RHYTMME

Hydrometeorological Risks in Mediterranean Mountainous areas

supported by

Région Provence-Alpes-Côte d'Azur

UNION EUROPÉENNE

The European Union supports RHYTMME. Europe is involved in Provence-Alps-Côte d'Azur Region with Fonds Européen de Développement Régional

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RÉPUBLIQUE FRANÇAISE

Ministère de l'Écologie, du Développement durable et de l'Énergie

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1 : Météo-France ; 2 : Irstea

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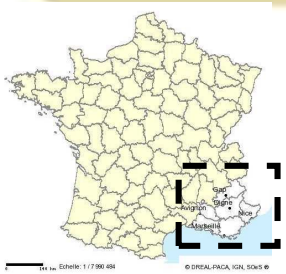
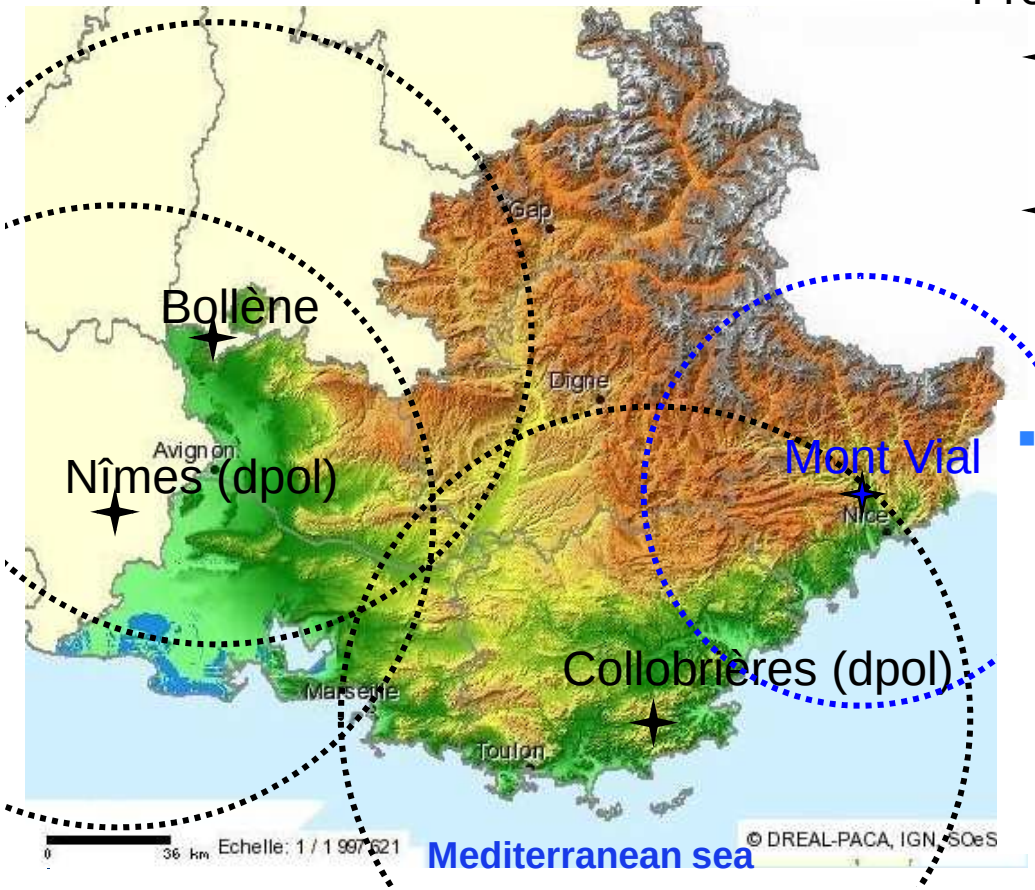
The birth of RHYTMME project … in 2008



- all the ~1000 districts are concerned with at least one of these natural hazards : floods, debris flow, landslides, avalanches, forest fires. All are linked to precipitations.

Provence - Alpes - Côte d'Azur region



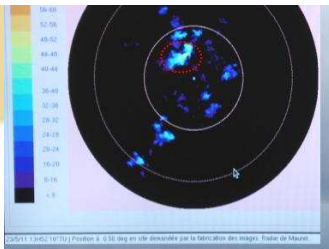
Pre-existing radars:

- S-band radars (Météo France operational network)
- X-band dpol radar (CNRS, Novimet)

