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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)

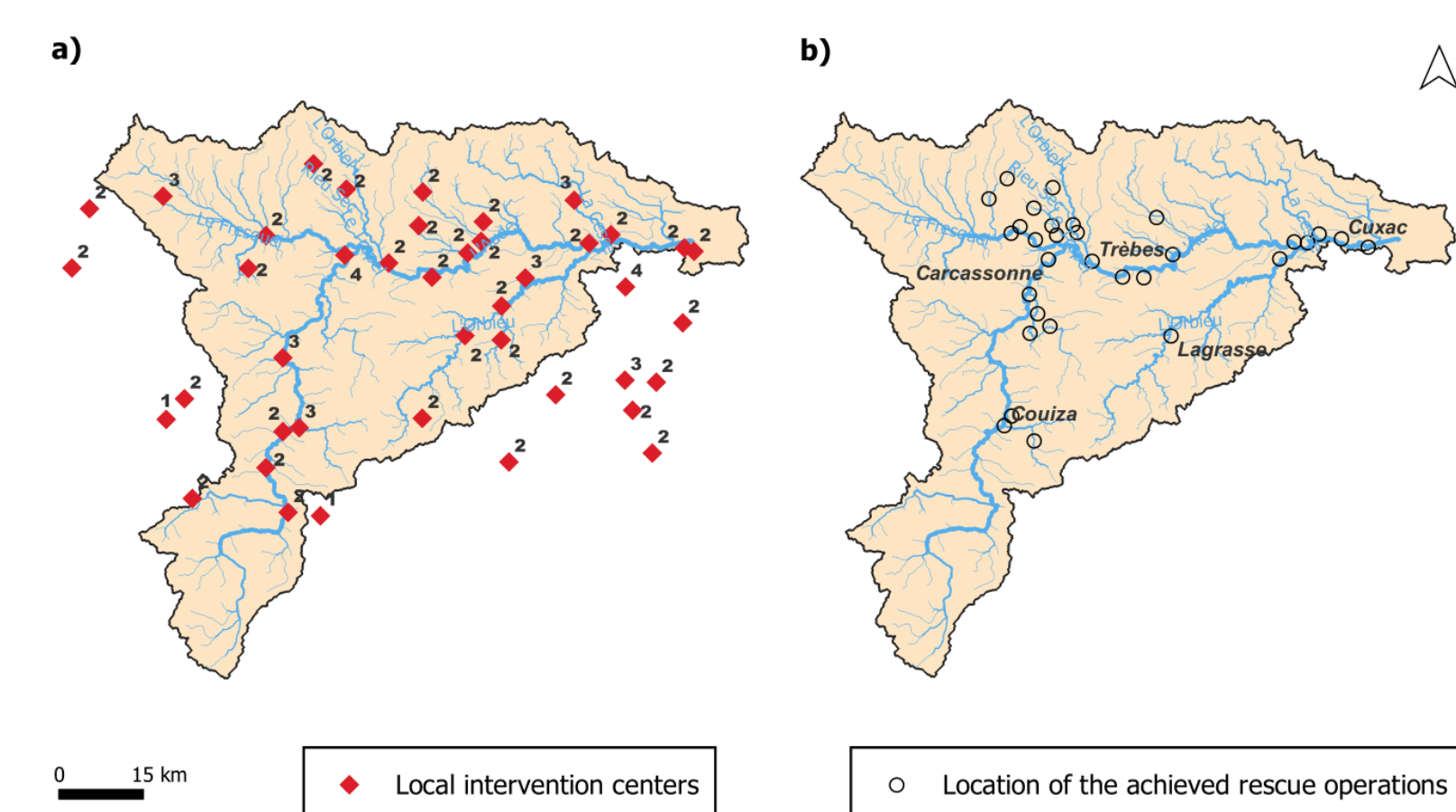
Case study

