Lame d’eau du radar bande X du MtVial (région PACA) dans le cadre du projet CRISTAL

Emmanuel Moreau (NOVIMET)

Projet CRISTAL

CRISTAL (CRues par l'Integration des Systèmes Transfrontaliers Alpins-2008-2011)

- Suite du projet FRAMEA
- Déploiement d’une application pré opérationnel de prévision des crues
- 2 radars bande-X (France et Italie)

Radar HYDRIX

- Radar Doppler bande X
  - Antenne ∅ 1,5 m
  - Ouverture: 1,5°
- Diversité de polarisation
  - Technologie hybride (HV simultanés)
- Traitement ZPHI®

- Mode d'exploration
  - Cycle hydro. : 5 élévations
  - Temps de revisite 2.5mn
  - Cycle volumique: 5 élévations
  - Temps de revisite: 15mn
- Résolution
  - Distance: 300m
  - Azimut: 0.5°

HYDRIX

- Compact, light weight, and low-power consumption.
- Easily installed with limited secondary costs.
- Dual polarization capability.
- High sensitivity level.
- Attenuation correction through integrated ZPHI® software.

Radar control

TELRAD

FEATURES
- complete radar remote control
- multi-radars management
- programmable scanning modes
- generation of sophisticated meteorological products
- data archiving
- data visualization
- Built-In-Test-Equipment monitoring (BITE)
- user friendly menu system

ZPHI_SOFT

BUILT-IN FEATURES
- Correction for attenuation due to rain medium.
- Correction for calibration bias.
- Correction for rain variability.
- Precipitation classification.

PRODUCTS
- Precipitation type (rain, snow, hail).
- Rainfall rate.
- Raindrop kinetic energy.

Measured data

Weather data

Measured data

Local radar database

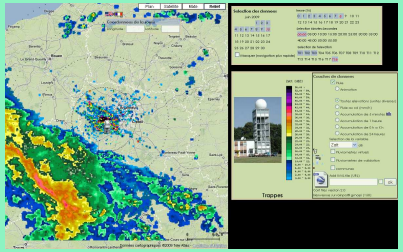
Data synchronization

Main database

RAINPOL

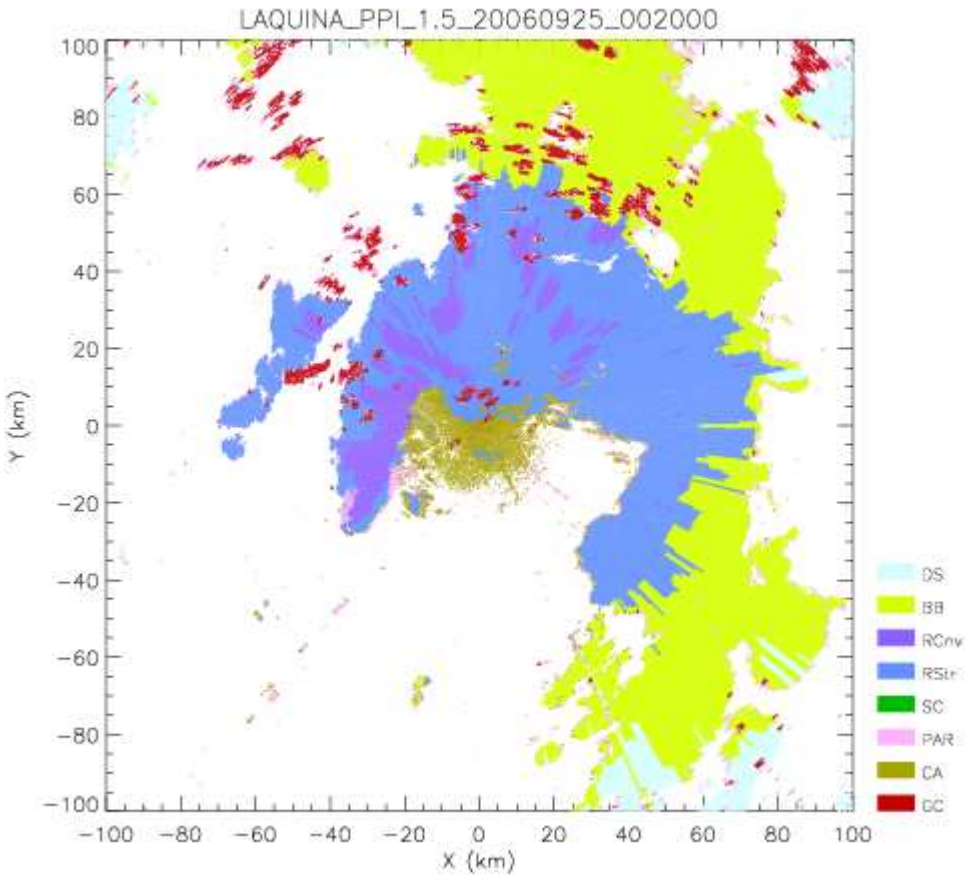
FEATURES
- Precipitation mapping.
- Interpretation and follow-up of precipitation data on different land-size scales: from a small farm field to a water catchment of several thousand square kilometers.
- Web based application.
- Easy integration capabilities.

