Deterministic versus probabilistic seismic hazard assessment for the Shillong Plateau, NE-India

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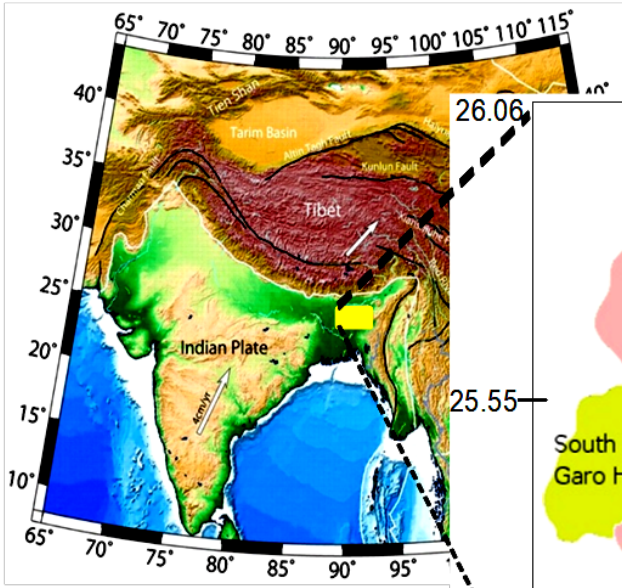
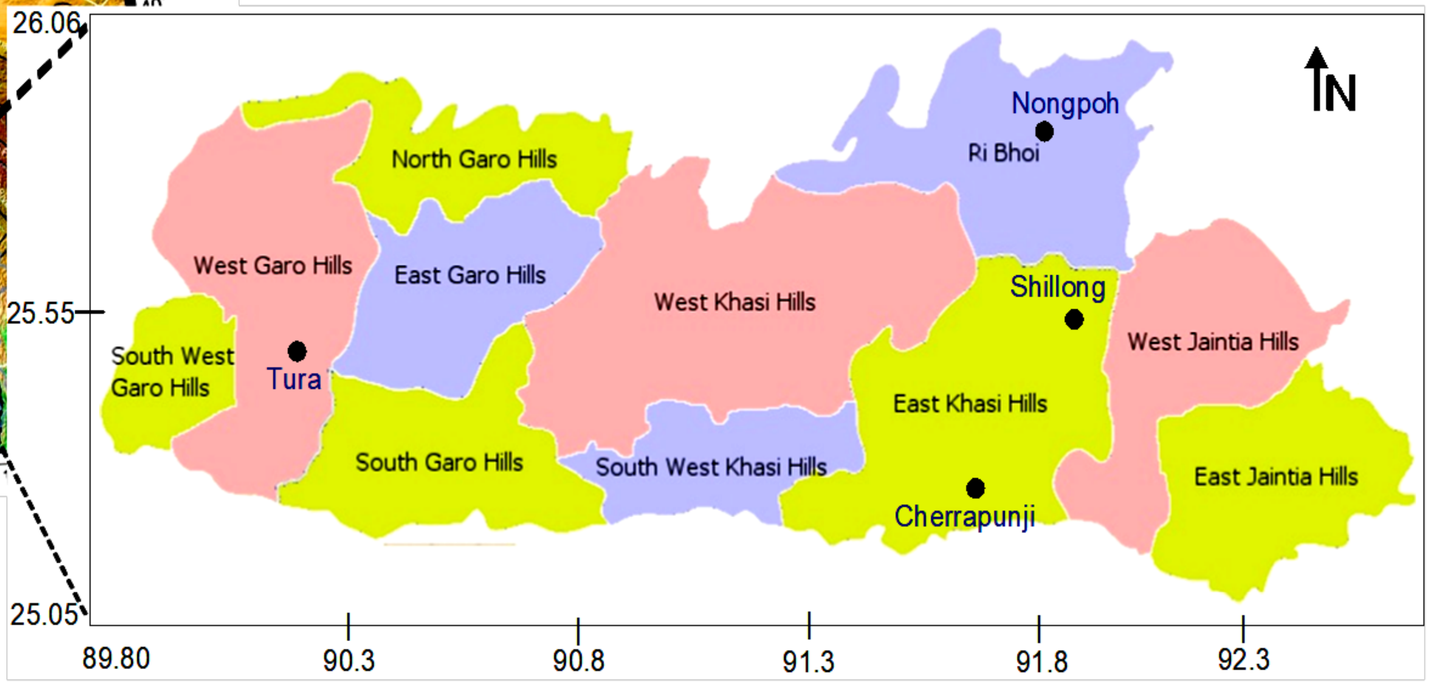
EGU General Assembly 2020 "Sharing Geoscience Online“, Abstract EGU2020-3834

