Detection of ground deformation at the Neapolitan volcanic area (Southern Italy)

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The correct definition of the background level of ground deformation is a very important aspect in geodetic monitoring of volcanic areas. Indeed, it could allow a fast identification of an anomalous deformation trend that evolves towards an eruptive event. It is interesting confirm that any ground deformation modifies the distribution of the time series amplitude so significantly that this behaviour could be used as the marker of an effective source driven deformation.

As an example, we analyse the site position time series of Neapolitan Volcanic Continuous GPS (NeVoCGPS) network operating on three volcanic active districts (Somma-Vesuvius volcano, Campi Flegrei Calder and Ischia Island) in a densely inhabited area, recorded during the period 2001-2007. These GPS time series reveal a very peculiar behaviour. When a clear deformation is observed, the amplitude distribution evolves from a gaussian to a bivariate gaussian distribution. This behaviour can be characterized by evaluating the kurtosis. The time series for all stations have been modelled with a fifth order polynomial fit. This represents the deformation history. Indeed, when this polynomial is subtracted from the time series, the distributions become again gaussian. A simulation of the deformation time evolution reveals that the amplitude distribution evolves towards a non gaussian behaviour if the ground deformation starts at 2/3 of the time series duration.