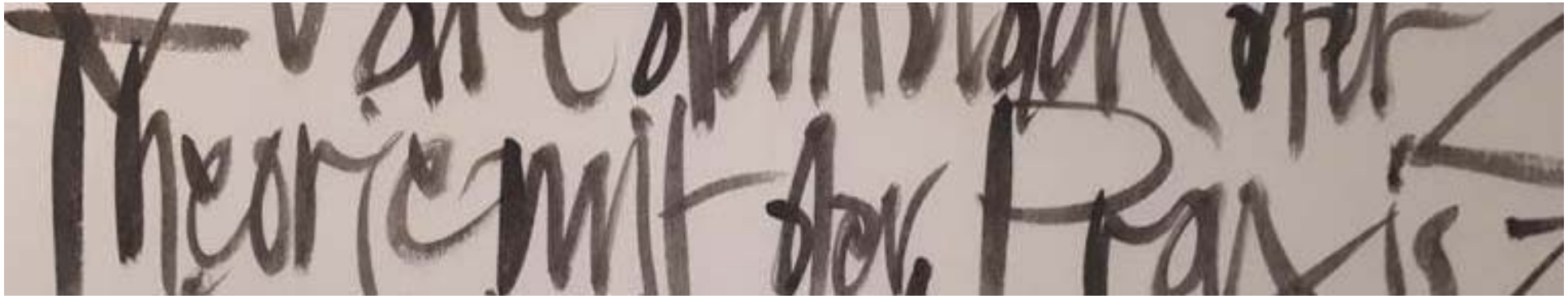
ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

TU WIEN TECHNISCHE UNIVERSITÄT WIEN

Three examples of transferring science progress into the engineering practice

Günter Blöschl, TU Wien



Gottfried Leibniz (1646–1716)

Novel hydrological concepts for the engineering practice, 29 Sep. 2021, Bologna

Theory and practice

"He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast."

Leonardo Da Vinci (1452–1519)

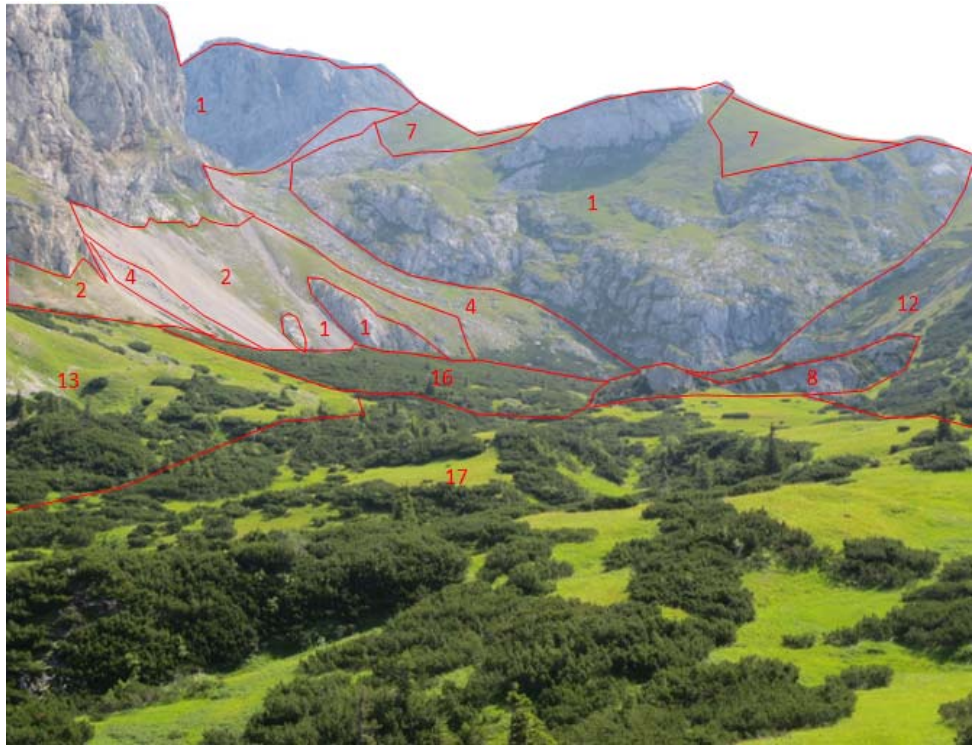
Three examples of

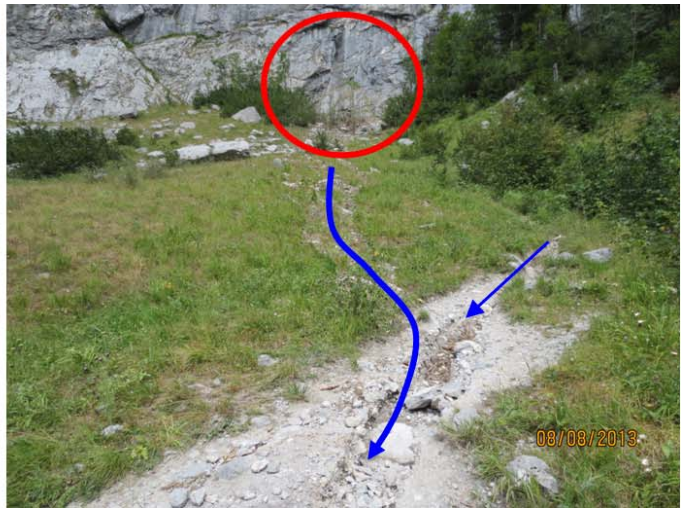
- **new scientific concepts** from my own research group that have been used to
- support **real world decision making**, illustrating
- its added **value**

