



Anticipating flash-floods: Multi-scale aspects of the social response



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SUMMARY

This paper aims at exploring the anticipation phase before a flash flood, corresponding to the time between the first climatic signs and the peak-flow. We focus the analysis on people's behaviors observing how they use this period to organize themselves for facing the event. The analysis is made through the definition of three specific scales: the timeliness scale, an analytical scale of anticipatory actions and the scale of human response network. Using a cross-scale and cross level analysis enables to define different phases in the anticipation period where different kind of environmental precursors are mobilized by the actors in order to make sense of the situation and adapt. Three main points deserve attention at the end: firstly, the concepts of timeliness, anticipatory actions and crisis network scales enable to understand differently what happens both physically and socially during an extreme event; secondly, analyzing the precursors shows that each level of crisis network uses different kinds of signs for estimating the situation, organizing and reacting; thirdly, there is a potential for improvement in observation on both social and physical processes at different scales, for verifying the theory of the anticipatory phases.

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1. Introduction

The general goal of this research is to describe how people behave in front of a flash flood with a specific reference to the dynamics of their physical and human environment. Flash flooding is a short-fuse natural hazard demanding a prompt response to avoid casualties and damages (Ruin et al., 2008; Borga et al., 2011). Like other research groups over the last decade (Drobot and Parker, 2007), we are interested in how individuals behave in such situations, under what physical conditions and how they are warned and communicate together. We focus on the period between the onset of the generating storm (precursor) and the flood outbreak (peak of danger) that we name the anticipation period. Previous papers presented different aspects of the data collected (Creutin et al., 2009) and the specific methodology used to collect them during post flood investigations (Ruin et al., 2014). The space–time framework defined to appreciate the timeliness of human anticipation of flash floods has already been presented in Creutin et al. (2013). This paper uses the same set of field observations complemented with a new case. These observations were

collected through a sort of snowball sampling: based on testimonies from emergency services, we start the interviews with people who experimented a critical situation, but got out alive. During the interviews, we collect the interpersonal network carried out during the event. The following interviews are taken inside this interpersonal network with the aim at covering the entire network. Therefore, the interviewees can be people affected by the flood, their relatives, or neighbors, emergency agents, or people who were by chance in the same place at the same moment during the flood. This method enable us a cross validation of information given the different interviewees.

Overall, the database counts 137 interviews made after three events: the 2002 Gard event in France (30 interviews), the Fella River event occurred in Italy in 2003 (42 interviews) and the 2010 Var event, France (65 interviews). The two first events have already been described in Creutin et al. (2013). The Var event has already been presented by Ruin et al. (2014). If the grid for qualitative interviews evolved from one investigation to another, the method first developed in Creutin et al. (2009) has been used for coding the responses into actions undertaken during the events. Thus the set of data analyzed counts 165 anticipated actions, with descriptive information about the place and time of the actions, their social context (improvisation alone, with other people, or action following a planned strategy). The categorization of the actions regarding their objectives is made following the proposed classification, with

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a distinction between information, organization and protective actions.

The current paper elaborates more on the multi-scale and multi-level construction of the human response to flash-floods using terminology and concepts proposed in multi-disciplinary environmental problems to achieve some common understandings about cross scale issues (like in Gibson et al. (2000) or Cash et al. (2006)).

As for all extreme situations, the exceptional nature of flash flooding makes the observation and study of human response complicated. First, we need to analyze real-life experiences to bridge the gap between the intended behaviors and actual actions. The consequence is that post-event survey is the main mode of investigation with its inherent limitations in terms of sampling and reliability of narratives. Second, the framework used to study social responses when facing exceptional conditions needs to be quite open to a combination of approaches, as it is the case in an increasing number of social studies (Punch, 2013). Third, qualitative methodologies appear as a compulsory first step given the above-mentioned limitations in term of sampling and novelty of the type of environmental observation.

In our studies, the social response is addressed in terms of flash flood coping practices (as opposed to representation) through the narration of individuals who performed those actions, that we call stories. Given the scarcity of the narratives and the richness of their contents describing a variety of situations, we closely associated the data collection with its analysis by using a pragmatic approach. These methodological choices pertain respectively to the “practice based approach” (see for instance Corradi et al. (2010)) and the “grounded theory” (see for instance Corbin and Strauss (1990)).

