Measuring Mount Rainier

Why measure mountains? Along with adventure, there are also very practical scientific, geodetic and public safety reasons.

While not the highest peak in the continental U.S., Washington state's iconic 4,392 m (14,410 ft) Mount Rainier is one of the most brutal and unforgiving to climb—with an always-present risk of volcanic activity. The glacial peak of treacherous crevasses and unpredictable weather can defeat even experienced mountaineers, sometimes tragically: the mountain claims lives nearly every year.

As an active volcano, Mount Rainier's height is of great interest and concern to surrounding communities; height changes could indicate volcanic activity that could release deadly walls of water and mud in what is known as a "lahar" mudslide.

In July 2010, the Land Surveyors Association of Washington (LSAW), using Trimble GNSS equipment and receiving data from the statewide Trimble VRS network, mounted their third expedition to measure the mountain. The U.S. Geological Survey (USGS) also provided gravity meters and sent a researcher to gather gravity readings, valuable for volcanic research and to provide more data for geoid models.

LSAW's "Rainier 2010" was in stark contrast to their first expedition in 1988, which was the first measurement of a major mountain using GPS. With more than 140 volunteer climbers and support personnel, the 1988 team used the pioneering Trimble 4000 Series Receivers as part of a regional post-processed GPS campaign. A second expedition in 1999 used Trimble 4800 Receivers and 32 volunteers.

The Rainier 2010 team of 14 volunteers used lightweight Trimble R8 GNSS Receivers and Trimble TSC2 Controllers, as well as solar chargers, portable meteorological units and broadband cellular, which enabled rapid connection to the Washington State Reference Network.

Supported by a base camp team of six, two teams of five and three climbers, respectively, set off on different routes, gathering gravity data and performing GNSS observations along the way. A storm destroyed the tent of the three-man team on the mountain's northwest face, forcing them to spend the second night in a snow cave. After descending the next day to get a new tent, they caught up to the team on the summit in one day: an amazing feat of climbing.

Once on the summit, the teams discovered that some of the original survey monuments had been stolen and the one remaining monument had been pried up several inches. Observations proceeded despite the continuing wild weather. A clever solution for dealing with the high winds was to place the R8 GNSS directly on the monument and brace it with rocks and snow. All climbers returned safely and the expedition is viewed as a great success.

With the observed height only a few inches higher than the previous expeditions, precisely the amount that the vandalized monument had been pried up, the LSAW issued a press release stating that the "published height of the mountain would remain the same," with no outward signs of volcanic activity.

See feature article in American Surveyor's February 2011 issue: www.amerisurv.com