

# Ensemble streamflow forecasting over France: use of the system SIM

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National Flood Forecasting Center "SCHAPI"

FRANCE

Ressources, territoires et habitats  
Énergie et climat Développement durable  
Prévention des risques Infrastructures, transports et mer

Présent  
pour  
l'avenir



# PLAN OF THE PRESENTATION

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- Presentation of the french organisation in flood forecasting

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- The ensemble streamflow prediction system SIM

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- Conclusion over the use of SIM

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- Prospect for a better use of SIM and EFAS

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# The french organisation in flood forecasting

## SCHAPI...

Technical centre with **national responsibilities**

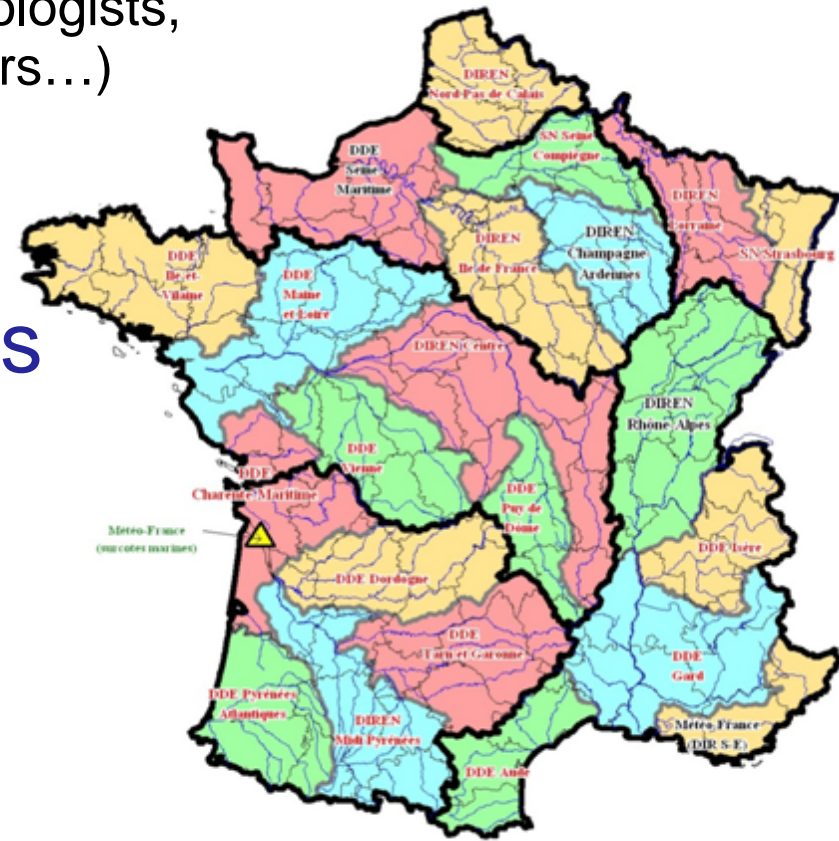
About 35 people (hydrologists, meteorologists, computer scientists, database managers...)

## ...and the **regional services**

22 services

About 200 people

Responsible for vigilance and flood forecasting



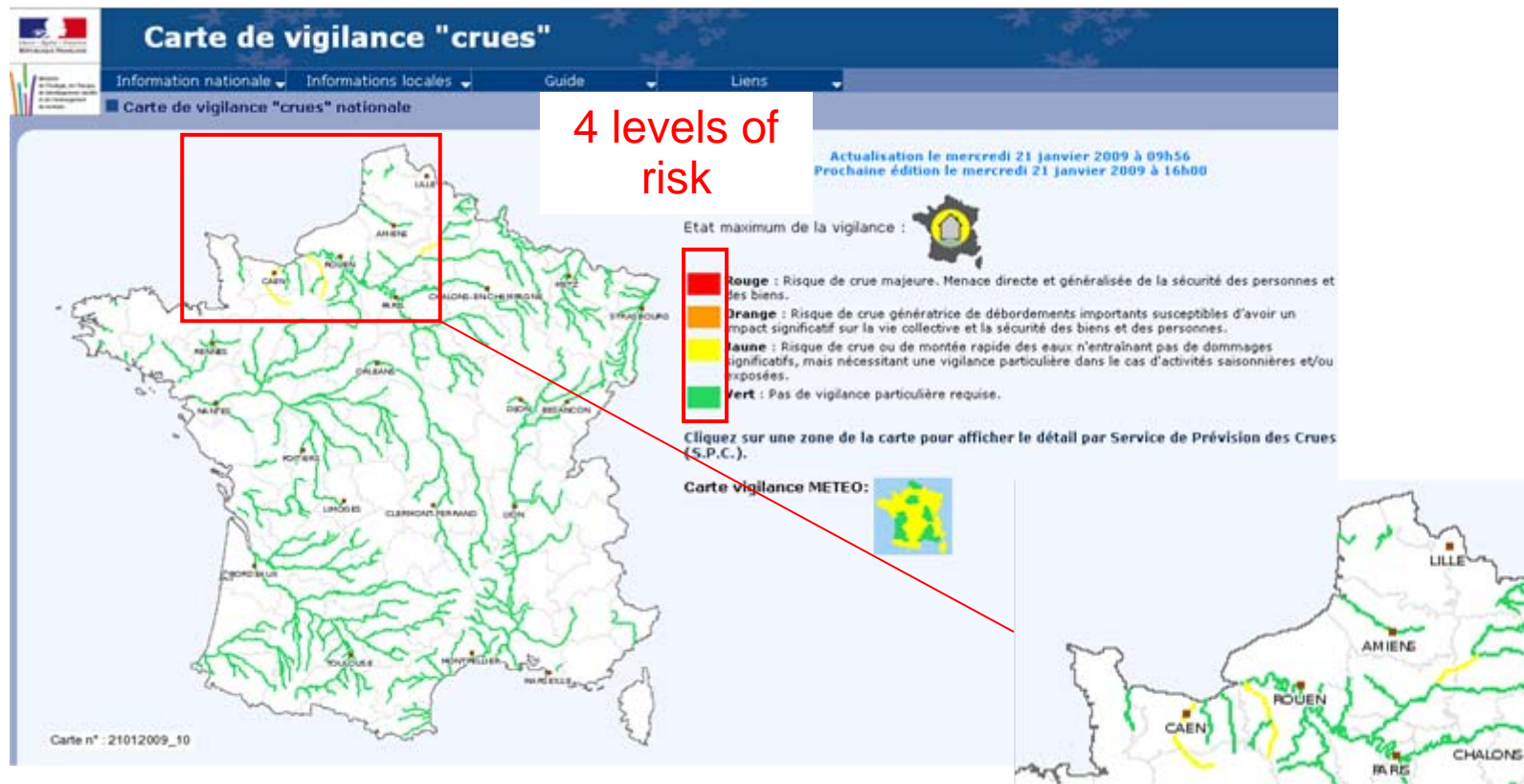
# The french organisation in flood forecasting