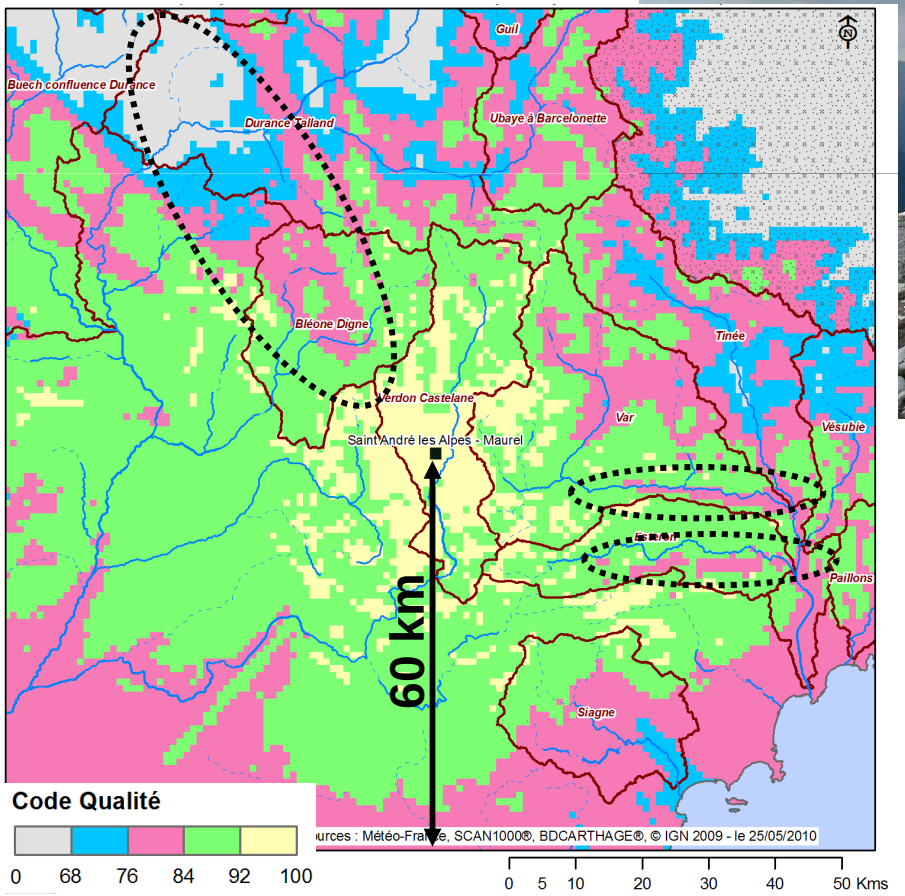
- In such a context, the aims are :
  - –to complete the existing radar network in **rugged** areas
  - –to develop a software platform delivering **real-time warning services** for risk managers

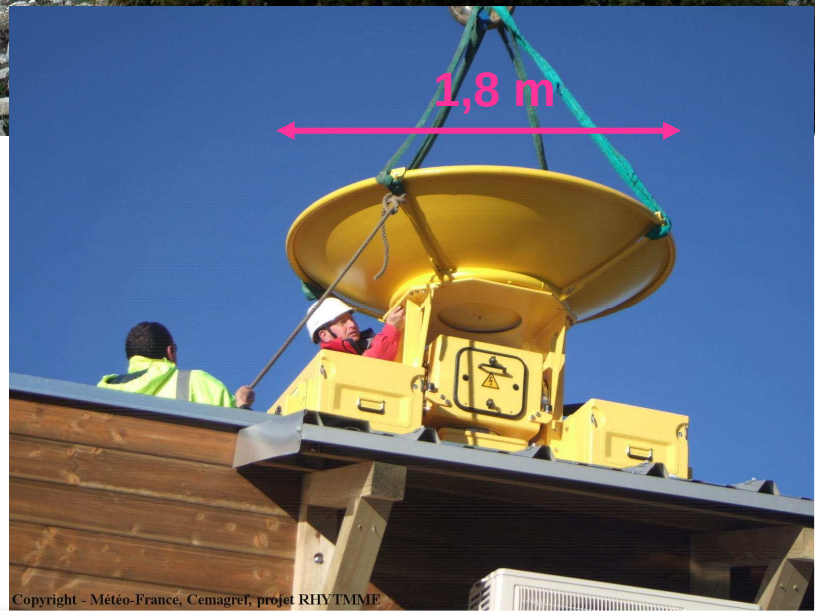
The first X-band radar of the project (Maurel mountain, 1770m)

- Inaugurated on May 2011
- 60m/s wind-proof radome



Simulated radar quality indexes (0-100)

