Monitoring our hazardous planet with Sentinel-1 InSAR: Results and prospects from COMET

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Sentinel-1A has now been in orbit since April 2014, and collecting data routinely for more than a year. Here we review progress within COMET(*) towards our ultimate goal of building a fully-automated processing system that provides deformation results and derived products to the community for all tectonic and volcanic areas.

The Sentinel-1 constellation (the 1B satellite will be launched in early 2016) has several advantages over previous radar missions for InSAR applications: (1) Data are being acquired systematically for tectonic and volcanic areas, (2) Images cover a wide footprint, 250 km from near to far range in Interferometric Wide Swath (TOPS) mode, (3) Small perpendicular and temporal baselines greatly improve interferometric coherence at C-band, (4) The mission is planned to be operational for 20 years, with 1C and 1D planned for future launches, (5) Data are freely available to all users.

Since reaching its operational orbit in August 2014, Sentinel-1A has provided valuable data for a number of geological events. These include earthquakes in Napa (August 2014), Nepal (April 2015), and Chile (September 2015) and eruptions at Fogo (November 2014) and Calbuco (April 2015). We will show results from these events, as well as the ongoing monitoring of postseismic deformation following the earthquakes.

Many tectonic faults and volcanoes are deforming very slowly. To provide results with this accuracy comparable to GPS (~1 mm/yr) on tectonic length scales (~100 km) requires time series analysis of 3-5 years of data acquired every 6-12 days, and atmospheric corrections. With 1 year of data, we can only expect to resolve slow deformation in areas where the deformation occurring in 1 year exceeds ~40% of the uncorrected atmospheric noise. This condition should be met along the North Anatolian Fault, and for some volcanic systems in South America. We will show preliminary regional analyses of these areas.

We will also show results of a systematic analysis of interferometric coherence in tectonic and volcanic areas, and discuss the future goals and timeline for our processing system.

* COMET is the UK Natural Environment Research Council's Centre for the Observation and Modelling of Earthquakes, Volcanoes, and Tectonics.