

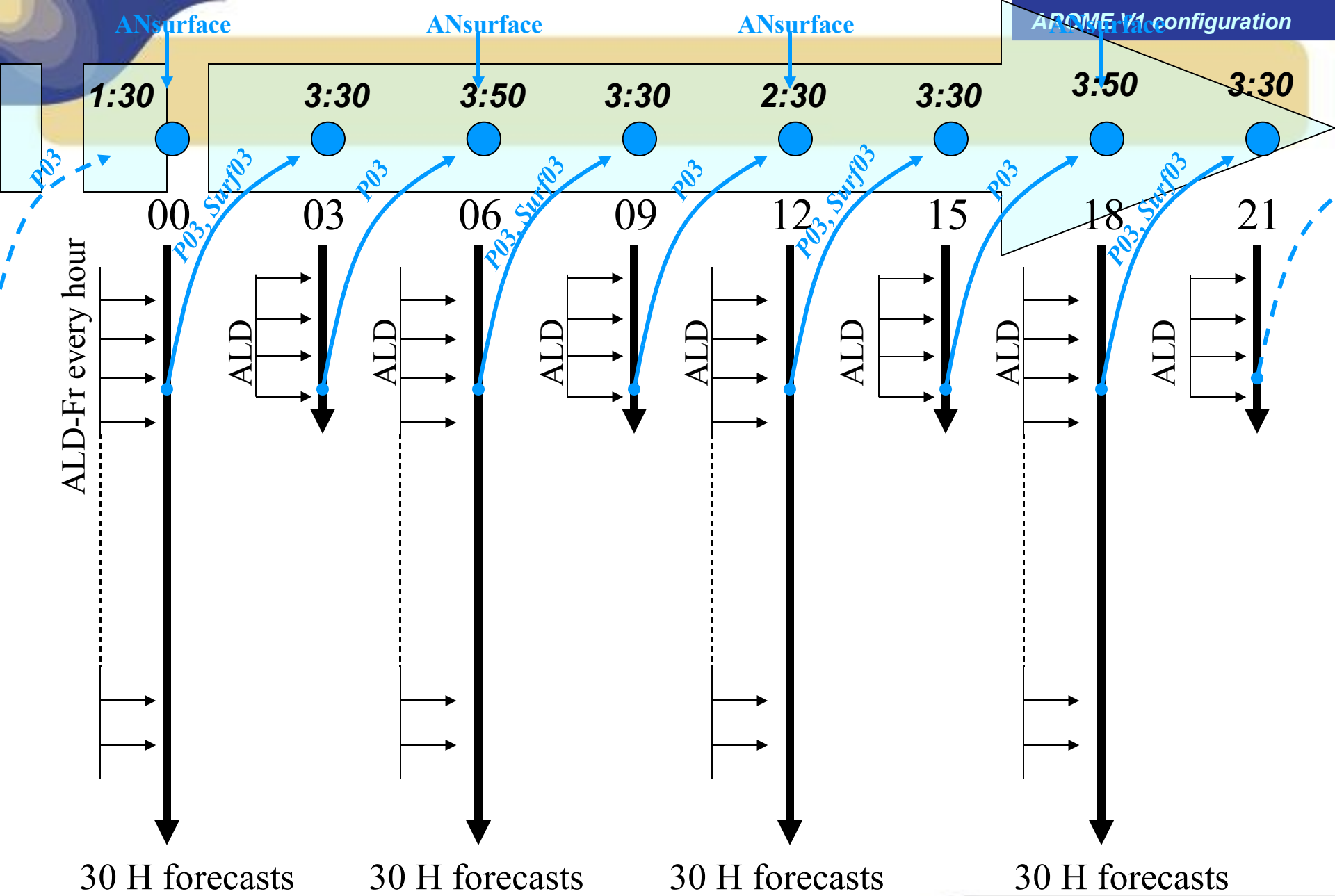
# Arome in Météo-France

## Operational configuration

Convection workshop  
23-24 novembre, Toulouse



**METEO FRANCE**  
Toujours un temps d'avance

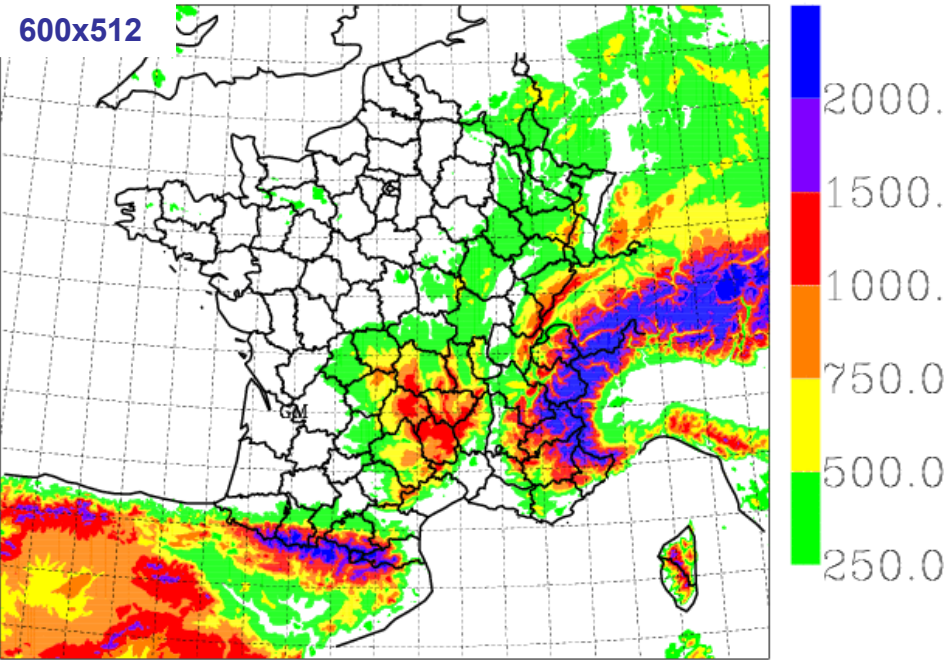


# Geographical domains

- Domain

このドメインはフランスの全土をカバーする

600x512

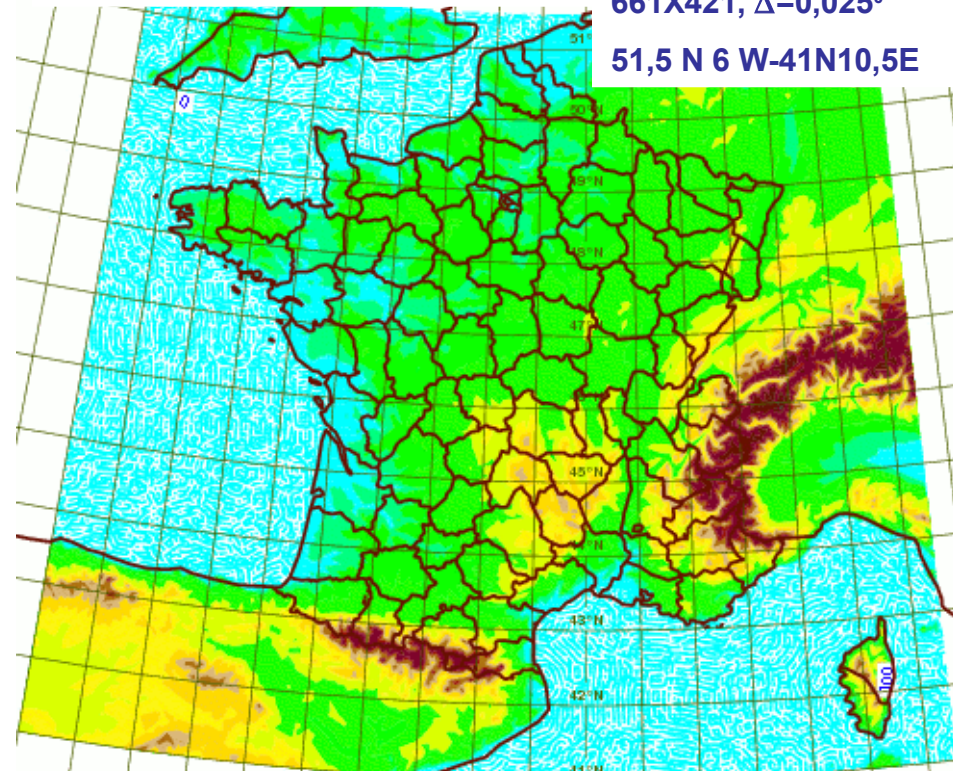


600x512pts, Dx=2.5km, 41L, Dt=1mn

このドメインはフランスの全土をカバーする  
ドメインのメッシュは

661X421,  $\Delta=0,025^\circ$

51,5 N 6 W-41N10,5E



661X412,  $Dlon=0.025^\circ$ ,  
Pressure & Z-level  
(00/06/12/18), forecasts up to 30 hours  
outputs every hours.

# First operational version of Arome at Météo-France

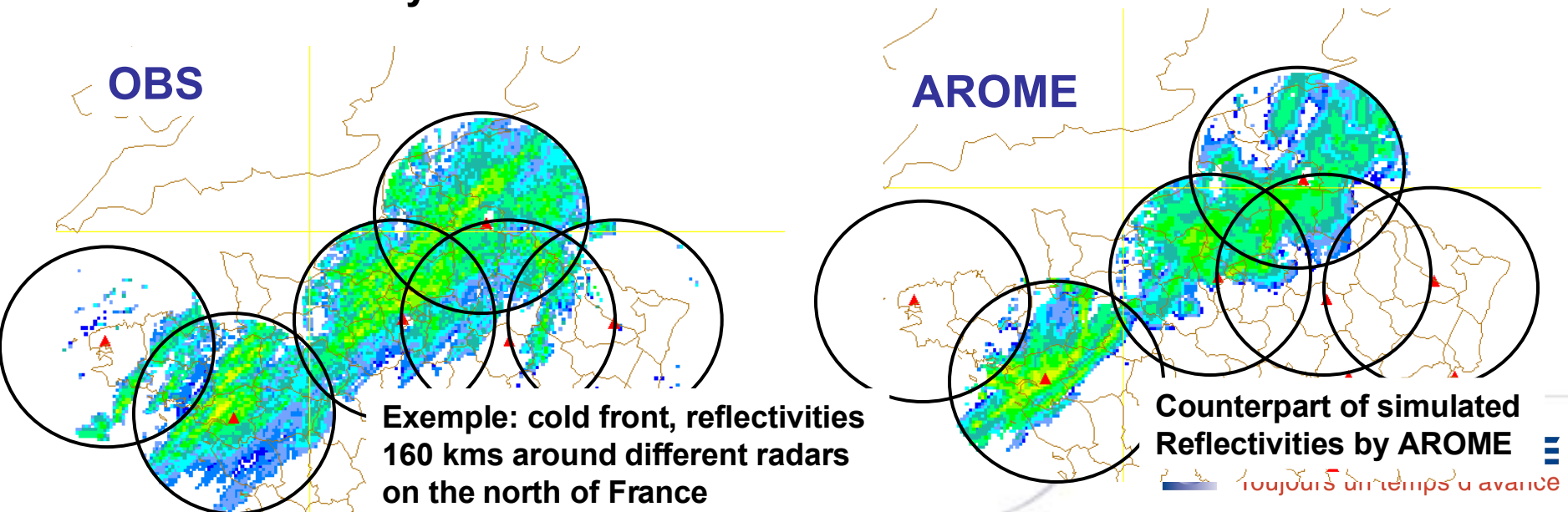
- The pre-operational suite is now running in its final form. This one contains :
  - Dynamical core :
    - The dynamical core of Arome is the one of Aladin-NH (*Bubnova et al. 1995*). It uses also a SISL2TL with a 1 minute time step.
    - The coupling to the large scale is done every hour with the operational Aladin-France
  - Atmospheric physical package :
    - Pronostic microphysics (ICE3) with 5 water species (*Pinty and Jabouille, 1998*)
    - 1D Tubulence scheme with pronostic turbulent kinetic energy (*Cuxart and al. 2000*)
    - Radiation : so called rrtm scheme in long wave (*Mlawer and al. 1997*) and Fouquart Mocrete with 6 channels in short wave. The frequency of the radiation call is every 15 time steps
    - Shallow convection : EDKF scheme (EDMF type, Pergaud et al 2009)
  - Surface physical package :
    - Surfex witch includes the modelisation of nature (*Isba scheme Noilhan and Planton 1998*), sea (Ecume fluxes), town (TEB scheme :*Masson 2000*) and lakes. Surfex have been recently been improved with the development of a turbulent scheme inside the canopy (Masson and Seity 2009)



# First operational version of Arome at Météo-France

- The pre-operational suite is now running in its final form. This one contains :
  - Assimilation part :
    - 3D variational assimilation every 3 hours (*Fischer et al. 2006*). The background error statistics is calculated using an ensemble-based method (*Berre et al. 2006*).
    - Same assimilated observations as in ALADIN-France : conventional observations, 2m temperature and humidity, IR radiances from ATOVS and SEVIRI instruments, winds from AMV and scatterometers, ground based GPS.
    - + wind for doppler radars.

