4-23-2021

Communicating Dam Failure Hazards to Society Through a Virtual Reality Environment of the Teton Dam Failure

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Abstract

Dam failures worldwide devastate downstream communities, so communicating the severity of these hazards is critical. However, complex multi-resolution representations of modeling results are crucial for dam failure research but difficult to implement. Therefore, we propose that using a multi-dimensional model created in a Virtual Reality (VR) environment would bypass the need for 2D resolution and allow for new analyses. We model the Teton Dam failure of 1976, based on a GeoClaw 2D Dam Failure Model, to visualize both the spatial and temporal hazard components associated with the duration of the historic dam breach. We evaluate and validate our model on the Oculus Quest 2 headset, parameterizing the environment using historical dam breach data and remote-sensing data, such as drone photogrammetry. This study balances the enhanced speed of interaction on the Oculus Quest 2 with the demanding computational requirements. Our output simulation of the 1976 Teton Dam failure's 3D rendering agrees with historical data and the 2D GeoClaw model. Modeling in the VR environment is tailored for improving research and teaching activities alike. Our approach is essential because non-specialist audiences, such as legislators, K-12 students, and downstream community citizens, can experience complex dam failure through a customized immersive VR simulation.

Authors

Hannah Spero, Kenny Miller, Iker Vazquez Lopez, Rezvan Joshaghani, Steven Cutchin, Donna Calhoun, and Josh Enterkine

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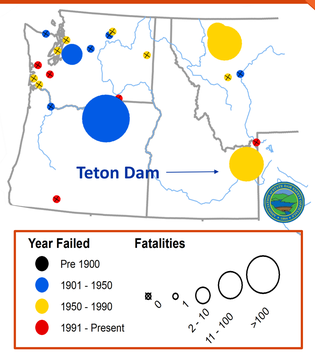
Introduction

Dam failures worldwide devastate downstream communities, so communicating the severity of these hazards is critical.

We model the Teton Dam failure of 1976, based on a GeoClaw 2D Dam Failure Model (Figure B), to visualize both the spatial and temporal hazard components associated with the duration of the historic dam breach.



http://www.clawpack.org/geoclaw

Modeling

Complex multi-resolution representations of modeling results is crucial for dam failure research but difficult to implement.

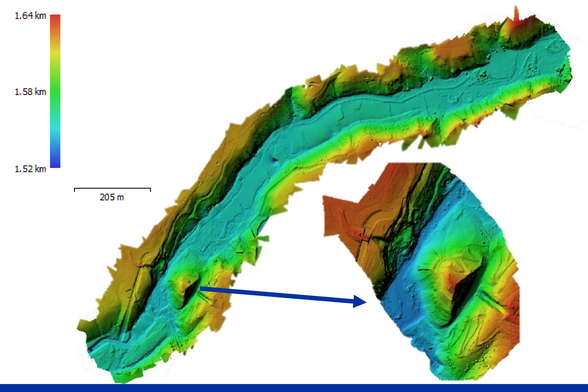
Therefore, we propose that using a multi-dimensional model created in a Virtual Reality (VR) environment would bypass the need for 2D resolution and allow for new analyses.

Teton Dam Failure Eastern, ID, 1976.

Remote Sensing Data

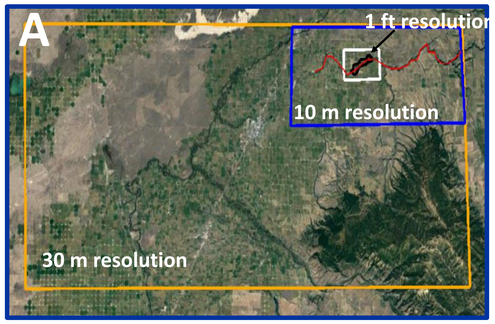
We evaluate and validate our model on the Oculus Quest 2 headset, parameterizing the environment using historical dam breach data and remote-sensing data.

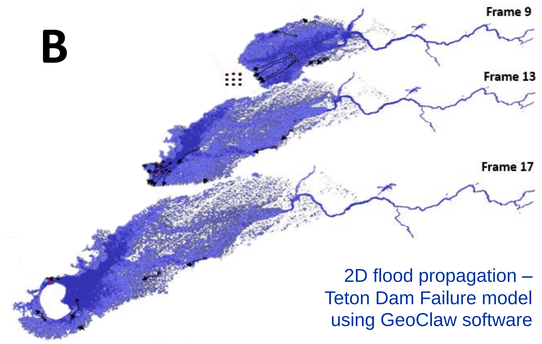
Drone photogrammetry provided by the Bureau of Reclamation provides high-resolution topography (HRT) for simulations.



TIME TRAVEL TO THE 1976 TETON DAM FAILURE

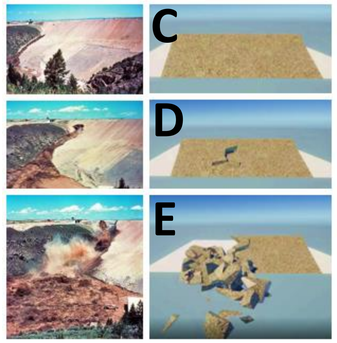
Virtual Reality Environment





2D flood propagation – Teton Dam Failure model using GeoClaw software

Modeling in the VR environment is tailored for improving research and teaching activities alike.



Results

This study balances the enhanced speed of interaction on the Oculus Quest 2 with the demanding computational requirements. Our output simulation of the 1976 Teton Dam failure's 3D rendering agrees with historical data and the 2D GeoClaw model.

Discussion

Our approach is crucial because non-specialist audiences, such as legislators, K-12 students, and downstream community citizens, can now experience complex dam failure through a customized immersive VR simulation.

Future work includes:

- **Simulating other geohazards** that are numerically modeled for improved spatial and temporal understanding of the risks they pose to communities.
- **Geoscience education and outreach assessment** – how can we use VR for teaching about hazards and historical events?
- **Refining the current VR model** for other analyses such as determining where the historic hydraulic jump occurred.

References

Scan me

Scan the QR code to access a document detailing the references for this poster

Acknowledgements

BOISE STATE UNIVERSITY Department of Mathematics

BOISE STATE UNIVERSITY Department of Geosciences

BOISE STATE UNIVERSITY College of Engineering Department of Computer Science

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CLAWPACK

Thanks especially to:

Boise State Institute for Scholarship and Diversity Spring 2021 Undergraduate Research and Creative Activities (URCA) Grant funding

VizLab and Dr. Steve Cutchin

Boise Center Aerospace Laboratory Resources (BCAL)

Also, thanks to the great VR team! Pictured (Left to Right): Iker, Kenny, Steve, myself (Hannah), and Rezvan.

Not pictured Donna or Josh.

Research Funded by Boise State University URCA (Undergraduate Research and Creative Activities 2021 Grant)

Let's Connect!
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