AVAILABLE SERVICES
- Urban hydrology: territorial area management with accurate and customized precipitation information.
- Rural hydrology and natural risk management: large water catchments management and potential flood prevention.
- Agriculture: parcel management, plant diseases evaluation, chemical efficiency, irrigation control, agricultural works planning, hail anticipation and evaluation.
- Airport: accurate wind and precipitation information for air traffic management



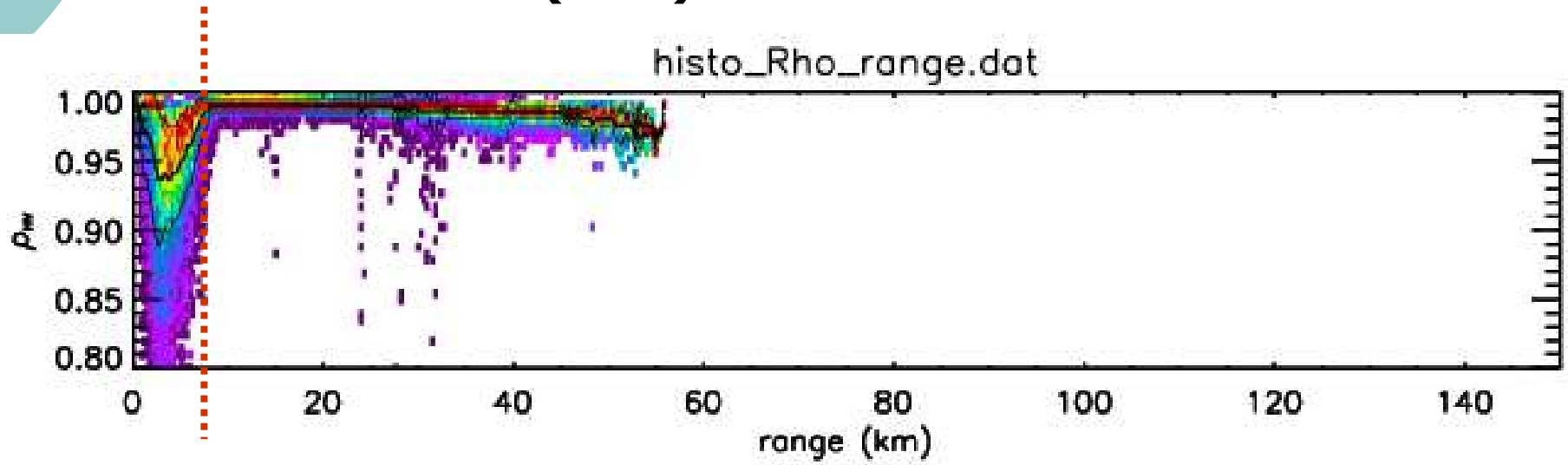
ZPHI® Processing: Classification

- **Step #1**
  - Hydrometeor
  - Non-hydrometeor
- **Step #2**
  - Rain
  - Melting Layer
  - Dry snow
- **Step #3**
  - Stratiform rain
  - Convective rain