## Towards reflectivity assimilation : illustration of radar simulator in the model



# 2007-2008 : evaluation of Arome prototype and associated evolution

- 3 experimentations with forecasters : february 2007, June-July 2007, november-december 2007 & a systematic evaluation by our forecast laboratory
- Outcomes : evaluations of the prototype that lead to evolutions of the prototype contains
  - Warm biais of 2M temperature → Introduction of Canopy in the proto (oct 2007)
  - FA « Fireworks »: over-estimation of low-level wind circulation associated to convective celles → re-tuning of horizontal diffusion (oct 2007)
  - « herringbones »: same kind diagnoses but on shallow cumulus in weakly convective boundary layers over land → introduction of EDKF (in test oct 2007, activated in sep 2008)
  - Over-estimation of convection that leads to too much precipitation on intense precipitation → activation of slhd (semi lagrangian horizontal diffusion) on hydrometeors (sep 2008)

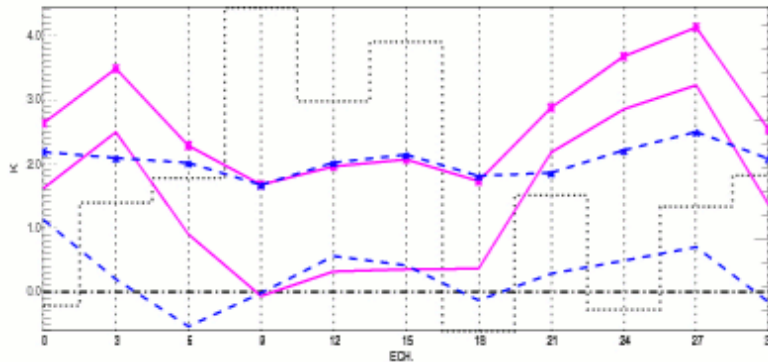




# Evolution of the Arome prototype

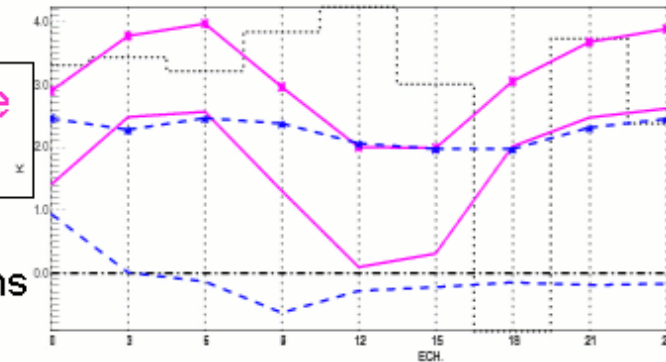
juillet 2007

janvier 2007



-- Référence  
-- CANOPY

Toutes stations



Heidke Skill Score (persistence)

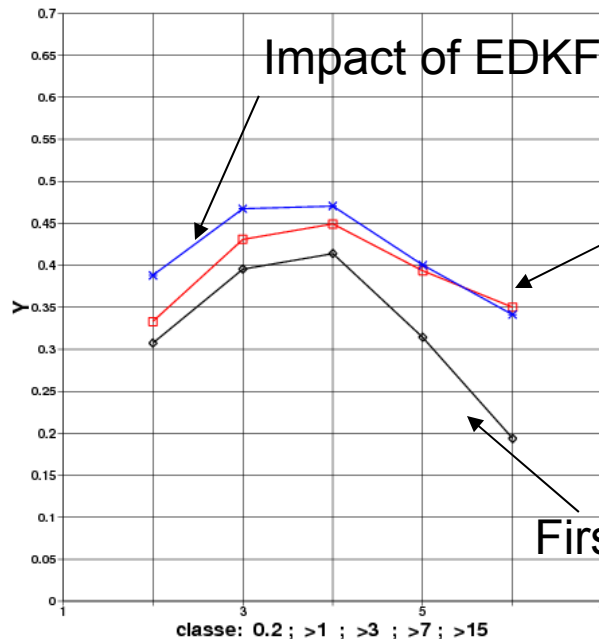
2007JuinNov

Impact of EDKF clear on weak precipitation

Impact of slhd clear on important precipitation

Current version of Arome

First version of the prototype



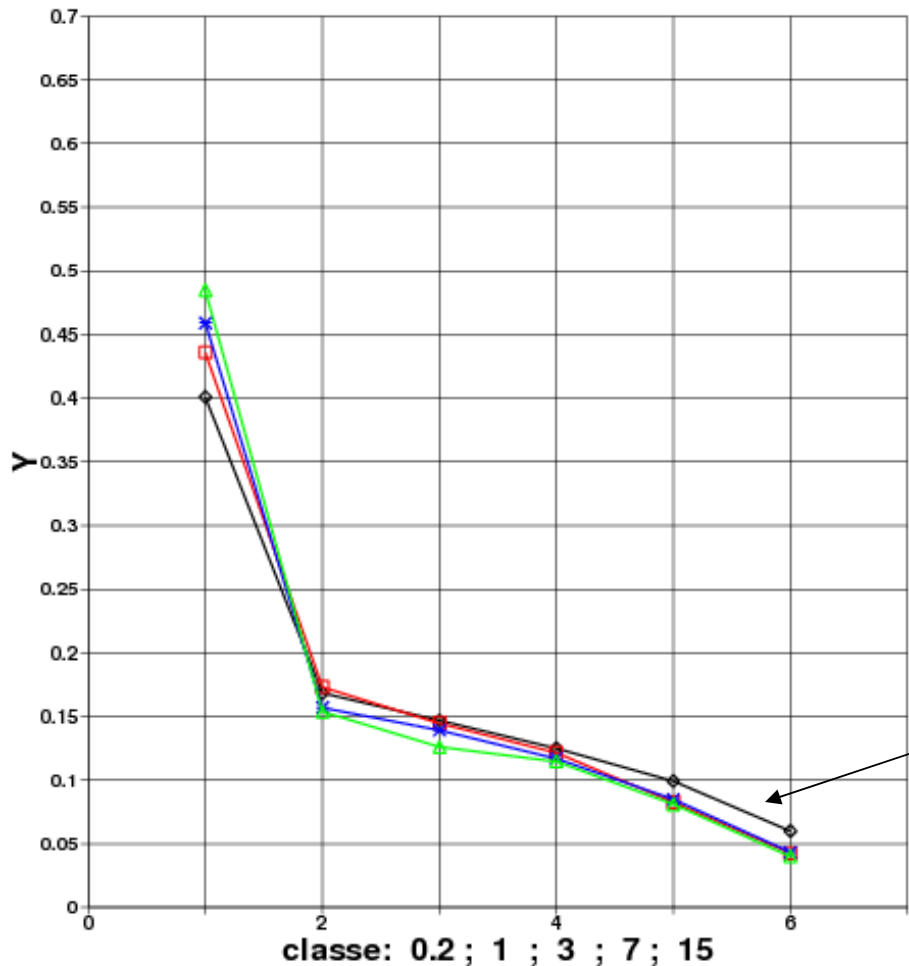
AROME\_SLHD\_EDKF  
AROME\_SLHD  
AROME\_62SR



# Evolution of the Arome prototype

HISTOGRAM

2007JuinNov



Current version of Arome

- △— OBS
- ×— AROME\_SLHD\_EDKF
- AROME\_SLHD
- ◇— AROME\_62SR

First version of the prototype



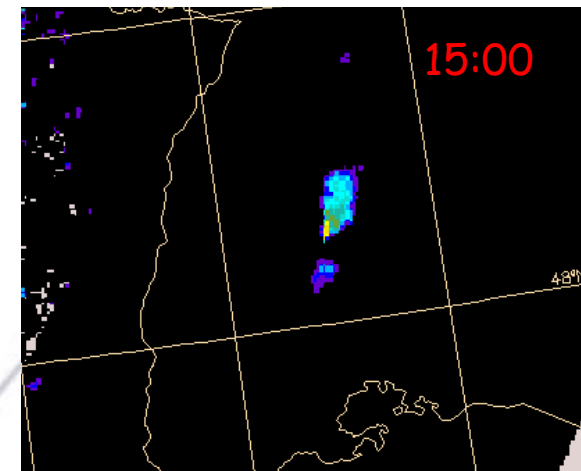
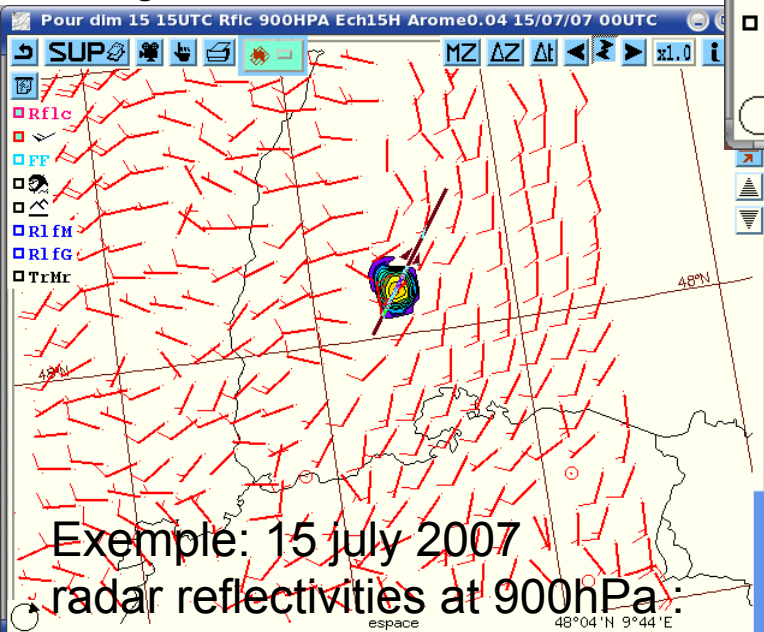
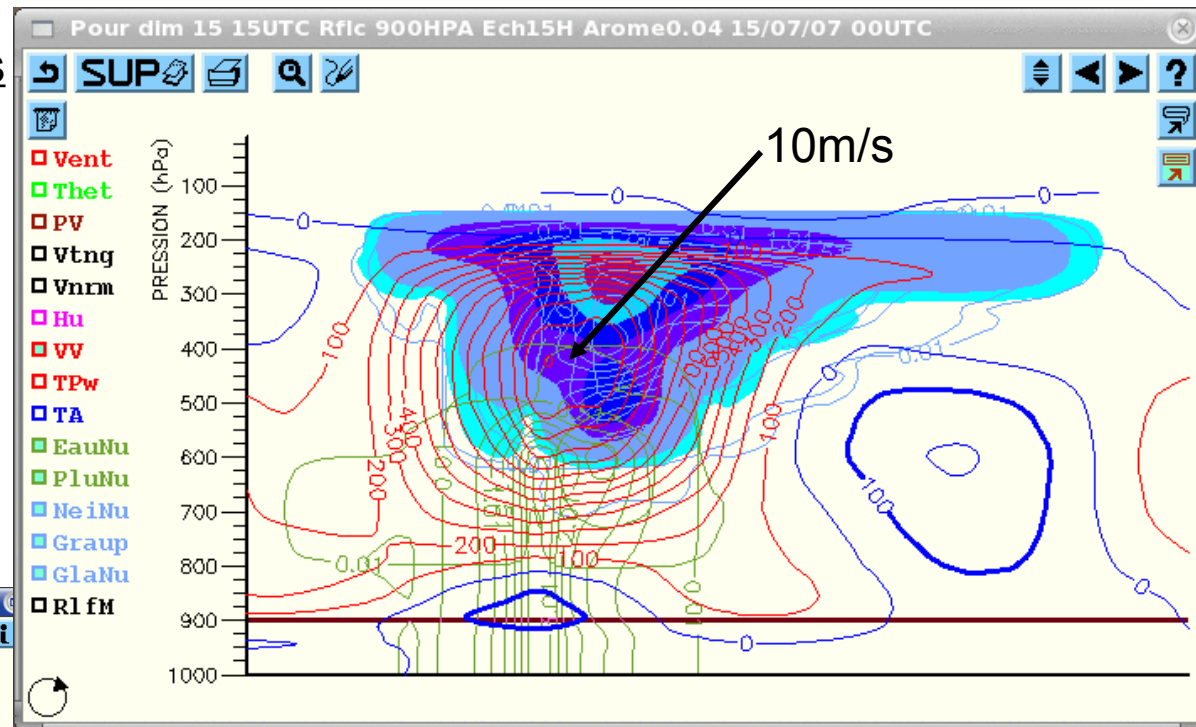
# Arome products

special formation of forecasters needed to these new physics:

« How to look at AROME ? »

→ New physical fields to look at (hydrometeors)

→ New meteorological structures in the model:  
e.g. convection, breeze fronts



Exemple: 15 July 2007  
radar reflectivities at 900hPa:

