Towards a national Landslide Early Warning System for Switzerland:
a pilot study to assess the use of soil wetness information and physically-based modelling
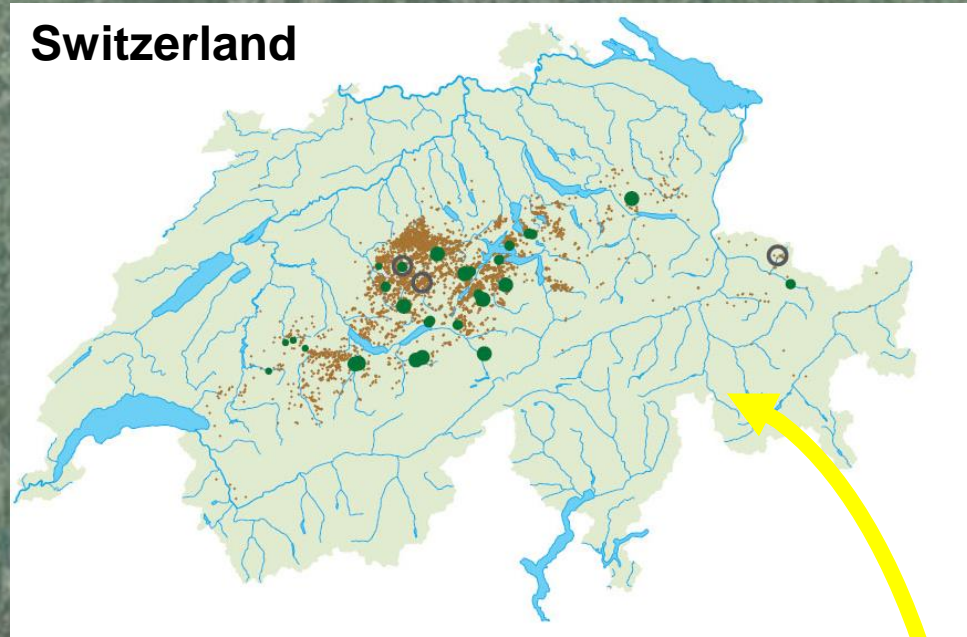
Manfred Stähli[1], Tobias Halter[1], Adrian Wicki[2], Peter Lehmann[3]

[1] Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland
[2] Federal Office for the Environment, Bern, Switzerland
[3] ETH Zürich, Zürich, Switzerland
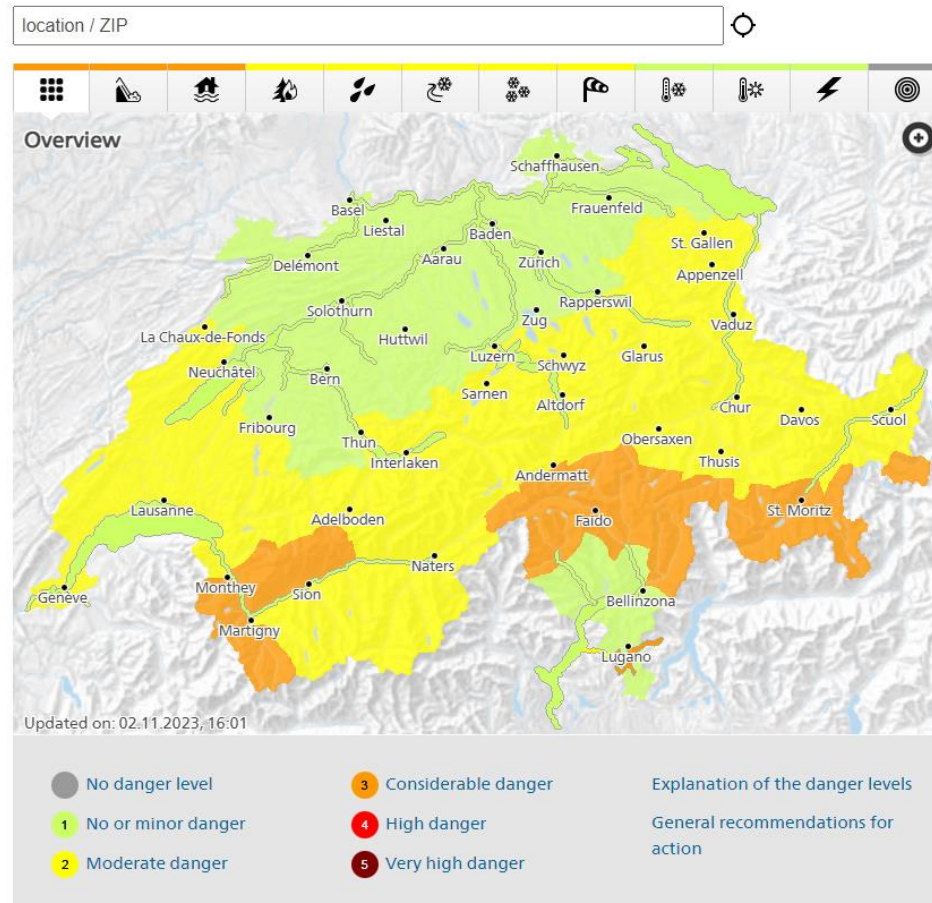
Storm event of 21-23 August, 2005

Switzerland

Florence

A national Landslide Early Warning System for Switzerland

Currently under development – operational from 2025

- National disposition warning on shallow landslides and hillslope debris flows

- Existing warnings on national level: Floods, snow avalanches, forest fire, etc.