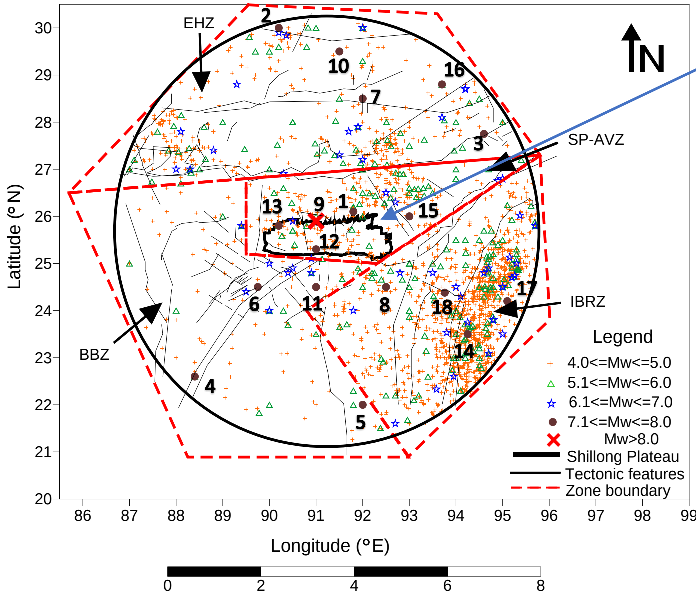
Map showing the eleven districts of Meghalaya, an Indian state



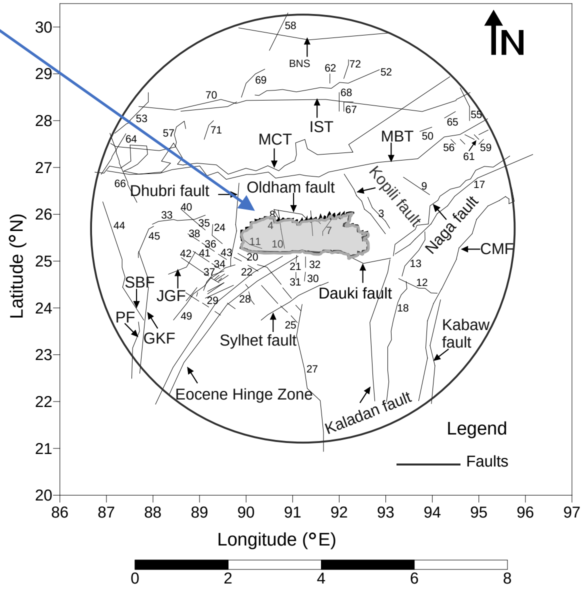


Baro, Kumar, Ismail-Zadeh (2018)