1st example

Science = Surface flow paths in karst areas

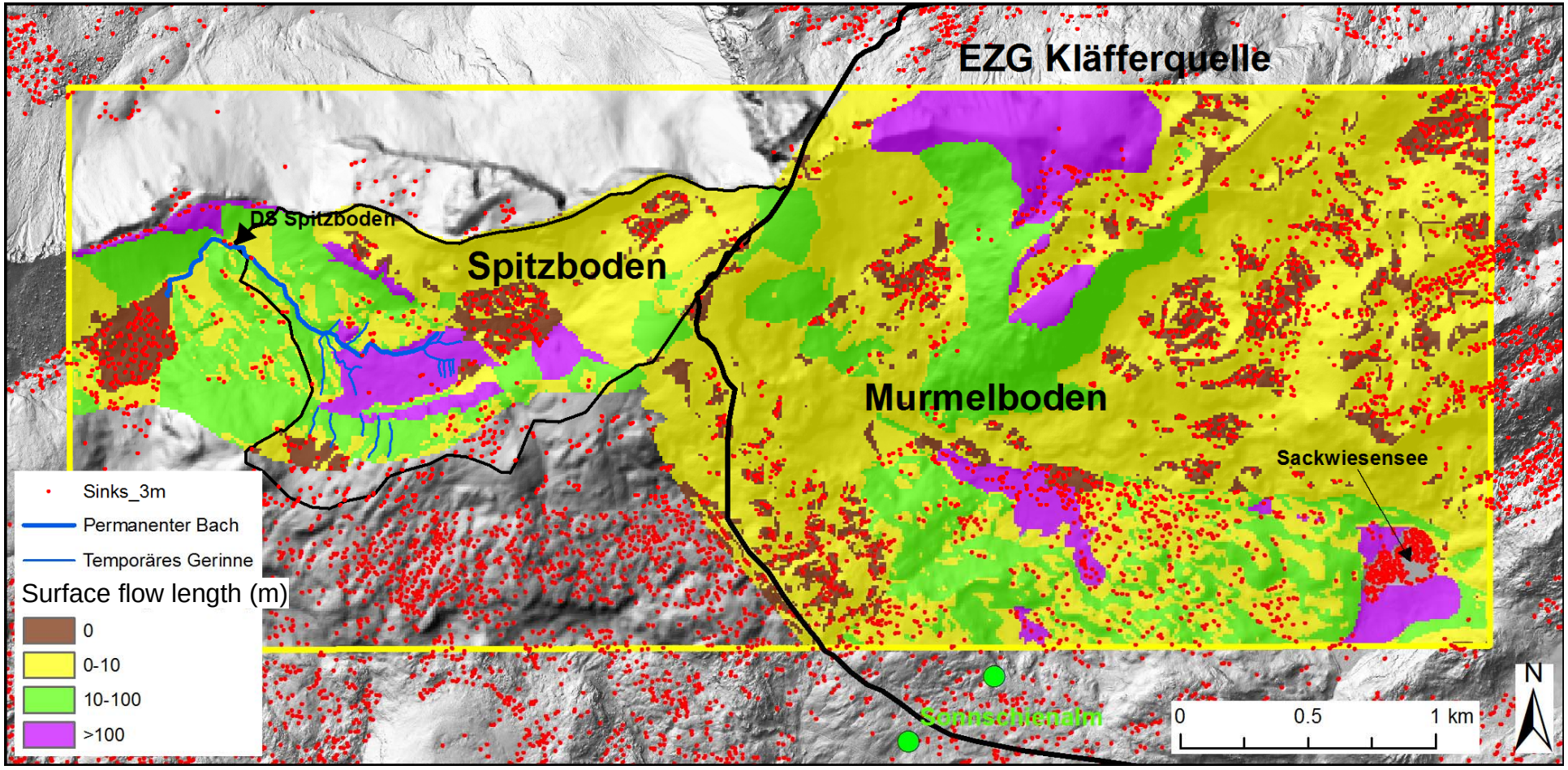
- New mapping method (field based, large scale)
- Spatial information for distributed hydrol. models





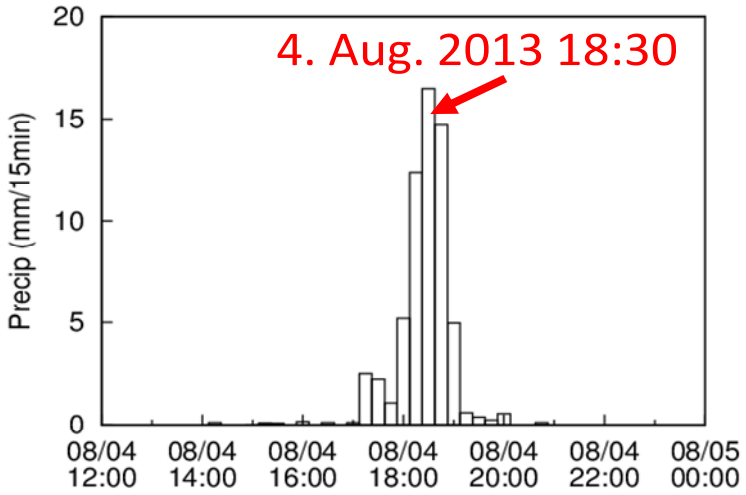
Reszler et al. (2018) *HESS*

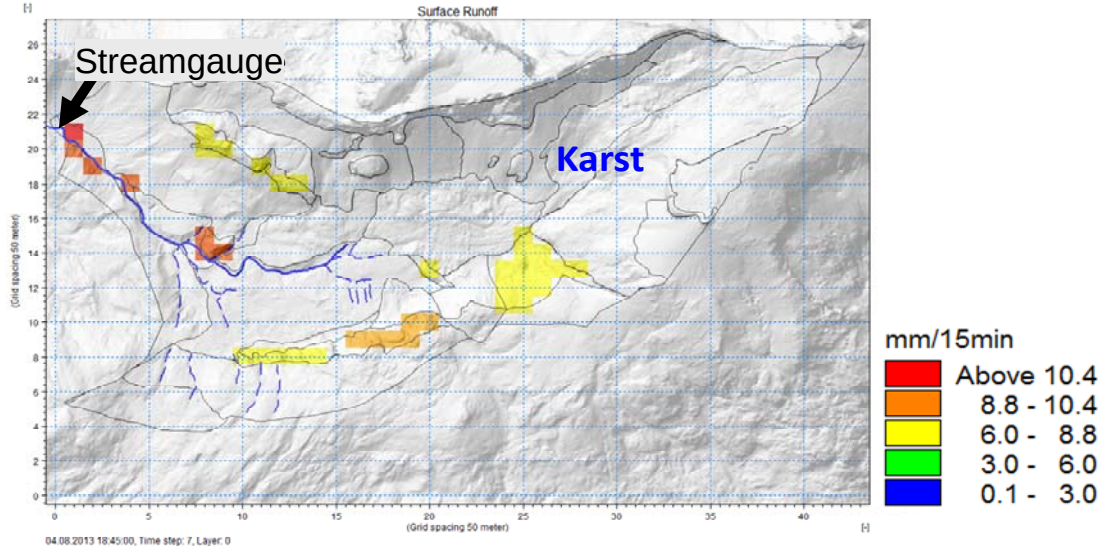
- Flow path lengths from new mapping method
- Testing against sink holes from Lidar

