



A Preliminary Earthquake Report of February 17th, 2025, New Delhi, (M 4.0)

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An earthquake of magnitude M 4.0 occurred at 05:36:55 IST, located in the New Delhi, whose epicenter is at 28.59°N and 77.16°E at a shallow depth of 5 km. The epicentre is 10 km SW of Rd Fort. The event was well recorded by more than 30 broadband seismic stations installed by National Centre for Seismology. The analysis of seismic data indicates that the sequence of events occurred along a NW-SE trending lineament. This structural feature serves as a highly favorable location for the triggering of the mainshock, primarily due to the significant structural heterogeneity present in and around the epicentral region. The variation in subsurface geological structures likely contributed to stress accumulation and subsequent rupture along this trend. An examination of past seismic activity within a 50 square kilometre radius of the epicentre reveals that a magnitude 4.6 earthquake occurred south of the current epicentre on December 25, 2007 within 6 km periphery of today's earthquake (M 4.0) that rocked beneath the Jheel Park, Dhaula Kuan. This suggests a normal pattern of seismogenesis in the past that corroborated with the seismic activity since 1990 in the region, highlighting the presence of pre-existing stress conditions and interactions among several lineaments and faults present in the area that may have influenced the recent event due to sub-surface heterogeneities of weaker category like association of source rock materials with fluids and water from the past riverine and lacustrine formations beneath the source zone. This 17th February 20025 Jheel Park-Dhaulta Kuan, New Delhu earthquake (M 4.0) occurred due to normal faulting that supported the concept of hydro fracturing as the principal cause of seismogenesis of varying strengths. Furthermore, the preliminary fault plane solution, derived from moment tensor inversion, indicates that the earthquake was associated with a normal faulting mechanism. The fault plane is oriented along a NW-SE strike, consistent with the regional stress regime and geological structures. Additionally, two well-known regional faults, the Mathura Fault and the Sohna Fault, are located in close proximity to the epicentre. Felt reports of maximum Intensity IV (MMI scale) in the epicentral region and minimum intensity III (MMI Scale) have been reported from a distance of around 0 km and 15 km from the epicenter, respectively (**Fig. 2**).