Daily at 10 am and 4 pm:

(+ more if necessary)

A **flood vigilance map** - National and regional **bulletins**

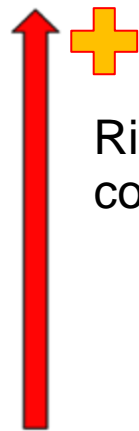
- The same medium for general public, local and national authorities



# The french organisation in flood forecasting

What do those 4 levels mean ?

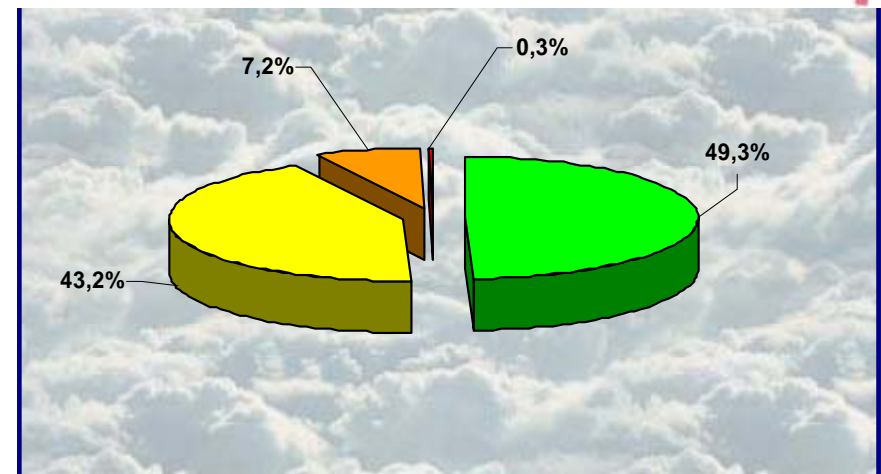
➡ link with consequences and potential damage  
(not on climatology flood return probability)



Risk level and potential consequences

Any danger to fear.

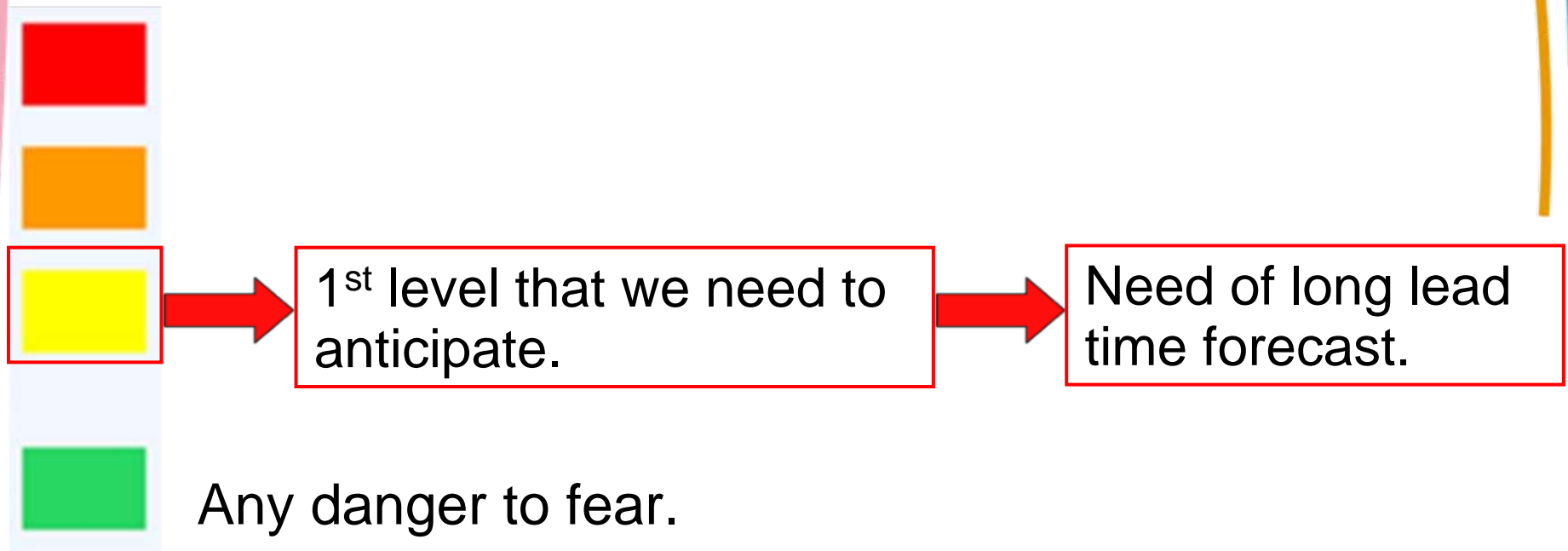
Flood vigilance  
(~1800 maps / 2 years)



