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# Neural network flash flood forecasting : generalizing to ungauged basins

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# **1. The Cévennes region : a remarkable region for flash floods**



- Numerous heavy rainfall episodes leading to flash floods,
- More than 100 fatalities and billions of damage costs in the past years,
- Low predictability and great difficulty to understand hydrological processes.

# 3. Statistical modeling on ungauged basins : how to ?



- Journal of Applied Intelligence vol. 35, 2, pp. 1078-189.
- France), Natural Hazards and Earth System Sciences 12, pp. 3307-3324, doi : 10.5194/nhess-12-3307-2012.

Left : location of the Gardon d'Anduze basin in the Cévennes range; **Right :** number of events above 200 mm in 24 hours from 1958 to 2010 per administrative (Meteo department France).



• Toukourou, M.S., Johannet, A., Dreyfus, G. and Ayral P.-A., 2011, Rainfall-runoff modeling of flash floods in the absence of rainfall forecasts: the case of "Cévenol flash floods",

• Kong-A-Siou, L., 2011, Modélisation des crues de bassins karstiques par réseaux de neurones, cas de l'aquifère du Lez (Montpellier), thèse de l'Université Montpellier 2, 230p. Artigue, G., Johannet, A., Borrell, V., Pistre, S., 2012 : Flash flood forecasting in poorly gauged basins using neural networks: case study of the Gardon de Mialet basin (southern

## 4. Results on ungauged basins of the Cévennes range

For more than 30 sq.km basins and when representative rainfall are available, the model proved it was able to generalize to ungauged basins. Its ability to generalize is limited to hydro-climatic similar areas but could be transposed to other areas.

.ead time	0h30	1h	1h30	2h
ge predicted	0.40/	070/	070/	070/
tage of peak	94%	81%	81%	8/%
n predicted	87%	84%	86%	86%
tage of peak				
30% predicted	80%	80%	88%	80%
tage of peak				



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Design of two models : recurrent for poorly gauged basins (left) static with observed and discharge for well gauged basins (right).

Output noise governing in the first case, state noise governing in the second case.

58 intense events the in database, with one very intense event, out of the training set.

Specific discharge forecasts up to 2h without rainfall forecasts.

> +1h30 forecast for the Baume basin (oct. 2004 event)

