

Presented by:



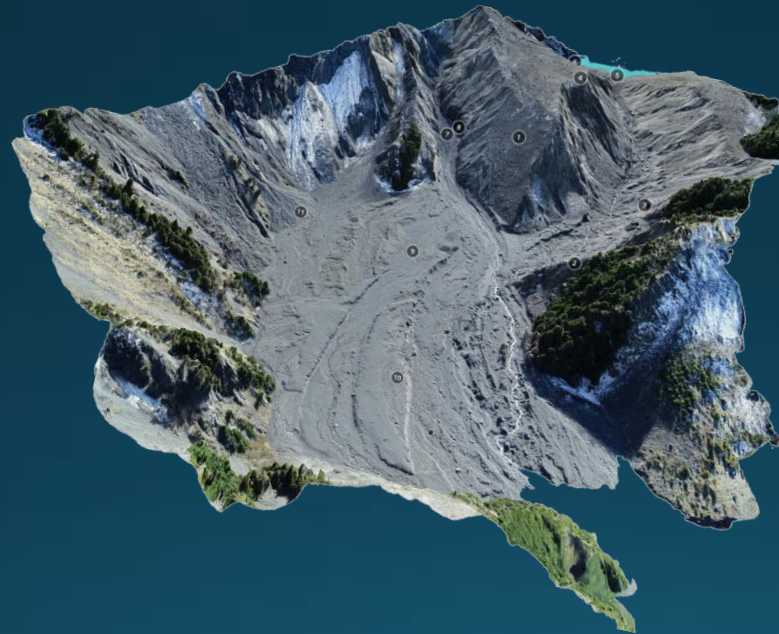
Chris Goodell  
Kleinschmidt  
Associates



Krey Price  
Surface  
Water  
Solutions

AWS Free Webinar: 4 August 2021

# Natural Dam Failures Past, Present, and Future



# Webinar Resources

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Natural dams: Past, present, and future

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## Natural dams: Past, present, and future

Thanks for joining us for the 4 August 2021 Australian Water School free webinar: [Natural Dam Failures: Inherent Risk Factors](#).

Below are additional resources to supplement the presentation material.

### Webinars and videos

ICIMOD's Dr. Arun Shrestha discusses Himalayan GLOFs and the increasing risks posed by climate change in this 2019 Australian Water School webinar:

#73 State and fate of the Hindu Kush Himalaya water resources

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# Natural Dams

“Dam”: A barrier preventing the flow of water

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Landslide dam

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Ice dam

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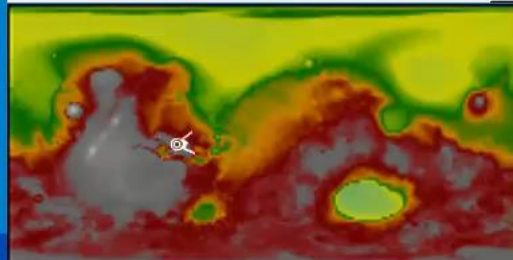
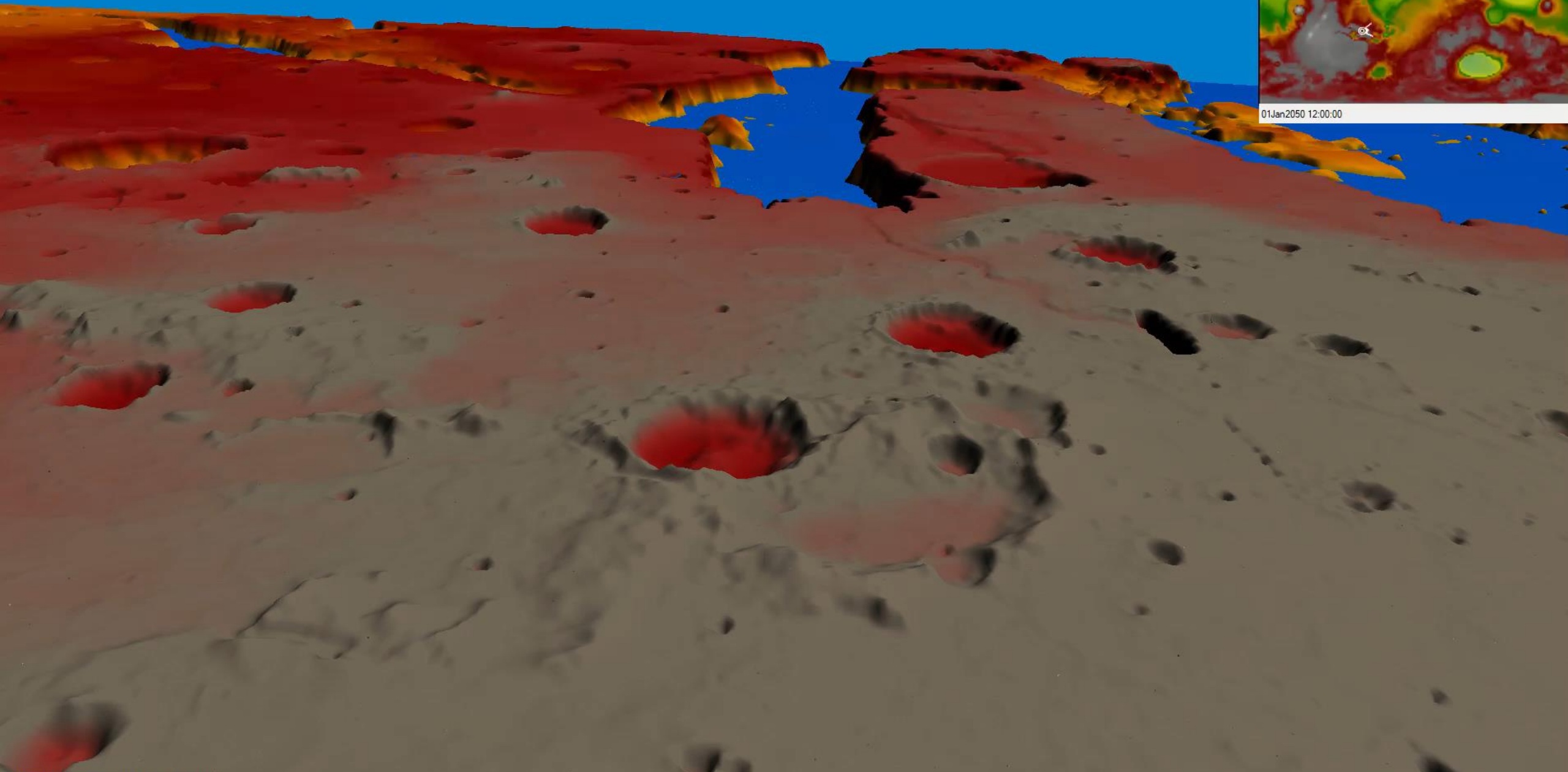
Moraine dam

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Lahar dam

---

Alluvial fan avulsion



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# Landslide Dam: Lake Waikaremoana



Lake Waikaremoana

# Landslide Dam: Sarez Lake



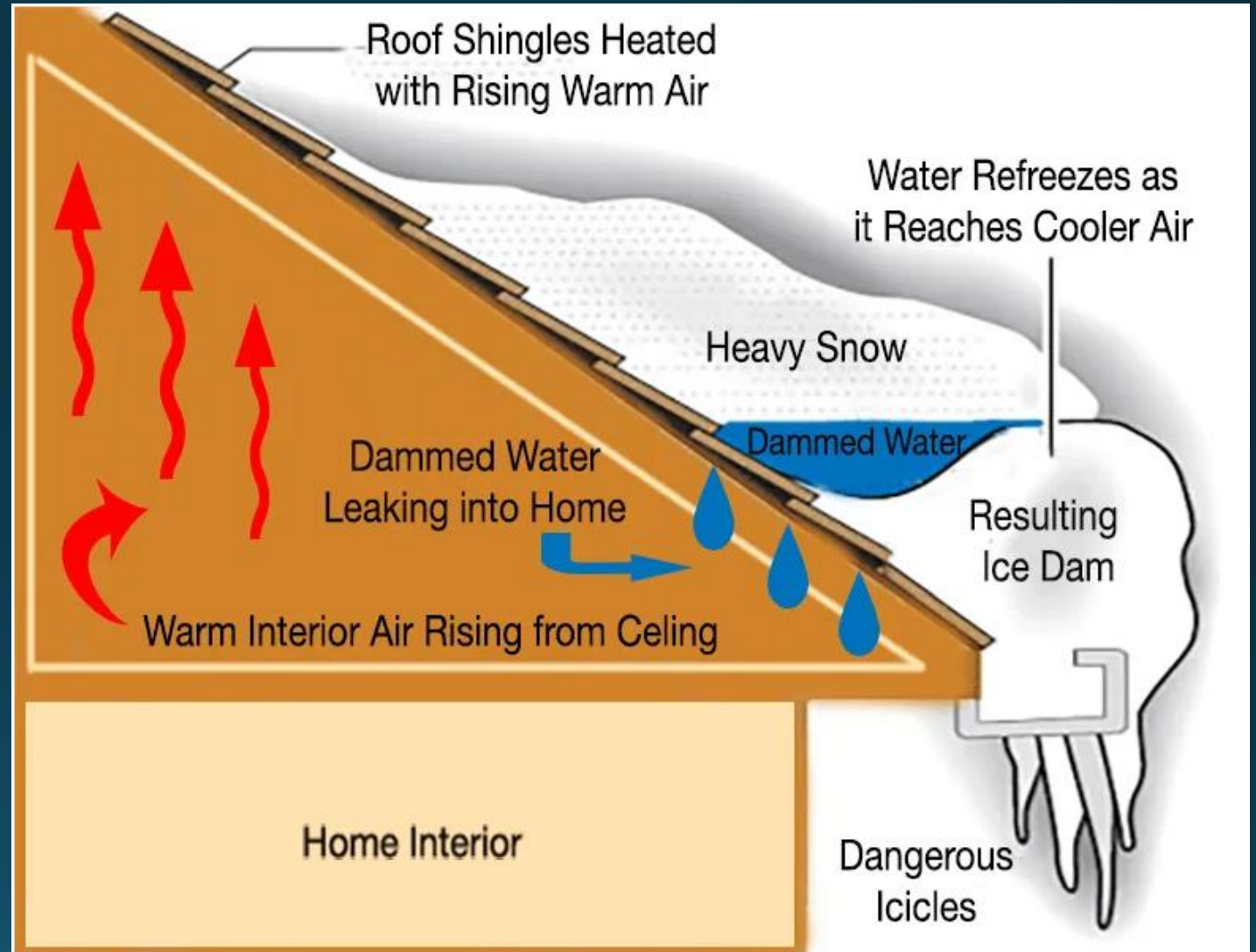
15 deaths per year in the U.S.

