Visualizing Stages of the Earth's Water Cycle Using Virtual Reality

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Acknowledgement

This study was supported by NOAA grant NA19NES4320002 (Cooperative Institute for Satellite Earth System Studies - CISESS) at the University of Maryland/ESSIC.

Why educate about the water cycle?

- Important to incentivize future generations to learn geoscience to tackle climate change
- Explain how weather systems and geological processes can influence daily life

What is Virtual Reality?

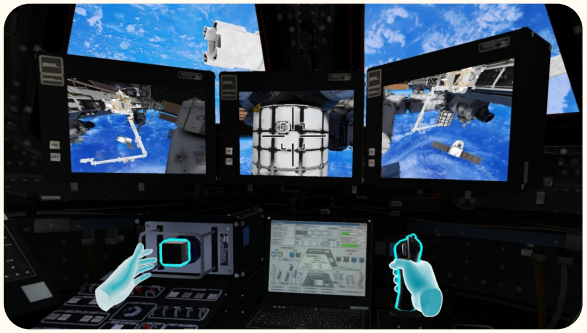
- Simulated virtual 3D environments that a user can interact with using a head-mounted display and hand controllers
- Mixed Reality attempts to blend elements of the real world with the virtual experience
- Our main target audience is users that have affordable VR technology like the Meta Quest.

Image of Meta Quest 3S

Image of Meta Quest 3

Why Virtual/Mixed Reality for Education?

- Infinite possibilities to the experiences that can be created.
- Create an engaging and immersive environment that subtracts distractions
- Growing audience that has access to VR/MR headsets

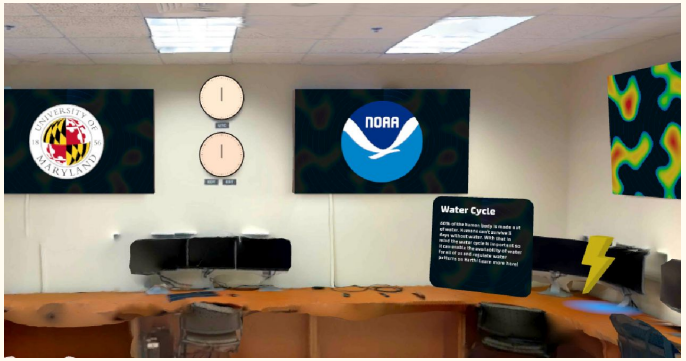


A virtual-reality tour of the ISS (Image credit: Mission: ISS)

Out of Scale – an educational VR game made by popular science channel Kurzgesagt

What is the CISESS Virtual Proving Ground Lab?

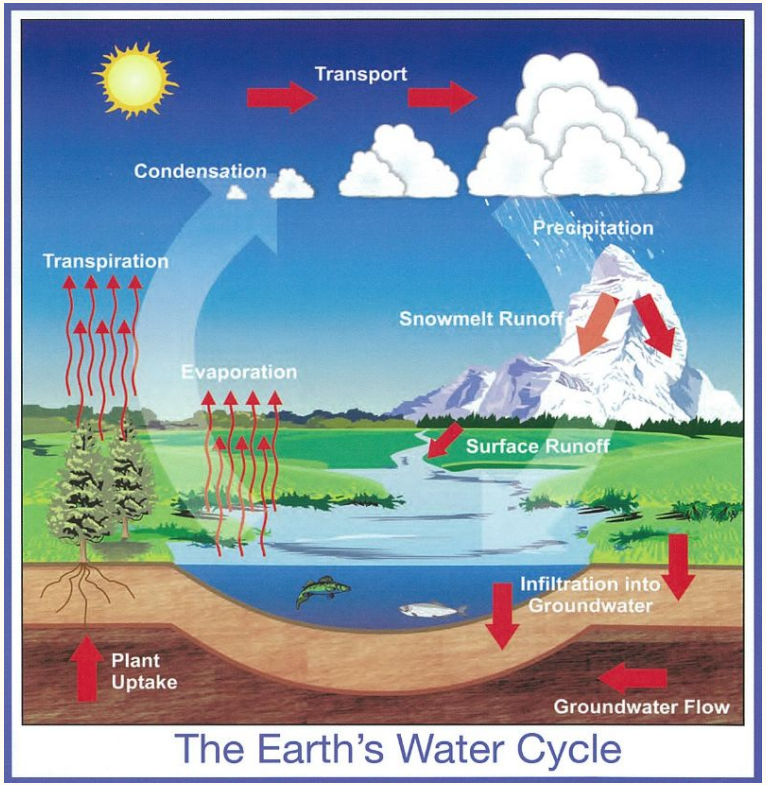
The CISESS Virtual Proving Ground Lab is an interactive VR application designed to educate and show the user different aspects of geoscience via educational models.