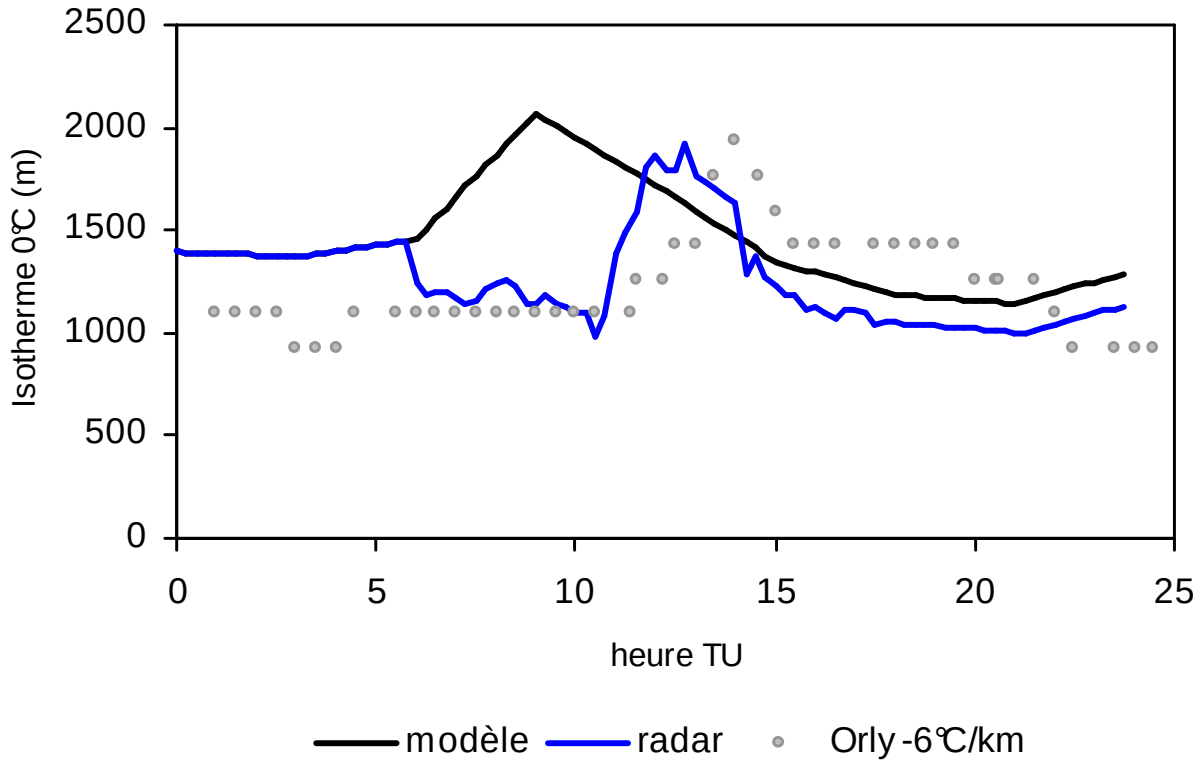
ZPHI® Processing: altitude iso0℃

- **« Ébauche » à partir d'une prévision MF 0-24hr**
- **Ajustement à partir de RHOHV à haute élévation (>4°)**

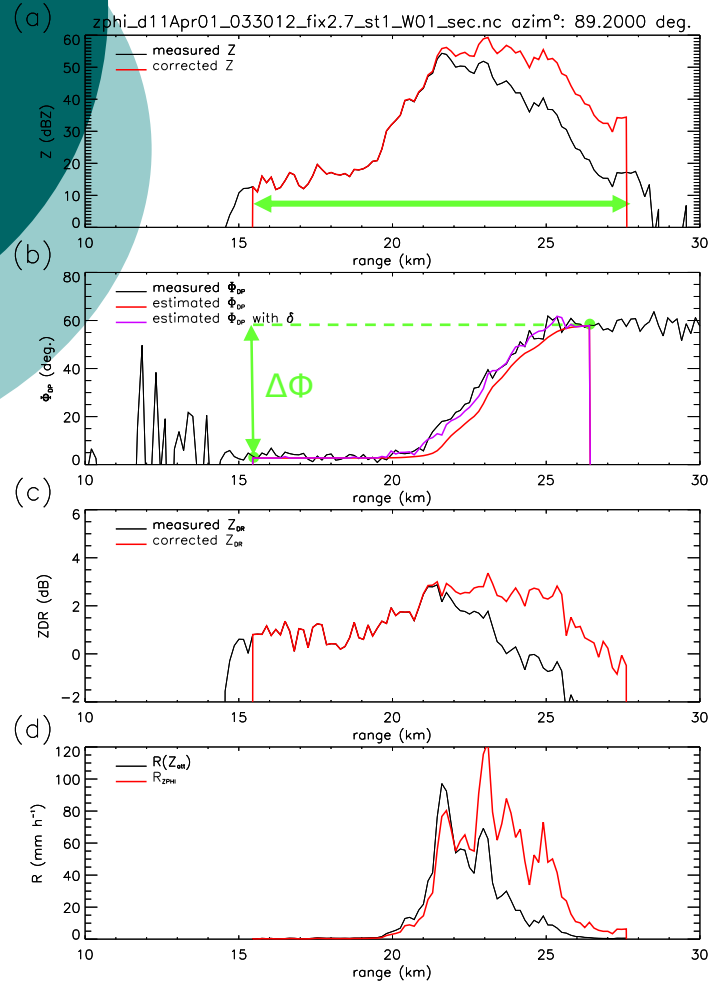


- **Ajustement par radiale**

ZPHI® Processing: altitude iso0℃



ZPHI® Processing:
Corr. atténuation Z & Estimation R



- Traitement « profileur »
- Un algorithme par type d'hydrométéore

Pluie:

- Corr. de l'atténuation Z_c
- Calcul de N_0^*
- Estimation à deux paramètres du taux de pluie

$$\mathbf{R} = a\, \mathbf{N_0}^{*(1-b)} \mathbf{Z_c}^{b}$$

Bande-Brillante:

- Corr. de l'atténuation Z_c

Neige:

