GPS Can't Do That, Can It?

How developing a GPS seismometer led to a GPS snow, soil moisture, vegetation, and water level sensor

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About a decade ago I began working on developing methods so that GPS could be used to measure ground displacements during large earthquakes. At the time, almost all geodesists estimated station positions once per day, as this is entirely adequate for tectonic applications. Standard geodetic analysis tools (then and now) ignore the error caused by signals that reflect off the land surface. My group quickly realized that surface reflections were the largest error source in GPS seismology and developed tools to mitigate their impact. That early work in GPS seismology ultimately led us to new work in hydrogeodesy - where reflected GPS signals are used to turn a GPS antenna into a bi-static radar. The reflected GPS signals can be used to measure soil moisture, snow depth, water level and vegetation water content. We have been able to take advantage of the recently installed Plate Boundary Observatory (PBO) to apply these methods on a large scale; we call this initiative PBO H_2O (http://xenon.colorado.edu/portal). In this talk I will provide some background on GPS for tectonic and seismic applications, explain how GPS interferometry works, and then show water cycle products from the western U.S. derived from GPS data. I will also share some new work I've done using GPS data to detect volcanic plumes.