## Ice Dam



15 deaths per year in the U.S.

# Ice Dam





What's a  
GLOF  
and where  
would you  
find one?

## Glacial Lake Outburst Flood:

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Ice or rock avalanches

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Collapse of moraine dam

---

Washing out fine materials (piping)

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Earthquakes

---

High upstream inflow

# Lahar Dam



# Alluvial Fan

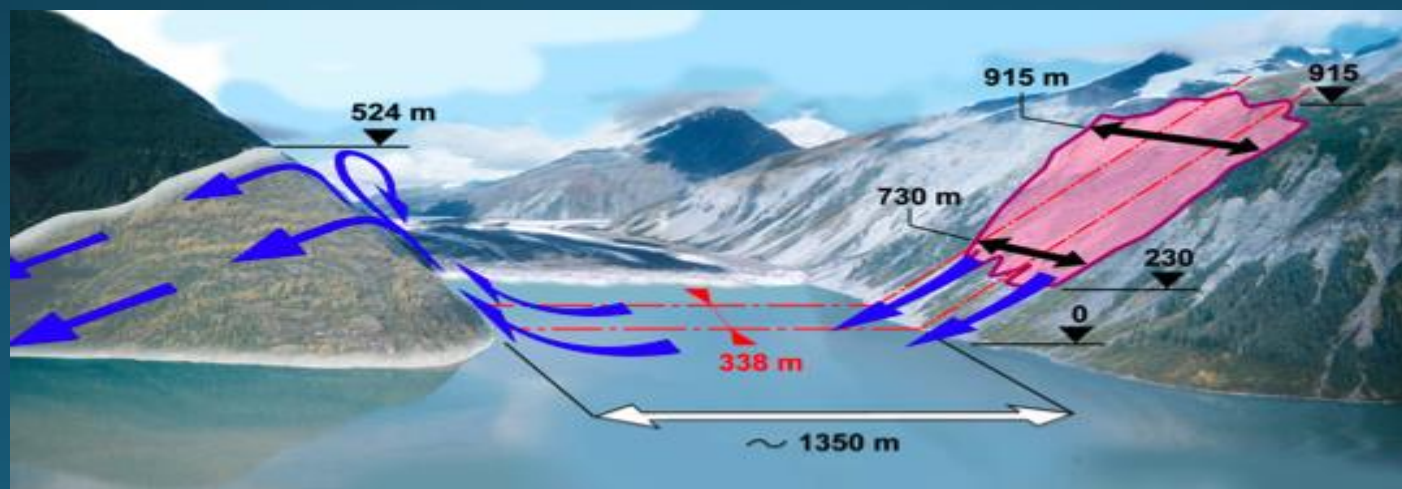
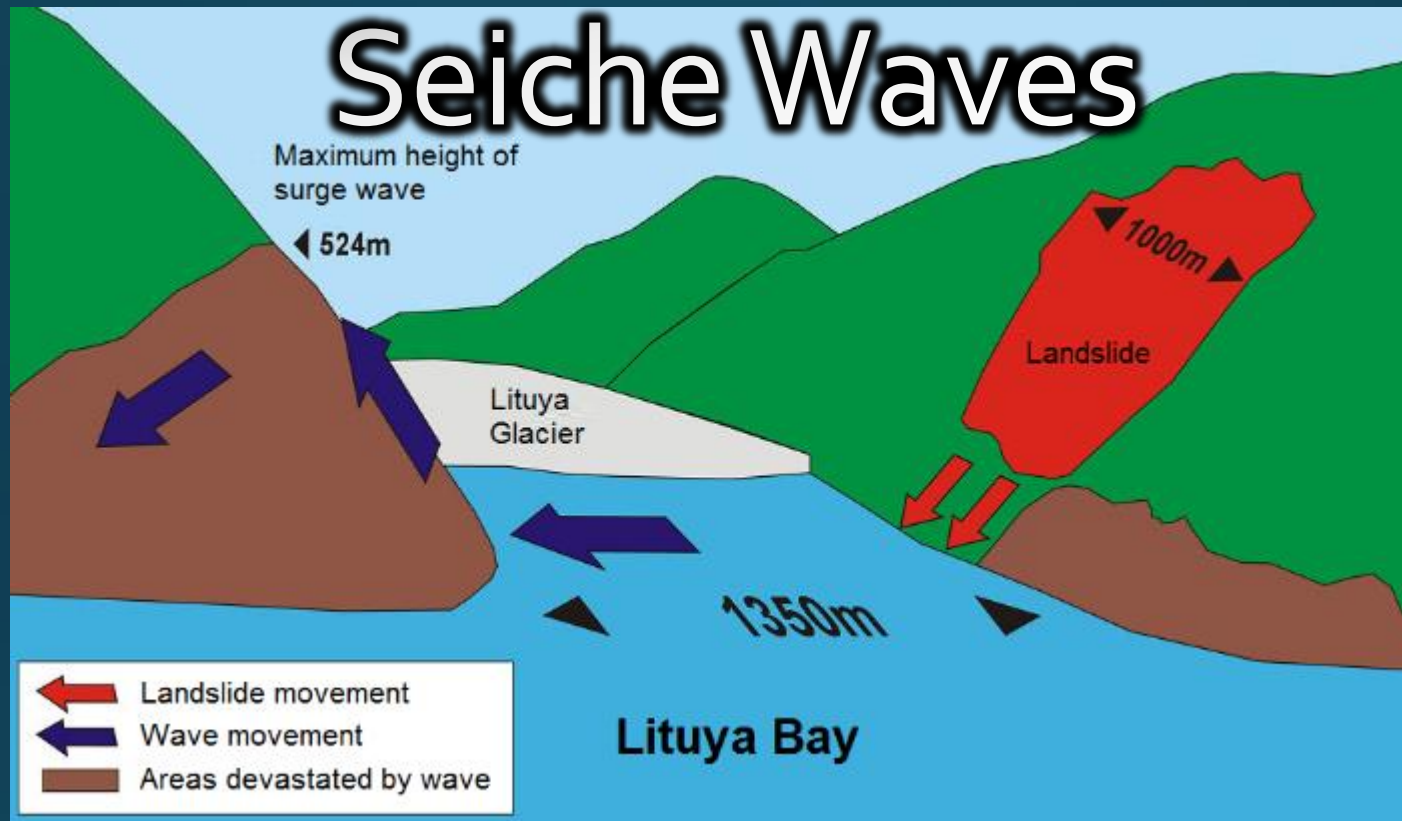


