A fast and robust technique for inversion of earthquake source rupture process was developed and applied to some of the recent significant earthquakes in China and worldwide. Since May 2008, source rupture processes of about 20 significant earthquakes in China and worldwide were inverted by using the newly developed technique and the inverted results were timely released on the website within 3 to 5 hours after the occurrence of the earthquakes. These earthquakes included the $M_{W}7.9$ Wenchuan, Sichuan, earthquake of 12 May 2008, the $M_{W}6.3$ L’Aquila, Italy, earthquake of 6 April 2009, the $M_{W}7.0$ Haiti earthquake of 12 January 2010, the $M_{W}8.8$ Chile earthquake of 27 February, 2010, the $M_{W}6.5$ Jiaxian, Taiwan, earthquake of 4 March 2010, the $M_{W}7.2$ Mexico earthquake of 4 April 2010, the $M_{W}7.8$ Sumatra earthquake of 6 April 2010, and the $M_{W}6.9$ Yushu, Qinghai, earthquake of 14 April 2010. It is found that in addition to the usual earthquake source parameters, such as the epicentral location, focal depth, focal mechanism of the earthquake source, the fast inverted results of the spatio-temporal rupture process of the earthquake sources provided important information such as possible disastrous areas and the timely release of these results proved very useful to earthquake emergency response and seismic disaster relief efforts.