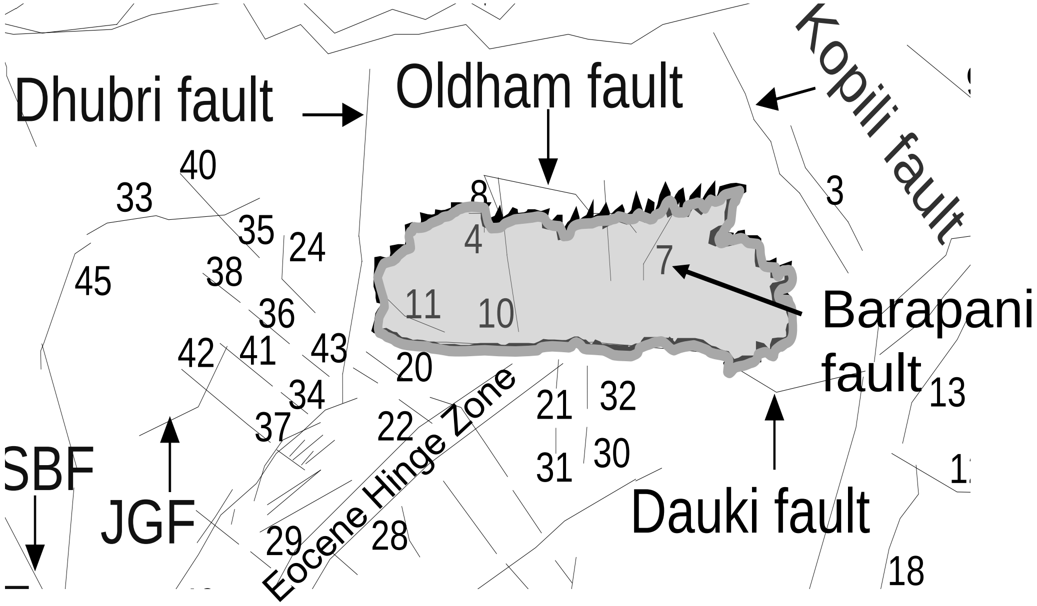
Shillong Plateau

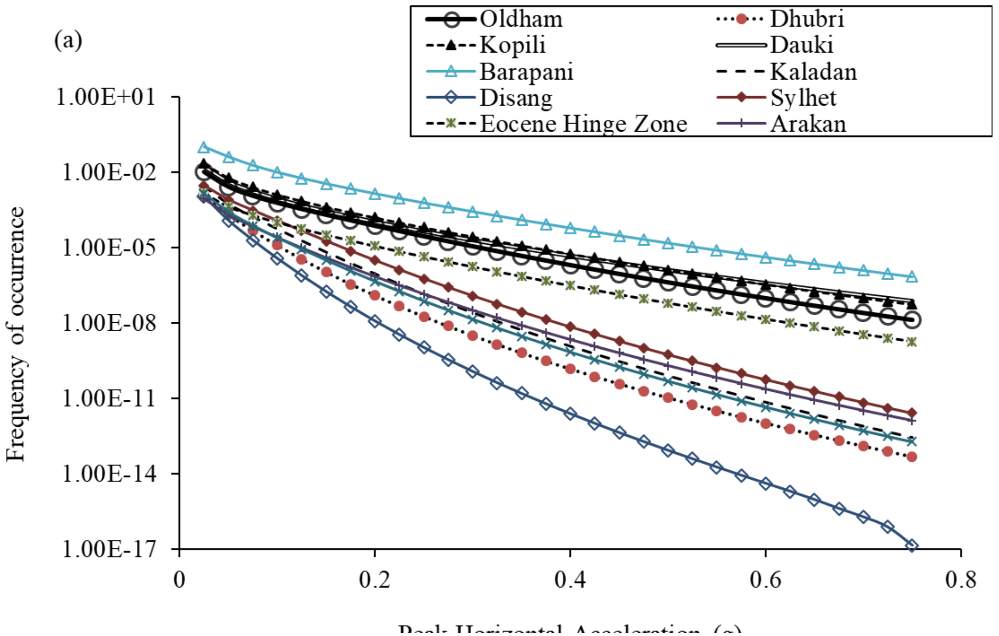


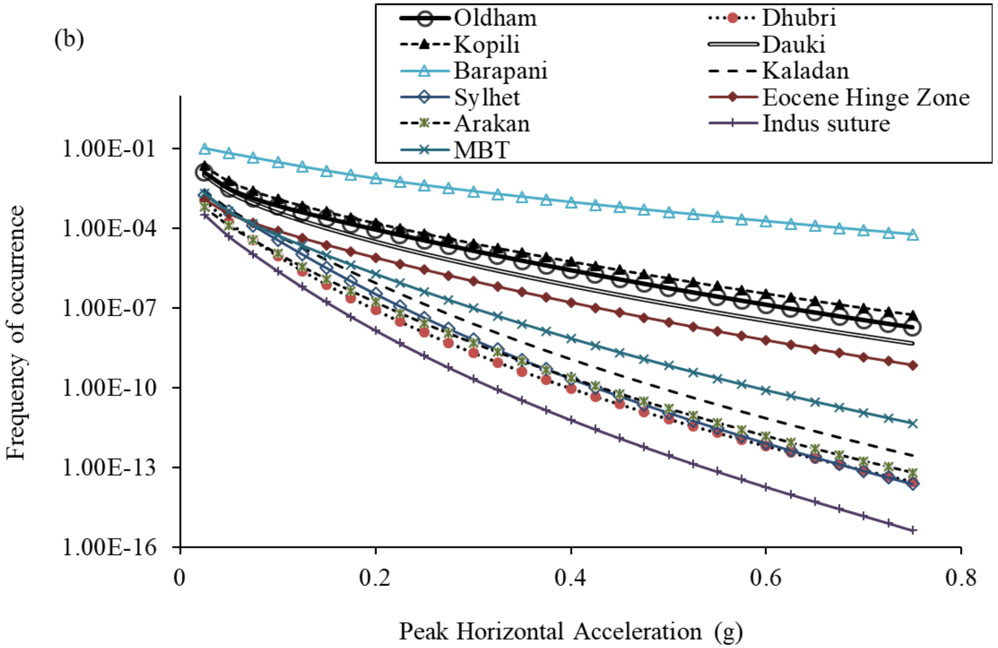
Seismotectonic map of the SP showing four seismic source zones, EQ epicenters from the declustered catalogue, and active faults. Numbers in the figure represent significant EQs; **1**- 825EQ (M-8.0); **2**-1411EQ (M-7.7); **3**-1697EQ (M-7.2); **4**-1737EQ (M-7.2); **5**-1762EQ (M-7.5); **6**-1787EQ (M-7.8); **7**-1806EQ (M-7.7); **8**-1869EQ (M-7.5); **9**-1897EQ (M-8.1); **10**-1915EQ (M-7.1); **11**-1918EQ (M-7.6); **12**- 1923EQ (M-7.1); **13**-1930EQ (M-7.1); **14**-1938EQ (M-7.2); **15**-1943EQ (M-7.2); **16**-1947EQ (M-7.7); **17**-1954EQ (M-7.7); **18**-1957EQ (M-7.0).