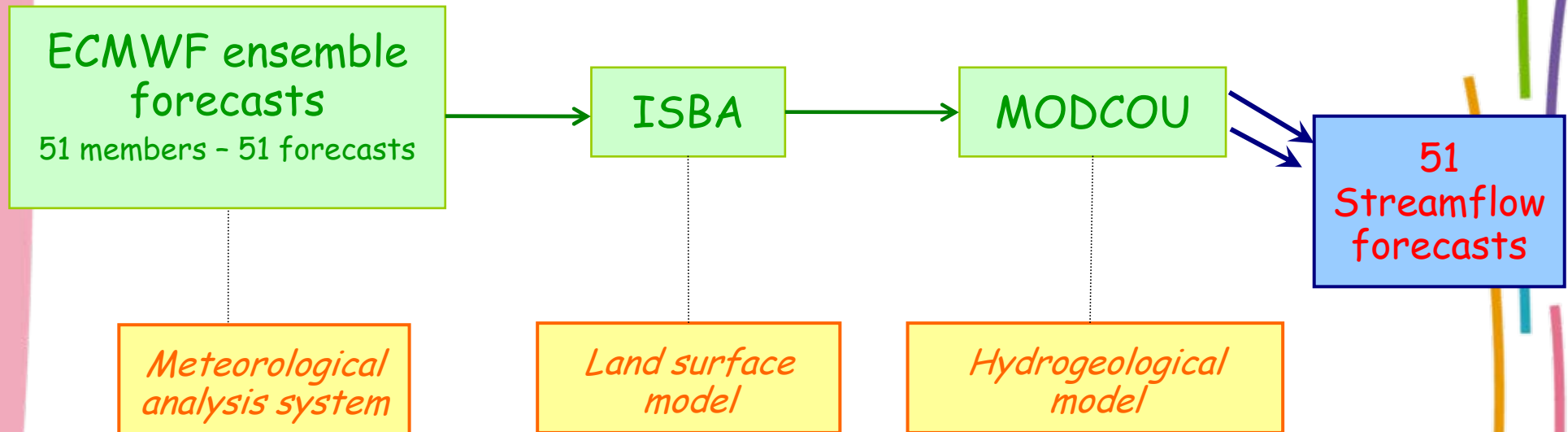
# The french organisation in flood forecasting

What do those 4 levels mean ?

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# *The ensemble streamflow prediction system SIM*

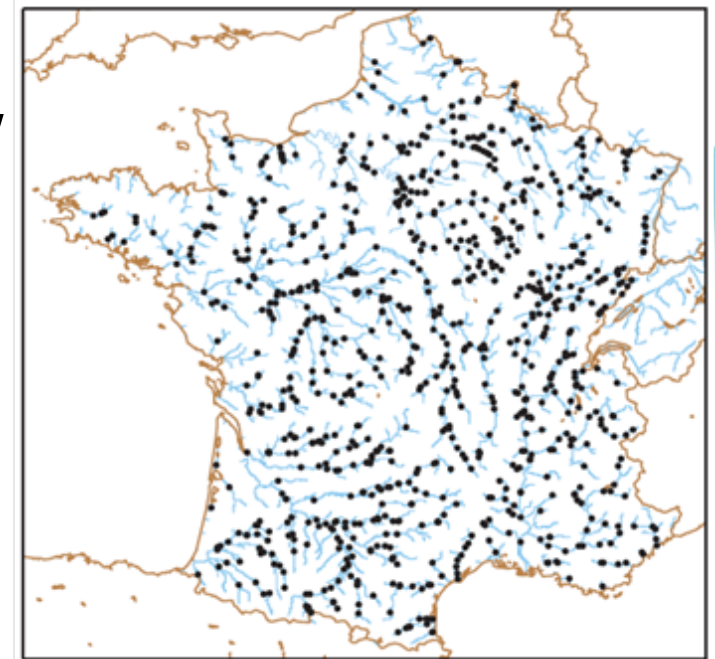


- Based on the coupled hydrometeorological model SIM (Météo-France)
- As EFAS, SIM is forced by the 10-day meteorological ensemble forecasts from the ECMWF

# *The ensemble streamflow prediction system SIM*

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- Produces 51 ten-day streamflow forecasts for about 900 river gauges over France



- SIM EPS has been running by Météo-France since sept. 2004
- Only available for the National Flood Forecasting Center since the beginning of 2008: special website (limited access)



# The ensemble streamflow prediction system SIM

## Liste des stations

Bienvenue sur le site SIM -- Pr vision d'ensemble - Temps r el - Climatologie

### Bassin de l'Adour-Garonne

L'Adour   St-Vincent  
L'Ari ge   Auterive  
La Dordogne   Bergerac  
L'Isle   Abzac  
La Garonne   Portet-sur-Garonne  
La Garonne   Tonneins  
Le Lot   Villeneuve-sur-Lot  
Le Tarn   Villemur-sur-Tarn

