

Long-period ground oscillations at Campi Flegrei caldera from borehole tiltmetric data

Mariarosaria Falanga¹, Enza De Lauro², Simona Petrosino³, Ciro Ricco³

¹*Università di Salerno, Dip. di Ingegneria dell'Informazione ed Elettrica e Mat. applicata/DIEM, Fisciano, Italy*

²*Università degli Studi Roma Tre, Dipartimento di Architettura, Rome, Italy*

³*Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Napoli - Osservatorio Vesuviano, Italy*

We show an analysis of tiltmetric time series from borehole instruments at Campi Flegrei caldera. We evaluate the crustal response in terms of ground tilting of the entire caldera to external excitations such as long/medium period tidal constituents, by adopting Independent Component Analysis, a nonlinear technique. The main aim is to understand an eventual relation between long-period tides and fluid circulating in the hydrothermal shallow system.

Indeed, diurnal (solar) and long-period (fortnightly and monthly) components are recognized in the tilting. These tidal constituents cause an oscillatory deformation pattern, superimposed to the normal deformation trend of the area. Moreover, we show that the tilting plane orientations are controlled by the local stress field and the structural features and that the amplitude of the tilt reflects the rheology of the site.

These observations indicate the occurrence of structural and thermoelastic site effects. Their knowledge is useful not only for removing the external tidal contribution in the tiltmetric series, but also in delineating the local geology and focusing on the internal sources related to the volcano dynamics. A variation in the fluid circulation may induce a change in the revealed pattern, which can be promptly detected.

The promising results we obtain lead us to believe that the same approach can be extended to other tiltmetric networks in volcanic areas, for thorough and detailed analyses of the tiltmetric time series and more accurate studies of the endogenous sources.