

A 4th Leg for EarthScope:

New Possibilities with InSAR and Imaging Geodesy

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For centuries, measurement of the shape of the Earth (called the science of geodesy) was necessarily time consuming. Even with new technologies like the Global Positioning System (GPS), vast portions of the Earth remain infrequently monitored for movement. Recently, a new form of geodesy has rapidly developed whereby image pairs can be compared to infer movements of the Earth's surface. Called geodetic imaging, the synoptic aircraft or satellite views allow large regions to be surveyed densely without any human setting foot in the area. Imaging geodesy encompasses several different types of methods including Interferometric Synthetic Aperture Radar (InSAR), the automated comparison of SAR and optical images via pixel tracking, and precise measurements of topography and topographic change using high-resolution stereo photographs and Lidar.

A US InSAR satellite to study crustal deformation was part of the original Earthscope plans, and will not happen sooner than 2020. On the other hand, InSAR data for North America is becoming increasingly available from foreign space agencies. Thanks to efforts from the GeoEarthscope project, NASA, the Alaska Satellite Facility, UNAVCO and WInSAR (winsar.unavco.org), there are more than 300 Terabytes of raw SAR data available over the Earthscope area between 1992-2011. Vastly more data is anticipated: The European Space Agency launched the Sentinel SAR satellite in 2014 and has an open data policy and a 20-year plan for continuous acquisition. NASA and the Indian Space Agency currently have a SAR mission in formulation called NISAR that is scheduled to launch in 2020. Thus, the vision in the Earthscope founding documents for spatially and temporally dense InSAR observations over North America is being realized. Other types of geodetic imaging were less mature when

Earthscope was being developing in the 1990's. The GeoEarthScope project collected a significant airborne Lidar dataset, but with current datasets (for example the Digital Elevation Models derived from the < 1 m/pixel WorldView optical images available through the Polar Geospatial Center) and software, there is the potential for mapping topography and topographic change on continental scale. In the presentation, we will describe how imaging geodesy can be used to synthesized with other datasets to address Earthscope science questions.



Fig. 1. The slide at left was shown by the first author during a Mini-course during the 2007 Earthscope National Meeting entitled "GPS/InSAR and Earthscope" and too many times since then. In 2015, it can now be retired.