UNIVERSITÄT BERN
OESCHGER CENTRE | Mobiliar Lab for Natural Risks

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Do hazard maps mirror flood loss data?

A vulnerability assessment based on loss data and hazard maps

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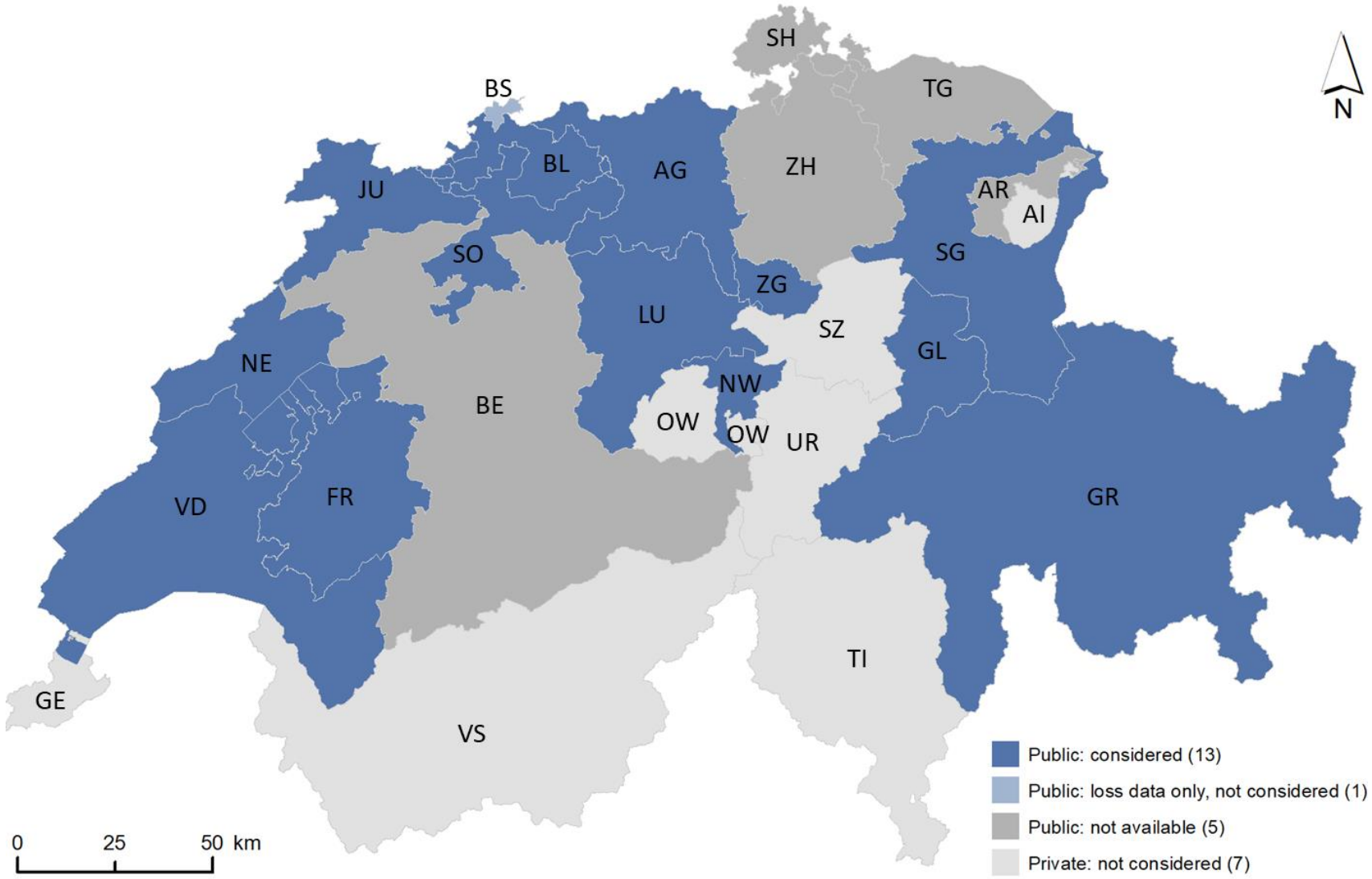
Descriptive flood loss data analysis I



The analysis of flood damage in Switzerland was conducted using damage claim records of the **Swiss public insurance companies for buildings (PICBs)**.

