

The interdisciplinary scClim project: Assessing hail risk and its impacts in a changing climate

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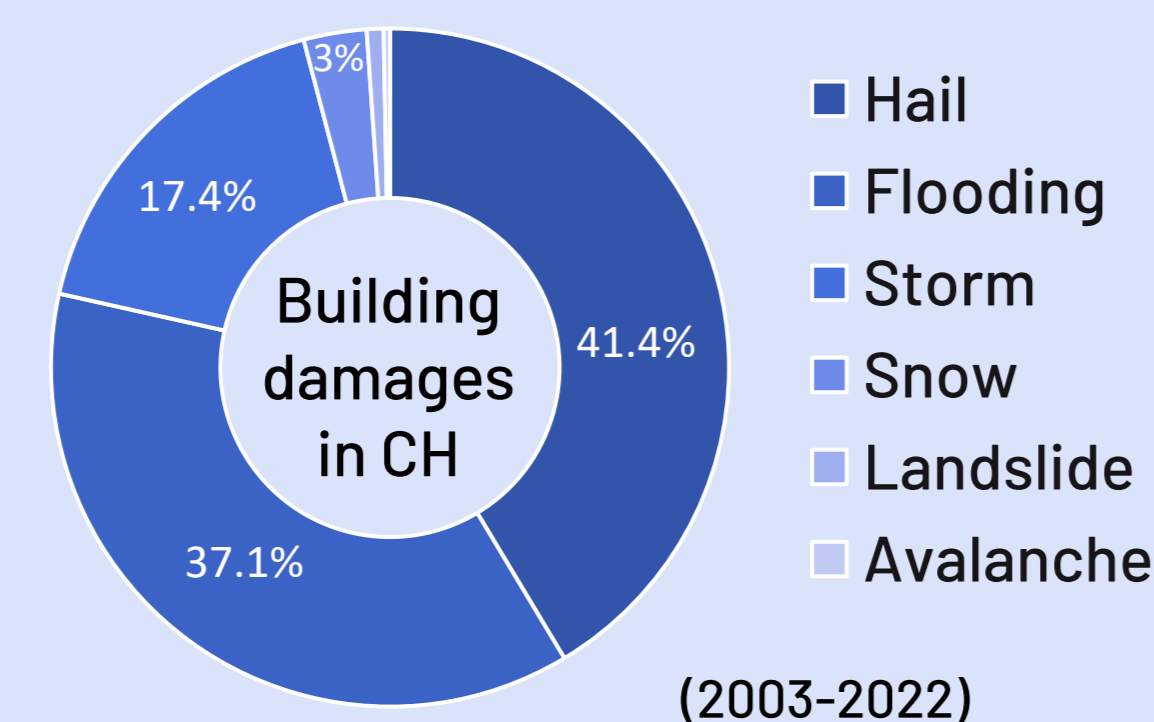
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01 Why do we care?

Hail is the **costliest weather-related hazard** in Switzerland and a major driver of convective storm losses globally, yet large **uncertainties remain** about how hail and its impacts will evolve in a **warming climate**. Stakeholders, decision-makers, and public authorities require actionable information on hail risk to strengthen risk management and climate adaptation. This motivated the Swiss research initiative **scClim** which aimed to advance the understanding of hail risk in a changing climate across Europe.



02 The project

ScClim united **researchers, insurers, first responders and public agencies** to develop an integrated framework for understanding and managing hail risk. It combines **novel observations, impact modeling, climate simulations**, and a co-developed **online demonstrator platform** to translate science into decision-making tools.

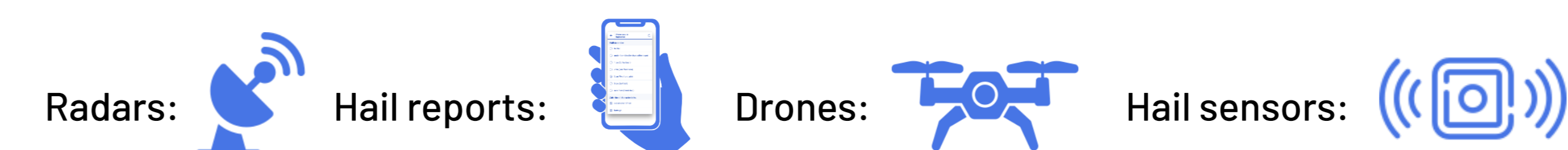
> 12 scientists > 15 partners

03 Innovations

- New hail observation datasets**
 - ... combining multiple methods, data sources and Europe-wide products to better capture hail occurrence and size
- Probabilistic hazard-to-impact model chain**
 - ... linking weather prediction, observations, climate simulations and impact modeling to assess hail risk across sectors and time scales
- Online demonstrator**
 - ... co-developed with stakeholders to provide real-time hazard, impact, and forecast information for decision-support
- Future hail risk**
 - ... assessment using high-resolution climate simulations (+3°C) to analyze changes in hail frequency, intensity, and impacts across Europe