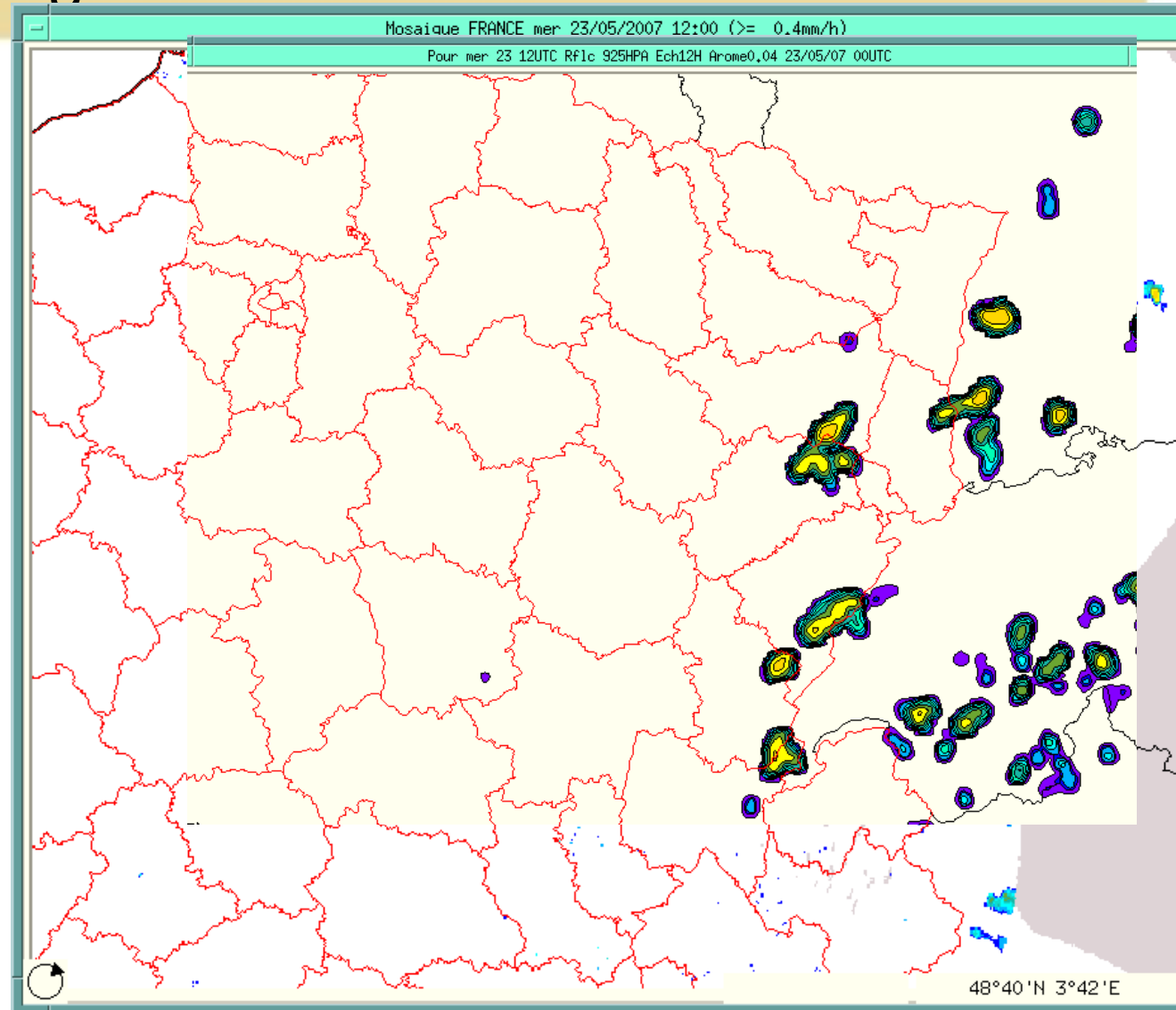
# Démarrage convection diurne et relief

Obs radar 12 UTC

**AROME**

Réfl. 950 hPa

**12 UTC**

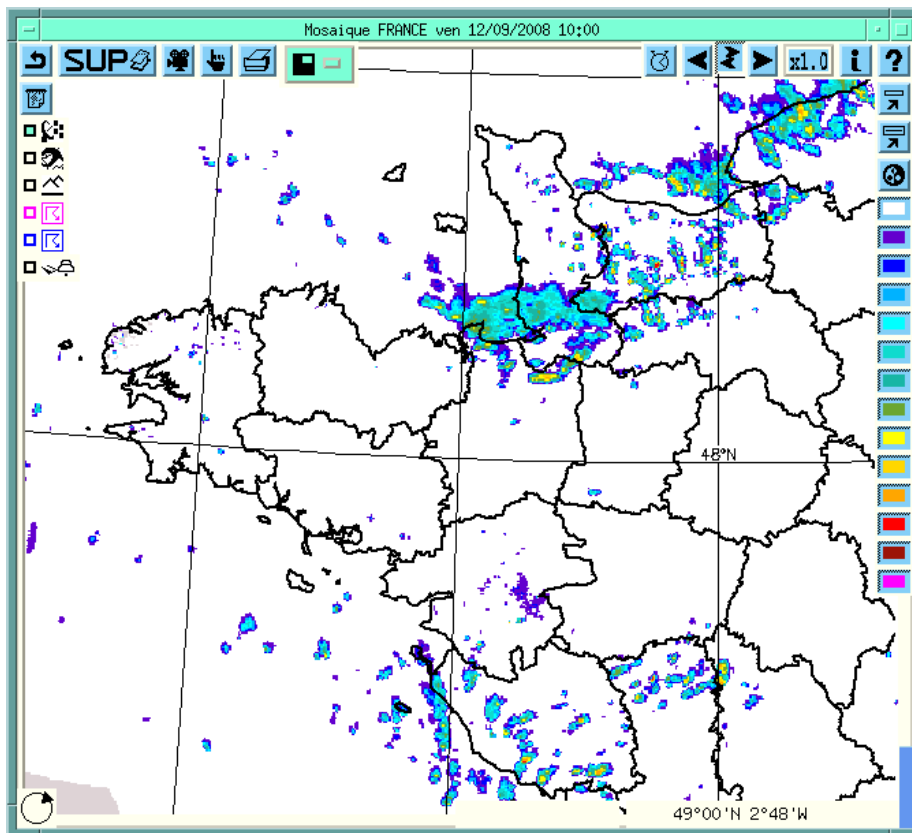


Diurnal convection



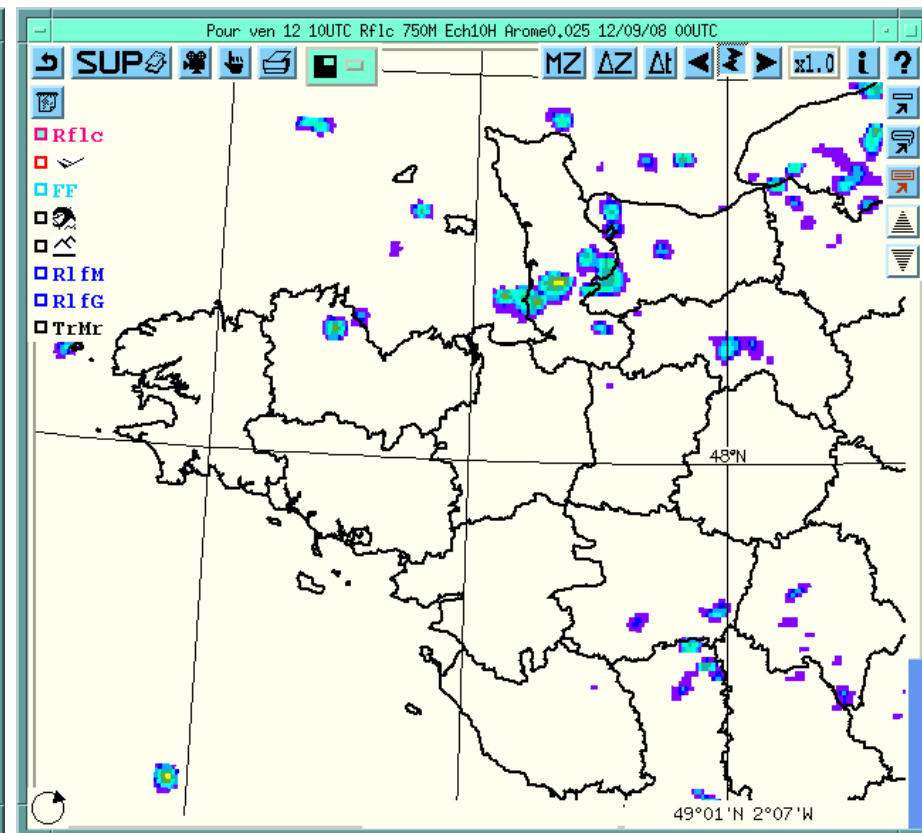
# Convection Nord-ouest France, réfl rad vs AROME (1)

(merci à Claude Dumont DIRO)