# Seiche Waves



Photo: GNS

# Seiche Waves



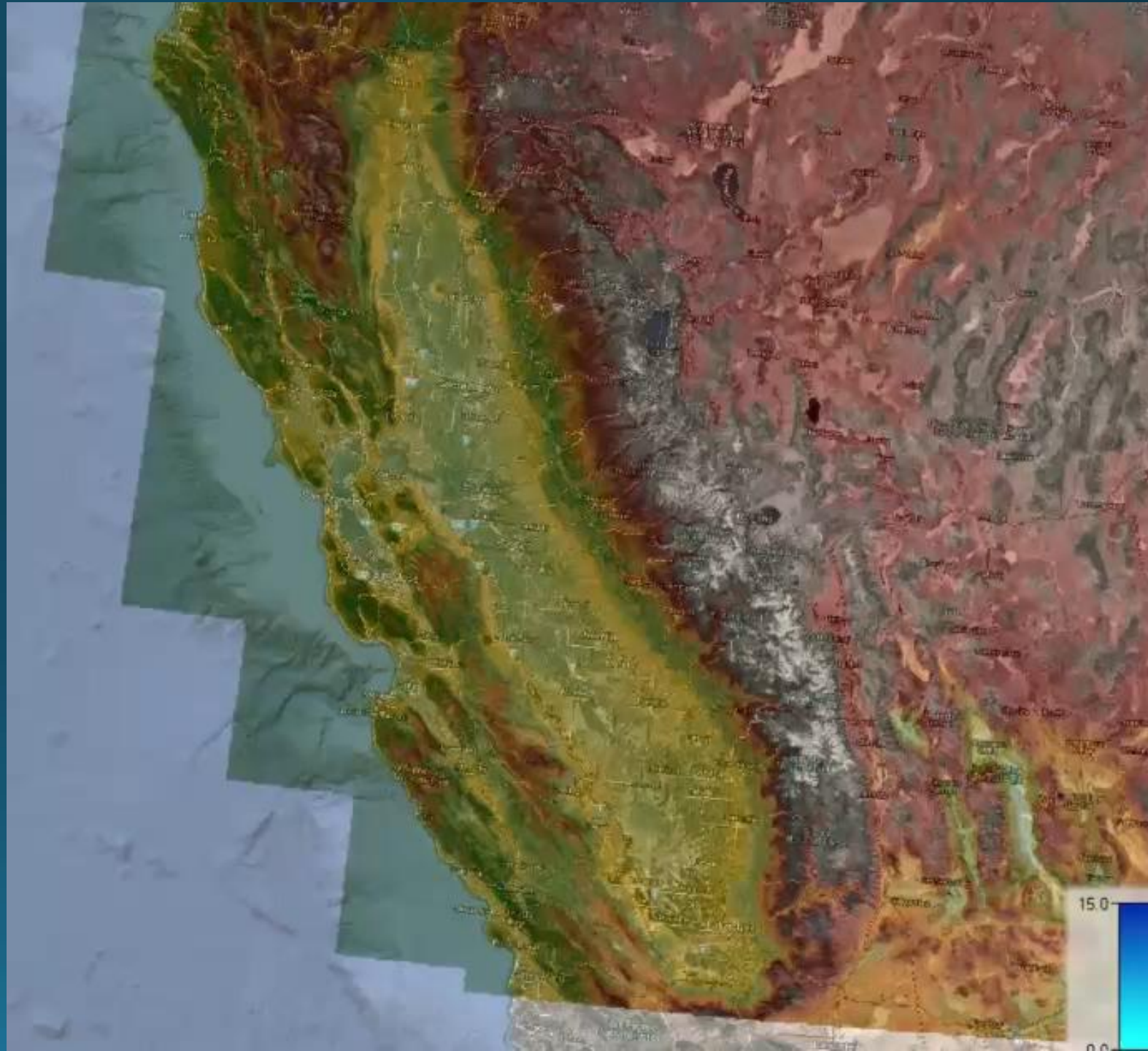
# Prehistoric Dam Failures



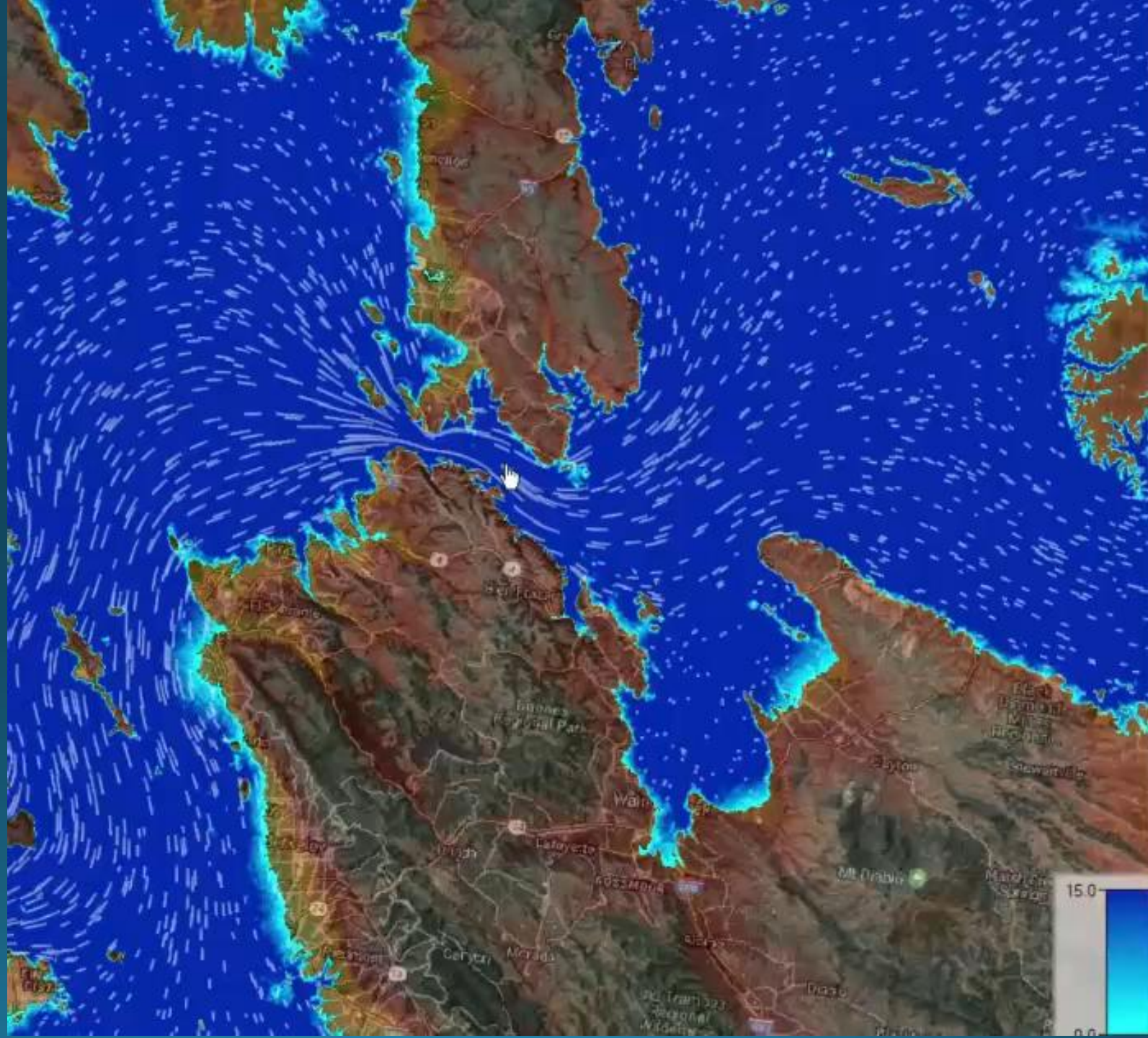
Lake Bonneville

Lake Missoula

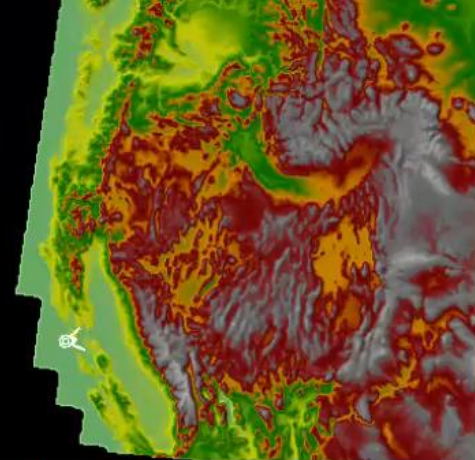
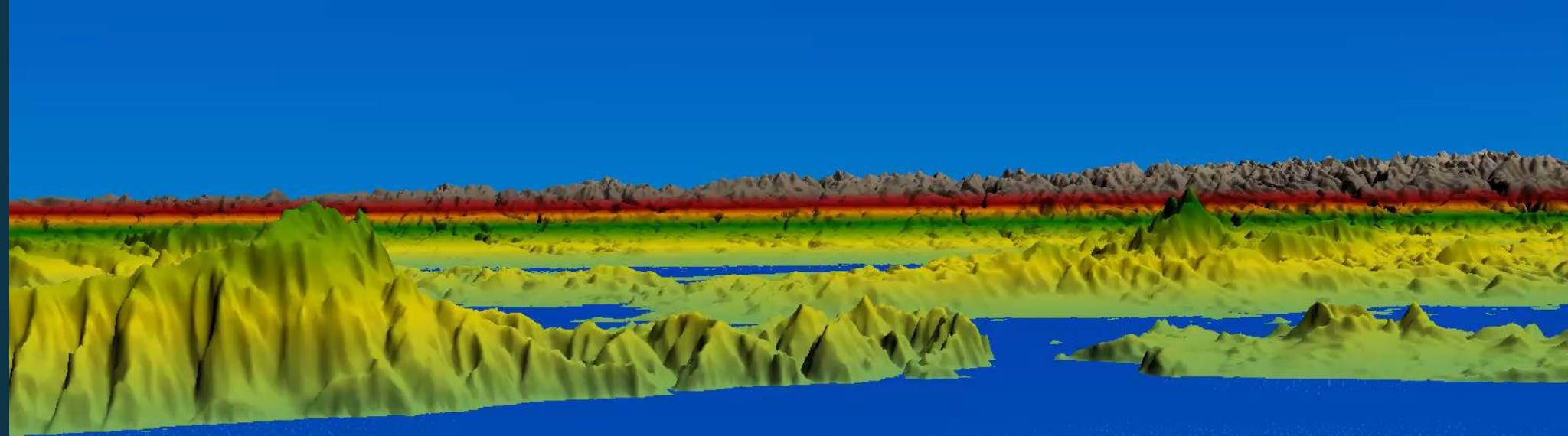
# Lake Corcoran



# Lake Corcoran







01Jan2050 12:00:00

# Lake Corcoran

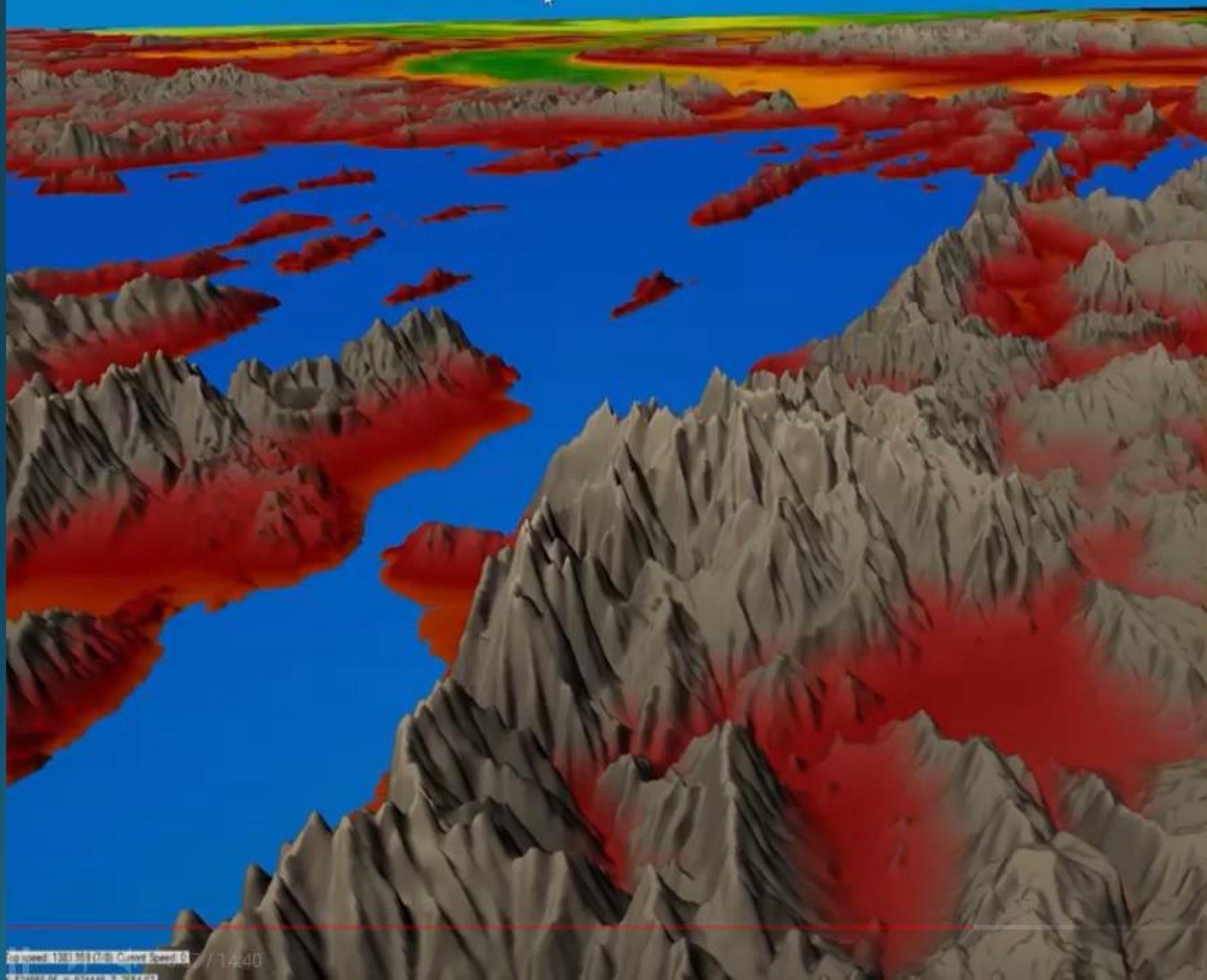
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X: 800.84, Y: 774756.5, Z: 623.2