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

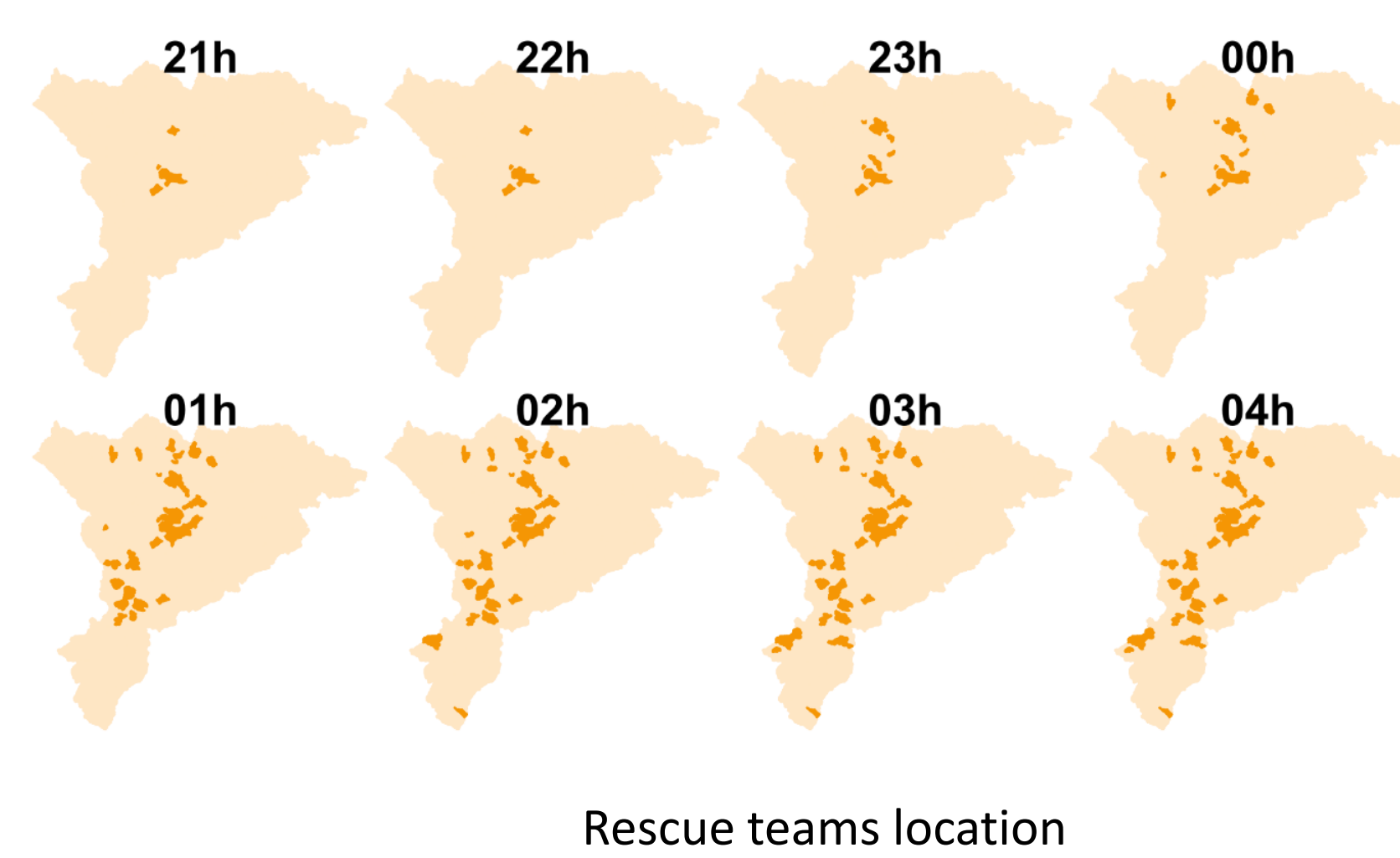


Methodology

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

- Agent-based modelisation (ABM):