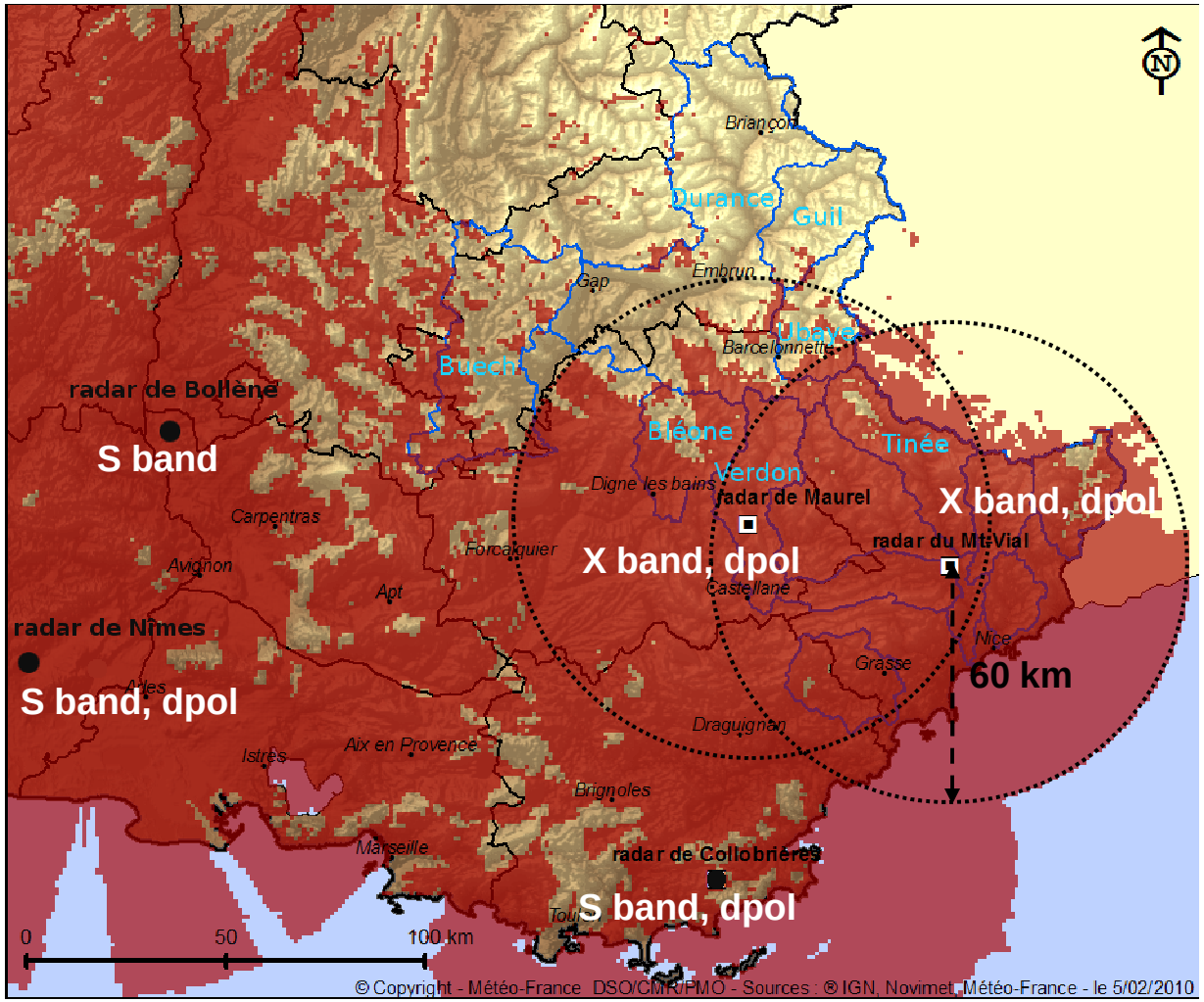




ERAD 2012

Current radar network

Simulated radar quality indexes (0-100) **> 84**



- Météo-France operational radar network

+ X-band Doppler dual polarized radar (Mont Vial 1550m, Novimet company)

+ First RHYTMME X-band Doppler dual polarized radar (Mont Maurel 1770m)

Significant overlapping :
-to mitigate attenuation and extinction
-to minimize mask effect

Quality indexes > 84

Main catchment basins

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How are these radar data processed ?

