Complex Seismic Activity at Koyna, India

Harsh Gupta
Panikkar Professor, National Geophysical Research Institute, Hyderabad-500007, India
harshg123@gmail.com

We examine the case of Reservoir Triggered Seismicity (RTS) at Koyna, India. Soon after the impoundment of the Koyna dam in 1961, triggered earthquakes started to occur. Globally the largest RTS event of M 6.3 occurred at Koyna on December 10, 1967. Later, another reservoir, Warna, was impounded in the near vicinity of Koyna. Over the past 46 years, 20 earthquakes of M ≥ 5 and several thousand smaller events have occurred in the Koyna- Warna region. Earthquakes occur in a small area of 20 X 30 sq. km, there are no other seismically active regions in the near vicinity.

It is observed that earthquakes of magnitude (*M*) 4–5 are often preceded by well-defined clusters of foreshocks of $M \leq 3$, referred to as nucleation that is found to last typically for 100–400 h. Based on continuous monitoring of seismic activity, a nucleation pattern was identified and an earthquake of *M* 4+ was forecasted on 16 May 2006. An earthquake of *M* 4.2 did occur on 21 May 2006 within the forecasted parameters. Since August 2005, 24 events of M ≥ 3.5 have occurred in the Koyna region, which could broadly be placed in three Zones (Figure 1). It is noted that while the earthquakes in Zone A show precursory nucleation, the same is not true for Zones B and C. We discuss the complexity of earthquake forecast in a small region.

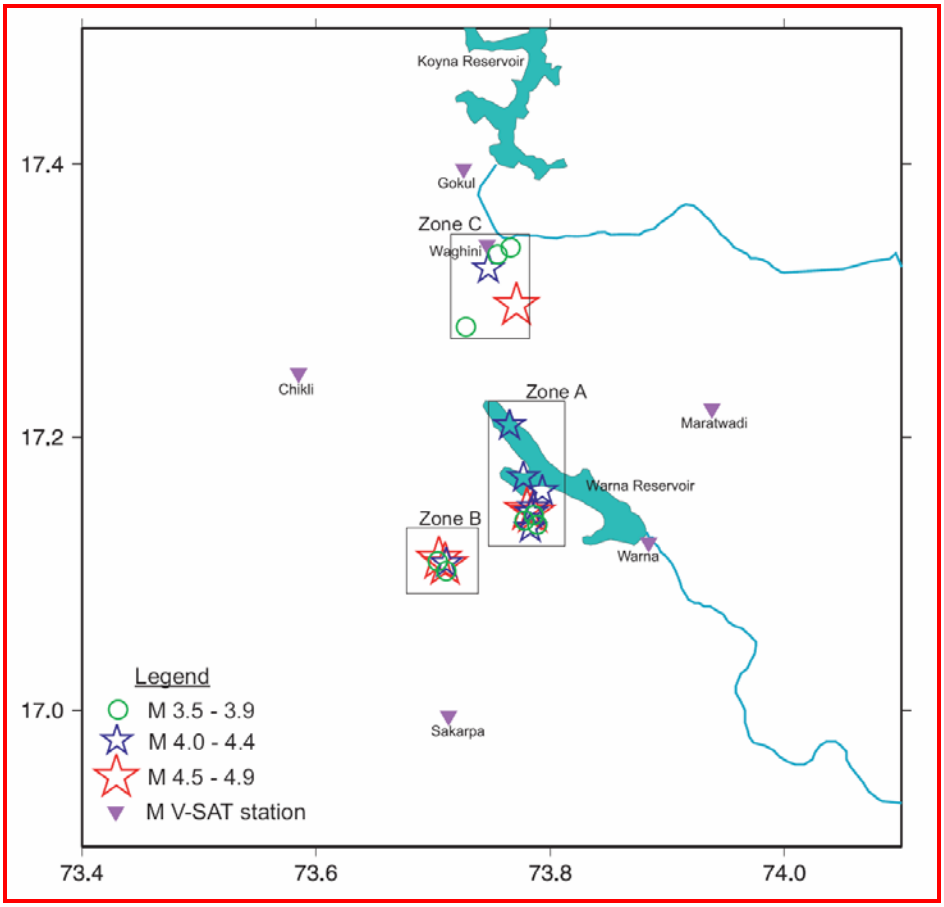

Figure 1: Earthquakes of magnitude range 3.5-4.9 in the Koyna-Warna region during August 2005-November 2009. Zone 'A' indicates area in which most of the M 3.5 and above earthquakes preceded by nucleation, where as in Zone 'B' and Zone 'C' nucleation was not observed.