- Assessment based on decision support system

  - Empirical rainfall thresholds

  - Qualitative judgment of snow melt and soil saturation

  - Exchanges with cantonal authorities and national weather service (MeteoSwiss)

www.natural-hazards.ch

Pilot study Napf region (Emmental, central Switzerland)
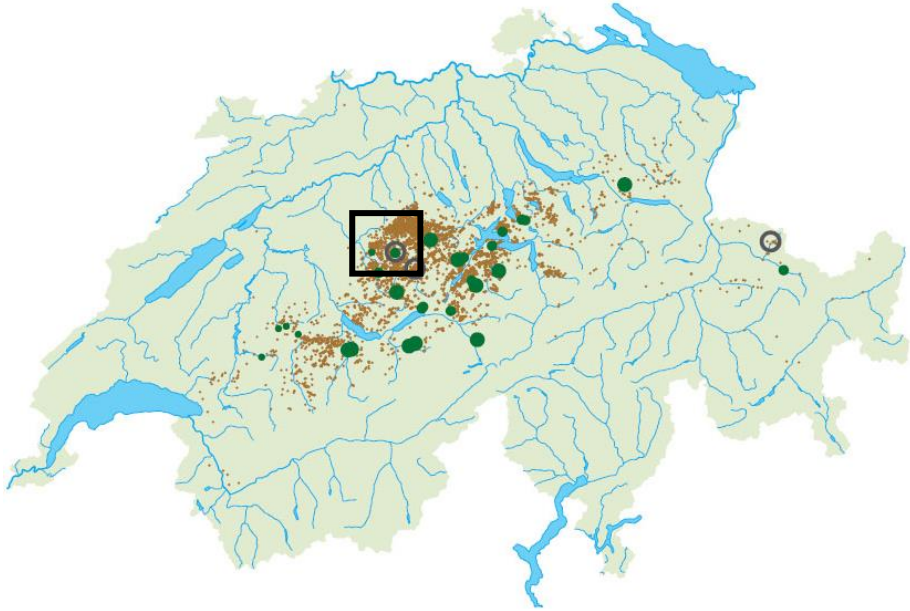
Area: 186 km^2
Altitude: 700-1'400 m a.s.l.
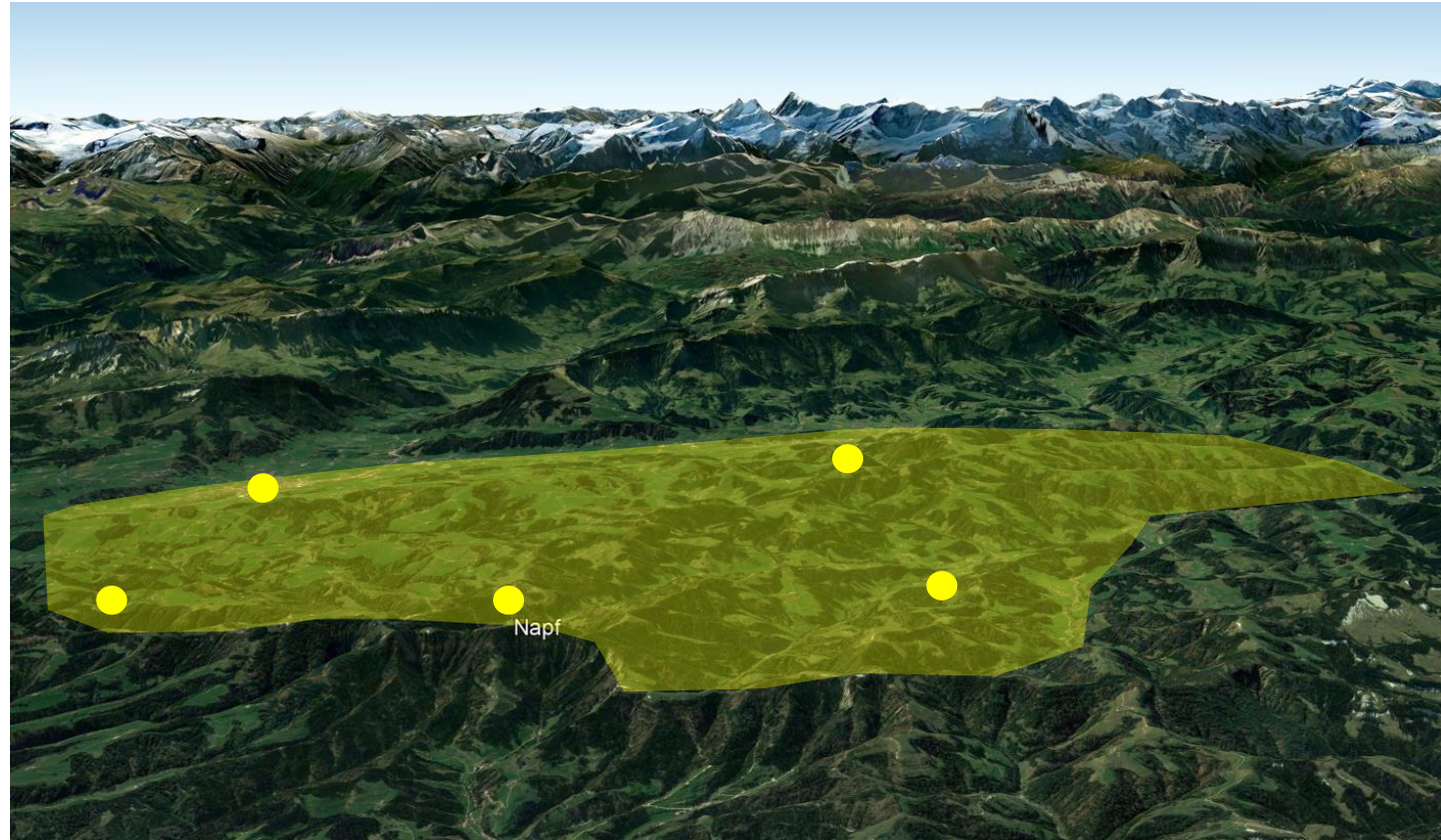Geology: tectonic unit of the Molasse Basin