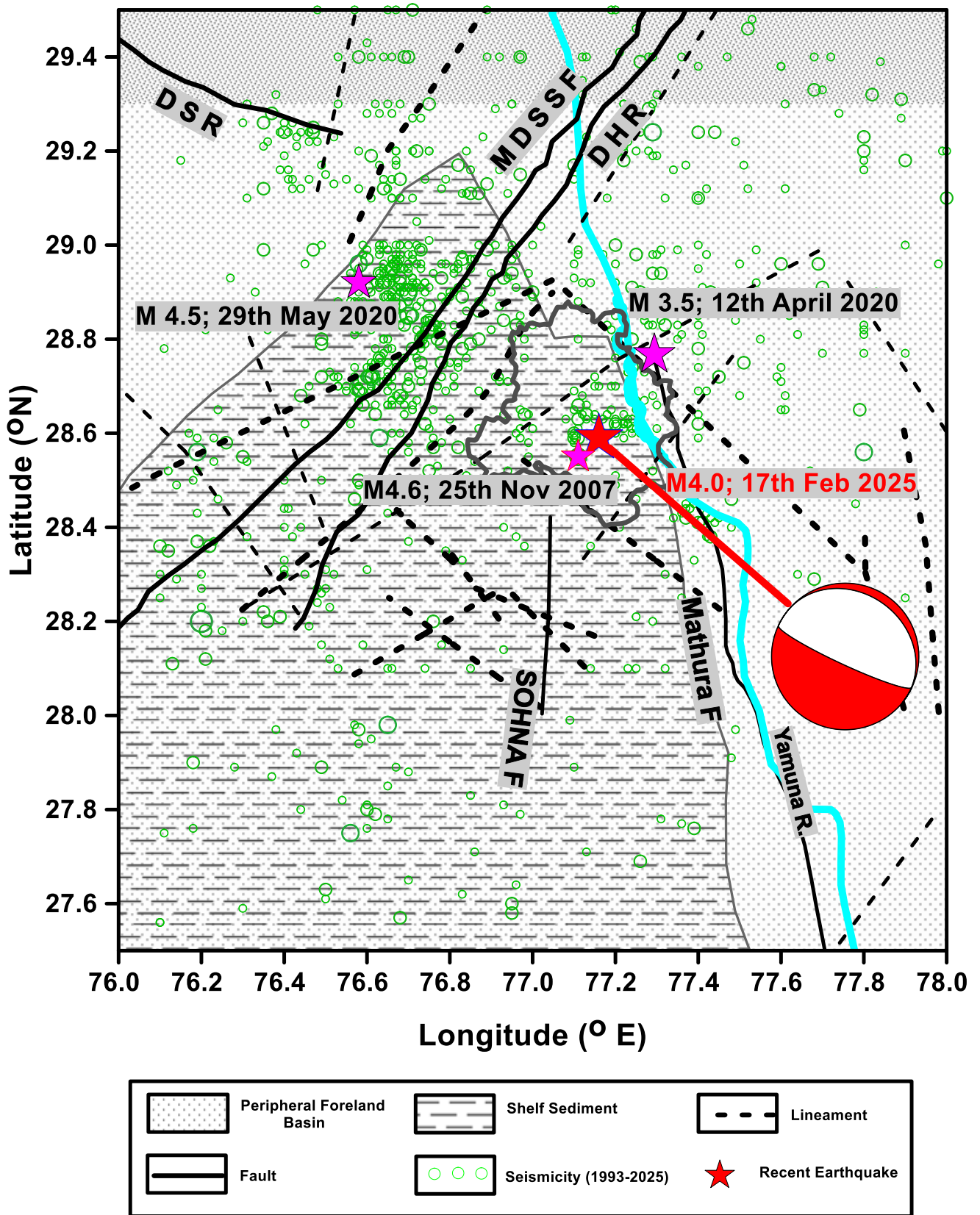


Figure 1: The present earthquake (M 4.0) of 17th February 2025 (Star in Red colour) and past seismicity in the epicentral and surrounding region, along with recent felt earthquake near the epicentral region (source: www.seismo.gov.in; NCS-MoES). The geological faults and lineament were obtained from Bhukosh, GSI. Magenta stars are past felt events in the Delhi region.

The recorded earthquakes as per EQ Catalogue of NCS reveals that the region is associated with small to moderate earthquake (**Fig.1**) in the last 10 years.

The earthquake is widely felt in the Delhi-NCR region and neighbouring states (**Fig. 3**). Within one hour 191 felt reports due to this earthquake, have been received from Delhi-NCR, Haryana, Western Uttar Pradesh through NCS website and Mobile App having intensity ranging from II to III on Modified Mercalli Intensity (MMI) Scale (**Fig. 3**).