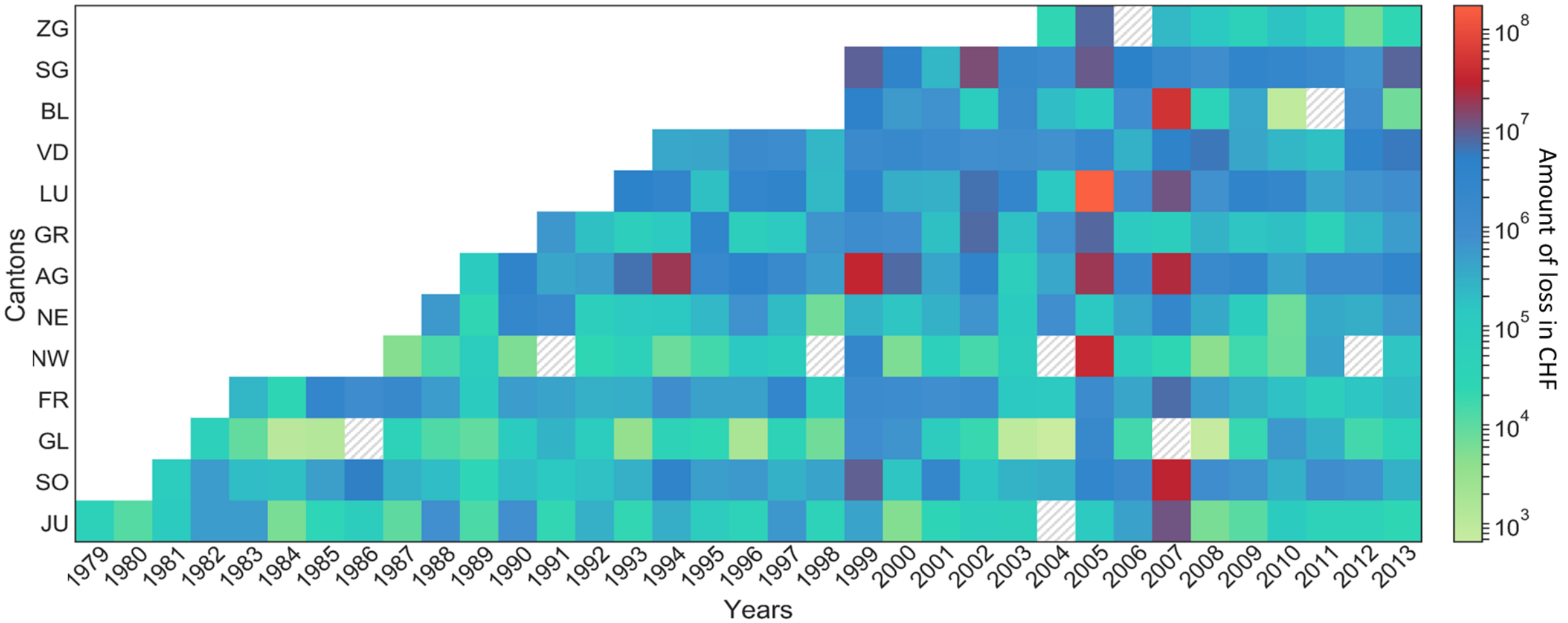
In Switzerland, the PICBs are monopoly institutions covering building damage associated with hydro-meteorological and geomorphological hazards in 19 out of 26 cantons the buildings.

In the remaining cantons, private insurance companies provide compulsory insurance cover [1]. The data provided by the PICBs cover a total of **39,554** claims during **35 years (1979-2013)**, each of them including information regarding the **date** of the damage, the **location** of the damage (address or coordinates), the resulting direct **property loss** and the **building value** to the respective building.

The figure provides an overview of in which cantons PICBs are operating (n=19), which of these provide data (n=13) and where private insurance companies can be found (n=7).

[1] D. B. Bernet, V. Prasuhn, and R. Weingartner, “Surface water floods in Switzerland: What insurance claim records tell us about the damage in space and time,” Nat. Hazards Earth Syst. Sci., vol. 17, no. 9, pp. 1659–1682, 2017.