04 Unique data basis and new datasets

Hail monitoring in Switzerland:



Complemented in scClim with:

- 10yr European convection-permitting climate simulations (+3°C, using HAILCAST)
- Detailed hail damage and exposure data for buildings, vehicles, and crops

New datasets created:

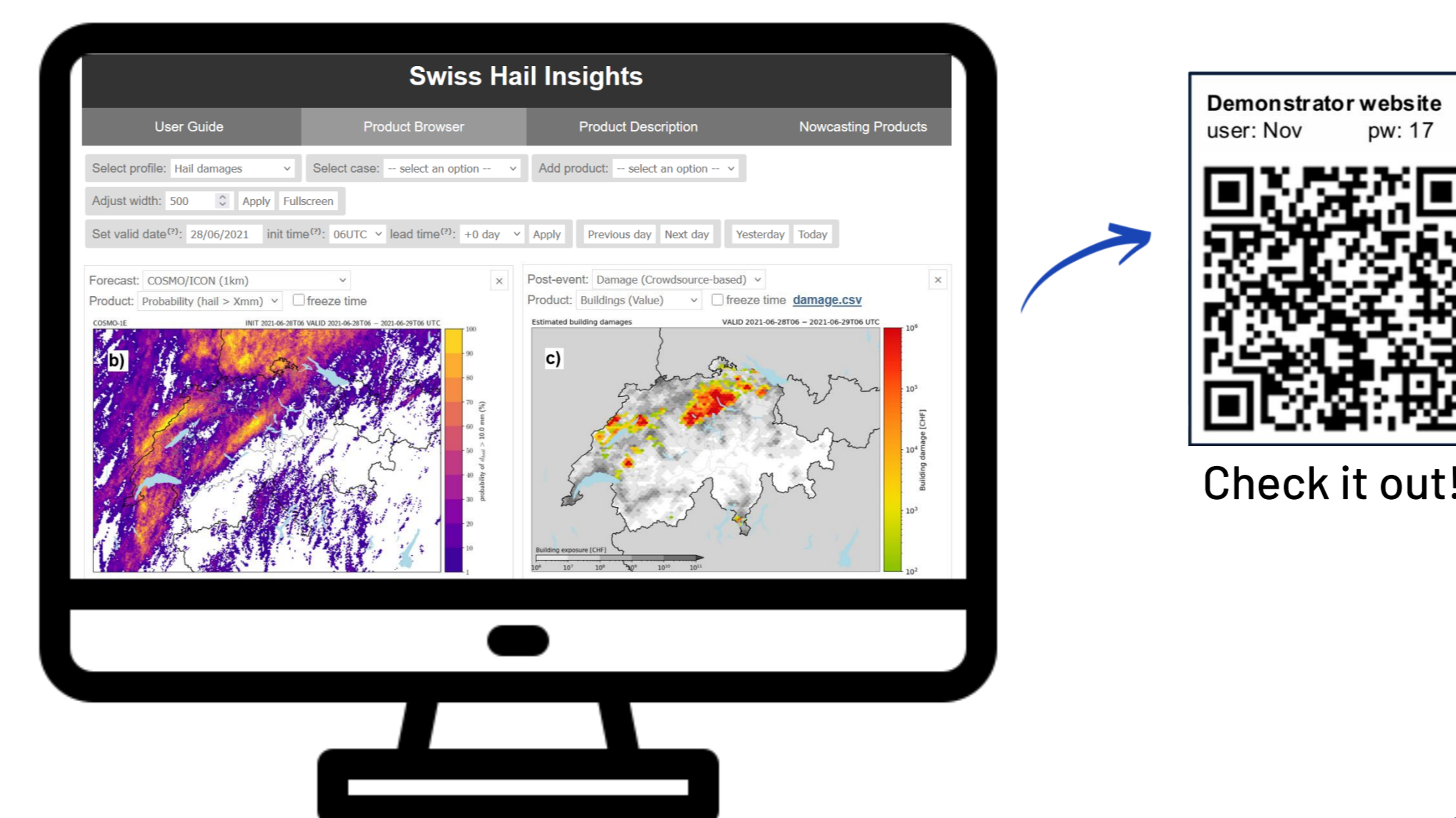
- Gridded hail size report dataset (Schmid et al. 2025)
- Radar-based hail sizing algorithm (Aregger et al., in review)
- Long-term hail-day reconstruction (Wilhelm et al. 2024)
- Pan-European hail occurrence dataset (Cui et al. 2024)

Basis for hail damage modeling, climatological analyses, and model validation

06 From science to decision-making: interactive tool for stakeholders

An interactive platform was co-developed with stakeholders to translate model results into decision-relevant tools and **iteratively improved through user feedback**. It provides hindcasts, nowcasts, forecasts, impact-based warnings, and damage estimates for buildings 🏠, vehicles 🚗, and crops 🌾 for Switzerland.
 → Supports first responders, insurers, and public agencies in short- and long-term risk assessment and decision-making

A screenshot of the online demonstrator displaying the NWP probability of hail with a diameter >10mm (left) and the post-event building damage estimates based on the gridded crowdsourcing dataset (right) for June 28th 2021.



