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# Relevance of using ensemble forecasts of flash-flood impacts for an emergency service: an evaluation for the October 2018 flood event in the Aude river basin, France

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## Context & Objectives

### Context

- Flash flood: important proportion of flood damages and fatalities
- Limited predictability, fast dynamic high specific discharge, high spatio-temporal variability → low anticipation capacity for flood emergency management

### Objectives

- Comparative evaluation of 3 rainfall ensemble forecasting products: Arome-PE, pepi & pertDpepi (experimental products)
- Evaluation based on effectiveness of SDIS emergency service during the october 2018 Aude flood (Agent-based model)

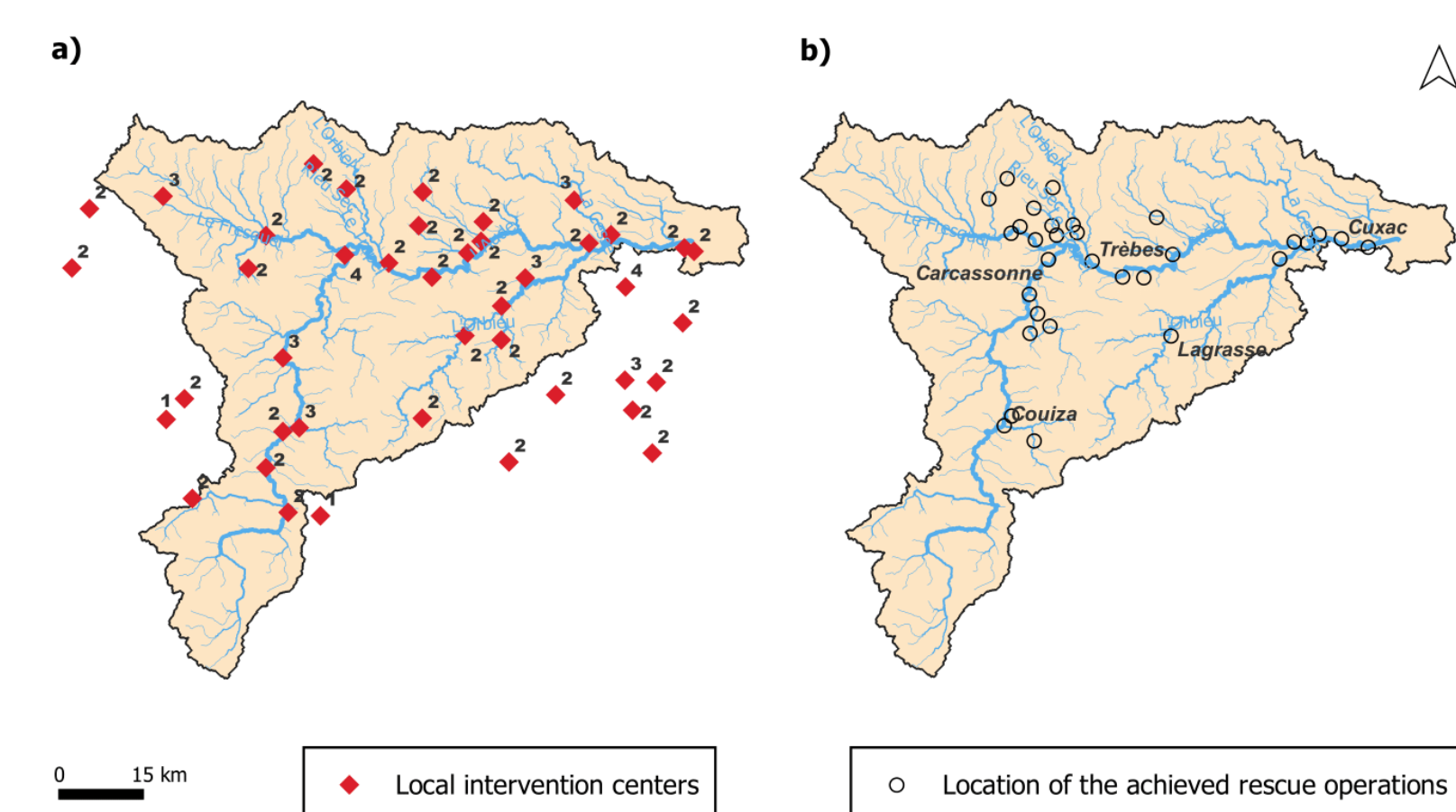
## Case study

### 14th to 16th October 2018 flood of the Aude river

- Heavy precipitation event: 300 mm locally (return period > 100 years), high spatio-temporal variability
- Large flood: 14 deaths, around 100 injuries and 130-180 million euros damages