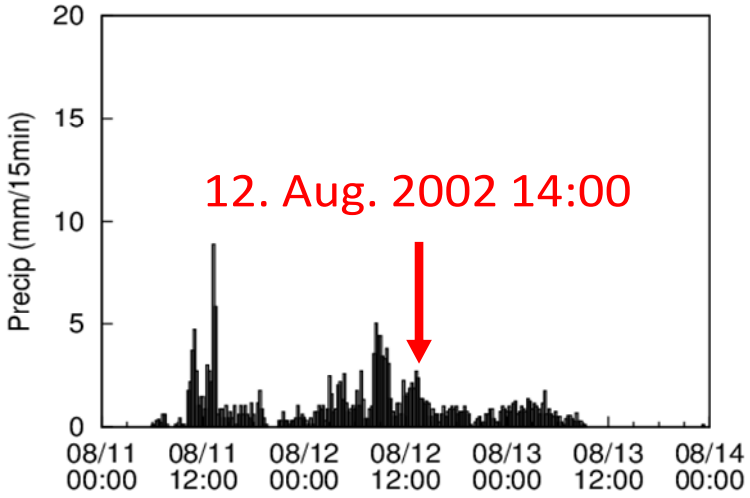


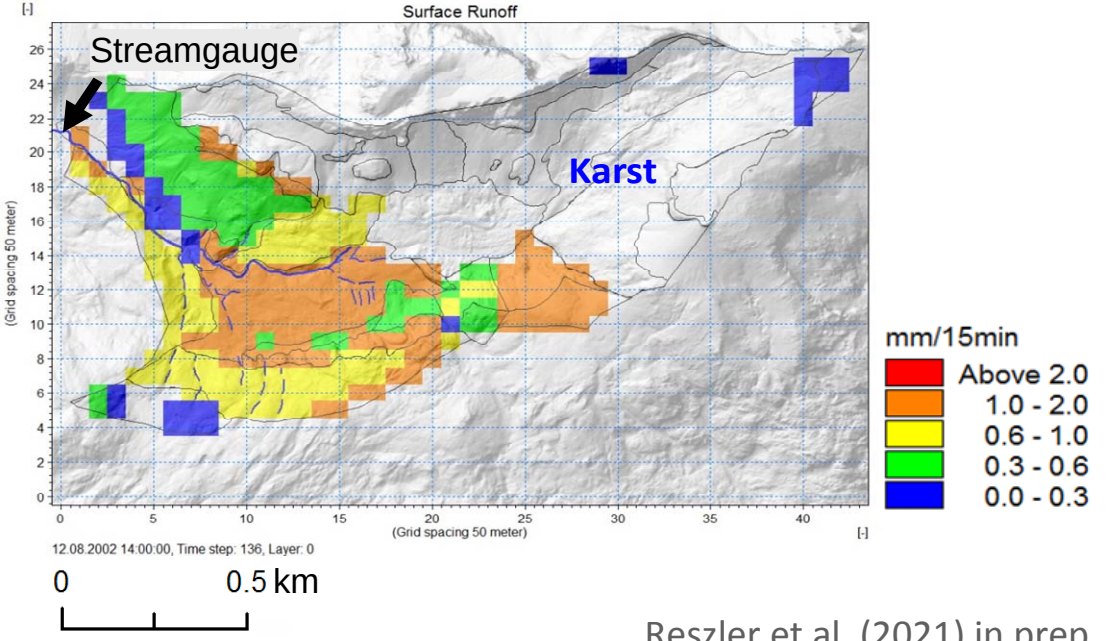
Reszler et al. (2018) *HESS*

Modelled spatial patterns of surface runoff based on flow paths









Reszler et al. (2021) in prep.

Practice = Land management to protect karst springs (Vienna Water Supply)

