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Effects of the troposphere on GPS and InSAR point target analysis for measurement of crustal deformation and vertical motion near Yucca Mountain, Nevada

W. C. Hammond[1]; G. Blewitt[1]; H. Plag[1]; C. W. Kreemer[1]; Z. Li[2]
1. Nevada Bureau of Mines and Geology, Nevada Geodetic Laboratory, Reno, NV, United States.
2. Department of Geographical and Earth Sciences, University of Glasgow, Glasgow, United Kingdom.

Precise measurement of vertical motions of the solid Earth with space based geodetic techniques such as GPS and Interferometric Synthetic Aperture Radar (InSAR) is complicated by the presence of the atmosphere. A fundamental question is to what degree do GPS and InSAR provide similar information about the delays in signal propagation associated with the troposphere. Knowledge of this relationship can improve methods for using GPS to correct for the effects of atmosphere in InSAR, or vice versa.

To isolate residual signals associated with the atmosphere in GPS using the GIPSY-OASIS II software, we apply a height-dependent dry delay, and solve for wet zenith delay and its two horizontal gradients every five minutes as a random walk process. We estimate the residual phase from InSAR as the difference between phase and the expected phase based on interferometric point target analysis performed with the Gamma IPTA software module. We will investigate correlations between 1) the GPS troposphere zenith delay estimates at the time of radar scene acquisition, 2) the GPS height estimate residual to the linear rate in height, and 3) the GAMMA IPTA derived atmospheric delays (including orbit errors).

As a test case we will use the long running and stable GPS sites of the Basin and Range Geodetic Network (BARGEN) in the vicinity of Yucca Mountain, Nevada. These sites have been shown to exhibit extremely clean time series, likely attributable to the very high quality monumentation, stability of GPS equipment, dry atmosphere over the Great Basin, and low rates of crustal deformation. This, in addition to the high density of stations (16 sites within a 50 km radius), makes the Yucca mountain regional network one of the best possible localities for the analysis of the relative contributions to noise in GPS vertical rates and atmospheric contributions to InSAR measurements.

Contact Information
William C. Hammond, Reno, Nevada, USA, 89557-0178, click here to send an email