Ensemble streamflow forecasting over France: use of the system SIM

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PLAN OF THE PRESENTATION

- Presentation of the french organisation in flood forecasting
- The ensemble streamflow prediction system SIM
- Conclusion over the use of SIM
- Prospect for a better use of SIM and EFAS
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

![Flood Vigilance Map](image_url)

4 levels of risk:
- Rouge: High risk of flooding, direct and generalized threat to public safety and property.
- Orange: Risk of flooding leading to severe damages on public goods and property.
- Jaune: Risk of flooding with rapid rise of water leading to minor damages.
- Vert: No immediate risk.

Click on a zone of the map to view details from the Service de Prévision des Crues (S.P.C.).
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.
The french organisation in flood forecasting

What do those 4 levels mean?

- Link with consequences and potential damage
  (not on climatology flood return probability)

1st level that we need to anticipate.

Need of long lead time forecast.

Any danger to fear.
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

- 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

**Bassin de l’Adour-Garonne**
- L’Adour à St-Vincent
- L’Ariège à Autterive
- La Dordogne à Bergerac
- L’Isle à Azac
- La Garonne à Portet-sur-Garonne
- La Garonne à Tonneins
- Le Lot à Villeneuve-sur-Lot
- Le Tarn à Villefranche-sur-Tarn

**Bassin de la Loire**
- L’Allier à Moulins
- Le Cher à Châtillon-sur-Cher
- La Loire à Montjean
- La Loire à Nantes
- La Vienne à Nouatré

**Bassin du Rhône**
- Le Doubs à Besançon
- L’Isère à Grenoble
- Le Rhône à Beaucraze
- Le Rhône à Viviers
- La Saône à Mâcon

**Bassin de la Seine**
- L’Aube à Arcis-sur-Aube
- La Marne à Châlons-en-Champagne
- L’Oise à Sempigny
- La Seine à Paris
- La Seine à Poses
- L’Yonne à Courlon-sur-Yonne

Bienvenue sur le site SIM -- Prévision d’ensemble - Temps réel - Climatologie

*** PAGE des TABLEAUX d’ALERTE sur la France ***

Pour visualiser les prévisions CEP (site intranet DP/SERVIAGRO) : 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
The ensemble streamflow prediction system SIM

Persistence diagram

For each station, we can go through …

Last forecast for the next 10 days
The ensemble streamflow prediction system SIM

For each station, we can go through ...
Conclusion over the use of SIM

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

- 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 > \( Q_{97\_simul} \)

\( Q_{97\_simul} \) 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 > \( Q_{90\_obs} \)

\( Q_{90\_obs} \) 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: \( Q_{97\_simul} \)

Rules for coloration:

- **Green**: 0 % - 30 %
- **Yellow**: 30 % - 70 %
- **Orange**: 70 % - 90 %
- **Red**: 90 % - 100 %

Our choice
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?

\[ Q_{\text{median}} - \text{Threshold} \times 100/\text{Threshold} \]
Conclusion of the study

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

- 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?

French Flood Vigilance Map:
http://www.vigicrues.ecologie.gouv.fr/

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Downscaling of EPS rainfall (SIM)

ECMWF newsletter, spring 2007