The Daily Camera

GPS tracks mountain action

$600,000 study focuses on the Rio Grande Rift

By Todd Neff, Camera Staff Writer
September 3, 2005

Go for a hike in the mountains, and a handheld global-positioning-system device can estimate your location to about 50 feet.

Measuring how the mountains themselves move takes a bit more accuracy.

A group led by Anne Sheehan, a University of Colorado geology professor and fellow of CIRES, is using GPS technology to track the otherwise subtle movement of mountains — in fact, of the entire Rio Grande Rift.

CIRES is a joint CU-National Oceanic and Atmospheric Administration research institute based on campus. The five-year study will focus on data from 24 GPS stations mounted along the rift in Colorado and New Mexico.

The Rio Grande Rift is a fracture in the Earth's crust that begins near Leadville and extends south through the San Luis Valley, Santa Fe and Albuquerque, N.M., and then south into Mexico. Geologists using seismic data have found that the continent is pulling apart at the rift by as much as half a centimeter per year. Over millions of years, it could turn the Rockies into a volcanic basin.

"We think it's just unzipping Colorado," Sheehan said.

But nobody quite knows how the Rio Grande Rift is going about its business. Mountains could rise or fall. The region may or may not become earthquake-prone.

And that's why Sheehan wanted to do the $600,000 study, funded by National Science Foundation.

GPS provides a window into geology normally closed to all but the hills themselves. Data taken over months or years can show volcanoes as they breathe, faults as they slip and land as it rebounds from the burden of the last ice age. But doing so pushes GPS technology to its limits.

GPS works by receiving signals from at least four orbiting satellites. These send both an estimate of their position and the atomic time. GPS receivers use the time of reception to understand how far away each satellite is, and then can use a receiver's distance from the satellites to estimate ground position.

Frederick Blume, a project manager with Unavco, a Boulder-based nonprofit that provides hardware and expertise to scientists using GPS for geological research, said squeezing GPS accuracy from 20 meters to millimeters takes two steps, both involving a lot of data processing.

First, engineers take into account such subtleties as gravitational variation and solar radiation pressure to understand exactly where GPS satellites were at the moment of transmission.

Second, they use the GPS radio-waves themselves — and not just the information carried by them — to more accurately measure exact distance to the satellites.

But even the millimeter-level precision these techniques afford don't cut it — the rift may only shift that much in a year. That's where time comes in.

Long-term measurements allow scientists to determine almost exactly where the GPS instrument was at a given moment.

The GPS monitors will be installed in the coming months. The measurements will occur over three years.

Geophysicists will use the data to model how tectonic plates undergo rifting.

Contact Camera Staff Writer Todd Neff at (303) 473-1327 or nefft@dailycamera.com.