A flood risk preparedness model that aims at the construction of resilience indicators

Isabelle Alvarez, Bruno Bonté, Katrin Erdlenbruch, Sylvie Huet, Sophie Martin, Charline Smadi

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Flood risk is a crucial social and economic issue in our societies (IPCC 2012, OECD 2014). The adaptation of populations to such a climatic event is a challenge as many studies on recent disasters confirm. The viability theory offers some indicators of resilience to deciders (Martin, 2004). We aim to assess the relevance of these indicators, planning to present and discuss them with local decision-makers of regions exposed to floods. These indicators are computed from a dynamic model of the studied system. Then, as a prerequisite, we need to have a dynamic model of the level of protection against flood of a population. This model has to be simple enough to compute the viability kernel, i.e. every viable state reachable by the population, and useful to compute the corresponding resilience indicators.

We essentially represent the dynamics of preparedness of a population to flood risk. The modelling considers various socio-psychological theories (Maddux & Rogers, 1983; Rogers, 1975; Rouquette, 1998, Slovic 1987) that have been applied to the flood issue (Baggio & Rouquette, 2006; Raaijmakers, Krywkow, & van der Veen, 2008, Richert, Erdlenbruch, & Figuières, 2017) . They all refer to basic close concepts that are embedded in three interrelated variables in our model. These variables indicate the population's state in terms of perception of the risk and confidence in their capacity to cope with. They are: (1) the perceived importance of damage in case of flood (or catastrophic potential); (2) the perceived level of personal exposure to the risk (or understanding of the risk); (3) the perceived control of people in their ability to protect themselves against flood risk (or controllability). These variables are used to compute the preparedness to face the risk of the population.

The perceived damage depends on the existence of collective protection infrastructure such as a dam for example, and on possible institutional actions diminishing the cost of damage. When a flood event occurs, it is also updated considering the difference between the expected damage (ie variable 1.) and the real observed damage. Overall, in absence of unexpected flood, the perceived damage decreases over time. This is also the case of the perceived level of exposure which can be increased through media campaigns or real floods. The perceived control of the flood risk depends on the preparedness of the whole population which is taken as a norm indicating what to do and the easiness of the adaptation (the more adopted, the easier). It is also impacted by flood events, especially through the difference between the expected damage and the real observed damage which indicates the confidence to attribute to the current level of preparedness.

People are exposed to flood series varying in intensity and frequency. They adapt by decreasing or increasing their preparedness. They can benefit from institutional actions such as a media campaigns about possible options for protection, public aid after a "declaration of natural disaster" helping them to recover from the damage, or some subsidies to set up adaptation measures in their homes. Our talk will show the behavior of the model regarding the level of protection of the population for various flood series (with different intensities and frequencies), and for different possible institutional actions.

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