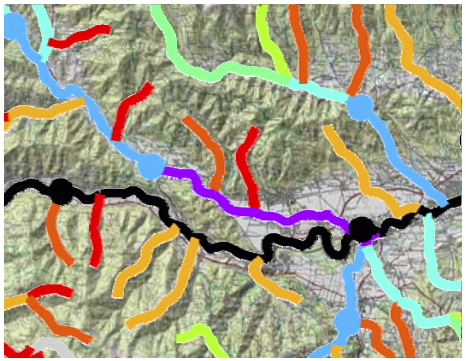
- Surface runoff may enhance pollution

Value = Prioritisation of protection zones, management options

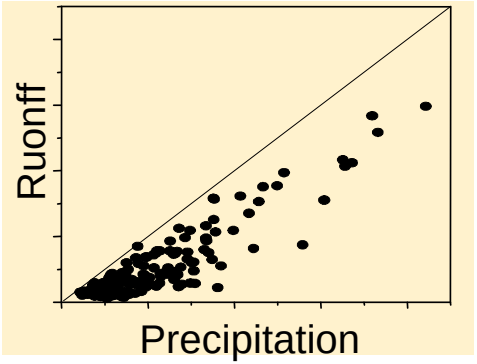
2nd Example

Science = flood frequency hydrology

Combining process understanding + statistics

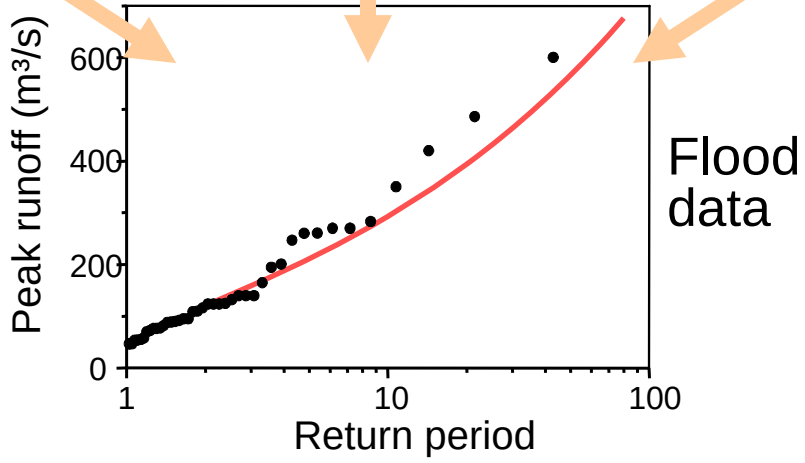


Spatial information



Causal information