- Corr. PVR climatologique
- Estimation du taux de pluie

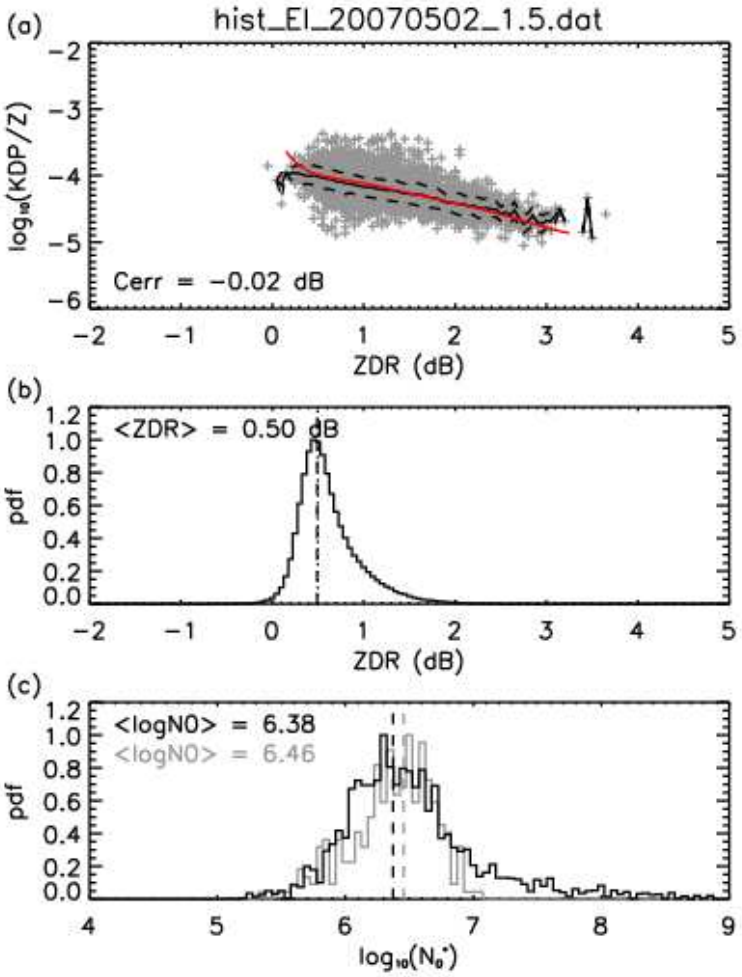
$$\mathbf{R} = a_n\, \mathbf{N_0}^{*}_{\mathbf{fixe}}{}^{(1-b_n)} \mathbf{Z_c}^{bn}$$

ZPHI® Processing: Etalonnage

- Etalonnage externe: comparer la statistique d'un paramètre ZPHI à une info extérieure.

- Etalonnage interne: comparer deux paramètres ZPHI différemment sensibles à l'étalonnage.

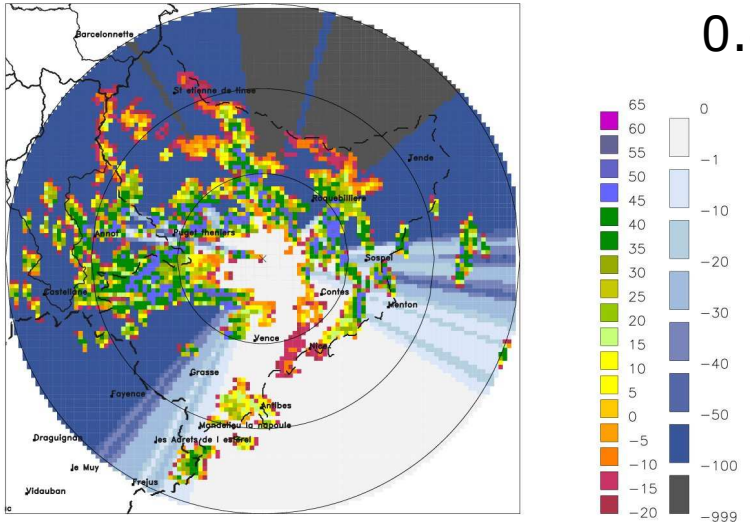
ZPHI® Processing: Etalonnage



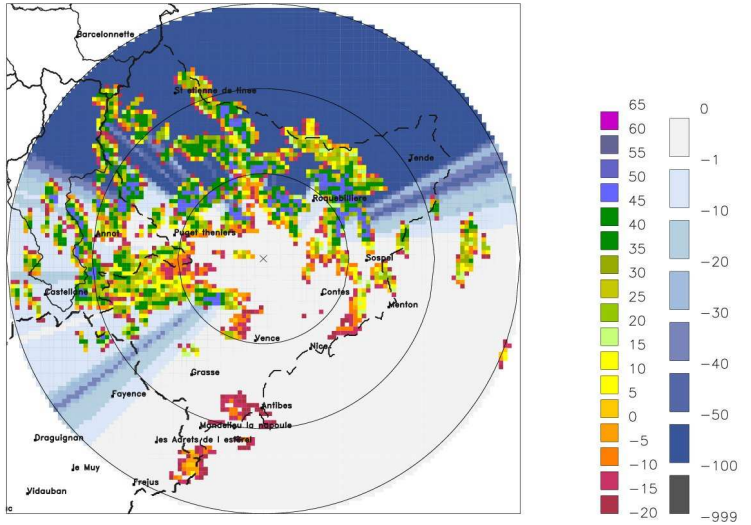
- Étalonnage de ZDR
- Fit de KDP/Z – ZDR
- Vérification: statistiques N_0^*