## Data

- Precipitation
- Obs (QPE): high-resolution radar Antilope
- Forecasts (QPF): short-range (0-6h) ensemble forecasts (AROME-EPS, pepi, pertDpepi)
- Fire brigade location, rescue team number, location of rescue operations

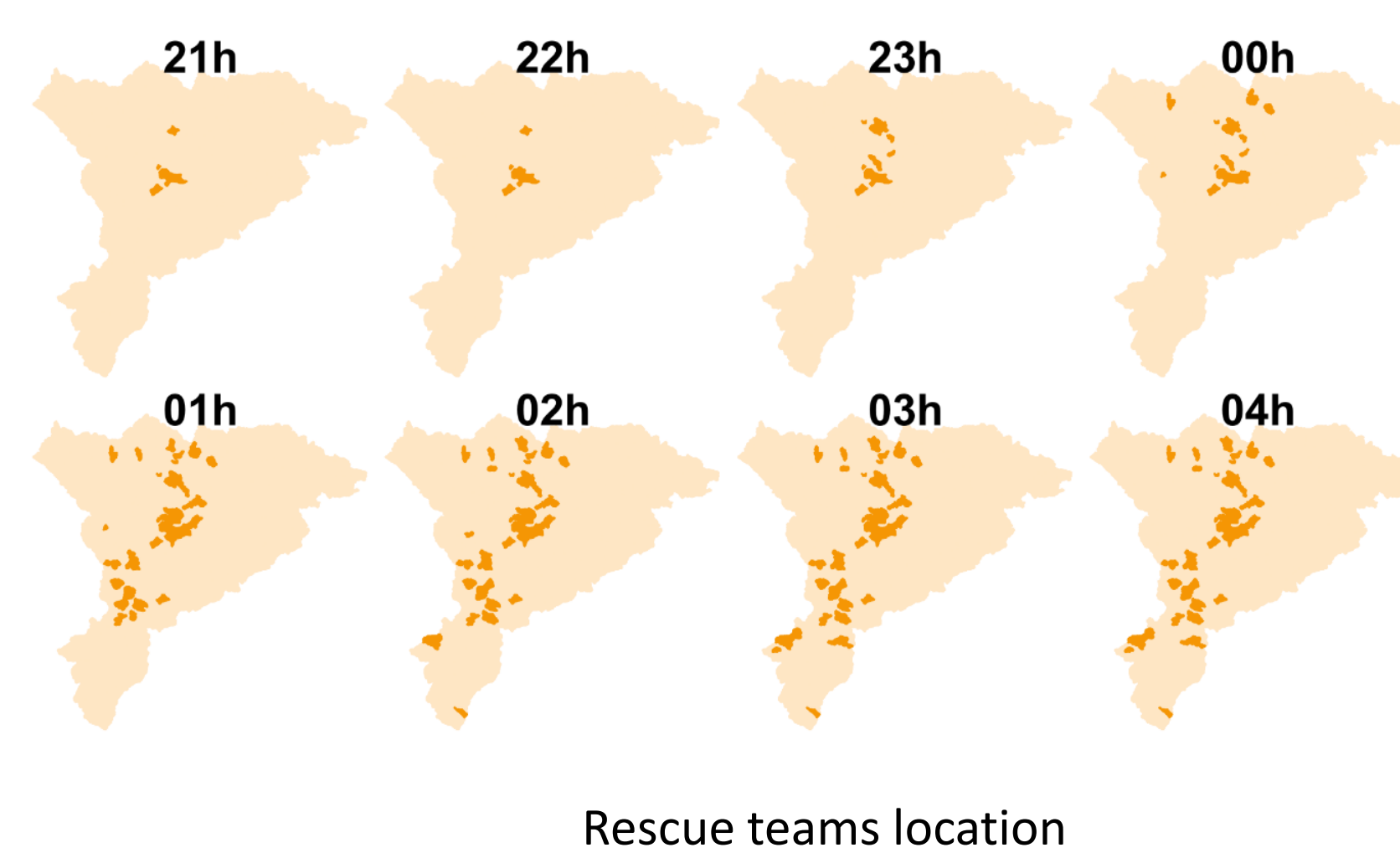


## Methodology

- Hydrometeorological flash flood impact chain to forecast number of inundated building

