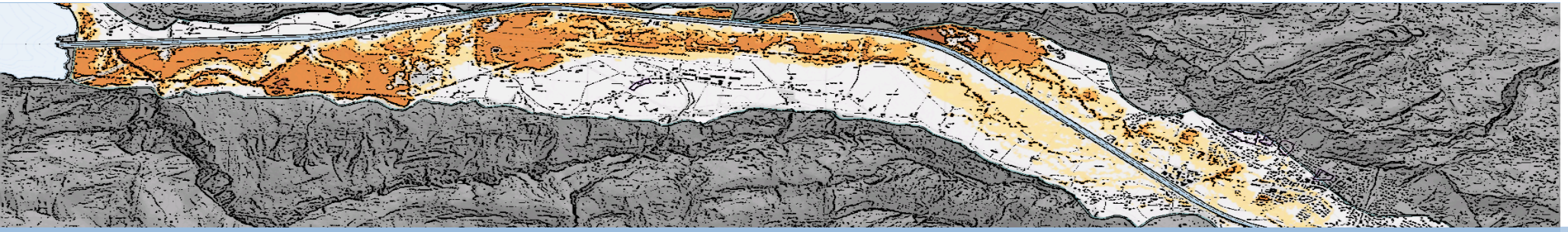

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Sensitivity of flood impacts in the main rivers and lakes of Switzerland

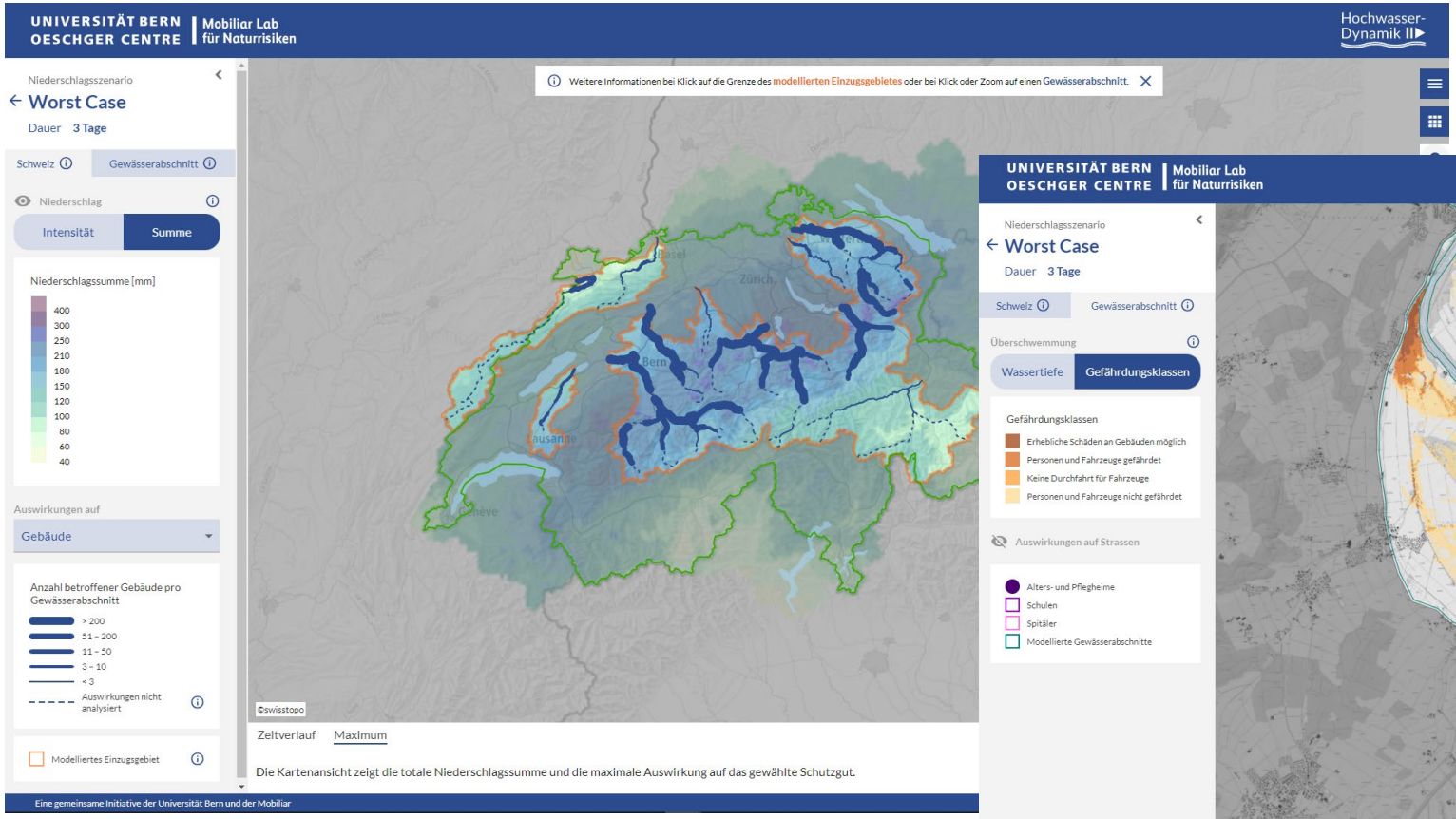
Markus Mosimann, Anna Fehlmann, Govert Verhoeven, Andreas Zischg

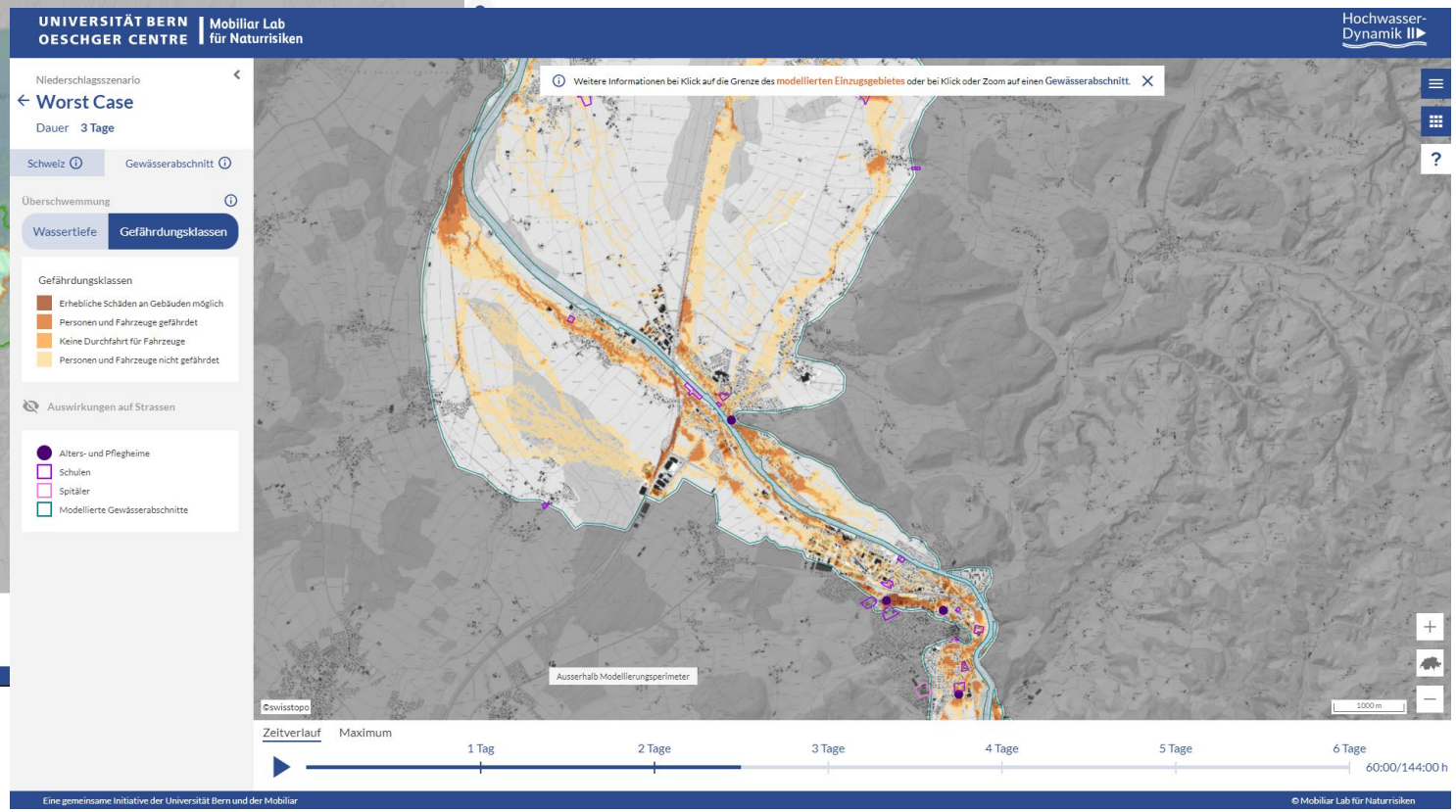
Institute of Geography & Mobiliar Lab for Natural Risks (OCCR), University of Bern, Bern, Switzerland

