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A model for seismicity rates observed during the 1982-1984 unrest at Campi Flegrei Caldera (Italy).

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In order to model seismicity during the 1982-1984 unrest at Campi Flegrei caldera (Italy), we compute static stress changes caused by an inflating source in a layered half-space. Stress changes are evaluated on optimally oriented planes for shear failure, assuming a regional deviatoric stress with horizontal extensional axis trending NE-SW. The inflating source is modelled as inferred by previous studies based on the inversion of geodetic data and having the same crustal model here assumed. We found that the area affected by the largest Coulomb stress changes is elliptical and that inverse slip over the source can be discouraged by the assumed regional stress. These results are in agreement with observations concerning seismicity developed during the 1982-1984 unrest at Campi Flegrei. We assume that the temporal evolution of uplift observed by a tide-gauge at Pozzuoli, normalized to the maximum value, was due mainly to time dependent processes occurring at the inflating source. We attribute the same normalized time-dependence to each component of stress change (shear and normal stress changes) averaged in the region interested by the observed seismicity. We then model seismicity rate changes associated to these time-dependent stress changes, by following the approach indicated by Dieterich (1994) on the basis of the rate- and state-dependent rheology of faults. The seismicity rate as a function of time resulting from the present model is in general agreement with observations for the period 1982-1984. According to observations, several peaks of deformation rate history are closely followed by peaks in seismicity rate. In order to model this effect, a prompt response of the fault system is required, allowing to constrain the direct effect on friction ($a\sigma$) on the same faults.