Check it out!

08 Transferability

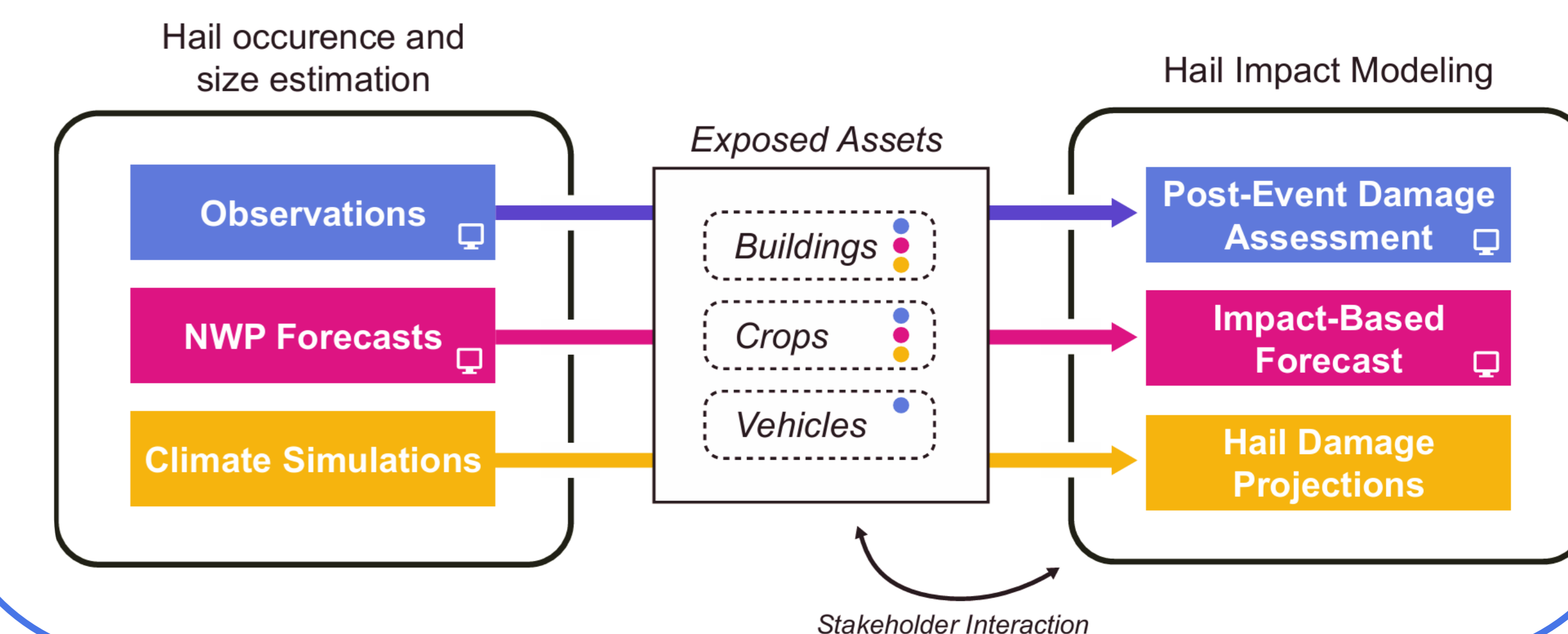
ScClim can serve as a prototype for interdisciplinary, user-oriented climate-risk research:

- The fully open-source **seamless hazard-to-impact model chain** for multiple sectors can be applied to **other convective hazards** such as wind, flash floods, or compound events, and to **other regions**
- **All datasets, impact functions, the interactive platform and code are publicly available**

For more information and all scClim papers see **Wilhelm et al. 2026** (accepted for BAMS)

05 One modeling chain addressing multiple sectors

We developed a **seamless model chain** translating **hail hazard** to **sector-specific impacts** across **multiple time scales**. Hail hazard from observations (radar + crowdsourcing), NWP forecasts (COSMO 1E+2E), and the scClim climate simulations feeds into **impact models for buildings, vehicles, and crops**, calibrated using insurance damage data within the CLIMADA framework.
 → Enables post-event damage assessment, impact-based forecasts, and future risk projections



07 Example result: hail and impacts under 3°C warming

In the future, hail days (>12.5 mm) increase in northeastern and central Europe and decrease in southwestern Europe (b).

Hailstorms become **more severe** on average (c).

Building damage potential increases across most of Europe (+25-42%), with decreases mainly in France and the Iberian Peninsula (d).