25th of January 2024
BASEMENT User Meeting

markus.mosimann@unibe.ch

THROWBACK:
www.flooddynamics.ch



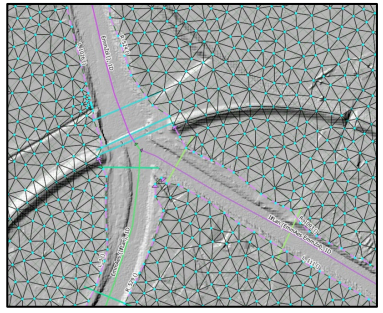


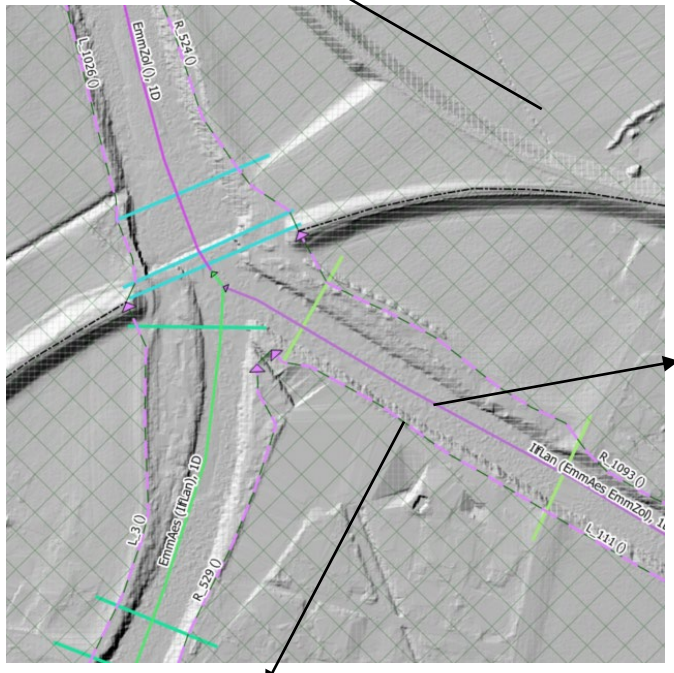
Munz, Lukas; Kauzlaric, Martina; Mosimann, Markus; Fehlmann, Anna; Martius, Olivia; Zischg, Andreas Paul (2023): Participatory development of storymaps to visualize the spatiotemporal dynamics and impacts of extreme flood events for disaster preparedness. In *International Journal of Disaster Risk Reduction* 98, p. 104039. DOI: 10.1016/j.ijdrr.2023.104039.

THROWBACK:
BASEMENT used for flooddynamics.ch

gid	2166
type	river
modified	2022-01-14T15:20:41
mod_by	mmosimann
use_bl	t
meshed	2022-01-14T15:28:25
surrogates	{IlfLan,EmmZol}

BASEmesh 1.4.2
(max 200 m²)





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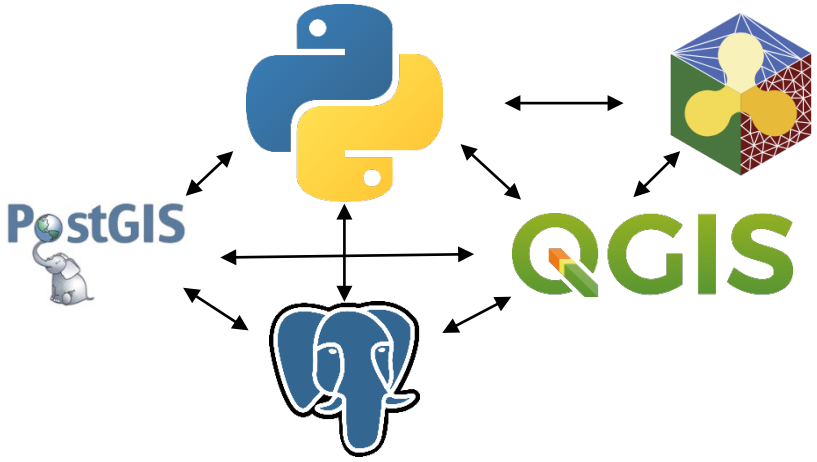
river	Emme
subdomain	1D
surrogate	EmmAes
boundaries	IlfLan
ds_zhyd_num	NULL
storyline	EmmZol
weir_from_dyke1d	f
internal_levees	t
kst_riverbed	27
kst_embankment	27
calib_station	2409
max_coupling_dist	-1
init_flowdepth	1.00
date_surrogate	2022-01-16T14:20:10
date_storyline	2022-02-02T13:47:38
remarks	
modified	2022-01-14T16:26:04
mod_by	mmosimann
surrogate_man	f
storyline_man	f
ds_zhyd	
us_zhyd	
validated	t
cs_to_ignore	

id	111
fluss	
floodplain	
seite	L
stringdef	L_111
wse	NULL
weir_from_dyke1d	f




```
        }}
    }}
    BOUNDARY {{
        string = upstream
        type   = {us_type}
        slope  = {cs_Qout.slope.loc[0]}
        file   = {us_type}_{riv}.txt
    }}
    BOUNDARY {{
        string = downstream
        type   = {d.ds_boundary}
    }}
    FRICTION {{
        type             = strickler
        default_friction = 33
    }}
    INITIAL {{
        type = backwater
        q_out = {cs_Qout.q.loc[0]}
        WSE_out = {cs_Qout.wse.loc[0]}
    }}
    {d.inner_boundaries}
}}
OUTPUT {{
    output_time_step  = {d.output_ts}
    console_time_step = {d.output_ts}
```

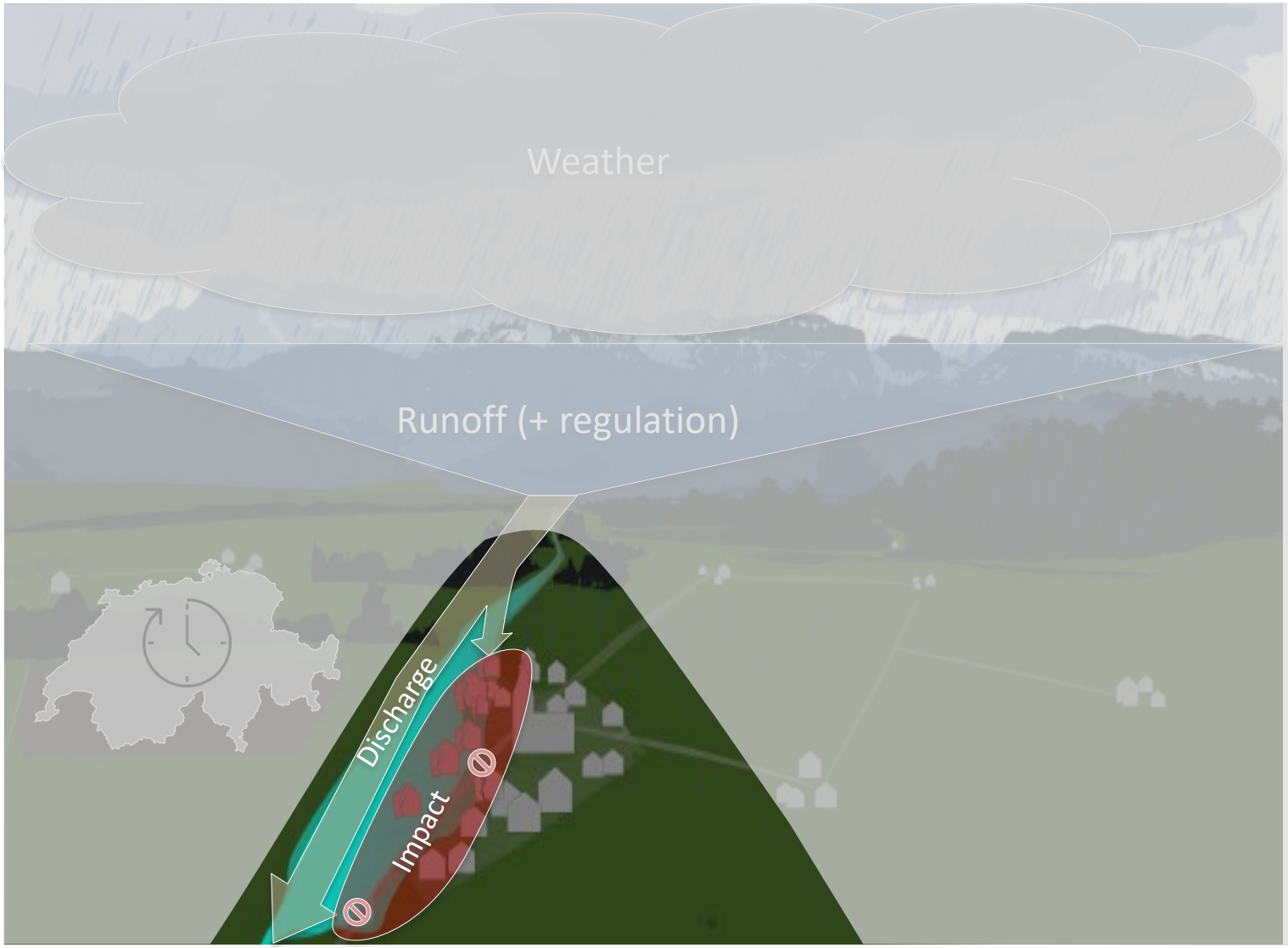
Objectives

- **Detection and quantification of (climate) sensitivity of impacts in floodplains**

  => small changes in magnitude, big changes in impact

- **Scenario neutrality**
  - ➢ uncertain which RCP comes to reality
  - ➢ unknown in which way the flood frequency will be affected