Descriptive flood loss data analysis II

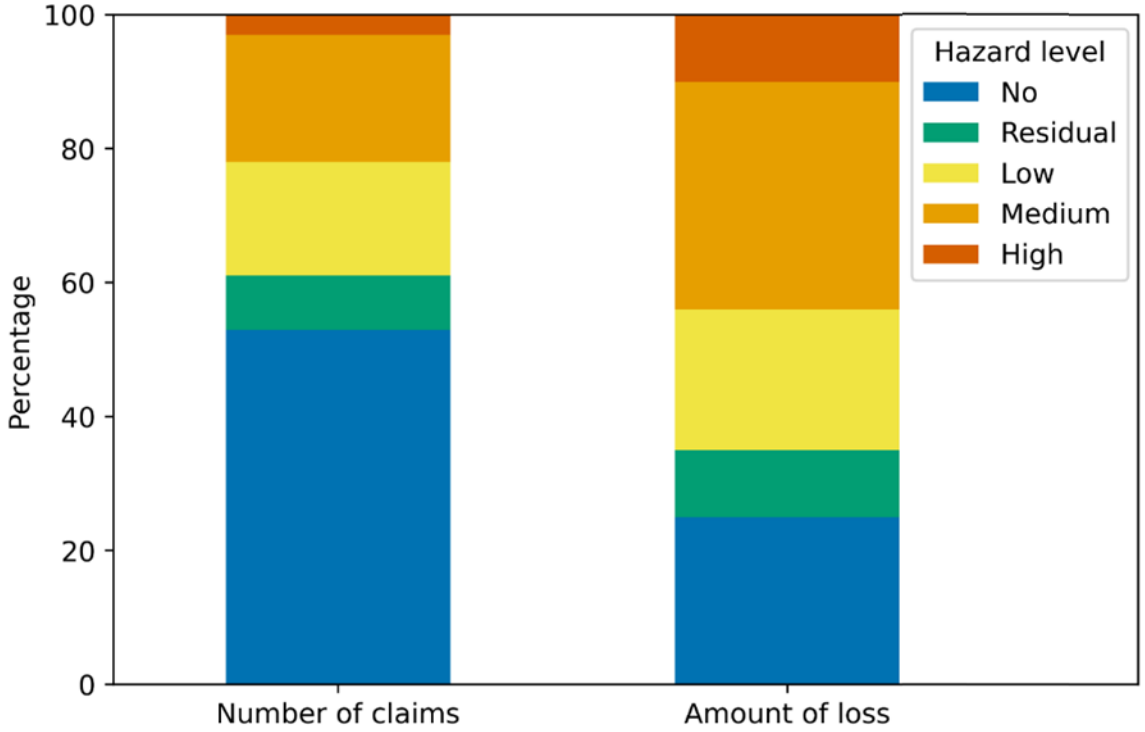


The figure shows the **amount of flood loss in CHF** per **year** and **canton**. It is visible how many cantons reported loss claims for each year.

The **white area** indicates that respective cantons have not yet started providing damage claim records. The **grey striped** area represents the years without claims in the respective cantons.

The prominent flood years 1999, 2005 and 2007 are clearly visible in the figure. In contrast, the flood year 1987 does not stand out, as only slightly affected cantons provided data during this time.

