



## **GPS Can't Do That, Can It? – How building a GPS seismometer led to the development of GPS snow, soil moisture, vegetation, and tide gauge sensors (Christiaan Huygens Medal Lecture)**

Kristine M. Larson

Department of Aerospace Engineering Sciences University of Colorado, Boulder, CO, United States

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 GPS reflection data are used to measure soil moisture, snow depth, sea 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<sub>2</sub>O (<http://xenon.colorado.edu/portal>). In this talk I will describe how we estimate soil moisture, snow depth, snow water equivalent, vegetation water content, and sea level from GPS data. I will also show some new work I have been doing using GPS signals to detect ash in volcanic plumes.