Masques Orographiques / Échos fixes

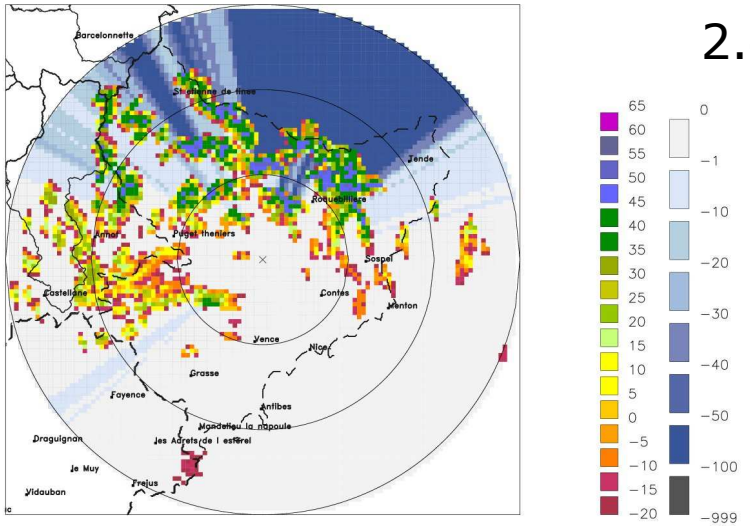
-1.0°



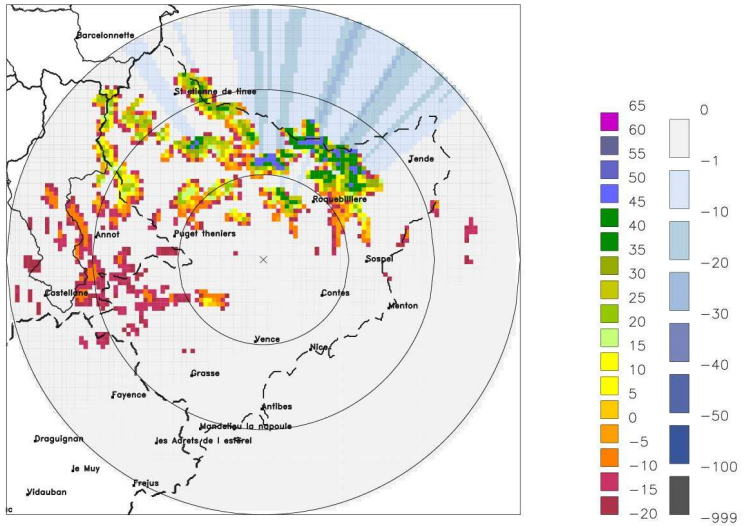
0.4°



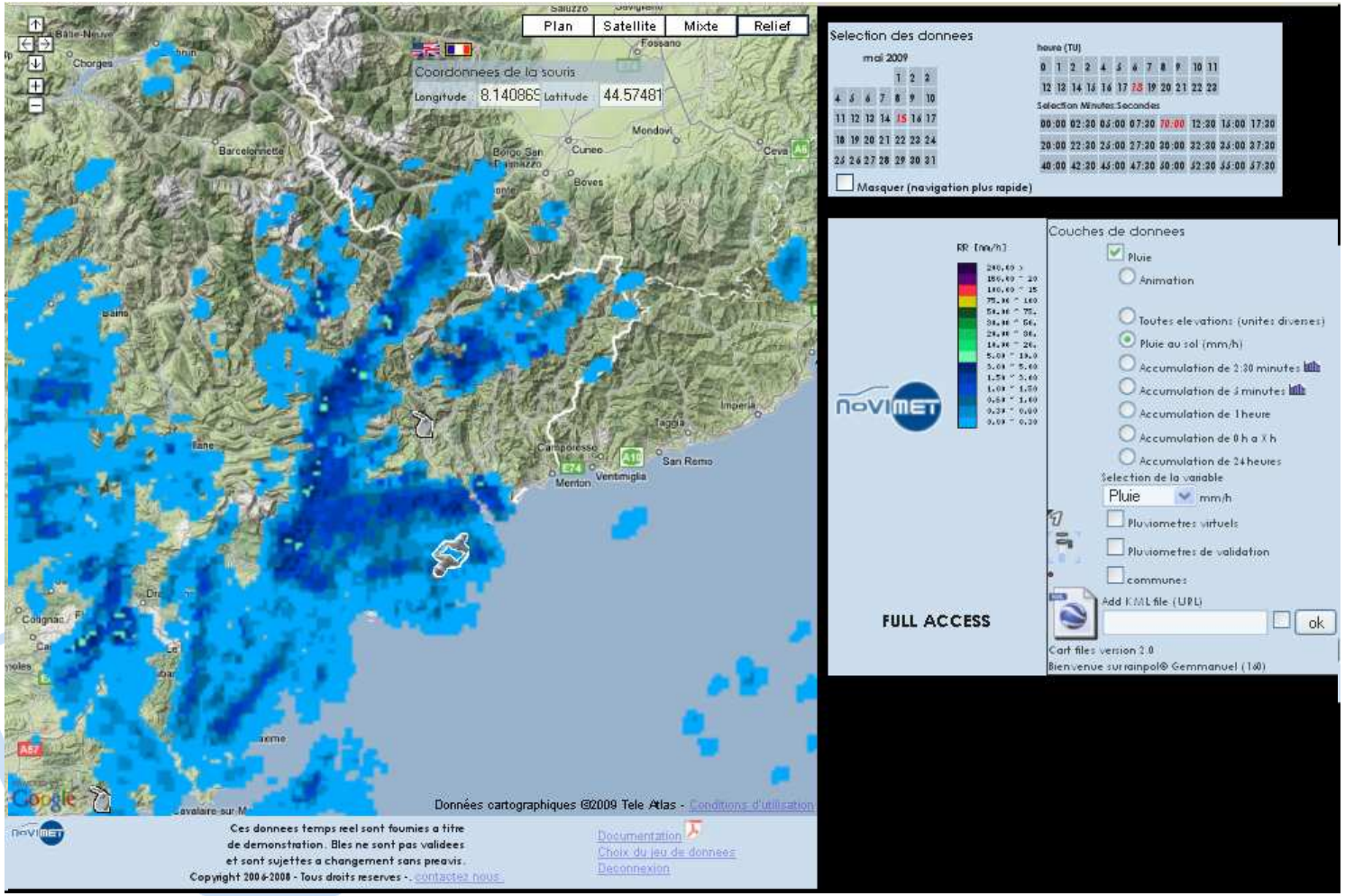
1.2°



2.4°

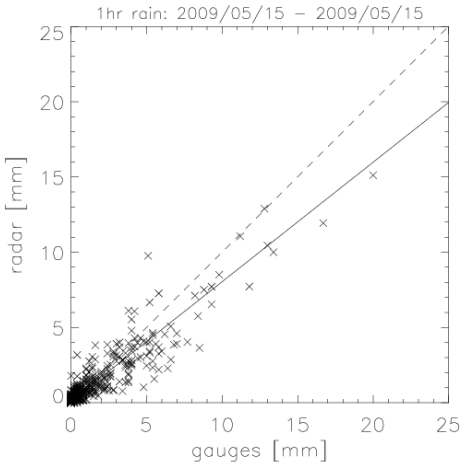


Lame d’eau:
Synthèse multi élévation

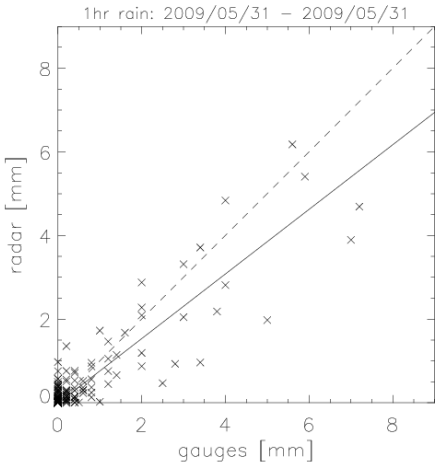


