

**Flood risk vulnerability assessment: what are the main factors?
Hierarchization of the main factors at a regional scale**

Zéhir KOLLI¹, Gwenaél JOUANNIC¹, Tiffany LEGENDRE¹, Mario MARCHETTI¹, Philippe GASTAUD¹, Julien GARGAN², Romain LERMET¹, Clément AUGÉARD³, Didier FELTS³, Fabrice ARKI¹

¹ Cerema, Laboratoire Régional de Nancy, 54510 Tomblaine, France

² Université Paris Sud - Laboratoire GEOPS, UMR 8148, 91405 Orsay, France

³ Cerema, Laboratoire Régional de Bordeaux, 33073 Bordeaux, France

Recent studies have shown that the national flood risk exposure is high in France, with one fourth of the total population and a third of jobs located in risk areas. In this context, a global vulnerability assessment methodology is currently being developed in France to bring adequate tools for local territories to manage flood risk. This study addresses the question of the quantification, the qualification and the choice of these vulnerability indicators for a given territory. This work aims to propose a classification of nearly 40 of these indicators in terms of their relative impacts on the risk level estimated on two territories:

- Chalon-sur-Saône (Saône river)
- Garonne estuary (Garonne and Dordogne rivers, and Atlantic ocean)

Through these cases study, 3 different spatial scales have been compared: the Prés-Saint-Jean district inside Chalon (0.6 km²), the city of Ambès (28.8 km²) and Chalon with its suburbs (72.2 km²).

A principal component analysis (PCA) was applied and indicated a threshold in terms of urban impacts between the different flood scenarios. On Chalon, the PCA discriminates 2 groups of flood and highlighted a threshold between T20 and T50. A partial least-square regression (PLS) was computed to make predictions on vulnerability indicators values modelled on new flood scenarios. Their results were is useful to identify the most relevant vulnerability indicators as a function of their flood exposure. These statistical analysis aims to highlight the relationship between a variable of exposure level (hydrologic impact: water levels and flow velocity) with spatialized vulnerability indicators in a 100 m grid (e.g., population, job, etc.). Finally, to get a hierarchy of variables depending on their impact on the risk level, an ANOVA was computed. The selection of variables was performed with a stepwise selection to assess contributions of each dependant variable on the F-statistic as they are added to or removed from the model.