- **FROM TOP-DOWN TO BOTTOM-UP**



Source background image: www.flooddynamics.ch

Methods: The surrogate model and the impact curve

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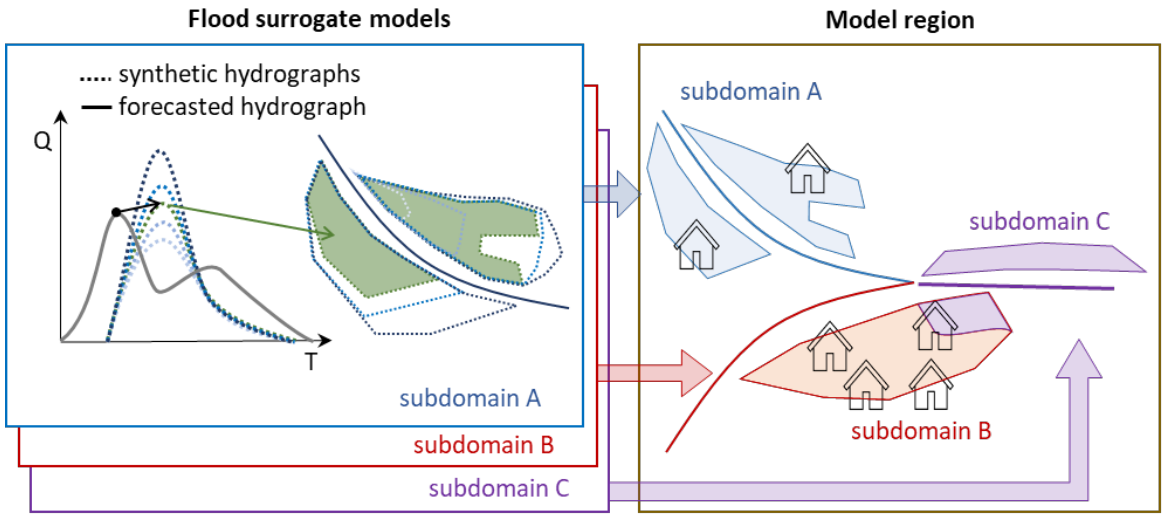
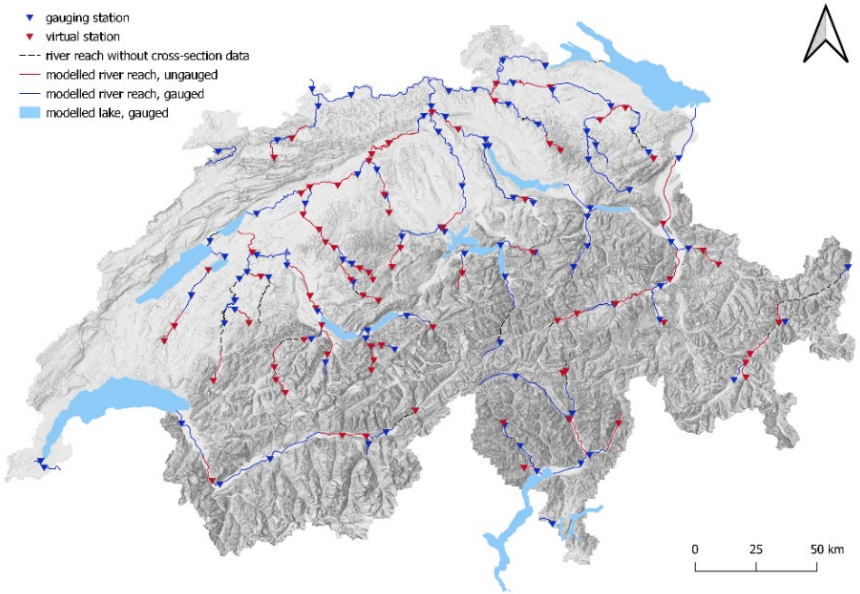
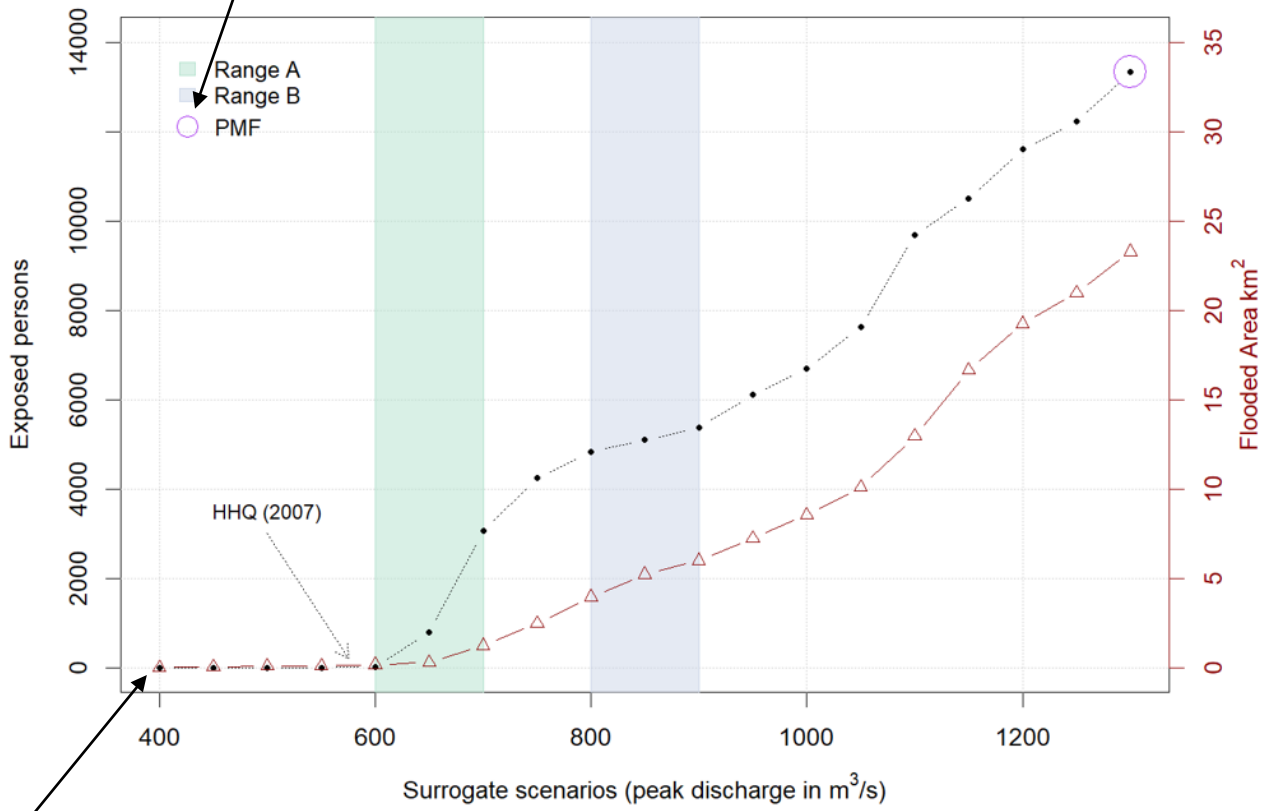




In the best case…



Source: Mosimann et al. (in prep.)

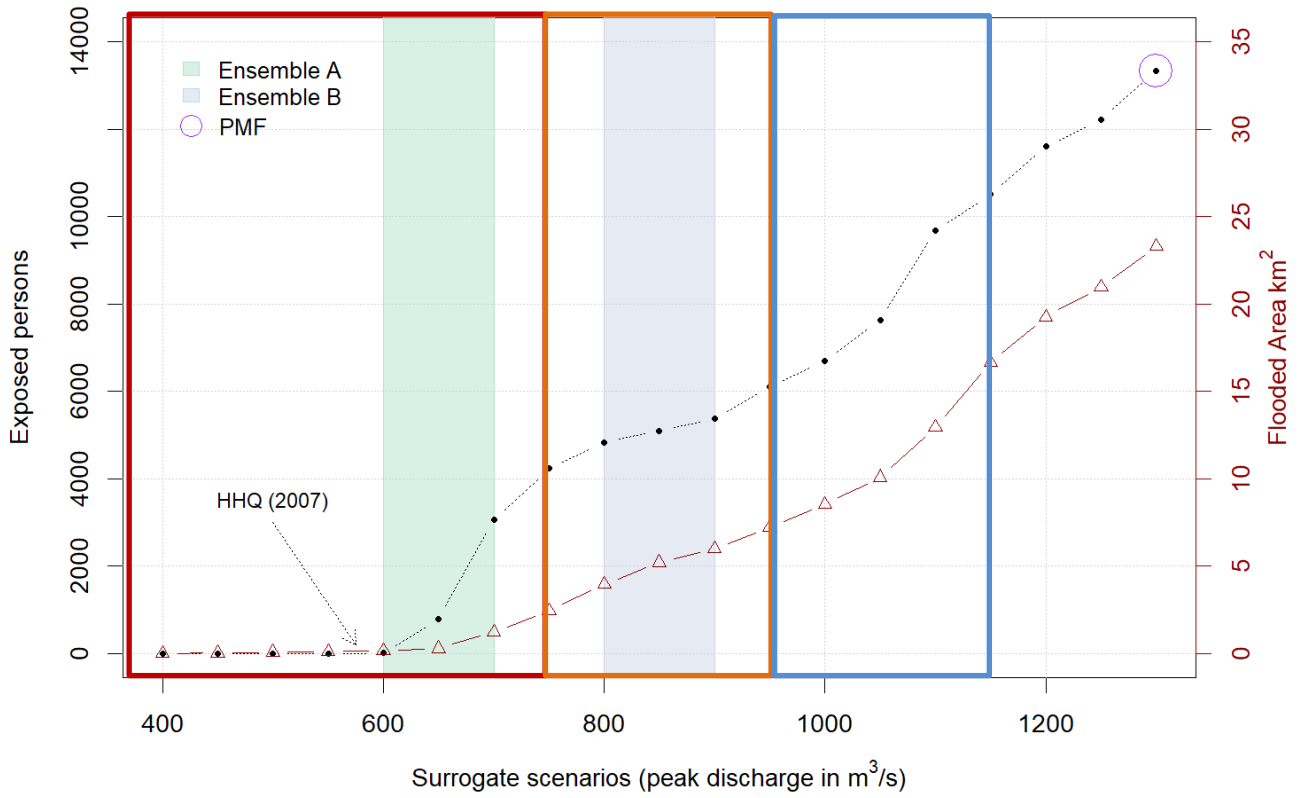
Threshold to reach hazard level 3 of 5 (FOEN)

