

## Rupture history of the 1997 Umbria-Marche (Central Italy) main shocks from the inversion of GPS, DInSAR and near field strong motion data

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### Abstract

We investigate the rupture history of the three largest magnitude earthquakes of the 1997 Umbria-Marche sequence by inverting GPS, DInSAR and near-source strong motion waveforms. We use the frequency domain inversion procedure proposed by Cotton and Campillo (1995) and calculate the Green's functions for a layered halfspace using the discrete wavenumber and reflectivity methods. We first invert GPS measurements and DInSAR interferograms to image the coseismic slip distribution on the fault planes in a layered half space for the two earthquakes that occurred on September 26, 1997 at 00:33 UTC ( $M_w = 5.7$ ) and 09:40 UTC ( $M_w = 6.0$ ) near Colfiorito. We also invert DInSAR interferograms to infer the slip distribution during the subsequent earthquake that occurred on October 14, 1997 at 15:23 UTC ( $M_w = 5.6$ ) in the SE section of the seismogenic zone near Sellano. We also explore the set of acceptable solutions using a genetic algorithm to have information on the available resolution of geodetic data. The slip models obtained by geodetic data inversion are used to perform a forward modeling of strong motion waveforms for all three events. We adopt a constant rupture velocity of 2.6 km/s and a constant rise time of 1 s. Our results show that these rupture models provide an acceptable fit to recorded waveforms. Finally, we invert the recorded ground displacements, collected during the September 26th 09:40 main shock and the October 14th Sellano earthquake, to constrain the rupture history. We use the geodetic slip distribution as starting model for the iterative inversion procedure. The retrieved rupture models are consistent with those inferred from geodetic data and yield a good fit to recorded seismograms. These rupture models are characterized by heterogeneous slip distribution and an evident rupture directivity in agreement with previous observations.

### Keywords

slip history; waveform inversion; geodetic data modeling; Colfiorito earthquakes; kinematic source models

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### References

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
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