Radar

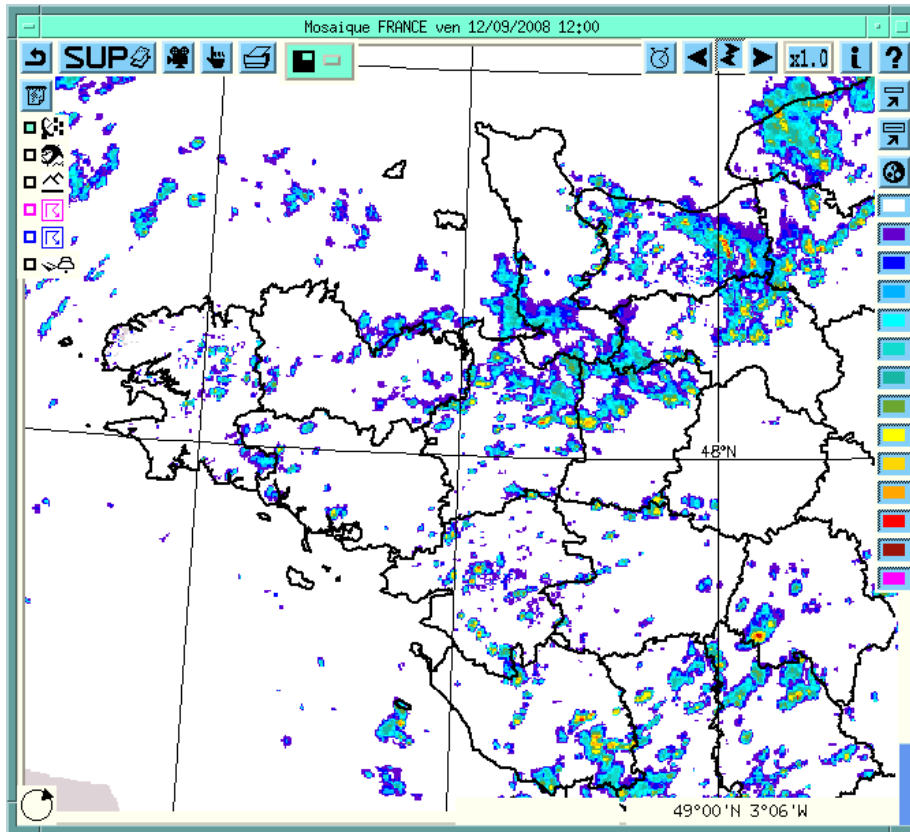
10 UTC



Rf1c AROME

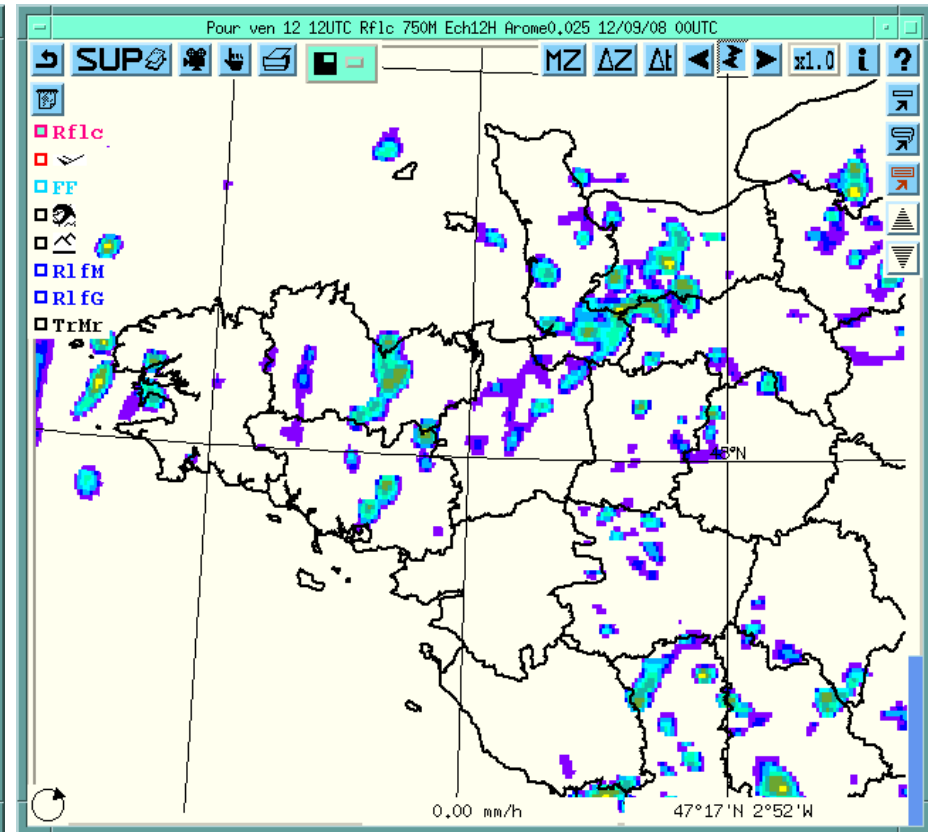


# Convection Nord-ouest France, réfl rad vs AROME (2)



Radar

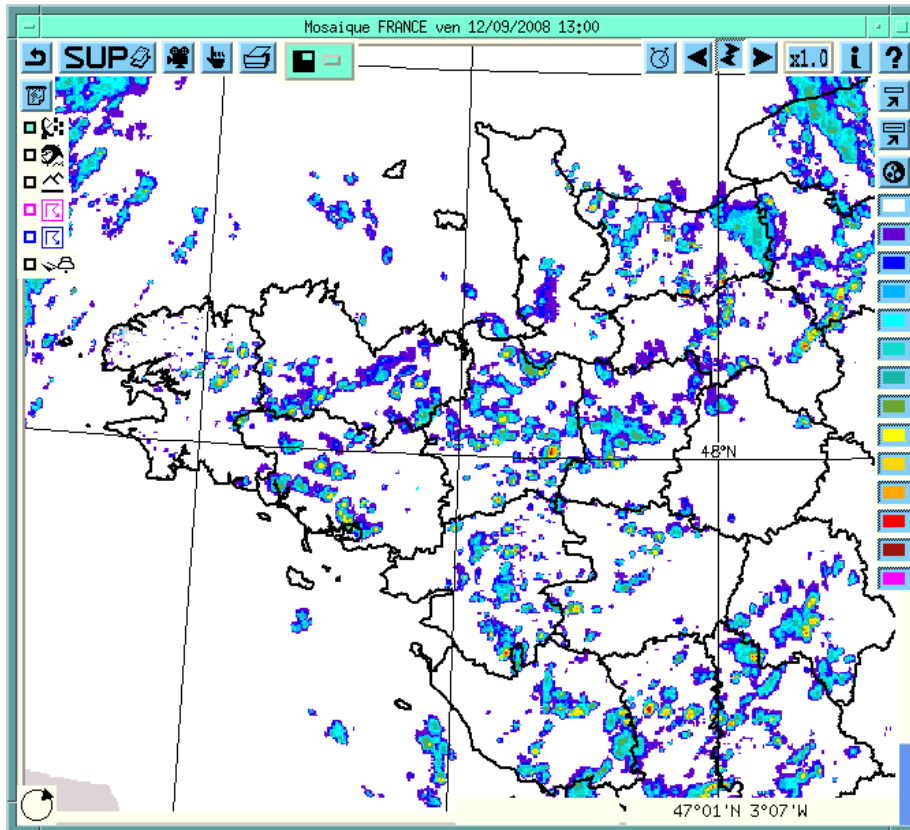
12 UTC



Rf1c AROME

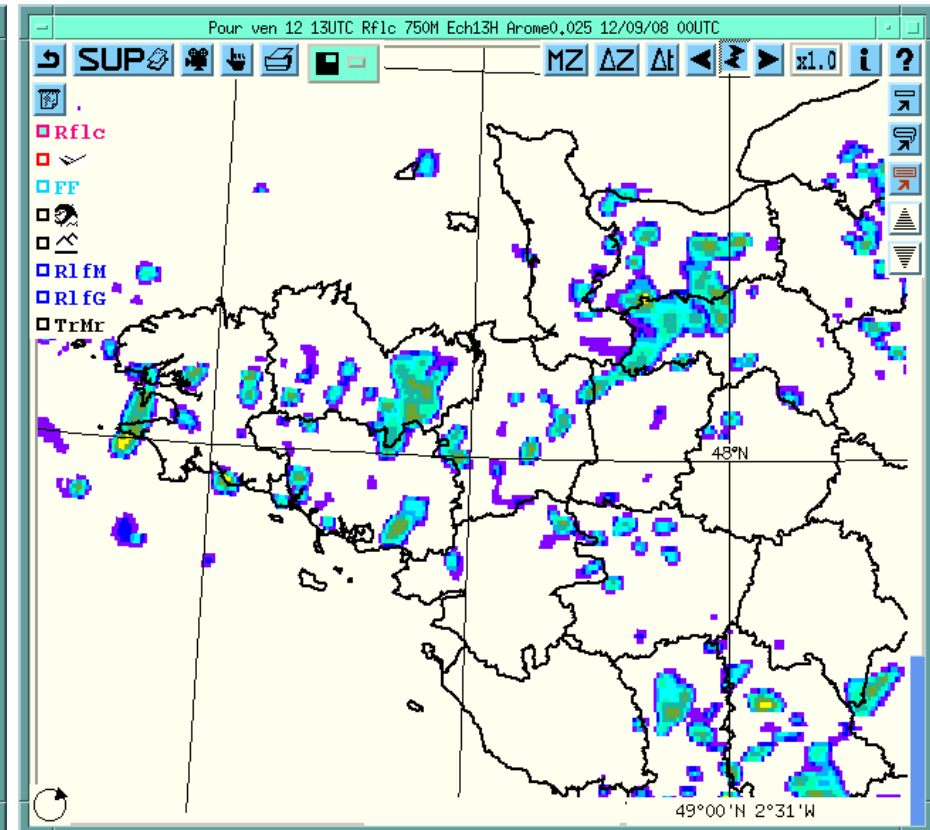


# Convection Nord-ouest France, réfl rad vs AROME (3)



Radar

13 UTC

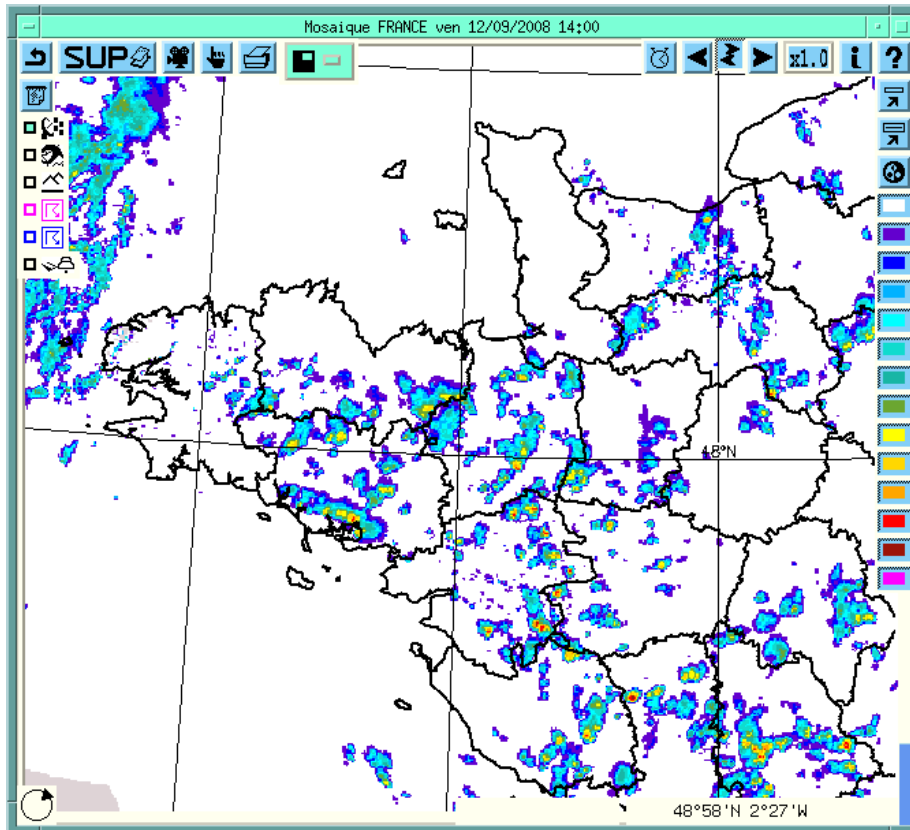


Rf1c AROME



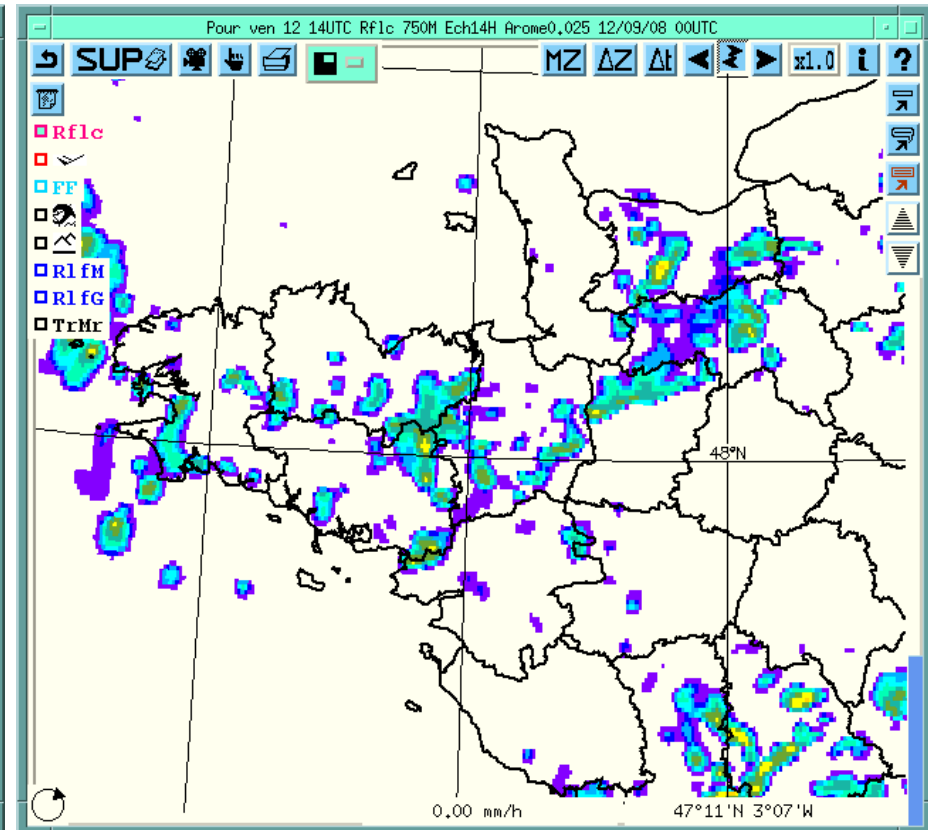


# Convection Nord-ouest France, réfl rad vs AROME (4)



Radar

14 UTC

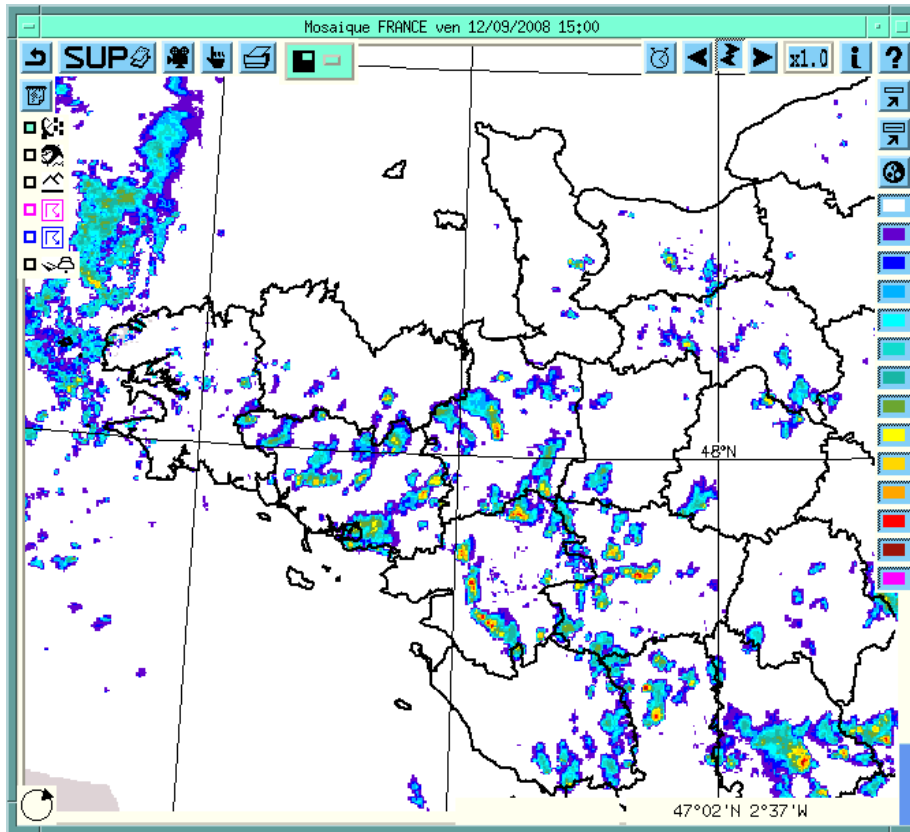


