Journal of Asian Earth Sciences 98 (2015) 105–115

Contents lists available at ScienceDirect

Journal of Asian Earth Sciences

journal homepage: www.elsevier.com/locate/jseaes

Non-double-couple mechanism of moderate earthquakes occurred in Lower Siang region of Arunachal Himalaya: Evidence of factors affecting non-DC

Rohtash Kumar [a], S.C. Gupta [b], Arjun Kumar [c,*]

[a] Bhabha Atomic Research Centre (Govt. of India), India
[b] Department of Earthquake Engineering, Indian Institute of Technology, Roorkee 247667, Uttarakhand, India
[c] Department of Civil Engineering, Arni University, Kathgarh (Indora), Himachal Pradesh, India

A R T I C L E   I N F O

Article history:
Received 26 March 2014
Received in revised form 21 September 2014
Accepted 15 October 2014
Available online 8 November 2014

Keywords:
Moment tensor solution
DC
CLVD
Microeathquakes
Arunachal Himalaya
ISOLA

A B S T R A C T

Moment Tensor solutions of 104 earthquakes which were observed at local distances in Lower Siang region of Arunachal Himalaya have been estimated using ISOLA code. The magnitude range of analyzed earthquakes lies between 1.8 (M_w) and 5.3 (M_w). Out of 104 earthquakes, only 32 events are having good data. The signal noise ratio of these 32 events is greater than 6 with magnitude greater than 2.5. All possible sources of non-DC such as, noise present in the data, depth of the source, low azimuthal coverage of the event and non-DC as a part of real earthquake source process are examined. The study reveals that non-DC is highly dependent on the source depth as comparatively shallow events shows high CLVD%. The CLVD is also highly affected by the noise present in the data. Another factor is the magnitude of the event. The high magnitude event shows quite high DC%. So the source mechanisms of high magnitude events are double couple (DC).

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

One of the major questions in the seismology is the origin of non-DC (CLVD) components of MTs of earthquakes. A number of earthquakes cannot be explained as a pure double couple (Knopoff and Randall, 1970; Gilbert and Dziewonski, 1975; Dziewonski et al., 1981; Kanamori and Given, 1981, 1982; Dziewonski and Woodhouse, 1983; Giardini, 1984; Scott and Kanamori, 1985). Some explanations reveal that deviation from DC is caused by the presence of noise in the data (Stump and Johnson, 1977; Patton and Aki, 1979; Patton, 1980; Ward, 1980; Wallace, 1985; O'Connell and Johnson, 1988). The non-DC component can be of various origins (Frohlich, 1994; Julian et al., 1998; Miller et al., 1998). Frequently, the non-DC component of spurious origin as a product of imperfect modeling was also reported when the amount of data is limited or when the Green functions are inaccurate (Kuge and Lay, 1994). The oversimplification of source processes such as, point source approximation of finite extant faulting or multiple faulting on with different orientation on fault plane can produce non-DC (Sipkin, 1986). The assumption of homogeneous and isotropic medium can also produce spurious non-DC components (Sileny and Vavrycuk, 2000).

However, some earthquake processes shows that the non-DC mechanism such as, landslides (Hasegawa and Kanamori, 1987), change in magma chamber in volcanic areas (Mori and McKee, 1987), geothermal and volcanic areas where tensile faulting caused by high fluid pressure areas (Ross et al., 1996; Julian et al., 1998; Vavrycuk, 2001), an anisotropic region by shear faulting (Kawasaki and Tanimoto, 1981; Fojtíková et al., 2010; Stierle et al., 2014a,b).

Despite of various explanations of non-DC, the origin of non-DC is still a mystery. So the resolution of non-DC component of earthquake is essential. In order to undertrained earthquake source processes in a batter way, we need to find the factors affecting the CLVD. The basic purpose of this study is to identify the source of non-DC for microearthquakes. These earthquakes have been recorded by a six-station local seismological network deployed in Lower Siang region of Arunachal Himalaya.

2. Seismotectonics of the regions

Among the most dramatic and visible creations of plate-tectonic forces is the Himalaya, having stretch of 2900 km along the border between India and Tibet. It is formed by the collision of India and

* Corresponding author.
E-mail addresses: rohtash21@gmail.com (R. Kumar), scgupta49@gmail.com (S.C. Gupta), arjundeq@gmail.com (A. Kumar).

http://dx.doi.org/10.1016/j.jseaes.2014.10.025
1367-9120/© 2014 Elsevier Ltd. All rights reserved.