Image: Google Earth

Pilot study Napf region

Specific objectives

- To assess the added value of in-situ soil wetness measurements

- To investigate the potential and limits of a numerical physically-based hydro-mechanical model as a forecasting tool for regional landslide occurrence

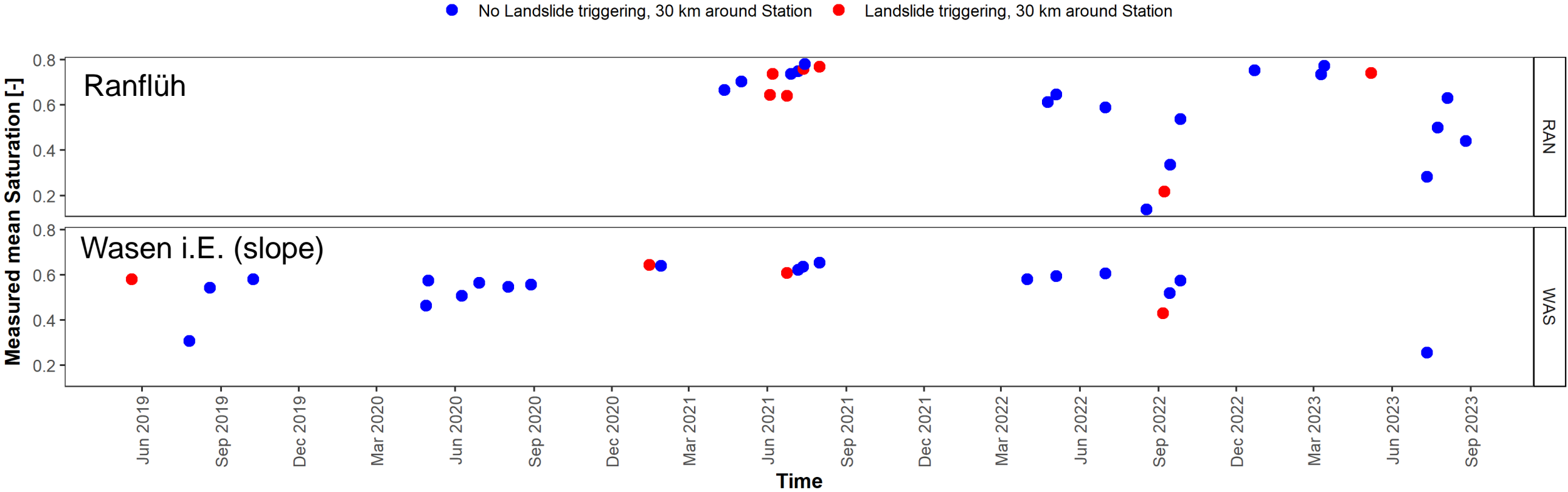- To explore Distributed Acoustic Sensing (DAS) as an indicator of imminent or ongoing landslide triggering