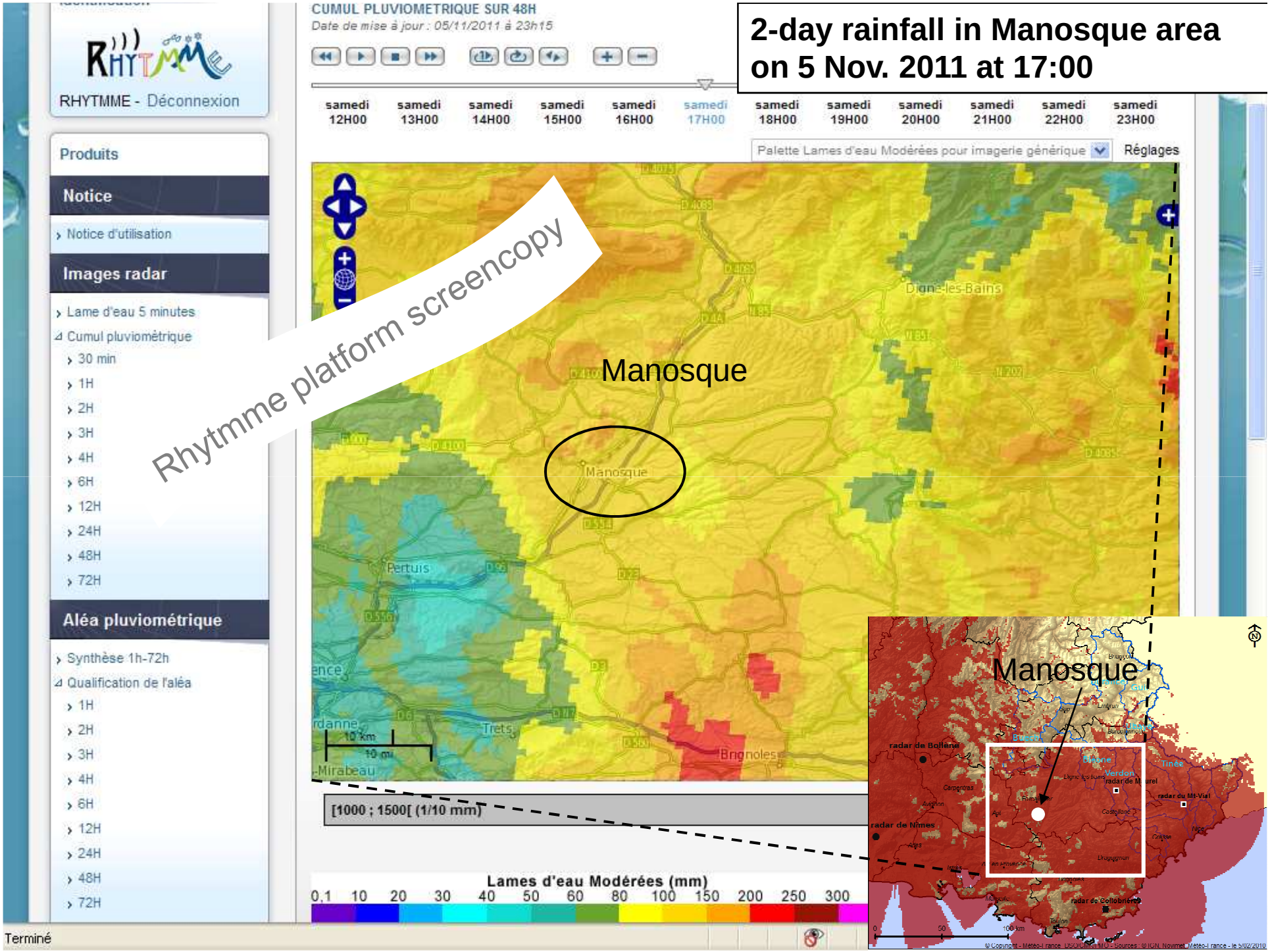
- QPE algorithms
  - Since June 2011, real-time QPE (Figueras QPE-I ; Champeaux, poster 7QPE)
  - Very soon : reflectivity and specific differential phase (“Z-KDP”) (Kabeche, QPE-III ; Figueras i Ventura, QPE-I ; Al-Sakka, MIC-I)
- effect of wet radome on rainfall estimates (Frasier, poster 232NET)
- 3D Wind field retrieval (Beck, NET-II)
- NWP model improvement with assimilation of radar wind, reflectivity (Wattrelot, NWP)
- retrieval of refractivity measurements (Besson, SP-I)

