Title: A comprehensive GPS velocity field along the Dead Sea fault system: A preliminary view of near-field kinematics from the Gulf of Aqaba to Iskanderun

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Abstract

This study presents an initial synthesis of GPS observations focusing on different parts of the Dead Sea Fault System (DSFS) in order to construct a comprehensive view of crustal deformation along the entire length of this left-lateral, transform boundary between the Arabian and Sinai plates. As one of the main tectonic elements in the eastern Mediterranean region, an understanding the kinematics of the DSFS elucidates the broader understanding of the regional tectonic framework. Furthermore, reconciling short-term (geodetic) measurements of crustal strain with neotectonic data on fault movements can yield insight into the mechanical and rheological properties of crustal deformation. In addition to regional continuous GPS stations, this study assembles results from GPS networks in Syria (observed 2000 - 2008), Lebanon (observed 2002 - 2008), and Jordan (observed 2005 - 2008). Older GPS survey sites yield velocity uncertainties less than 0.8 mm/yr, whereas the newer sites (i.e., those first measured in 2005) have uncertainties around 1.0 mm/yr. Analysis of the GPS velocities using elastic dislocation models suggests slip rates of 4.0 - 5.0 mm/yr along the southern section, 4.0 - 4.6 mm/yr within the central restraining bend, and a maximum of 2.1 - 3.1 mm/yr along the northern DSFS. Additionally, the modeled locking depths of the fault are deeper (15 - 25 km) along the southern and central DSFS, whereas they are shallower (5 - 10 km) along the northern DSFS. This difference in slip rates is also consistent with differing

estimates of total fault slip since the mid Miocene: 20 - 25 km along the northern DSFS versus about 45 km along the southern DSFS. Hence, the northern DSFS appears to be kinematically different from other two segments. This may, in part, reflect internal deformation within both the Arabian and Sinai plates. The improved understanding of kinematic variations along the DSFS suggest that the Dead Sea Fault System may not behave as a "simple" transform, and these will contribute to a more robust estimate of the associated earthquake hazard.