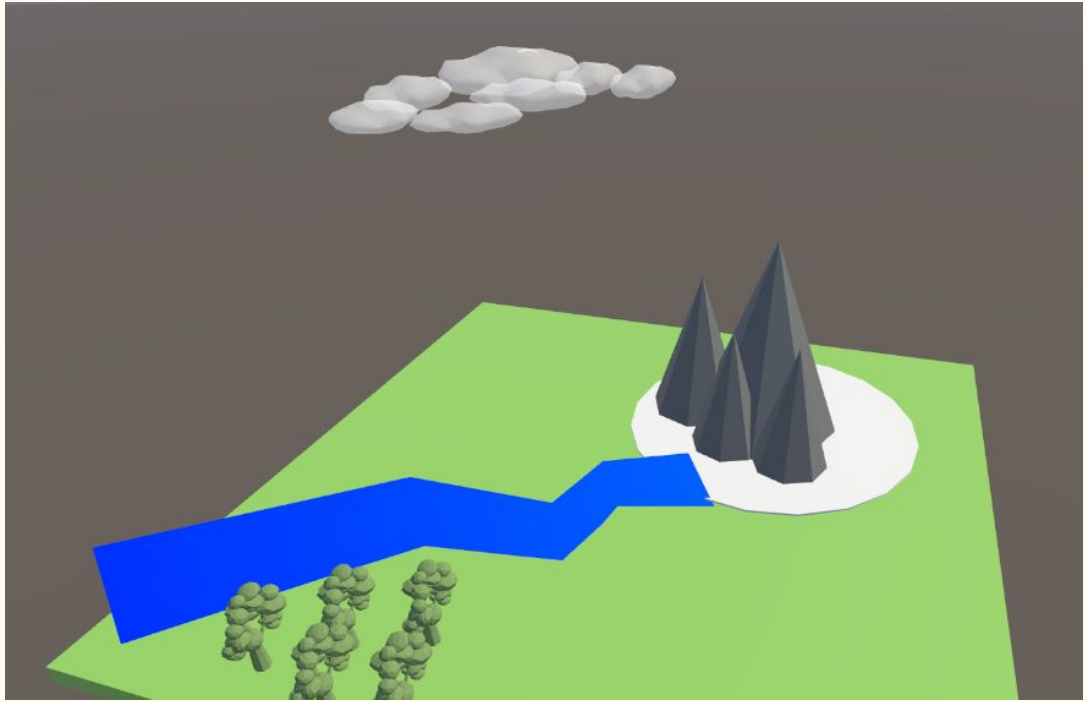
This is effective so that users don't have to open a separate application when they want to switch to a different component of geoscience.

Objectives

- The primary objective is to create a VR application that demonstrates the Earth’s water cycle as a part of the Virtual Proving Ground and Training Center.
- To achieve this we use visualizations to depict key processes of the water cycle that are designed using the Unity Game Engine.
- This project is designed to be accessible to a wide audience, aiming to educate students and the general public.



Visualization provided by NOAA.