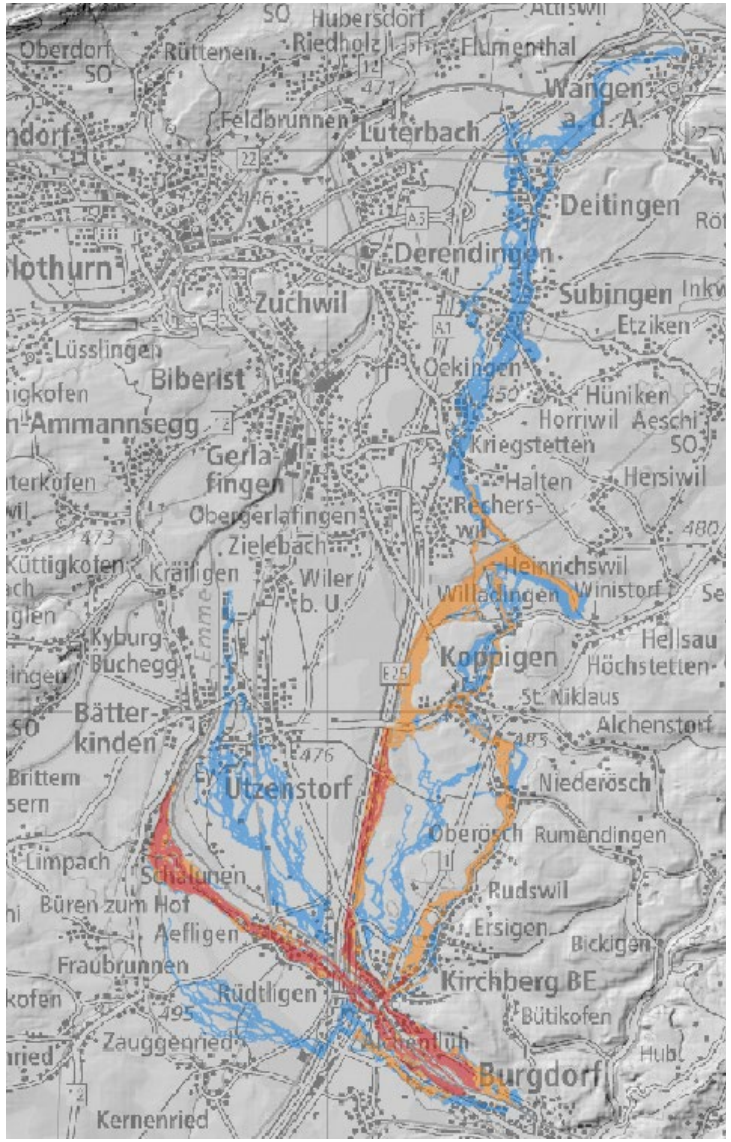
Mosimann, Markus; Kauzlaric, Martina; Schick, Simon; Martius, Olivia; Zischg, Andreas Paul (2023): Evaluation of surrogate flood models for the use in impact-based flood warning systems at national scale. In Environmental Modelling & Software, p. 105936. DOI: 10.1016/j.envsoft.2023.105936.

Method

Small changes in magnitude, big changes in impact

-> indicators? Slope and (or) curvature?





Risk sensitivity tool

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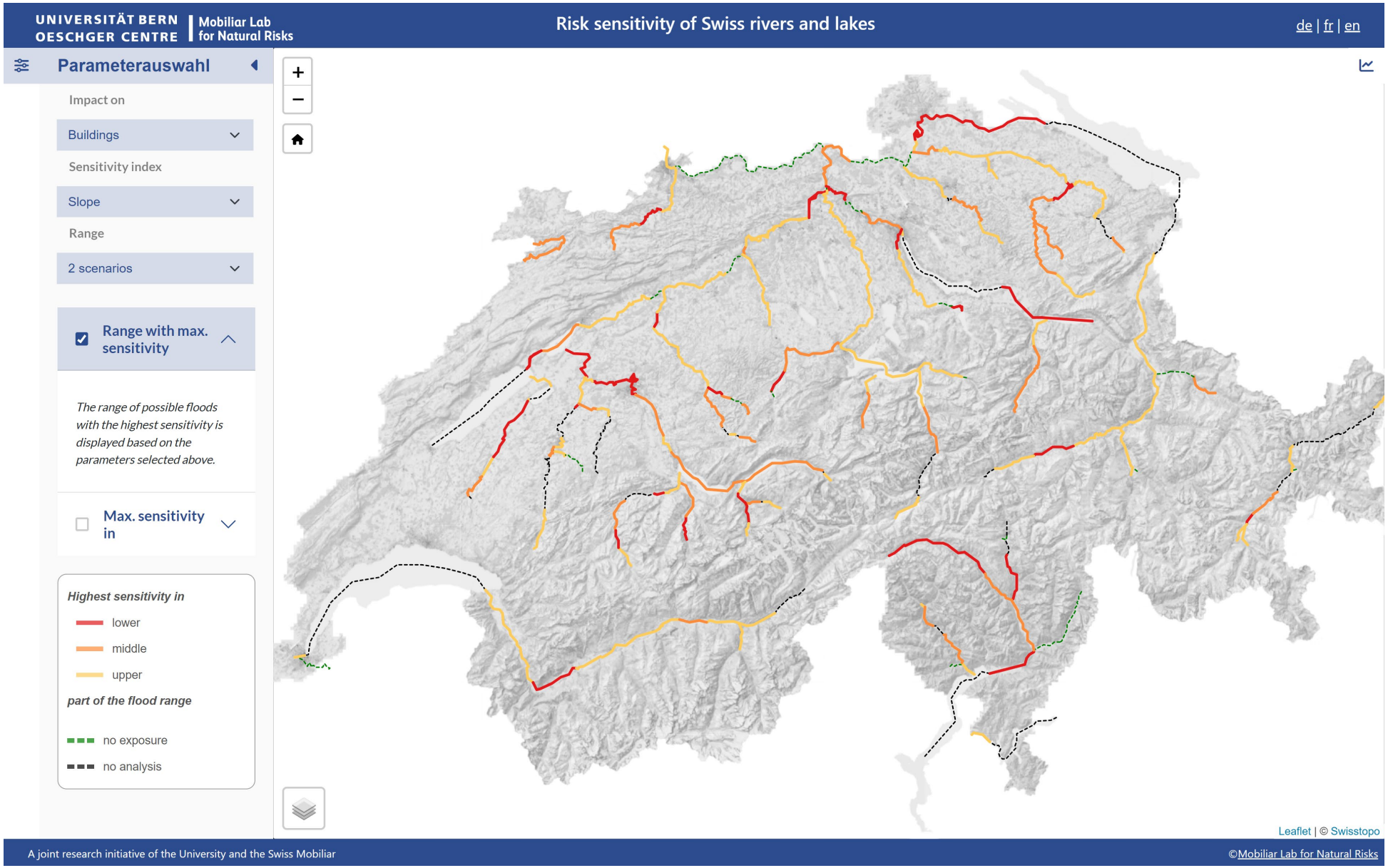