Lame d'eau:
Comparaison avec réseau sol MF

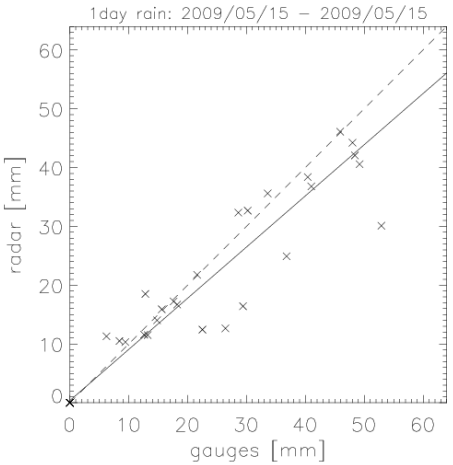
- 2009/05/15 & 31, <60km, 1-hr et 24-hr



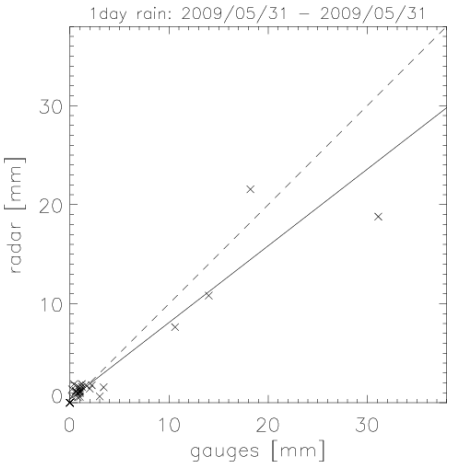
N : 315
NASH: 0.80 Mean X: 2.17
CORR: 0.91 Var X: 7.55
Slope: 0.79 Mean Y: 1.83
Offset: 0.11 Var Y: 4.72
RMSE: 1.24
Norm. bias: −15.66