Temporal information

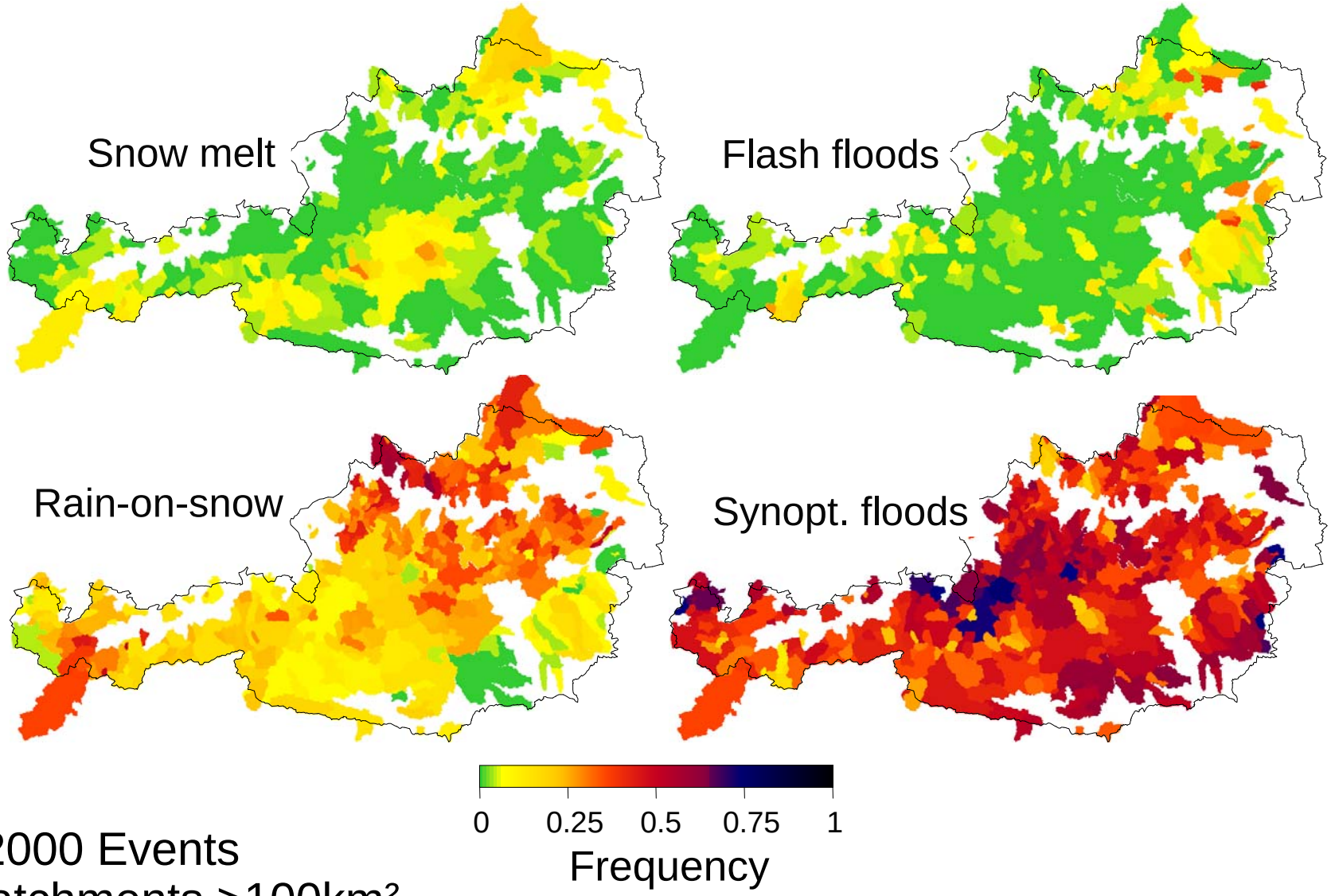


Flood data

Merz und Blöschl (2008) *WRR*
Viglione et al. (2013) *WRR*

Causal expansion of information

e.g. Frequency of flood process types

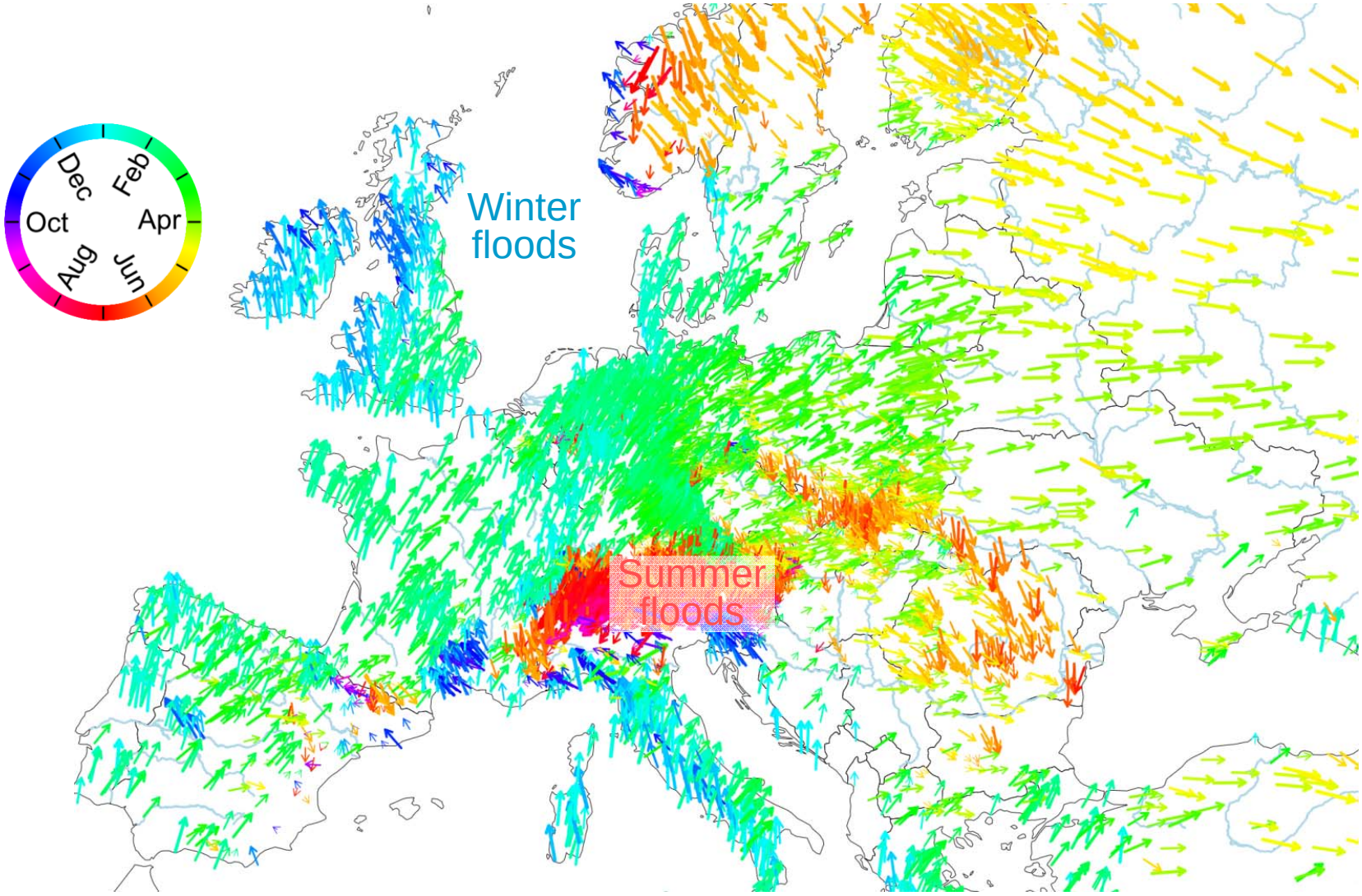


12000 Events
Catchments >100km²

Merz und Blöschl (2004) *WRR*

Causal expansion of information