### Bassin de la Loire

L'Allier   Moulins  
Le Cher   Ch tillon-sur-Cher  
La Loire   Montjean  
La Loire   Nantes  
La Vienne   Nouatre

### Bassin du Rh ne

Le Doubs   Besan on  
L'Is re   Grenoble  
Le Rh ne   Beaucaire  
Le Rh ne   Viviers  
La Sa ne   M con

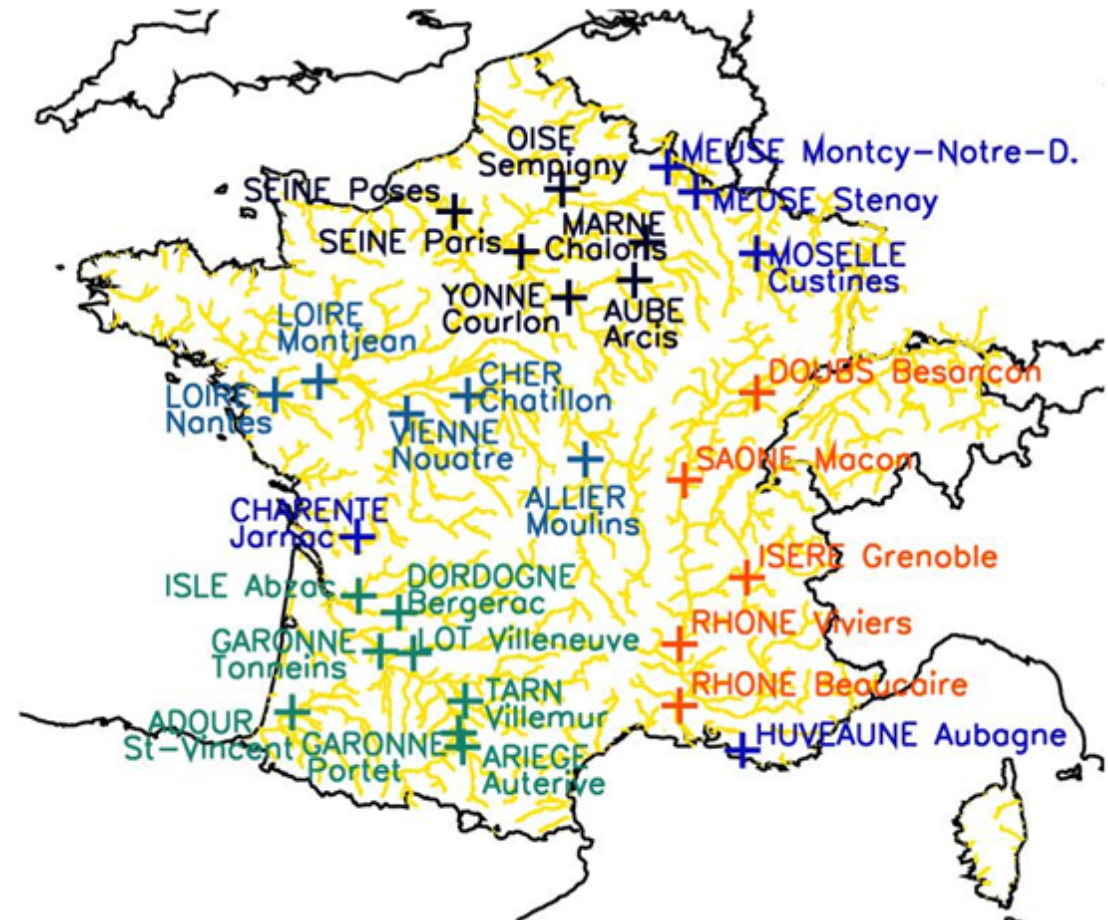
### Bassin de la Seine

L'Aube   Arcis-sur-Aube  
La Marne   Chalons-en-Champagne  
L'Oise   Sempigny  
La Seine   Paris  
La Seine   Poses  
L'Yonne   Courlon-sur-Yonne

\*\*\* [PAGE des TABLEAUX d'ALERTE sur la France](#) \*\*\*

Pour visualiser les pr visions CEP (site intranet DP/SERV/AGRO) : [cliquer ici](#)

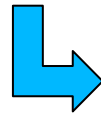
Lien vers la carte vigilance crue du SCHAPI : [cliquer ici](#)



29 stations over France

# The ensemble streamflow prediction system SIM

Q90: threshold based on observations  
(mean daily streamflow)

