



## Clues of the deformation source at Campi Flegrei (Italy) from the use of the Akaike Information Criterion

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Volcanic risk in the explosive Campi Flegrei (CF) caldera is extremely high, because of its location in a densely populated area about 15 km west of Naples inside the Campanian Plain. The caldera has been generally subsiding (at about 1.5 cm/yr) from 1538 (last eruption) till 1969. A substantial ground uplift, more than 1.5 m, occurred in the period 1969-1972 and, after a small subsidence of about 30 cm after 1972, a very large uplift occurred in the period 1982-1984 (about 1.8 m), with subsequent partial recovery (about 60 cm in 2 yr). Superposed on the still continuing subsidence are some short uplift phases (mini-uplifts with a few cm amplitude); ground level still remains about 2.5 m above pre-1970 levels at the town of Pozzuoli.

The interpretation of deformation data (levelings, EDM, GPS, SAR) is the subject of long-lasting work and several papers. A number of different source models have been tested and/or proposed, including points of isotropic expansion (Mogi sources), rectangular tensile sources, pressurized cracks, expanding prolate spheroids, small triaxial ellipsoids, small sources with a generic moment tensor. Also the number of sources (one, two, or even more) is debated.

Up to now, there is no systematic comparison among the capability of the different sources to account for deformation data. In case two or more sources are compared, the model giving the lowest normalized chi square is usually preferred. But the minimum normalized chi square is not a good criterion of choice. If nested models (the more complicated model includes the simpler one as a particular case) have to be compared, the F-test approach could be used. Unfortunately, the F-test is unreliable if residuals depart from the normal distribution even slightly, and is not valid if the models are not nested. The Akaike Information Criterion (AIC) is a measure of the goodness of fit of an estimated statistical model. It is based on information theory and does not use hypothesis testing, so there is no conclusion about statistical significance and rejection of a model, but does not require the models to be nested, and thus all models can be compared.

Here we show the results of a systematic comparison among different models of the source(s) of the Campi Flegrei deformation, with particular emphasis on the 1982-1984 unrest, using AIC.