Mount St. Helens returned to an active eruptive state March 20, 1980. Since then explosive and dome building eruptions have caused major topographic changes to the mountain and surrounding drainages. Monitoring of the southern side of the mountain by six tiltmeters at distances between 6 km and 12 km was conducted during the period of July 1, 1980 to December 31, 1980. Records obtained from the tiltmeters were analyzed and compared to data from precision geodetic surveys.
Results of this analysis indicated that minimal correlation existed between any of the tiltmeter sites and geodetic surveys at any given time. Correlation of tiltmeter change to eruptive events was also minimal. Short term changes in tilt correlative to eruptive event onset were not distinguishable above background noise. Possible minor correlation of tilt change to the October, 1980 eruption exists for the Ape Cave and Ape Cave North tilt sites, but absolute correlation was not possible. Long term tilt results indicated that the borehole tiltmeter sites recorded downslope soil movement greatly in excess of predicted volcanic deformation.

Results of deformation modeling indicated that at distances greater than 6 km from the vent, changes in tilt would be less than 3 μrad for any eruption, commonly near 1 μrad. Records from all of the tiltmeter sites indicated changes from any eruption during the study period were less than 1 μrad. Single chamber model deformation curves fit early 1980 deformation patterns, explaining recorded eruption related tilt change at Ape Cave North during the May 18, 1980 eruption. Evolution of the magmatic system into a two chamber system by October, 1980 correlates well to modeled surficial deformation from a two chamber model.

Conclusions from the study in terms of far-field tiltmeter use in monitoring Mount St. Helens are: 1) based on modeled deformation patterns, for volume changes of less than .05 km$^3$, the deformation changes at distances greater than 6 km from the vent termination will be indistinguishable above background noise at any tiltmeter site in use during this study, 2) all borehole tiltmeters sites used in this study
recorded soil creep in great excess of expected volcanic deformation changes, and 3) that use of far-field tiltmeters for real time monitoring of this type of deformation system is of little value.