Seismological constraints on the intrusive mechanism leading the 2001 Etna eruption

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The 2001 Etna eruption occurred from July 17th to August 9th, 2001 and was preceded by several days of intense seismicity and ground deformation. We investigated the seismic activity recorded during November 2000 - June 2001 interval time preceding the eruption, to understand the meaning of the seismicity connected to the dike intrusion, that locally modified the stress field acting in the area.
The earthquakes were recorded by the permanent local networks operating during that time and run by the Istituto Internazionale di Vulcanologia (IIV-CNR) and the Sistema POSEIDON.
During the analyzed period, 683 earthquakes have been firstly localized by means of a 1D velocity model derived from Hirn et al., 1991 using the software HypoEllipse [Lahr, U. S. Geol. Survey, Open-File Report, 89/116, 81 pp., 1989].
In order to further improve the quality of the seismic dataset, we extracted 522 earthquakes with Gap less than 200°, Erh < 1.5 km, Erz < 2 km, RMS less than 0.5 sec, and a minimum number of S phases equal to 2. This latter seismic dataset was relocated using TomoDD code [Zhang and Thurber, BSSA, 93, 1875-1889. 2003] and a 3D velocity model [Patanè et al., Science, 313, 821-823, 2006 after modified].
Using first motion polarity data, 3D fault plane solutions were computed by means of the software FPFIT [Reasenberg and Oppenheimer, U.S. Geological Survey Open File Report, 85/739, 109 pp, 1985]. Then, adopting restricted selection criteria (Npol more than 12; focal plane uncertainties less than 20°; number of solutions < 2; number of discrepancies less than 15%), we selected 116 FPSs.
This dataset represented the input file for the stress and strain tensors computation using the inversion codes developed by Gephart and Forsyth,[JGR 89: 9305-9320, 1984] and by Kostrov [Izv Acad Sci USSR Phys Solid Earth, 1, 23-40], respectively.
On the basis of P and T axes distribution and the orientation of the main seismogenic stress and strain axes, we put some seismological constraints on the recharging phase leading to the 2001 Etna eruption.