Risk sensitivity tool

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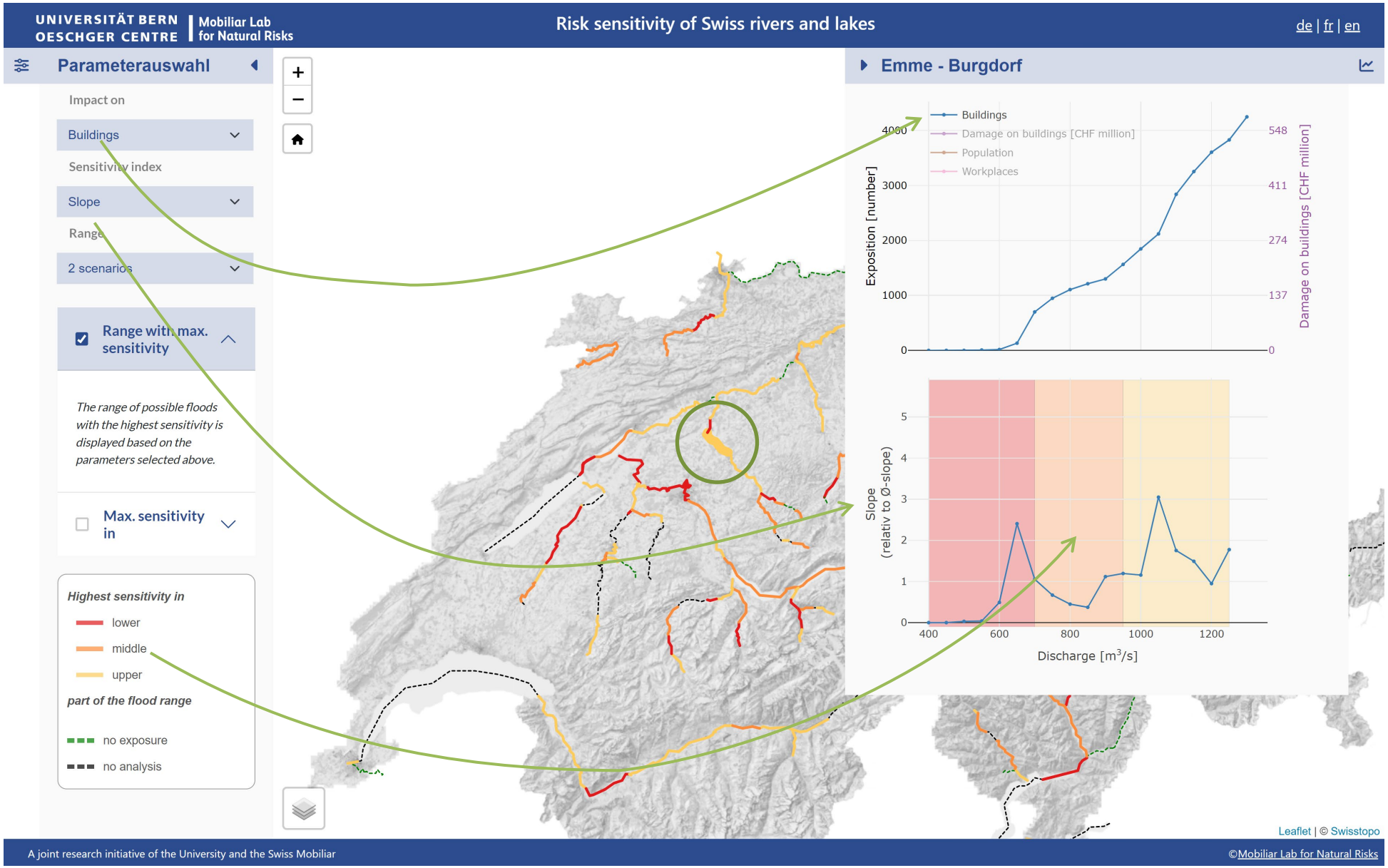

Risk sensitivity tool

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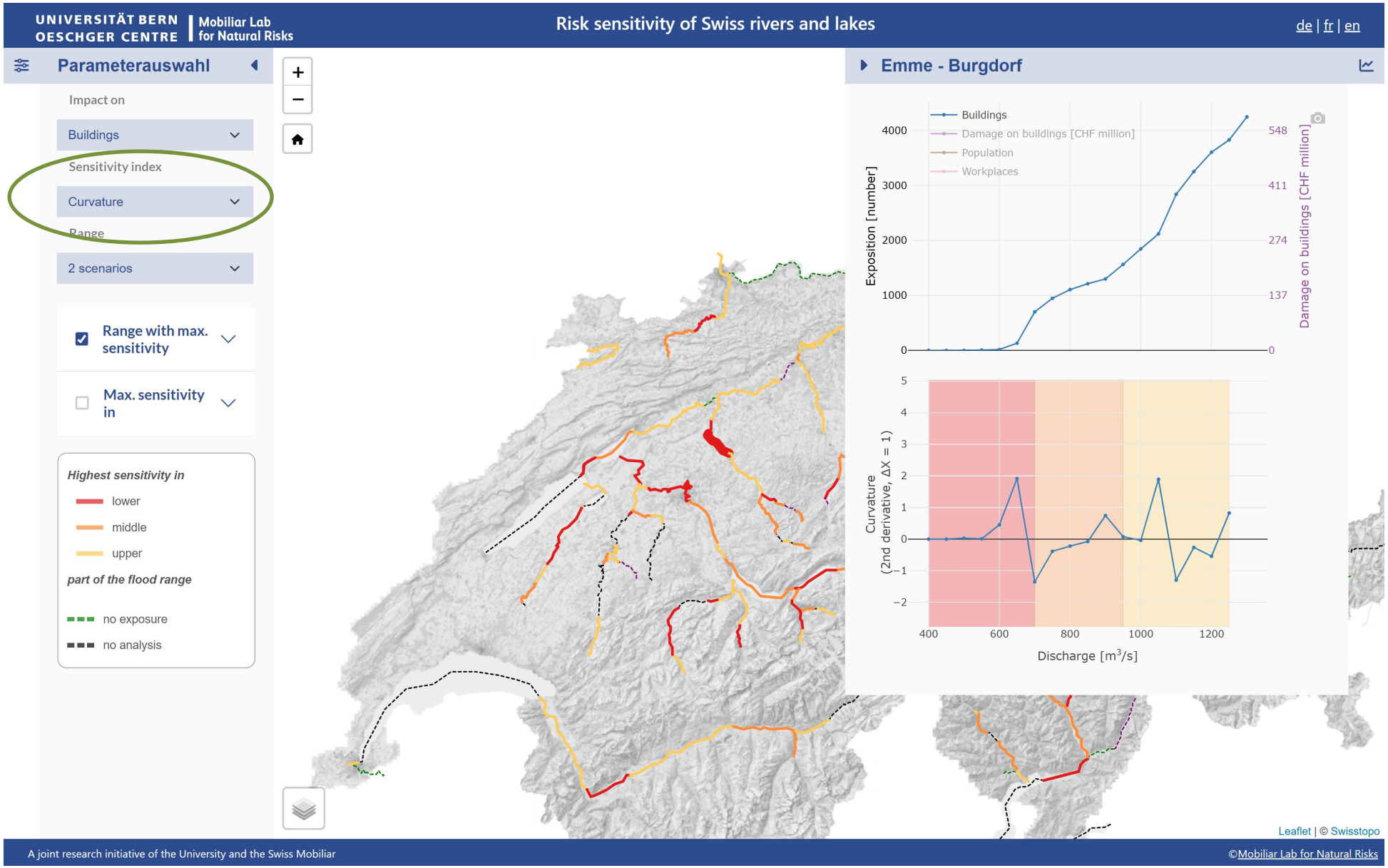

Risk sensitivity tool

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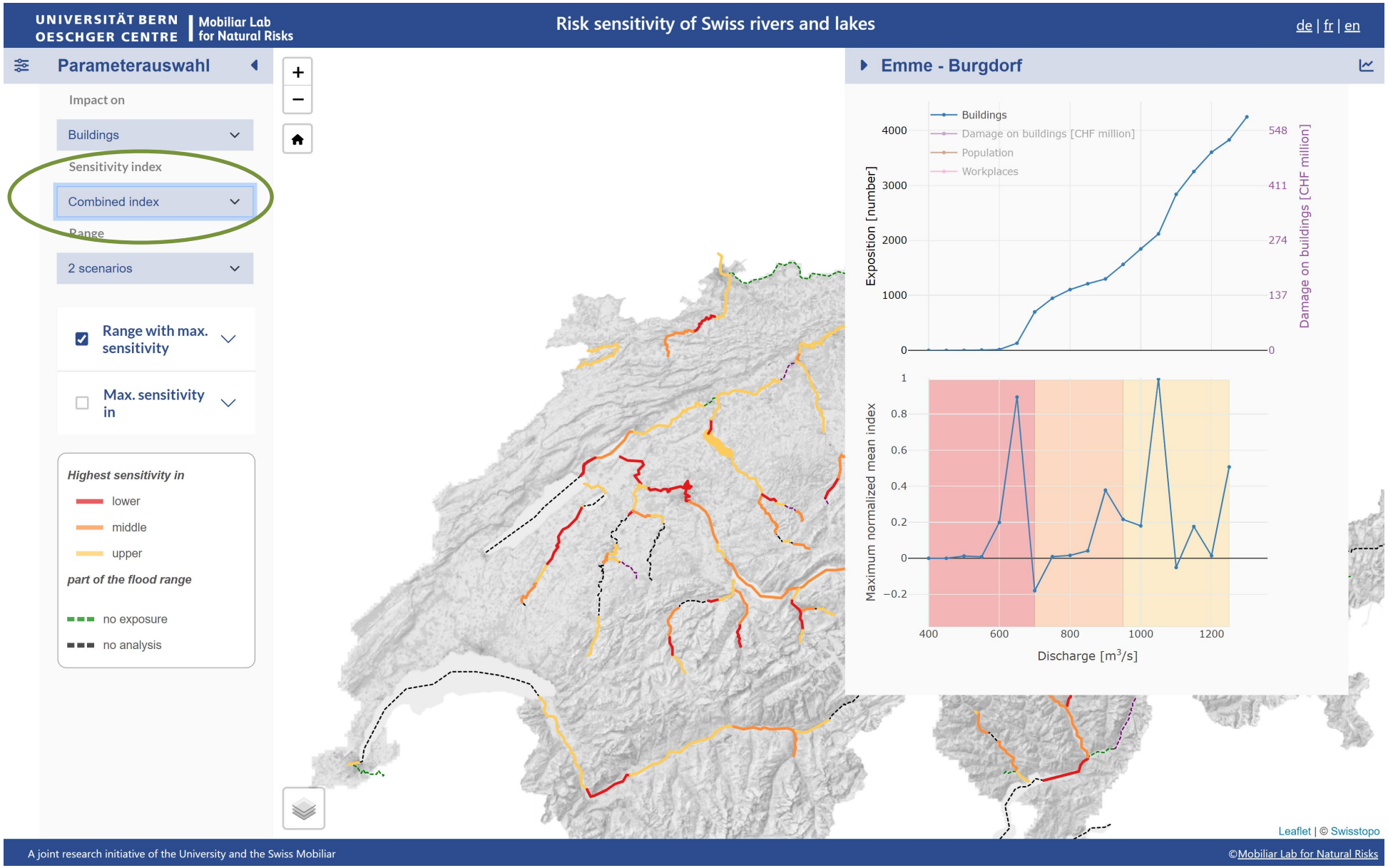

