

Geomorphology: the science of rocks falling downhill

Exciting opportunities in understanding land surface
hazards in subduction zones

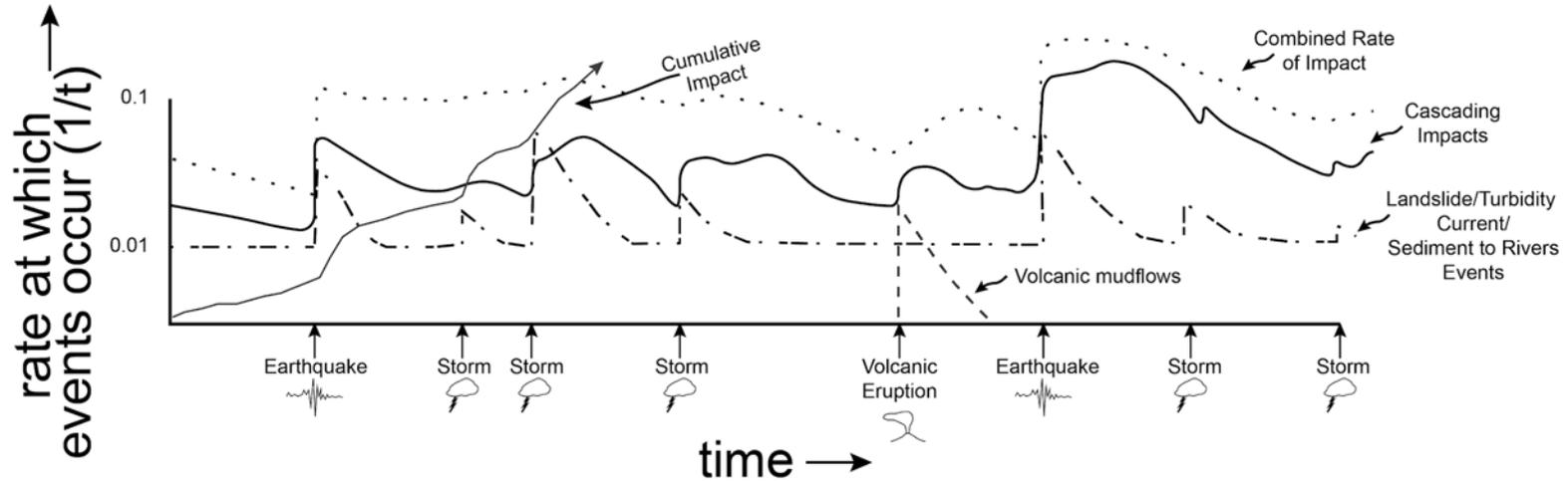


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How do events within Earth's atmosphere, hydrosphere, and solid Earth generate and transport sediment across **subduction zone** landscapes and seascapes?



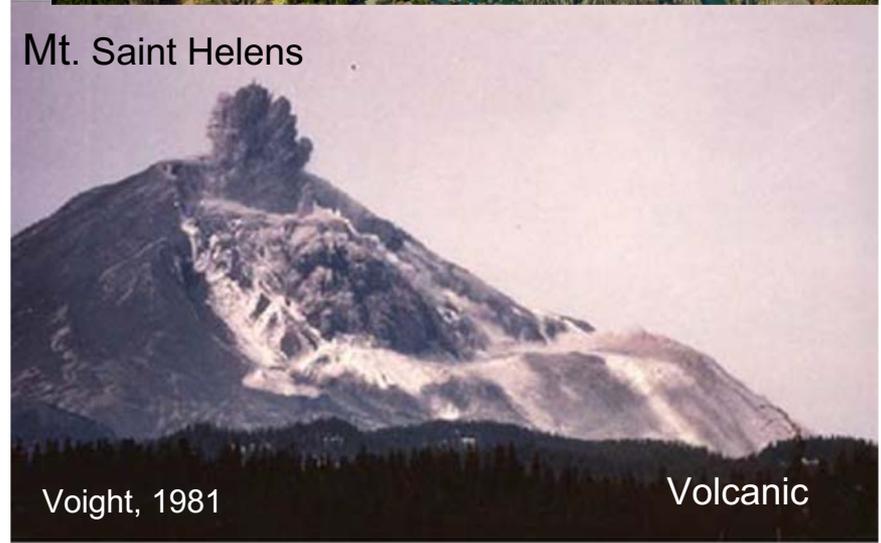
The front line of solid earth and atmosphere interactions

