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Guillaume Artigue, Anne Johannet, Valérie Borell-Estupina, Séverin Pistre. Neural network flash flood forecasting: generalizing to ungauged basins. EGU General Assembly 2019, Apr 2019, Vienne, Austria. EGU General Assembly 2019, 2019. hal-02510794

HAL Id: hal-02510794

<https://imt-mines-ales.hal.science/hal-02510794v1>

Submitted on 31 Mar 2022

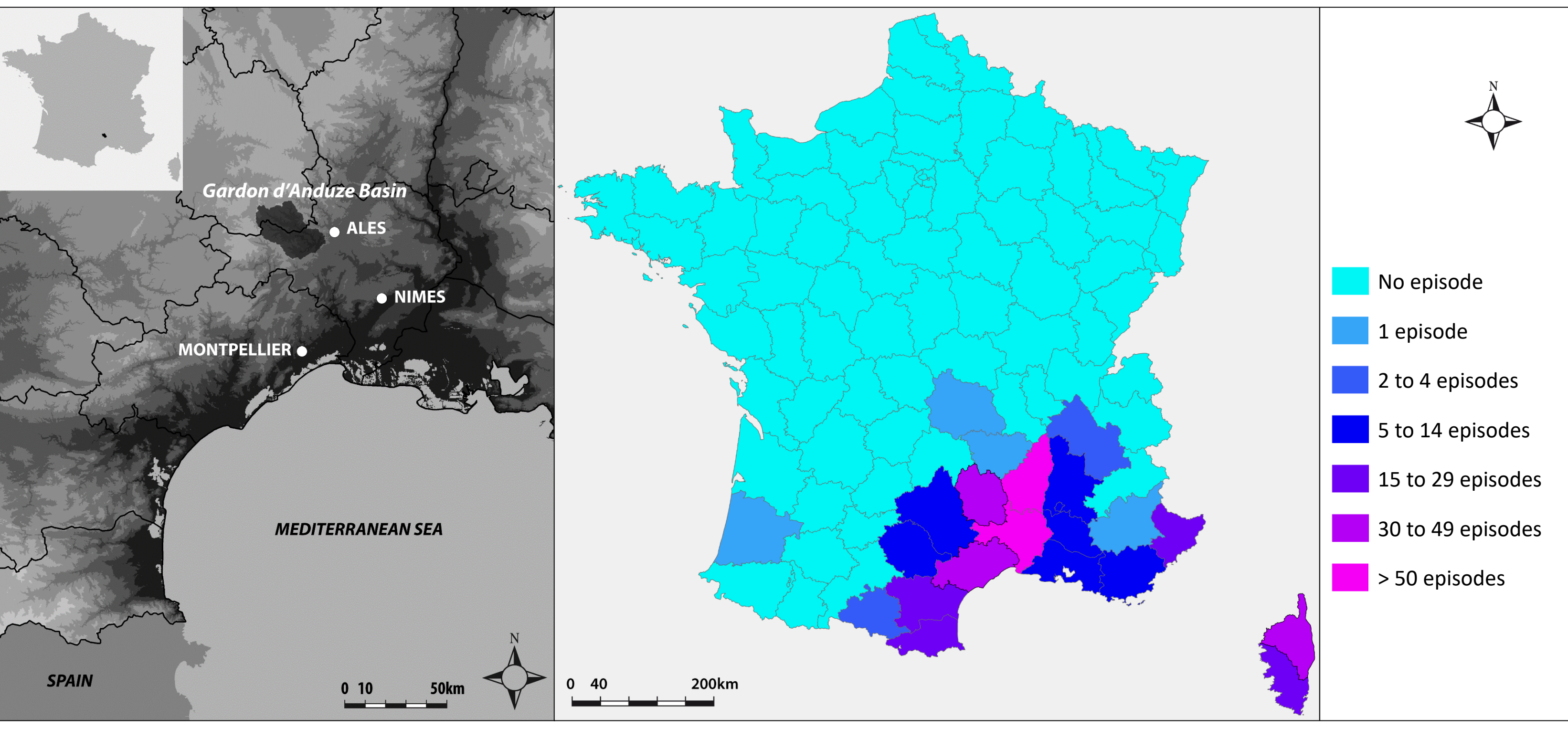
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Neural network flash flood forecasting : generalizing to ungauged basins

