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Physical and institutional vulnerability assessment method applied in Alpine communities. Preliminary Results of the SAMCO-ANR Project in the Guil Valley (French Southern Alps)

Benoit Carlier (1,3), Constance Dujarric (1,3), Anne Puissant (2,3), Candide Lissak (1,3), Vincent Viel (1,3), François Bétard (1,3), Malika Madelin (1,3), Monique Fort (1,3), Gilles Arnaud-Fassetta (1,3)

(1) UMR PRODIG, Université Paris 7 Diderot, Paris, France, (2) UMR 7362 LIVE, Université de Strasbourg, Strasbourg, France, (3) ANR 12 SENV-0004 SAMCO

The Guil catchment is particularly prone to torrential and gravitational hazards such as floods, debris flows, landslides or avalanches due to several predisposing factors (bedrock supplying abundant debris, strong hillslope-channel connectivity) in a context of summer Mediterranean rainstorms as triggers. These hazards severely impact the local population (fatalities, destruction of buildings and infrastructures, loss of agricultural land, road closures). Since the second half of the 20th century, the progressive decline of agro-pastoralism and the development of tourism activities led to a concentration of human stakes on alluvial cones and valley bottom, therefore an increase of vulnerability for mountainous communities. Following the 1957 and 2000 catastrophic floods and the 1948 and 2008 avalanche episodes, some measures were taken to reduce exposure to risks (engineering works, standards of construction, rescue training...). Nevertheless, in front of urban expansion (land pressures and political pressures) and obsolescence of the existing protective measures, it is essential to reassess the vulnerability of the stakes exposed to hazards. Vulnerability analysis is, together with hazard evaluation, one of the major steps of risk assessment.

In the frame of the SAMCO project designed for mountain risk assessment, our goal is to estimate specific form of vulnerability for communities living in the Upper Guil catchment in order to provide useful documentation for a better management of the valley bottom and the implementation of adequate mitigation measures. Here we present preliminary results on three municipalities of the upper Guil catchment: Aiguilles, Abriès, and Ristolas. We propose an empirical semi-quantitative indicator of potential hazards consequences on element at risk (based on GIS) with an application to different (local and regional scale) scales. This indicator, called Potential Damage Index, enable us to describe, quantify, and visualize direct (physical injury, structural and functional damage on buildings, lifelines and land cover) and indirect (socio-economic impacts) consequences. The method allows estimating the possible damage caused by torrential and gravitational hazards by combining weighted indicators (age, state, land use, number of occupied floors, etc.) reflecting the exposure of elements at risk (land cover, buildings, and lifelines) to obtain different maps of total consequences. Besides, this method allows introducing temporality by modifying the weight and the combination of variables. For example, we can operate the distinction between day and night or between the off-season and the touristic season. Another benefit of this method is to permit the visualization of the vulnerability evolution producing diachronic maps. All these maps, combined with adequate hazards map, will contribute to a better assessment of vulnerability in the Queyras and must help the development of better land use and evacuation plans, and thus are important tools for local authorities. This study will be completed by an analysis of social and institutional vulnerability realized on the basis of interview with local councillors and risk perception survey led with the local populations and the tourists.