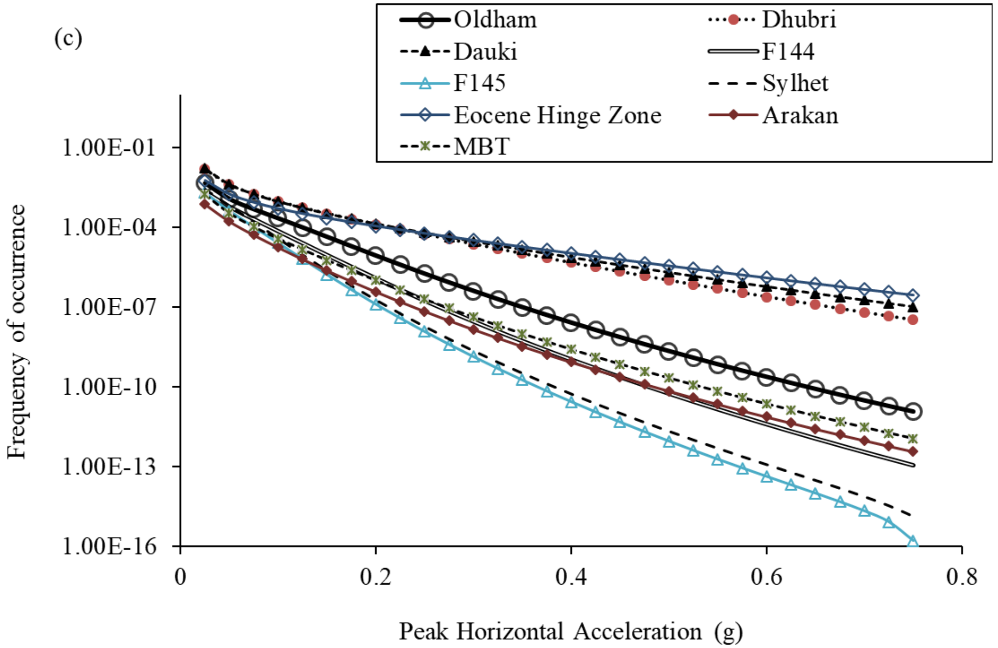


Source map showing major faults within the seismotectonic region (IST – the Indus Suture thrust, BNS – the Bangong-Nujiang Suture, MCT – the Main Central Thrust, MBT – the Main Boundary Thrust, CMF – the Churachandpur-Mao Fault, GKF – the Garhmayna-Khanda Ghosh Fault, JGF – the Jangipur-Gaibandha Fault, PF – the Pingla Fault, and SBF – the Sainthia-Bahmani Fault.



