

Geologists look at earthquakes in 3D

Virtual reality technology allows for close inspection of fault lines

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The Greeks believed Poseidon caused earthquakes when he hit the ground with his trident. Legends in Siberia held that the earth shook when mythical dogs scratched at fleas. In Mexico, it was El Diablo who ripped the earth open from the inside. The lesson: earthquakes are beyond mortal control.

Humans can't stop earthquakes, but we can study them to learn what to expect in the future.

A fledgling virtual-reality technology at the UC Davis Keck Center for Active Visualization in the Earth Sciences (CAVES) allows scientists to view earthquake damage in three dimensions. CAVES projects 3-D high-resolution images onto three walls and the floor of a small room.

"It's better than a video game," said Michael Oskin, associate professor of geology at UC Davis.

By wearing 3-D goggles and holding a black remote sort of like a Nintendo Wii controller, geologists can zoom over an earthquake zone and draw on the 3-D map. They can stand inside the fault lines or peer out from underneath a mountain. Measuring the rates and directions of tectonic plate movement helps geologists predict the future magnitudes and frequency of quakes.

In the CAVES facility, the landscape doesn't seem bound by the confines of the room. Researchers stand on the floor, but the images make it feel like they are hovering above the ground.

"There's no sense of where the wall is," said Louise Kellogg, professor of geophysics at UC Davis. "The technology just drops away."

The CAVES program was created for UC Davis by the computer science department. Most of the images used by CAVES are taken by an aircraft-based imaging system that sends laser pulses toward the ground and records when the pulses bounce back - it's like radar, but with light.

Traditionally, teams of geologists walk along fault lines and meticulously hand-record the changes in topography. While this approach is detailed, it allows for human error. It's also hard to use the notes to create a clear before-and-after picture of a region.

Oskin pointed out that data could be missed from the ground; along the San Andreas Fault, many farmers have bulldozed over signs of earthquakes in the topography. With CAVES, geologists can inspect the landscape in a way that would not be possible otherwise.

"There's an exploration aspect to this," said Oskin. "It's so exciting."

After the earthquake in Haiti on Jan. 12, geologists wanted to study the area and assess the chances of future aftershocks, but adding scientists to the chaos in Port-au-Prince would have been irresponsible. At the time, World Bank was using planes to take 3-D images of refugee camps, and a group of geologists convinced them to fly over the fault too.

"The advantage of [CAVES] is we can do research without getting in the way of the rescue efforts and recovery efforts," Oskin said.

CAVES is useful for more than earthquake research. Kellogg said other 3-D programs allow scientists to stand on the surface of Mars or study the structures of proteins.

"It brings everything, whether it's really small or really big, to a human scale," Kellogg said.

According to the United States Geological Survey, there are about 10,000 earthquakes (mostly undetectable) every year in Southern California alone. Even if CAVES looks like a fancy videogame, it's a technology that could be useful in detecting future seismic shocks.