Landslides

A quiet disaster

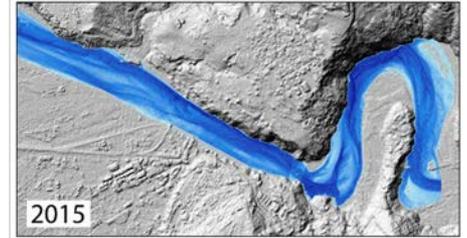
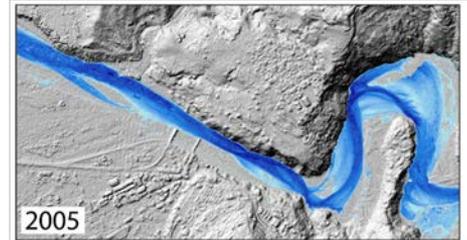
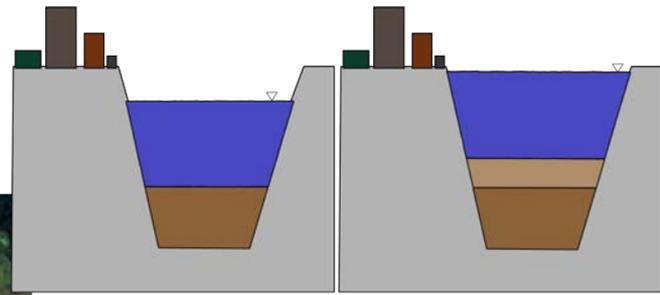
Deaths:
40-50 per year in US
4k globally
Petley et al., 2012

\$\$
\$1.5-3B in US alone



Hazard cascades...

