

Earthquake focal mechanisms

We take into account earthquakes with $M \geq 4$, usually moment magnitude (M_w), and crustal depth within the first 40 km, although most of hypocentres with depth ≤ 20 km. We assign C-quality to all focal mechanism data.

For the oldest 23 seismic events, occurred between 1908 and 1975, we consider results from polarity solutions of earthquakes computed by different authors in the past.

For the seismic events from 1976 to 2017, we take into account CMT-like solutions of earthquakes selected from the [European-Mediterranean RCMT Catalog](#) (Pondrelli and Salimbeni 2015, and reference therein) and the [Italian CMT dataset](#) (Pondrelli et al. 2006). Taking into account the systematic error of CMT-like solutions ($\pm 14^\circ$ according to Helffrich 1997) and the range of stress orientations that would be consistent with each focal mechanism and that the orientation of the P-, B- and T axes could slightly deviate from the principal stress orientations (McKenzie 1969), the [World Stress Map project](#) (Heidbach et al. 2010) assigns C-quality to focal mechanism data (stress orientations within $\pm 25^\circ$) (see also Montone et al. 2012 for a detailed explanation).

Since 2018, we use the Time Domain Moment Tensor catalogue ([TDMT-INGV](#); [ISIDe working group 2016](#)). The focal mechanism solutions (Scognamiglio et al. 2009) are obtained from the high-quality data of the Italian broadband and the Mediterranean seismographic networks using the long period full waveform inversion code originally proposed by Dreger and Helmberger (1993).

Although focal plane solution principal axes could not be indicative of stress axes, the possible differences between S_{hmin} derived from P, T and B axes and S_{hmin} from slip vectors lie within the error of the attributed quality as shown in Montone et al. (2004) for the Italian dataset. Moreover, regional compilations show that the average orientation for compression (P), null (B), and extension (T) axes determined from a number of earthquakes gives a good indication of the stress orientation throughout a region (e.g. Zoback and Zoback 1980). Thus, the orientation of the kinematic P, B, and T axes is assumed to coincide with the one of the dynamic σ_1 , σ_2 and σ_3 axes.

To identify the S_{hmin} azimuth and the tectonic regime we use the plunge of the P, T and B axes applying the criteria of Zoback (1992), modified for S_{hmin} instead of S_{Hmax} (see table 5 in Montone et al. 1999). We discard all the focal solutions with P, T and B axes that do not define a clear tectonic regime. We show on the map all the possible categories: in addition to TF (pure thrust faulting), NF (pure normal faulting) and SS (pure strike-slip faulting), we also include NS (normal with strike-slip component) and TS (thrust with strike-slip component).

[WSM guidelines](#), see cap 3.

Dreger D.S. and Helmberger D.V. (1993). Determination of source parameters at regional distances with three-component sparse network data, *J. Geophys. Res.*, **98**(B5), 8107–8125.

Heidbach O., Tingay M., Barth A., Reinecker J., Kurfeß D., Müller B. (2010). Global crustal stress pattern based on the World Stress Map database release 2008, *Tectonophysics*, **482**, 3–15, doi:10.1016/j.tecto.2009.1007.1023.

Helffrich G.R. (1997). How good are routinely determined focal mechanisms? Empirical statistics based on a comparison of Harvard, USGS and ERI moment tensors, *Geophys. J. Int.*, **131**, 741–750.

[ISIDe working group \(2016\) version 1.0, DOI: 10.13127/ISIDe](#).

McKenzie D.P. (1969), The relation between fault plane solutions for earthquakes and the directions of the principal stress, *Bull. Seismol. Soc. Am.*, **59**, 591–601.

Montone P., Amato A., Pondrelli S. (1999). Active stress map of Italy, *J. Geophys. Res.*, **104**, 25,595–25,610.

Montone P., Mariucci M.T., Pondrelli S., Amato A. (2004). An improved stress map for Italy and surrounding regions (central Mediterranean), *J. Geophys. Res.*, **109**, B10410, doi:10.1029/2003JB002703.

Montone P., Mariucci M.T., Pierdominici S. (2012). The Italian present-day stress map, *Geophys. J. Int.*, **189**, 705–716, doi: 10.1111/j.1365-246X.2012.05391.x.

Pondrelli S., Salimbeni S., Ekström G., Morelli A., Gasperini P., Vannucci G. (2006). The Italian CMT dataset from 1977 to the present, *Phys. Earth Planet. Int.*, doi:10.1016/j.pepi.2006.07.008,159/3-4, pp. 286–303.

Pondrelli S. and Salimbeni S. (2015). Regional Moment Tensor Review: An Example from the European Mediterranean Region. In: *Encyclopedia of Earthquake Engineering*, p. 1-15, Springer Berlin Heidelberg, http://link.springer.com/referenceworkentry/10.1007/978-3-642-36197-5_301-1.

Scognamiglio L., Tinti E., Michelini A. (2009). Real-Time Determination of Seismic Moment Tensor for the Italian Region, *BSSA*, **99**, 4, 2223–2242, doi: 10.1785/0120080104.

Zoback M.L. and Zoback M. (1980). State of stress in the conterminous United States, *J. Geophys. Res.*, **85**(B11), 6113–6156, doi:10.1029/JB085iB11p06113.
 Zoback M.L. (1992). First- and second-order patterns of stress in the lithosphere: the World Stress Map Project, *J. Geophys. Res.*, **97**(B8), 11703-11728.

Table - Stress regime assignment for earthquake focal mechanism data (modified from Zoback 1992; see also [World Stress Map project guidelines](#), Table 3.5-1).

P/S1-axis	B/S2-axis	T/S3-axis	Stress regime	S_{Hmax} orientation	S_{Hmin} orientation
$pl \geq 52^\circ$		$pl \leq 35^\circ$	NF	azimuth of B-axis	azimuth of T-axis
$40^\circ \leq pl < 52^\circ$		$pl \leq 20^\circ$	NS	azimuth of T-axis+90°	azimuth of T-axis
$pl < 40^\circ$	$pl \geq 45^\circ$	$pl \leq 20^\circ$	SS	azimuth of T-axis+90°	azimuth of T-axis
$pl \leq 20^\circ$	$pl \geq 45^\circ$	$pl < 40^\circ$	SS	azimuth of P-axis	azimuth of P-axis +90°
$pl \leq 20^\circ$		$40^\circ \leq pl < 52^\circ$	TS	azimuth of P-axis	azimuth of P-axis +90°
$pl \leq 35^\circ$		$pl \geq 52^\circ$	TF	azimuth of P-axis	azimuth of B-axis

P, B and T axes; pl: plunge of P, B and T axes; S1, S2 and S3 correspond to sigma1, sigma2 and sigma3 axes; NF: normal faulting; SS: strike-slip faulting; TF: thrust faulting; NS: normal/strike faulting; TS: thrust/strike faulting.