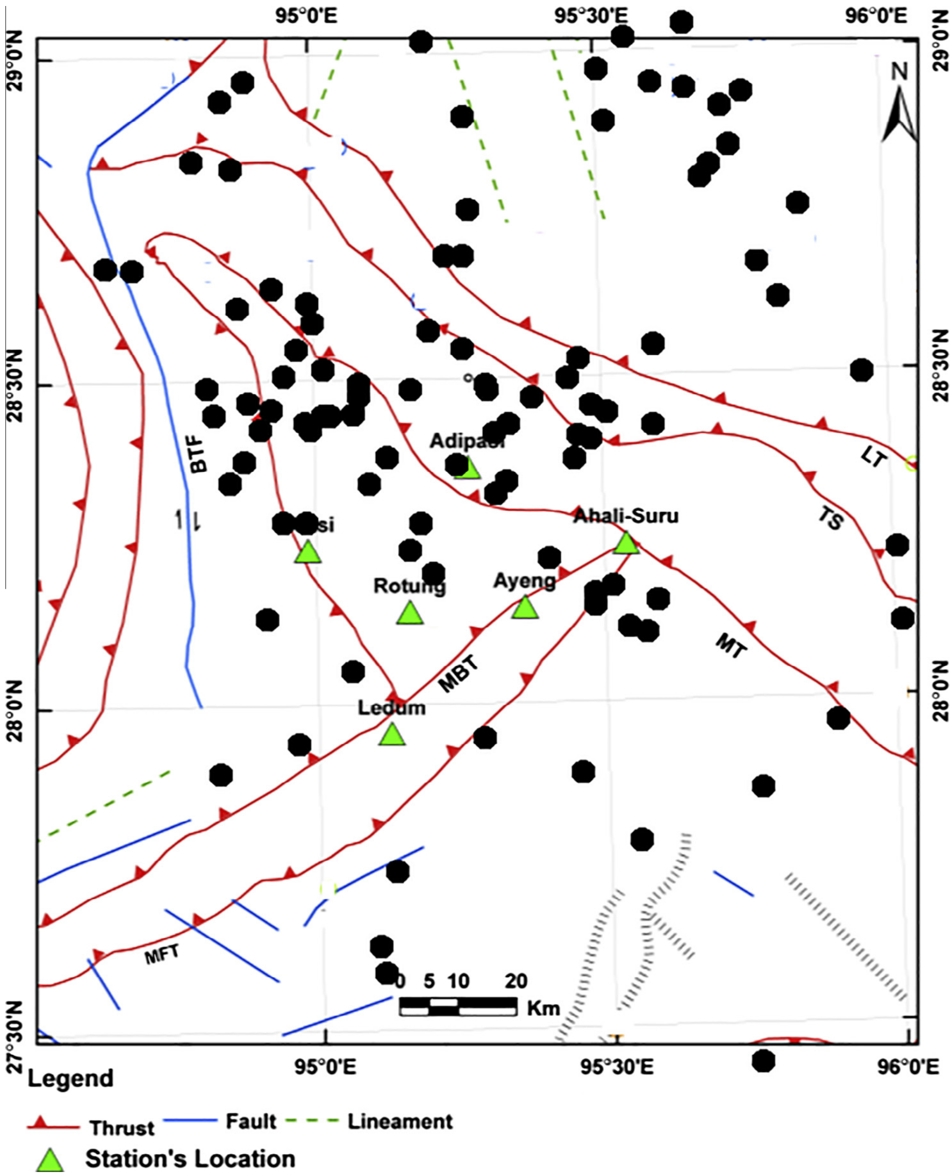

Fig. 1. Map showing epicenters of events recorded during July 2011 to May 2012 (solid circles). Tectonics after GSI (2000).

Eurasia which are driven by plate movement with age between 40 and 50 million years ago. Both of these continental landmasses have about the same rock density so one plate could not be subducted under the other. Therefore, collision creates structural features. Himalaya structurally (tectonically) from north to south can be divided as: Tibetan Himalaya (Northwest part of Arunachal Himalaya bordering Bhutan and Tibet, NE–SW trending), Higher Himalaya (limits between Tibetan Himalaya and MCT, ENE–WSW trend adjacent to Bhutan and changes to NE–SW eastward), Lesser Himalaya (limits between Higher Himalaya and Sub Himalaya, trending E–W in western part, swing NNE–SSE till the syntaxial then NW–SE), Sub Himalaya (trending E–W near Bhutan, swings ENE–WSW towards east). The division from east to west: the Eastern Himalaya, Central Himalaya and Western Himalaya (Gansser, 1964; Le Fort, 1975).

The Eastern Syntaxis is built up of Proterozoic to Cenozoic rocks arranged in distinct litho-tectonic belts. The Eastern Syntaxis is a belt where two distinct tectonic domains with ENE–WSW trend in the west (Singh, 1996). This trend gradually changes to NE–SW Siang valley which terminates against Siang fracture (Nandy, 1976). The Eastern Syntaxis is composed of three major thrust sheets, namely Siang, Siyom and Rikor in descending tectonic order. A complex Para autochthonous zone is exposed in the central part which contains the Abor Volcanic, the Yingkiong Formation and the Dalbuing Formation. Rocks exposed in the Eastern Syntaxial region belong to three major units of Himalaya; the Sub-Himalaya (Siwaliks), the Lesser Himalaya (including the Gondwana Group) and the Higher Himalaya (Gansser, 1964). In addition, central part of the syntaxial structure is occupied by a sequence of sedimentary rocks of Eocene age, associated with basic volcanic rocks (Singh, 1993).

Table 1
Velocity model for the Lower Siang Region of Arunachal Himalaya (Khattri et al., 1983).

Velocity (km/s)	Depth (km)	Layers
4.00	0.0	Sedimentary
6.00	1.0	Granitic
6.70	25.0	Basaltic
8.10	45.0	Moho

Download English Version:

https://daneshyari.com/en/article/6444358

Download Persian Version:

https://daneshyari.com/article/6444358

Daneshyari.com