Typhoon Morakot, 2009 Taiwan

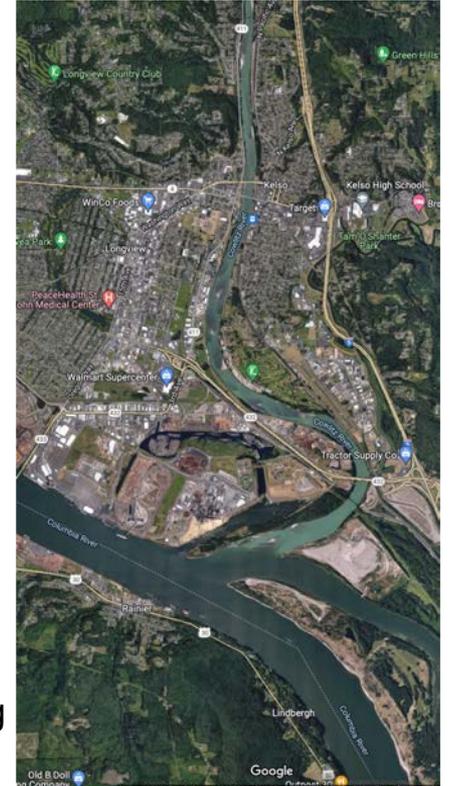


Can last for years to centuries following the original event

Mount Saint Helens



USACE will spend another \$400M by 2035 when congressional mandate ends



Longview Port Authority estimates ~\$10M in dredging costs needed soon

Bacolor, 1995 (cascade following Pinatubo), ~100 killed



Exciting opportunities in the SZ4D framework

Arc to coast lidar

Environmental sensor network

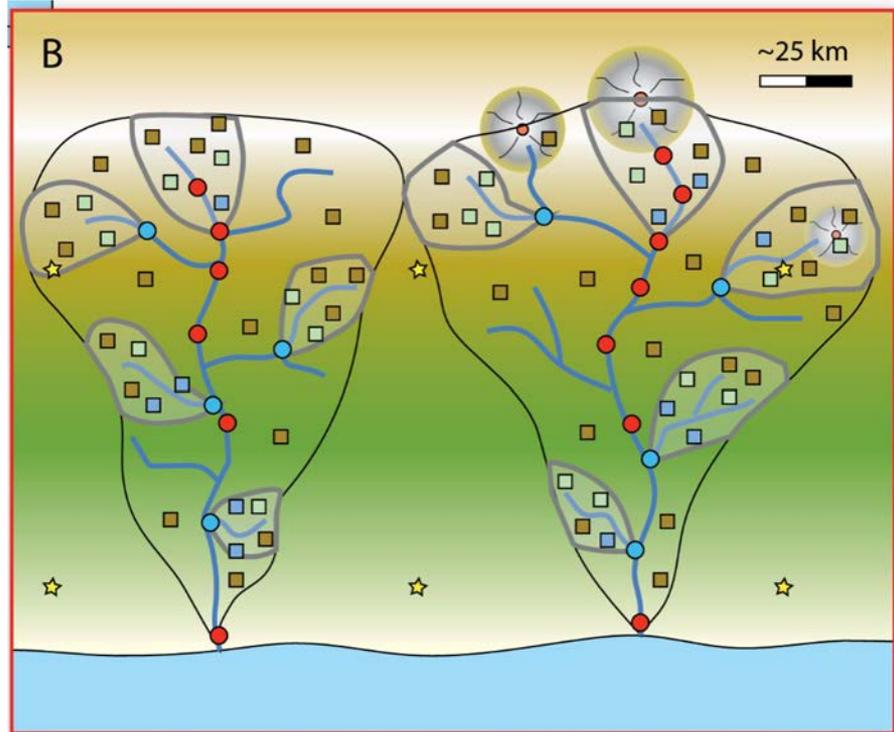
Coordinated effort with cutting-edge technology

"Backbone" Stations

- ★ Stream Gauges
- Main stem
- Tributary

Hillslope Stations

- High-end
- Mid
- Low end



Outstanding questions

How do landslides initiate? Can we forecast or predict them?

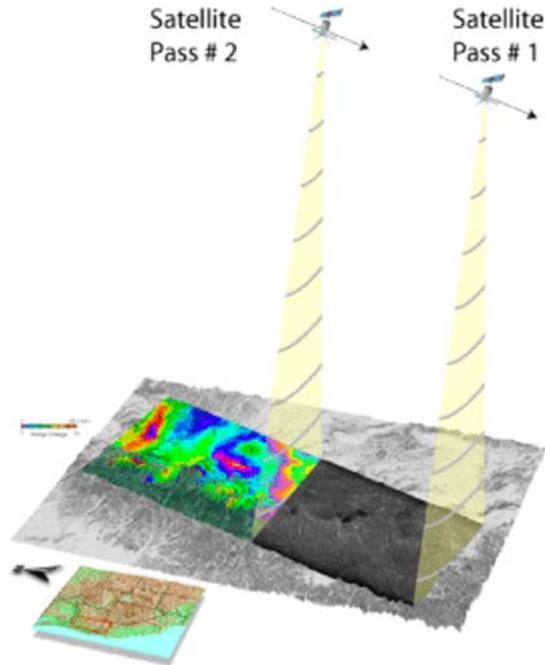
Once a landslide initiates, what controls the dynamics of runout?

When pulses of sediment enter a fluvial system (e.g. from landslides or volcanic eruptions), how fast does the sediment move through the system?