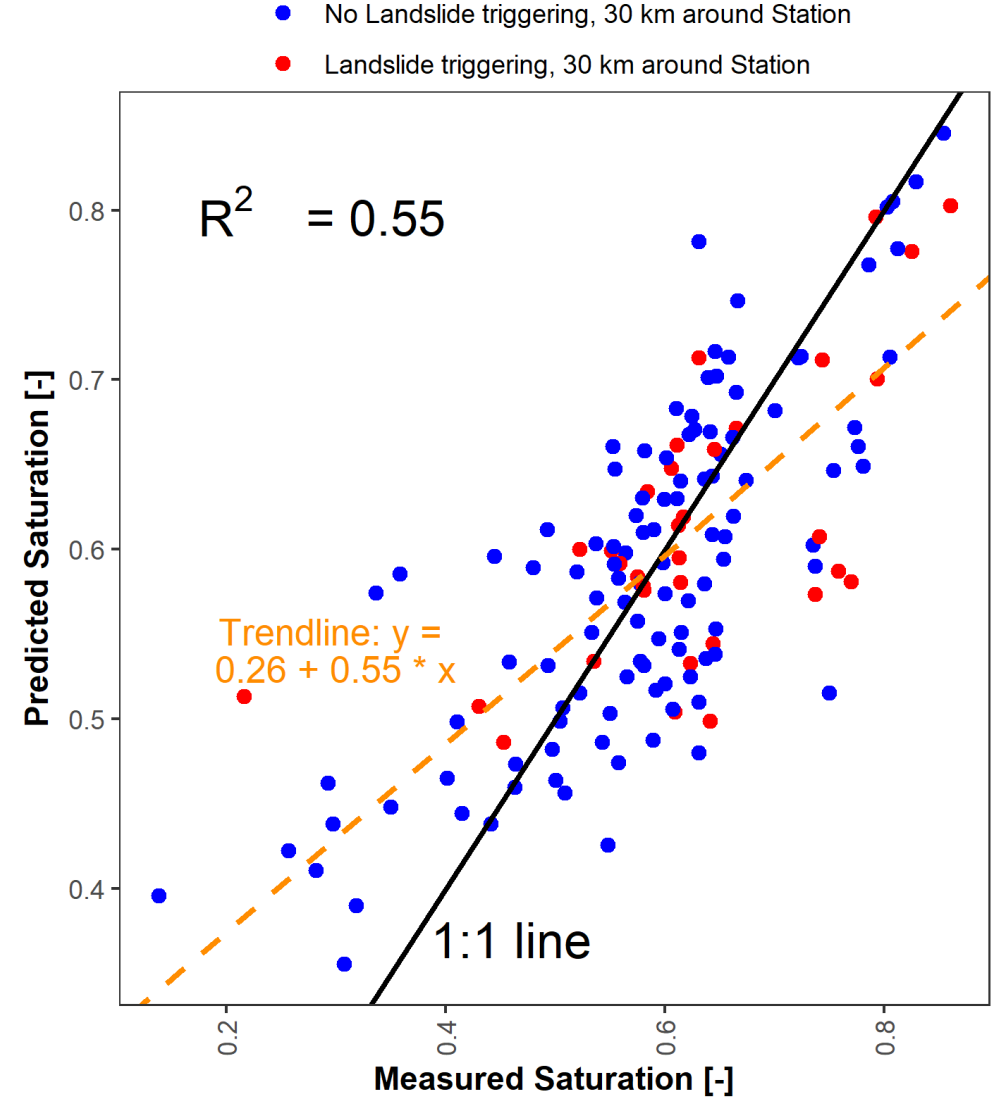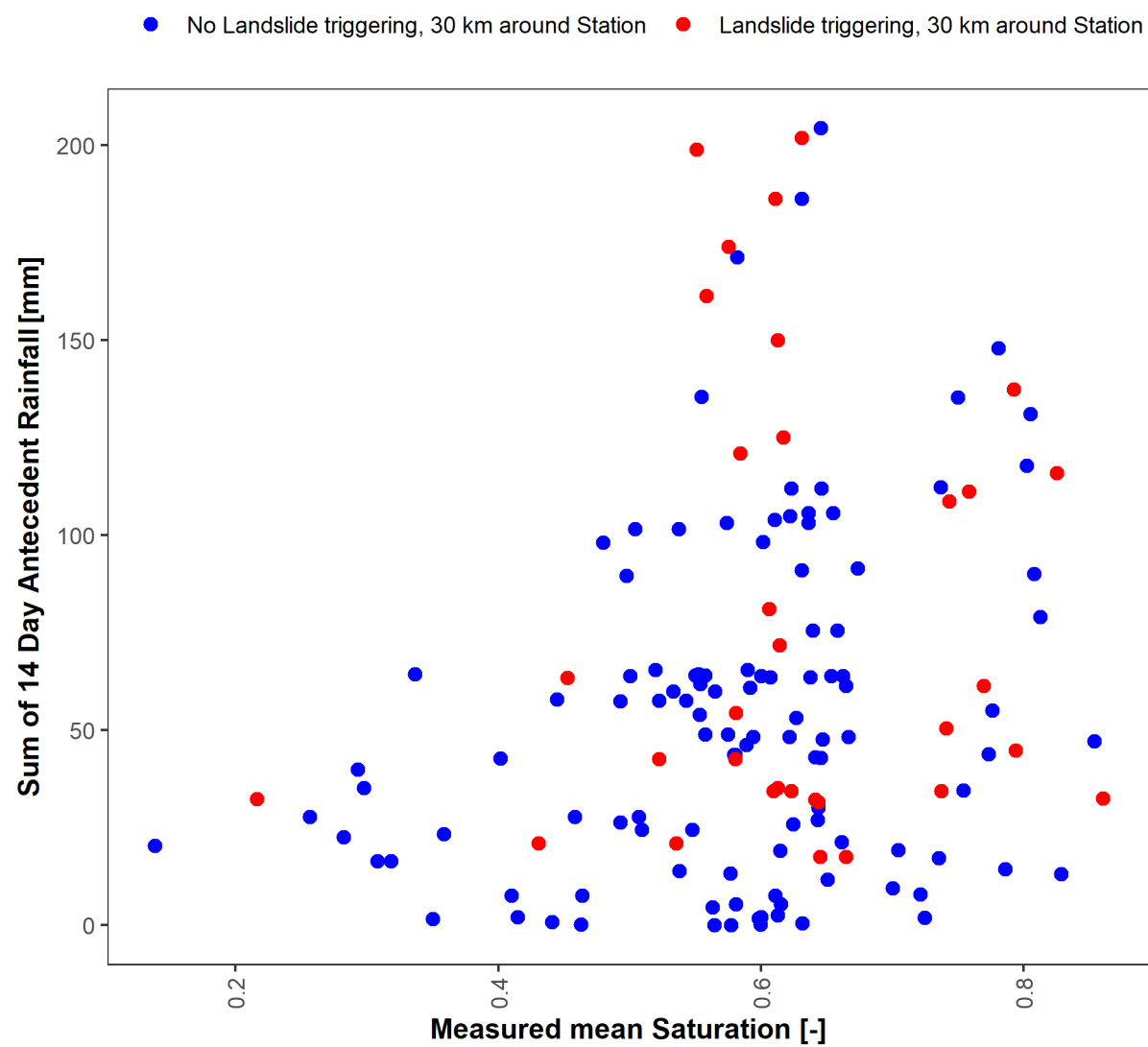# Pilot study Napf region (since May 2019; ongoing)
