

SEDIMENT SUPPLY AFFECTS UNCERTAINTIES AND MEMORY IN ALPINE GEOMORPHIC SYSTEMS



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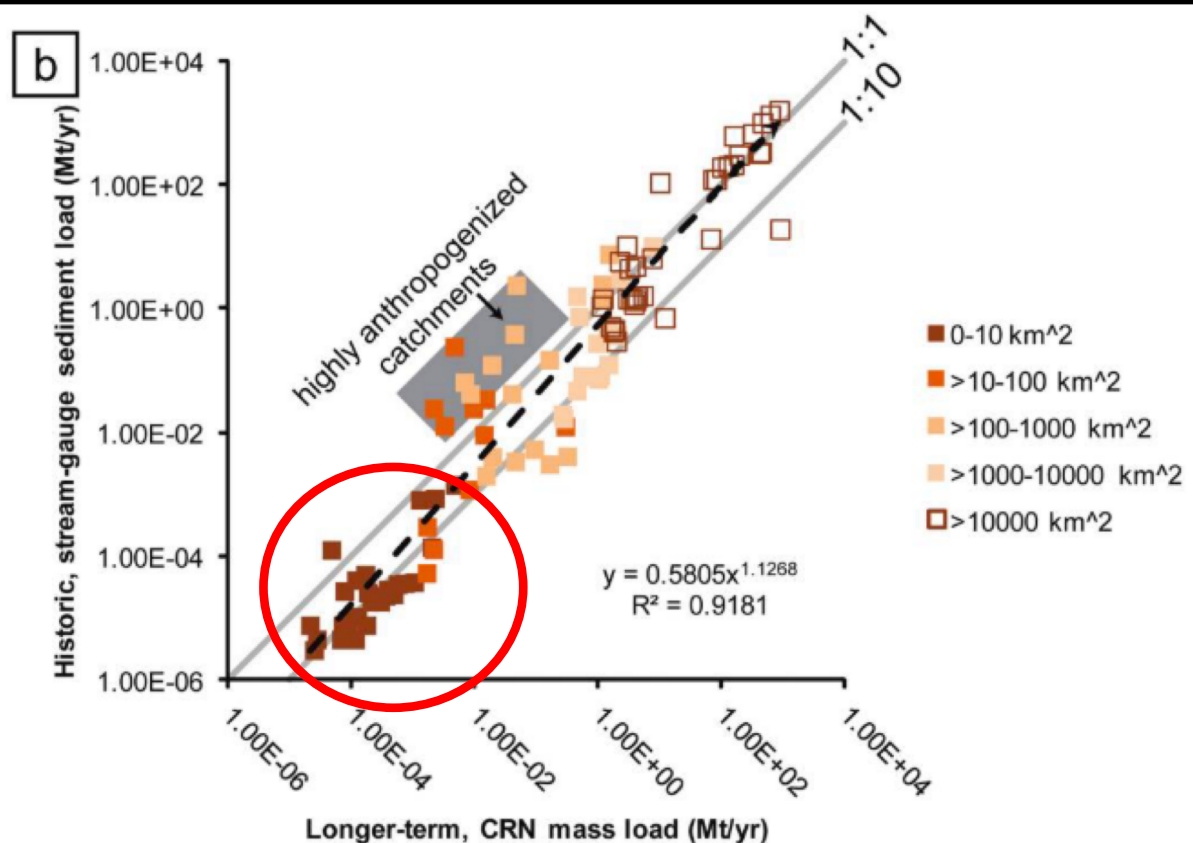
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ETH zürich



Underestimation of sediment yields in small, natural basins



Covault et al., 2013

- Discrepancy in short- vs. long-term sediment yield estimates
- Detectability of environmental signals in sediment records (Jerolmack and Paola, 2010; Armitage et al., 2011)