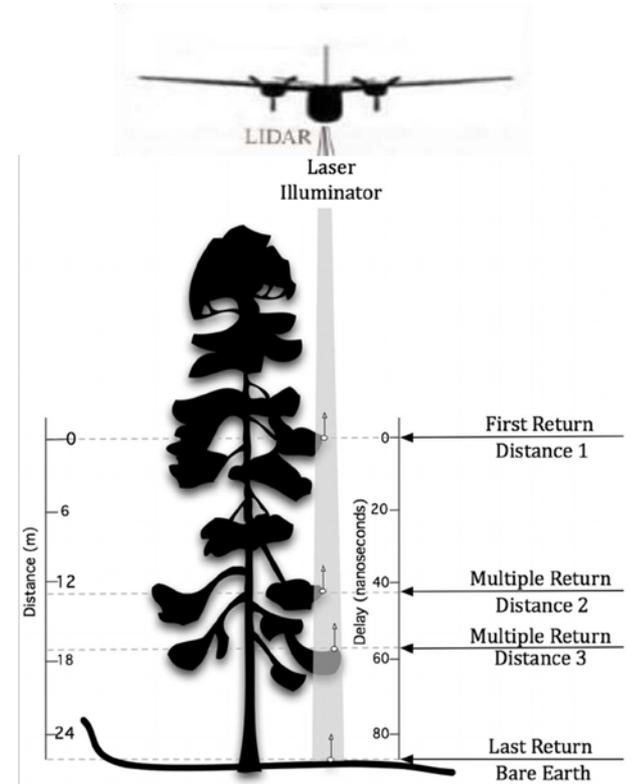


Advancements in technology is helping us address these questions, especially when coupled to environmental sensor networks