- Agent-based modelisation (ABM):

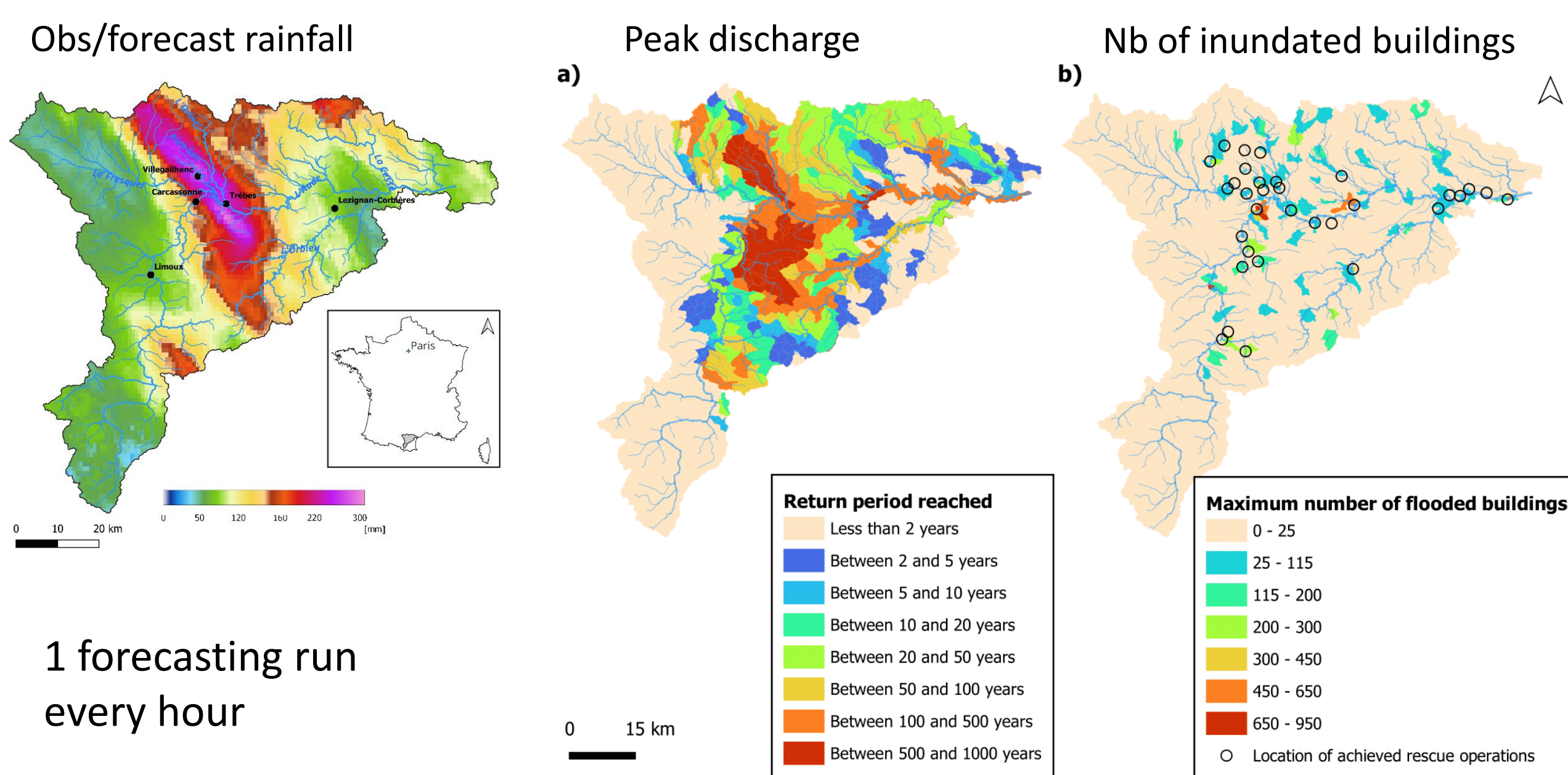
Modelisation of SDIS rescue intervention