N : 73
NASH: 0.73 Mean X: 1.36
CORR: 0.87 Var X: 2.81
Slope: 0.77 Mean Y: 1.04
Offset: −0.01 Var Y: 1.90
RMSE: 0.87
Norm. bias: −23.60



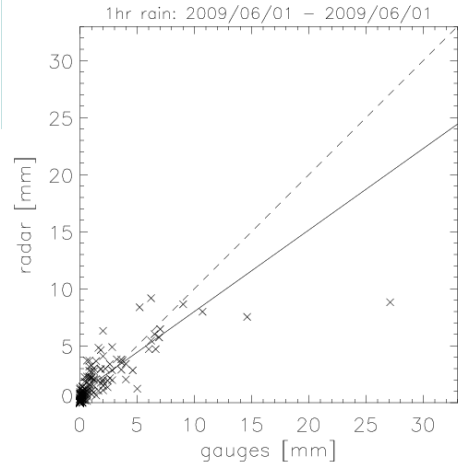
N : 25
NASH: 0.73 Mean X: 27.35
CORR: 0.89 Var X: 213.86
Slope: 0.87 Mean Y: 24.18
Offset: 0.39 Var Y: 151.89
RMSE: 7.39
Norm. bias: −11.57



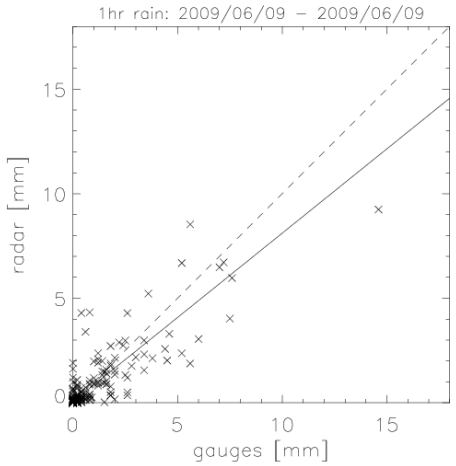
N : 26
NASH: 0.84 Mean X: 3.83
CORR: 0.94 Var X: 50.80
Slope: 0.77 Mean Y: 3.33
Offset: 0.36 Var Y: 29.77
RMSE: 2.76
Norm. bias: −13.04

Lame d'eau:
Comparaison avec réseau sol MF

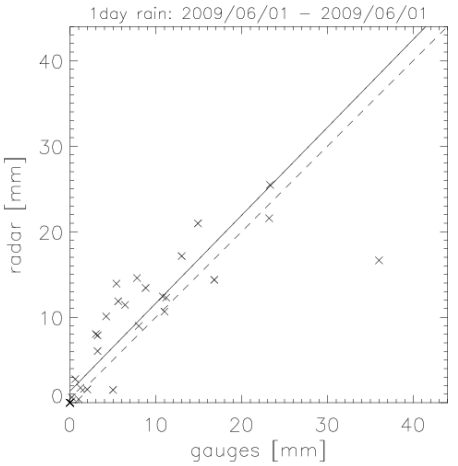
- 2009/06/01 & 09, <60km, 1-hr et 24-hr



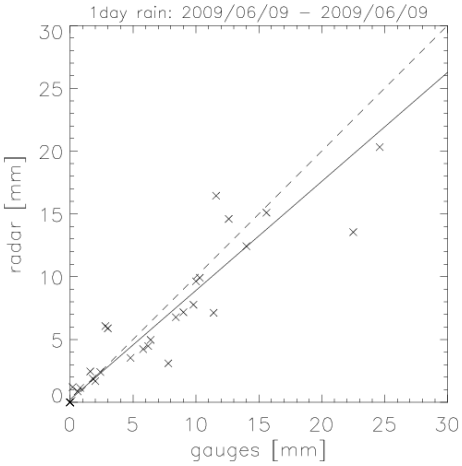
N : 105
NASH: 0.54 Mean X: 2.15
CORR: 0.75 Var X: 11.89
Slope: 0.71 Mean Y: 2.40
Offset: 0.87 Var Y: 4.45
RMSE: 2.34
Norm. bias: 11.78



N : 126
NASH: 0.65 Mean X: 1.62
CORR: 0.82 Var X: 4.26
Slope: 0.81 Mean Y: 1.35
Offset: 0.05 Var Y: 3.03
RMSE: 1.22
Norm. bias: −16.38



