Physical, social and institutional vulnerability assessment in small Alpine communities. Results of the SAMCO-ANR project in the Upper Guil Valley (French Southern Alps)

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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 hill-slope-channel connectivity) in a context of summer Mediterranean rainstorms as triggers. Since the second half of the 20th century, the progressive decline of agrarianism 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 (improvement works, standards of construction, rescue training...). Nevertheless, just few of them considered physical injury, structural and functional impacts - and indirect consequences - socio-economic impacts - induced by hazards; this by combining weighted parameters reflecting the exposure of elements at risk. buildings, network and land cover (Fig. 3). At least 1980 buildings, 367 km of land cover and 920 km of network were considered. Vulnerability maps were then crossed to hazard map reflecting different scenarios of exposure. To take into account the temporal variability of vulnerability, we produced different maps for summer and winter periods. To assess social and institutional vulnerability in a context of global change, we developed a systemic approach to assess three components of vulnerability - physical, social and institutional - for the six municipalities of the Upper Guil catchment: Ristolas, Abriès, Château-Queyras, Moïres-en-Queyras and St-Véran (Fig. 1).

1- Background

- The potential structural and functional vulnerability map for flooding (Fig. 5) put forward urbanized and cultural space which are often close to torrential rivers.
- Historical villages near torrential confluence areas:
  - Ristolas
  - Abriès
  - Aiguilles
  - Château Queyras
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- As expected, total potential vulnerability for flooding (Fig. 7) is the highest for public services, recent housing and networks close to the Guil River and its main tributaries. Combined with the 100-year 1957 flood extension, we observed that more than 411 ha of land and 289 buildings could be endangered.

2- Methods

- Physical vulnerability (i.e. total potential consequences of hazards on stakes) was estimated and mapped via GIS model from Potential Damage Index (PDI) (Fig. 2). This index allowed us to quantify and describe both direct - physical injury, structural and functional impacts - and indirect consequences - socio-economic impacts - induced by hazards; this by combining weighted parameters reflecting the exposure of elements at risk. buildings, network and land cover (Fig. 3). At least 1980 buildings, 367 km of land cover and 920 km of network were considered. Vulnerability maps were then crossed to hazard map reflecting different scenarios of exposure. To take into account the temporal variability of vulnerability, we produced different maps for summer and winter periods.
- To assess social and institutional vulnerability in a context of global change, we developed a systemic approach to assess three components of vulnerability - physical, social and institutional - for the six municipalities of the Upper Guil catchment: Ristolas, Abriès, Château-Queyras, Moïres-en-Queyras and St-Véran (Fig. 1).

3- Results: physical vulnerability assessment

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4- Results: Social and institutional vulnerability assessment

- As expected, total potential vulnerability for flooding (Fig. 7) is the highest for public services, recent housing and networks close to the Guil River and its main tributaries. Combined with the 100-year 1957 flood extension, we observed that more than 411 ha of land and 289 buildings could be endangered.

5- Conclusion

- As expected, total potential vulnerability for flooding (Fig. 7) is the highest for public services, recent housing and networks close to the Guil River and its main tributaries. Combined with the 100-year 1957 flood extension, we observed that more than 411 ha of land and 289 buildings could be endangered.

This work remains part of a large study on risk in mountainous region that should lead to a web demonstrator intended for risk stakeholders. We expect that these first results on vulnerability will contribute to a better assessment of the global vulnerability of the upper Queyras region to hydrogeomorphic hazards. This work must help the development of better land use and could be used to help local authorities to improve and update their Emergency Action Plan on their Prevention Plan.

The next step of this work will be to try to elaborate a method combining these maps to produce a global risk map for mountain risks.

For your municipality...
- You (or your family) could be injured by the next flood.
- You (or your family) could be affected by financial loss.
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