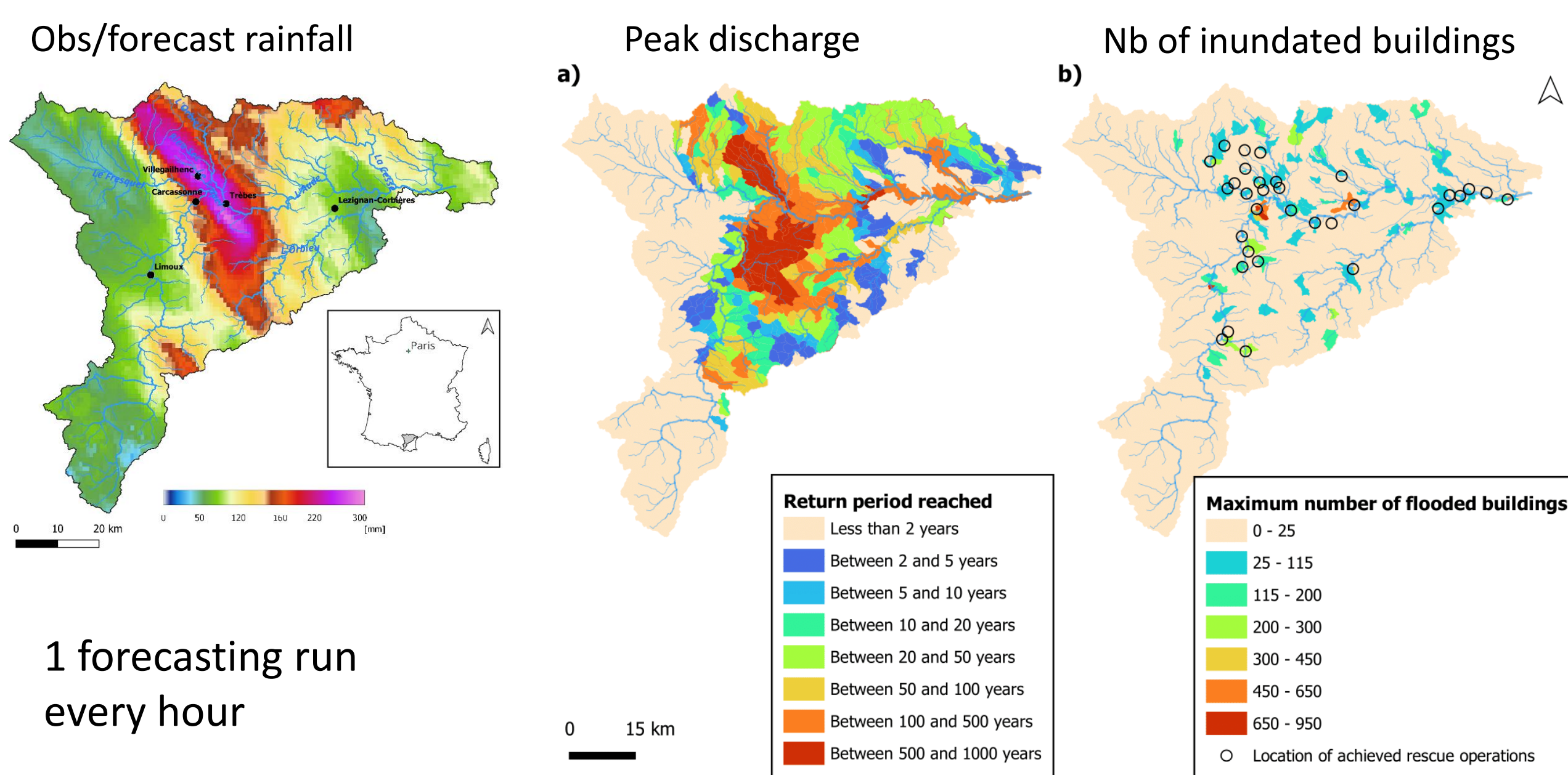
Modelisation of SDIS rescue intervention



