

Drivers' risk perception of severe storms hazards in Southern France

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I. INTRODUCTION

Severe storms and related flash flood, are the most dangerous hazards in southern regions as they affect targets that are difficult to protect, such as isolated dwellings, road users and eco-tourists. Due to the spatio-temporal characteristics of this type of flood, i.e. the variability in rainfall and drainage basin response times, flash flood deaths are often correlated with inappropriate behaviours during crisis periods (Gruntfest and Ripps, 2000; Ruin and Lutoff, 2004). Studies (Jonkman and Kelman, 2005; Kundzewicz and Kundzewicz, 2005) show that a large number of disaster deaths occurred on the road among motorists, especially in the face of flash floods (Staes et al., 1994; Gruntfest, E.C. and Handmer, 2001; Bourque et al., 2006). The Languedoc-Roussillon region (France), especially prone to flash flooding, has suffered about seventy fatal floods over the last 600 years, causing around one thousand deaths (Antoine et al., 2001). In the last fifty years, 40% of these fatal accidents were vehicle related.

II. PRESENTATION OF RESEARCH

People's behavior in the face of natural hazards is often independent from natural hazards but constrained by social, economic and political forces beyond individuals' reach. This perspective emphasizes people's vulnerability or their susceptibility to suffer from damage should natural hazards occur (D'Ercole, 1994). Hence, risk perception should be seen as one among many other aspects of people's vulnerability in the face of natural hazards which also includes people's well-being and strength, their livelihood resistance, their ability and willingness to protect themselves, the societal protection and the social capital among others (Cannon, 1994). This emerging claim for a better contextualization of risk however seldom gave way to perception studies in the context of specific everyday activities. People's perception of Nature's threat in driving situation is one of the significant contextualization of risk perception ignored by the literature. Yet, driving and the purpose for travelling may be a powerful constraint on risk perception and people's behaviour when facing natural hazards. Flash floods are those floods characterized by their suddenness, fast and violent movement, rarity, small scale but high level of damage (Gruntfest and Handmer, 2001). In the study presented here we assume that these flash flood hazard

specificities may result in difficulties for individuals and particularly road users to perceive danger on their usual itinerary. Based on this hypothesis, the study follows two objectives (i) investigate road users perception on their daily journeys in order to anticipate their potential itinerary in case of a flash flood event, (ii) provide practitioners with qualitative and quantitative data that inform social vulnerability on the basis of objective physical vulnerability of road networks.

To face the challenge of assessing risk perception on travel itineraries, research methods and tools traditionally used to assess risk perception (key informant interviews, questionnaire-based survey) turn out to be insufficient. It is particularly evident in relation to the spatial dimension of travel itineraries. This study contributes towards filling in this gap by providing an innovative methodology which merges traditional questionnaire-based survey with cognitive mapping. It particularly focuses on the perception of risk of 200 users of a road network, prone to flash flood, located between Nimes and Ales in the Gard territory. In order to be representative both statistically and spatially, we used spatially stratified sampling, enabling an equal representativeness of motorists from crowded urban municipalities and from rural ones. Thanks to that methodology we were able to compare the motorists' perception of danger on their usual itinerary with road sections that were reported to be regularly flooded by the local department of transportation.

III. RESULTS AND PERSPECTIVES

Over the 200 people surveyed, we found that 68 people, nearly 30 % under-estimate danger and an other 26 (13%) over-estimate it on their usual itinerary. Some variables as ages, profession, familial status, area of living and experience of flash flood were shown to influence drivers' perception of danger along roads (table I).

This study gives three interesting perspectives. Firstly, the methods and tools used allow to gather on a common GIS database - the one used on a daily basis by the agency in charge of roads network management - information about physical vulnerability of the network but also its associated perception for each road section used. This way of doing may lead to a better integration of social inputs in everyday roads network management and consequently may help practitioners in their preparedness to crisis. It gives them the opportunity to

<i>Variables</i>	<i>Under – estimation</i>	<i>Over – estimation</i>
Age	under 25 and over 45	Not significant
Profession	Unemployed	Mid and upper-classes
Family status	Without children	Not significant
Area of living	ERZ, NUZ ^a	NUZ, WRZ ^a
Flood experience	Without	With

^aAreas of study; ERZ = East rural zone, NUZ = Nimes Urban Zone, WRZ = West Rural Zone.

TABLE I: Table of the significant variables of risk perception along roads in Gard, Southern France

really focus their effort on building an environment that take into account propensity of users in the face of a flash flood. Secondly, this study is a helpful pre-requisite in the assessment of the local mitigation policies usefulness or efficiency. It gives interesting insights about the present level of risk perception among motorists and the discrepancy between different geographical areas within the Gard territory. This discrepancy may be due to several factors independent from individuals' personal characteristics and hazards features but in relation to the social, cultural, economic and political context. How local authorities deal with the flash flood problem may be of critical importance. Our results already display differences on individual's perception and level of information that may be a good starting point for further detailed studies on that aspect. Finally and on the same line, this study is the necessary first step before investigating in depth the reasons of the differences between risk perception among individuals. For instance, on the basis of the road sections where danger was under-estimate or appropriately assessed, some future research may use the original "cognitive mapping" process to understand what are the key elements that lead to that particular perception. This would certainly have interesting implications for planning.

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V. REFERENCES

- Antoine, J.-M., Desailly, B., Gazelle, F., 2001. Les crues meurtrieres, du Roussillon aux Cevennes. *Annales de Geographie*, 622 597-623.
- Bourque, L., Siegel, J., Kano, M., Wood, M., 2006: Morbidity and mortality associated with disasters. In: Quarantelli, E., Dynes, R. (Eds.), *Handbook of disasters*. Springer, 97-167.
- Cannon, T., 1994: Vulnerability analysis and the explanation of "natural" disasters. In: Varley, A. (Ed.), *Disasters, Development and Environment*. J. Wiley & Sons Ltd, Chichester, 13-30.
- D'Ercole, R., 1994: Les vulnerabilites des societes et des espaces urbanises : Concepts, typologies, mode d'analyse. *Revue de Geographie Alpine*, 32 (4) 87 - 96.
- Gruntfest, E., Handmer, J. (Eds.), 2001: *Coping with flash floods*. Vol. 77. NATO Advanced Study Institute, Kluwer, Dordrech.
- Gruntfest, E., Ripps, A., 2000: Flash floods: Warning and mitigation efforts and prospects. In: Parker, D. (Ed.), *Floods*. Vol. 1. Routledge, London, 377-390.
- Jonkman, S., Kelman, I., 2005: An analysis of causes and circumstances of flood disaster deaths. *Disasters*, 29 (1) 75-97.
- Kundzewicz, Z., Kundzewicz, W., 2005. Mortality in flood disasters. In: Kirch, W., Menne, B., Bertollini, R. (Eds.), *Extreme weather events and public health responses*. Springer, Berlin, 197-206.
- Ruin, I., Lutoff, C., 2004: Vulnerabilite face aux crues rapides et mobilites des populations en temps de crise. *La Houille Blanche*, 6-2004 114-119.
- Staes, C., Orengo, J. C., Malilay, J., Rullan, J., Noji, E., 1994. Deaths due to flash-floods in puerto-rico, january 1992: Implications for prevention. *International Journal of Epidemiology*, 23 (5) 968-975.