Rf1c AROME



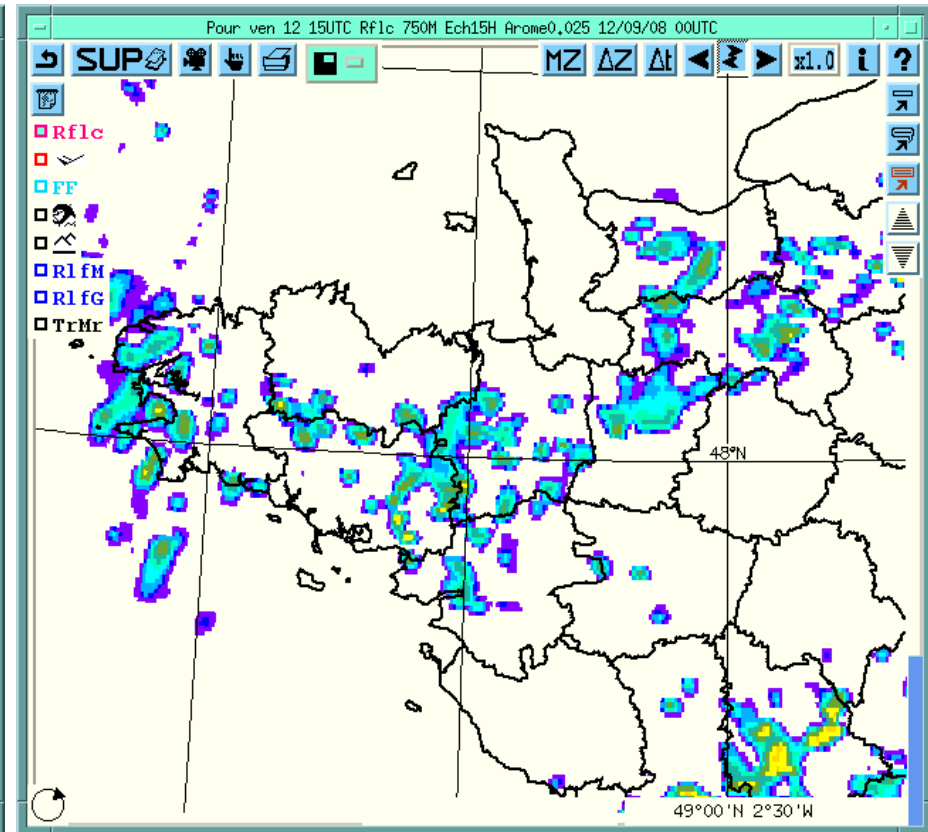


# Convection Nord-ouest France, réfl rad vs AROME (5)



Radar

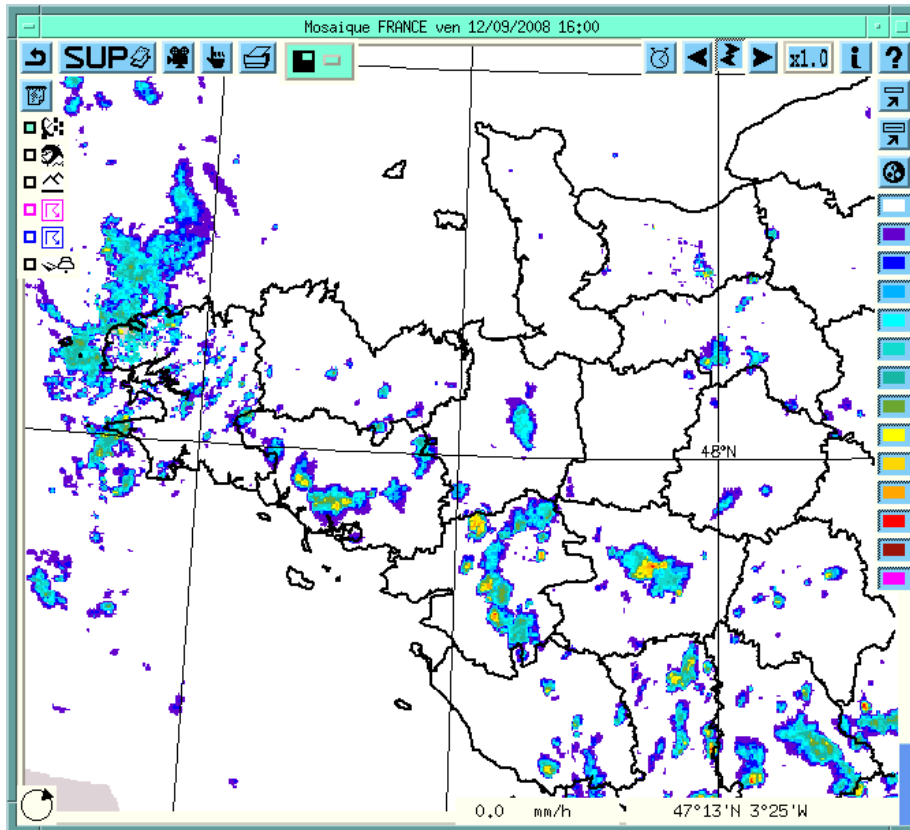
15 UTC



Rf1c AROME

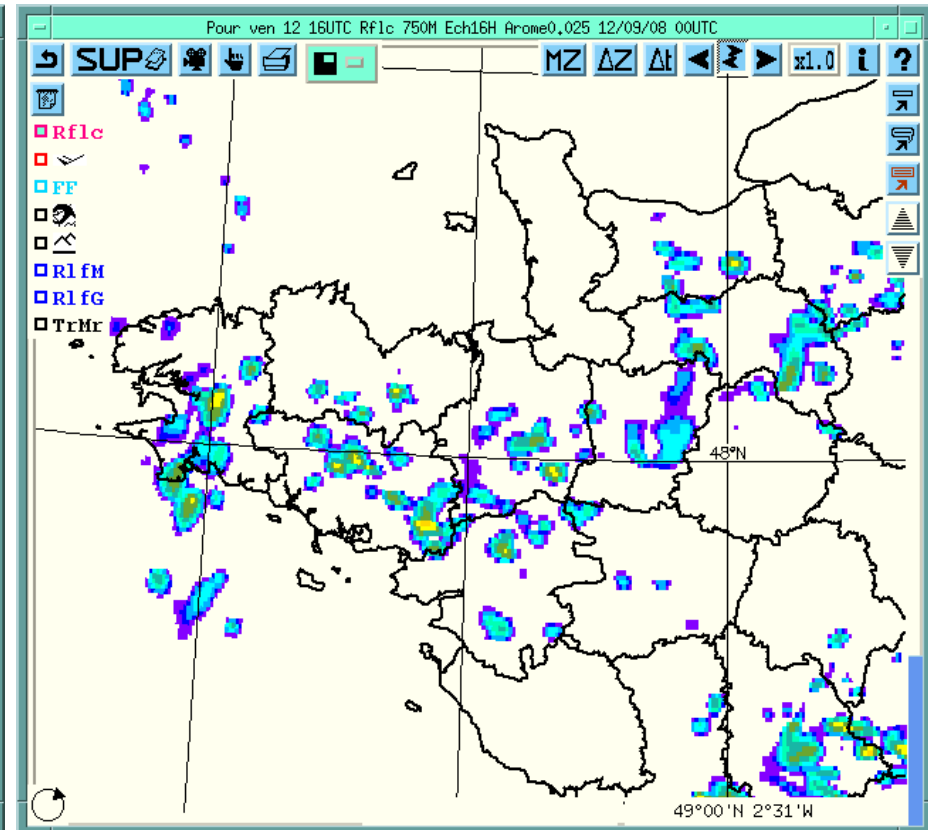


# Convection Nord-ouest France, réfl rad vs AROME (6)



Radar

16 UTC



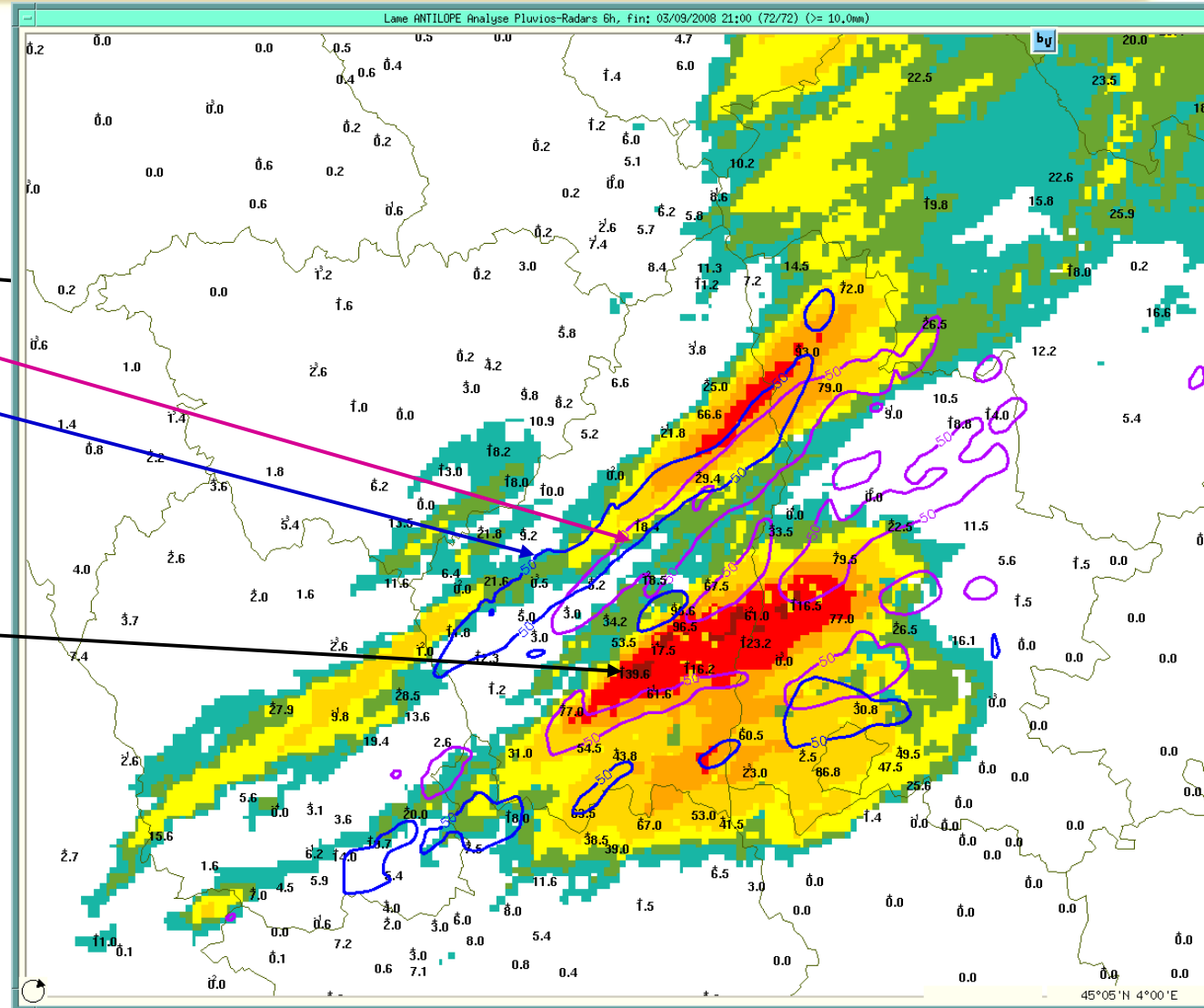
Rf1c AROME



# Convection, cas vigilance Drome-Ardèche 3 Sept 08

- RR\_6 h 3 Sep 21 UTC  
Obs et Antilope (> 7 mm)  
Vs modèles > 50 mm
- ALADIN en noir
- AROME V1 en rose
- AROME nouveau en bleu