e.g. timing of floods within the year to understand changes



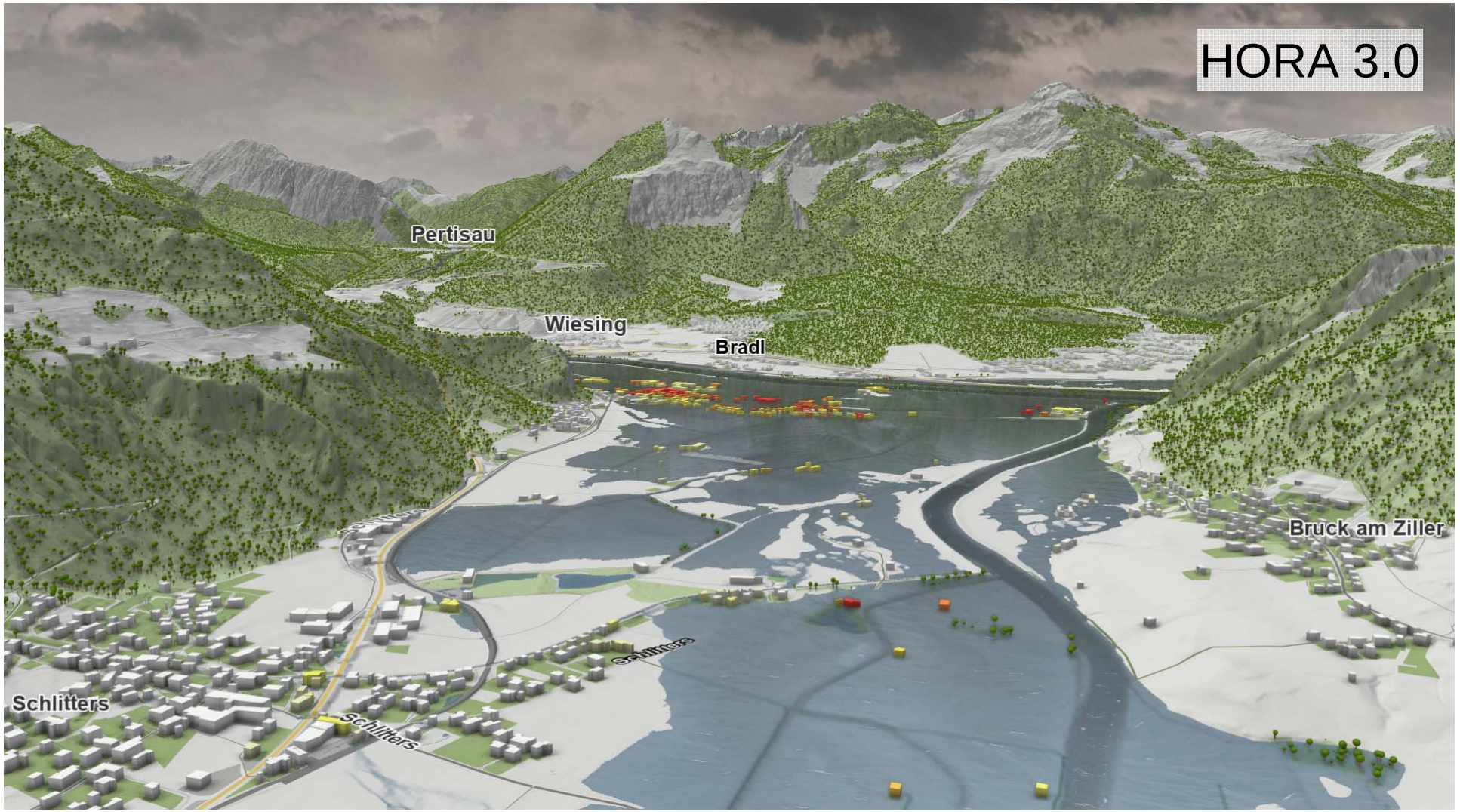
5000 Stations, 1960-2010

Blöschl et al. (2017) *SCIENCE*

Practice = Flood risk mapping Austria (HORA 3.0)

(Ministries, insurance industry, general public) www.hora.gv.at

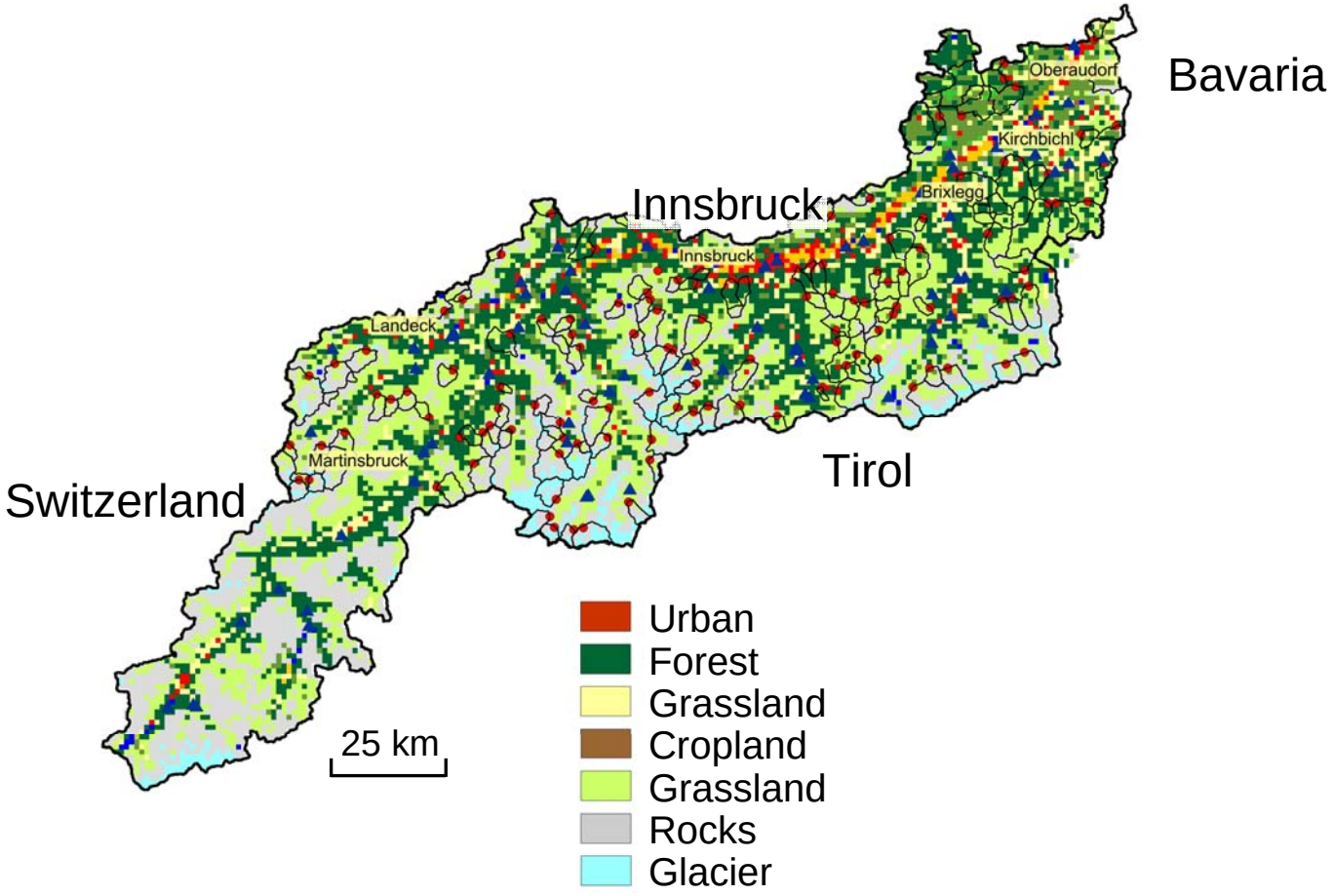
Value = More reliable risk estimates under change



