Contribution of an exposure indicator to better anticipate damage with the AIGA flood warning method: a case study in the South of France

C. Saint-Martin, C. Fouchier, J. Douvinet, P. Javelle, F. Vinet

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Clotilde Saint-Martin (1), Pierre Javelle (1), Freddy Vinet (3), Johnny Douvinet (2), Catherine Fouchier (1)
(1) Irstea, Aix-en-Provence, France, (2) UMR Espace, Avignon, France, (3) UMR GRED, Montpellier, France

In 2015 alone, flash floods caused important damage estimated at several hundred million euros and 27 fatalities in small basins of south of France. Those figures underline once again the need for more efficient and faster flood warnings to enable the population and the stakeholders to be prepared.

1. The AIGA method

There are only 22.700 out of the 120.000 kilometres of the French stream network monitored so far (Fig.1). To cope with this issue, Irstea and Meteo-France have developed an alternative warning system for ungauged basins called AIGA [1].

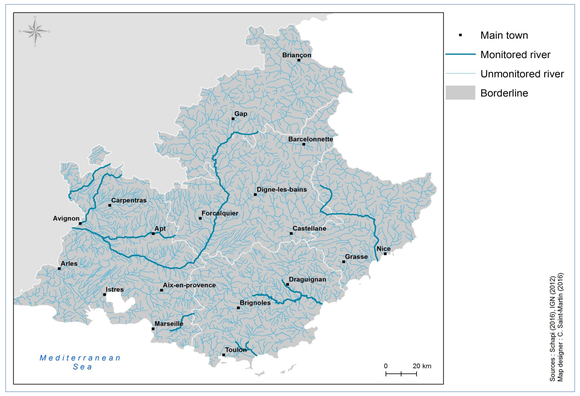


Fig. 1 : Proportion of monitored river network by Vigicrues in Provence-Alpes-Côte d'Azur (SCHAPI)

It is based on a simple distributed hydrological model running at a 1km² resolution using radar rainfall information. The warnings result of the comparison of these real time flow simulations with statistical data.

2. Objectives

AIGA only focuses on the hazard level and doesn't take into account the infrastructures at risk in the studied areas. Therefore, it cannot assess what the potential damage will be.

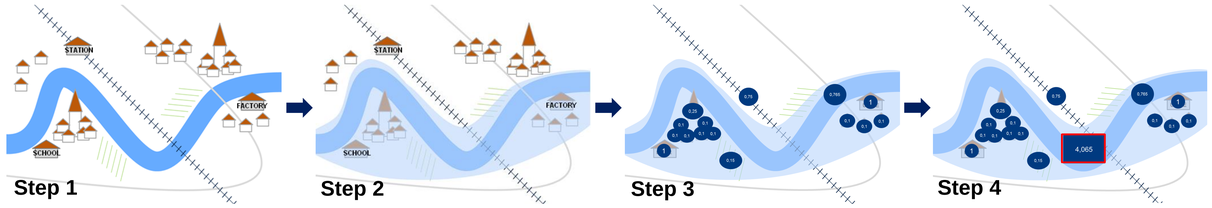
Though, to improve the efficiency of the AIGA method :

- We develop **an exposure indicator** in order to quantify the land-use surrounding a river,
- We implement a **damage database** in order to validate this indicator.

References *:*
[1] Javelle, Pierre, Demargne, Julie, Defrance, Dimitri, Pansu, Jean, & Arnaud, Patrick. (2014). Evaluating flash-flood warnings at ungauged locations using post-event surveys: a case study with the AIGA warning system. Hydrological sciences journal, 59(7), 1390-1402.
[2] Saint-Martin, Clotilde, Catherine Fouchier, Pierre Javelle, Johnny Douvinet, and Freddy Vinet. "Assessing the Exposure to Flooding to Implement a Flood Impact Model for French Mediterranean Basins." In Floodrisk - 3rd European Conference on Flood Risk Management, p. 10. Lyon, France 2016.

Research unit RECOVER
Irstea Aix-en-Provence
3275, route Cézanne - CS 40061
13 182 AIX-EN-PROVENCE Cedex 5
Contact :
clotilde.saint-martin@irstea.fr
www.irstea.fr

3. Definition of exposure and risk damage indicators



The **exposure indicator (EI)** that we implement is based on the different types of infrastructures that may be damaged by a flood, namely the networks, buildings and sites with a special function (school, hospital…).