Overview of Water Cycle


Evaporation
Evaporation is a process in which water becomes water vapor.
Evaporation occurs when sunlight warms the surface of the water. The heat from the sun makes the water molecules move faster and faster, until eventually they escape as a gas.
Evaporation from the oceans is vital to the production of fresh water, because when water evaporates salt is left behind.
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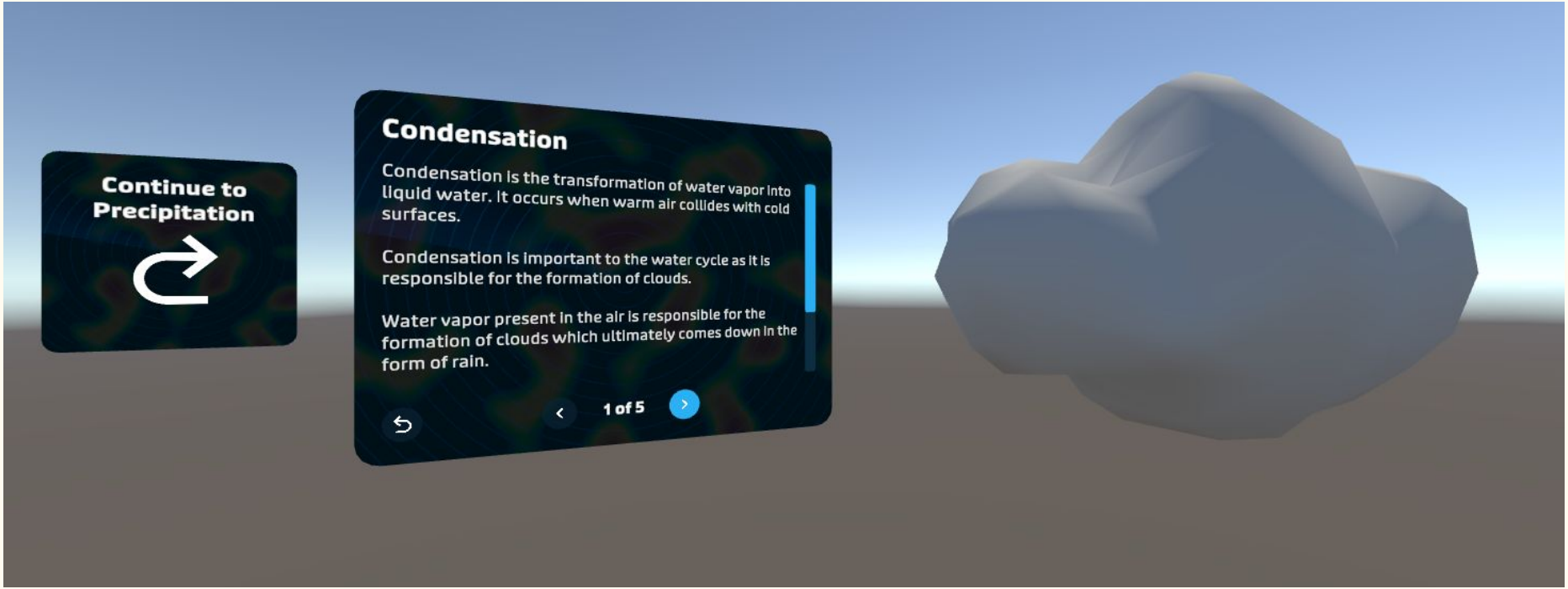
Continue to Precipitation
Condensation
Condensation is the transformation of water vapor into liquid water. It occurs when warm air collides with cold surfaces.