From radar data to end-user platform

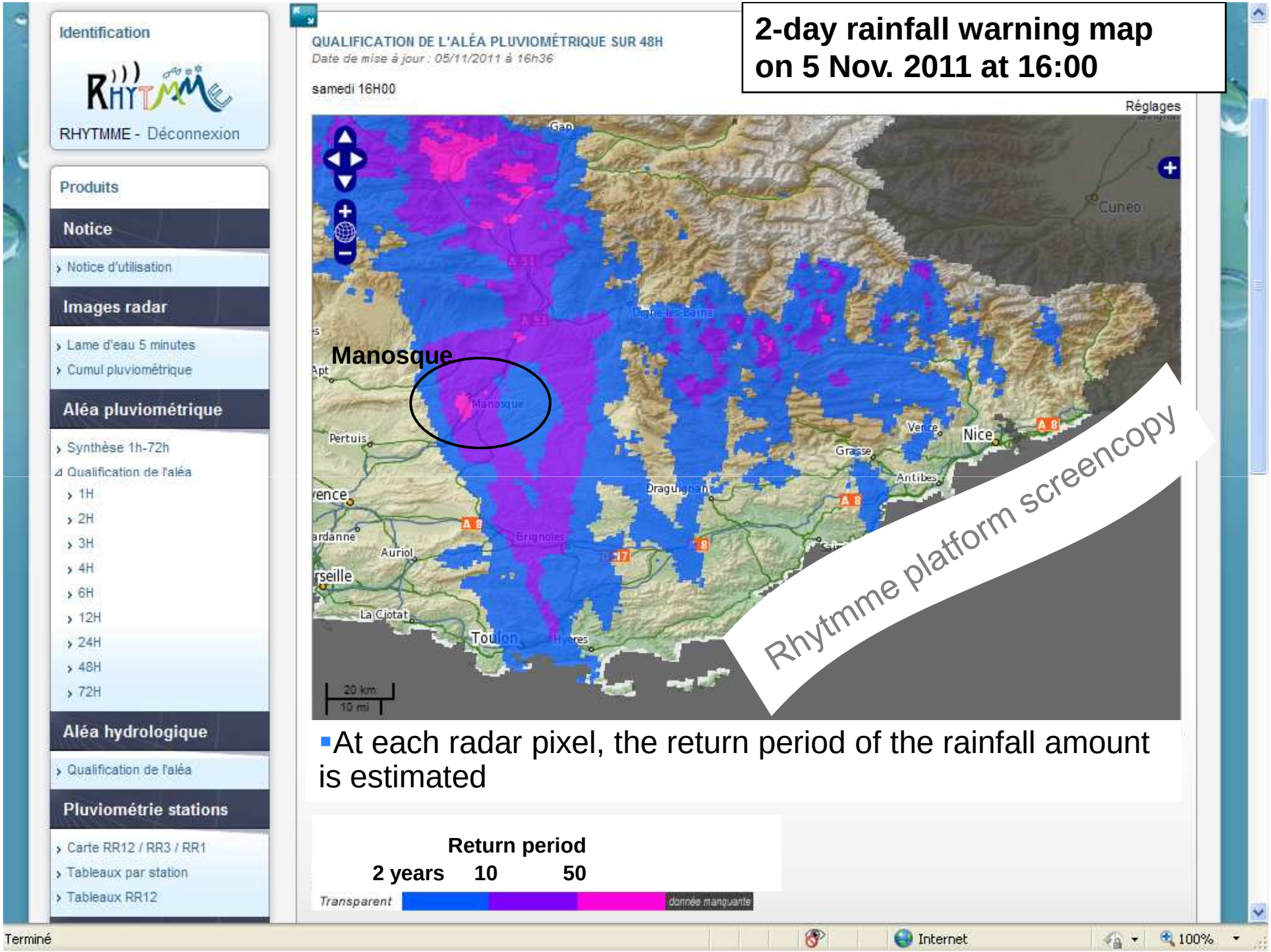
- Radar algorithms deliver real-time QPE every 5 minutes at 1 km^2 resolution
- Hydrometeorological geocoded maps are built with these QPE :
  - maps of rainfall cumulated over 5 minutes to 3 days ;
  - rain and flash flood hazard warning maps.
- These maps are made available by a Web Map Server and can be displayed in real-time on Internet
- This platform has been tested by an end-user group for november 2011

  ~40 representatives from Government agencies, departmental councils, districts, river associations, Forest agencies, nature reserves and companies (national electric power enterprise, train transportation national society, …).

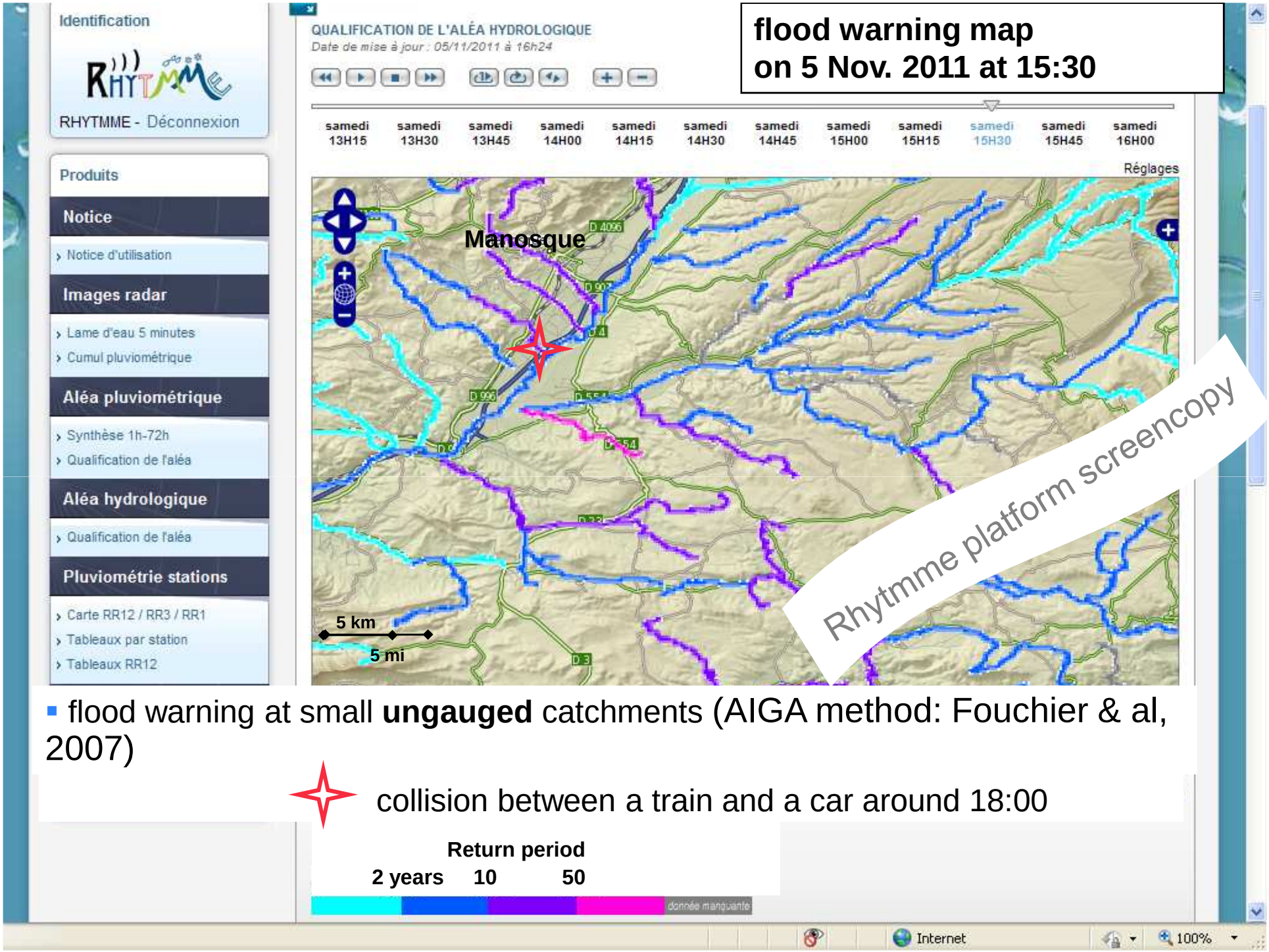
2-day rainfall in Manosque area on 5 Nov. 2011 at 17:00