**Agents:** firemen rescue teams: available, travelling; arrived at site, in operation

**Decision criteria:** based on expected level of flood impacts  
 - intervention threshold: from 25 forecasted inundated buildings  
 - intervention capacity: 100 buildings/team  
 - reallocation of rescue teams if rescue operations achieved

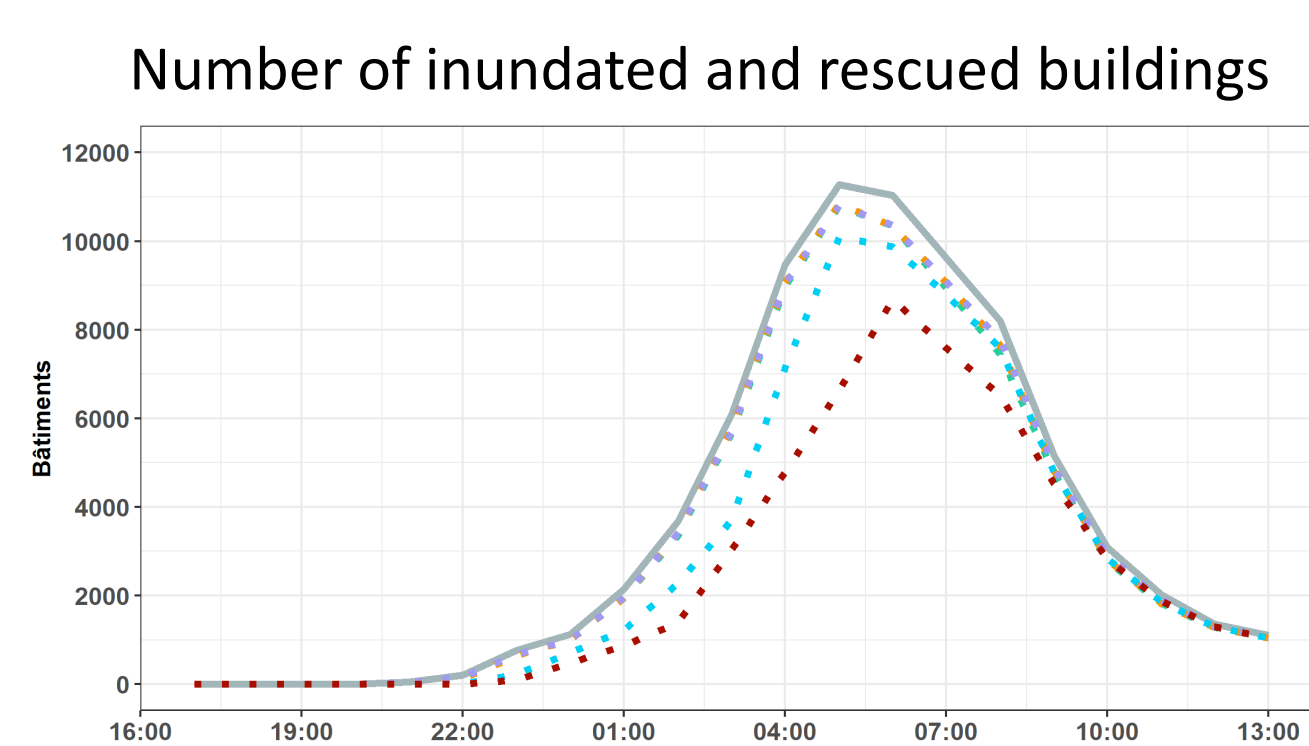
**Cost function:** damage level based on the delay between onset flooded building and rescue team arrival



