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Insights into the Long Period Earthquakes detected by Ocean Bottom Seismometer experiment in the Andaman Sea

K. K. Aswini; K. A. Kamesh Raju; Pawan Dewangan; V. Yatheesh; Pabitra Singha; T. Ramakrushana Reddy; Lalit Arya

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Abstract HTML

Insights into the Long Period Earthquakes detected by Ocean Bottom Seismometer experiment in the Andaman Sea

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K. K. Aswini ; K. A. Kamesh Raju ; Pawan Dewangan ; V. Yatheesh ; Pabitra Singha ; T. Ramakrushana Reddy All Authors

Abstract:

Long Period Earthquakes (LPEs) linked to the volcanic activity offer understanding the kinetics of active magmatic systems. These events are usually caused by cracks resonating as magma and gases move at the subsurface level or towards surface. The off Nicobar region in the Andaman Sea is observing recurrent earthquake swarms after the 2004 megathrust event. The earthquake swarms have happened in January 2005, March and Oct 2014, Nov 2015 and Apr 2019. Passive Ocean Bottom Seismometer (OBS) experiment conducted for the first time in the Andaman Sea by CSIR-NIO during December 2013-May 2014 provided new insights to the genesis of the recurrence of swarms in off Nicobar region. In addition of OBS data, we have also combined Andaman ISLANDS network data and land stations data from the IRIS Data Centre. Hybrid very long-period earthquakes were detected for the first time with prominent hydro-acoustic phase during the March 2014 earthquake swarm; these were documented by passive OBS experiment. On the 21st and 22nd of March 2014, a total of 141 high-frequency events were recorded, with 71 of these being low-frequency oscillations. The spectral analysis of these events shows a spectral peak at 0.13 Hz. This event's initial onset is predominated by a high-frequency phase, which is trailed by lengthy low-frequency vibrations. The observed swarms roughly align in the NW – SE direction on the trend of underwater volcanic arc and Great Sumatra Fault. High resolution multibeam bathymetry data in the off Nicobar region revealed a pattern of faults depicting the joining of Seulimeum Fault (SF) and Aceh Fault (AF) of the Sumatra Fault with the West Andaman Fault and Andaman Nicobar Fault. We have identified 26 closely spaced distinct volcanoes, which include well-developed cratered seamounts with fissure and fracture features in the off Nicobar region, suggesting the occurrence volcanic eruptions in the recent past.These swarms were also detected using hydrophone component of OBS unit. Earthquake epicentre information determined from T wave rise time suggested subsurface magma migration from deeper to shallow crust. LPEs and a prominent T phase are indicators of subsurface tectono-magmatic activity. The temporal variation of b-values also analysed for all swarms' using data from both the global network and the OBS. Temporal variation of b-value suggests bimodal characteristics of frequency-magnitude distribution. This proposes that the swarms were caused by a complex seismic process that was influenced by both tectonic and volcanic activity. The stress generated from magma movement has triggered volcano-tectonic events due to reactivation of pre-existing sliver faulting and generated long period ringing.