# SuperSAR: A Mission to Detect Earth Surface Deformation in Three Dimensions from a Single Satellite Platform

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Earth surface deformation occurs in three dimensions. The technique of repeat-pass interferometric synthetic aperture radar InSAR is a powerful tool for monitoring the deformation that arises through a broad spectrum of natural hazards and commercial processes. Applications of InSAR include studies of co-seismic, inter-seismic, and post-seismic deformation, tectonic rifting, volcanic uplift, land subsidence, landslides, glacier motion, the extent of grounded ice sheets, atmospheric water vapour, wetland flooding, canopy biomass, and signals associated with the commercial extraction and injection of gases, fluids, and solids. The major limitation of the current generation of InSAR sensors remains their ability to detect only a single component of the Earth surface deformation vector, in a direction perpendicular to the instrument flight path.

SuperSAR is a novel, multi-azimuth SAR that is capable of detecting Earth surface deformation in three dimensions. The instrument will sample deformation perpendicular and parallel to the satellite ground track, simultaneously, using the established techniques of repeat pass, conventional InSAR and multiple aperture InSAR, respectively. The third component of the deformation vector is resolved through a combination of observations recorded in ascending and descending satellite orbits. The key design feature of SuperSAR is the addition of multiple beams in the azimuth direction that are generated using simultaneous or sequential excitation of the same antenna. The multi-azimuth concept means that SuperSAR is uniquely able to resolve the full three-dimensional deformation vector using only a single satellite platform, providing a fundamental advance in the capacity of the present and planned generations of InSAR sensors.