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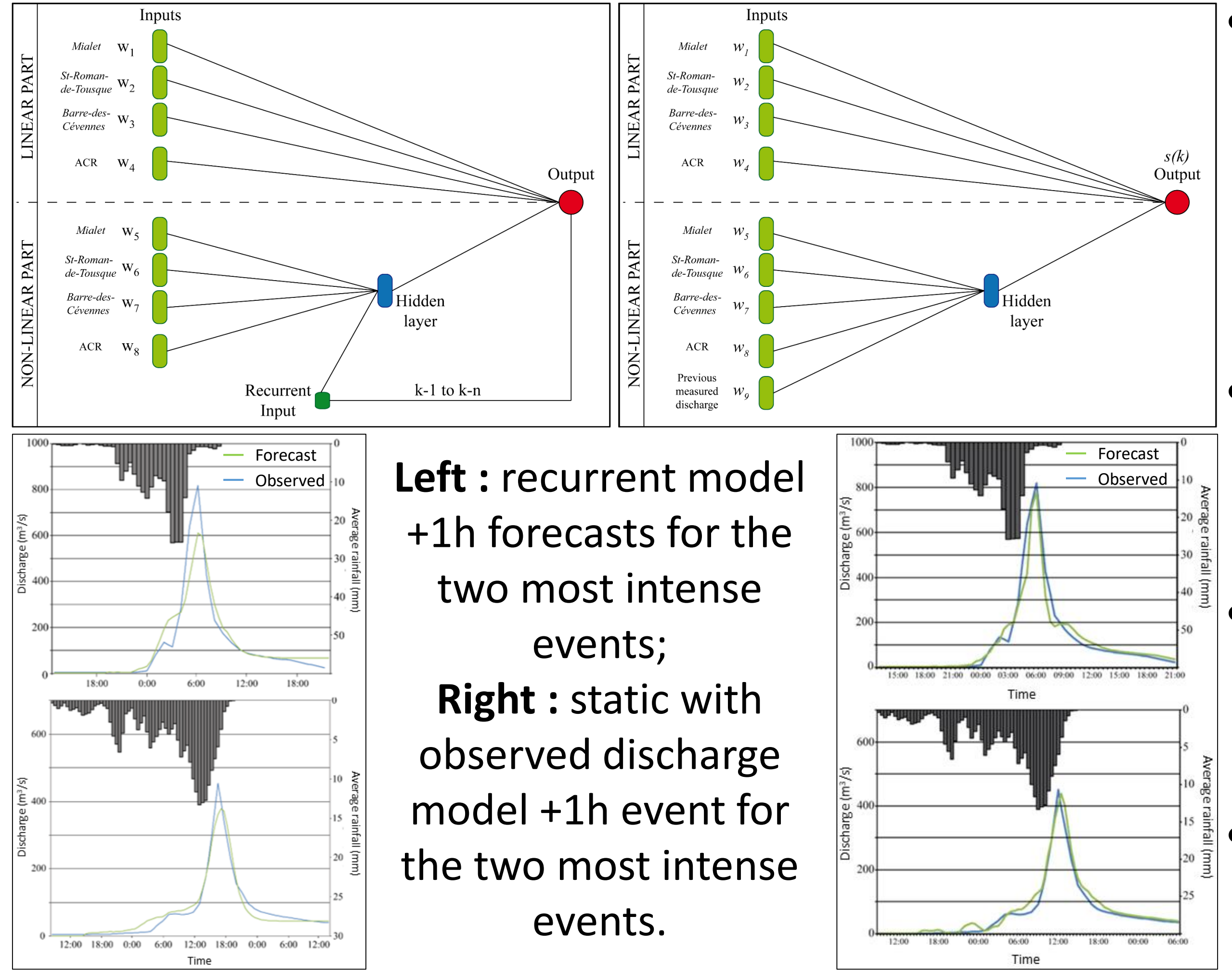
1. The Cévennes region : a remarkable region for flash floods



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 department (Meteo France).