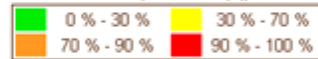


Risk to exceed or remain under the Q90 threshold

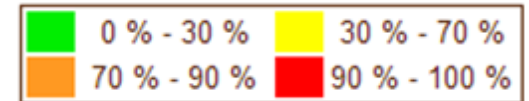
## TABLEAUX d'ALERTE

**Dépassement du Q90**

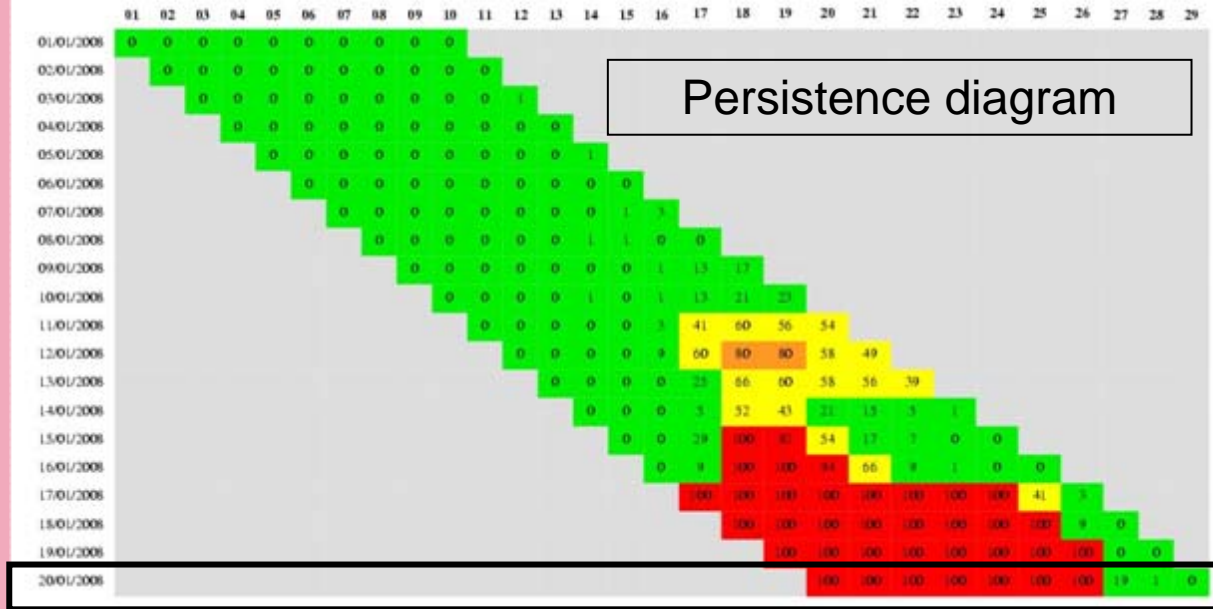
Débit dépassant le seuil Q90 (val en m<sup>3</sup>/s) (probabilité prévue en %)



| 15/12/2008     | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| L'ADOUR A ST-  | 100 | 100 | 100 | 100 | 100 | 1   | 0   | 0   | 0   | 0   |
| L'ALLIER A MO  | 0   | 0   | 0   | 0   | 0   | 9   | 31  | 58  | 70  | 72  |
| L'ARIEGE A AU  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| L'AUBE A ARCI  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA CHARENTE A  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LE CHER A CHAT | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA DORDOGNE A  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LE DOUBS A BES | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA GARONNE A P | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA GARONNE A T | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| L'HUVEAUNE A   | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| L'ISERE A GRE  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| L'ISLE A ABZA  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA LOIRE A MON | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA LOIRE A NAN | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LE LOT A VILJ  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA MARNE A CIA | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| LA MEUSE A MON | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

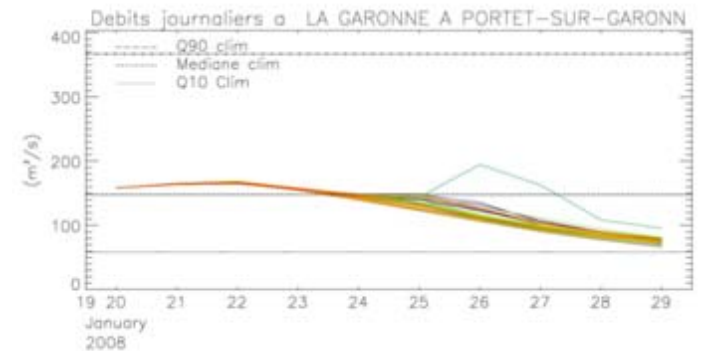


# The ensemble streamflow prediction system SIM



Last forecast for the next 10 days

For each station, we can go through ...