Condensation is important to the water cycle as it is responsible for the formation of clouds.
Water vapor present in the air is responsible for the formation of clouds which ultimately comes down in the form of rain.
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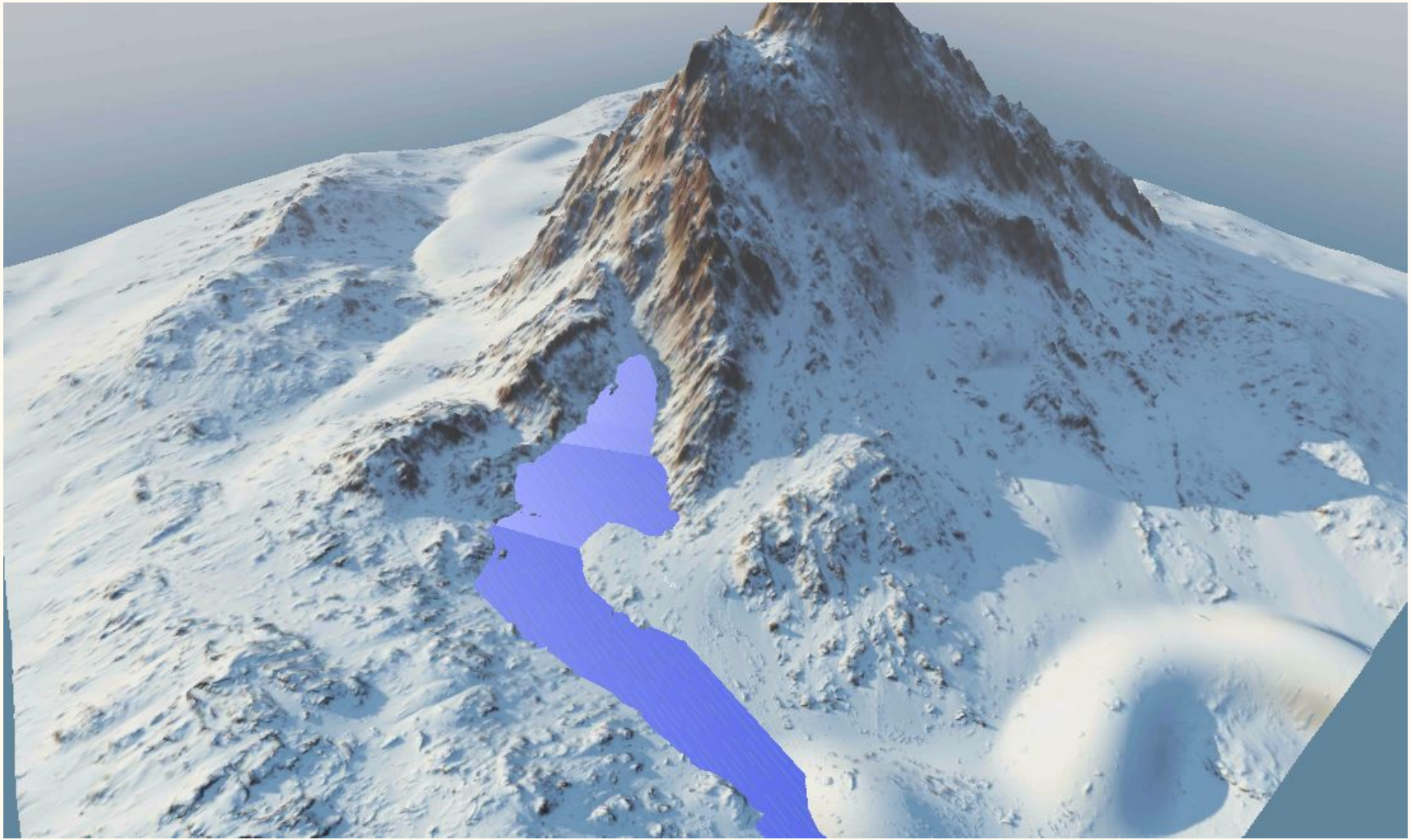
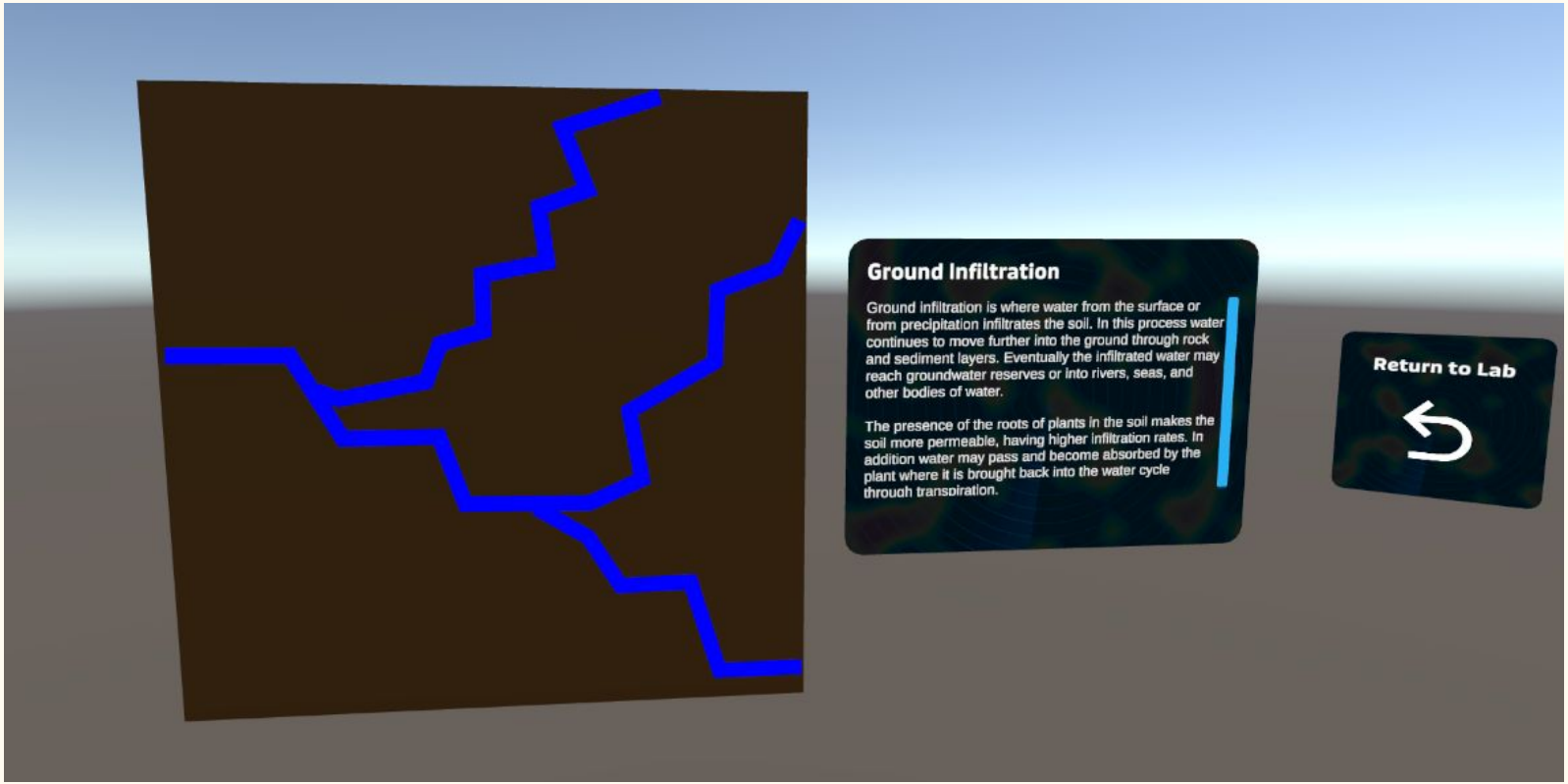
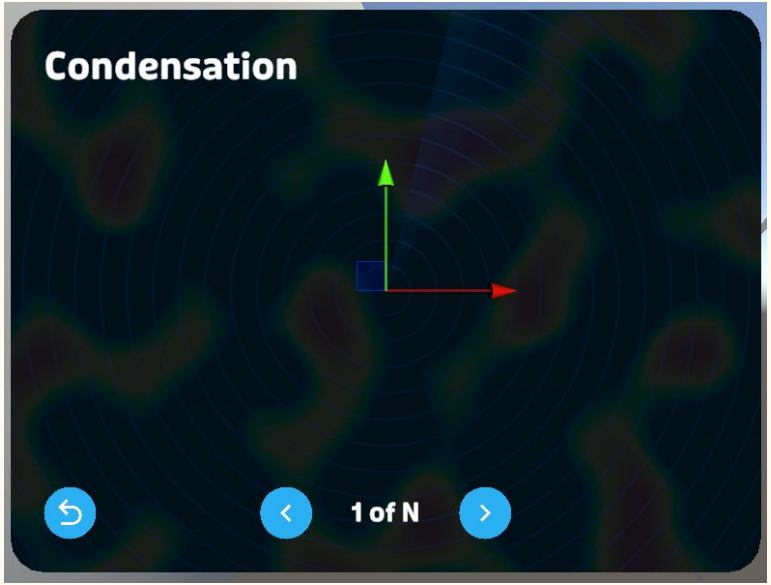



Ground Infiltration
Ground infiltration is where water from the surface or from precipitation infiltrates the soil. In this process water continues to move further into the ground through rock and sediment layers. Eventually the infiltrated water may reach groundwater reserves or into rivers, seas, and other bodies of water.
The presence of the roots of plants in the soil makes the soil more permeable, having higher infiltration rates. In addition water may pass and become absorbed by the plant where it is brought back into the water cycle through transpiration.
Return to Lab

Educational Panels

As the user navigates through the educational panels the environment changes. This creates user interaction while also informing the user about geological processes.



Results and Conclusion

- VR application with detailed visuals for each process in the hydrological cycle.
- Reinforces knowledge through slide decks.
- Will be available on Quest Store soon.