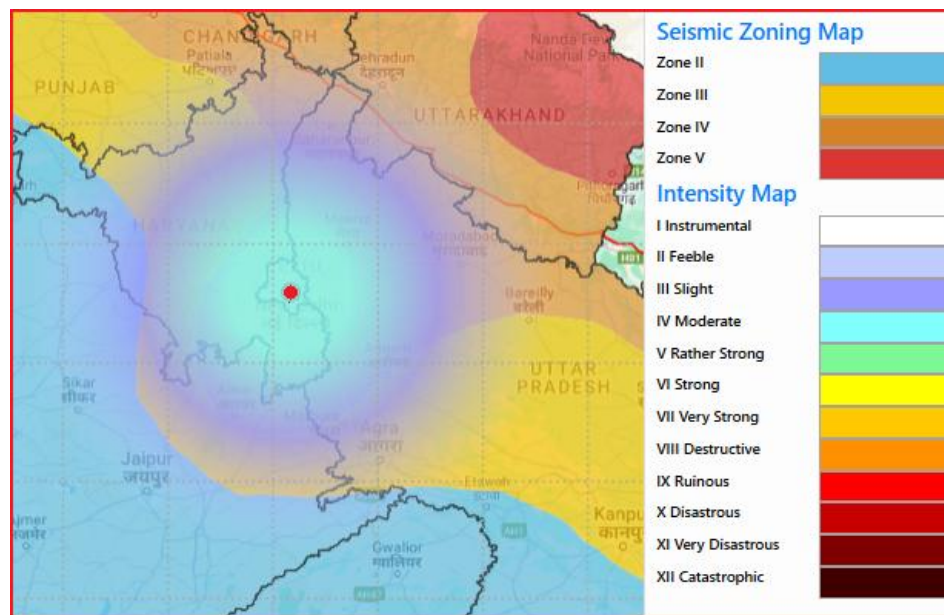


Figure 2: Estimated earthquake Intensity Map of the earthquake of $M:4.0$ of 17th February 2025.

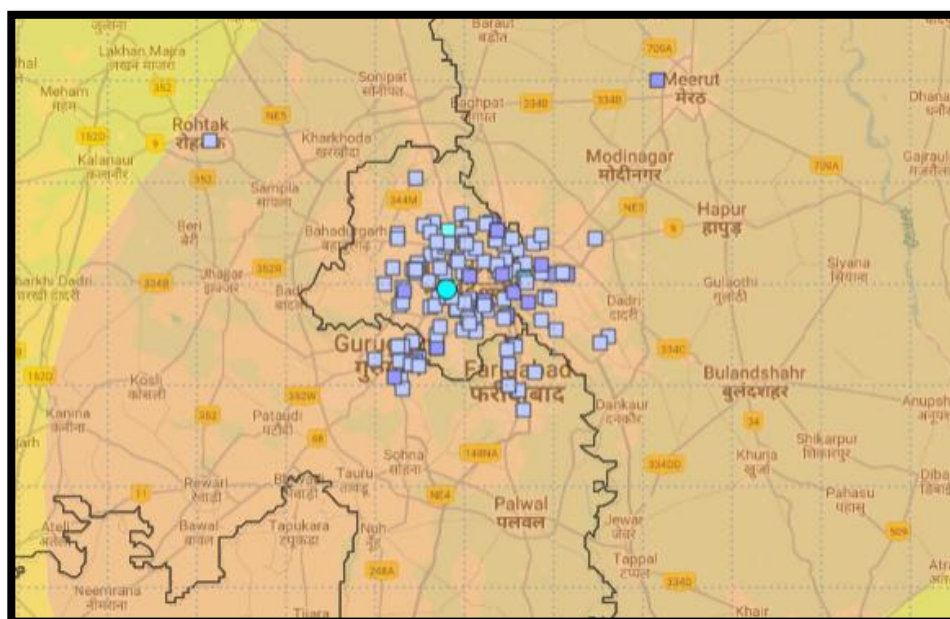


Figure 3: Felt responses (squares) of the 17th February 2025 earthquake M 4.0 (circle) from different users reported on www.seismo.gov.in and BhooKamp mobile-app. 190 responses were received within one hour from the time of occurrence of earthquake.

