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Geodetic investigation of crustal deformation along the Dead Sea Transform and the Carmel Fault System

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We use GPS measurements and elastic modeling to study the crustal deformation in the Levant. In this region, large-scale crustal deformation is mainly related to the Dead Sea Transform (DST) and the Carmel Fault System (CFS). The former is an active left lateral transform, bounding the Arabian plate and the Sinai sub-plate, and the latter branches out of the former and separates the Sinai sub-plate into two tectonic domains. In this study we obtain the velocities of 33 permanent GPS stations and 145 survey stations that were surveyed in three campaigns between 1996 and 2008. We use a simple elastic dislocation model to infer the slip rate and locking depth along various segments of the DST. We infer a 3.1–4.5 mm/yr slip rate and a 7.8–16.4 km locking depth along the DST north of the CFS, and a slip rate of 4.6–5.9 mm/yr and locking depth of 11.8–24 km along the Jericho Valley, south of the CFS. Further south, along the Arava Valley we obtain a slip rate of 4.6–5.4 mm/yr and a locking depth of 12.1–22.5 km. We identify an oblique motion along the Carmel fault with about 0.7 mm/yr left-lateral and about 0.6 mm/yr extension rates, resulting in N-S extension across the Carmel fault. This result, together with the decrease in DST slip velocity from the Jericho fault to the Jordan fault confirms previous suggestions, according to which part of the slip between Arabia and Sinai is being transferred from the DST to the CFS.