Insar

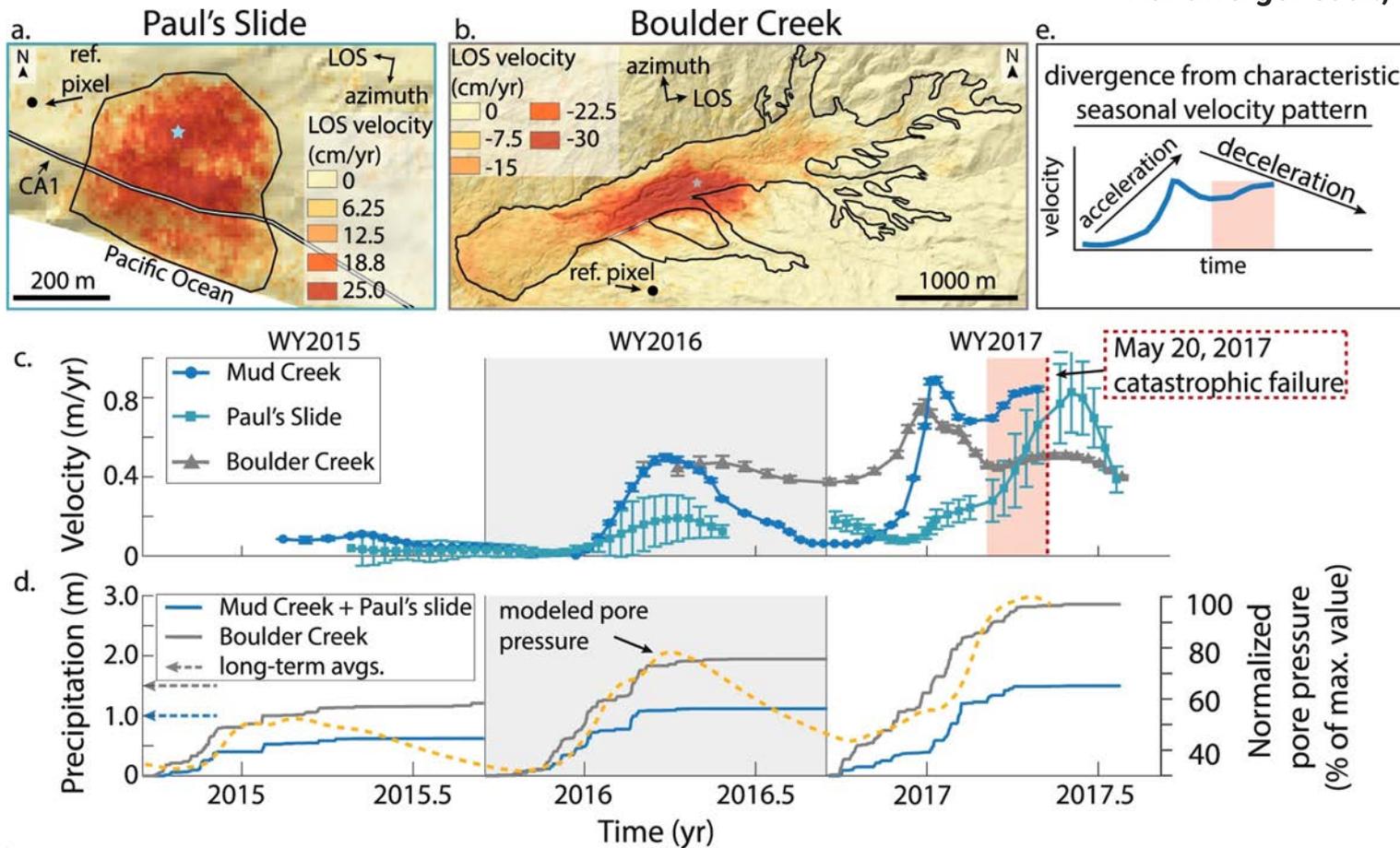


Lidar



InSAR and landslides

Handwerger et al., 2019

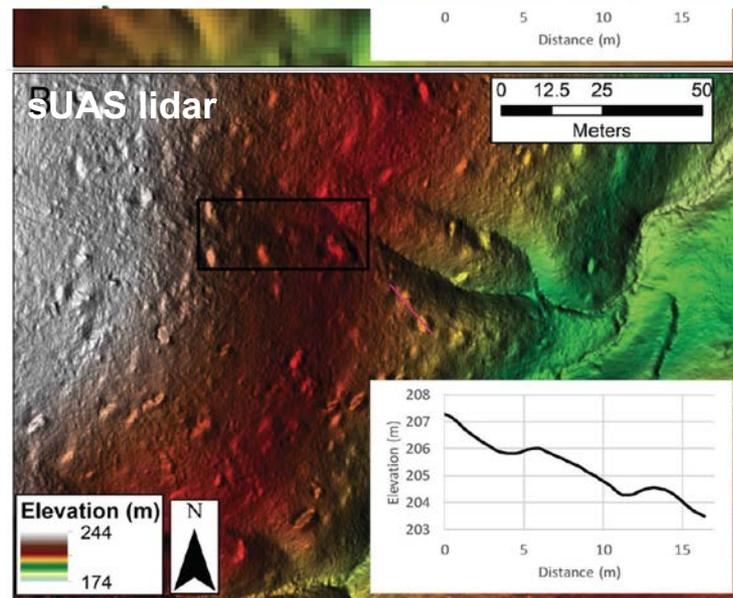
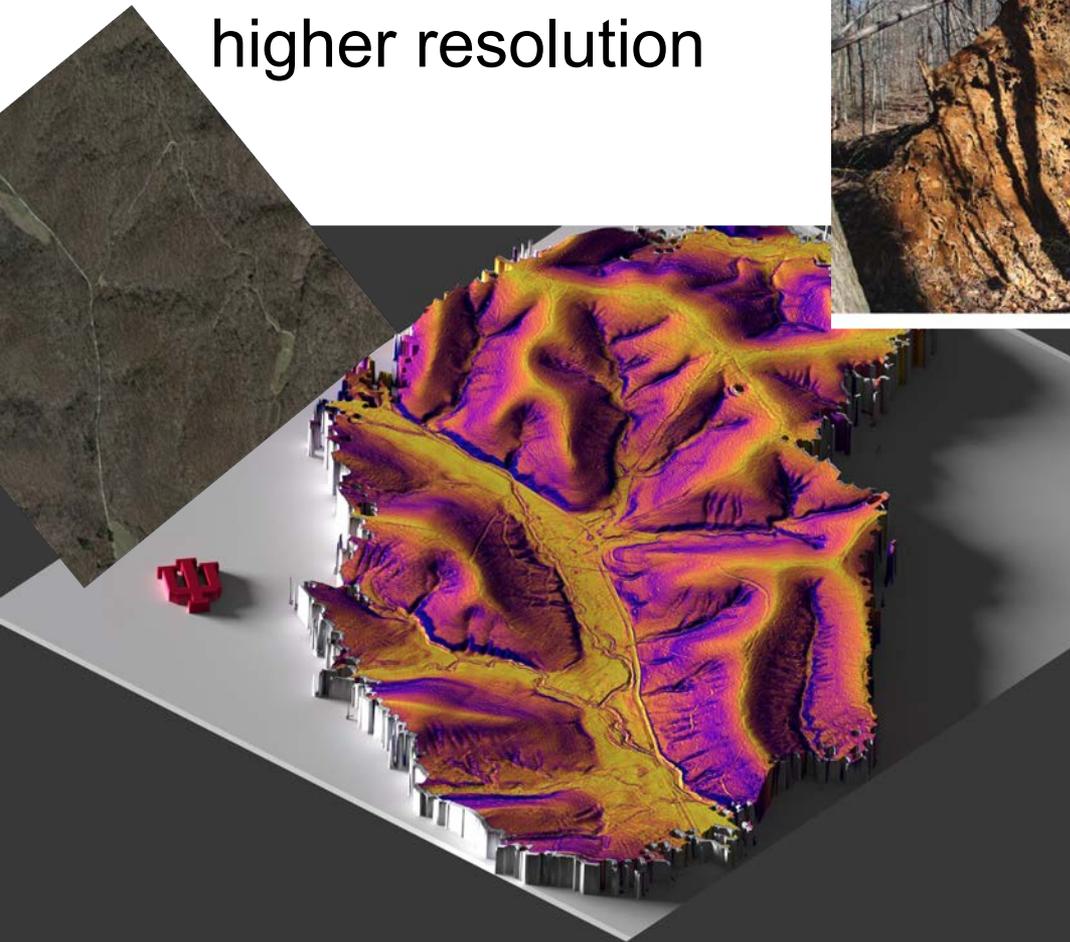