Risk sensitivity tool

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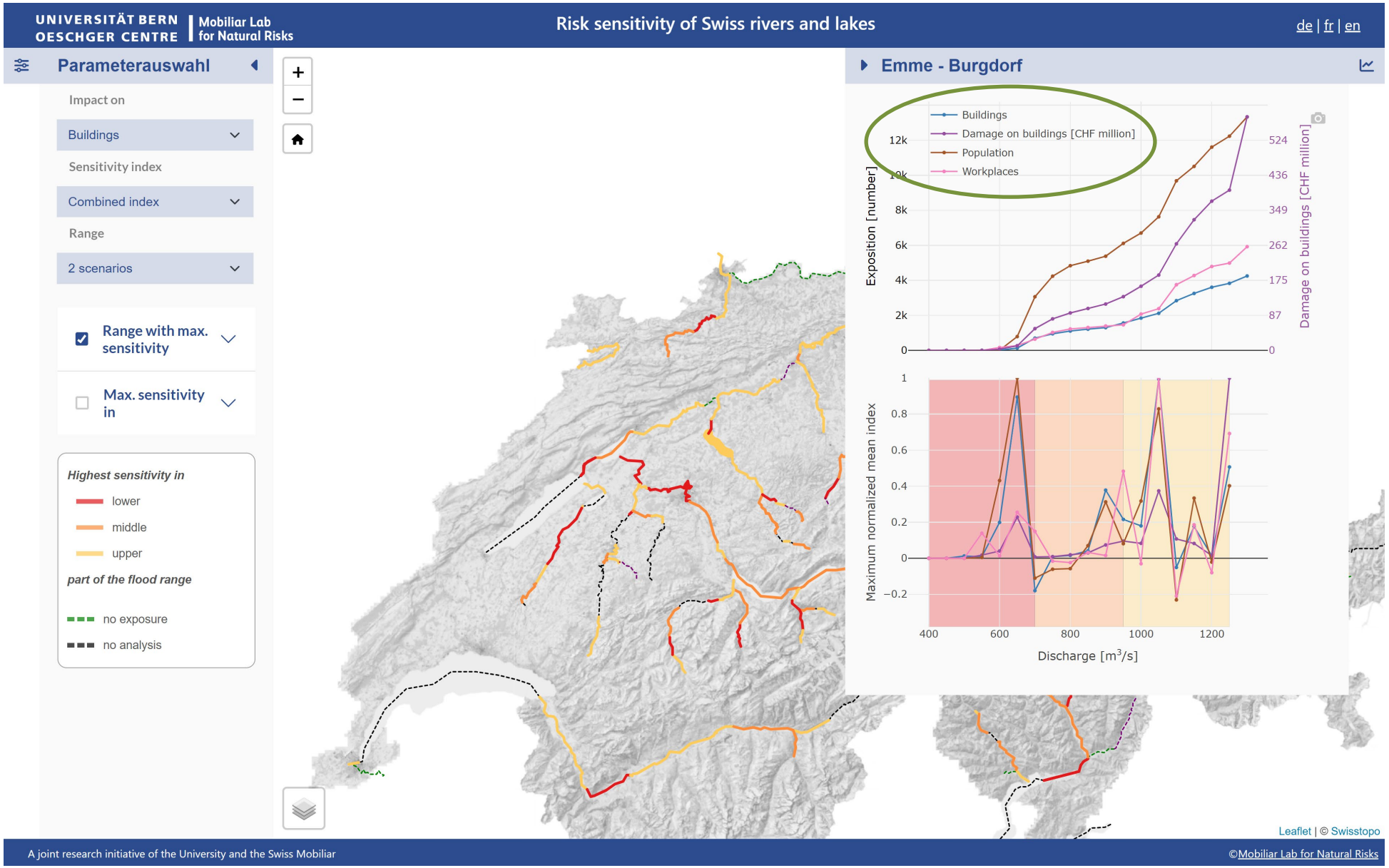

Risk sensitivity tool

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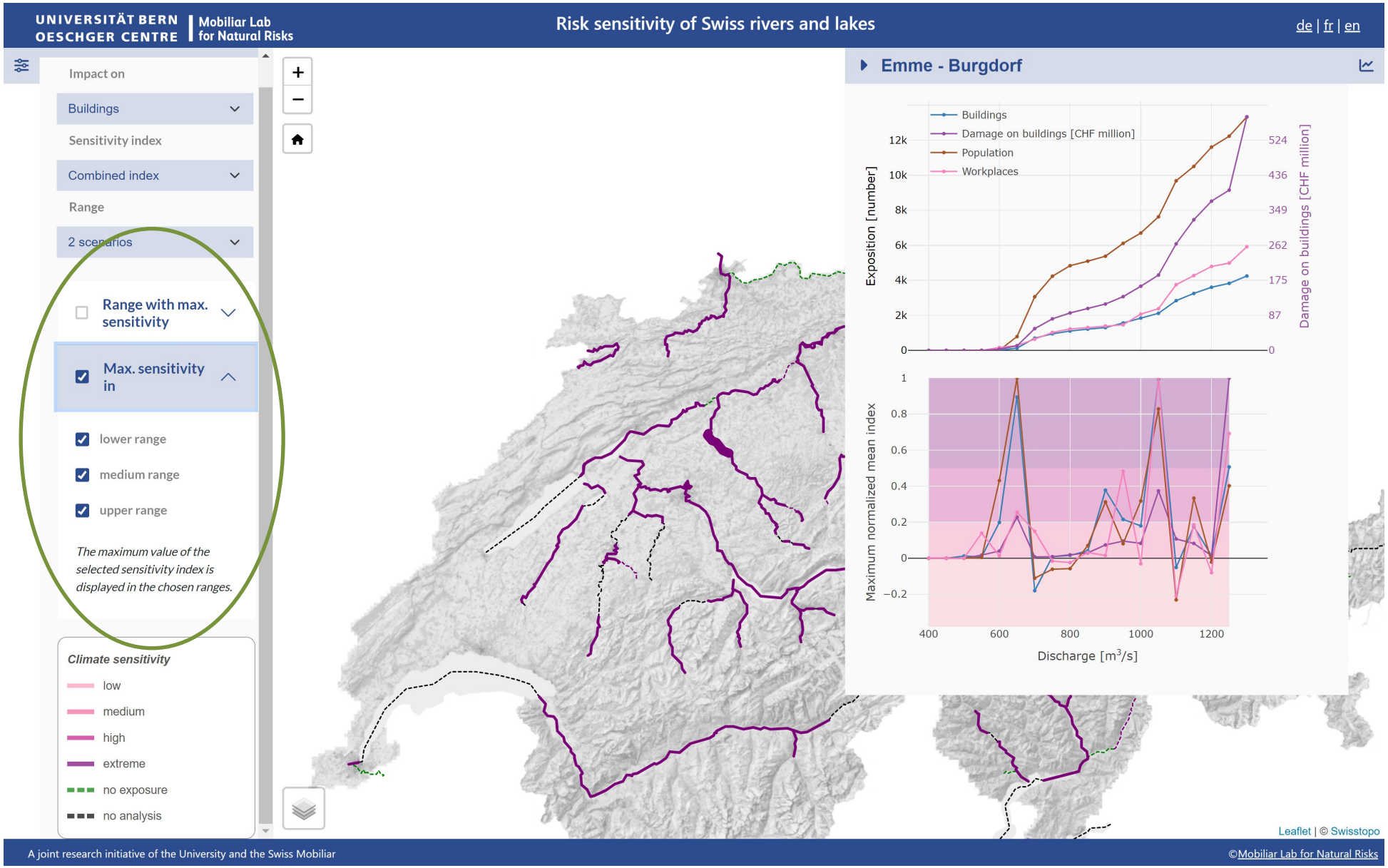