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

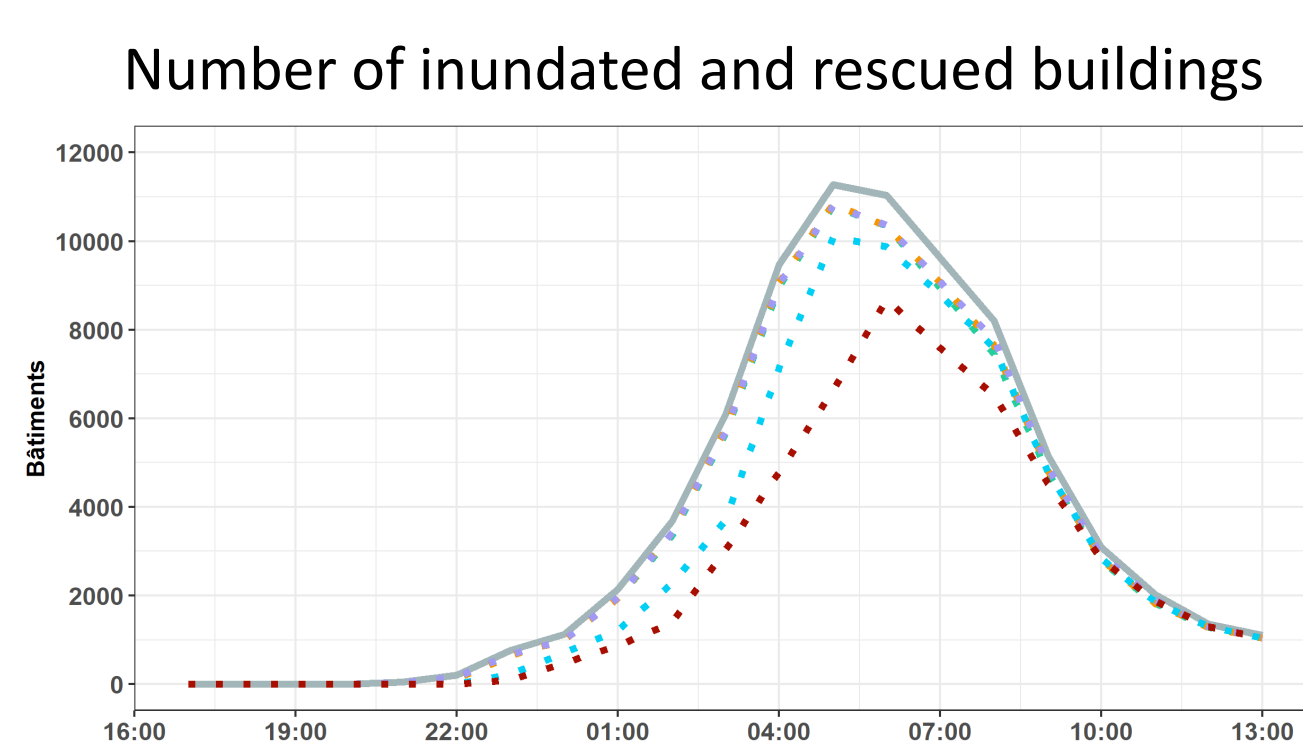
Cost function: damage level based on the delay between onset flooded building and rescue team arrival