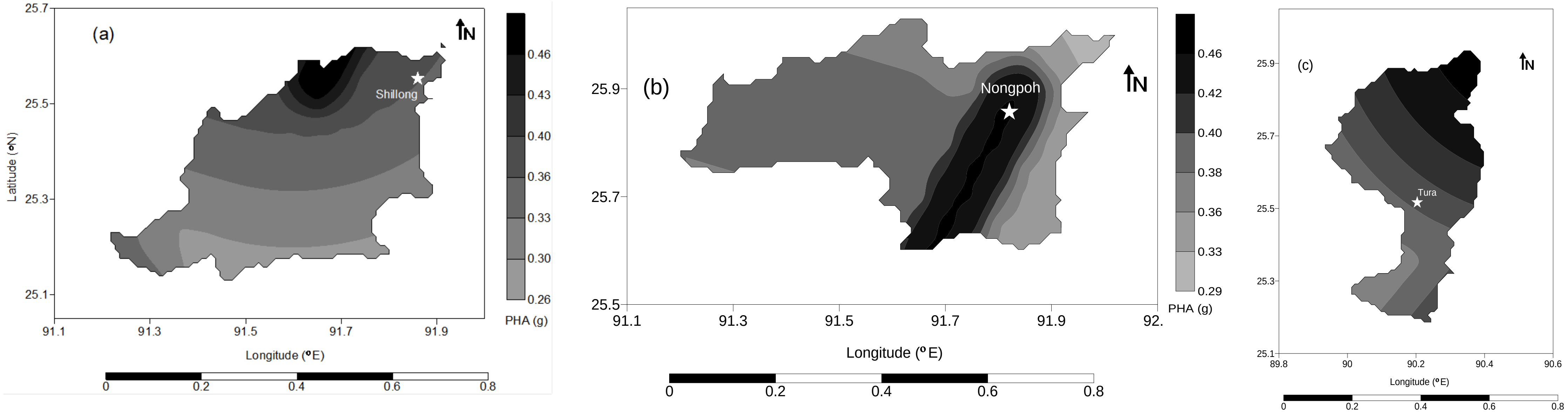




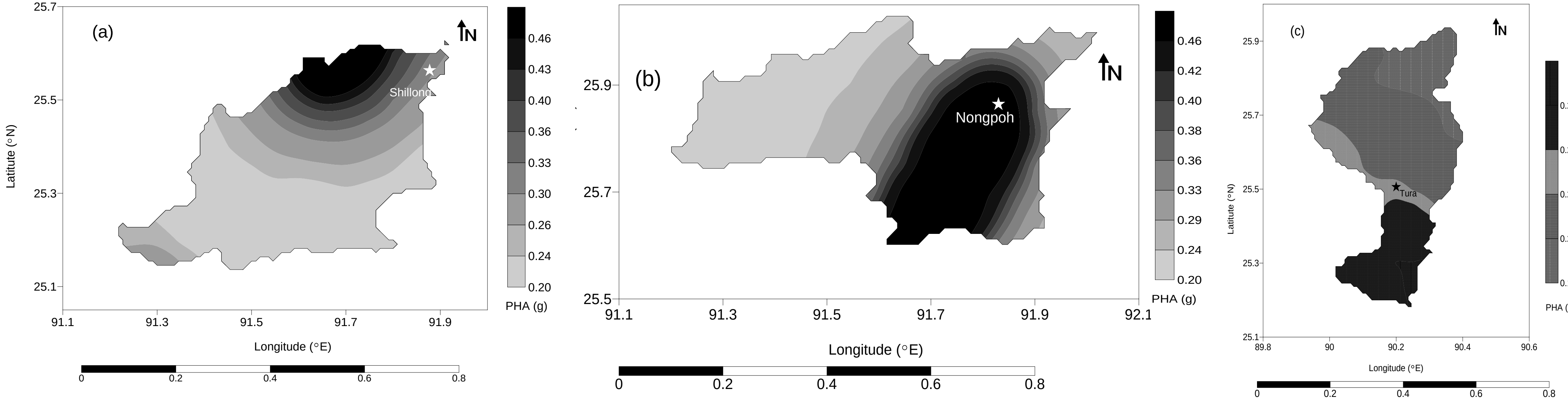


Hazard curves at (a) Shillong city, (b) Nongpoh, and (c) Tura

Peak horizontal accelerations in DSHA for the (a) East Khasi hills, (b) Ri-Bhoi, and (c) West Garo hills districts



Peak horizontal accelerations in PSHA for the (a) East Khasi hills, (b) Ri-Bhoi, and (c) West Garo hills districts for 2% probability of ground motion exceedance in 50 years



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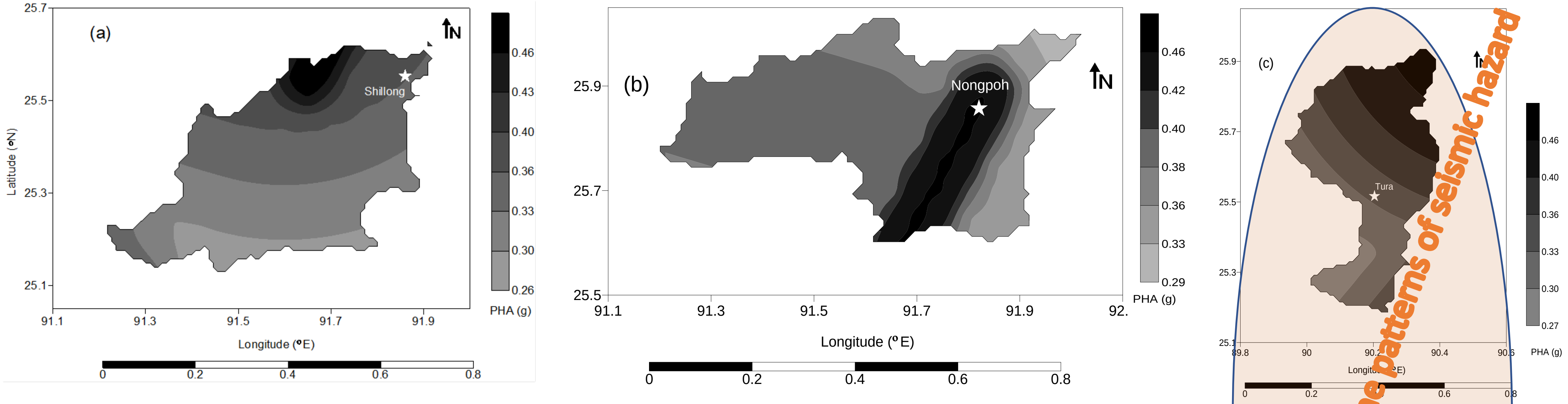