Risk sensitivity tool

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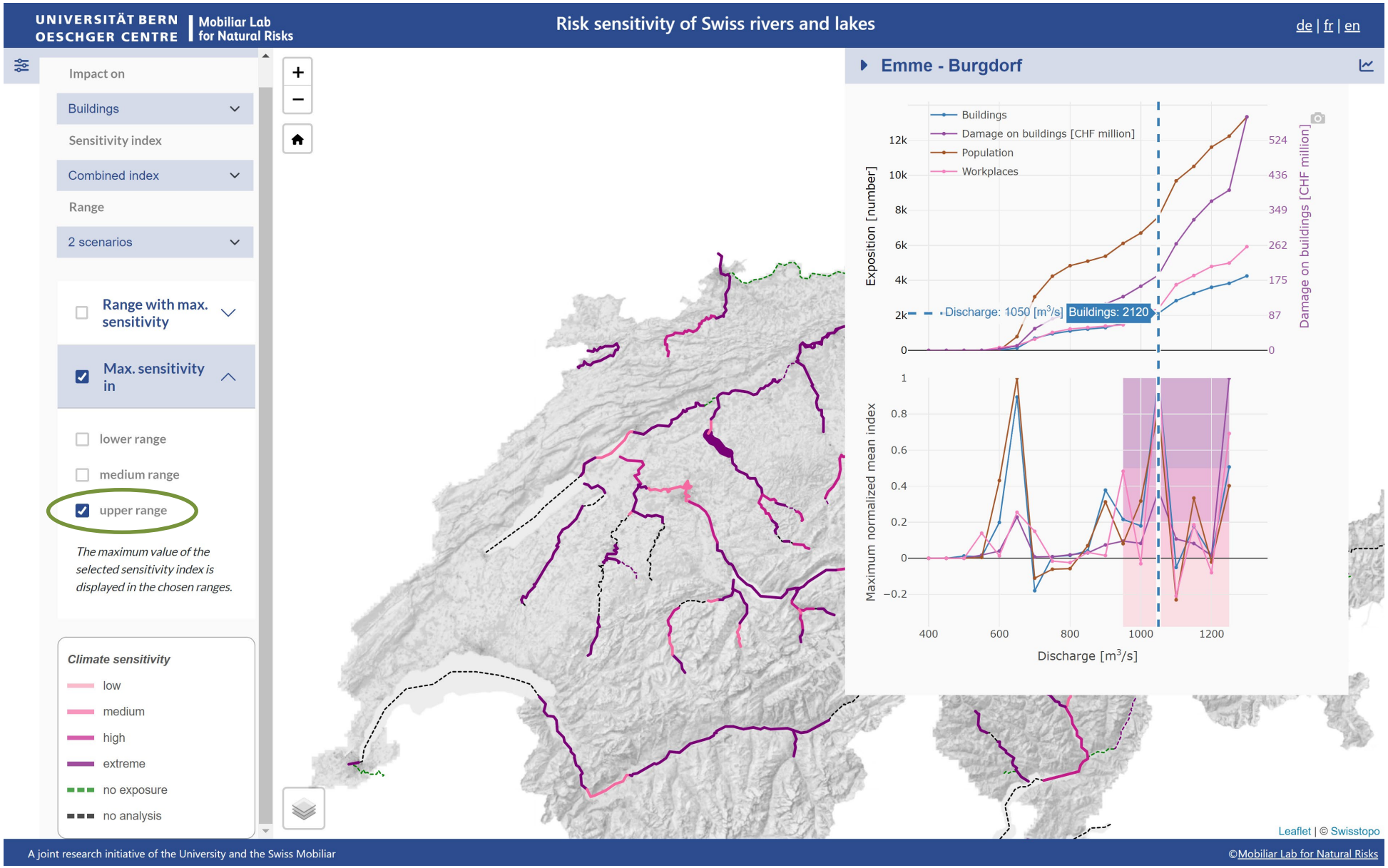

Risk sensitivity tool

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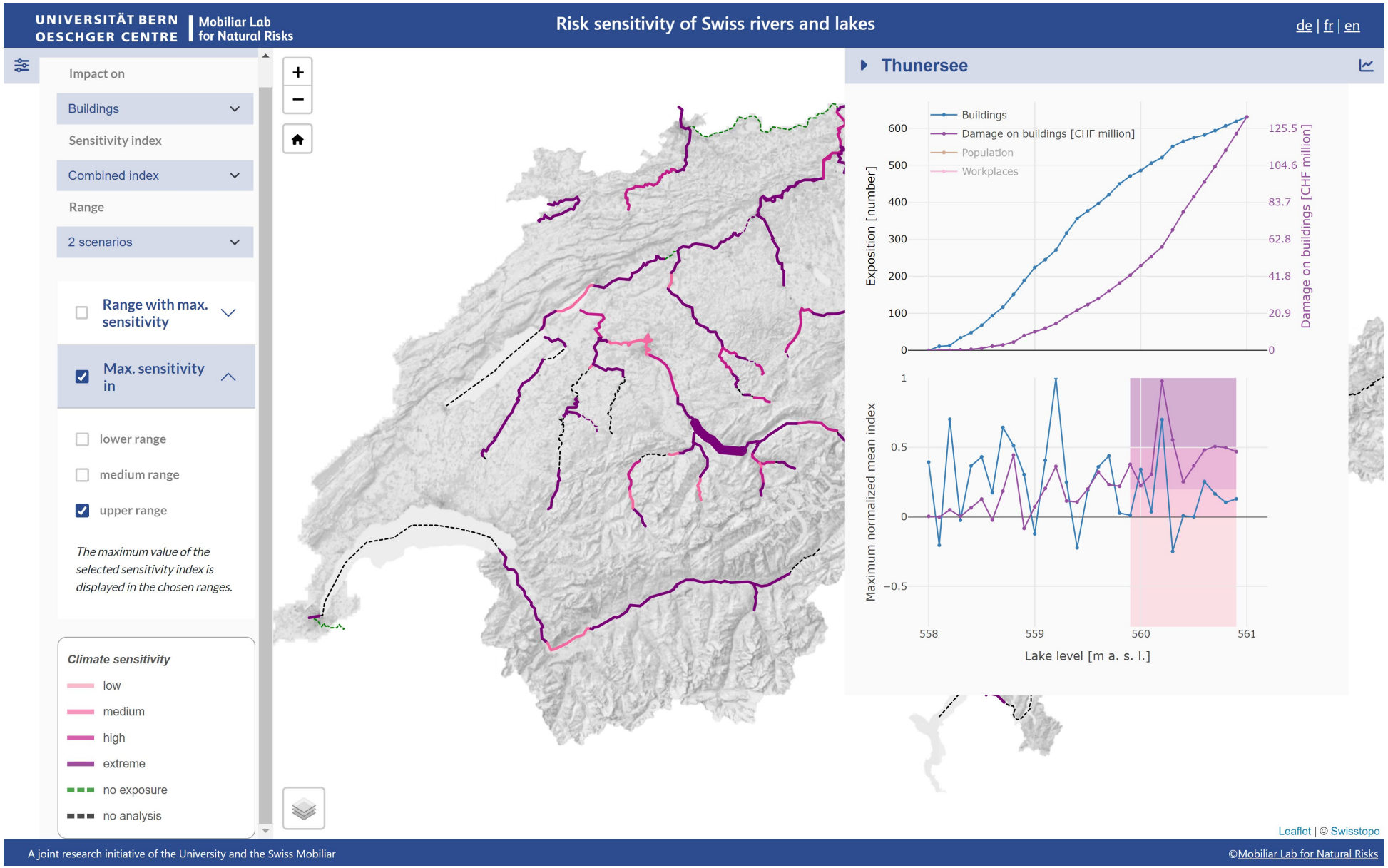

Risk sensitivity tool

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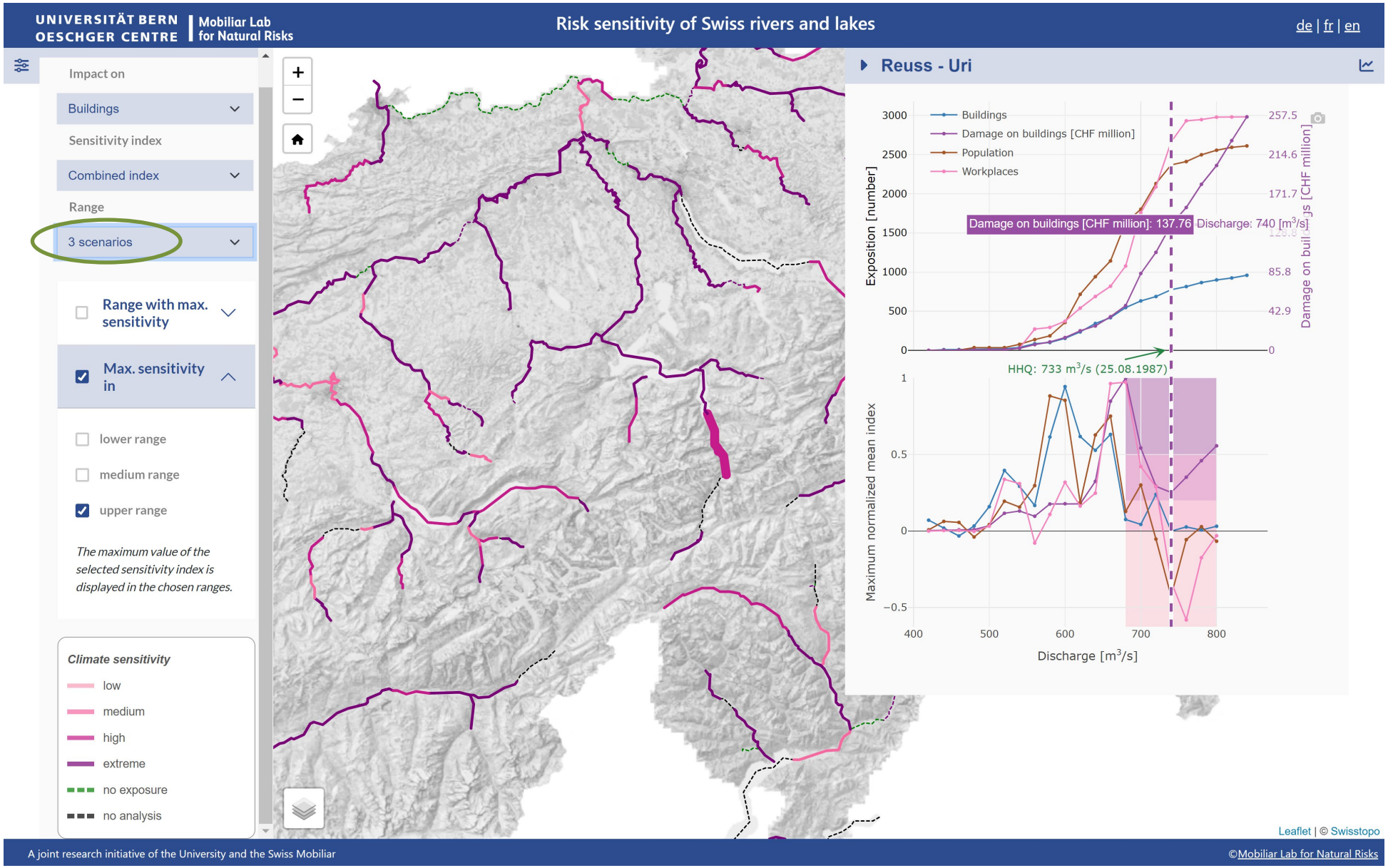