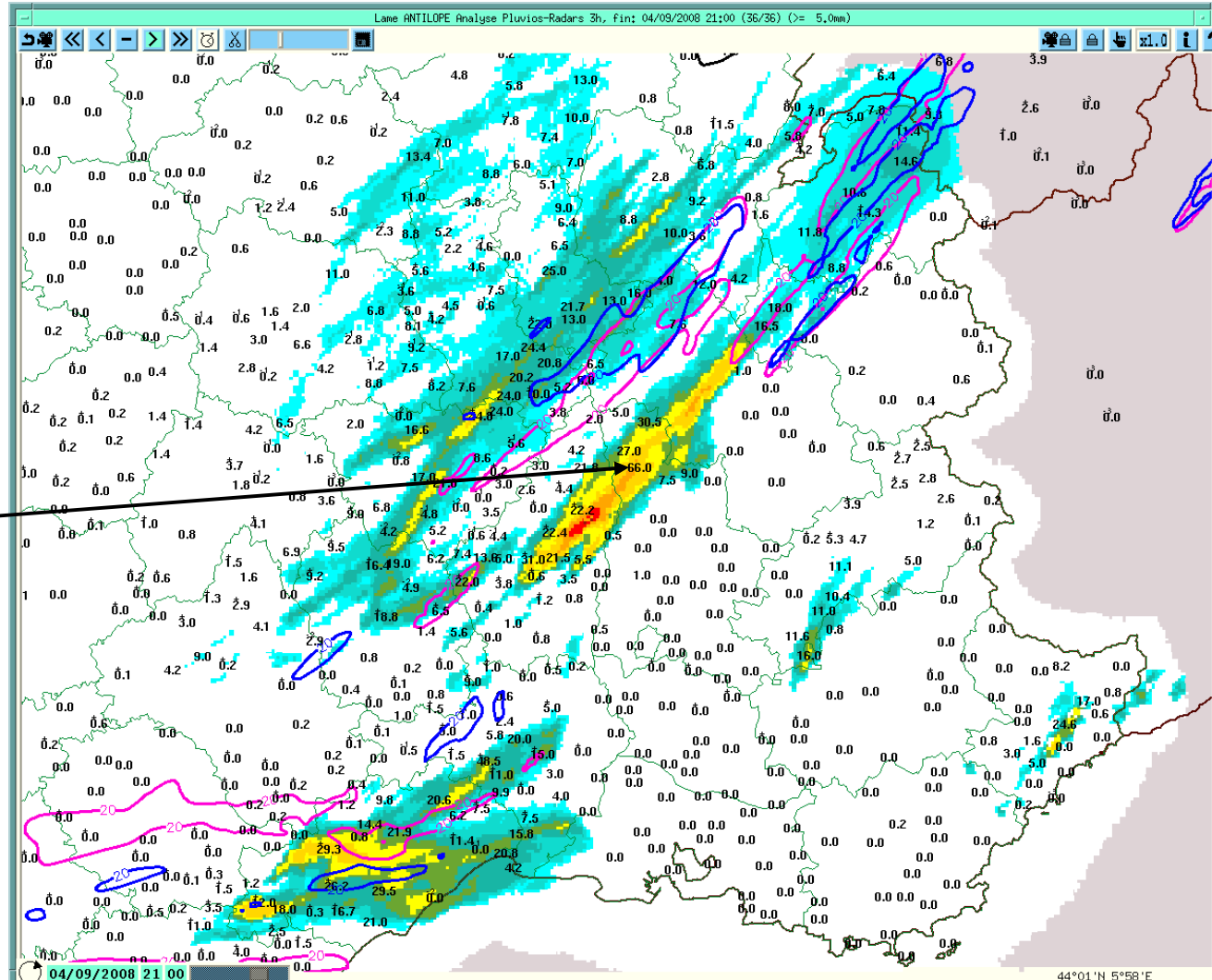
Obs : 140 mm



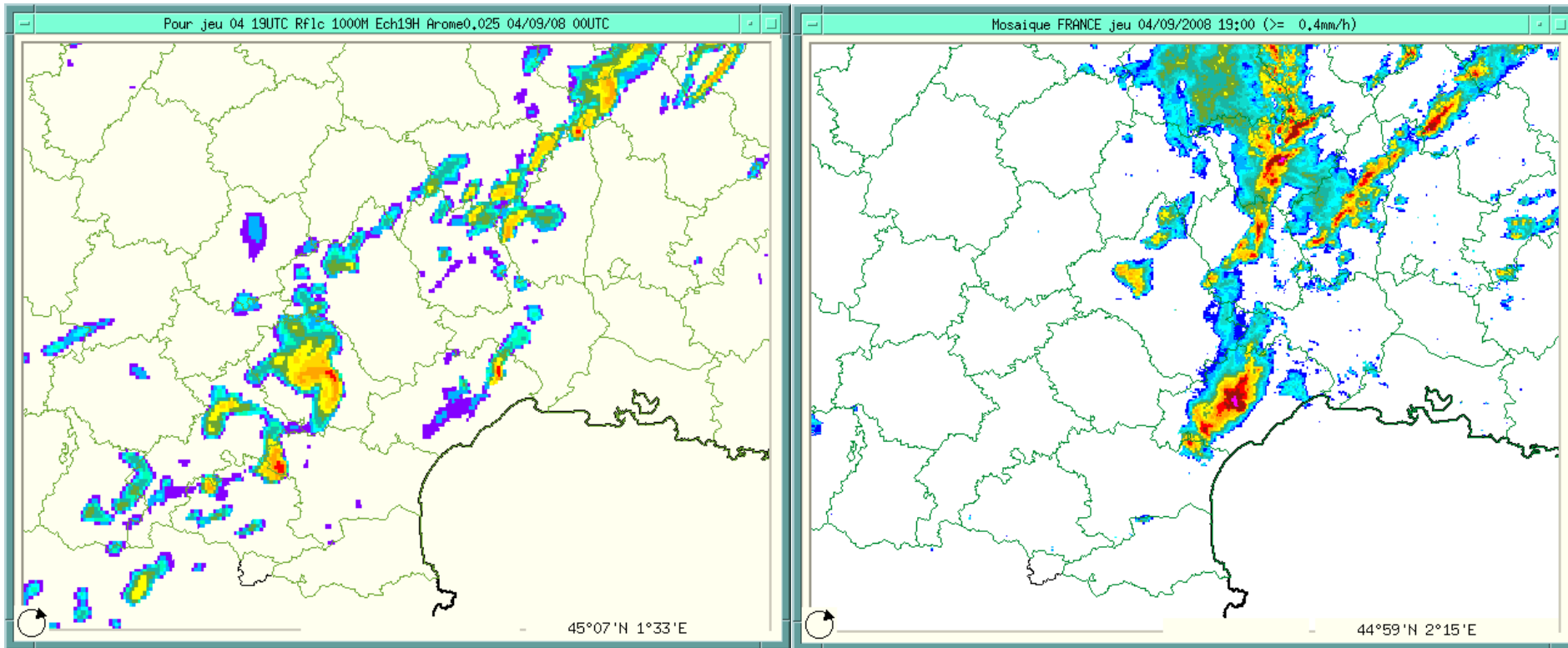
# Convection, cas vigilance E et SE, 4 Sept 08 (1)

- RR\_3 h 4 Sep 21 UTC
- Obs et Antilope (> 7 mm)
- Vs modèles > 20 mm
- ALADIN en noir (rien...)
- AROME V1 en rose
- AROME nouveau en bleu

