Quick moment tensor solution for 6 April 2009, L'Aquila, Italy, earthquake*

Chao Liu¹ Lisheng Xu^{1,*} and Yun-tai Chen^{1,2}

¹ Institute of Geophysics, China Earthquake Administration, Beijing 100081, China

² School of Earth and Space Sciences, Peking University, Beijing 100871, China

Abstract A M_w 6.4 earthquake occurred in L'Aquila, central Italy at 1:32:42 (UTC), April 6, 2009. We quickly obtained the moment tensor solution of the earthquake by inverting the P waveforms of broadband recordings from the global seismographic network (GSN) stations using the quick technique of moment tensor inversion, and further inferred that the nodal plane of strike 132° , dip 53° and rake -103° is the seismogenic fault.

Key words: L'Aquila earthquake; moment tensor solution; focal mechanism; fault parameter

CLC number: P315.3

Document code: A

A M_S 6.4 strong earthquake occurred in L'Aquila (42.4°N , 13.3°E), central Italy (from China Earthquake Network Center (CENC)) at 1:32, April 6, 2009 (UTC). We quickly obtained the moment tensor solution of the earthquake by inverting the P waveforms of broadband recordings from the GSN stations using the quick technique of moment tensor inversion (Liu et al, 2008). The inverted results are shown in Tables 1, 2 and Figure 1, in

which the epicenter and source depth are from USGS/NEIC.

During the inversion process, we used the standard global velocity structure model (Kennett and Engdahl, 1991) and the reflectivity method (Kennett, 1983) to calculate the Green functions. And we used the P-waveforms of the vertical component only since horizontal components of the recordings get more interfered.

2009-04-06 01:32:42 UTC
(2009-04-06 09:32:42 Beijing Time)
Epicenter: 42.334 13.334

IGP-CEA Moment Tensor Solution
Chao Liu, Li-sheng Xu, Yun-tai Chen

Depth 10 km No. of sta: 32
 $M_w = 6.4$

Moment Tensor: Scale $10 \times 18 \text{ N} \cdot \text{m}$
 $M_{rr} = -3.23$ $M_{tt} = -0.85$
 $M_{pp} = -4.49$ $M_{rt} = 0.57$
 $M_{rp} = 2.66$ $M_{tp} = 0.94$

Principal axes:
 T Val= 6.39 Plg= 7 Azm= 231
 N -2.98 10 140
 P -3.41 77 356

Best Double Couple: $M_0 = 4.9 \times 10 \times 18$
 NP1: Strike= 132 Dip= 53 Slip= -103
 NP2: 333 39 -73

Institute of Geophysics
China Earthquake Administration
2009-04-09 00:37:00 UTC
(2009-04-09 08:37:00 Beijing Time) released

Figure 1 The best double-couple solution from the moment tensor solution for April 6, 2009, Italy M_w 6.4 earthquake.

* Received 1 July 2009; accepted in revised form 13 July 2009;
published 10 October 2009.

* Corresponding author. e-mail: xuls@cea-igp.ac.cn.

The inverted results indicate that this earthquake is typical normal-faulting event. From the local seismo-tectonic characteristics and spatial distribution of the

aftershocks, we further inferred that the nodal plane of strike 132°, dip 53°and rake –103° be the seismogenic fault.

Table 1 Moment tensor solution for April 6, 2009 L’Aquila, Italy, M_w 6.4 earthquake

M_{rr}	M_{tt}	M_{pp}	M_{rt}	M_{rp}	M_{tp}	M_{DC}	Scale/N·m	M_w	Source
–3.23	–0.85	–4.49	0.57	2.66	0.94	4.9	10^{18}	6.4	This study

Table 2 Best double-couple solution for April 6, 2009 L’Aquila, Italy, M_w 6.4 earthquake

Nodal plane I			Nodal plane II			T axis		B axis		P axis		Source
Strike/°	Dip/°	Rake/°	Strike/°	Dip/°	Rake/°	Az/°	Pl/°	Az/°	Pl/°	Az/°	Pl/°	
132	53	–103	333	39	–73	231	7	140	10	356	77	This study

Acknowledgements Thanks are given to the IRIS (Incorporated Research Institutions for Seismology) data center for providing the digital waveform data used in this study. Contribution No. is 09FE3007 of Institute of Geophysics, China Earthquake Administration.

References

Kennett B (1983). *Seismic Wave Propagation in Stratified Media*. Cambridge

University Press, Cambridge, 1–339.
Kennett B and Engdahl E R (1991). Travel times for global earthquake location and phase identification. *Geophys J Int* **105**: 429–465.
Liu C, Zhang Y, Xu L S and Chen Y T (2008). A new technique for moment tensor inversion with applications to the 2008 WenChuan M_s 8.0 earthquake sequence. *Acta Seismologica Sinica* **21**(4): 333–343.