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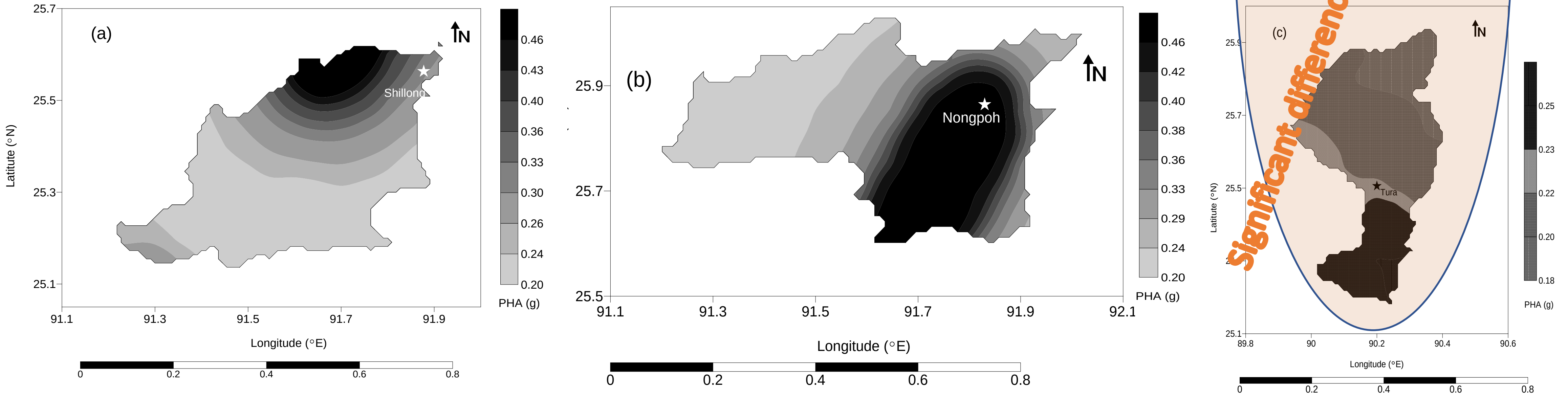

