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Operational monitoring of our hazardous planet with Sentinel-1

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The European Commission's Sentinel-1 constellation, operated by ESA, has been a game changer for operational monitoring of our hazardous planet. When fully operational, the Sentinel-1 mission is a two-satellite constellation; currently consisting of Sentinel-1A (launched in 2014) and Sentinel-1B (launched in 2016), the mission provides at least one SAR image for the whole land surface every 12 days, with both ascending and descending data acquired in tectonic/volcanic areas globally every 12 days, and images acquired in both geometries every 6 days over all of Europe. The narrow orbital tube, consistent imaging geometry, and long time series are optimised for ground deformation measurements with InSAR. Sentinel-1C and -1D have been built and will replace the existing satellites in due course. Perhaps the most important game changer has been the Copernicus data policy, which mandates fully free and open distribution of Sentinel-1 products for all applications, whether they are for research or commercial purposes. Sentinel-1 InSAR data has quickly become the primary data set for monitoring ground movement in our hazardous planet. Several research organisations/collaborations now process enormous quantities of Sentinel-1 data to produce deformation products that are made freely available through organisations like COMET in the UK, EPOS and the new European Ground Motion Service in Europe, and the Alaska SAR Facility in the US. Commercial providers are processing data at scales ranging from individual bridges/dams through to whole countries. In this presentation we will focus on Sentinel-1 results produced academically by COMET and commercially by SatSense Ltd. COMET now responds routinely to all continental earthquakes bigger than M5.5 and provides interactive tools and machine-learning-based alerting for global volcanoes. COMET is combining Sentinel-1 InSAR with GNSS to map tectonic strain at high spatial resolution on a continental scale, in areas including Anatolia, Tibet and Iran, and using the results to improve our understanding of seismic hazard. SatSense have demonstrated the value of Sentinel-1 InSAR for applications including dam monitoring, water pipe failures and railway infrastructure. The SatSense processing approach allows InSAR ground movement data to be kept continuously up to date for entire countries. We conclude the presentation by discussing prospects for the future of InSAR beyond Sentinel-1.