Obs : 66 mm



# Convection, cas vigilance E et SE, 4 Sept 08 (2)



Rflc AROME run 00

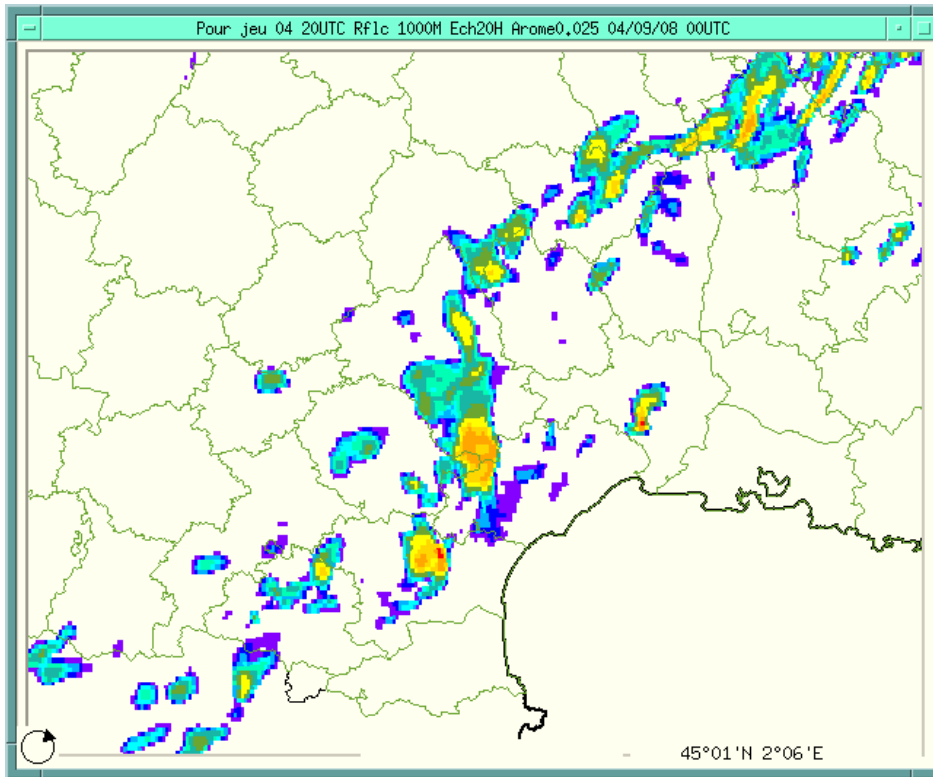
19 UTC

Radar



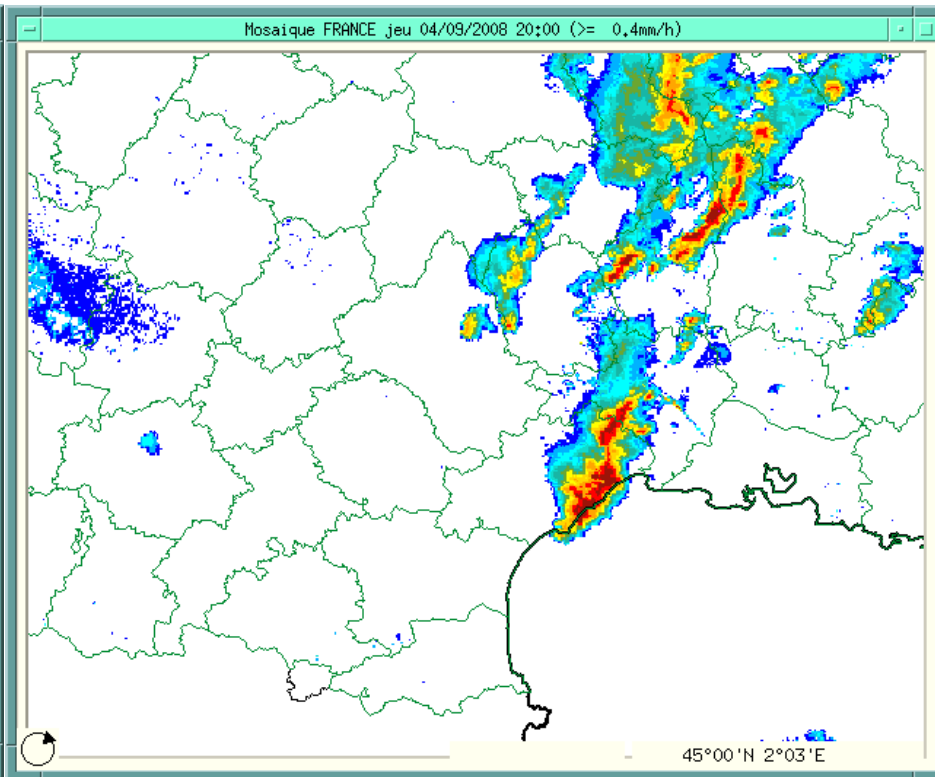


# Convection, cas vigilance E et SE, 4 Sept 08 (2)



Rflc AROME run 00

20 UTC

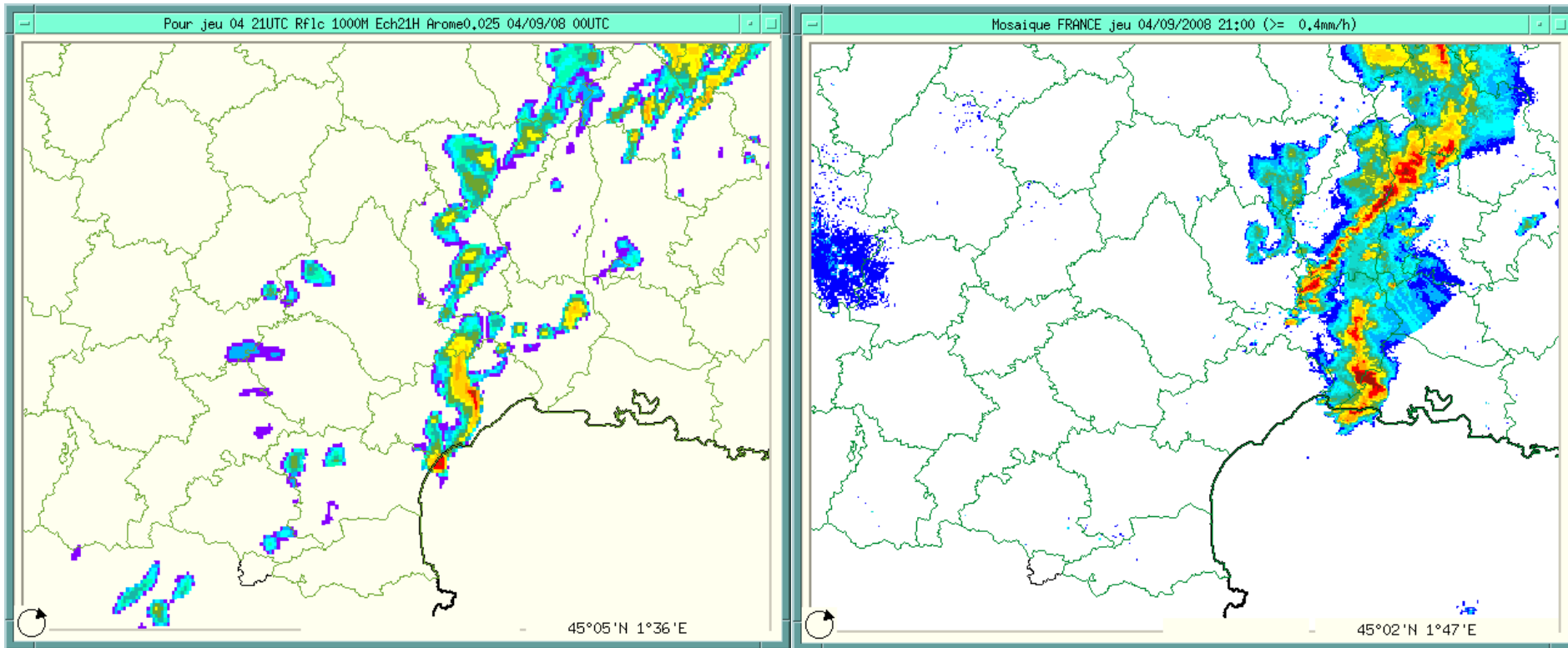


Radar





# Convection, cas vigilance E et SE, 4 Sept 08 (2)



Rflc AROME run 00

21 UTC

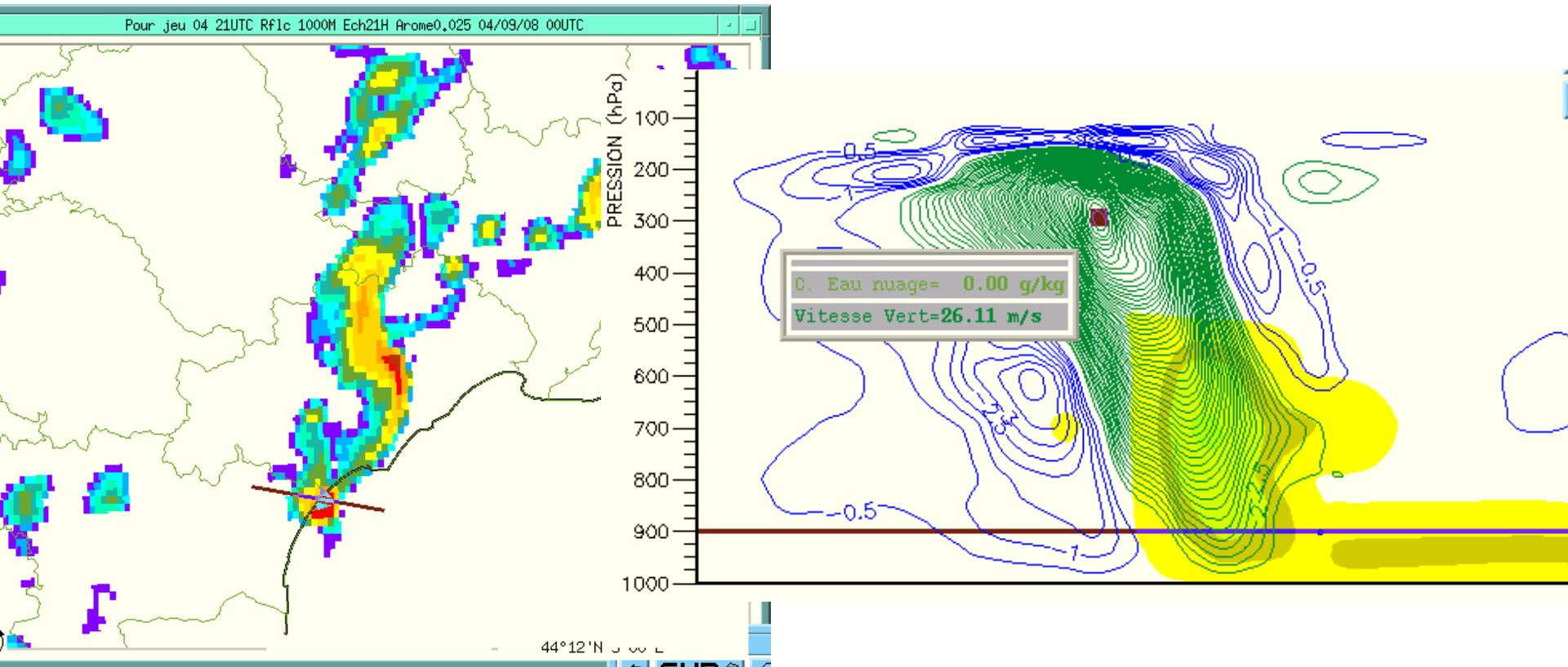
Radar

**Les réflectivités AROME indiquent la circulation d'un MCS intense sur le Languedoc (grêle forte observée sur l'hérault)**



# Supercellule sur Hérault, 4 Sept 08

- Réflectivités AROME 21 UTC et coupe verticale en vitesse verticale



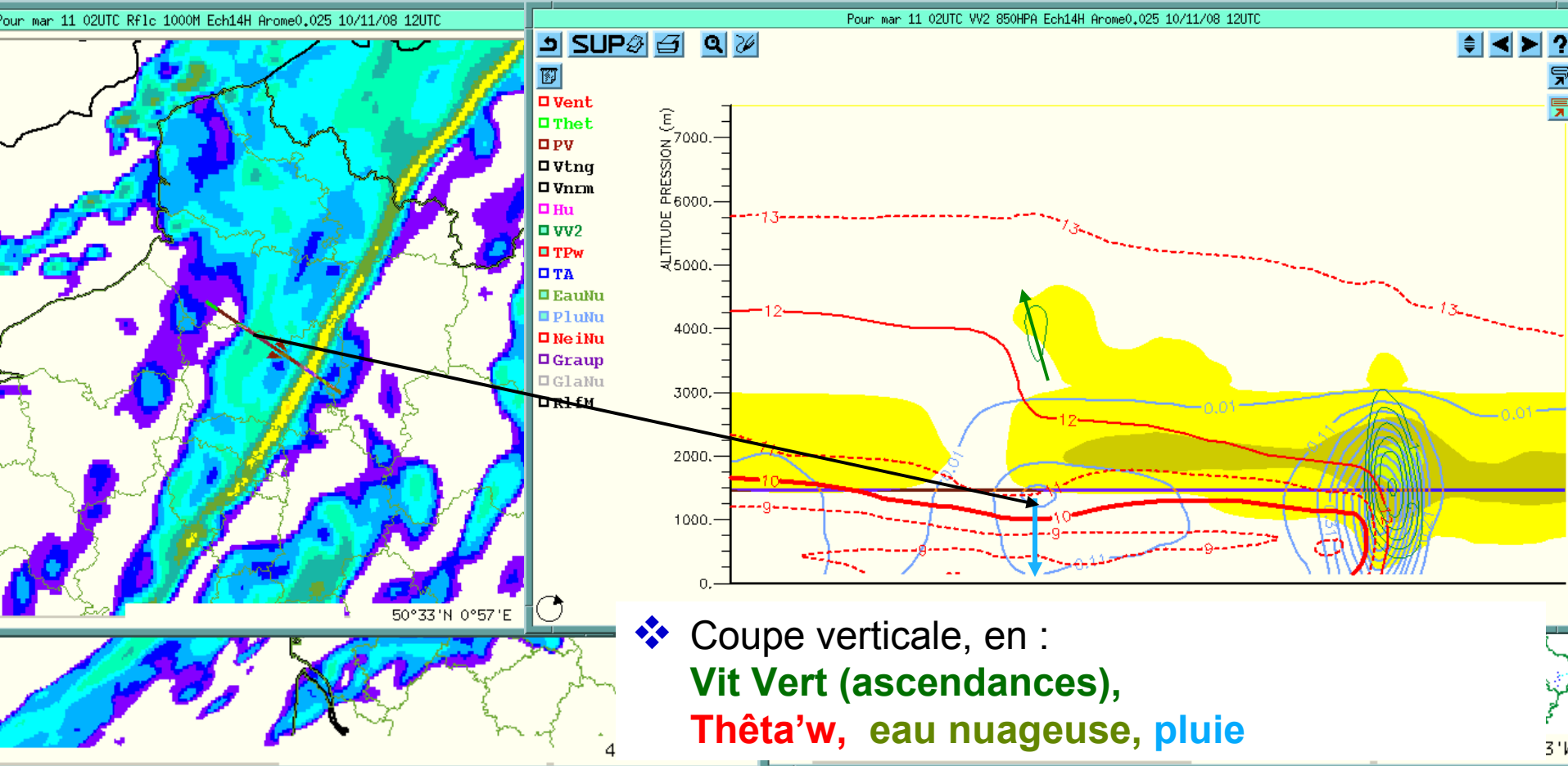
Supercell on Herault



**METEO FRANCE**  
Toujours un temps d'avance

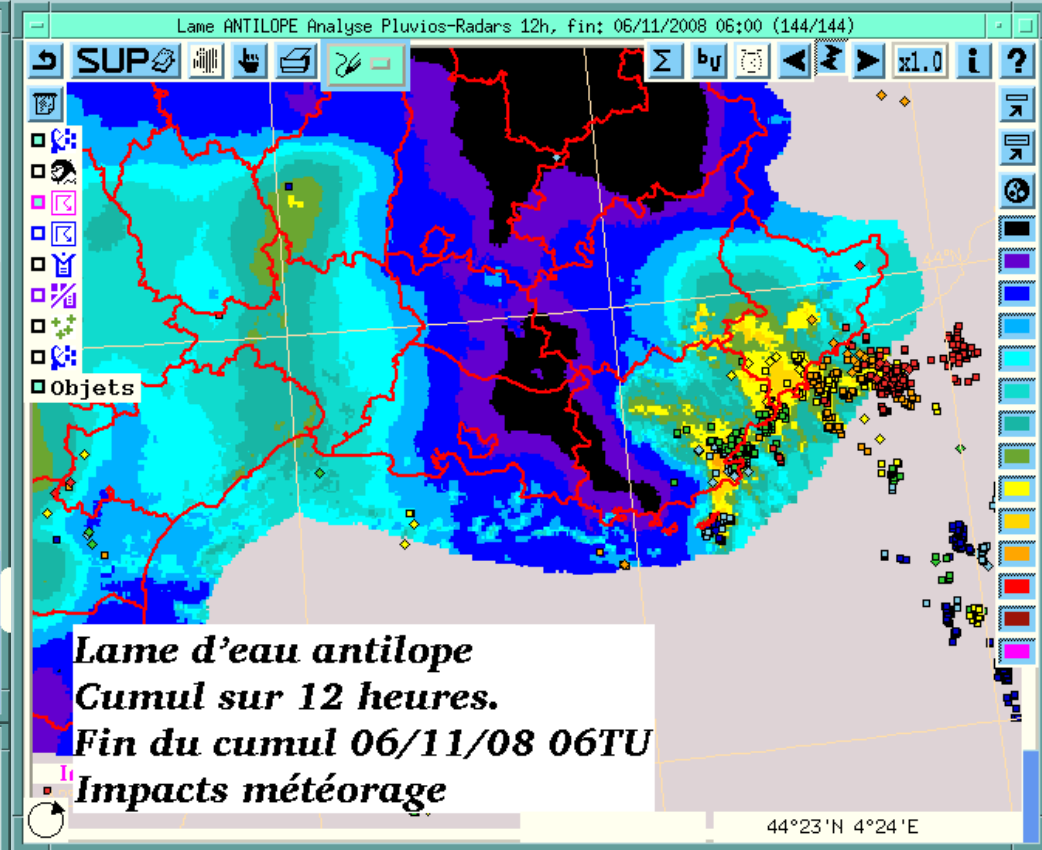
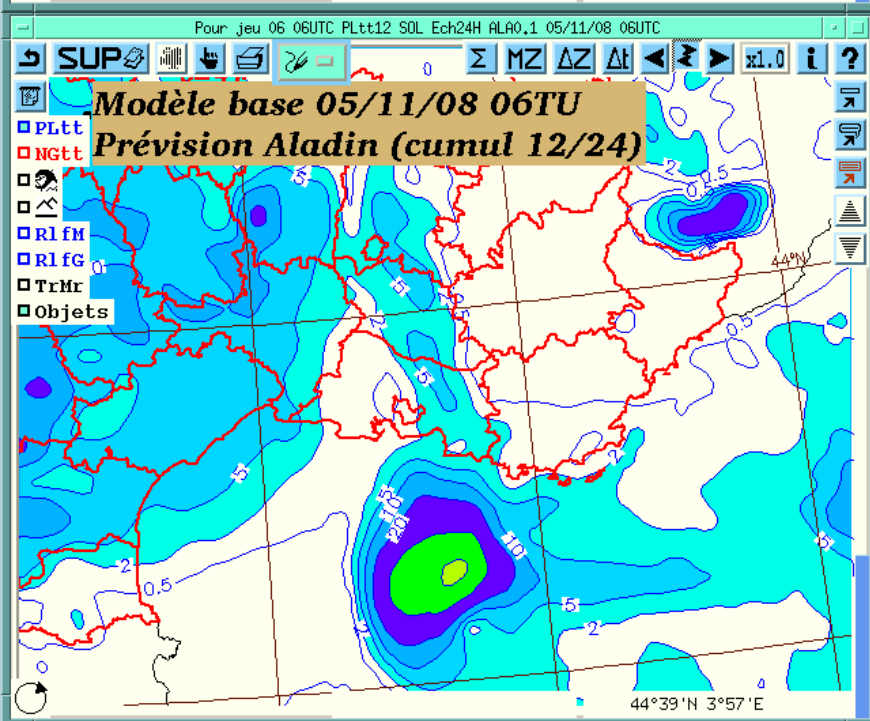
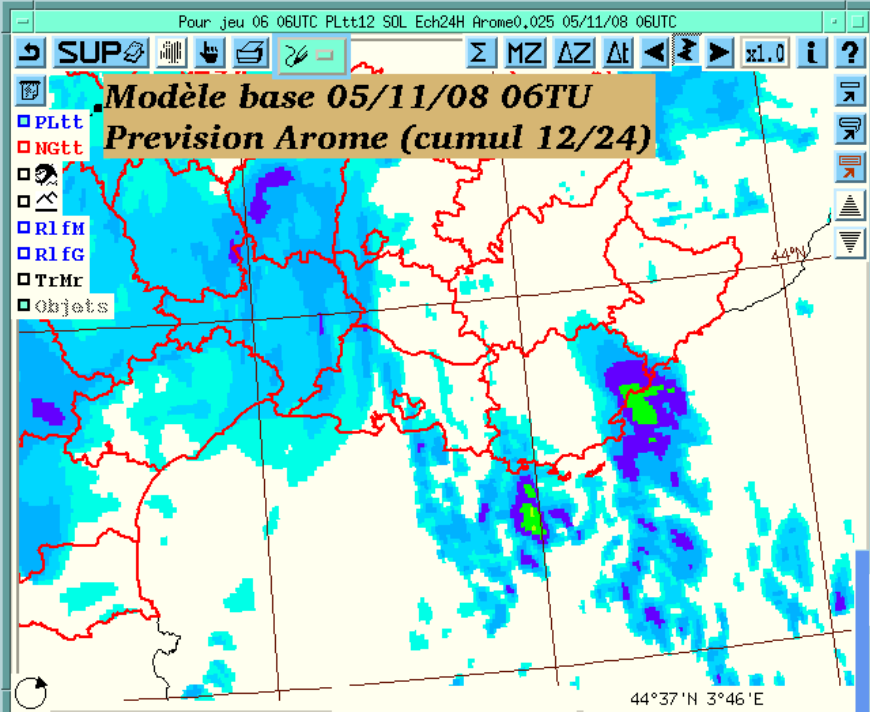
# Bandes de précipitations frontales