2-day rainfall warning map on 5 Nov. 2011 at 16:00



- At each radar pixel, the return period of the rainfall amount is estimated



flood warning map on 5 Nov. 2011 at 15:30

Rhytmme platform screencopy

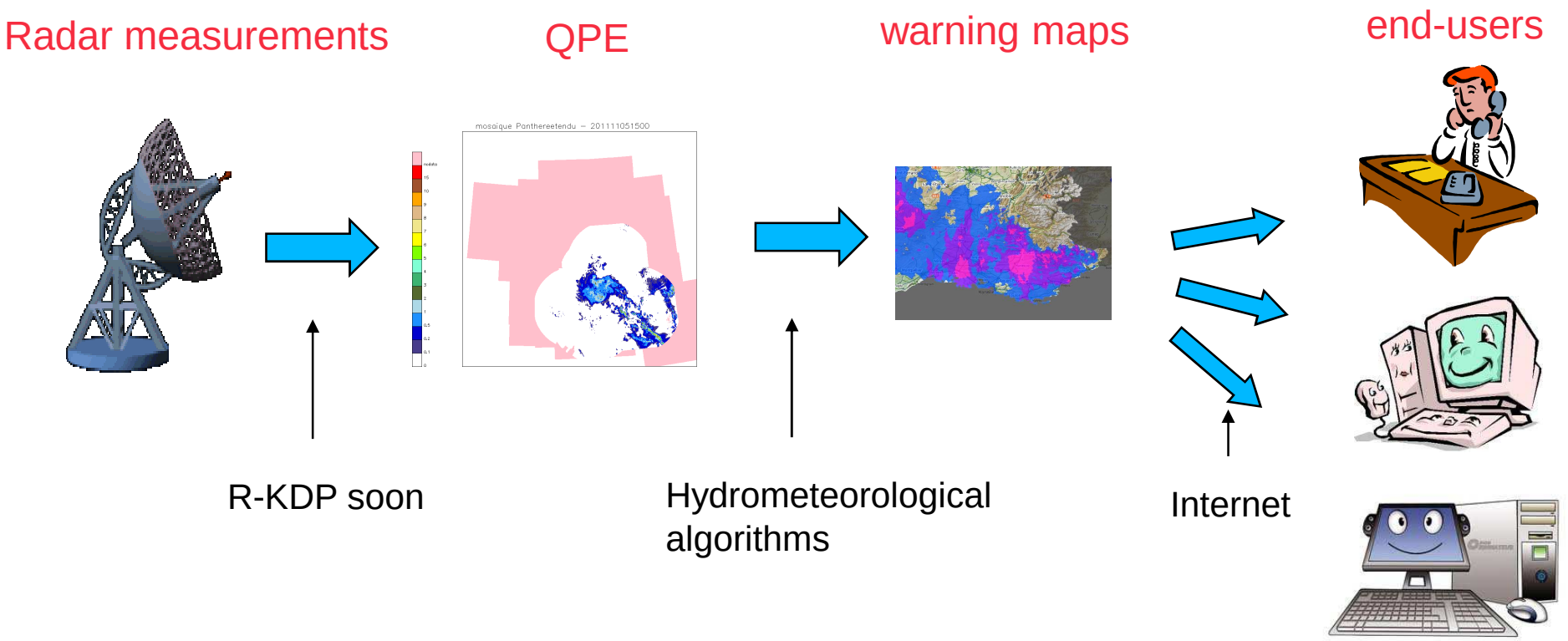
- flood warning at small **ungauged** catchments (AIGA method: Fouchier & al, 2007)

collision between a train and a car around 18:00

Conclusions

- **X-band Doppler dual polarized radar network** to complete the coverage over **mountainous areas** with a strategy of networking to cope with attenuation

