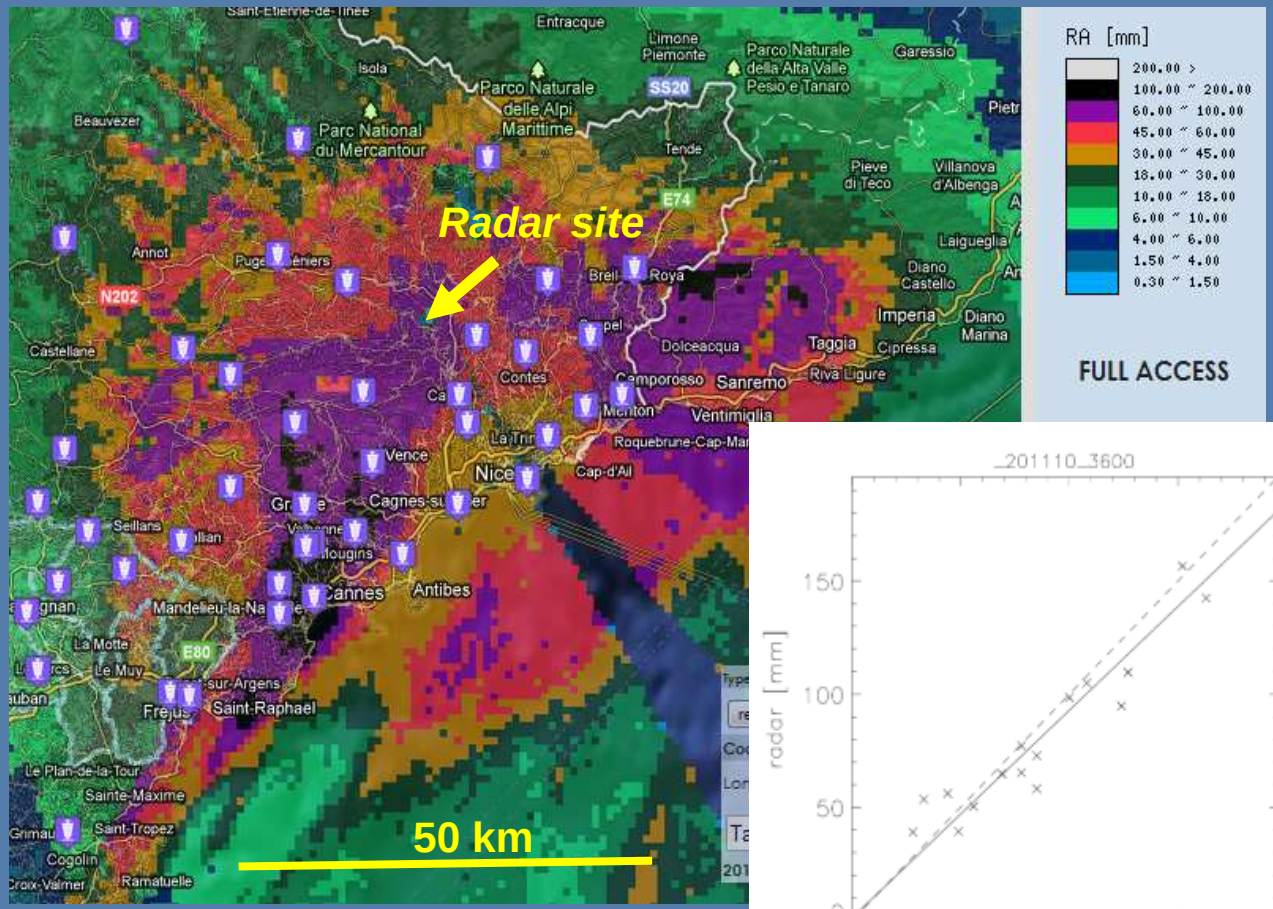
NOVIMET solution in
hydro meteorology
Rainfall high resolution real time

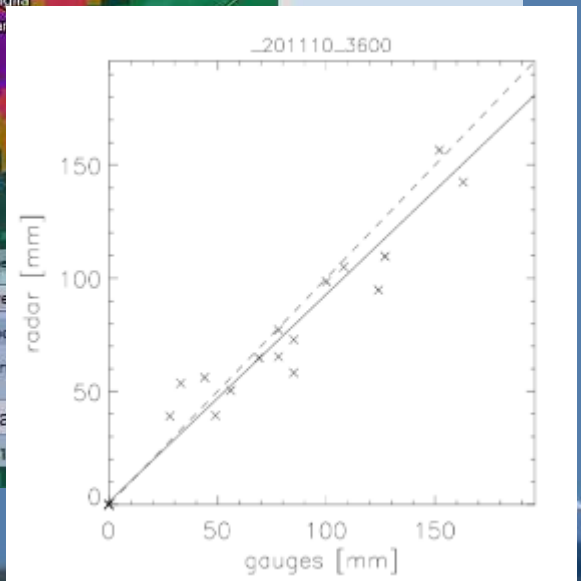
NOVIMET : actor of hydro meteorology

- Provider of technological solutions / Provider of information
- Our offer: an integrated solution, from the radar sensor to the platform to distribute services
- An innovative technology
  - Accurate and high resolution mapping of the precipitation, over wide areas, *without the use of rain gauges*

NOVIMET innovation

Rainy event on October 25th, 2011 in Maritimes Alpes





24-hr accumulated rainfall

- The radar as a stand alone instrument to measure rain (r < 60 km).
- Rain gauges only used as verification data.