Research questions

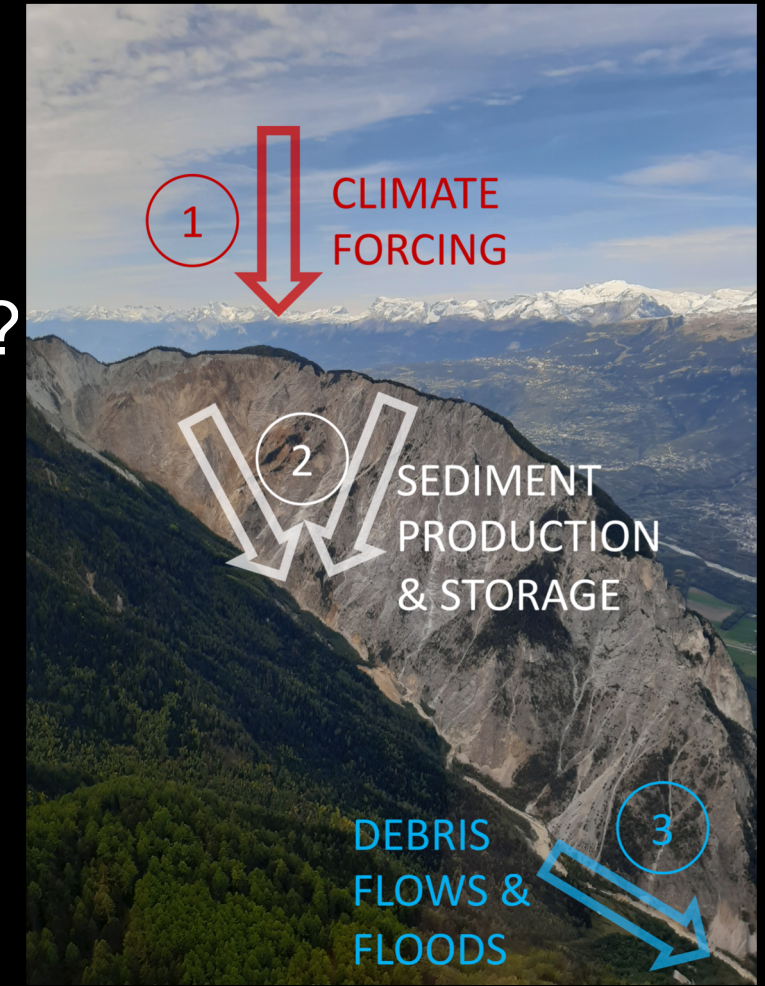
How is sediment yield affected by

a) Sediment supply limitations & mechanism?

b) Short observation records?

