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Calibrated surface ages for desert pavements from spaceborne radar measurements of surface roughness and application of this new dating method for quantifying tectonic slip rates across the Dead Sea Transform since ∼1 Ma.

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The Dead Sea Transform (DST) accommodates a total of ∼105 km of sinistral motion between Arabia and the Sinai sub-plate since the Miocene. Previous studies revealed time-averaged slip rates of ∼5-8 mm/yr since the Miocene that appear to be comparable to more recent slip rates of ∼3-9 mm/yr inferred from offset late Pleistocene – Holocene geomorphic markers and GPS measurements along the DST. However, quantitative constraints for Plio-Pleistocene slip rates across the transform remain limited because dating efforts of geomorphic features in this age range that were tectonically offset by the DST have been unsuccessful so far. Here, to address this data gap we use a newly established dating approach for desert alluvial surfaces that builds on satellite radar measurements of surface roughness as quantitative proxies for the age of abandoned alluvial surfaces in desert environments. Calibration of the radar measurements against previously obtained 'in-situ' surface ages (e.g., cosmogenic nuclides, luminescence dating) of abandoned alluvial units within the DST region allowed us to use radar to determine surface ages. Sensitivity analyses and validation experiments reveal a minor dependency on lithology, an effective age inversion range of ∼ 3 - 1500 ka and overall uncertainty of ∼35% for the radar-based age estimates. Newly obtained radar ages of ∼700 and 1000 ka for tectonically offset alluvial fans, which could not be previously dated with 'in-situ' methods, reveal a ∼constant lateral slip rate of ∼5-10 mm/yr across the DST since ∼1 Ma. Our results support the hypothesis that crustal velocities between Arabia and the Sinai sub-plate have remained ∼constant since the Miocene.