Results

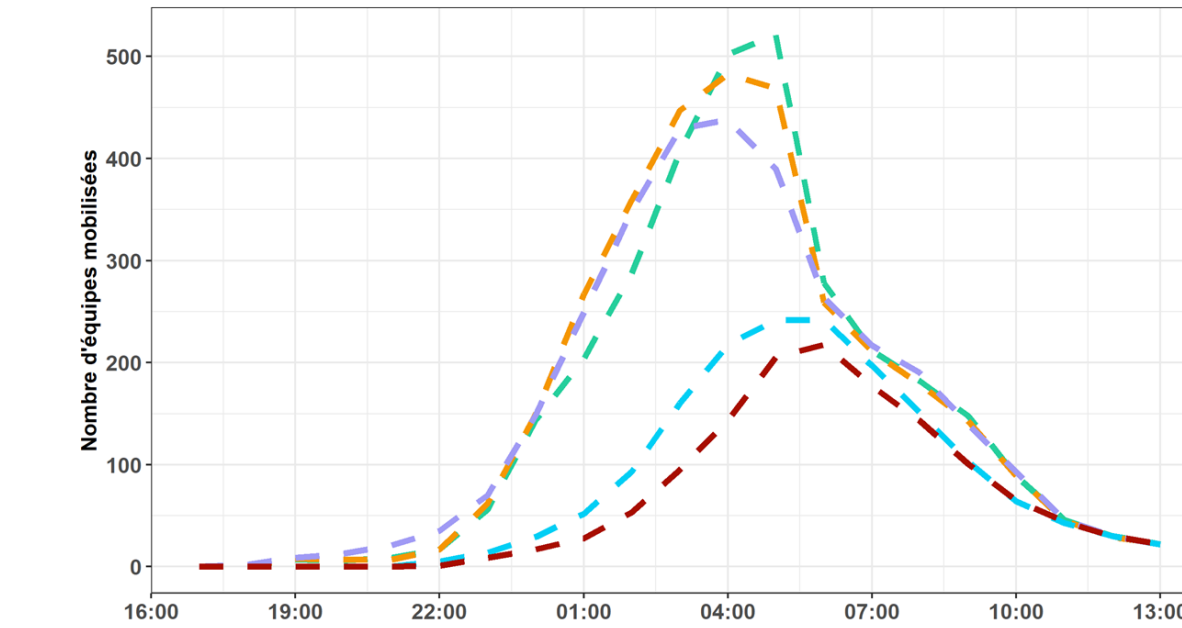
- Unlimited rescue teams

Optimistic case

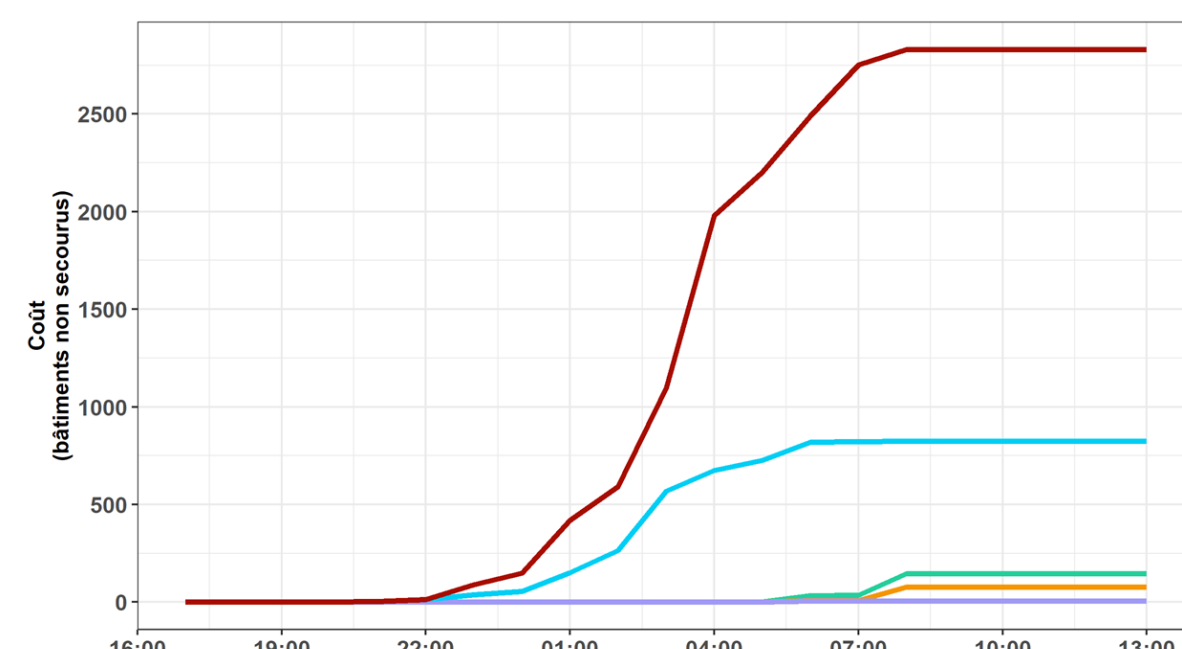


Potential value of hydrometeorological forecasts : timely assistance and cost reducing