# Lake Bonneville



# Lake Bonneville



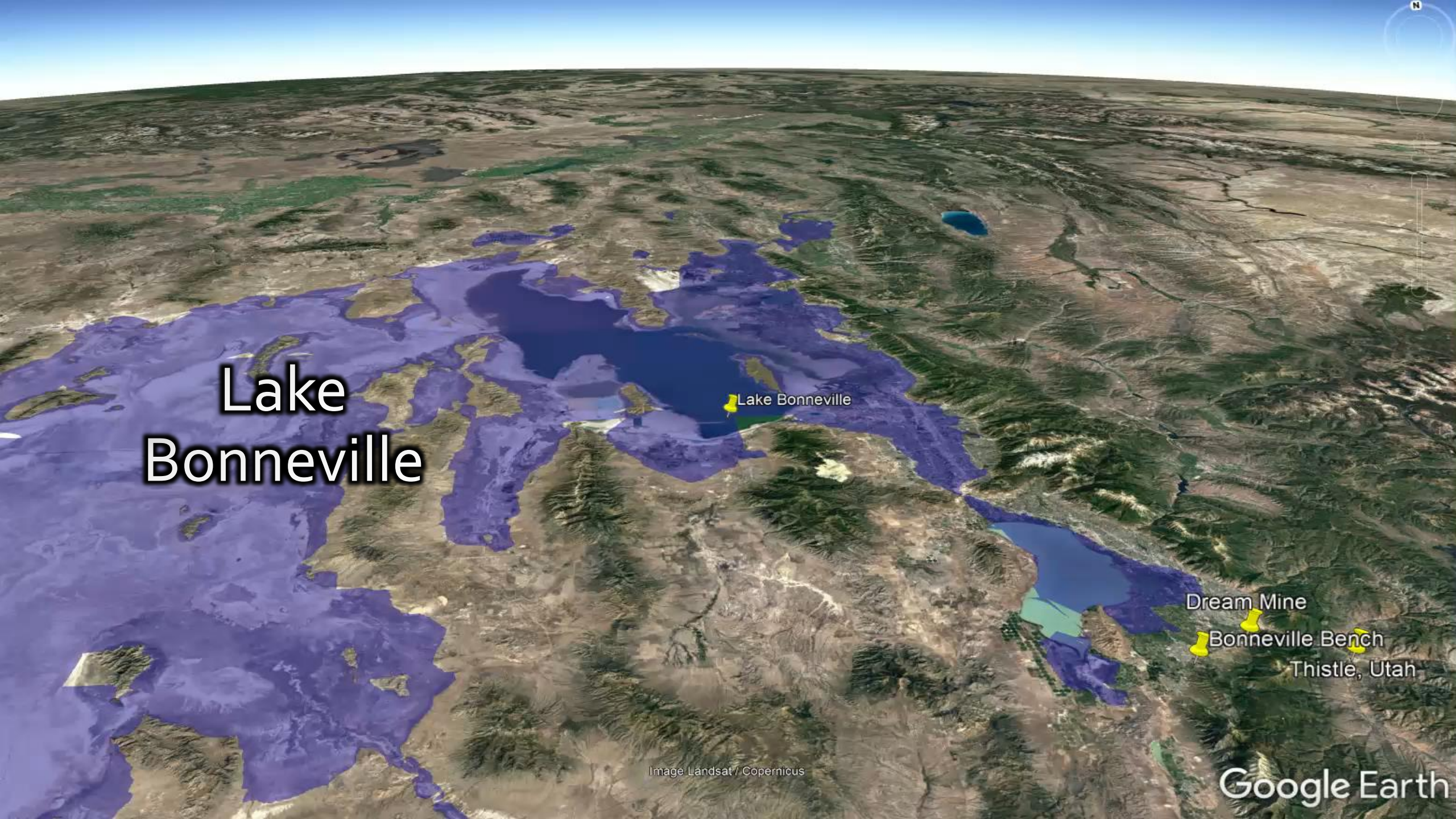
# Lake Bonneville

Lake Bonneville

Dream Mine

Bonneville Bench

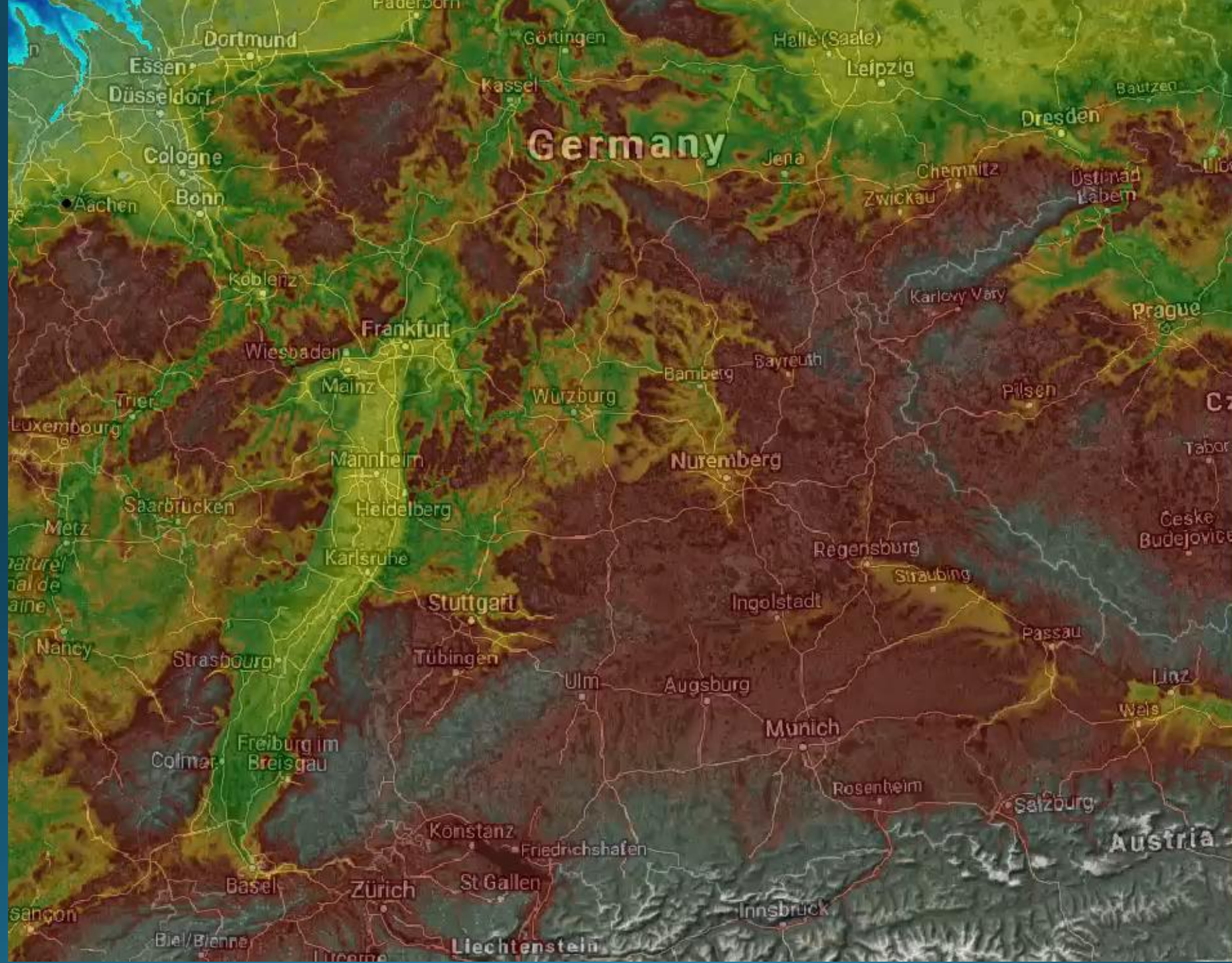
Thistle, Utah



# Thistle, Utah



# Lake Constance





Flims

# Flims Rockslide

China

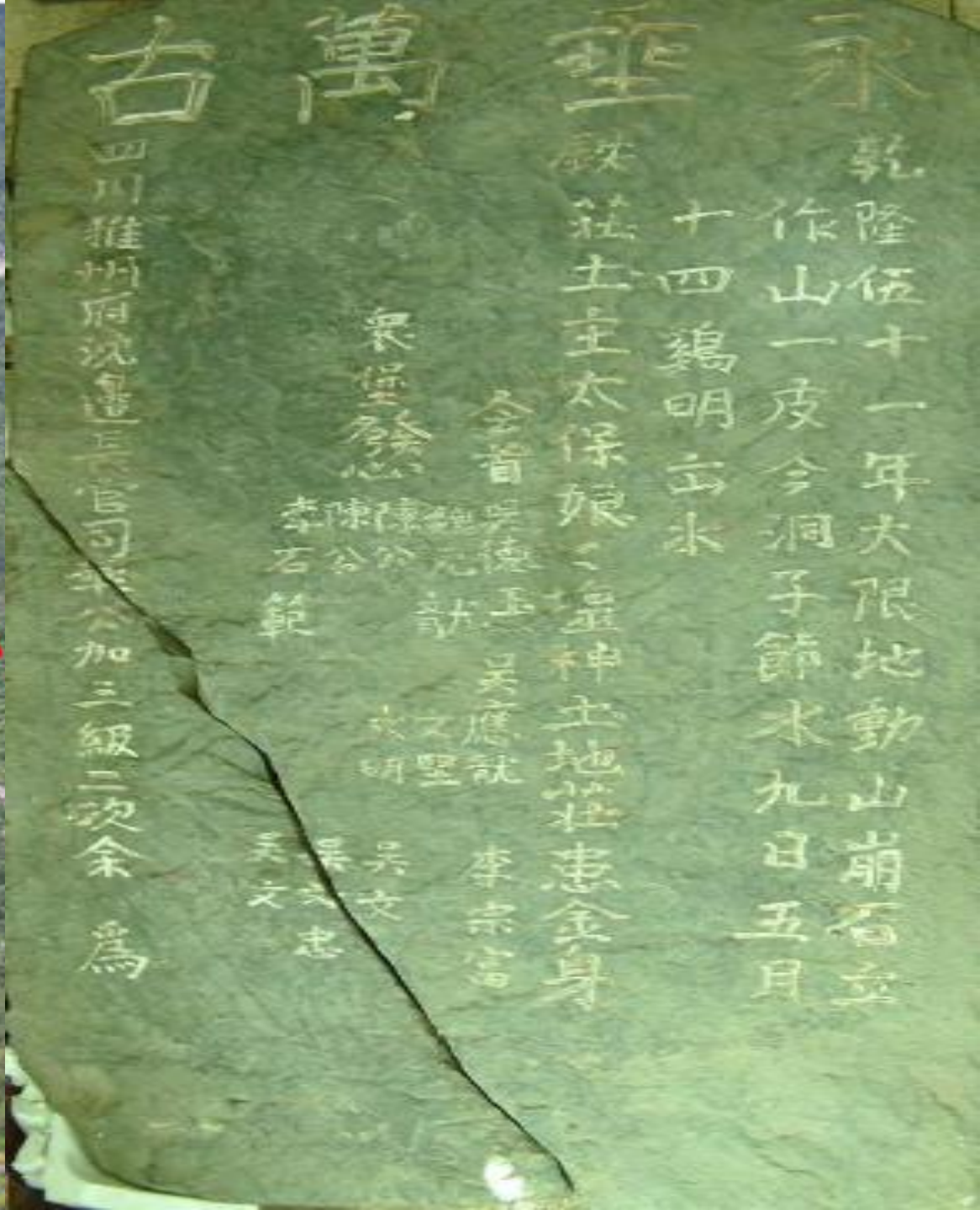
Slide No.2



Slide No.1



Dadu River, 1786







China



Diexi Lake, 1933 event

(a)

(b)