Urban hydrology

- Civil protection
- Management of rain water

Traditional solution: Specific high density rain gauge network + classical radar imagery

New solutions for various applications

Rural hydrology

- Food forecast, River hydraulics
- Management of aquifers

Traditional solution: Interpolation of regular rain gauge network (1/500km2)

Agriculture

- Optimisation of treatment by intrants
- Control of irrigation

Traditional solution: Interpolation of regular rain gauge network (1/500km^2)

Airports

Air traffic control- Management of meteorological hazards when landing and taking off

Traditional solution: images of the closest radar of the regular network

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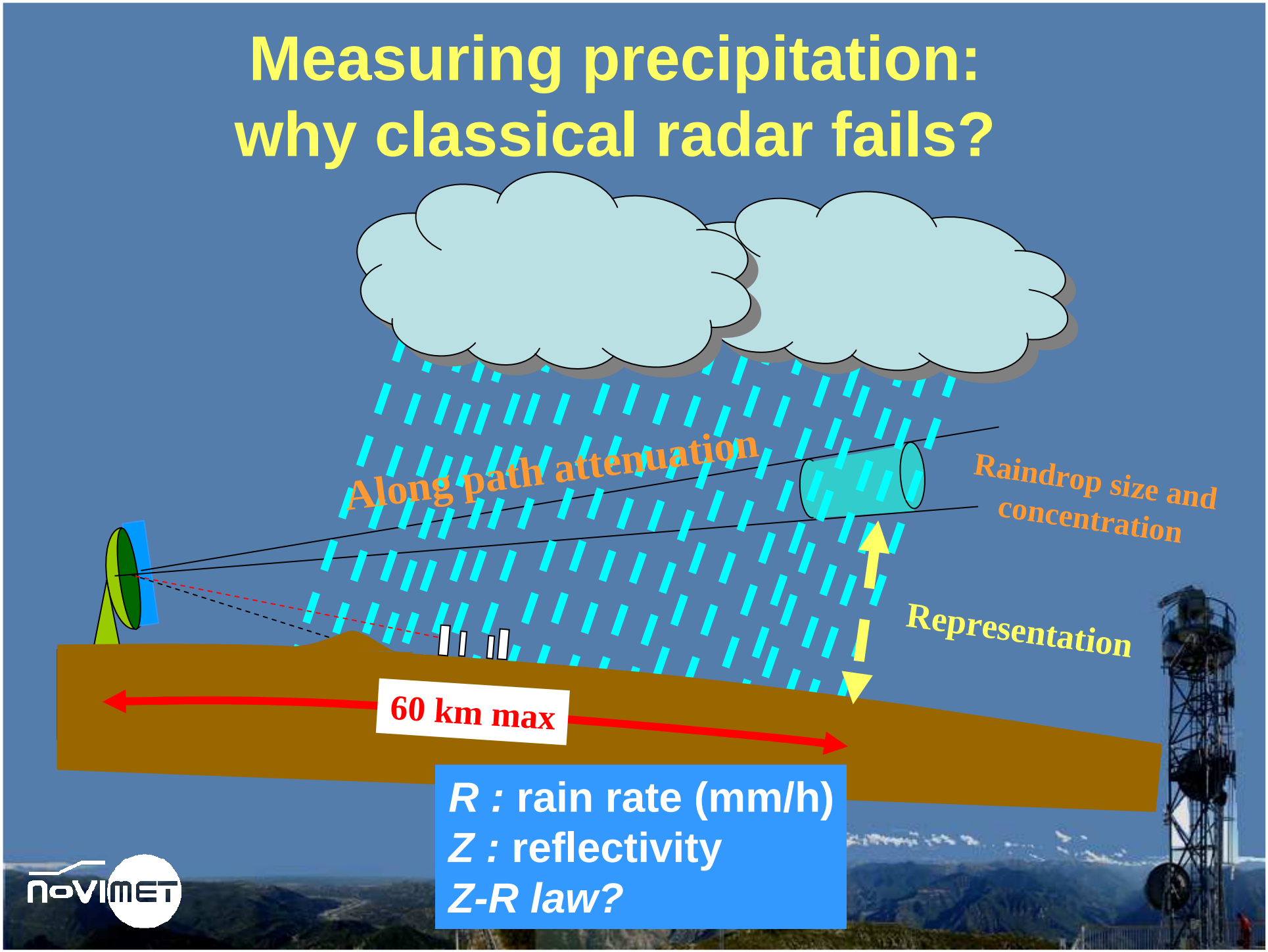
Measuring precipitation: why classical radar fails?



R : rain rate (mm/h)
Z : reflectivity
Z-R law?

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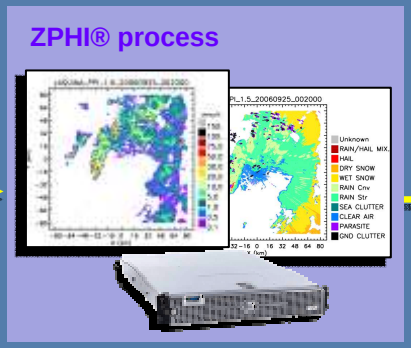
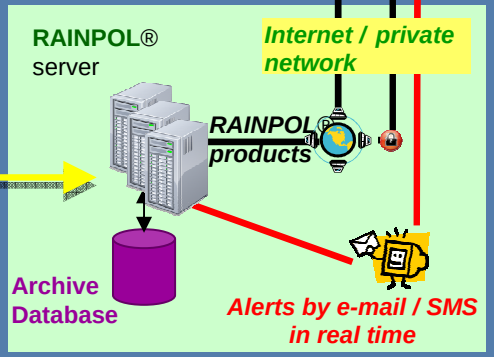
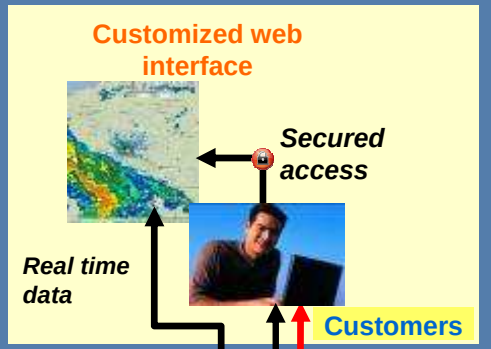
NOVIMET Solution