- A first real-time complete chain from radar measurement to end-user information :



Perspectives

Radar measurements

- Two more X-band radars installed in 2012 and 2013
- To use polarimetric algorithms for infering **snow fall estimates** (Moreau, poster 80MIC)

Rainfall consequences

- 2012
  - E-mails warning end-users
  - Hydrological model better fitted to very small catchments (5-10 km^2)
  - Advection of precipitation field
- 2013
  - Other hazard sensitivity maps (debris flow, landslides, forest fires)

Acknowledgements

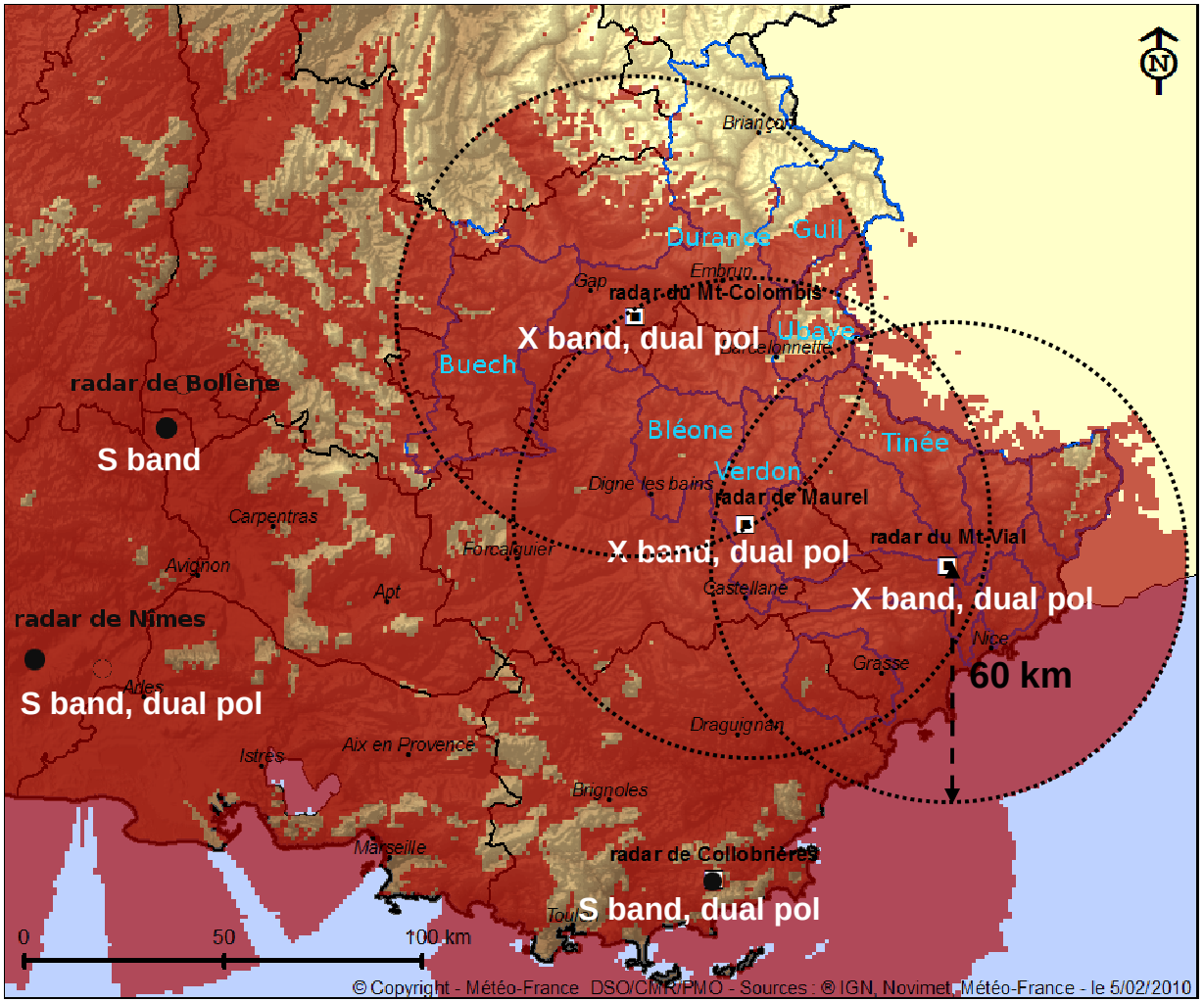
- Many thanks to :
  - the numerous people involved in RHYTMME project as well as local authorities whose cooperation is very pleasant.
    Manpower : 44 men.year (about one **hundred people**)
  - the supporting agencies (Provence-Alpes-Côte d'Azur Regional Council, European Union, French Ministry of Ecology)
    Budget : 10,5 M€ (13.5 M$) over 6 years (2008-2013).

