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Recent dynamic of Long Valley volcanic area investigated with Differential SAR Interferometry

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The Long Valley area is a tectonic basin surrounded to the West by the Sierra Nevada and to the East by the White mountains. The basin includes two different volcanic districts: the Long Valley caldera to the South and Mono Basin to the North. Long Valley caldera was formed following the cataclysmic Bishop Tuff eruption about 0.76 Ma ago; between 0.76 and 0.6 Ma ago, the caldera uplift and the rhyolitic lava flows eruption formed the resurgent dome. The most recent activity occurred about 600 yr ago from the Mono-Inyo craters to Mono lake [1]. In order to detect the mean deformation patterns of the Long Valley area and to analyze their temporal evolution we performed a Differential SAR Interferometry (DInSAR) analysis via the Small BAseline Subset (SBAS) algorithm [2]. In particular, we used 23 SAR images, spanning the time interval from 1992 to 2000, acquired by the ERS-1/2 sensors from descending orbits (track 485, frame 2845). Overall, we generated 64 multilook interferograms (with 20 looks in azimuth and 4 looks in range) characterized by a maximum spatial baseline of 300 m, a time interval not exceeding 4 years, and a maximum Doppler frequency separation of 1000 Hz. Precise satellite orbital information obtained from the Technical University of Delft (The Netherlands) and the 3 arc second (about 90 x 90

m) SRTM DEM of the investigated area were also used. As key results of the DInSAR SBAS analysis we generated both mean deformation velocity maps and displacement time series of the area. Based on the retrieved displacement we have identified two main deformation patterns. The first one involves a broad uplift of the Long Valley caldera floor that extends outside the caldera border. The second effect represents a subsidence of the volcanic Paoha island located within the Mono Lake. A comparison between the retrieved DInSAR deformation time series for these two areas shows deformation trends, during the 1995-1999 period, that are roughly equal but opposite in sign. Moreover, preliminary analysis highlights a good agreement between the DInSAR data and the geodetic measurements that are available inside the Long Valley caldera only. We will examine in this study the range of possible physical explanations that might account for this apparent deformation synchronicity between Mono lake and Long Valley caldera.

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[2] P. Berardino, G. Fornaro, R. Lanari, E. Sansosti: “A new Algorithm for Surface Deformation Monitoring based on Small Baseline Differential SAR Interferograms”, IEEE Transactions on Geoscience and Remote Sensing, Vol. 40, No. 11, pp. 2375-2383, November 2002.