Risk sensitivity tool

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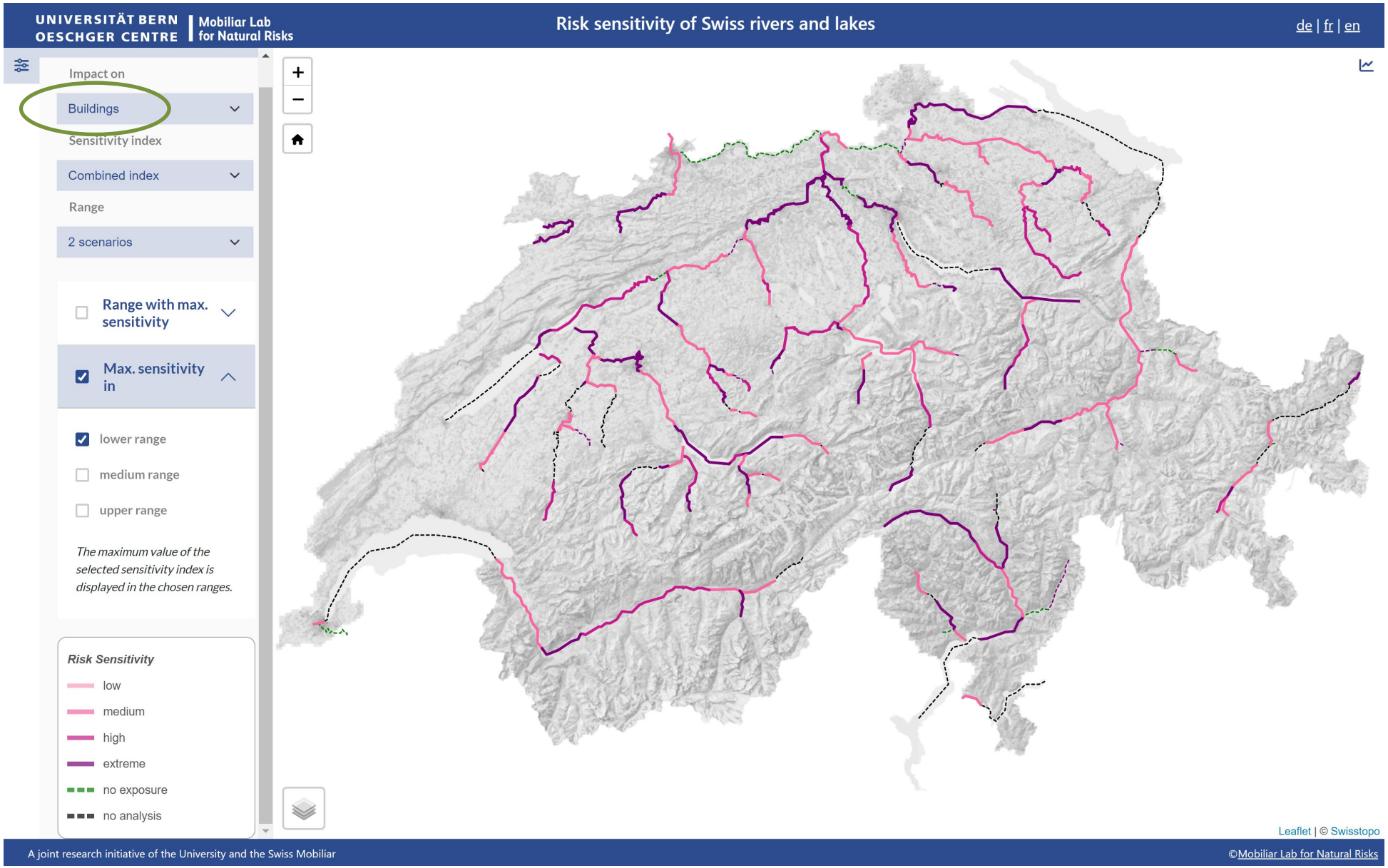

Risk sensitivity tool

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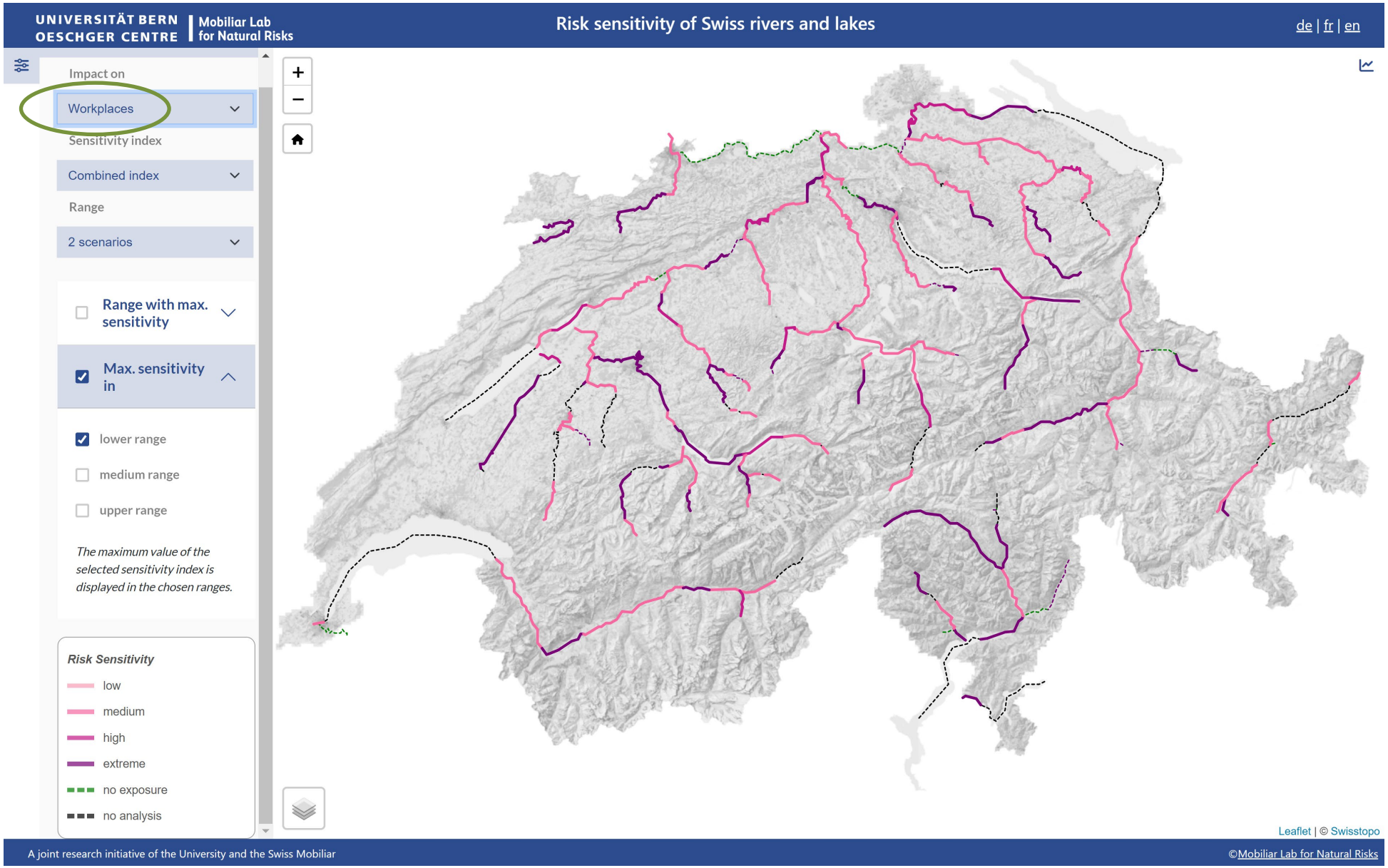

Conclusion

- No/unclear spatial patterns in sensitivity
- Different sensitivities among different impact types
- Quantitative assessment of «sensitive» thresholds that might be key for flood risk management
  -> short-term: impact-based warning
  -> long-term: climate change adaptation strategies

Practical application of scenario-neutral bottom-up approaches:

- Communication of uncertainties in (future) flood risk assessment
- Bottom-up approach as basis to decide where a detailed top-down approach might be meaningful

-> Combination of both approaches to face and estimate impacts of climate change on flood risk

Outlook / Limitations

- Finish and publish research background of tool (soon)
- Finish and publish risk sensitivity tool (end of May)
- Update data / code / software (-> still 2.8.1…) / …
- Provide flood simulation results via API (long-term…)
  … and maybe even the models used…

- Validation…
- Integrating culverts / underpasses not covered by DEM in computational mesh
- **Integrating bridges as inner boundaries (gates) into BASEchain (1D)**

Outlook / Limitations

Integrating bridges as inner boundaries (gates) into BASEchain (1D)

- Calibration with *weir_my*, *contraction_factor*
- Use of different *ehead_reference_location* cross-sections
- Sensitivity tests to *width*, *gate_bottom_level* and *gate_level*
- Optimization of width and height definition based on bridge profiles measured by FOEN -> «Lichtraumprofil»
- Interpolation of cross-sections with different distances
- …

Outlook / Limitations

Integrating Bridges as inner boundaries (gates) into BASEchain (1D)

Vergleich ‘interpoliert qp 30m’ vs ‘org mit neue Brücke lp’