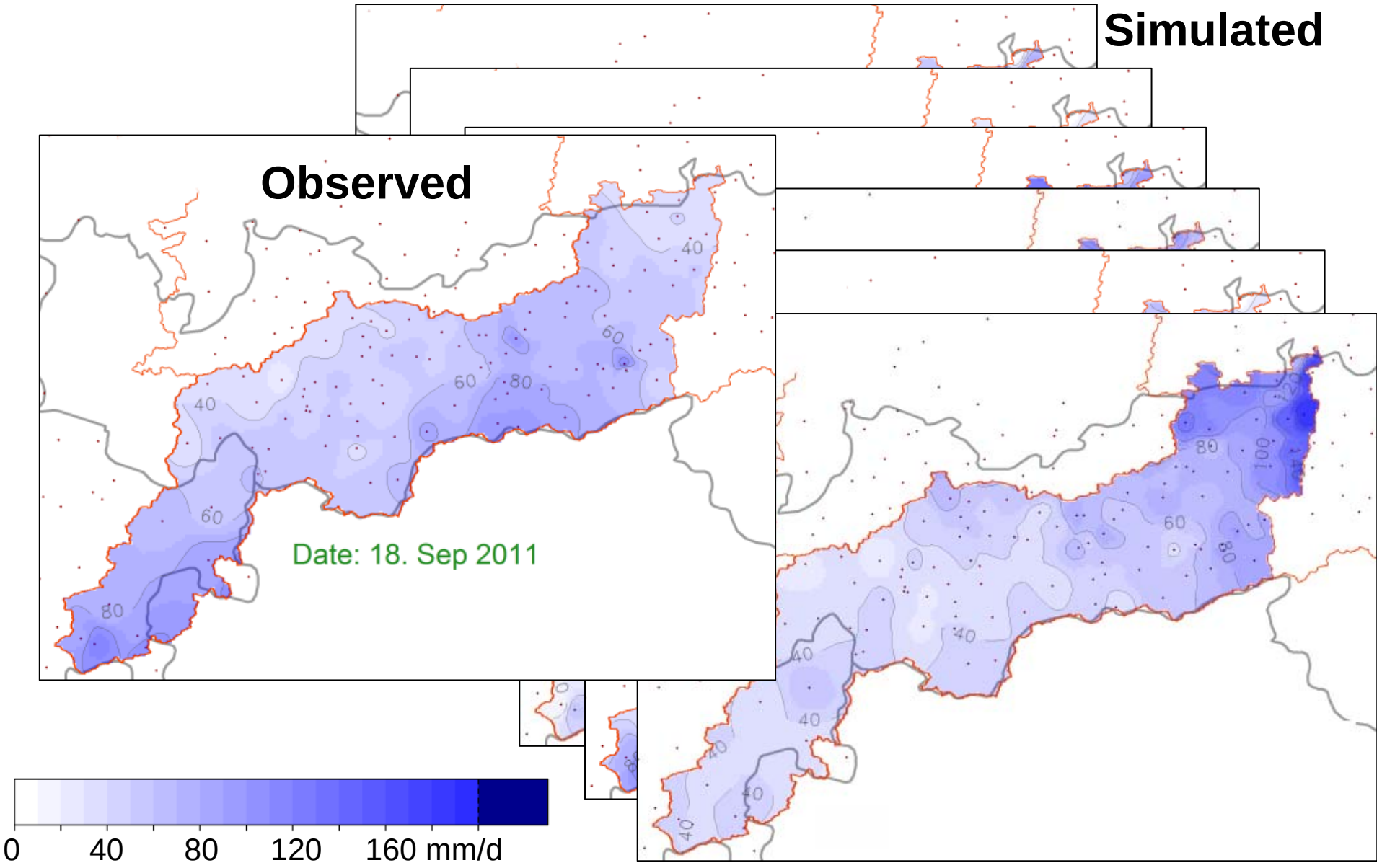
3rd example

Science = propagation of flood probabilities through catchments

- Robust spatial stochastic precipitation modelling
- Regional Monte Carlo Simulations



