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Moment tensor inversion of very-long-period seismicity observed in a very-near-field condition at Stromboli volcano

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In recent decades, waveform inversion for very-long-period (VLP, 2-100 s) seismicity associated with volcanic explosions has been widely used to estimate the best source mechanism and location by minimizing the residual between observation and model (e.g., Chouet et al., 2003; Ohminato et al., 2006; Maeda et al., 2011). Source mechanism of explosions at Stromboli volcano, Italy, has been interpreted to be the pressure source of an opening/closing crack embedded in the volcanic medium that is located at 160 m northwest of, 220-260 m beneath the active craters (Chouet et al., 2003). However, evidence indicates that the source of VLP at Stromboli is changing in time following the change of the shallow magma column (Ripepe et al., 2015; Valade et al., 2016).

We have conducted a temporary seismic observation at Stromboli on September 2016 with 5 temporary and 3 permanent broadband stations. The temporary network had been deployed as close as possible (only 100-300 m) to the active craters. We applied a moment tensor inversion method (Waite et al., 2008) to VLP signals associated with explosions at the north-east (NE) crater. The result shows that the optimal source location is located at ∼100 m west of, ∼160 m beneath the south-west (SW) crater. The source mechanism is greatly dominated by the vertical component of the moment tensor, although the polarity inverts with other two isotropic components and with the observed seismograms in the vertical component. The squared error between observation and model (Ohminato et al. 1998) is only 11%. However, if we consider the moment tensor solutions beneath the NE crater this is dominated by the isotropic three components and the polarities coincide with the observed seismograms. The squared errors remains of only 7-11% from the optimal solution. This suggests that the solution beneath the NE crater is also possible and that the moment tensor solution is not stable. These may be caused by the point source assumption and/or by the dramatic changes of the directivity of the seismograms in the 'very' near-field network due to small changes in the source location.