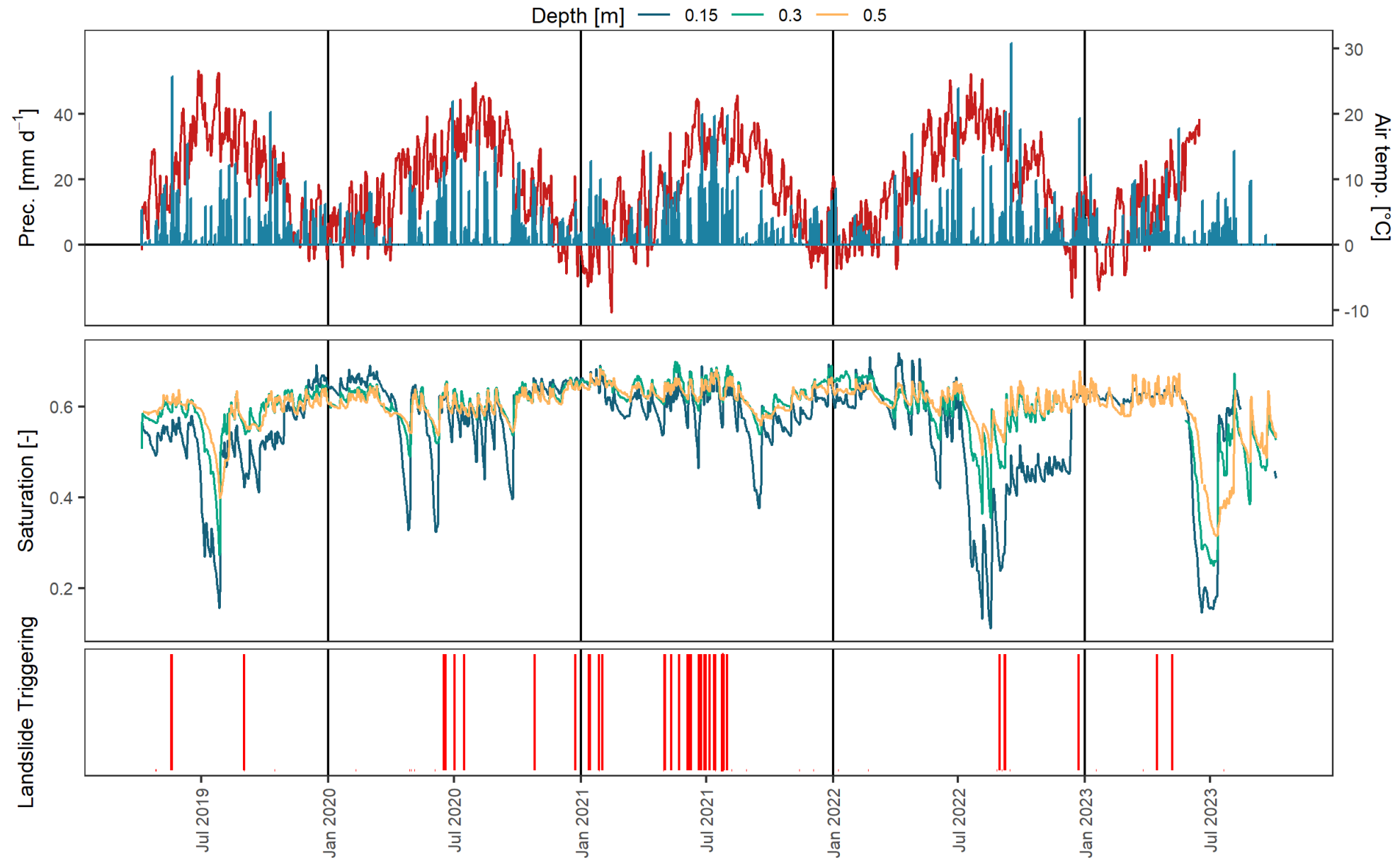
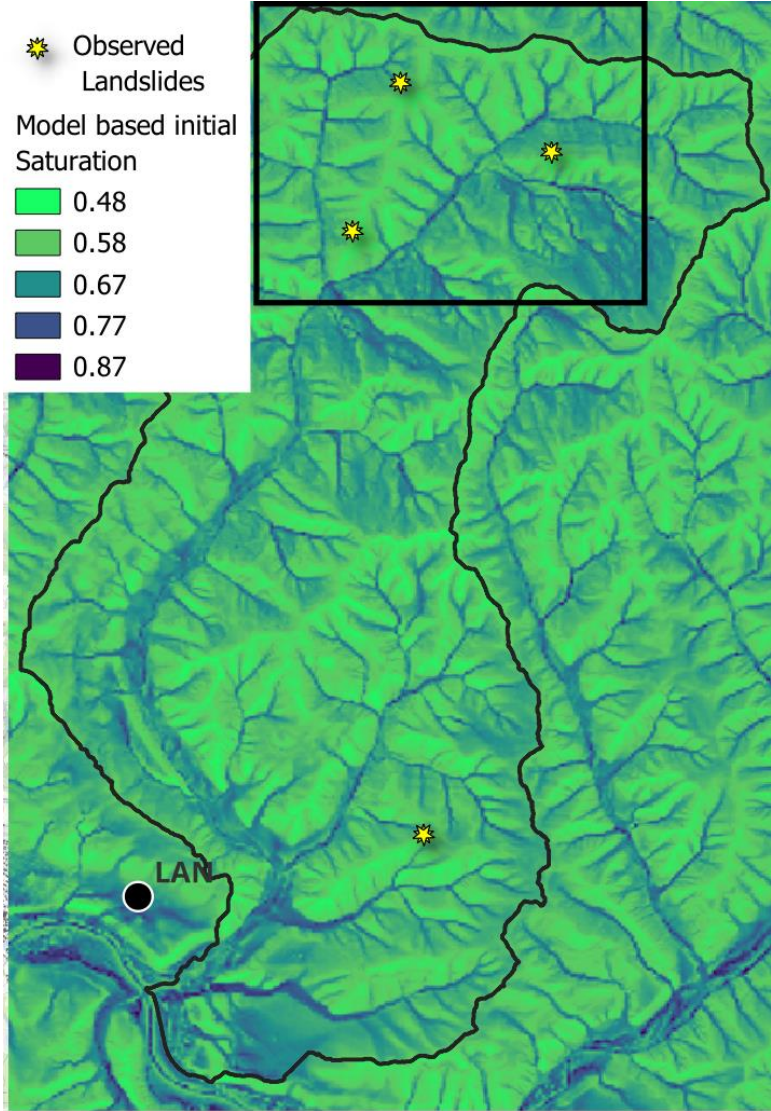# Observation of initial soil saturation …