Real time data



Real time data





HYDRIX™

Polarimetric radar

For measuring radar observables

ZPHI®

Software retrieval

Classification of précip. Rainfall rate

3 CNRS patents

RAINPOL®

Service Plateform

For user oriented applications

- **Geo Info System d'Info**
- **2-hr forecast**
- **Integrated Applications: hydrology, agriculture**
- **Interface web**

HYDRIX™ radar: X-band polarimetric & Doppler

Performance

- *Antenna*
- *low noise analog receiver*
- *Gain compensated / Temp*
- *Dynamics of numerical receiver*
- *Detection Threshold*
- *May operate without radome*

Maintenance

- *Remote monitoring of many BITE parameters*
  - *Transmitter*
  - *Analog receiver*
  - *Numerical receiver*
  - *Radar controller*
- *Test Signal Generator*

Reliability

- *Transmitter (solid state modulator)*
- *Positioner*
  - *holds 180 km/h without radome*
  - *Maintenance / 4 year*

Installation

- *Aerial weight 350 Kg*
- *Fits on existing infrastructure*
  - *Telecoms Tower, Water tower, Silo*
- *Power 5 KVA, 220V mono*
  - *Consumption 1.5 KW*
- *Telecoms 1 Mbit/s link*

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ZPHI® software: precipitation retrieval from polarimetric observables

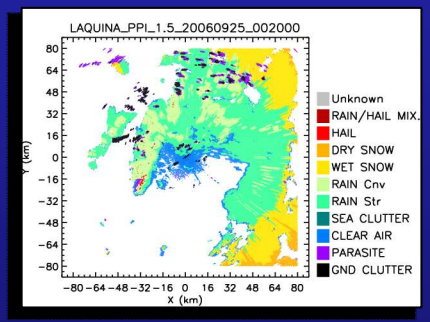
Input data: Z, Z_{DR}, Φ_{DP}, ρ_{HV}

Background:

- Physical models — *Normalised DSD, Drop shape*
- Scattering models — *T- Matrix, Others (ice particles)*
- Algorithm — *CNRS patent*

