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Composite seismic source of the great 1950 Assam earthquake, Eastern Himalayan Syntaxis

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The geometry and extent of the faults that generated the magnitude Mw 8.6 1950 Assam earthquake largest continental earthquake ever recorded, remain poorly constrained. We combine a reappraisal of aftershocks and triggered landslides along the devastated, 350 km-long Mishmi and Abor range-fronts and field measurements of co-seismic scarps and uplifted terraces to propose an earthquake source model consistent with first-order, large-scale topographic, geomorphic, geodetic and geological evidence. We found that co-seismic vertical throw was twice larger on the Mishmi Thrust (MT) (∼7 m) than on the Main Frontal Thrust (MFT) (∼2 to 3 m), in keeping with relative, average mountain heights (3500 m versus 1400 m, respectively) and thrust dips consistent with relocated aftershock depths (30° and 15°, respectively). Co-seismic surface slips (up to 30 m along the MT and 12 m along the MFT) are consistent with the moment re-assessed from long-period surface waves. Most of the 1950 first arrivals fit with a focal mechanism co-involving the two sub-orthogonal thrust planes, that intersect along the Dibang Valley, implying forced slip parallel to GPS vectors across the Eastern Himalayan Syntaxis. Hanging-wall uplifted terraces ages determined from 10Be surface exposure dates suggest bi-millennial return time for 1950-size events. Clearly, Himalayan mega-quakes are not blind and release most of the elastic shortening across the range.