Number of mobilized rescue teams

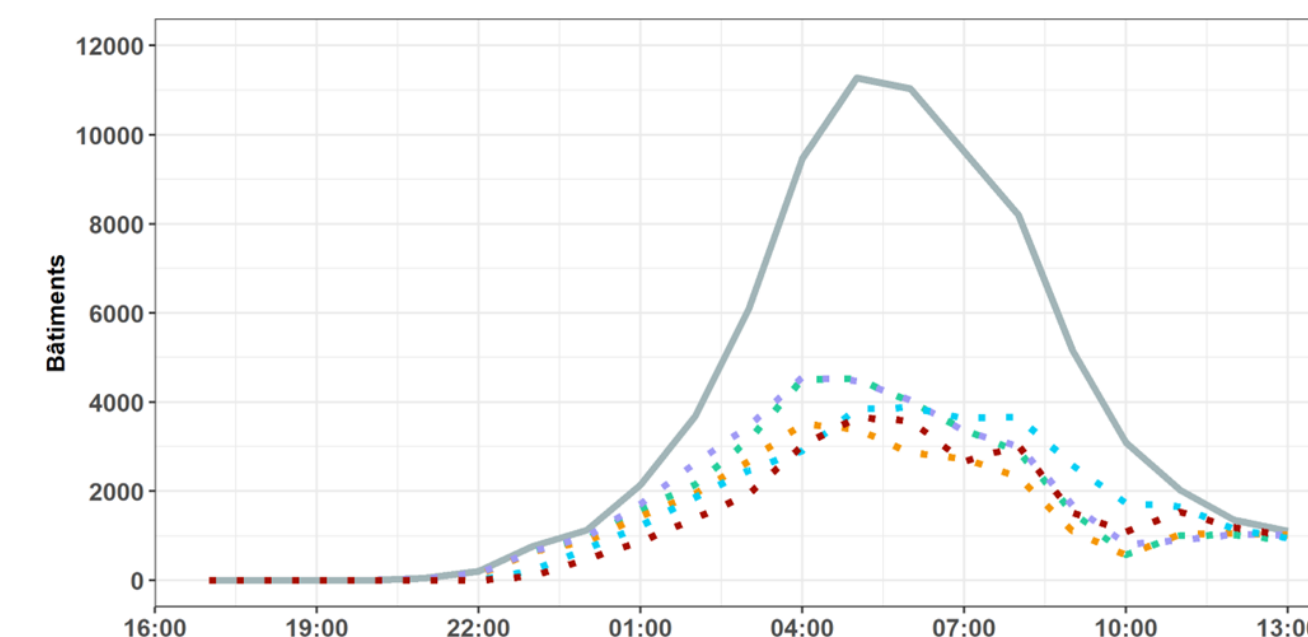


Cost: nb of buildings non rescued in time



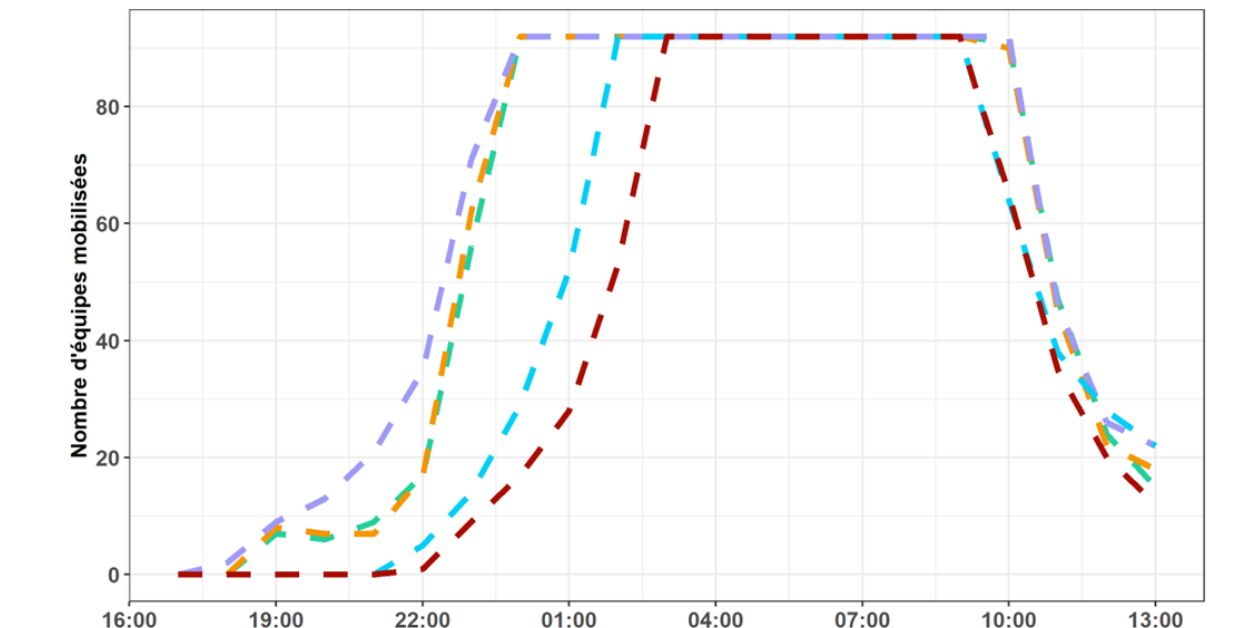
- Limited rescue teams (92 teams)

