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# Decisions and Behavioral Responses for Impact Estimation in Flash Floods

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Social response, flash floods, Agent-Based Model, GAMA Platform, coping behavior, individual vulnerability

## Abstract

Over the past years, flash flood forecasting has been significantly improved. However, it remains one of the most deadly natural disasters. Indeed, advanced forecasting still does not link natural hazards to exposition and vulnerability. Those elements are key to understand and prevent the emergence of dangerous situations and behaviors during flash flood events.

In the past, static modeling has been widely used to analyse natural hazard consequences. Nevertheless it fails to address complex interactions between individuals' behaviors and the social and environmental dynamics during the crisis. Conversely, Agent-Based Modeling (ABM) are well fitted to simulate complex coupled human-natural system dynamics.

Here we present the DeBRIEFF model (Decisions and Behavioral Responses for Impact Estimation in Flash Floods) which is part of the PICS project (Toward integrated nowcasting of flash flood impacts). The overall goal of the project is to enhance human, social and economical impact forecasting in the context of flash floods. DeBRIEFF aims at simulating the transition from individuals' routine activities (daily schedules) to self protective behaviors based on the reception and interpretation of environmental cues, alert messages and interpersonal interactions in the context of sudden flooding. This tool would allow testing hypotheses on the influence of warning message contents, spatial accuracy and lead times on the speed and adequacy of the social response with respect to the flooding dynamics. These questions are particularly relevant for the development of the improved weather warning system of the french Met office (carte de vigilance de Météo-France). In fact the system is currently being enriched with probabilistic information concerning the risks of dangerous phenomena in the longer term (from D+1 to D+7). Progressively it should also account for elements of territorial vulnerabilities to assess the risk at the "infra-departmental" scale, an information that may indeed change the perception and interpretation of end-users.

The model is implemented using the GAMA Platform, as it is particularly suitable to develop agent-based models integrating GIS data and complex human behaviors. For now, we are focusing on the case of Draguignan (36 000 inhabitants) having faced flash flood events in June 2010. The model combines the replay of the flash floods produced by external flash flood simulations with human beings' daily mobility and their adaptation to the hazard. The synthetic population, used to initialize the agents' population, has been produced by the Genstar library based on aggregated data from the INSEE in which individuals are defined by standard characteristics such as age and gender which allow us to define different profiles. The daily schedule of the people will be based on those profiles and so will be the alert threshold needed to trigger a reaction and the coping behavior.

As expected results, we plan to map both the human exposition and casualties due to the hazard depending on several scenarios of profile distribution and warning messages and signals.

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