ALOS Interferometry for Recovery of Coseismic and Interseismic Deformation

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PALSAR aboard ALOS is the first spaceborne L-band SAR designed for monitoring crustal deformation associated with earthquakes, volcanoes, and crustal fluids. Its long wavelength, high bandwidth, and accurate orbit make routine and accurate interferogram formation possible. The global acquisition scenario provides the opportunity to capture the coseismic signal from all major land earthquakes. The most important example was the recovery of 2 components of deformation from the 270 km long rupture from the M7.9 Wenchuan Earthquake, May 18, 2008 that killed 70,000 people and left 5 million homeless. The descending deformation map was provided by repeat-pass ScanSAR to ScanSAR interferometry – another first for ALOS. Although capturing co-seismic deformation with ALOS has become routine, monitoring interseismic deformation is much more challenging. We focus on the San Andreas Fault System (SAFS) where a devastating Wenchuan-size earthquake is likely in the next 30 years. The 1000-element GPS array of the Plate Boundary Observatory provides broad-scale crustal strain measurements but the GPS spacing is too large to capture the narrow strain concentrations along the faults. Models show that earthquake recurrence interval is inversely proportional to crustal strain accumulation rate so accurate measurements are critical for understanding the earthquake cycle and thus earthquake risk. Stacks of radar interferograms can be used to map the narrow areas of high strain concentration but temporal decorrelation of C-band interferograms prevents interseismic measurements on the northern ¾ of the SAFS. In contrast PALSAR interferograms retain correlation along the entire fault system for at least one year. We are developing a remove/restore approach to optimally combine the long wavelength (>40 km) strain derived from point GPS measurements with the short wavelength strain from ALOS. Because of the drifting orbit of ALOS and the relatively infrequent acquisitions, especially along descending tracks, at least two more years of data acquisition will be needed to completely resolve the strain field along the SAFS.