

Long-term seismic gaps of the Dead Sea Fault: are they significant?

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The combined geological and historical earthquake records along the Dead Sea Fault (DSF) document the individual coseismic left-lateral slip and cumulative offset in the last 14 Ka. The ~ 1000-km-long North-South trending transform fault presents structural discontinuities and includes segments that experienced large earthquakes ($M_w > 7$) in historical times. Active tectonics and geomorphological studies along the Wadi Araba, Jordan Valley, the Lebanese restraining bend, the Missyaf and Ghab fault segments in Syria and the Ziyaret Fault segment in Turkey display geometrical complexities made of step overs, restraining and releasing bends and constitute major obstacles to earthquake rupture propagation. Tectonic geomorphology with paleoseismic trenching and archeoseismic investigations indicate repeated faulting events and left-lateral slip rate ranging from 4 mm/yr in the southern fault section to 6 mm/yr in the northern fault section. Except for the northern most DSF sections, these estimates of fault slip rate are consistent with GPS measurements that show 4 to 5 mm/yr deformation rate across the plate boundary. However, fault sections show clear instrumental seismic gaps added with long-term period of seismic quiescence for large earthquakes. An estimate of the seismic slip deficit along the fault shows that the Missyaf segment, Jordan Valley fault and northern section of the Wadi Araba fault are the fault zones with a potential for large earthquake occurrence. In addition, The timing of past earthquake ruptures show the occurrence of earthquake sequences with a southward large earthquake migration and the existence of major seismic gaps along strike. In this paper, we discuss the signification of seismic slip deficit along fault segments at the gaps, and the level of seismic hazard and risk in the Middle-East.