- 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.

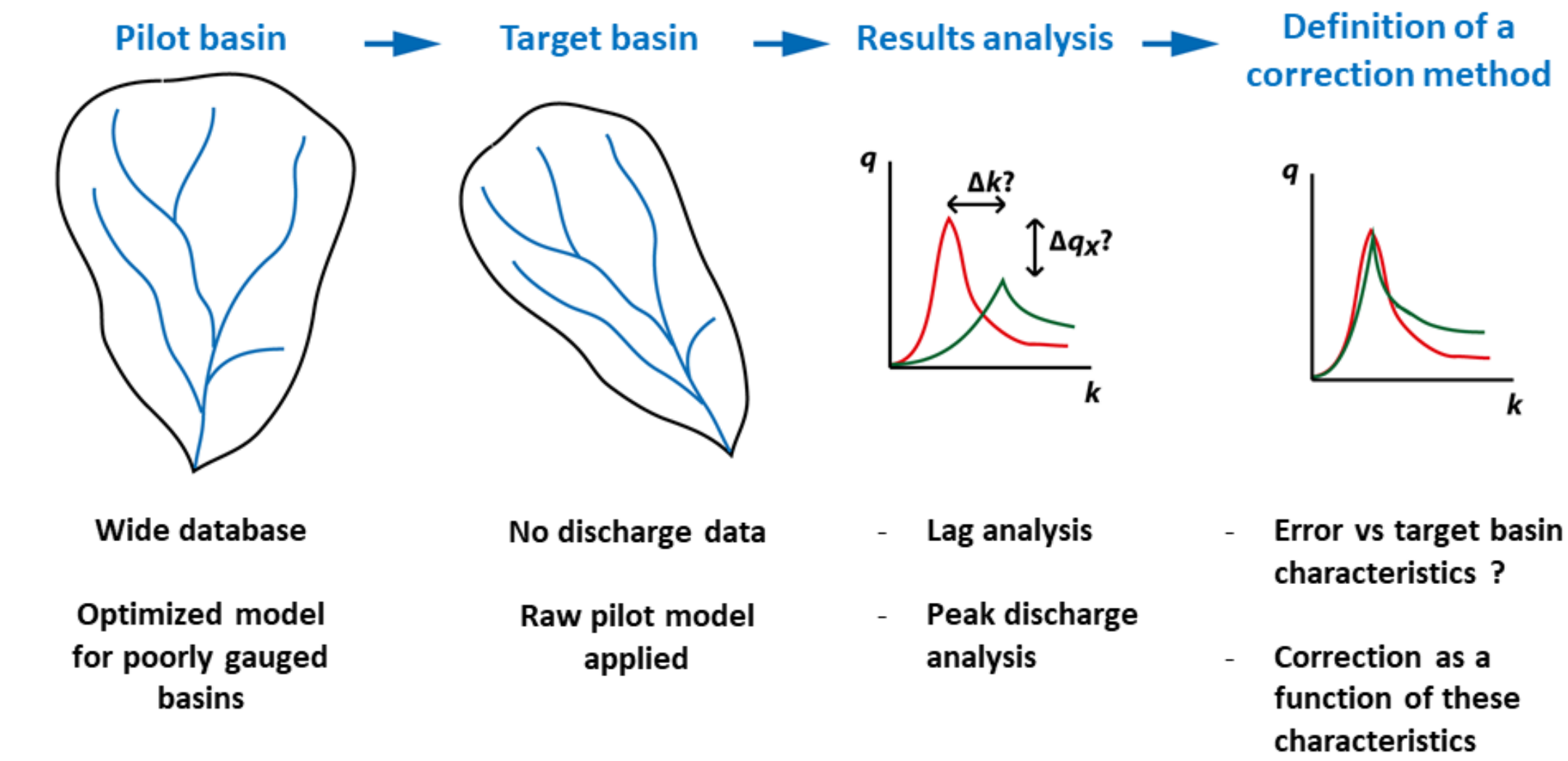
2. Neural networks for hydrology : adapting to available data