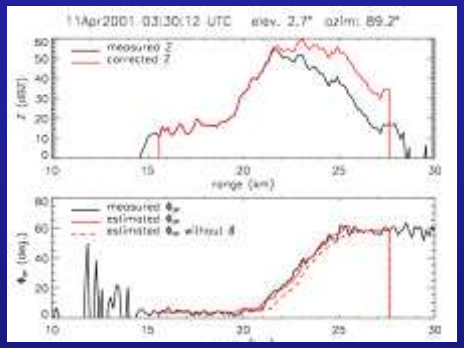
Classification of the precipitation

rain, snow, melting snow, hail



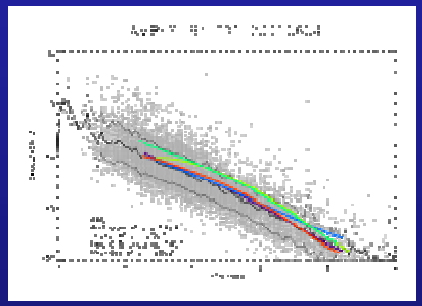
ZPHI® software

Rain rate (snow rate) retrieval : $R=f(Z_c,N_0^*)$



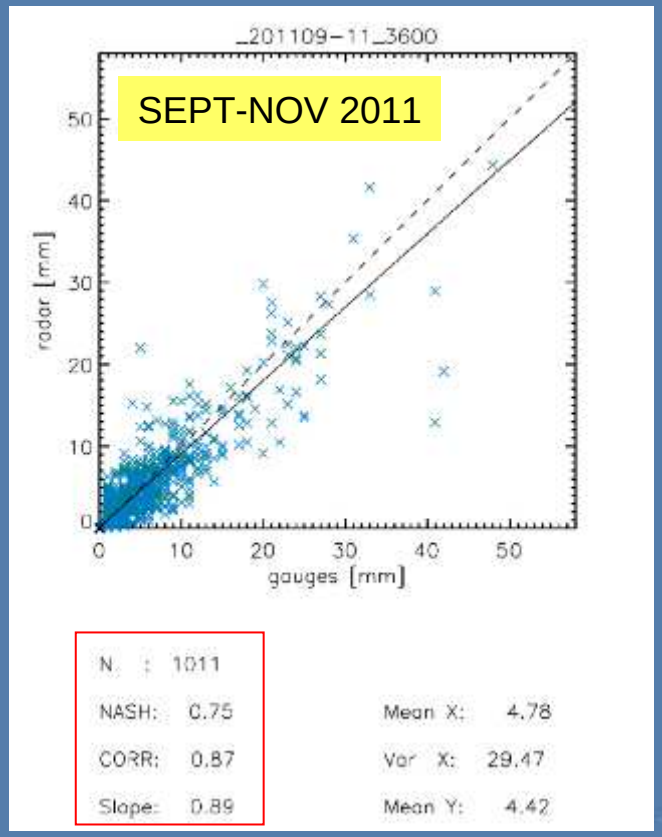
Monitoring of radar calibration

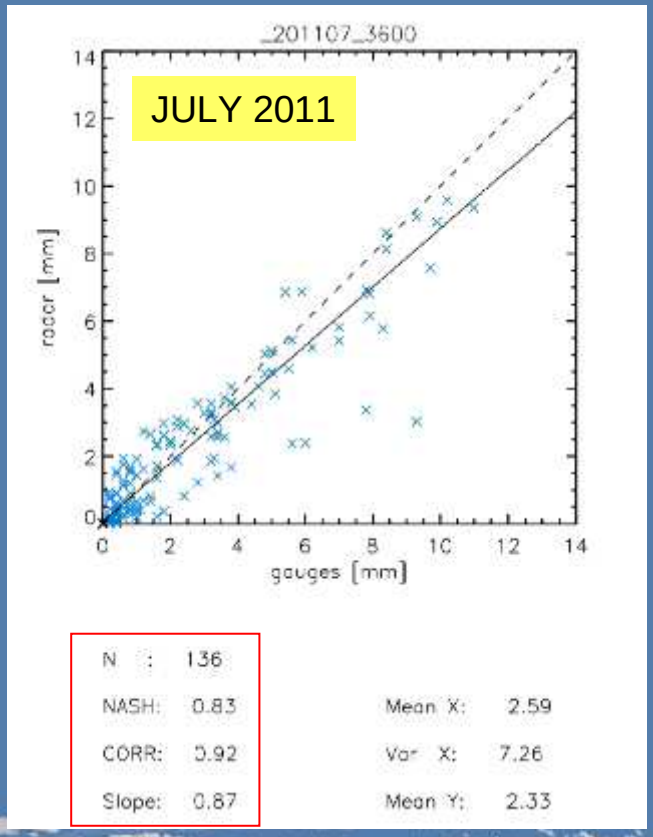
Consistency between Z_c, K_{DP}, Z_{DR}



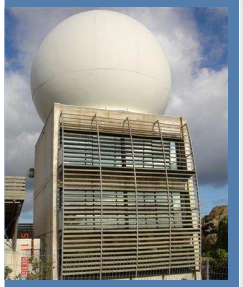
Comparison of ZPHI® estimate with Météo France rain gauges

- Evaluation for last four months

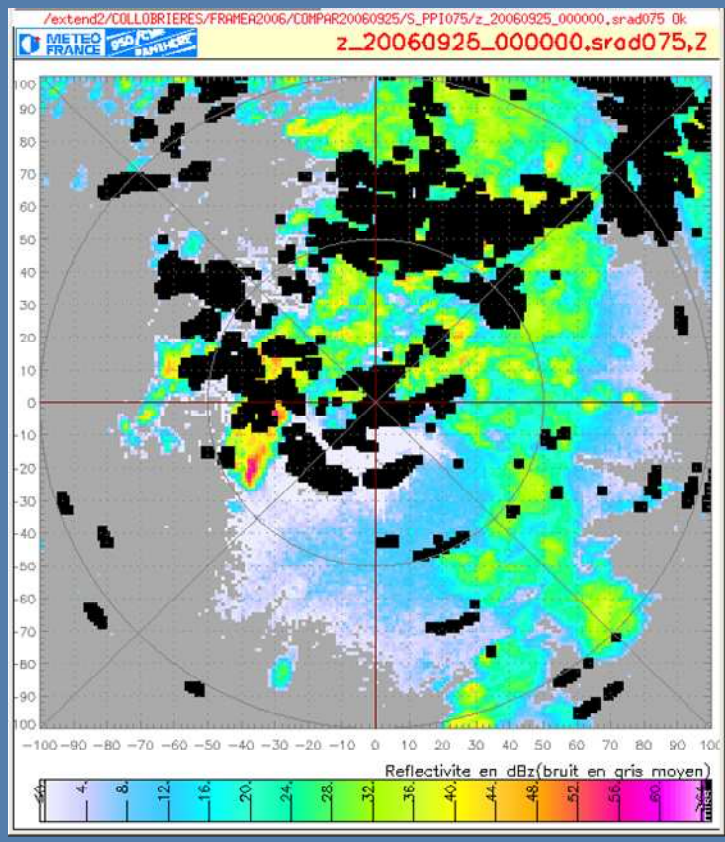


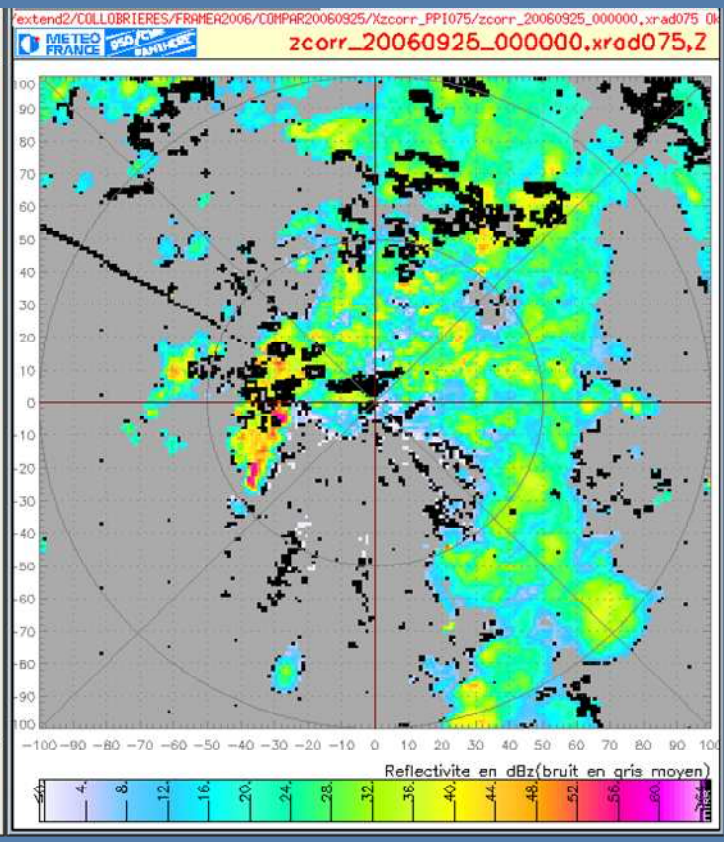


Compared visibilities of two radars, respectively S band and X band installed 4 km apart