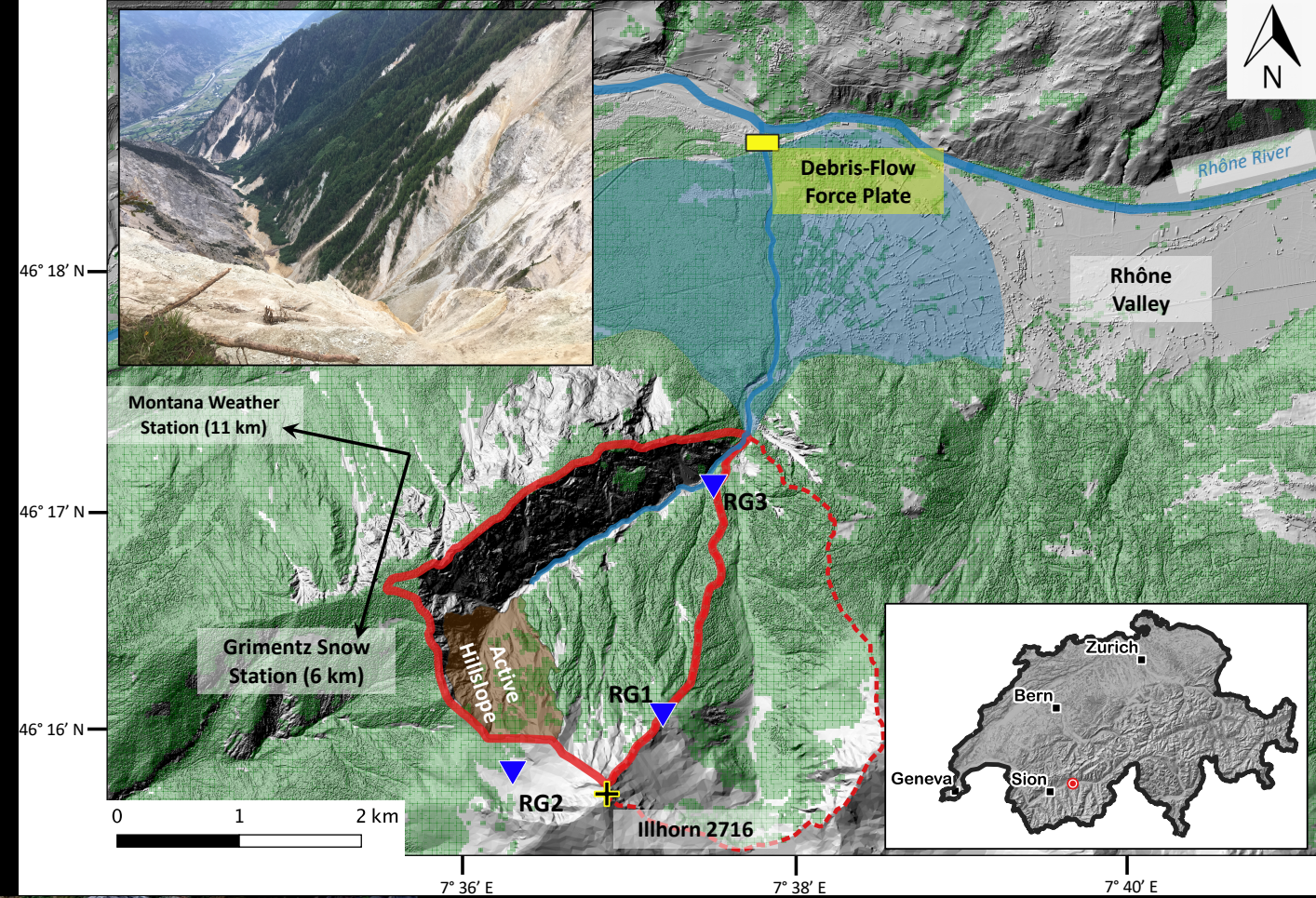
→ Sediment cascade model

→ Stochastic weather generator



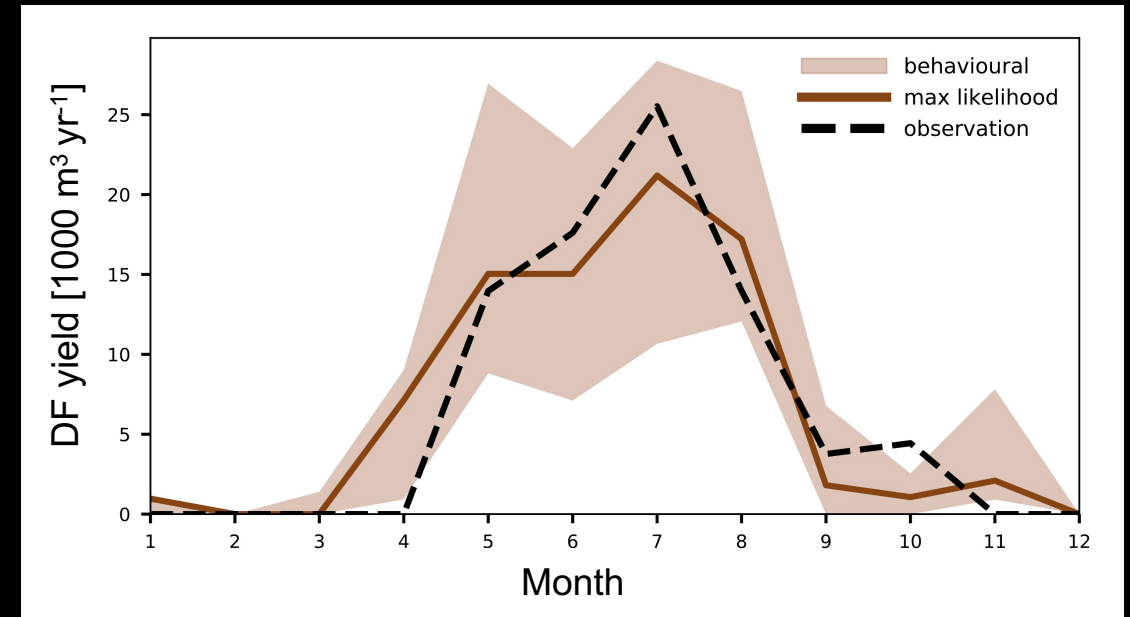
Illgraben

- 4.8 km²
- 18 years of observations (ongoing)
- 75 recorded debris flows (10³-10⁵ m³)
- Distinct sediment cascade



SedCas

- Probabilistic sediment cascade model (Bennett et al., 2014; Hirschberg et al., 2021)
- **Hydrology**: linear reservoir
- **Sediment recharge**: frost-cracking, stochastic magnitude (Bennett et al. 2012)
- **Debris-flow triggering** by threshold-exceeding runoff
- **SedCas reproduces debris-flow magnitudes and frequencies**



Hirschberg et al., 2021

**Independent confirmation
of model performance**

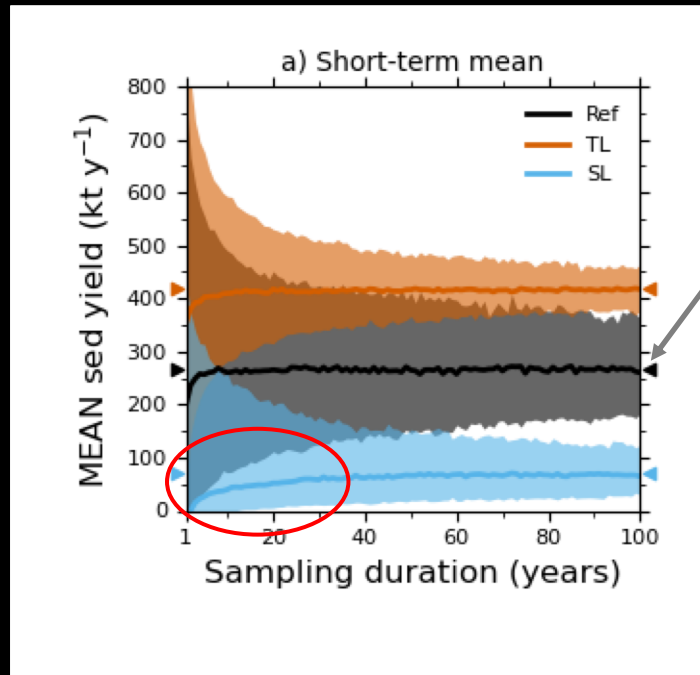
Sediment supply scenarios for long-term behavior

Scenario	Hillslope landslide trigger	Erosion rate # landslides per year	
0 Ref	frost-cracking	25	→ Illgraben
1	rainfall threshold	25	
2	random	25	
3	frost-cracking	16	
4 SL (supply-limited)	frost-cracking	8	→ Next slide
5 TL (transport-limited)			

Climate forcing: AWE-GEN weather generator (Fatichi et al., 2011)

→ All scenarios use same 10k year hourly weather simulated with AWE-GEN

Effects of short records on sediment yield estimates



Estimate from 10k years

- **Signal from sediment production mechanism destroyed**
 - **SL: short records underestimate sediment yield**
- **Implications for hazard & CCI ass.**



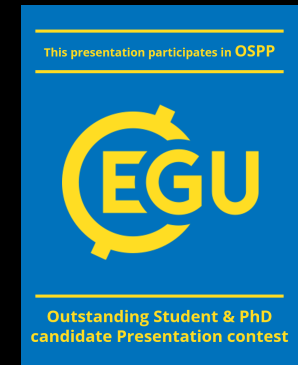
GRL paper

Memory

**Practical
implications**

Contact

OSPP



References

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