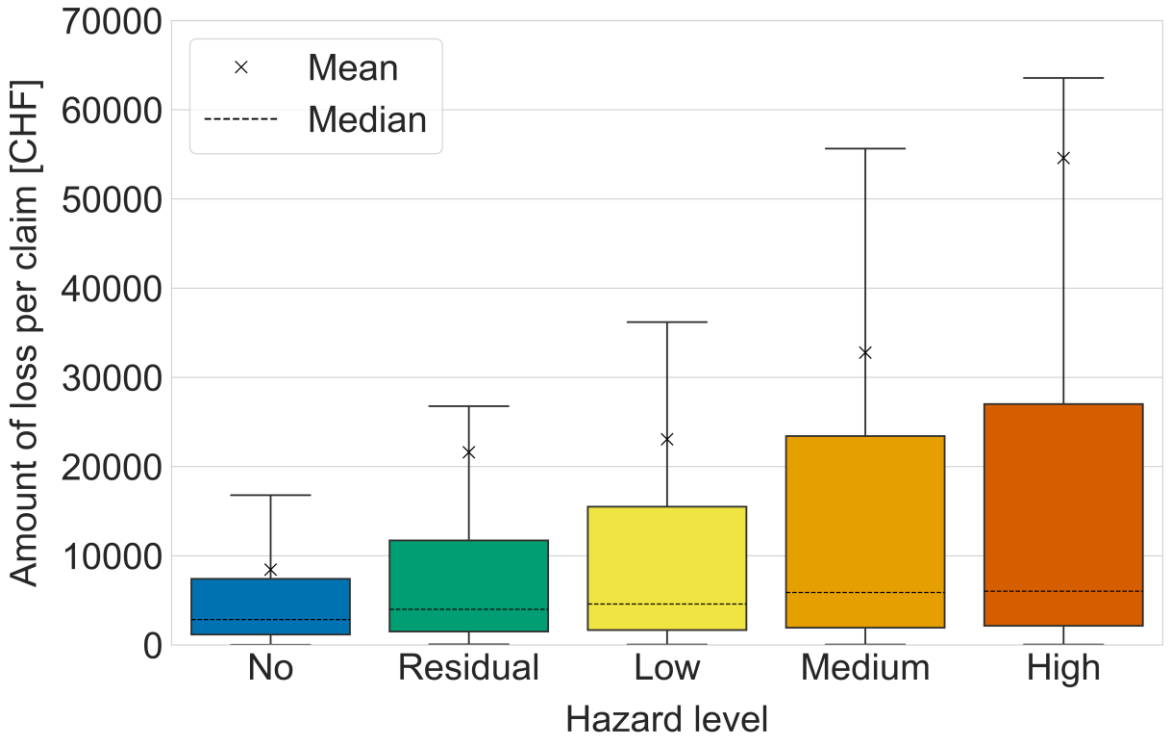
Descriptive flood loss data analysis III



The figure on the left shows the result of **intersecting the loss data with the five hazard levels**. The left stack represents the relative distribution of the number of claims that were reported per hazard level. The right stack illustrates the relative distribution of the total amount of loss per hazard level.

The left stack shows that more than half of the flood claims occurred **outside of the hazard map** (*no hazard level*) and only a very **small proportion** in the **high** hazard level.

The right stack shows that the amount of loss is **highest** in the ***medium*** *hazard level*, whereas the proportion **decreased** in the ***no*** *hazard level* and **increased** in the ***high*** *hazard level* compared to the number of claims-stack.



The figure on the right shows the **distribution** of the **amount of loss per claim** and **hazard level**. It is visible that the **inter quantile range**, the **median** and the **mean increase** with higher hazard levels. This linear increase indicates that small and medium damage values occurred in all hazard levels, but larger values were only recorded in the higher hazard levels.

The **median** and the **mean** values **deviate** strongly from each other. Furthermore, the **median** lies **close to the 25th quantile**. Both these factors indicate that the distribution across all hazard levels is **right-skewed**. Thus, there are a **high number of claims with a small amount of loss**.

Vulnerability modelling approach

Research question

Model degree of loss for all buildings in Switzerland.

DOL expresses how heavily a building was destroyed by flood event.

Target variable

Degree of loss (DOL)

$$\text{DOL} = \frac{\text{Damage value}}{\text{Building value}}$$

39,554 DOL values available from damage claim records of Swiss public insurance companies

Input variables

- Bio geographic region
- Building characteristics
  - Area
  - Building value
  - Height
  - Number of levels
  - Volume
- Building zone
- Catchment characteristics
  - Altitude
  - Discharge
  - Geology
  - Slope
- Hazard level
  - No
  - Residual
  - Low
  - Medium
  - High
- Precipitation
  - Annual mean
  - Extreme precipitation
- Topographic wetness index