## Results

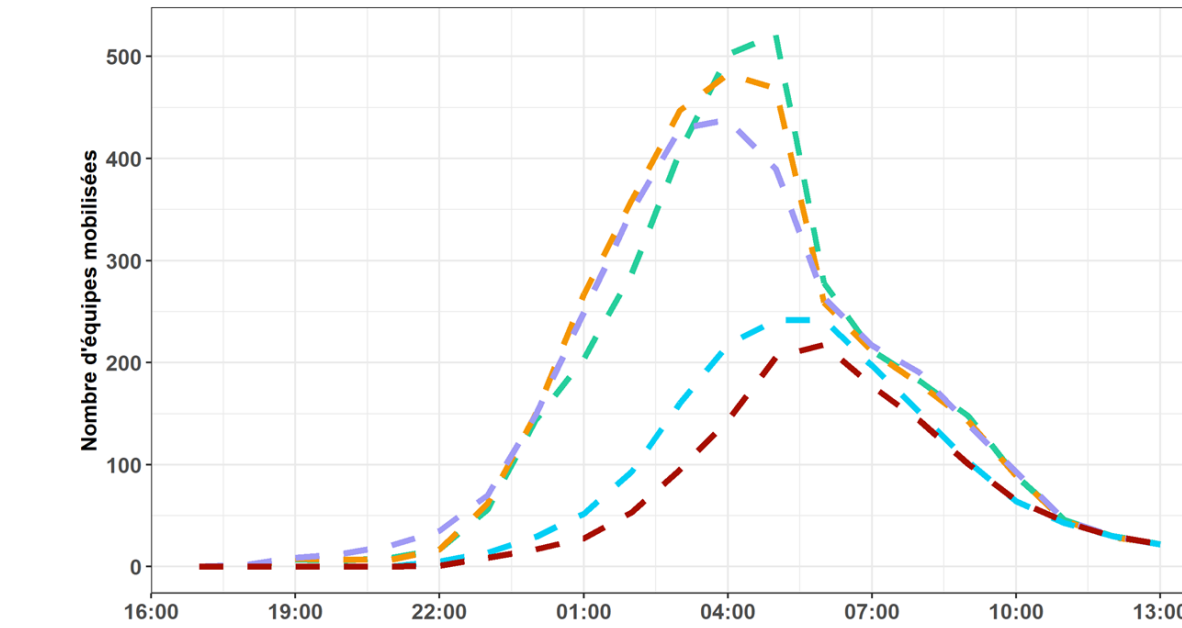
- Unlimited rescue teams

Optimistic case

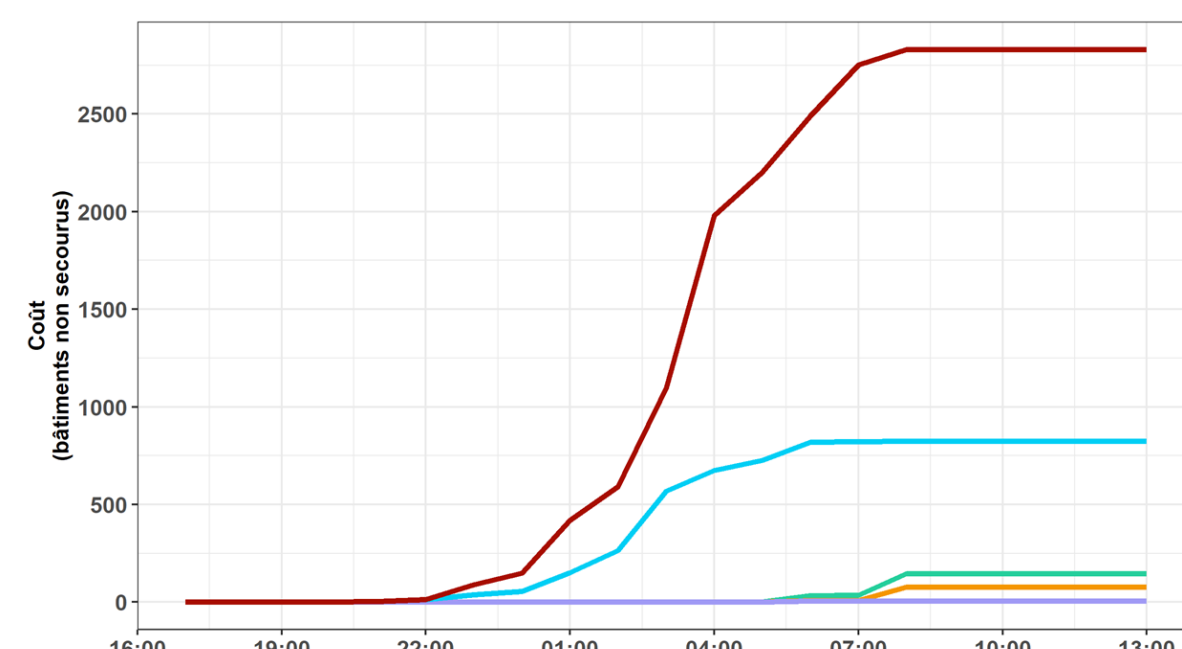


Potential value of hydrometeorological forecasts : timely assistance and cost reducing