Météo France Collobrières





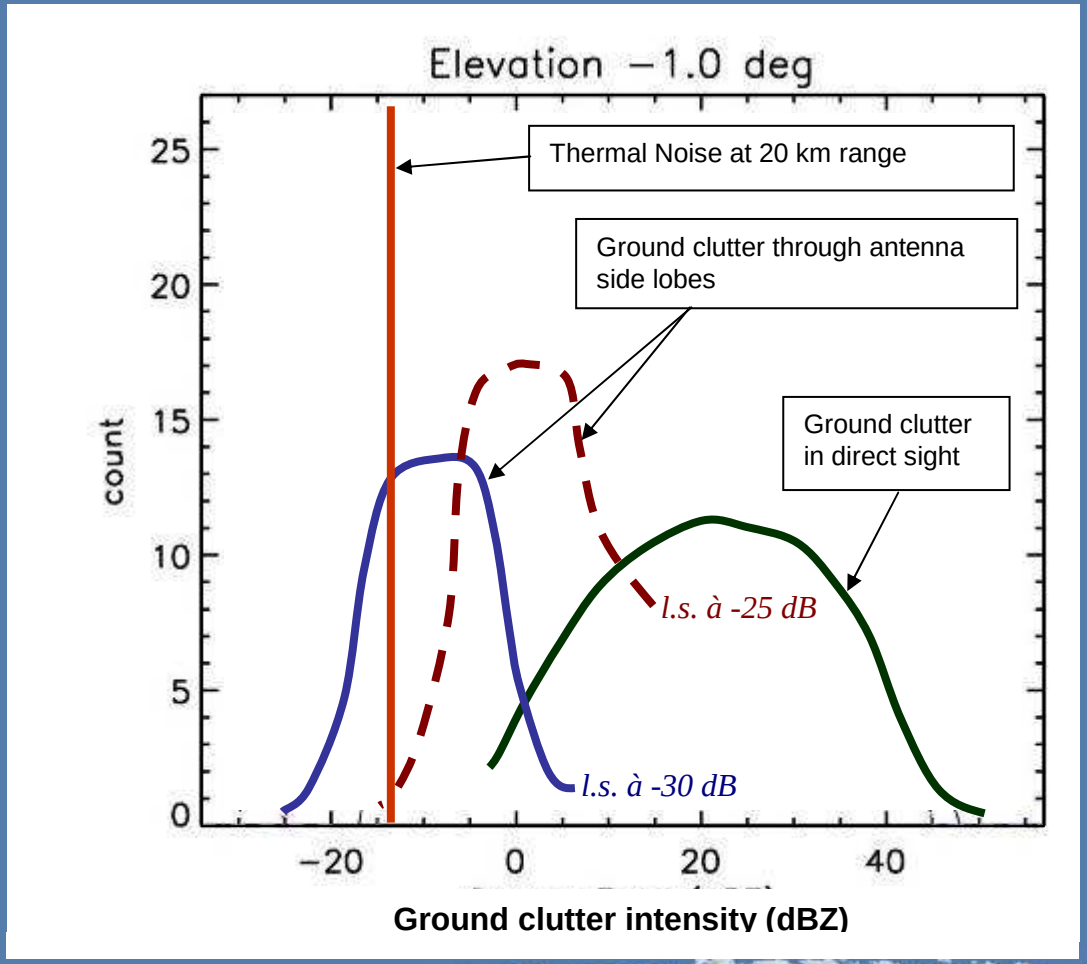
NOVIMET Laquina

Reflectivity provided by S band **Same picture provided by X band**

In black, blind areas due to ground clutter

Offset antenna to reduce ground clutter

Sidelobes level
< -30 dB

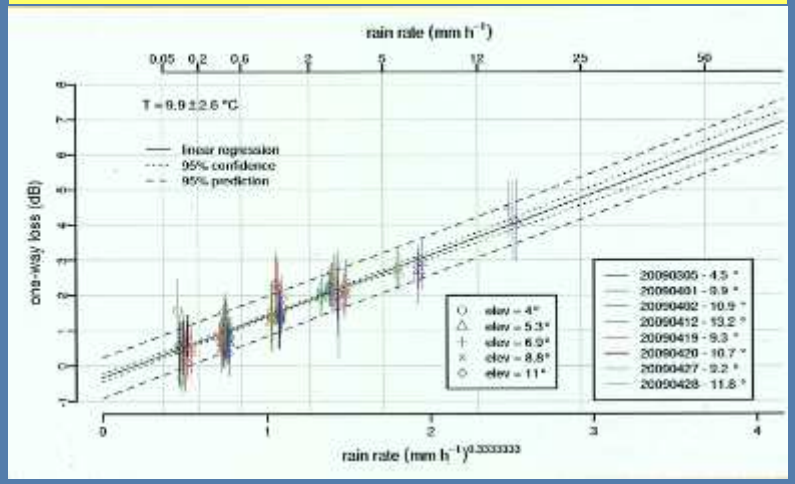


Side lobes level
< -25 dB

Does rain over the radar affects rainfall estimate?