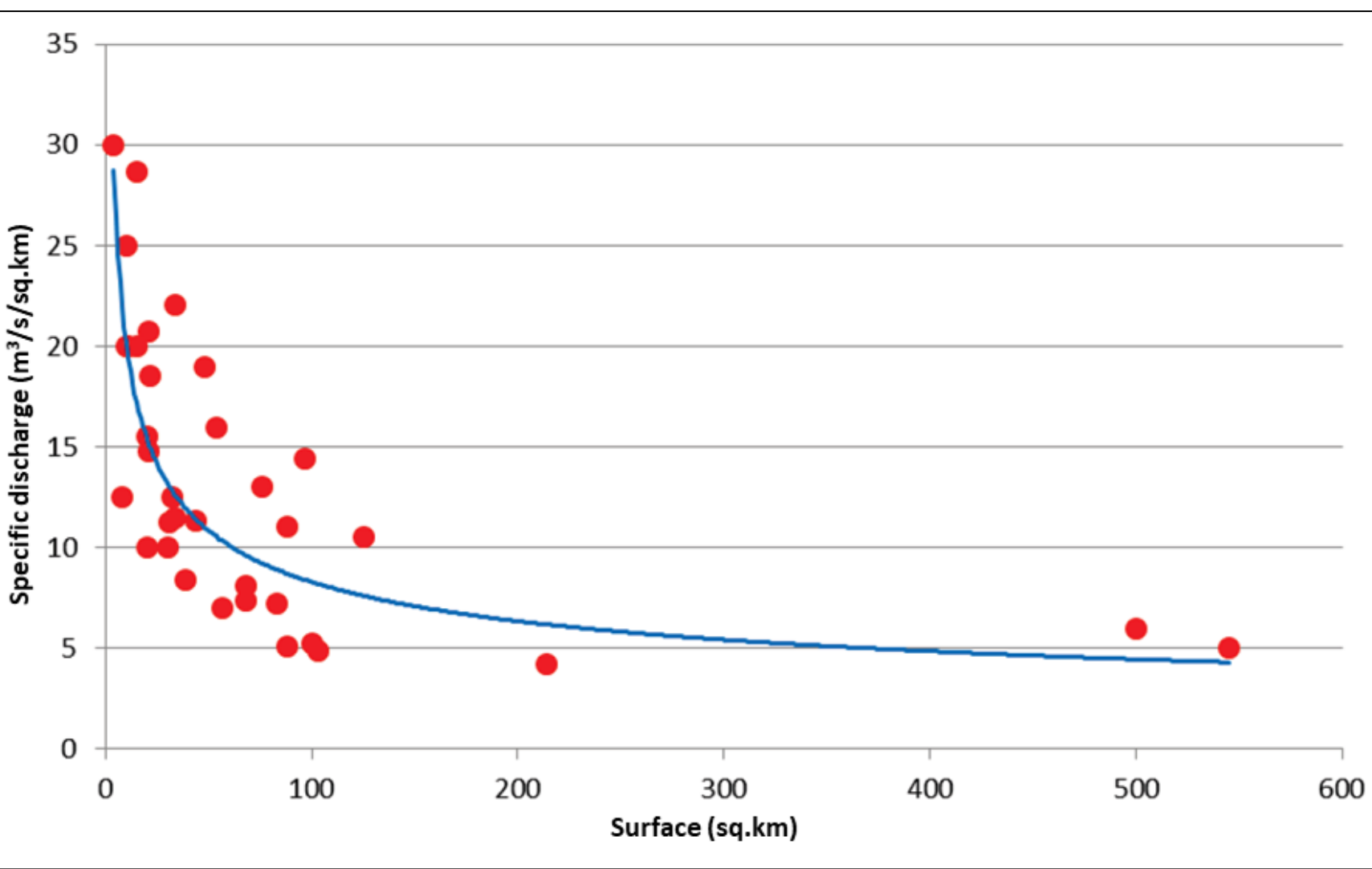
Left : recurrent model +1h forecasts for the two most intense events;
Right : static with observed discharge model +1h event for the two most intense events.

