Seismicity and Seismotectonic related to Jajarkot Earthquake 2023

Dr. Lok Bijaya Adhikari NEMRC/DMG

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Why earthquakes in Nepal?



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Past Earthquakes



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Recent Earthquake Ruptures and Seismic Gap



Interseismic Seismicity



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Seismicity after Gorkha Earthquake 2015



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Seismotectonics



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Event

Origin time: 2023/11/03 23:47 वि.सं. २०८० कार्तिक १७ गते राति ११:४७ Local Magnitude: 6.4 Moment Magnitude: 5.7 Focal depth: 12 km Epicenter: Ramidanda, Jajarkot District

Damage

- Casualties
 - 157 killed
 - 375 severely injured
- Houses
 - 26,512+ fully damaged
 - 39,374 partially damaged

(Jajarkot, Rukum West, Dailekh, Salyan, Surkhet, Jumla and Kalikot)

Location



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Epicenter and Aftershocks



Intensity by Other Agencies



Macroseismic Intensity Map USGS ShakeMap: 43 km E of Dailekh, Karnail Pradesh, NP Nov 03, 2023 18:02:56 UTC M5, 7 N28.84 E 62.216 Depth: 33.0km ID:us700018p5



| SHAKING | Not felt | Weak | Light | Moderate | Strong | Very strong | Severe | Violent | Extreme |
|-----------|----------|--------|-------|------------|--------|-------------|----------------|---------|------------|
| DAMAGE | None | None | None | Very light | Light | Moderate | Moderate/heavy | Heavy | Very heavy |
| PGA(%g) | <0.0464 | 0.297 | 2.76 | 6.2 | 11.5 | 21.5 | 40.1 | 74.7 | >139 |
| PGV(cm/s) | < 0.0215 | 0.135 | 1.41 | 4.65 | 9.64 | 20 | 41.4 | 85.8 | >178 |
| INTENSITY | 1 | 11-111 | IV | V | VI | VII | VIII | 1X | 260 |

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Mainshock at SC, Surkhet



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Signal of the Mainshock





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Signals of the Aftershocks



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Aftershocks during the first hours



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Seismic Network









Geology and Aftershocks



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Focal Mechanism, Mw and Depth



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- Two models were tested, CRUST1 (blue) and CRUST2 (orange), and inverted 3component data from 8 stations out to 2600 km (PALK and UOSS) to extend azimuthal coverage.
- Tested between depth 2 and 20 km with a 2 km step.
- Inverse mechanism similar to those published by other institutes.
- Depths are consistent, with maximum variance reduction (VR) around 12 km for both models.
- Mw magnitudes are also in agreement with IPGP and GFZ on CSEM, around 5.74-5.78 at +/-2 km from 12 km depth for both models.

Location Maximum Casualties and Damages



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Zone of Maximum Intensity (VI)



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Damage

- Only mud stone masonry buildings suffered damage
- No structural damage in concrete buildings
 - Maximum damages are concentrated along the river valley and ridges.
- Topographic effect and Local Site effect was noticed.

Topographic Effect

Khalanga



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Topographic Effect

Jyamire



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Topographic Effect

Goiri



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Topographic Effect

Chiuree



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Topographic Effect

Barekot, Limsa



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Damage

Chiuree



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Damage



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Jyamire

Damage

Khalanga



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Damage



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Khalanga



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Damage



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Chhepare



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Chiuree

Damage



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Limsa

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Local Site Effect



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Local Site Effect





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Damage



Rimna

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Damage

Rautgaun







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Surface Amplification



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Site Effect



(Modified after Cotton, 2001)

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Seismic Hazard Map of Nepal



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Thank you

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