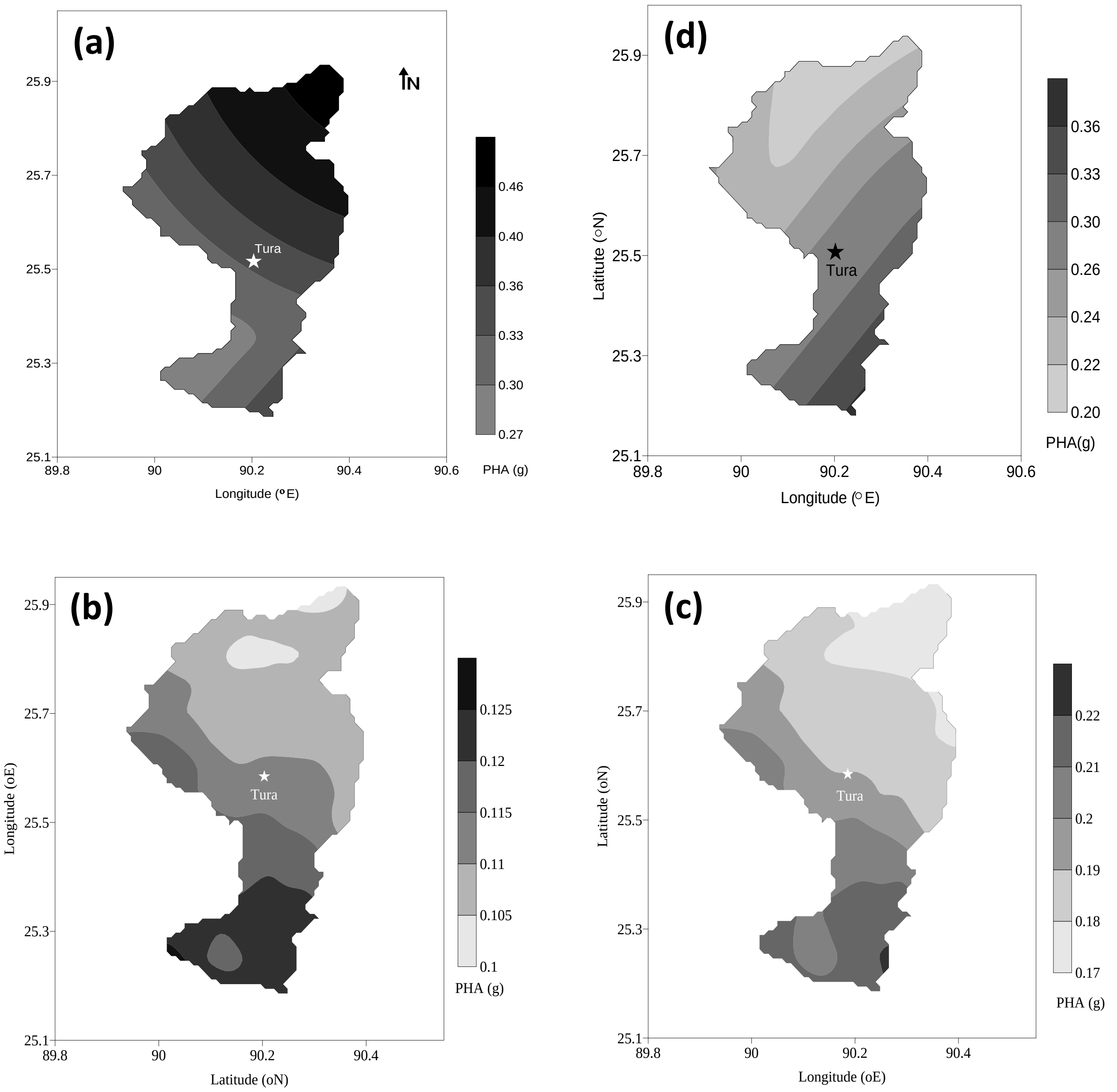

Hazard maps for the West Garo hills

(a) DSH assessment map

(b) PSH assessment map for 10% probability of exceedance

(c) PSH assessment map for 2% probability of exceedance

(d) DSH assessment map with no contribution of the Oldham fault

CONCLUSION

The northern part of the East Khasi hills district, eastern part of Ri-Bhoi district and southern part of the West Garo hills district show high PHA values. A comparative analysis of the results obtained from deterministic (DSH) and probabilistic seismic hazard (PSH) assessments for the same region show that a contribution of the Oldham fault to seismic hazard of the region is prominent in the case of DSH assessments, and much smaller in case of PSH assessments because of the recurrence time of large events at the Oldham fault.

Most of the practical problems require estimating risk for a specific territory (e.g. populated cities or districts) and within this territory separately for the objects such as lifelines, sites of vulnerable constructions, etc. Multi-scale hazard and risk assessments are helpful for decision-makers at local, municipal, and national levels. Therefore, the results of the PSH analysis together with the results of DSH analysis for three most-populated districts of the Meghalaya state is of important for decision-making.