…. for the **25 largest rain-fall events** at each soil measurement site
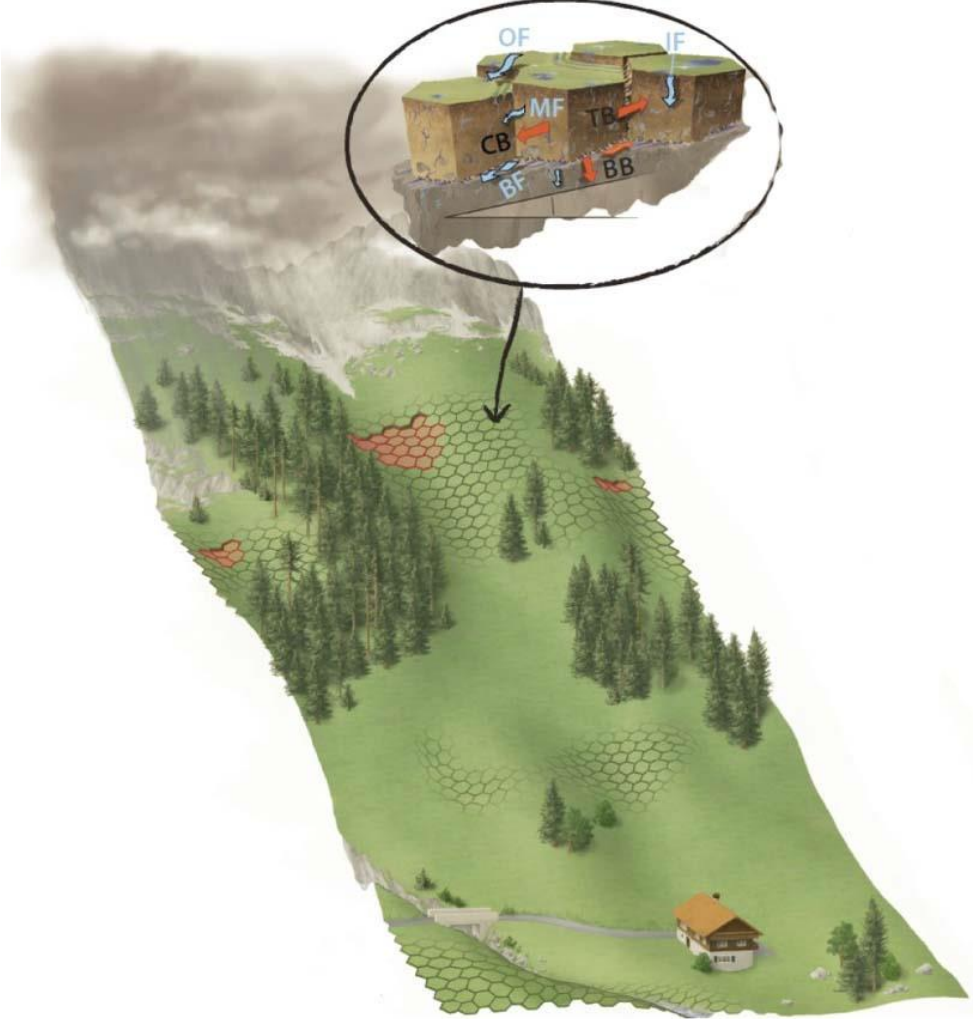
Spatial and temporal extrapolation of initial soil saturation