Lidar is transforming ability to quantify events



UAS: “on demand” and
higher resolution

A Airborne lidar

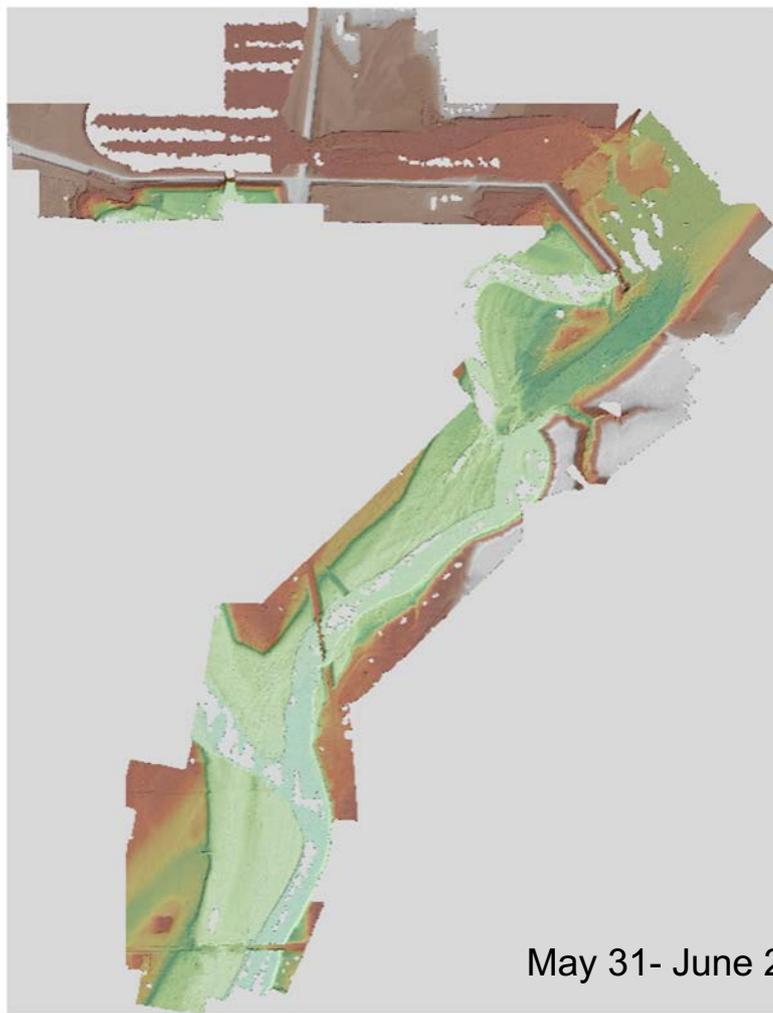


On demand, high resolution lidar:

Edenville, MI on May 19th, 2020



0 300 600 m



May 31- June 2nd

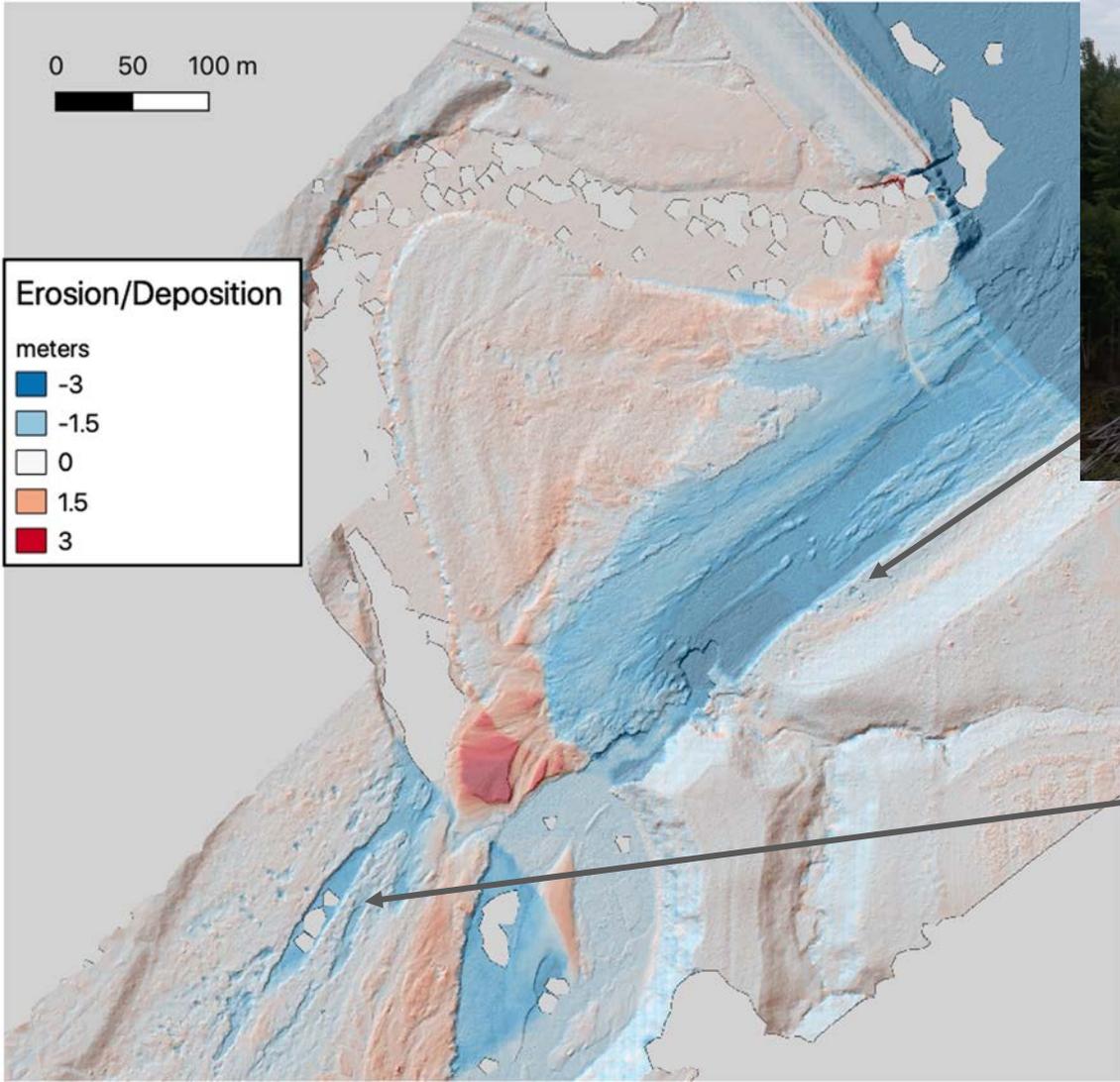
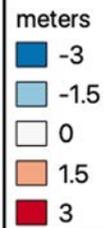


EAR-2038072

0 50 100 m



Erosion/Deposition



Bedforms in the outfield

Perishable data for calibrating/validating models



Conclusions

The cascade of sediment transport processes influences a number of hazards in landscapes

Subduction zones offer unique challenges, characteristics, and opportunities to studying the sediment cascade in landscapes and its implication for hazards

Emerging and new developments in technology can help us address critical, unanswered questions in land surface hazard science

We can constrain the environment in which an event happens, almost ‘watch’ the event occur, and efficiently observe and monitor how the event cascades across Earth’s surface.