Model

Model DOL for all building values with «random forest» model

→ Model is running now and results will be published soon

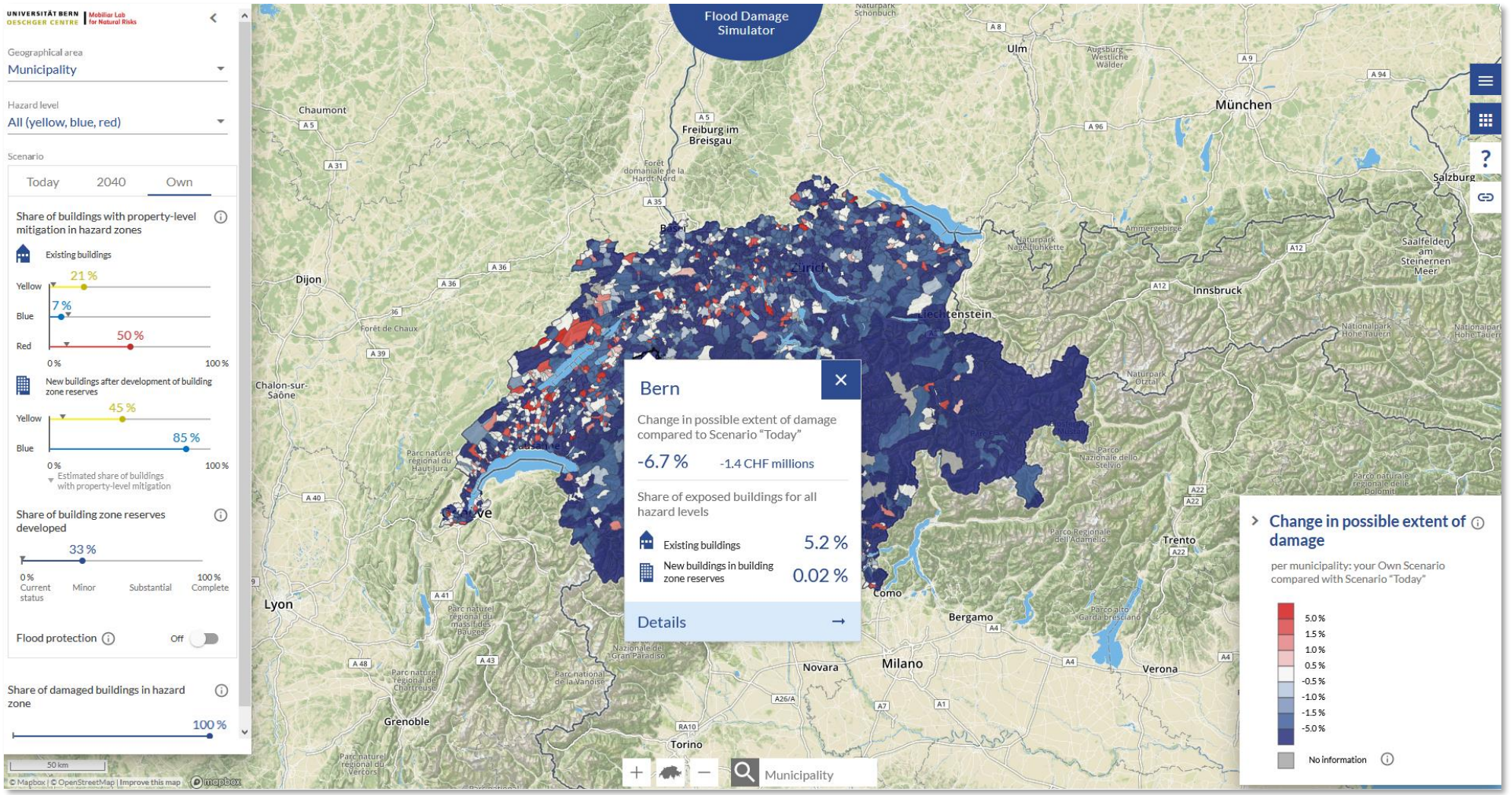
Application

Calculate extent of damage based on modelled DOL value for all building of Switzerland.

$$\text{Loss value} = \text{Building value} \times \text{DOL}$$

The calculation of the extent of damage forms the basis for the web tool «flood damage simulator».

Application in the web tool «flood damage simulator»



The **modelled damage extent** is applied in the «flood damage simulator». With this web tool it is possible to simulate the flood damage extent for **today and in future** by adapting different **influencing factors** or create **own scenarios** and learn about why and how flood risk may be changing.

Important note: The official release of the damage simulator is scheduled for **18 May** 2020. Therefore some texts are not yet available for the English version.

For further information about the web tool, see the presentation on «Damage simulator».

Click here to explore the tool