REQUIREMENTS AND OBSERVATIONAL ARCHITECTURES FOR MONITORING CRUSTAL DEFORMATION FROM SPACE

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An study was carried out for NASA to develop a long-term strategy for spaceborne observations and modeling to support improved earthquake forecasting. The investigation considered a range of approaches and observations, but focused the effort on obtaining high spatial and temporal resolution interferometric synthetic aperture radar (InSAR) measurements, as this approach was deemed to have the highest value in advancing understanding of earthquake physics and enabling improved earthquake forecasting. The InSAR observational requirements are driven by the need for long-term measurement series calibrated in an absolute sense to resolve interseismic strain, and high temporal resolution measurements to capture the spatial complexity of transient deformation such as postseismic relaxation, slow earthquakes and triggered seismicity. The study assumed that a pathfinder L-Band InSAR satellite in Low Earth Orbit (LEO) would be launched as planned to support EarthScope; our trade-studies therefore focused on higher vantage points and constellation architectures for follow-on observations. Three orbit altitudes were considered: enhanced LEO, Mid Earth Orbit (MEO), and Geosynchronous (GEO). To fully address the requirements for observing with frequent revisit times, a constellation of InSAR satellites is required, with higher MEO and GEO orbits offering significant advantages for continuous observing. An L-band system is favored for maintaining long-term correlation, while strategies for tropospheric mitigation (by stacking observations or modeling the wet delay) are key to maximizing the accuracy of the time series, and maintaining absolute calibration.