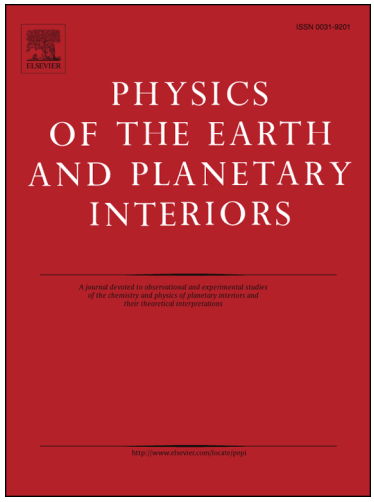

Earthquake Swarm of Himachal Pradesh in Northwest Himalaya and its Seismotectonic implications

Rakesh Singh, R. Arun Prasath, Ajay Paul, Naresh Kumar

PII: S0031-9201(17)30313-8
DOI: https://doi.org/10.1016/j.pepi.2018.01.002
Reference: PEPI 6120

To appear in: *Physics of the Earth and Planetary Interiors*

Received Date: 7 November 2017
Revised Date: 1 January 2018
Accepted Date: 2 January 2018

Please cite this article as: Singh, R., Prasath, R.A., Paul, A., Kumar, N., Earthquake Swarm of Himachal Pradesh in Northwest Himalaya and its Seismotectonic implications, *Physics of the Earth and Planetary Interiors* (2018), doi: https://doi.org/10.1016/j.pepi.2018.01.002

Earthquake Swarm of Himachal Pradesh in Northwest Himalaya and its Seismotectonic implications

Rakesh Singh*, R. Arun Prasath, Ajay Paul, Naresh Kumar

Geophysics Group, Wadia Institute of Himalayan Geology, Dehradun-248001, INDIA

*Correspondence to: rakeshgosain@hotmail.com

Abstract

On the 27th of August 2016, seismic swarm activity consisting 58 earthquakes ($1.7 \leq M_L \leq 4.4$) occurred in Rampur area of the Kullu-Rampur Tectonic window of Himachal Pradesh in Northwest Himalaya. The epicenters of these events are located at the northern front of the Berinag Thrust in its hanging wall. To better understand the seismotectonics of this region, we analyzed the spectral source parameters and source mechanism of this swam activity. Spectral analysis shows low stress drop values (from 0.05 to 28.9 bars), suggesting that the upper crust has low strength to withstand accumulated strain energy in this region. The Moment Tensor solutions of 12 earthquakes ($\geq 2.7M_L$) obtained by waveform inversion yield the shallow centroid depths between 5 and 10 km. All these events are of dominantly thrust fault mechanism having an average dip angle of ~30°. The P-axes and the maximum horizontal compressive stresses are NE-SW oriented; the relative motion of the Indian Plate. The present study reveals that the swarm activity Himachal region of NW Himalaya is related to out-of-sequence thrusting or the Lesser Himalayan Duplex system.

Keywords: Satluj valley, Rampur Swarm, Stress drop, Moment tensor inversion, Lesser Himalayan Duplex.

Highlights

- Low stress drop values indicate the low strength of upper crust in the study area.
- Maximum horizontal compressive stresses are NE-SW oriented.
- Seismotectonics of Rampur region attained using MT solutions for events in swarm.
- Cross-sectional study illustrates out-of-sequence thrusting or the LHD system along Satluj valley.

1. Introduction

Earthquake swarm is a sequence of large number of closely spaced earthquakes with no distinct or major earthquake within a short time period of time (Mogi, 1963; Scholz, 2002). A Swarm activity is usually identified to be occurred in the outermost layer of the earth i.e. the crust, owing to its high volcanic, geothermal and tectonic activities. The temporal evolution of earthquakes in a swarm activity cannot be explained by any simple law such as the Omori's Law for aftershocks; hence it can be distinguished from the aftershocks which accompany main shock (Hainzl, 2004). According to Main (1996), each individual earthquake of a swarm