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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.

2. Neural networks for hydrology: adapting to available data

- 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.

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.

<table>
<thead>
<tr>
<th>Lead time</th>
<th>0h30</th>
<th>1h</th>
<th>1h30</th>
<th>2h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average predicted percentage of peak</td>
<td>94%</td>
<td>87%</td>
<td>87%</td>
<td>87%</td>
</tr>
<tr>
<td>Median predicted percentage of peak</td>
<td>87%</td>
<td>84%</td>
<td>86%</td>
<td>86%</td>
</tr>
<tr>
<td>70 to 130% predicted percentage of peak</td>
<td>80%</td>
<td>80%</td>
<td>88%</td>
<td>80%</td>
</tr>
</tbody>
</table>

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