# Landslides generated by 2016 Kaikoura Earthquake




# Landslides generated by 2016 Kaikoura Earthquake

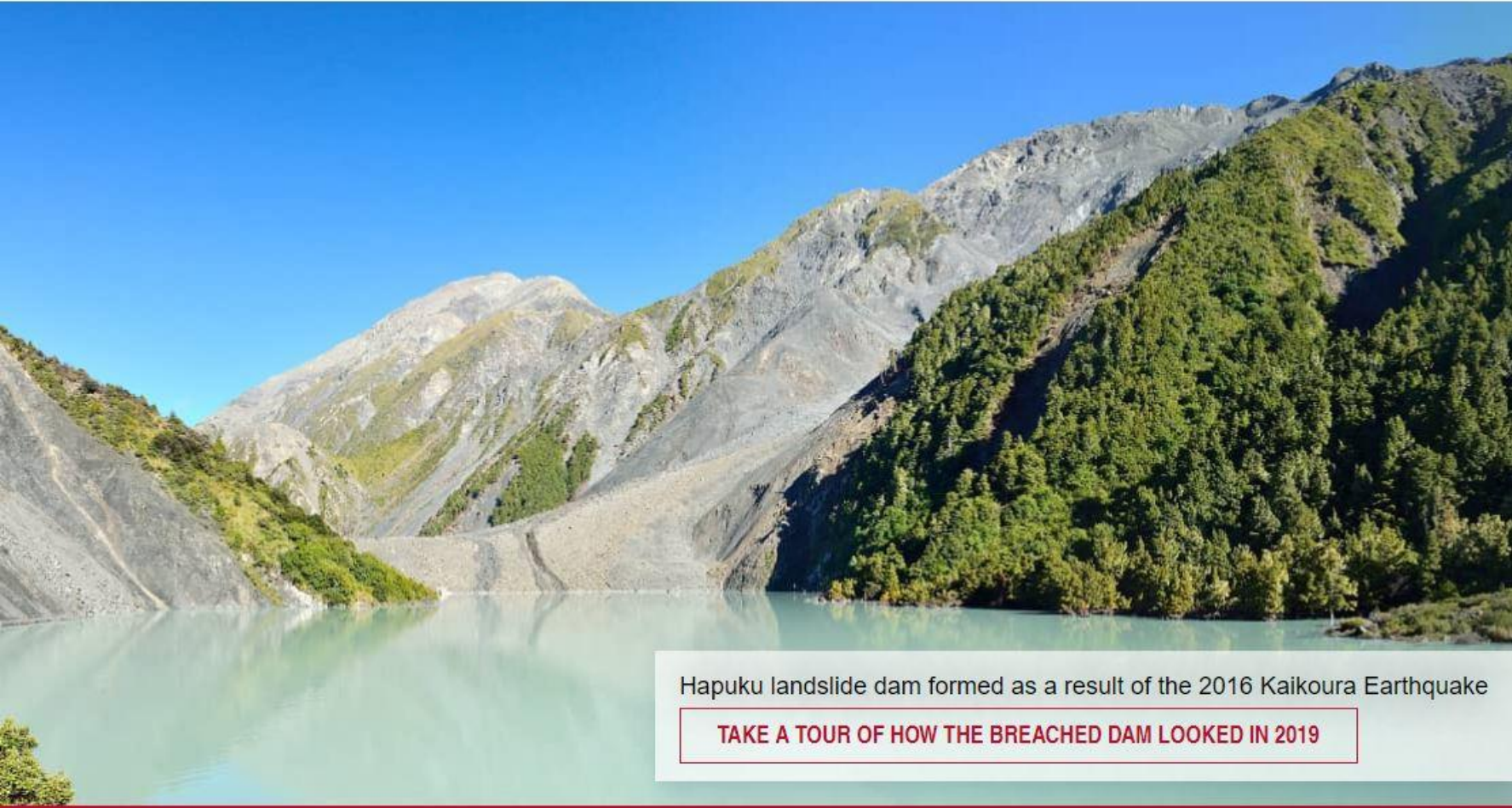
EILD Managing Risk from Earthq... x +

slidenz.net

Apps Gmail YouTube Maps eHost Login Bing Google Yahoo Apple Home -- Spatial Ref... Reading lis

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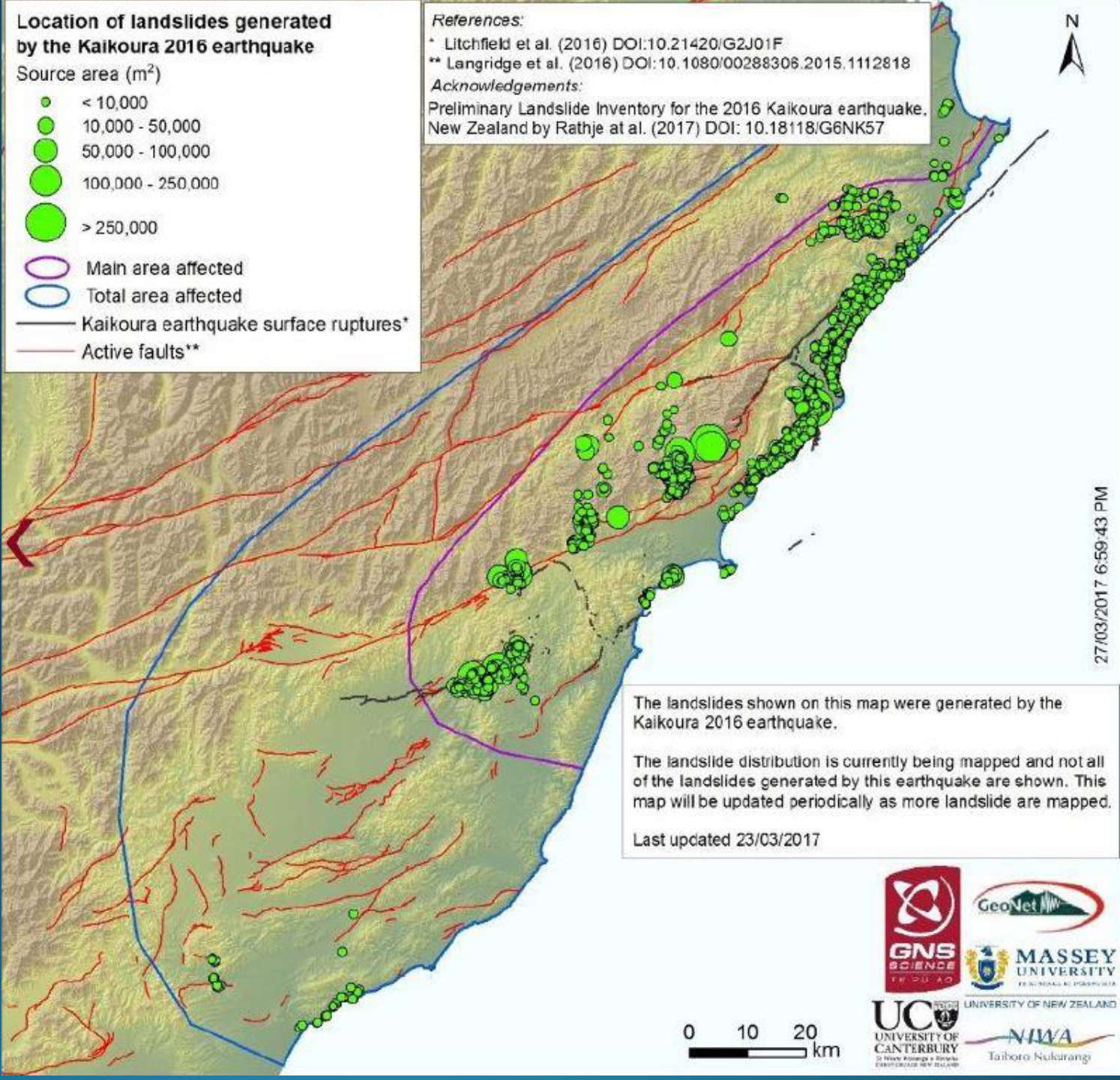
 **Earthquake-Induced Landscape Dynamics**