Rooting human actions in the space–time dynamics of the socio-physical environment by integrating the sensitivity to environmental clues and understanding the use of available information invite to understand better the links that tie “knowledge” to “action” – the goal of the Practice Theory. “Practice allows researchers to investigate empirically how contextual elements shape knowledge and how competence is built around a contingent logic of action” (Corradi et al., 2010). This theory considers “practices” as “embodied, materially mediated arrays of human activity centrally organized around shared practical understanding” (Schatzki et al., 2001). Looking at our problem through this prism transfers the question of the social response time to the question of a learning process in which a human “trial and error process” competes with the environment dynamics. Nevertheless, we face two limitations. One is related to the exceptional character of the investigated situations, a break of the daily activities in a narrow time–space window that corresponds to crisis definition (Reilly, 1993). The second is to be more interested in the performance of the response than in its motor. As stated by for science and technology studies, “a practice approach has often turned into an injunction to study performances rather than representations, doing rather than sense-making, the production of stability rather than the enactment of change” (Araujo et al., 2008). We believe that our approach is consistent with the view of the domain of social sciences given by as “neither the experience of individual actors nor the existence of any form of social totality but social practices ordered across space and time”.

The Grounded Theory, defined as “the discovery of theory from data” (Glaser and Strauss, 1999), aims at using data to derive theories that fits empirical situations (Strauss and Corbin, 1997; Glaser and Strauss, 1999). It fits well with the need of practical solutions in front of unusual situations. Our field observation method through interviews and the collection of narratives describing actions performed to cope with a rapidly changing situation shares many of the “canons and procedures” of this theory (Corbin and Strauss, 1990). We conduct in parallel data collection

and analysis, progressively elaborating “concepts” able to label types of activity that we code into “categories”. Although we did not keep track through “memos” of the various adaptations of our interview format, we must admit retrospectively that our analysis “patterns and processes” evolved progressively according to the progression of our “theory”. Our sampling is directly led by the happenings we learn about along the field investigation.

This paper presents the current stage of our flash flood response “theory” relying on a set of narrated practices collected during past field investigations. As for many coupled human and natural systems (CHANS), the dynamical interactions between humans and rivers during flash floods deserves multidisciplinary attention should we want to define better warning and prevention policies (Liu et al., 2007). The problem presents at least three main dimensions: (i) the spottiness of the hydro-meteorological drivers, (ii) the gradation of human actions in this type of exceptional situations and (iii) the multi-level nature of the activated social networks. This paper is mainly devoted to the two last points that are dealt in Sections 4 and 5. Section 2 examines the multi-scale nature of flash-flood anticipation, using a classical set of physical and human dimensions and introduces the notion of timeliness scale developed in Section 3. At the end, Section 6 opens the discussion concerning the cross levels and cross scales opportunities for better understanding the anticipation process facing flash floods.

2. Flash flood crisis dynamics

First, it is useful to recall the way we reduce the space–time dynamics of the flood drivers to a single dimension of “anticipation time” that summarizes the physical embedment of human activity.

Physically speaking, individual response to flooding is first considered to be a mobility issue: to move or to stay put. In fact when facing hazardous conditions individuals, being at home, at work, shopping or travelling between such places, have to decide whether it is safer to stay where they are or whether they should move to a safer place. Mobility in space and time and, more specifically the study of daily activities and travels and their links with Space–Time environmental constraints are classical study objects of Time Geography (Clark and Doherty, 2010). Event Ecology is another approach of interest recently derived from the Grounded Theory in order to “address complexly interacting causes in time and space” that relates to human–environment interaction (Walters, 2012). Our approach is similar, no theory is elaborated in advance and in a sense evaluated “forward” through field investigation, but “causal histories of interrelated social and biophysical events” are constructed “backward” from field observation. This research process is qualified as “abductive causal eventism”. An “event” is defined as “something that happens somewhere during a particular interval of time”. Event Ecology applies to two ways interactions: how human practices transform the environment and how the environment induces human actions. This “two ways” vision also applies to people–flood interaction. Floods have a direct impact on people and, conversely, people act on floods by, for instance, land use planning or protection work construction. These actions can reduce or worsen flood impacts (Calianno et al., 2013). During a flash-flood crisis, people have no action mean on the phenomenon and the central question is: how to organize and behave to reduce the impact? Both ways of asking questions are fundamentally interdisciplinary, work on a limited number of events and are multi-scale approaches.

A flash flood is thus seen as an event interrupting someone’s scheduled activity programs in a more or less expected manner. It is important to understand that flash flooding events operate over several orders of magnitude in time and space scales. During the same storm episode casualties can occur on “flood scenes” in

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