N : 25
NASH: 0.57 Mean X: 9.03
CORR: 0.78 Var X: 73.20
Slope: 1.03 Mean Y: 10.66
Offset: 1.37 Var Y: 47.12
RMSE: 5.51
Norm. bias: 17.99

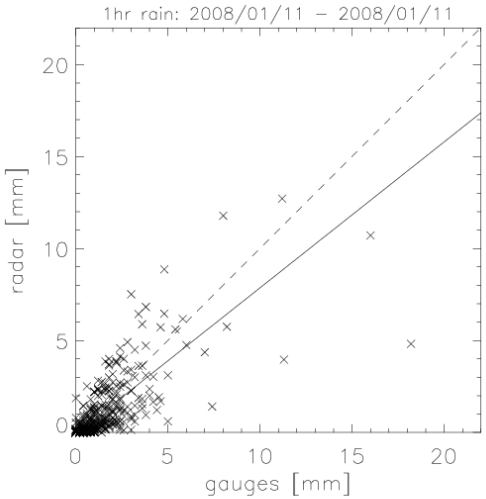


N : 26
NASH: 0.80 Mean X: 7.92
CORR: 0.90 Var X: 41.04
Slope: 0.87 Mean Y: 7.11
Offset: 0.23 Var Y: 29.06
RMSE: 2.84
Norm. bias: −10.28

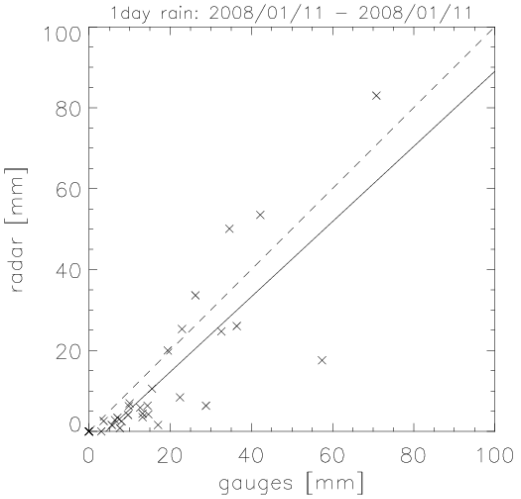
Lame d'eau:
Pb. Estimation Neige (2008/01/11)

- 2008/01/11, <60km, iso0°C ~1700m, 1-hr et 24-hr

- QI_{1hr}>0
- QI_{1hr}<0.7 ~Neige
- QI_{1hr}>0.7 ~Pluie



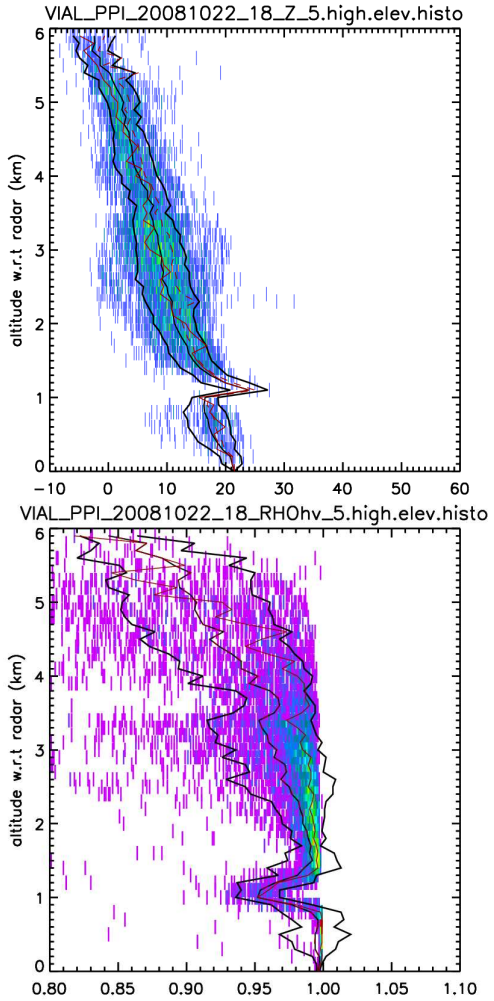
N : 317
NASH: 0.42 Mean X: 1.73
CORR: 0.71 Var X: 3.92
Slope: 0.79 Mean Y: 1.31
Offset: −0.07 Var Y: 3.30
RMSE: 1.51
Norm. bias: −24.57



N : 28
NASH: 0.46 Mean X: 20.17
CORR: 0.84 Var X: 267.00
Slope: 0.93 Mean Y: 14.87
Offset: −3.86 Var Y: 382.68
RMSE: 11.74
Norm. bias: −26.29

ZPHI® Processing: Neige

- Estimation du profile vertical « moyen » de N_0^* (Snow Profiling Algorithm, brevet CNRS)
- Ajustement par radiale (ZPHI Glace, brevet CNRS)



Merci ...