Hapuku landslide dam formed as a result of the 2016 Kaikoura Earthquake

[TAKE A TOUR OF HOW THE BREACHED DAM LOOKED IN 2019](#)

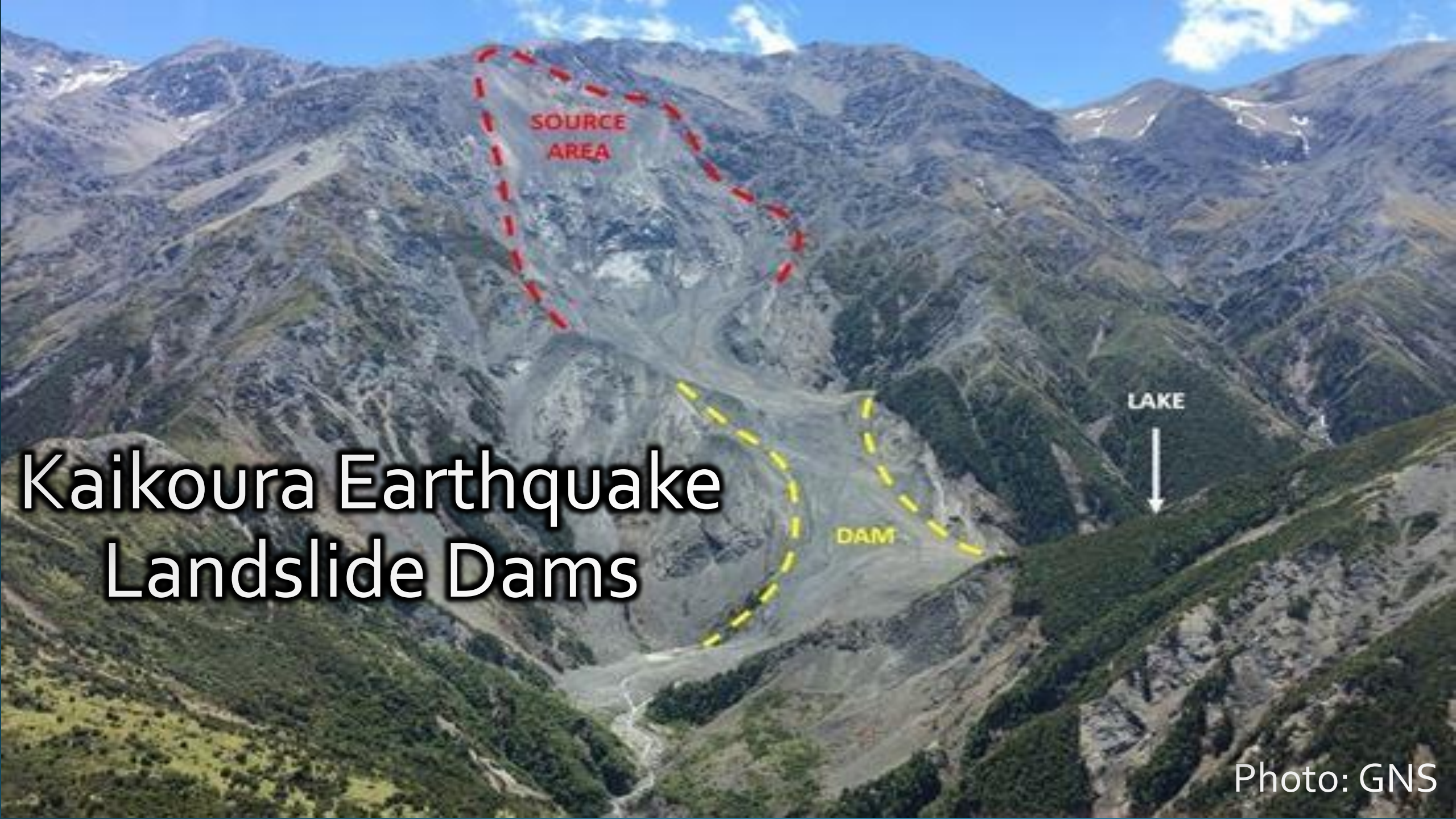
# Landslides generated by 2016 Kaikoura Earthquake