- First, we **select** the infrastructures localised in flood-prone areas,
- We **prioritize** then provide them with a value proportional to the consequences of their potential damage on the functioning of the area,
- We **aggregate** those values per watershed to obtain a final value corresponding to the exposure of the infrastructures located into each watershed to flooding,
- We sort the latter values into an **indicator** with 6 levels: from very low to very high exposure.

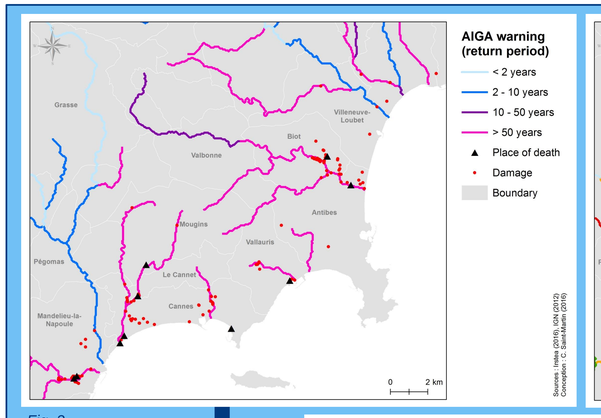


Fig. 2

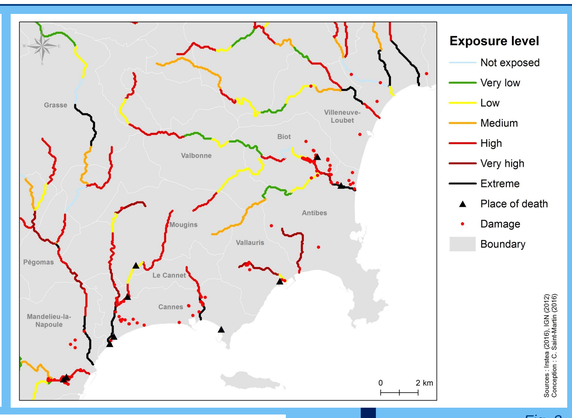


Fig. 3

HAZARD = $1 - \frac{1}{\text{Return period}}$

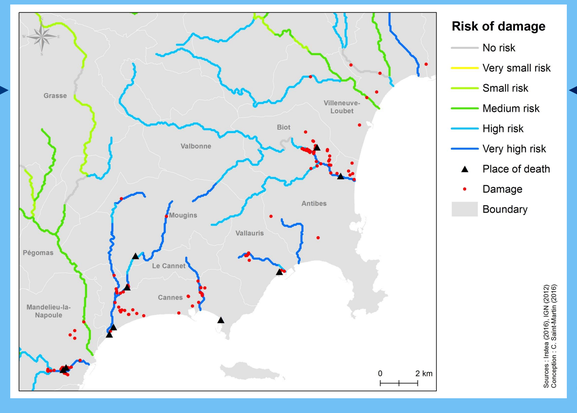


Fig. 4

EXPOSURE = $1 - \frac{1}{EI}$

RISK OF DAMAGE = HAZARD x EXPOSURE

To be able to check the relevance of the exposure levels, we compare them with **flood damage.**

- The damage are collected through field work, media and social networks to obtain the most exhaustive information possible, then gathered into a database.
- Each damage has **precise geographic coordinates** to identify the river section whose flooding is responsible.
- The database contains almost **800 damage points** due to flash floods in South of France since 2011.

4. Results

Example : The flood event of the 3rd October 2015

During this event, the AIGA method characterized many streams with a high warning level in the same area, making difficult for the rescue services to prioritize their actions (Fig. 2). The combination of those levels with the exposure ones, should enable to prioritize some streams from others.
The impacts are indeed localized near streams with high or very high exposure (Fig. 3).
Though, by combining both levels, we obtain an accurate indicator of the flood risk which, in real-time, would have allowed the stakeholders to identify the most damage generating prone streams (Fig. 4).

5. Conclusions

To conclude, this poster highlights the usefulness of an exposure to flooding indicator to generate more relevant flood warnings for stakeholders and risk managers.
Next step: implementing a real-time flood-risk warning system combining both AIGA warnings and our exposure indicator and validating it with damage data taken from former events.
It is the main objective of the **ongoing PhD work of Clotilde Saint-Martin in Irstea [2].**

European Geosciences Union General Assembly 2016 Vienna | Austria | 17–22 April 2016