# The ensemble streamflow prediction system SIM

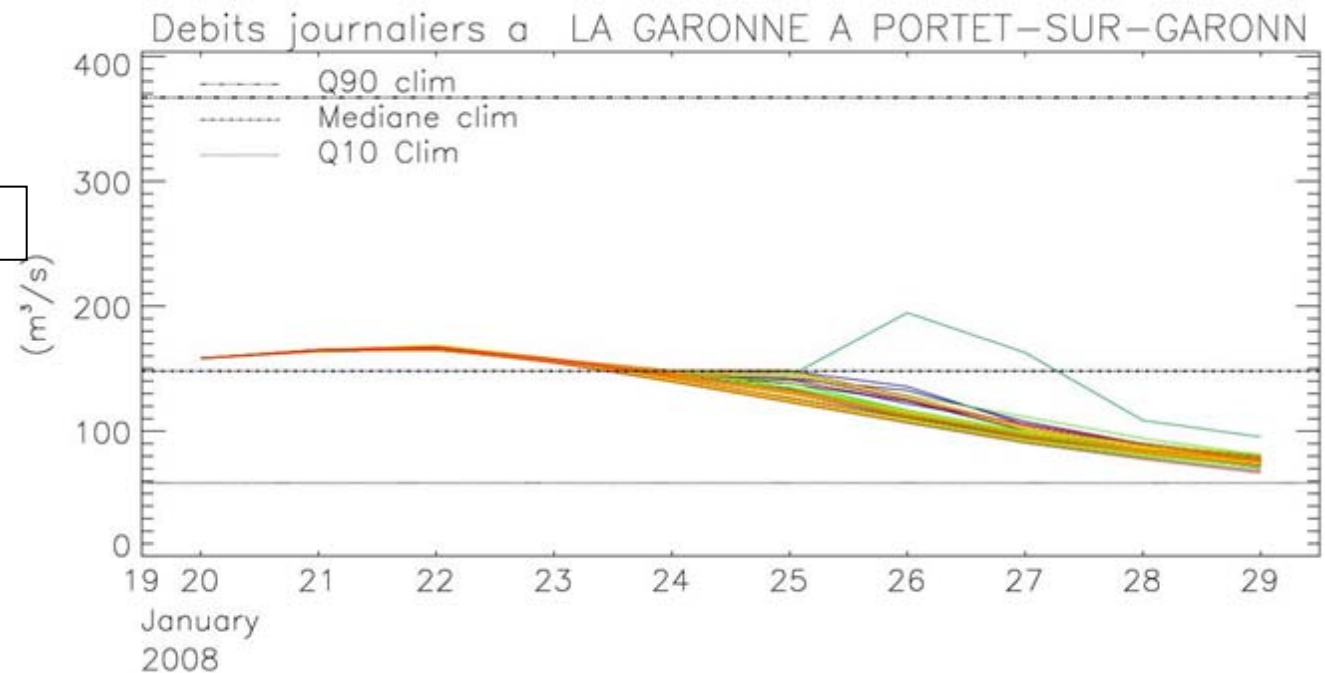
Persistence diagram



For each station,  
we can go through ...



51 daily streamflows



# Conclusion over the use of SIM

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**Available for SCHAPI and SPC since feb. 2008.**

1st assessment: only a few people were using the SIM EPS's forecasts:



“difficulty to link the SIM's alerts (based on Q90 threshold) with operational green/yellow/orange/red alert levels”

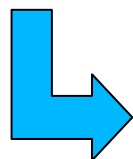
“simulated streamflows are not adjusted to observation”



# Prospect for a better use of SIM and EFAS

## 2 months' study (Camille Szczypka):

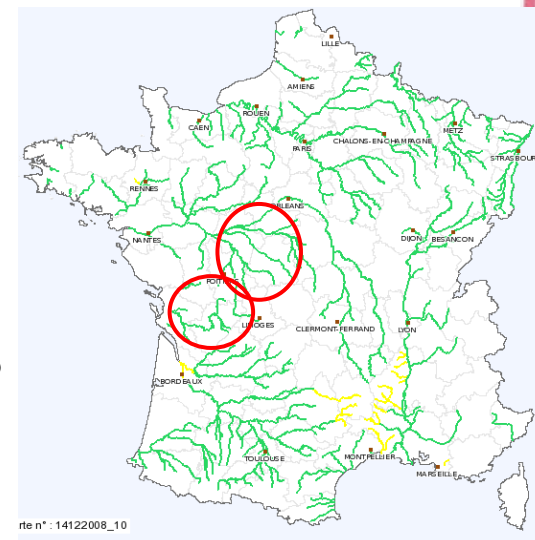
- comparison between SIM and EFAS (models)
  - Structure of the models
  - Input data



report (20 pages, in French...)

## - 1 case study: floods on Vienne and Charente in march 2007 (10-year floods)

- Did they detect the floods? early ?
- Did they help to estimate the gravity ?
- A suggestion to present synthetically information ?



# Prospect for a better use of SIM and EFAS

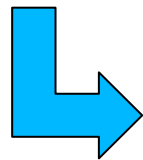
Step 1: to convert streamflow forecasts to be able to compare alerts

**EFAS:** rivers are coloured when at least 10% of the 51 runs of the EPS forecast a streamflow > Q97\_simul

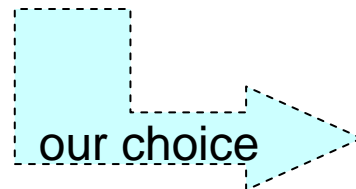
Q97\_simul corresponds 97% percentile of simulated streamflow computed from 1995-2008 simulated data

**SIM:** gauging stations are coloured when at least 30% of the 51 runs of the EPS forecast a streamflow > Q90\_obs

Q90\_obs is the 90th percentile of daily streamflow computed from 1989-2006 observed data