Importance of initial soil saturation for numerical modelling

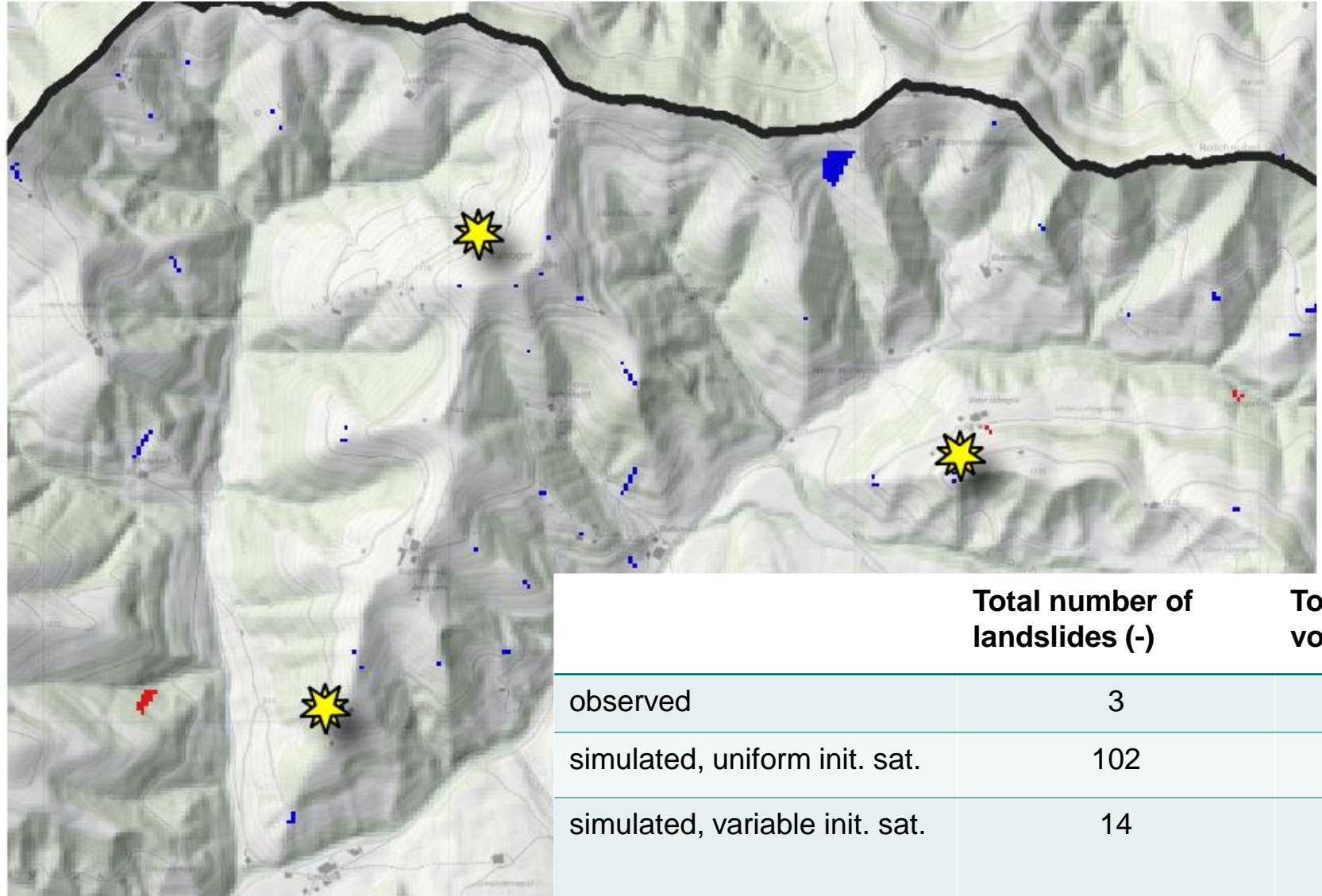**STEP-TRAMM model** (Lehmann et al., 2017)

