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The source of Ultra-Long-Period events preceeding vulcanian paroxysms at Stromboli volcano (Southern Italy)

L. D'Auria (1), F. Giudicepietro (1), M. Martini (1), A. Linde (2), and S. Sacks (2)

(1) Istituto Nazionale di Geofisica e Vulcanologia, sezione di Napoli, (2) Carnegie Institution of Washington, Department of Terrestrial Magnetism

Stromboli is usually characterized by a persistent mild Strombolian esplosive activity. During the two most recent effusive eruptions (2002-2003 and 2007) violent vulcanian explosions occurred.
The first event (April 5th 2003) was recorded by a network of 9 broadband stations. The event was preceeded by an Ultra-Long-Period (ULP) signal clearly recognizable since few minutes before the explosion onset. The characteristic period of these signals is much longer than the low cut-off frequency of the broadband sensors used (about 60 s), so it should be ascribed mostly to a tilt response rather than to a ground acceleration.
The second event (March 15th 2007) again was preceeded by a clear ULP event and was recorded by a network of 13 broadband stations and 2 dilatometers. The strain signal recorded by the dilatometers shows an emerging onset starting many minutes before the explosion.
The analysis of the source mechanism has been performed using an approach similar to the source function inversion technique used for Very-Long-Period and Long-Period signals. In this case we have assumed a quasi-static approximation, neglecting the contribution of the horizontal acceleration on the recorded signals. The ground deformations (displacement, horizontal tilt and volumetric strain) can be represented by a dipole moment tensor component giving information about the source centroid position and geometry. The introduction of a quadruple moment tensor component can give information on the source dimensions as well but this requires a different inversion strategy. Generalized Green's functions have been computed using a Finite-Element approach. Actually they consists in strain nuclei and their spatial derivatives up to second order. We will show some preliminary result of the inversion using the broadband recording and the dilatometric signals.
The study of these signals has both scientific and practical consequence. Contrary to the more known VLP events, which are related to the persistent Strombolian activity, because of their different mechanism the study of the ULP events can shed light over deeper portion of the conduit and different eruptive dynamics. On the other hand from an applicative point of view they are fundamental for developing an early warning system of these dangerous explosions.