Réalisme bande étroite de front froid, bandes larges et secteur chaud



Réflexivité simulée (prévi 13 h)

vs image radar, vd 11 Nov 2008 01 UTC

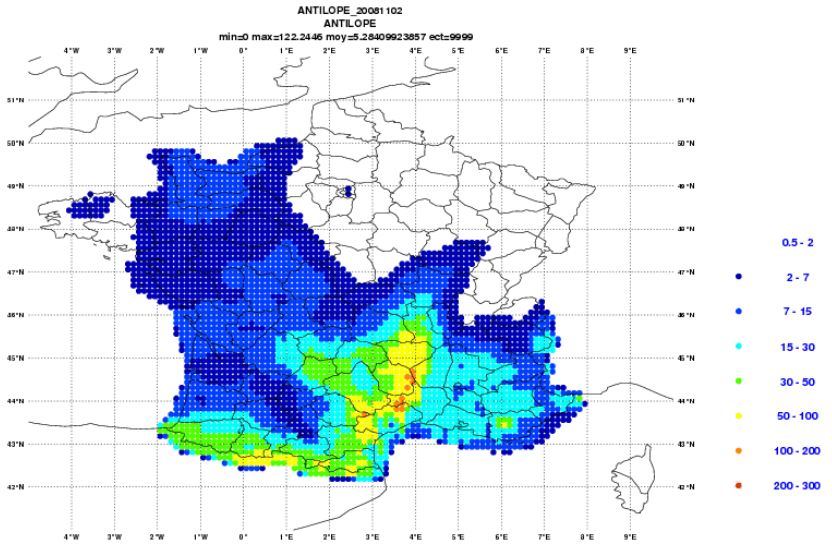


Arome parvient à créer une zone de forte activité sur le Var (RR sup à 50 mm) qui sera observée. Même s'il est encore éloigné de la réalité sur les Alpes –Maritimes on a un apport important pour le prévisionniste par rapport à ce que proposait Aladin.

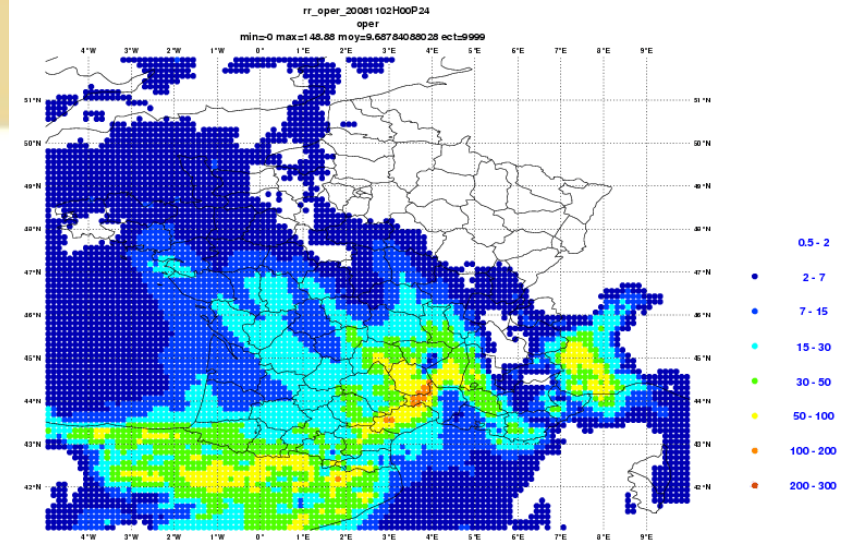
Intense activity over Var RR > 50 mm  
 Less interesting over maritim-Alps.



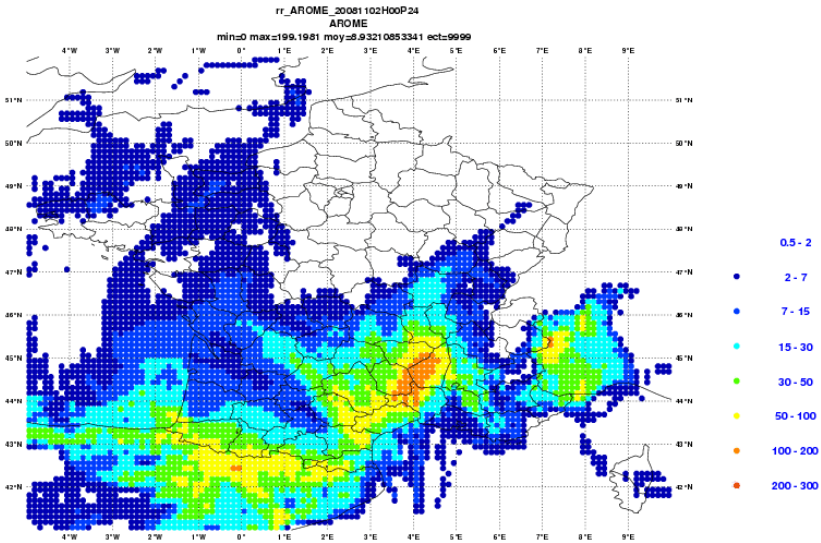
# ANTILOPE CUMUL 24H 20081102



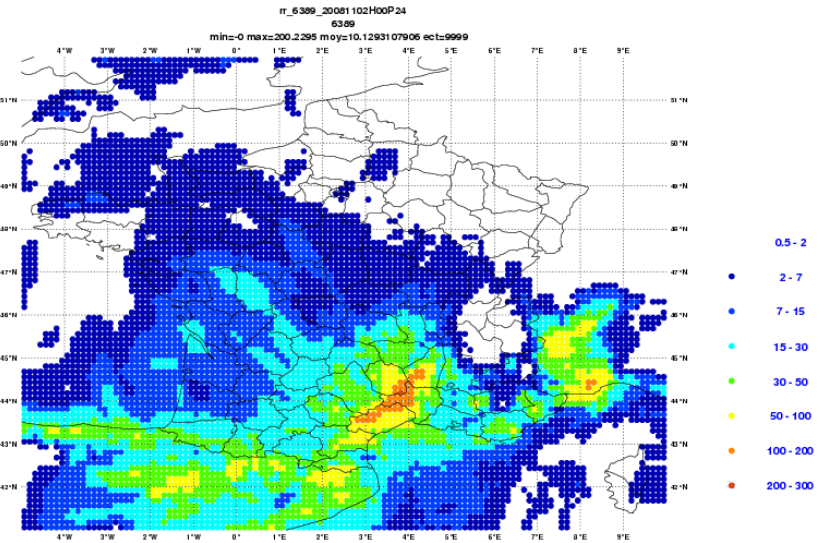
# ALADIN OPER CUMUL P24H

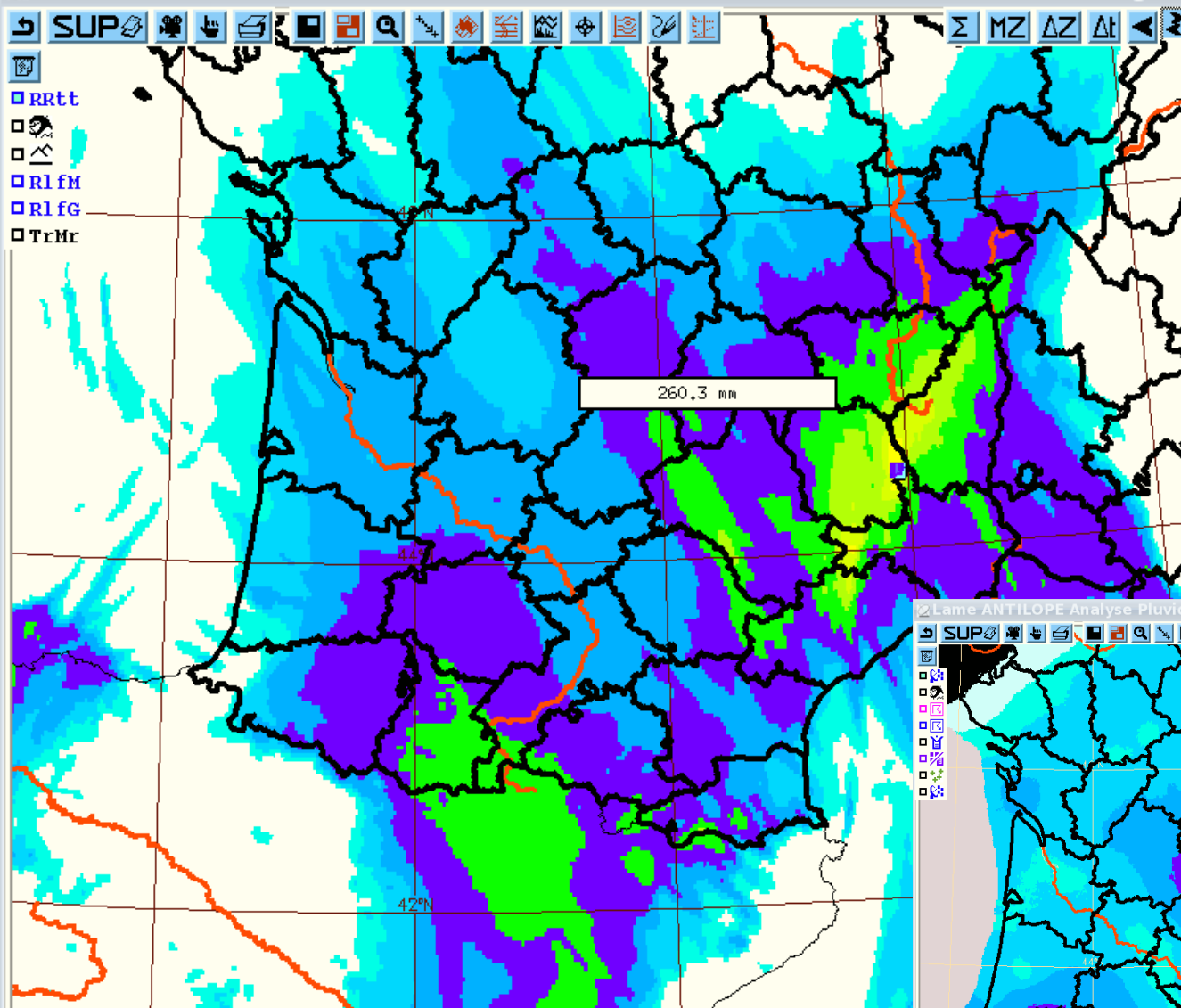


# AROME CUMUL P24H



# ALADIN DBL V2 CUMUL P24H



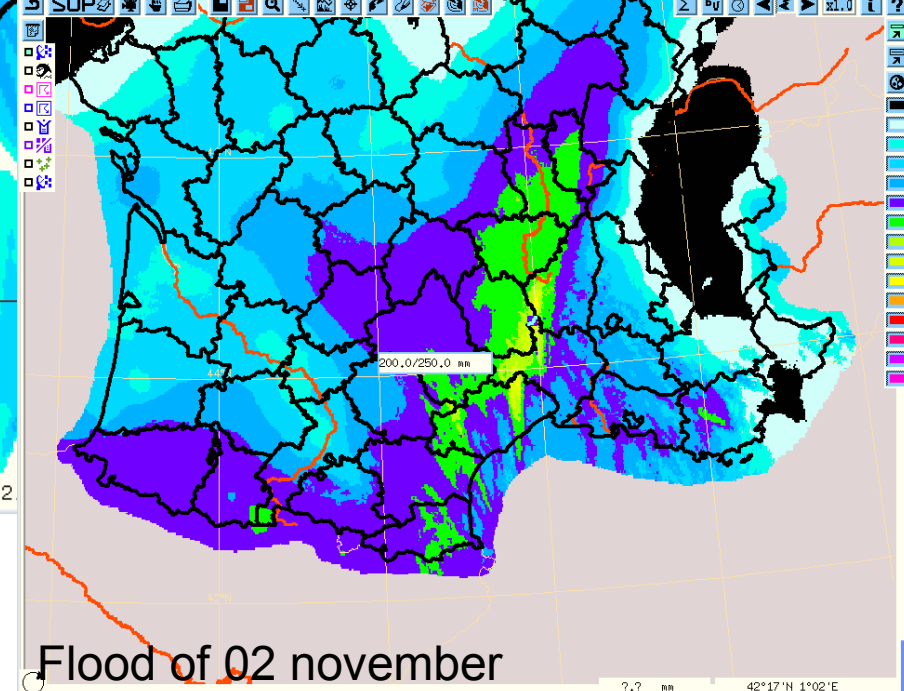


Precipitations (mm)	
BLUE_GREEN	> 2.0
NAVY	> 5.0
GREENISH_BLUE	> 10.0
PURPLISH_BLUE	> 20.0
GREEN	> 50.0
YELLOW_GREEN	> 100.0
GREENISH_YELLOW	> 150.0
YELLOW	> 200.0
ORANGE	> 250.0
RED	> 300.0
PURPLISH_RED	> 400.0
PURPLE	> 500.0
PURPLE_RED	> 600.0

Arome réseau du 01-12 UTC (p30 heures)

011108 12UTC

Valide le dimanche 02 18 heures



Flood of 02 november