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Detecting the unrest episode at Campi Fegrei, Italy, by nanosensitivity instruments

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The region of Campi Flegrei west of Naples, Italy, has a long history of local vertical deformation recorded both by marine terraces c. 6000 BC and by an archaeological record of subsidence and uplift of harbour works and other near-sea level structures since the days of ancient Rome Following the 1538 Monte Nuovo eruption which raised the coast near Pozzuoli 7 m, the coast subsided and was recorded sinking at 7 mm/yr between 1822 and 1848. This subsidence has been interrupted by episodes of uplift. Between 1982 and 1985 peak uplift of 1.7 m occurred which was associated with local microseismicity, since which time the region has been slowly subsiding. In the past decade subsidence has been arrested and has been replaced with intermittent episodes of inflation. At the time of writing coastal inflation continues at a rate of 0.1-1 mm/week. Since 2004 a nanostrain sensitive set of dilatometers allowed to monitor at unprecedented levels the miniuplift episode occurred in the period 2005-2006. We report here the installation of an array of water-pipe tiltmeters with lengths between 28 m and 278 m in tunnels near the region of inflation and deflation associated with subsurface magma chamber activity in the Phlegraean Fields, Italy. The objective of the measurements is both to monitor volume changes in subsurface magma system, and also to monitor possible changes in the ensemble rheology of the magma and its confining rock. The first requires instruments immune to local sources of non-tectonic noise, and the second requires sensors capable of monitoring onshore tilts resulting from the rich spectrum of tidal and seiche loading in the Bay of Pozzuoli at 1 to 20 cycles per day. We describe here initial results from two locations in the town of Pozzuoli that suggest that accuracies of 1% for sub-microradian tilts can be obtained in the period range 10 minutes to DC, with sub nanoradian resolution.