Need to use a comparable threshold, with common rules for coloration



Threshold: Q97\_simul

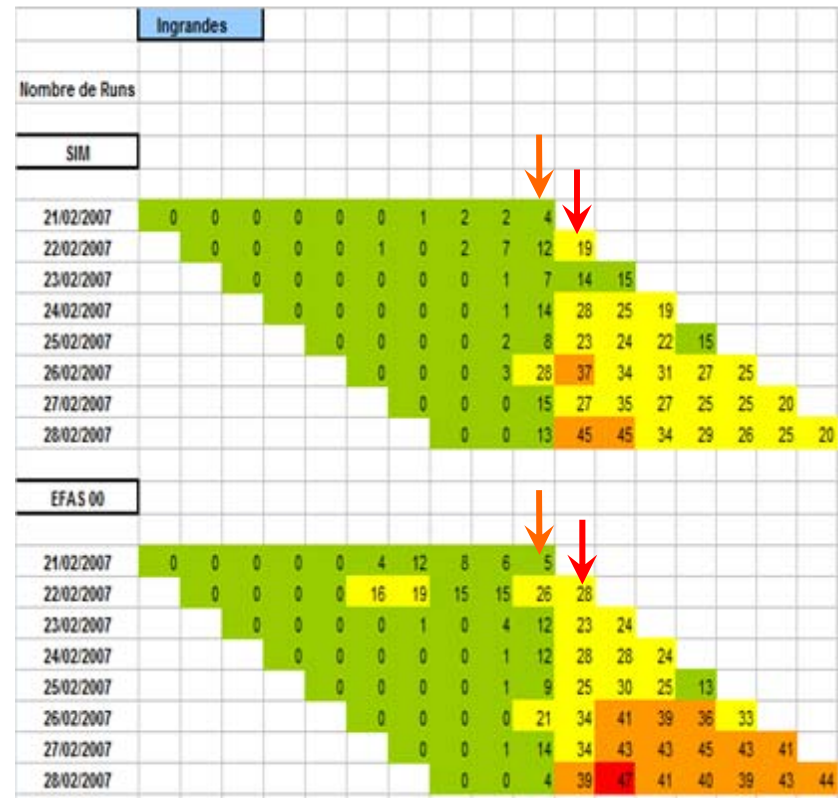
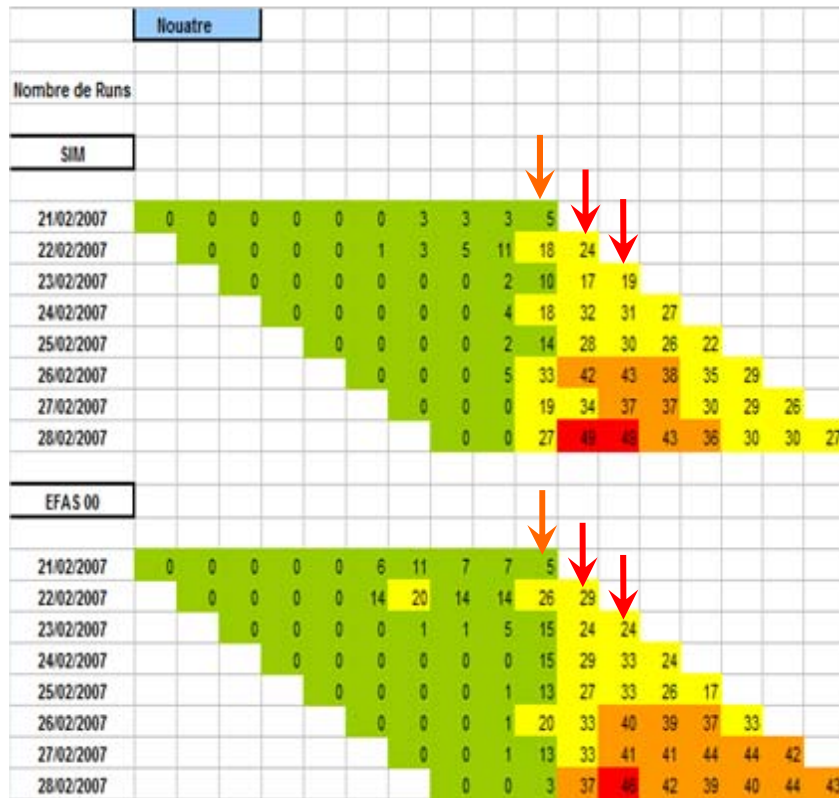
Rules for coloration:

|   |  |
|---|--|
|  0 % - 30 %  |  30 % - 70 %  |
|  70 % - 90 % |  90 % - 100 % |

# Prospect for a better use of SIM and EFAS

## Step 2: to summarize EPS information (1/2)

- “Persistence charts”: quick view of the forecast (number of runs over the threshold) and of its confirmation run after run



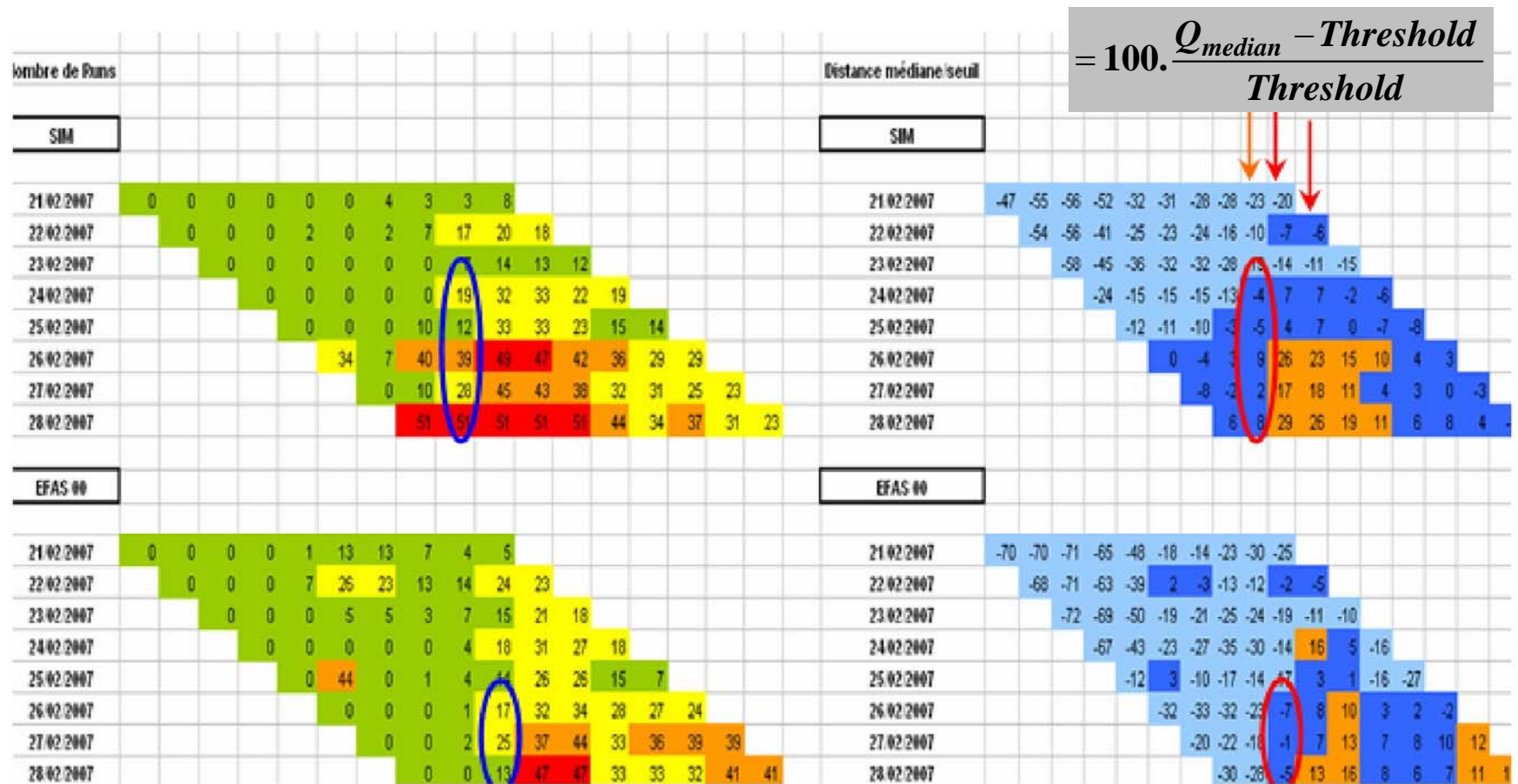
- ➔ Beginning of rising
- ➔ Day of the peakflow