Number of inundated and rescued buildings

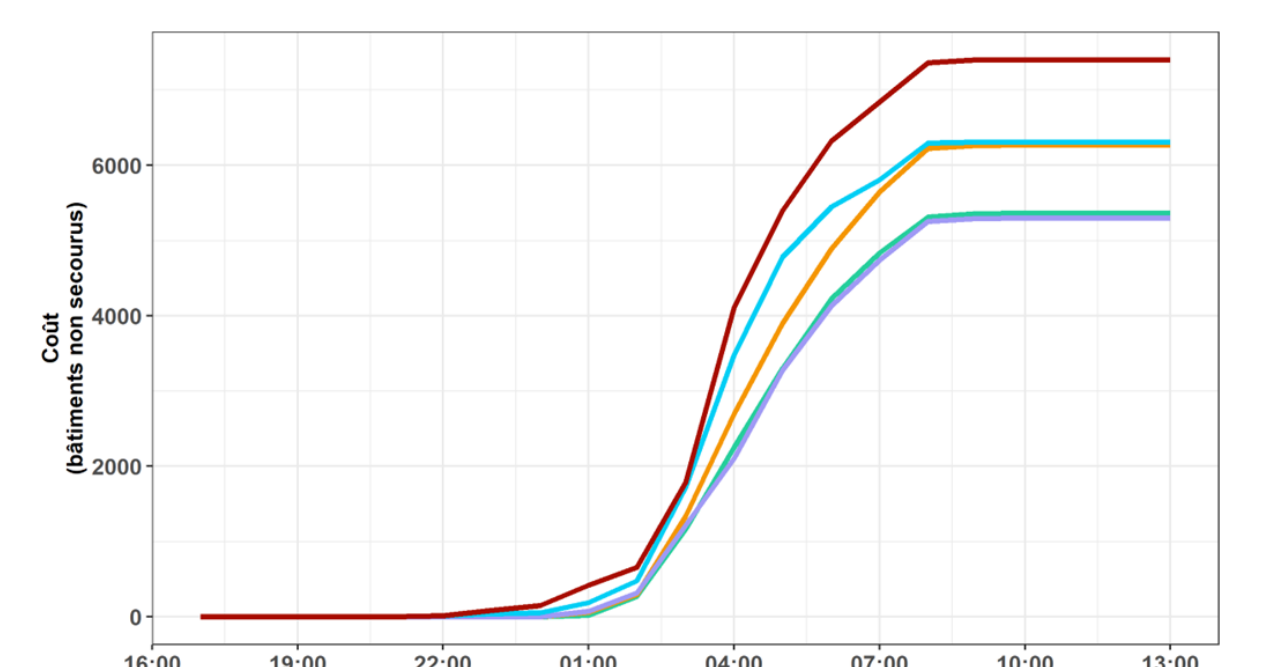


Constraint on the number of assisted flooded buildings → Higher costs

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