With radome

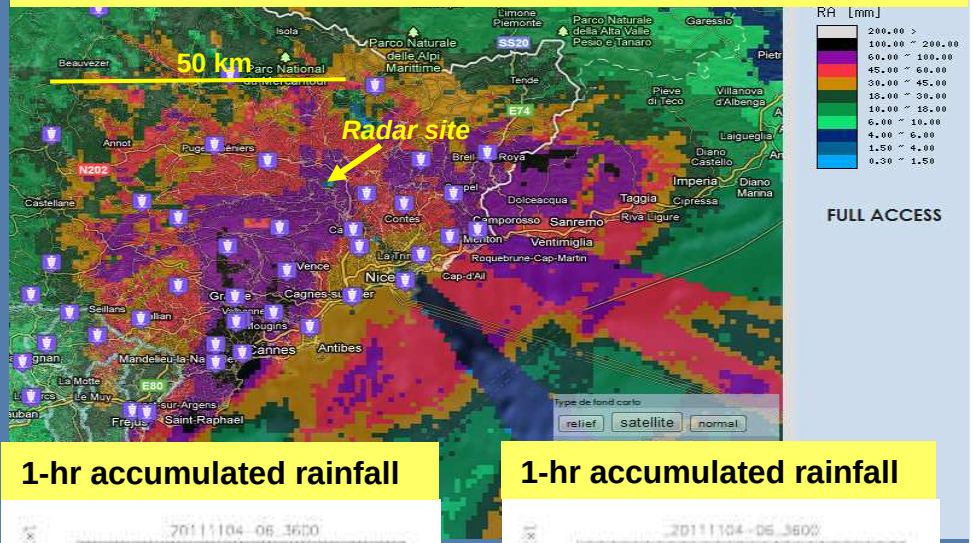
From Cremonini, 2011



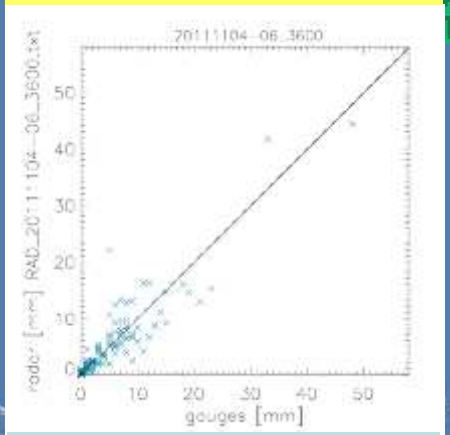
Rain rate	Two-way Loss
RR (mm/h)	L-radome (dB)
0,5	2,1
1	2,8
3	4,4
5	5,3
10	6,9

Without radome

Rainy event on October 25th, 2011 in Maritimes Alpes



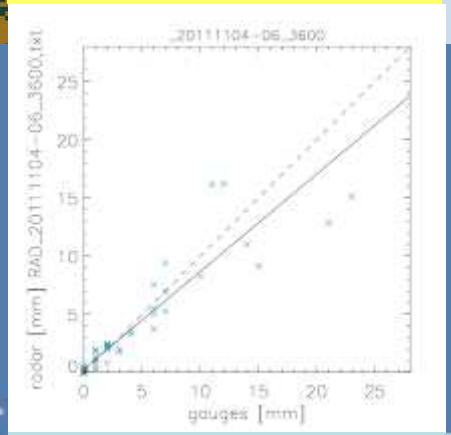
1-hr accumulated rainfall



RR_{1hr} ≥ 5mm (N=89)

0 dB

1-hr accumulated rainfall

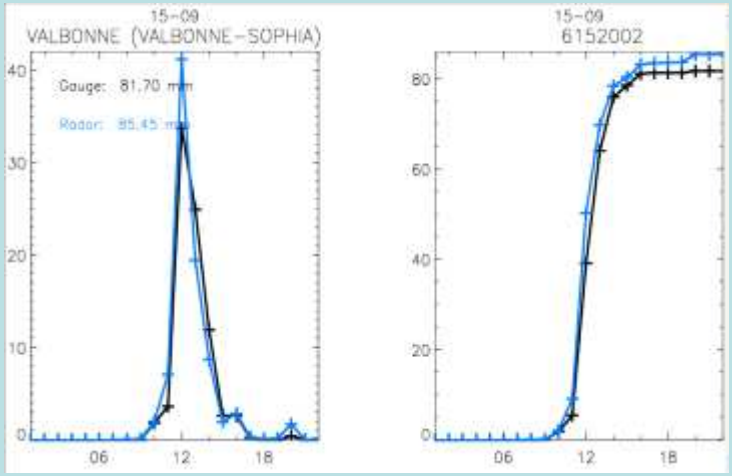


RR_{1hr} ≥ 10mm (N=30)

