

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Conclusion and future work

Conclusion:

- **The intercomparison approach shows a large ability to better understand the radar measurements and to evaluate the HCA.**

- **It can be used to calculate the constants (γ_H and γ_{DP}) of the Path Integrated Attenuation (PIA and PIDA).**

Future work:

- **Use the radar intercomparison method for : Bias detection, Study the coherence between radars, Study the wet radome effects, Monitoring tool and Calculation and/or revisiting membership functions.**

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Merci

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