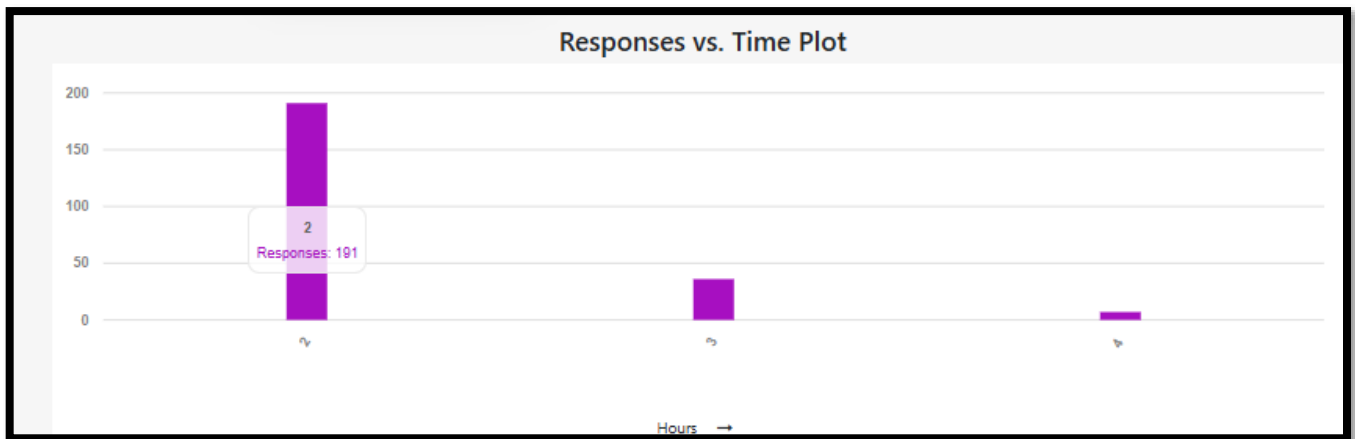


Figure 4: Number of felt responses with respect to time lapses

In nutshell, today's earthquake M 4.0 earthquake at shallow depth 5km) is associated with perceptible shaking due to Intensity at Source Zone is IV on MMI scale and maximum Peak Ground acceleration was measured in and around Lodhi Road in the area of New Delhi due to amplification of subsurface strata and comparatively amplifiable soil.

The source Zone beneath the Jheel Park near Dhaula Kuan, New Delhi is not associated with any of known Seismogenic faults rather occurred away from Sohna and Mahendragarh Fault whilst occurred near the set of several lineaments (weak zones) that might have broken due to structural heterogeneities embedded with past riverine or lacustrine deposits at depths through Hydro-fracturing. This mechanism is supported by the normal faulting of today's earthquake (17.02.2025).

Most importantly, the source zone witnessed several micro to moderate earthquake of maximum magnitude 4.6 in November 2007 at depth of 10 km. This earthquake M4.0 is not a puzzle rather occurred at shallow depth 5km, which causes the sound during the shaking when seismic waves reached to surface with air.

The signature of today's earthquake M4.0 is a good signature as the rock materials of source zone released energy prior to reaching its maximum credible past earthquake M4.6 of 2007 that occurred in the same epicenter source zone. The shaking is intense because of shallow depth of 5 km and of intensity IV. There is no report of any casualty in the area.

The details of the maximum peak ground motion (PGA) recorded, is tabulated below

Site	Maximum PGA (in g)	Distance from epicentre (km)
NPL, New Delhi	0.049	6.0
Jamia University	0.058	10.0
Narela	0.069	24.0

We also analyzed the earthquakes from 1993 to 2025 within 50 sq km of today's event, and it was found that a total of 446 earthquakes were reported with a magnitude ranging from 1.1 to 4.6. The maximum magnitude (M 4.6) of an earthquake is reported in the year 2007, 25th Nov which is about 6 km northwest of today event (Figure 5 and 6) .