Number of mobilized rescue teams

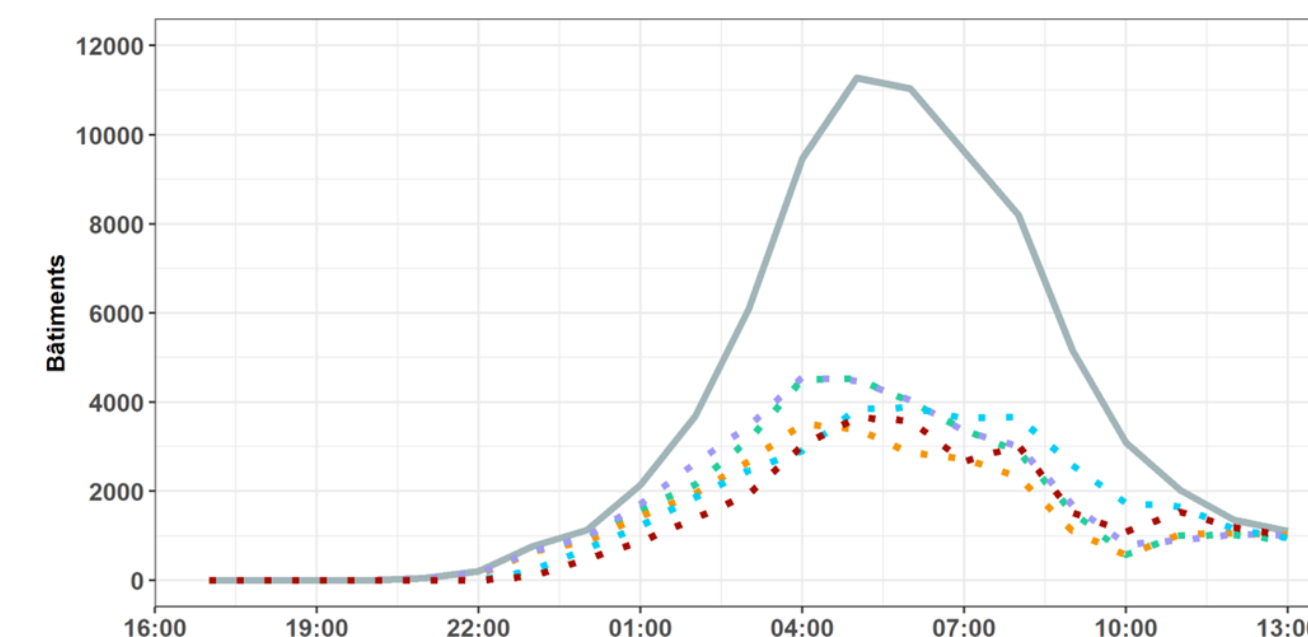


Cost: nb of buildings non rescued in time



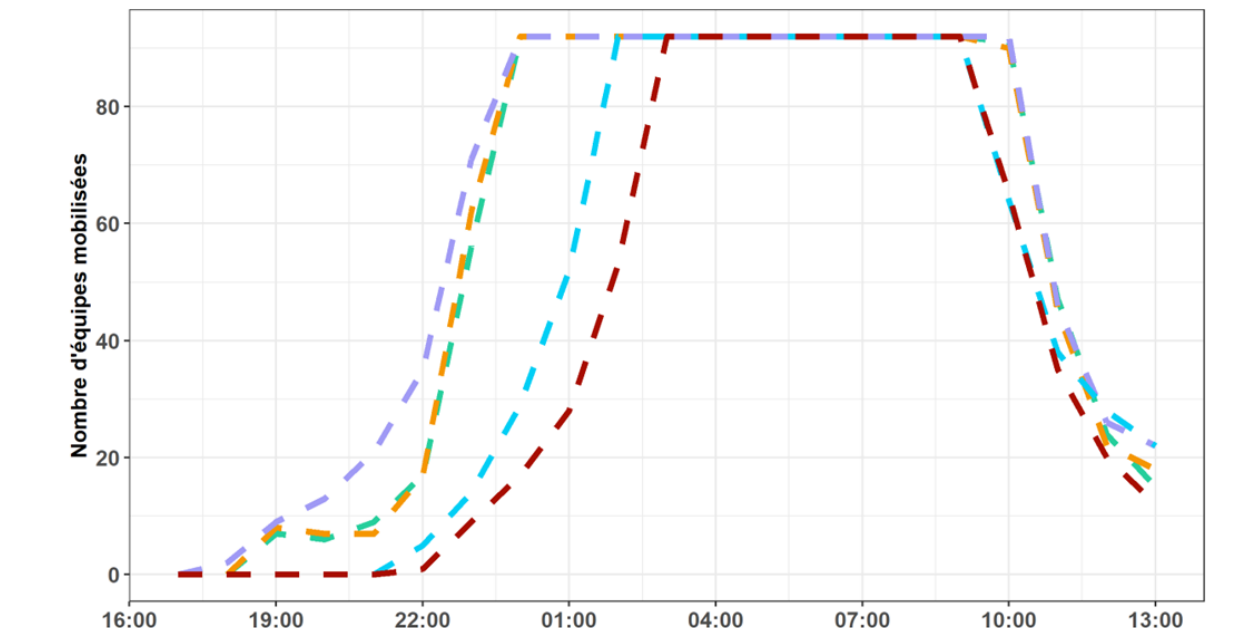
- Limited rescue teams (92 teams)