# Prospect for a better use of SIM and EFAS

## Step 2: to summarize EPS information (2/2)

- “distance to threshold charts”: globally, to situate the forecast, close or far to the threshold ?



➔ Beginning of rising  
➔ Day of the peakflow



# Conclusion of the study

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1 case study: floods on Vienne and Charente basins in march 2007 (10-year floods)

- Did they detect the floods early ?

**Yes !**

- Did they help estimate the gravity ?

**Not precisely...: Does Q97\_simul mean “yellow” level of gravity ?**

- A suggestion to represent synthetically information ?
  - ✓ **Synthetic charts to have a quick view (Persistence, distance to threshold charts)**
  - ✓ **Comparable forecasts (in term of threshold) => complementarity**



# General conclusion

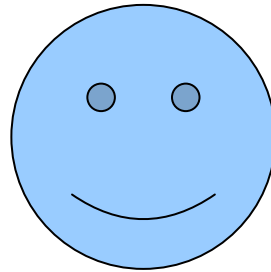
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- . **Alert thresholds should be linked with « operational » thresholds** (“yellow” for us)
  - tests planned on SIM with Meteo-France.
  - streamflow assimilation (in progress, Guillaume Thirel’s doctorate, CNRM) => “realistic” forecasts => “operational” thresholds can be used directly
  
- . **Quality scores should be available:**
  - for ex. contingency tables (good alerts/false alerts...)
  
- . EPS products are generally complex, and fit to large scales => for the moment, **the most efficient is an everyday reading by SCHAPI’s forecaster, who alerts the SPC only when a signal is clear and persistent**



# Questions ?

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French Flood Vigilance Map:

<http://www.vigicrues.ecologie.gouv.fr/>

Contact:

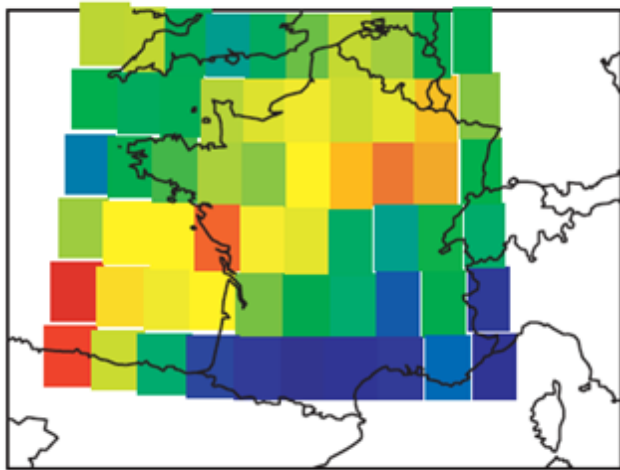
[celine.desaint-aubin@developpement-durable.gouv.fr](mailto:celine.desaint-aubin@developpement-durable.gouv.fr)

[christian.viel@developpement-durable.gouv.fr](mailto:christian.viel@developpement-durable.gouv.fr)

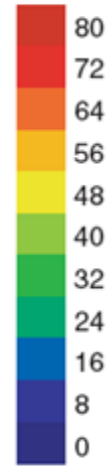
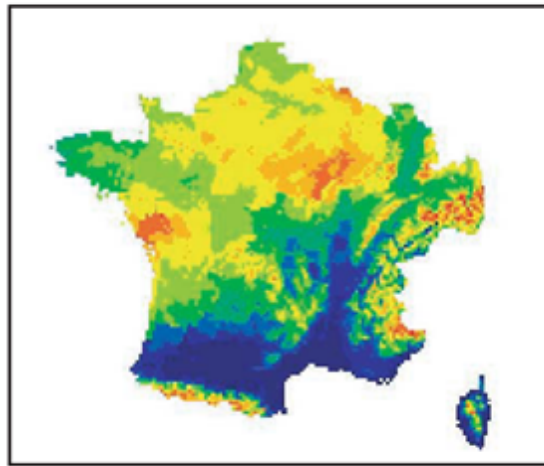


# Downscaling of EPS rainfall (SIM)

a ECMWF data



b Downscaled data



**Figure 3** Result of the spatial downscaling of the ECMWF ten-day cumulative rainfall (mm), forecast for 17 October 2004, from the first ensemble member: (a) data from ECMWF on the 1.5° grid and (b) data after downscaling on the 8 km grid.

ECMWF newsletter, spring 2007