# Kaikoura Earthquake Landslide Dams



Photo: GNS



SOURCE  
AREA

DAM

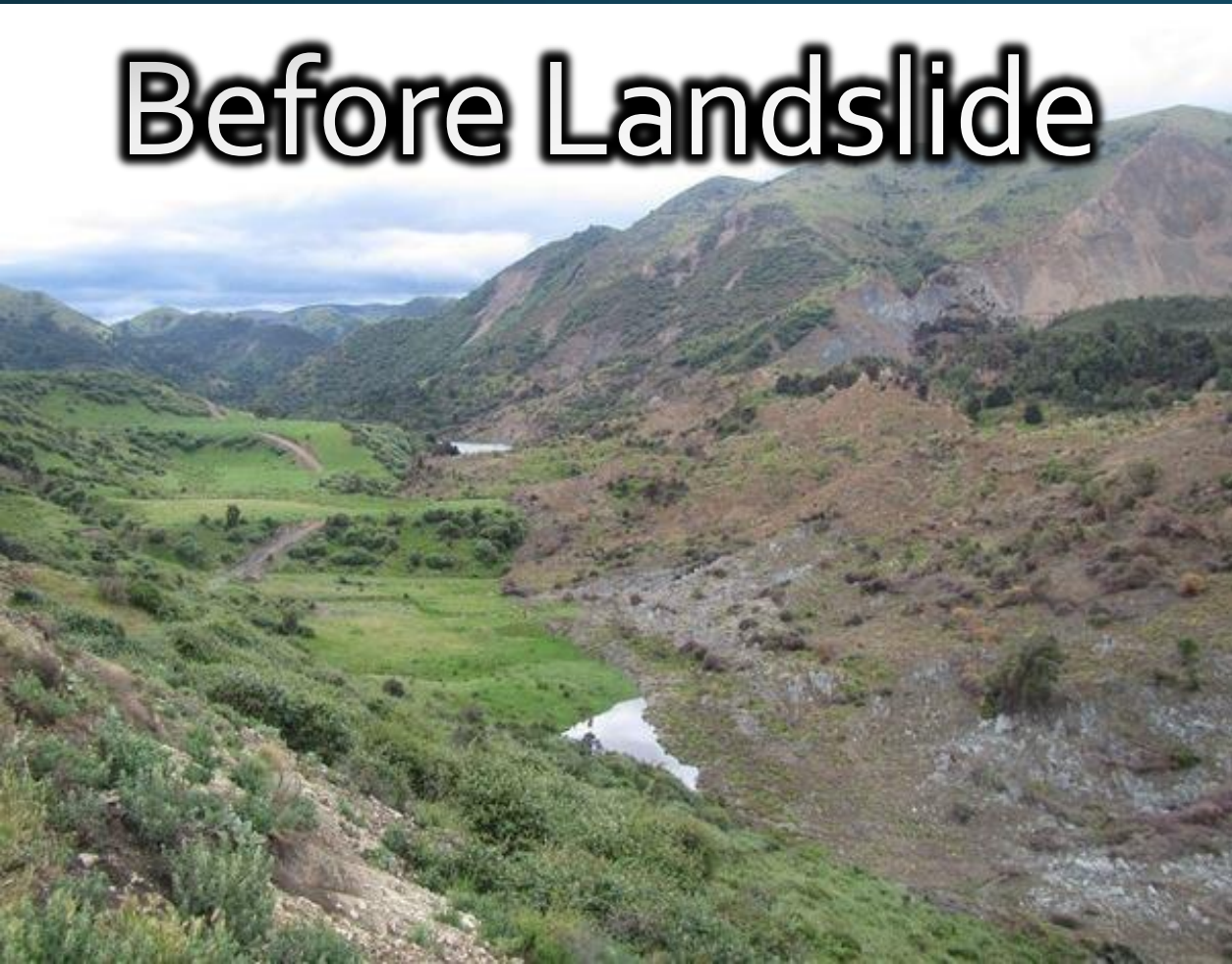
LAKE



# Kaikoura Earthquake Landslide Dams

# Leader Dam

Before Landslide



After Landslide



Photo: GNS

# Kaikoura Earthquake Landslide Dams



Photo: GNS



# Dam Breach Modelling Parameters

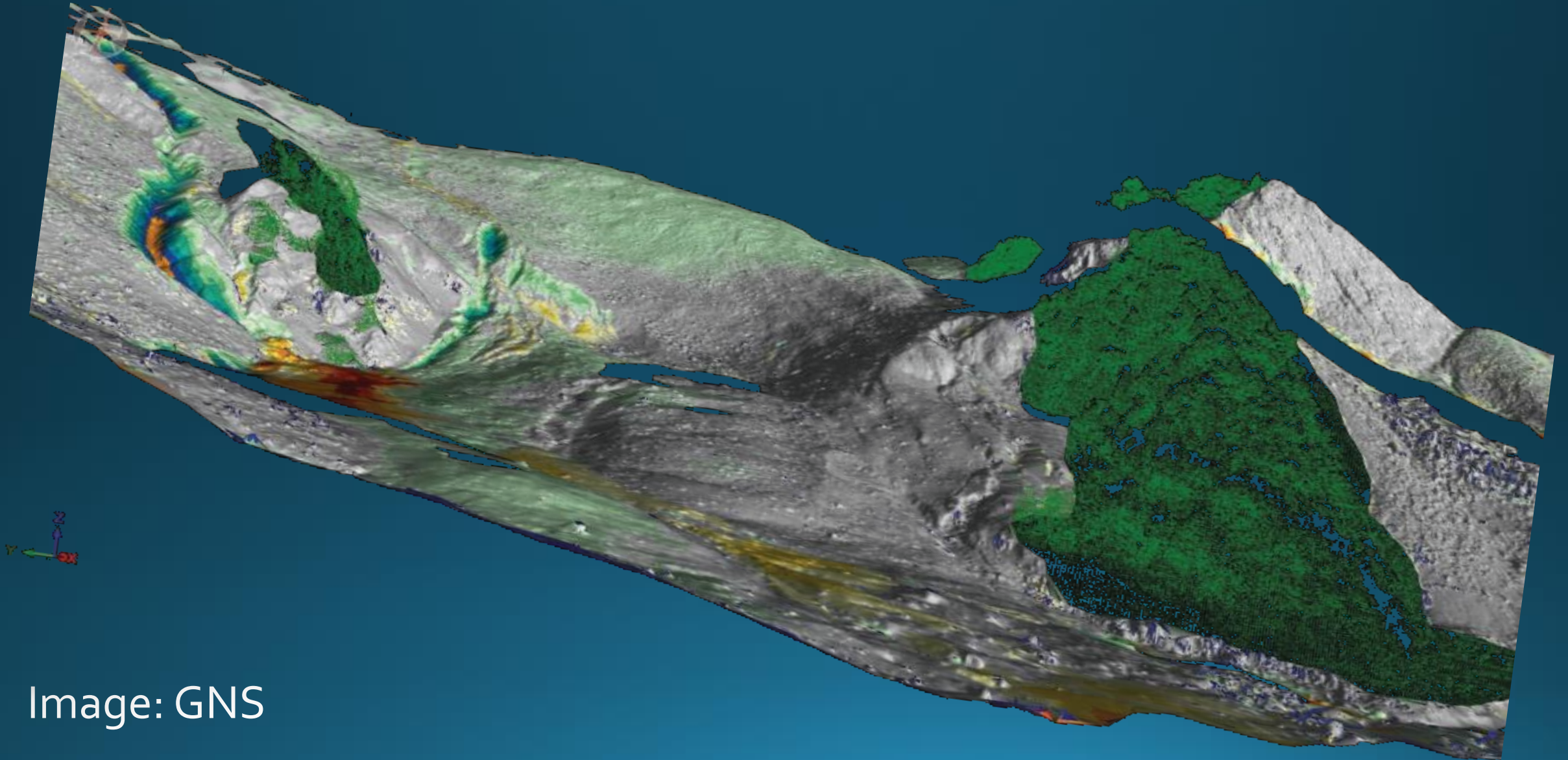


Image: GNS

# Dam Breach Modelling Parameters

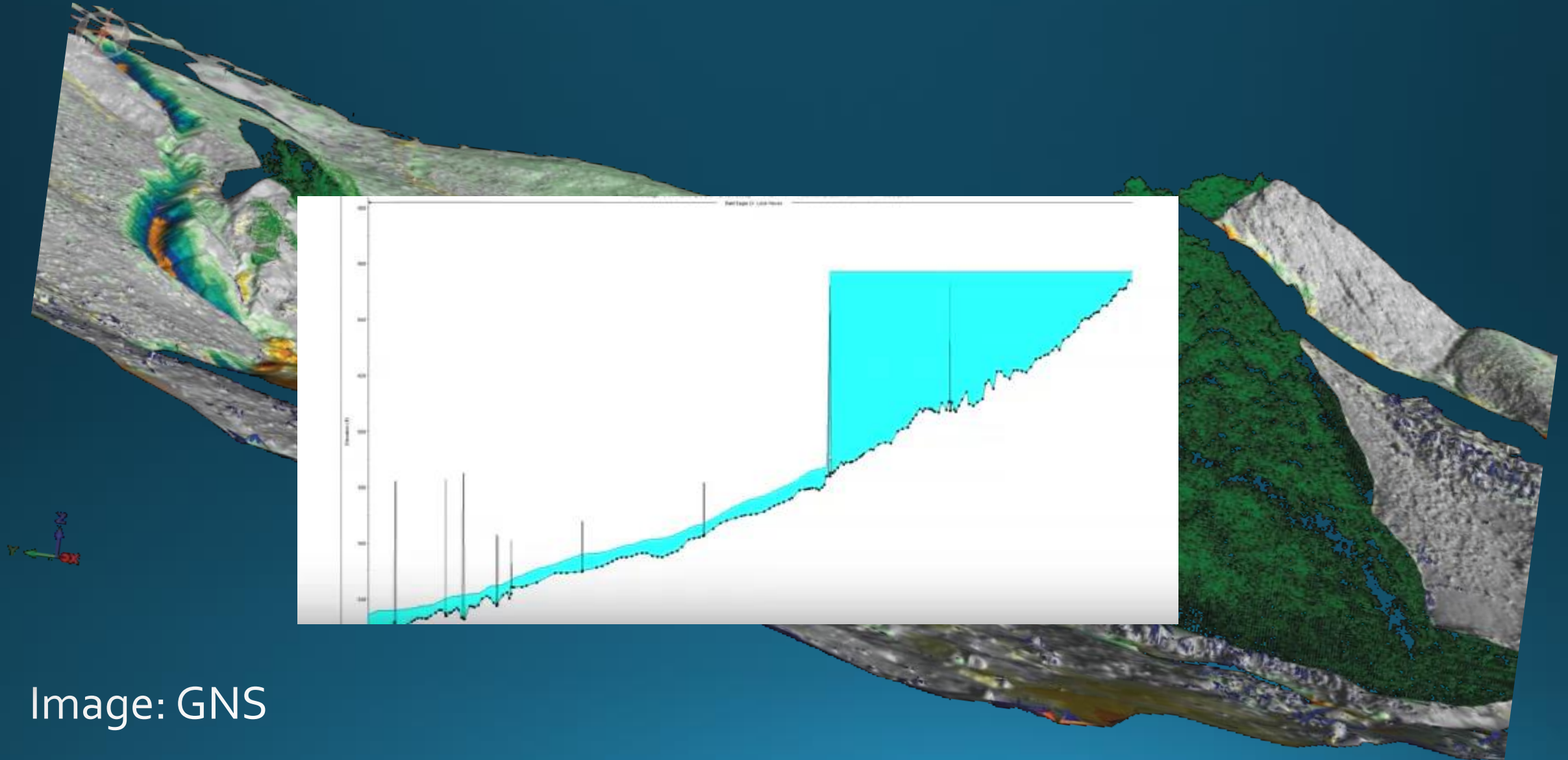


Image: GNS

# Dam Breach Modelling Considerations

Terrain data: Existing and new dam

Hydrological data: time to fill and spill

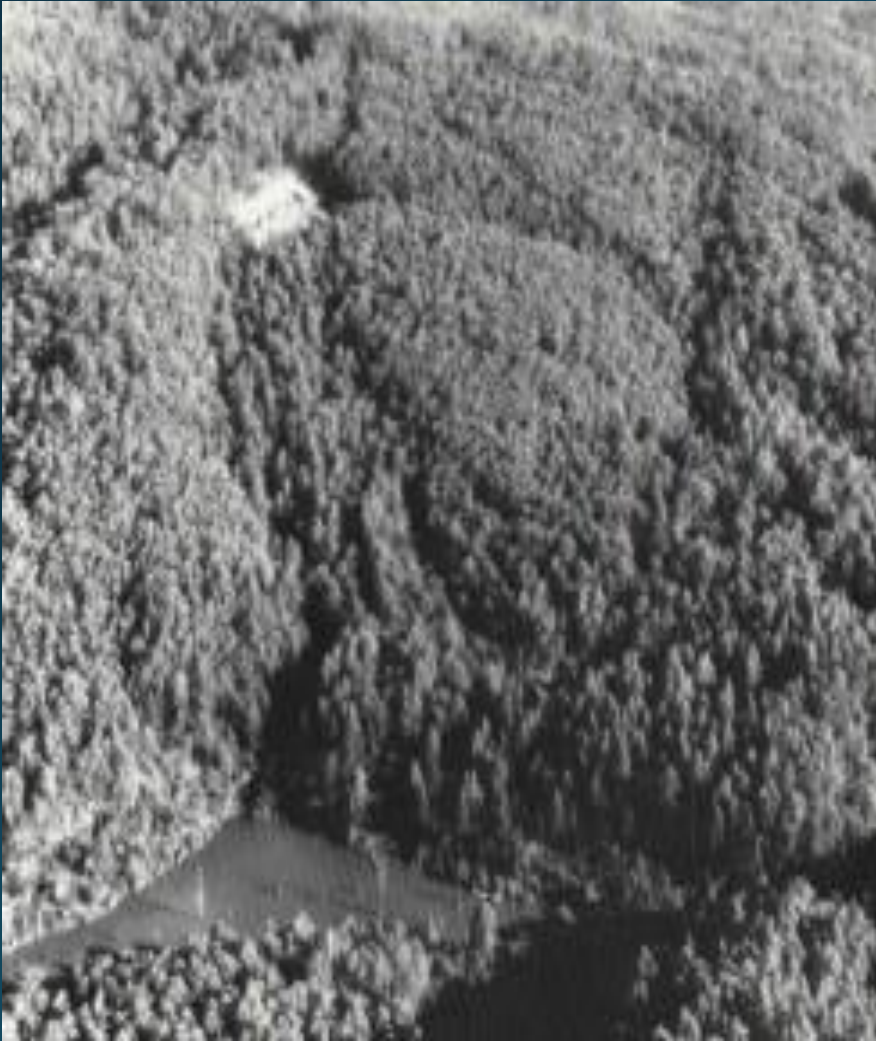
Geotechnical data: breach parameters

Population and infrastructure data

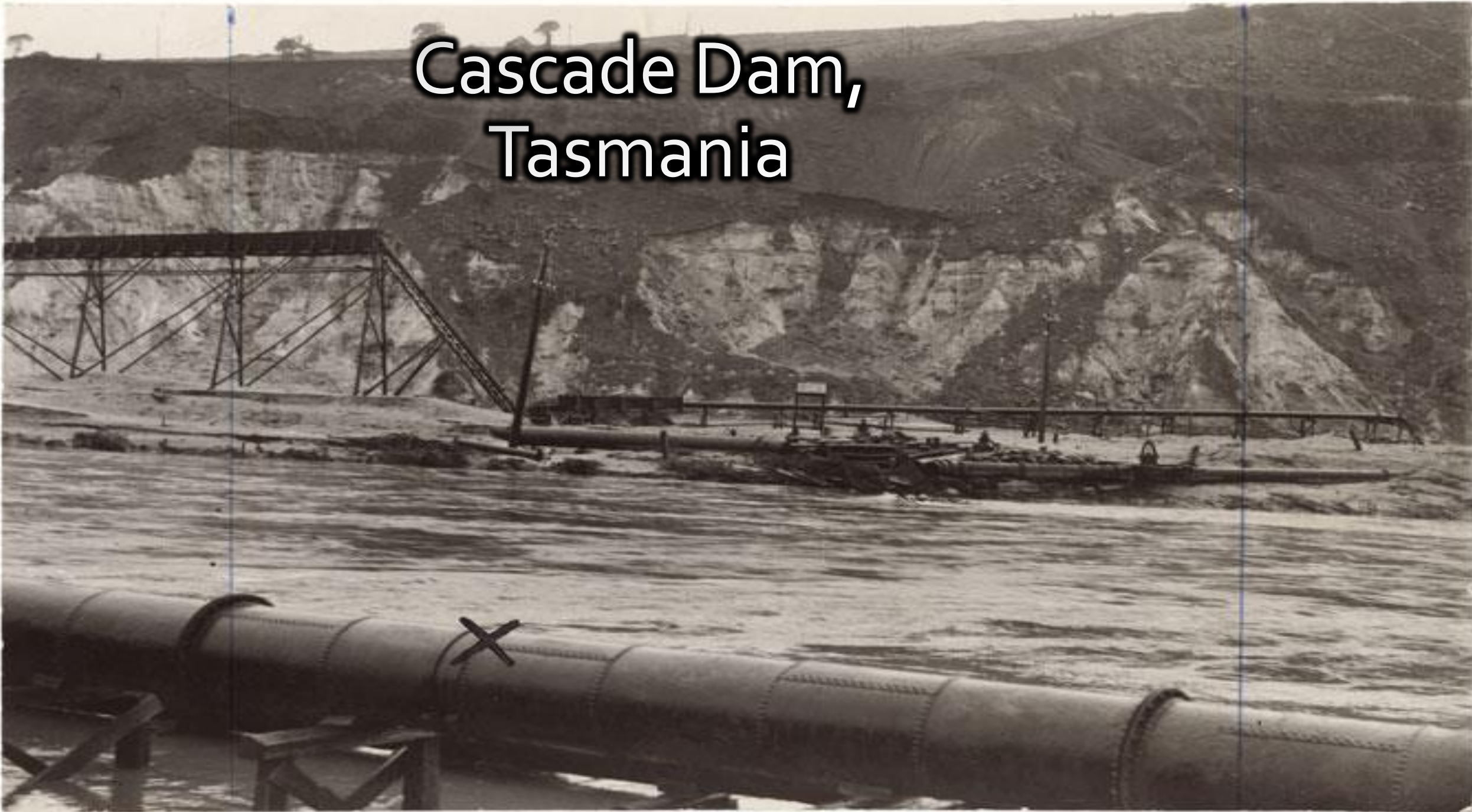
Modelling parameters:

Approach, grid size, time step, run time

# Australia: Lake Elizabeth, Victoria



# Cascade Dam, Tasmania



# Cascade Dam, Tasmania



Could a fatal landslide dam failure  
happen in Australia?

**Landslide**

**Dam Failure**

**Fatal**

Could a fatal landslide dam failure  
happen in Australia?



Landslide

Dam Failure

Fatal



Could a fatal landslide dam failure  
happen in Australia?



A Venn diagram with three overlapping blue ovals on a yellow background. The top-left oval is labeled 'Landslide', the top-right oval is labeled 'Dam Failure', and the bottom oval is labeled 'Fatal'. A large white question mark is positioned in the center where all three ovals overlap. A red scribbled line encircles the entire diagram.

Landslide

?

Dam Failure

Fatal

# Mining Implications



An aerial photograph of the Sunkoshi River in Nepal. The river flows through a valley, with a large, light-brown area of sediment deposition on a steep mountain slope. In the foreground, a dam structure is visible, with water flowing through its spillways. The surrounding landscape is lush green, with dense forest covering the hillsides. The sky is blue with scattered white clouds.

# Sunkoshi River Nepal



**Bhote Kishi River  
Tibet**

# Climate Change + Population Growth

Future risks



# Climate Change + Population Growth





#73 State and fate of the Hindu Kush H...




Watch later



Share

Future risks



Watch on  YouTube

# Mitigation





# Mitigation



## Ongoing research

USGS landslide dam likelihood index