Number of inundated and rescued buildings

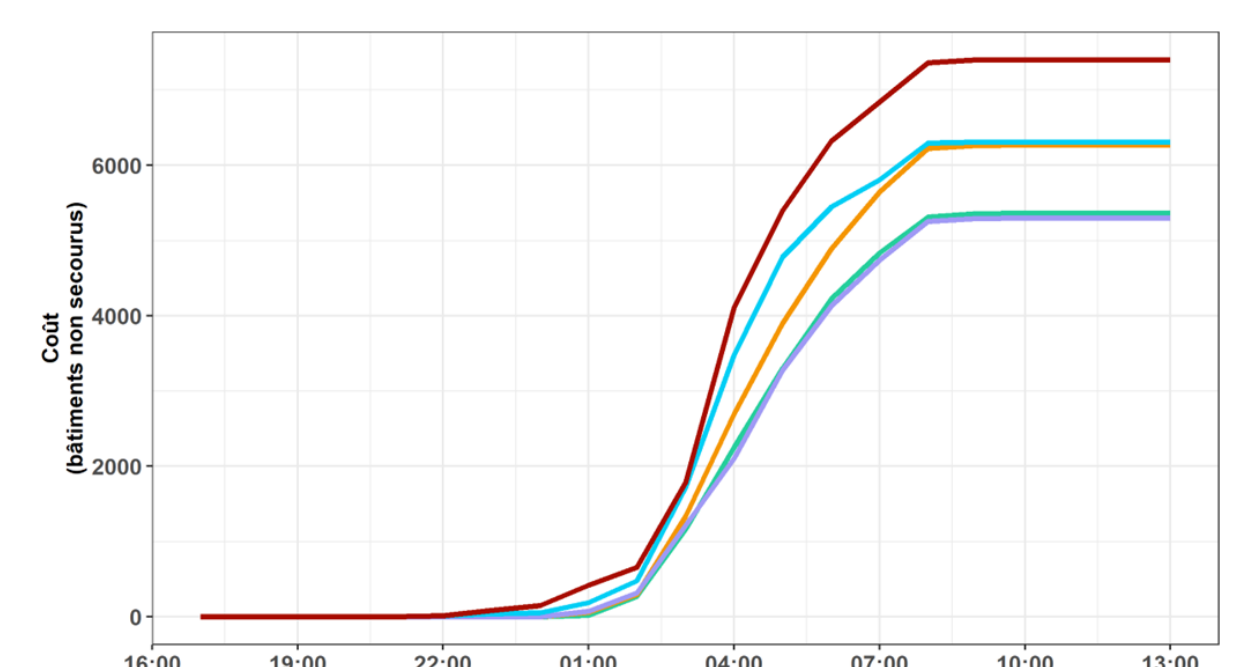


Constraint on the number of assisted flooded buildings → Higher costs

Number of mobilized rescue teams



Cost: nb of buildings non rescued in time



## Key take away

- Interest of ABM to evaluate ensemble forecasts for decision making and crisis management
- Capacity to represent complex dynamics of rescue operations in fast evolving and uncertain situation
- Better representation compared to conventional economic value approaches
- Anticipation using rainfall forecasts increases rescue operation efficiency but limited by intervention capacities, loss of time due to forecasts uncertainties (false alarms), and location of main impacts