- Design of two models : recurrent for poorly gauged basins (left) and static with observed discharge for well gauged basins (right).
- Output noise governing in the first case, state noise governing in the second case.
- 58 intense events in the database, with one very intense event, out of the training set.
- Specific discharge forecasts up to 2h without rainfall forecasts.

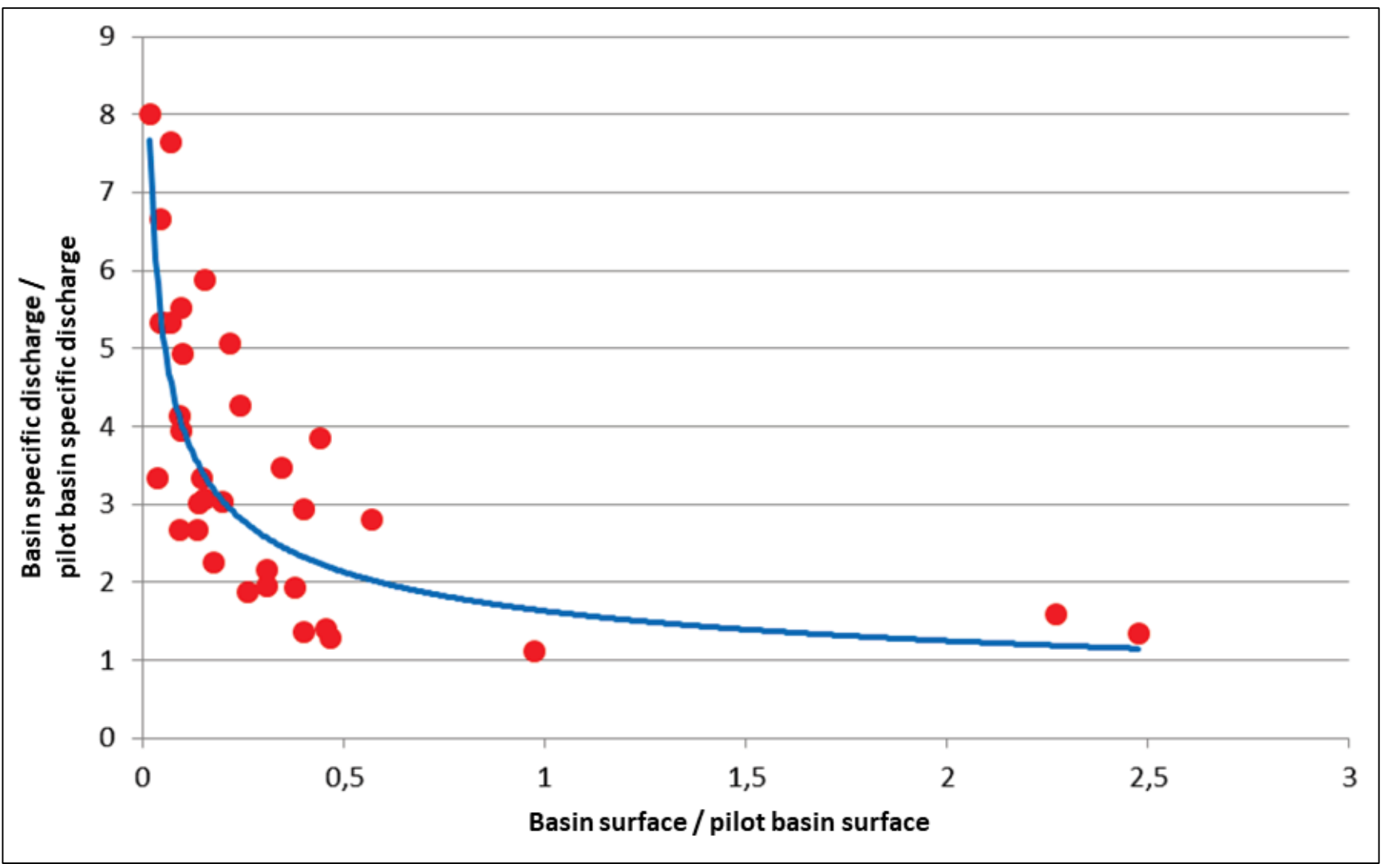
3. Statistical modeling on ungauged basins : how to ?