National NZ landslide dam inventory

Forecast model development

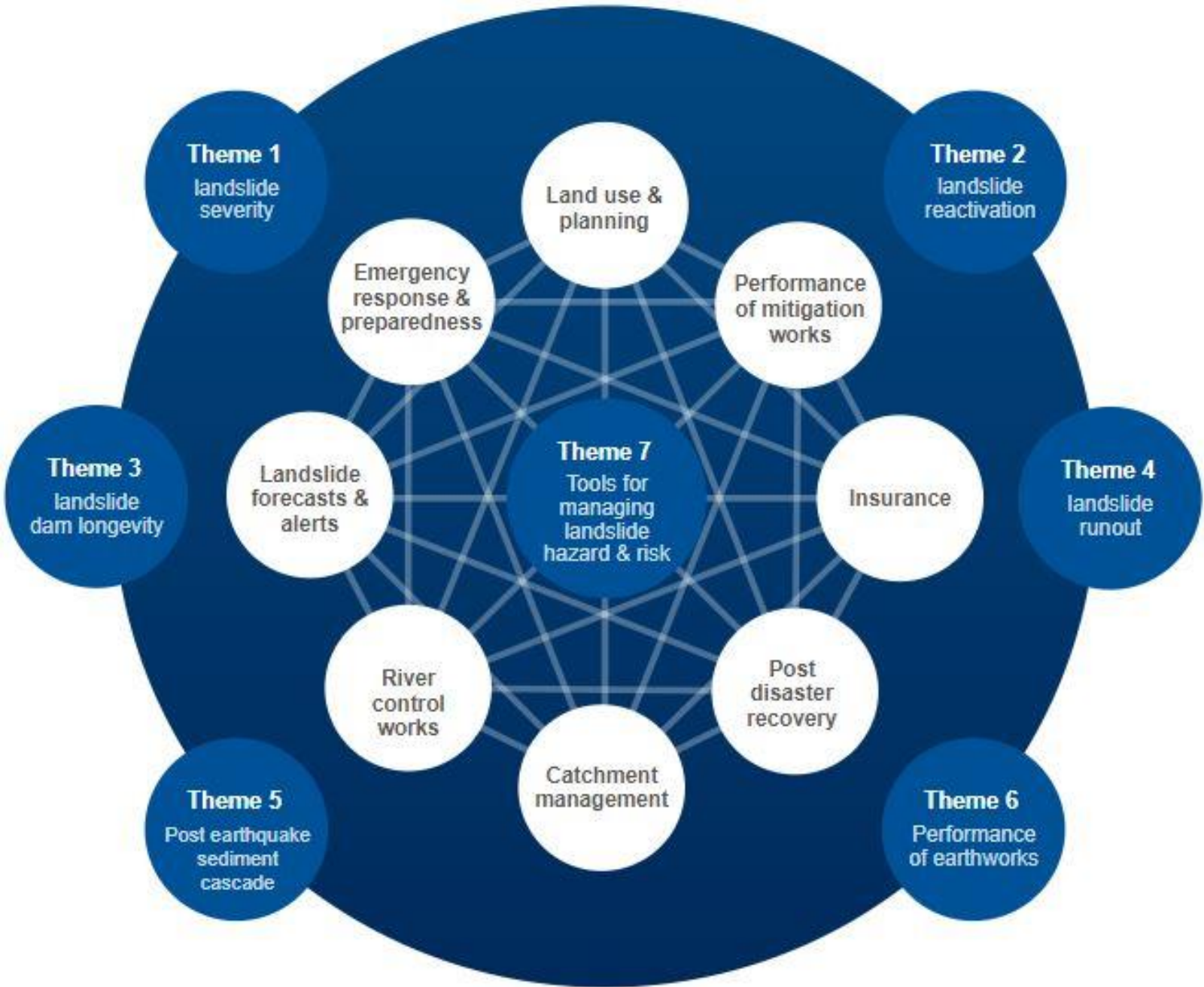
ICIMOD glacier climate change impacts

Kaikoura landslide dam monitoring

# Managing the risk from earthquake induced landslides

Large earthquakes, like the November 2016 Mw 7.8 Kaikōura earthquake, can generate thousands of landslides, landslide dams and damage hillslopes that are susceptible to failure during rainstorms and aftershocks. This debris, when mobilised, creates new hazards, including further landslides, landslide dams, rapid aggradation and formation of alluvial fans and floodplains, and increased river channel instability, as the debris cascades from hillslope to sea. These hazards may persist for decades and therefore represent a prolonged risk that must be managed by the impacted communities and stakeholders.

Earthquake-induced landscape dynamics is funded by the New Zealand Ministry for Business, Innovation and Employment Endeavour fund. The five year programme (2018-2023) is led by GNS Science in association with a number of research partners. The research is directed to effectively manage earthquake- and post-earthquake landslide risk using an integrated set of predictive tools guided by an evidence-based decision making framework by determining over what time scales do landscapes heal after major earthquakes. The Kaikōura earthquake provides a laboratory to quantify post-earthquake landscape dynamics.



# The research will:

Develop a framework and tools to allow people to manage the risk to life, property and infrastructure from landslide and other sediment hazards caused by the Kaikōura earthquake and other earthquakes in NZ. The research programme has seven themes

A tool box and decision-making framework will be developed that will better inform landslide risk avoidance and residual risk-management methods and practices for people and stakeholders: 1) affected by the Kaikōura earthquake; and 2) affected by future earthquakes in New Zealand and overseas.

[EXPLORE THE RESEARCH](#)

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# Natural Dam Failures Past, Present, and Future



Chris Goodell  
Kleinschmidt  
Associates



Surface  
Water  
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# QUESTIONS?