Importance of initial saturation for numerical modelling

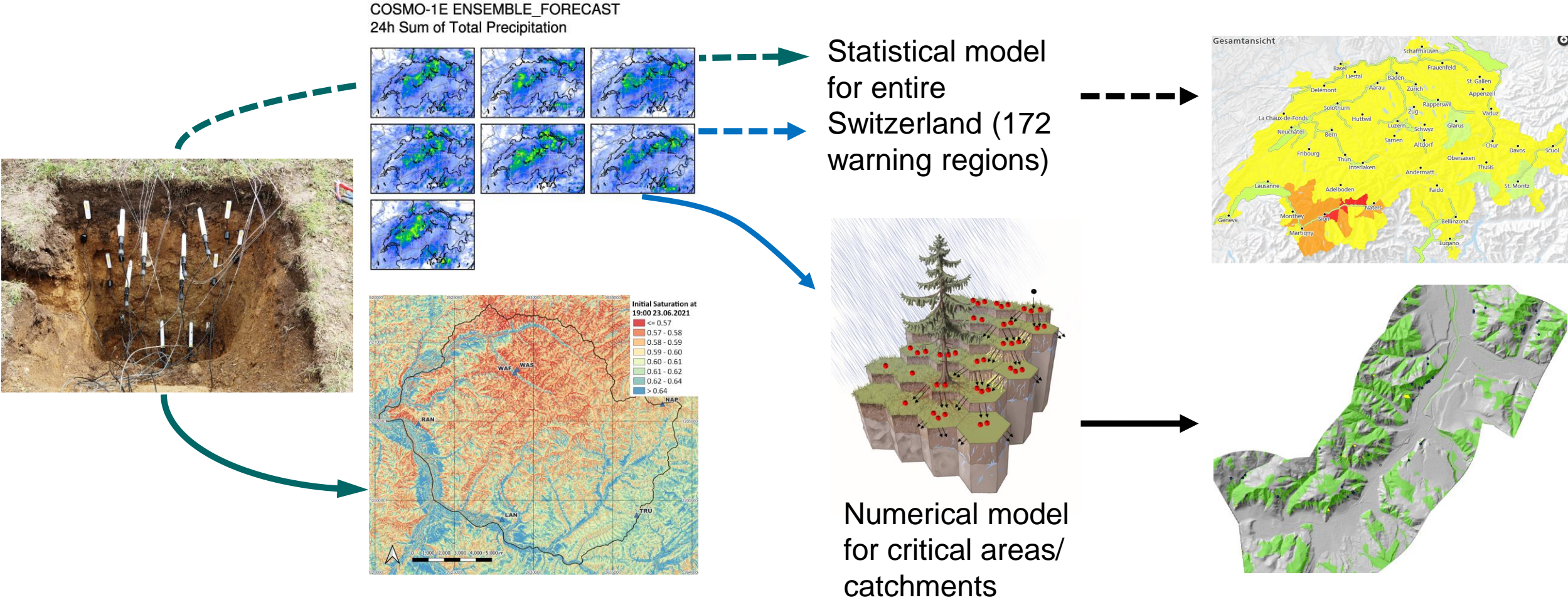Observed Landslides

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Simulated Landslides using distributed initial Saturation

Simulated Landslides using a homogenous initial Saturation of 0.62

	Total number of landslides (-)	Total landslide volume (m³)
observed	3	
simulated, uniform init. sat.	102	13'133
simulated, variable init. sat.	14	3'505

Conclusion: Potential workflow towards an advanced LEWS

COSMO-1E ENSEMBLE_FORECAST
24h Sum of Total Precipitation

Statistical model for entire Switzerland (172 warning regions)

Numerical model for critical areas/ catchments

WSL

A research institute
of the ETH Domain

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