To what extent do slip rates contribute to the seismic activity of faults?

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To what extent do slip rates contribute to the seismic activity of faults?

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Crustal deformation comprises a combination of seismic energy release occurring by earthquakes and aseismic unloading through creeping or frictional sliding. Efficient segregation of the seismic component attributed to faults is critical in evaluating Seismic Activity Rate (SAR) or Magnitude Frequency Distribution (MFD) of earthquakes in fault-based hazard assessment. The MFDs are routinely calculated by utilizing fault geometry and slip rate, evaluated from geodetic (or geological) data. The slip rates as an integrated representation of elastic and anelastic loadings overestimate the MFDs since earthquakes release only the elastic strain. To work around this problem, the seismic/geodetic moment-rate ratio defined as Seismic Coupling Coefficient (SCC) is incorporated in this study to account for the seismic portion of the total moment rate to calculate MFDs. The parameter has been studied for different tectonic regions worldwide, including the USA, Canada, Iran, Greece, and Italy. We modify the Moment Budget (MB) algorithm introduced by Pace et al. (2016) to weight the total moment rate corresponding to the maximum magnitude (M_{max}) generated by the modeled faults by incorporating the SCC. An updated mean recurrence time (T_{mean}) for the M_{max} and its corresponding uncertainty is computed when SCC is incorporated in the calculation. Then, the seismic moment, the SCC weighted T_{mean}, and its uncertainty are utilized to compute MFDs by balancing the modeled seismic moment rates (by Doubly Truncated Gutenberg-Richter (DTGR) or Characteristic Gaussian (CHG)) and the SCC weighted moment rates. This process is implemented by the Activity Rates (AR) tool of FiSH codes. Fault data of 89 fault segments in Zagros, Iran, are introduced into the algorithm to compute the SCC incorporated MFDs. The acquired fault-based hazard maps are in harmony with the history of seismicity and tectonics of the region, while the total moment rates exaggerate the calculated hazard. Future work involves implementing the processing algorithm on hazard assessment in the Gulf of Guinea.
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