Thank you for your attention !

Extra slides

Radar network at the end of 2012

Simulated radar quality indexes (0-100) **> 84**



19m-high radar tower planned at Mont Colombis

Quality indexes > 84

Main catchment basins

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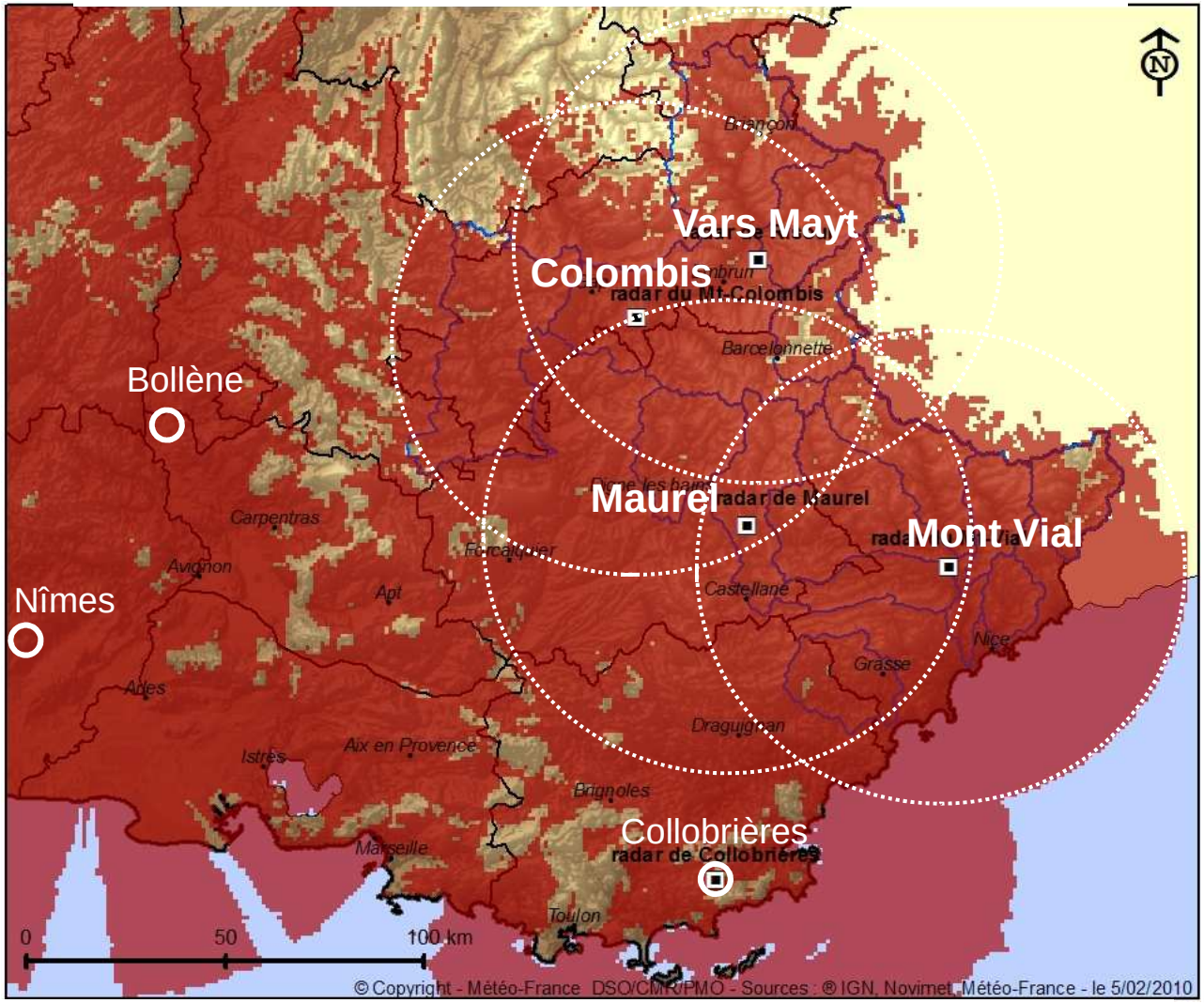
Radar network at the end of 2013

Simulated radar quality indexes (0-100) **> 84**



- 2013 : **Vars Mayt**, 2570m

Indices qualité > 84

Bassins versants

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