- Application of the model to 15 other “ungauged” basins
- Bad results expected : taking advantage of the meaningfulness of errors ?
- Building a correction method based on the basin characteristics.



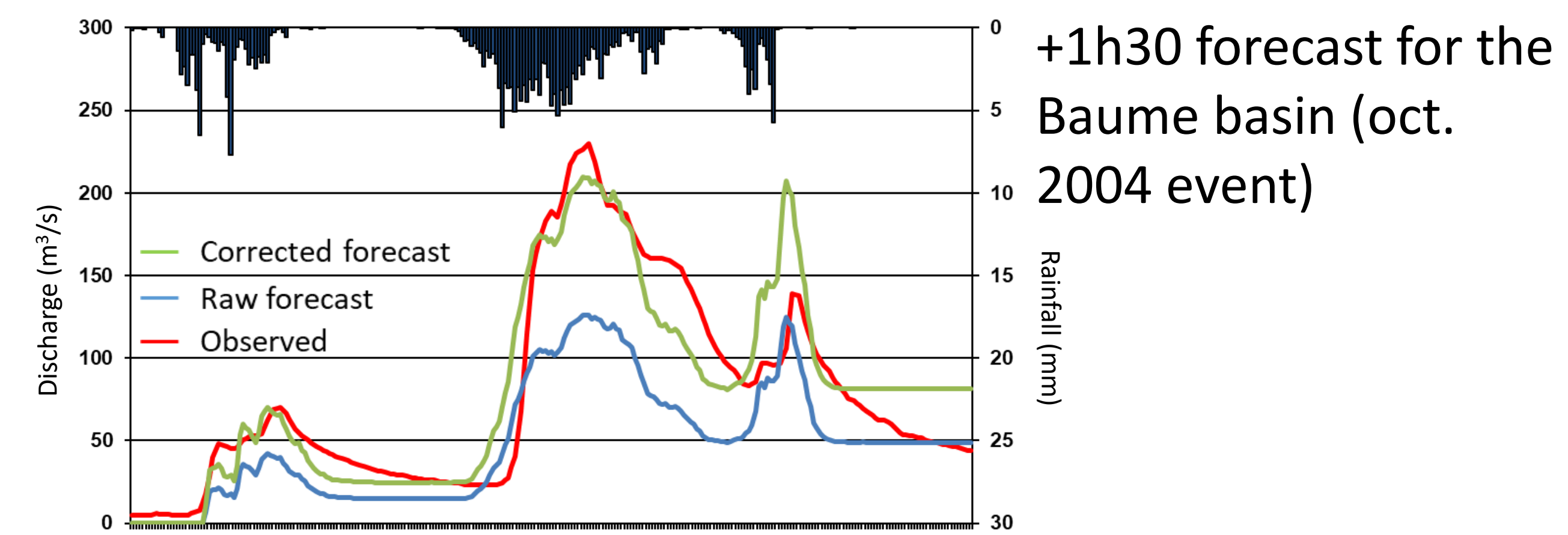
Dimensional (left) and non dimensional (right) relationship between specific discharge and surface.



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.

Lead time	0h30	1h	1h30	2h
Average predicted percentage of peak	94%	87%	87%	87%
Median predicted percentage of peak	87%	84%	86%	86%
70 to 130% predicted percentage of peak	80%	80%	88%	80%



- Acknowledgements to the French flood forecasting service (SCHAPI) for funding and data, to OHMCV for data and to Dominique Bertin from Geonosis for the development and constant improvement of the RNFFPro Software.

- Toukourou, M.S., Johannet, A., Dreyfus, G. and Ayrat P.-A., 2011, Rainfall-runoff modeling of flash floods in the absence of rainfall forecasts: the case of “Cévenol flash floods”, Journal of Applied Intelligence vol. 35, 2, pp. 1078-189.
- 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 France), Natural Hazards and Earth System Sciences 12, pp. 3307-3324, doi : 10.5194/nhess-12-3307-2012.