-0.6 dB

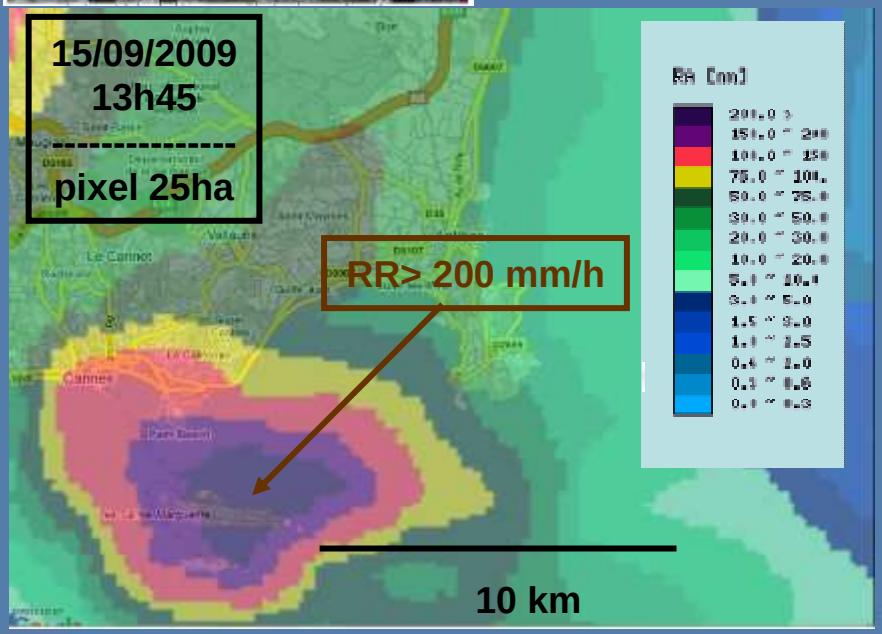
CANNES

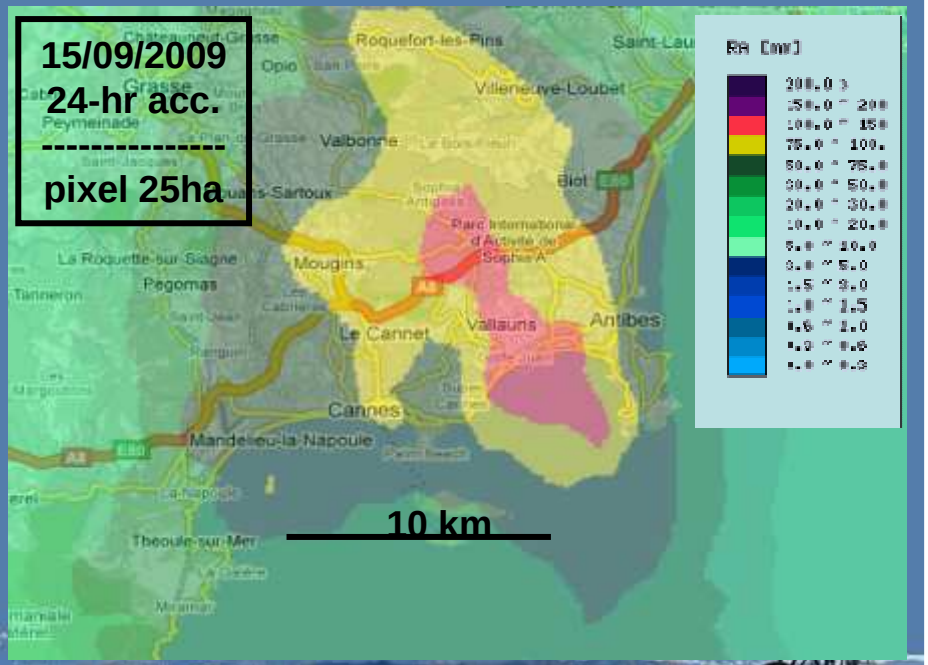
15/09/2009 13:00

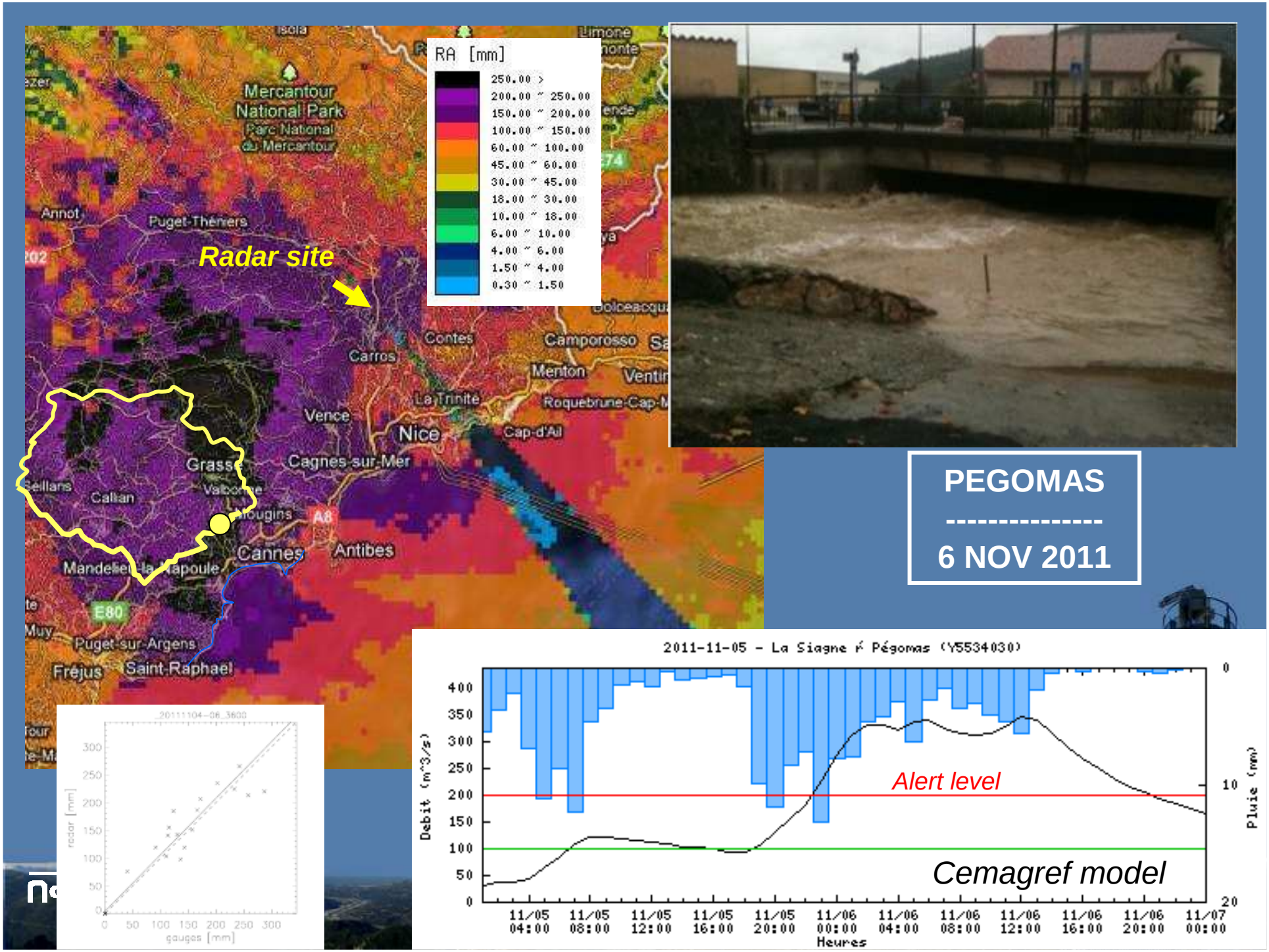


Rain rate (mm/h) accumulated rain (mm)

15 septembre 2009 à Valbonne

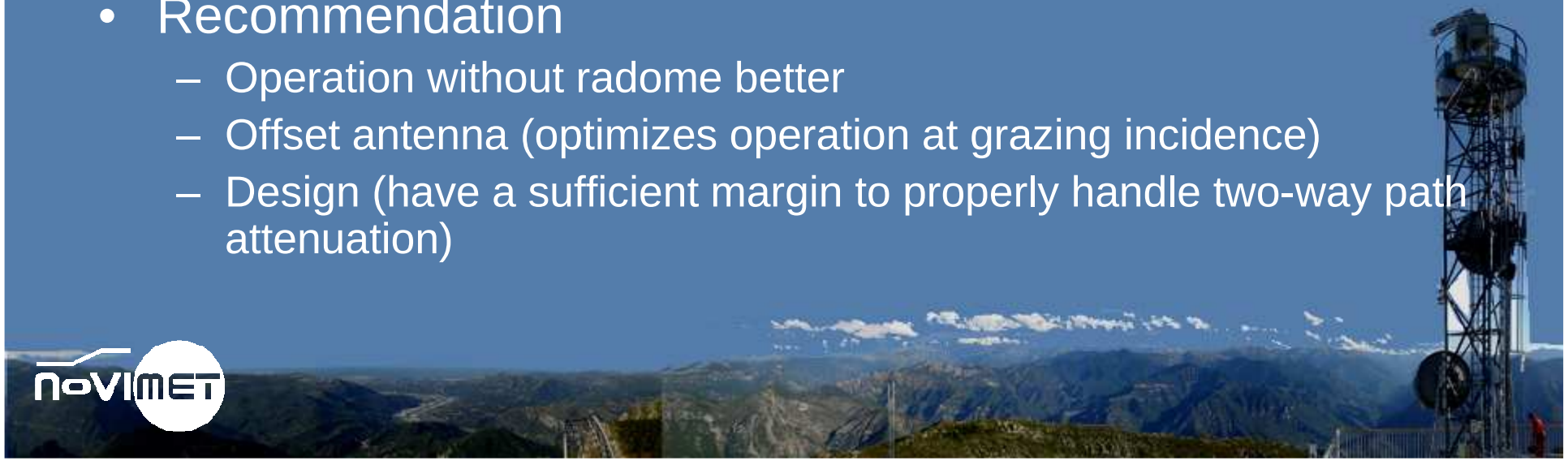





RA [mm]
250.00 >
200.00 ~ 250.00
150.00 ~ 200.00
100.00 ~ 150.00
60.00 ~ 100.00
45.00 ~ 60.00
30.00 ~ 45.00
18.00 ~ 30.00
10.00 ~ 18.00
6.00 ~ 10.00
4.00 ~ 6.00
1.50 ~ 4.00
0.30 ~ 1.50
Radar site
Mercantour National Park
Parc National du Mercantour
Annot
Puget-Théniers
Carros
Contes
Camporosso
Menton
La Trinité
Roquebrune-Cap-M
Vence
Nice
Cap-d'Ail
Grasse
Cagnes-sur-Mer
Callian
Cannes
Antibes
Mandelieu-la-Napoule
E80
Puget-sur-Argens
Fréjus
Saint-Raphaël
A8
PEGOMAS
6 NOV 2011
2011-11-05 - La Siagne à Pégomas (Y5534030)
Débit (m^3/s)
Pluie (mm)
Alert level
Cemagref model
Heures
11/05 04:00
11/05 08:00
11/05 12:00
11/05 16:00
11/05 20:00
11/06 00:00
11/06 04:00
11/06 08:00
11/06 12:00
11/06 16:00
11/06 20:00
11/07 00:00
radar [mm]
gauges [mm]

Our customers with Mont Vial radar

Customer	Produit/Service	Application
Météo France	Raw radar data, R&D on snow algorithm retrieval	Short term forecast
Conseil Général 06	Rainpol service	Civil protection, roads
Towns : Nice, Antibes, Cannes, Biot	Rainpol service	Civil protection
Water operators: Lyonnaise des Eaux, Véolia, Safège	Rainpol service	Urban water management, Mitigation of pollution by rain water

Interest of X band radar for urban hydrology

- Advantage of X band compared to S band
  - Easy to deploy in urban environnement - reduced infrastructure
  - Measurement accuracy of rain (→ 60 km), without using a rain gauges network
  - Pollution caused by ground clutter / sea clutter reduced
- Recommendation
  - Operation without radome better
  - Offset antenna (optimizes operation at grazing incidence)
  - Design (have a sufficient margin to properly handle two-way path attenuation)