

Atmospheric Temperature Rise over Latur Earthquake Area Emboldened to Investigate other Earthquake Precursors

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DESCRIPTION

Indian Stable Continental Region has been experiencing moderate-to-large intraplate seismicity since historical times that include 1819 Kachchh (Mw 7.7), 1927 Son-valley (Mw 6.4), 1967 Koyna (Mw 6.3), 1970 Broach (Mw 5.4), 1993 Killari (Mw 6.3) and 2001 Bhuj (Mw 7.7) earthquakes. Many of them were destructive in nature and occurred in the Deccan Volcanic Province, for example, the September 30, 1993 Killari earthquake that occurred in Latur district of Maharashtra. It is considered one of the deadliest earthquakes of modern times, killing more than 10,000 people. Its epicenter was located at 18.01°N, 76.56°E, and the focal depth was quite shallow at 6.0 km. This earthquake caused large scale surface deformation, groundwater table variation and gas emanations from the opened cracks in several nearby localities. It also witnessed a number of aftershocks, which were clustered in a rectangular area, lying southwest of the surface rupture zone. Depth sections of these events show a strike of about 135°E and a dip of ~45°. Fault plane solutions revealed reverse faulting for the main shock and deeper aftershocks (6 km–10 km), while it was of strike slip nature in case of shallower (depth <5 km) aftershocks [1].

An advertisement 'Leave Nothing to Chance' seen at a young age has always attracted us. I am mentioning one such case study. I was traveling from Mumbai to Hyderabad in a plane on 18th June 2007 and enjoying the flight which was just for about one hour. There were display boards wherein heights at which the plane is flying, time taken and time left to reach the destination and outside air temperature at that height are displayed. We normally see it but do not give much value to it. But I found something unusual, the temperature outside is shown as -17 to -18°C at the height of +11.27 km from the mean sea level. In this route at this height the outside temperature should be around -38°C to -42°C. I started writing the time taken from the departure point, the height of the flight, and the outside temperature which is showing warmer than usual. Temperatures at 11.27 km, 9.74 km, 7.20 km and 4.50 km were -17°C, -9°C, 6°C and 17°C respectively whereas the surface temperature of Hyderabad was 29°C. One can easily say that the temperature outside was warmer than usual at different heights. I tried to see

the route of the flight from Mumbai to Hyderabad which closely passes through the Latur area. So, the temperature above the Latur area is warmer than usual. I was also aware that temperature rise is one of the precursors of a possible big earthquake. There are some precursors such as geophysical, geochemical, geodetic, seismological, biophysical, thermal, groundwater fluctuation, etc. I was questioning myself whether I should leave it as it was or do something (to take a chance). So, I decided to follow 'Leave nothing to Chance' and immediately discussed it with my seismologists colleagues. After reaching NGRI, I along with other seismologists went to the Seismology Observatory located on the NGRI campus and started checking seismic activity in and around the Latur region such as sudden changes in seismicity characterized by seismic b-values. We found some seismic activity a few days back in the region. In fact, earthquakes of magnitude 3.0 and 3.4 were observed in this area in January 2006. So, we decided to send teams to find groundwater fluctuation, and helium release from the regions under operation "Quick Please" [2]. The team of hydrogeologists from CSIR-NGRI surveyed the Latur area from June 20-23 2007. 11 bore wells and dug wells were selected for continuous monitoring of the water level. The bore well was deep from 80 m to 170 m and dug well from 10m to 30 m. The job of monitoring for finding fluctuations of water level is very difficult due to the Monsoon period when the area gets the rain water as well as water pumping for agriculture purposes. All the wells showed rise and fall of water level due to rain and pumping respectively. After 4 days of continuous monitoring our team concluded that there is no natural change of water level and change of water level is due to rain and pumping. Another precursory element is helium survey in the area. In fact, a helium survey was carried out in the Latur area after the big earthquake of 1993. There was continuous monitoring of helium in the area right from 1993 every year till 1997 and then in 2005 and 2006 There was continuous decline of helium content from 20, 000 ppb after the earthquake in 1993 to 400 ppb in 2007. The CSIR-NGRI team observed during 21st, 24th and 25th June 2007 the helium value was 400 ppb and no change from 2005 and 2006. After finding that there is no correlation between observed thermal rise and changes in any subsurface geophysical parameters like change in water level and

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release of helium in the study time, the operation Quick Please was discontinued. We concluded that there is no earthquake pending from the area. The rise of temperature could be due to some other atmospheric phenomena for which we were constantly in contact with experts of meteorology and atmospheric science. However, doubt remains and hence the area has been studied intensively by earth scientists using various geophysical tools. It is interesting to see the results of two borewells in Killari in Latur area and another in Koyna in Maharashtra. There are many interesting results such as the Indian shield lithosphere in the earthquake region is characterized as unusually thin and warm [3-4].

CONCLUSION

The gist of the above investigations is 'leave nothing to chance' and investigate all possibilities without wasting time for any anticipated disaster. There is a need to investigate the earthquake prone area further geologically to understand unusual geological features. Further the earthquake region is characterized by high Moho temperature and pressure and fault plane solution for deeper and shallower aftershocks shows the reverse and strike slip respectively, hence any earthquake precursor (may be false) should not be ignored.

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CONFLICT OF INTEREST

We have no conflict of interest to disclose

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