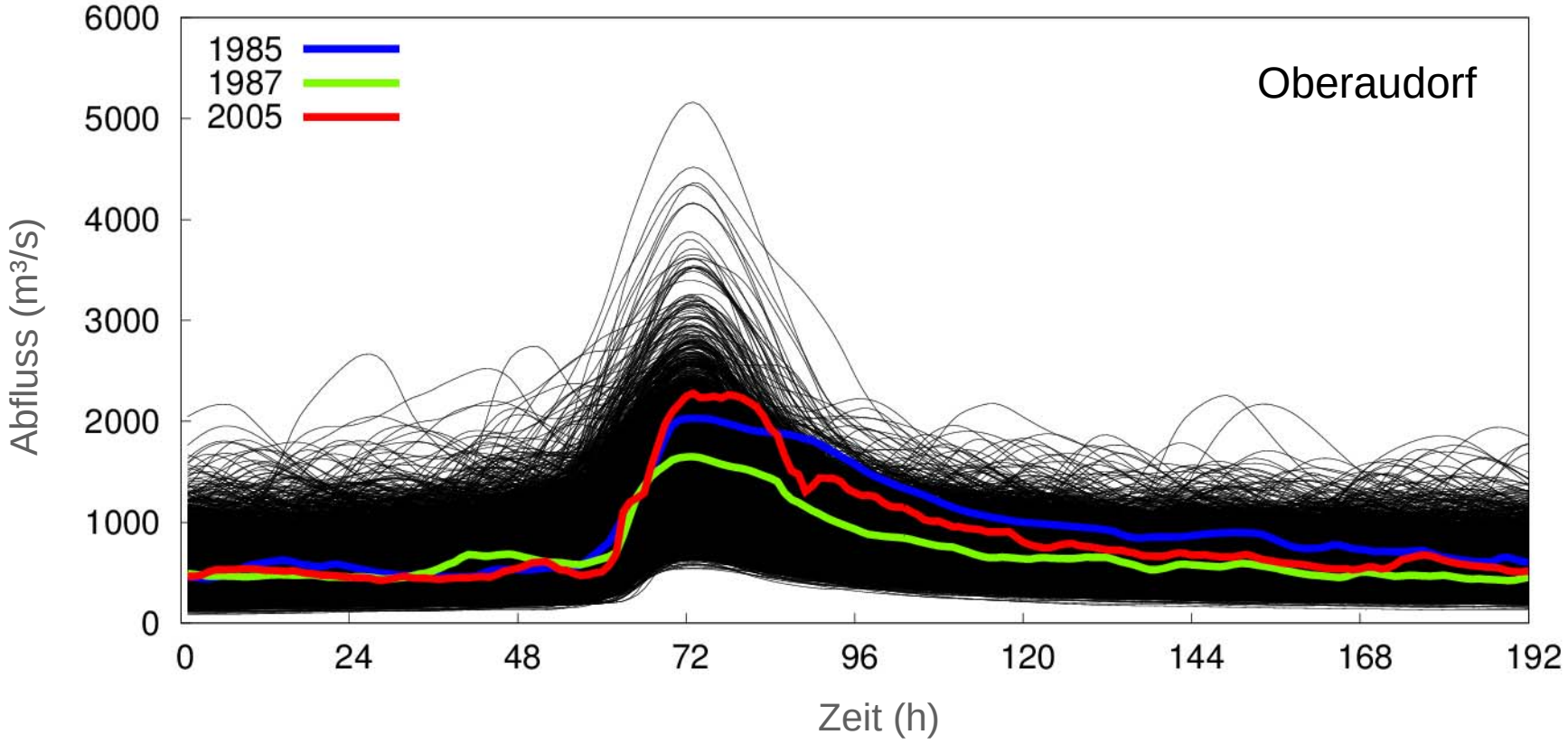
Stochastic precipitation model



Salinas et al. (2021) in prep.

Monte Carlo Simulations (spatially distributed rainfall-runoff)

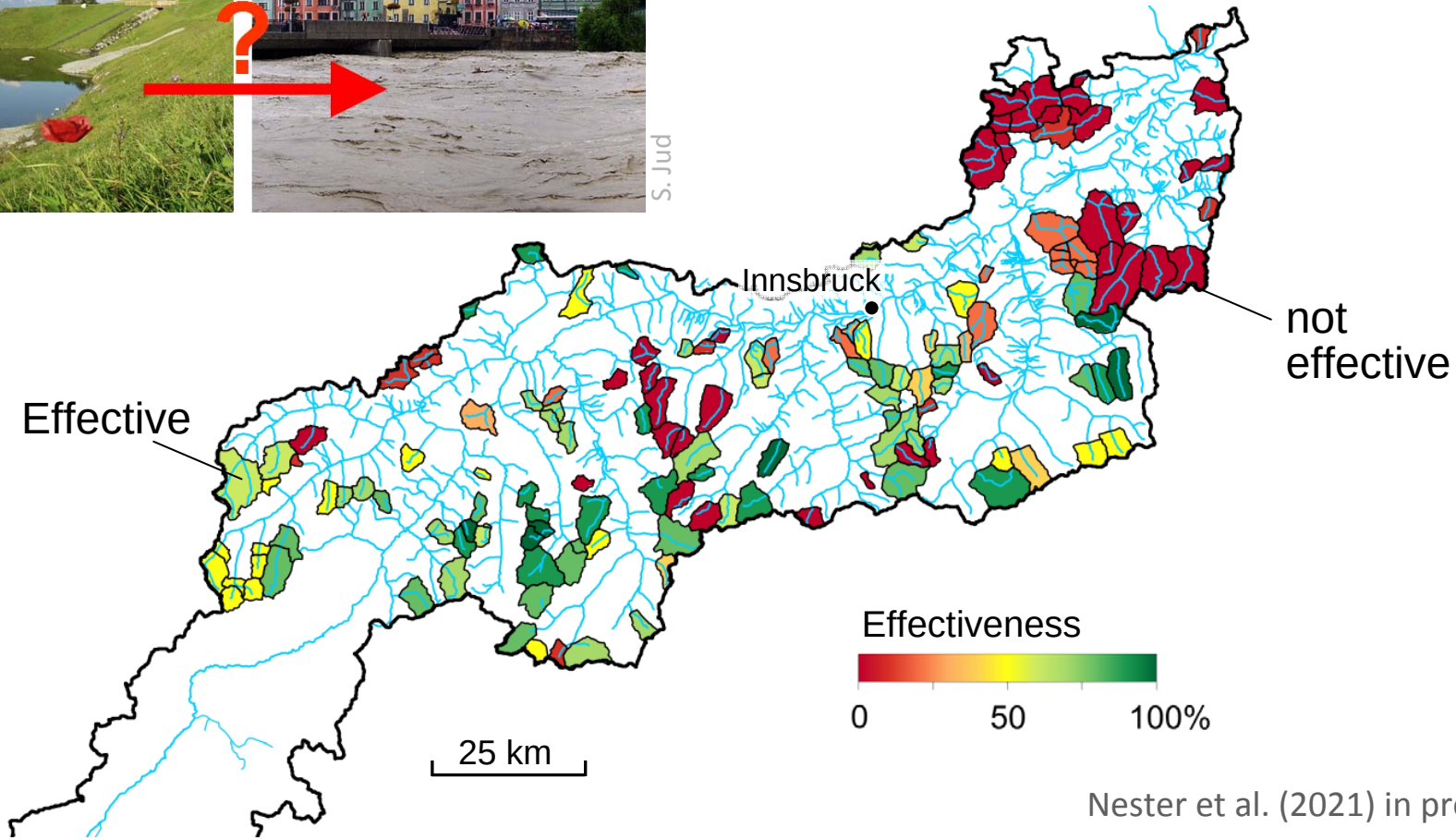
- Testing return periods of flood runoff spatially
- Confluence of floods – how do return periods combine?



Nester et al. (2021) in prep.

Practice = Strategic flood risk management at the Inn (Tirol, Bavaria)

Value = Understanding effectiveness of retention reservoirs in headwater catchments for main stream



Nester et al. (2021) in prep

Good science leads to better applications, which lead to better science

	Science .. published in recent literature	**Applications and services** .. direct societal value
1.	Surface flow paths in karst areas	Land management to protect karst springs (Vienna water supply)
2.	Flood frequency hydrology	Flood risk mapping (HORA), including change
3.	How do flood probabilities propagate through catchments?	Strategic flood risk management at the Inn (Tirol, Bavaria)