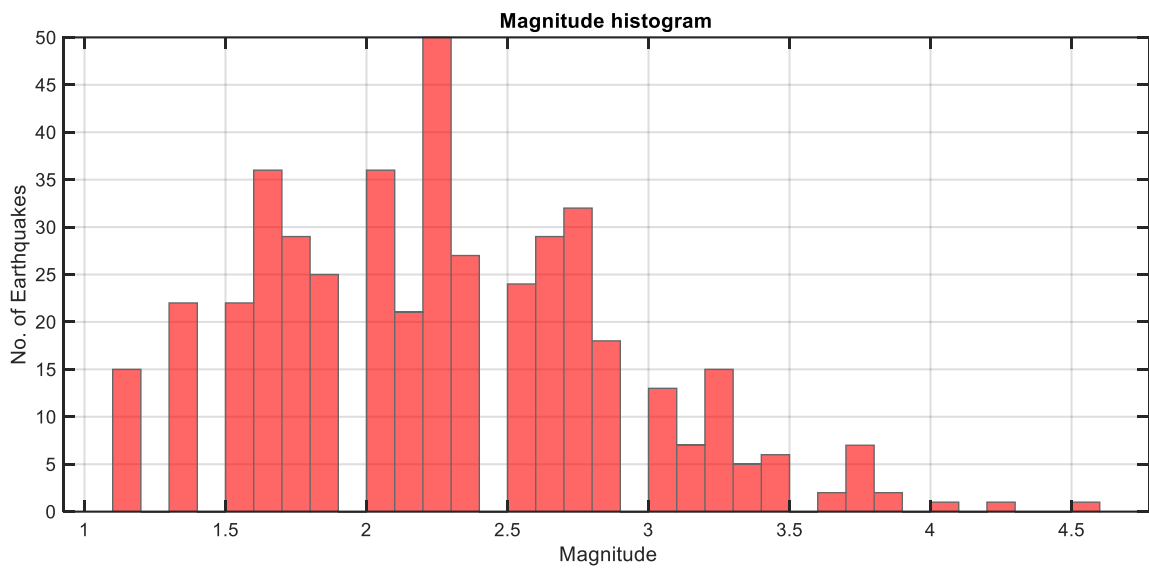


Figure5: Histogram plot of Magnitude since 1993-2025 within 50 sq km from 17th Feb 2025.

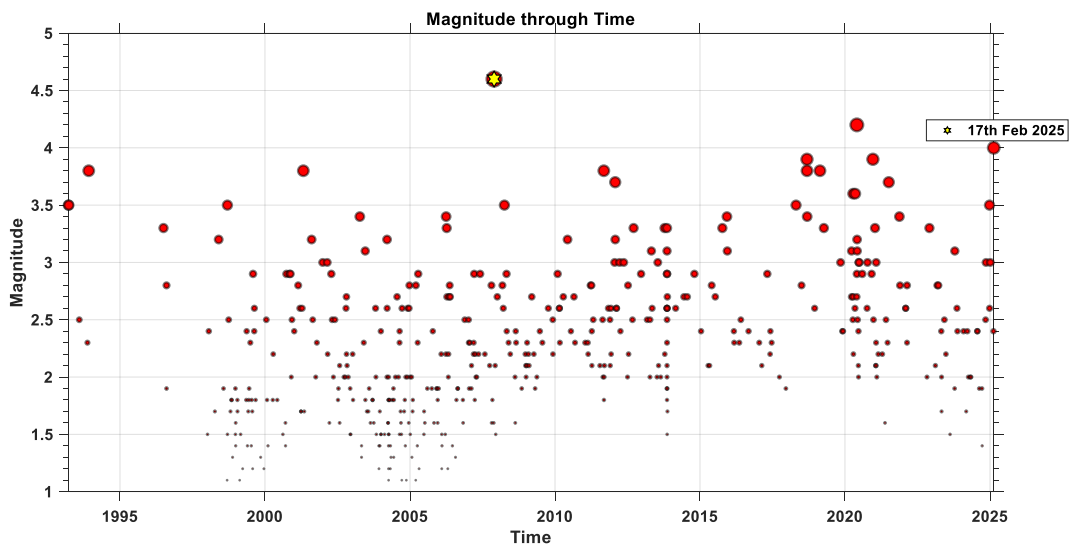


Figure 6: Time series plot of Magnitude versus time since 1993-2025 within 50 sq km from 17th Feb 2025.