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Continuous creep measurements on the North Anatolian Fault at Ismetpasa

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A graphite creep-meter was installed across the North Anatolian fault near a wall at Ismetpasa, Turkey, that has been offset by fault creep processes more than 51 cm since its construction in 1957. The creep-meter is 40-cm-deep, 16.5-m-long and crosses the fault at 30 degrees within a 2 cm diameter telescopic PVC conduit. The SW end of the 6-mm-diameter graphite rod is fastened to a buried stainless steel tripod, and motion of its free end relative to a similar tripod at its NE end is monitored by two sensors: an LVDT with 6 μm resolution and 13 mm range, and a Hall-effect rotary transducer with 30 μm resolution and 1.5 m range. The two sensors track each other to better than 1%. Data are sampled every 30 minutes and are publically available via the Iridium satellite with a delay of less than 1 hour.

Since May 2014, for periods of months the surface fault has been inactive, followed by several weeks or months of slow slip at rates of $\approx$3 mm/yr and with cumulative slip amplitude less than 1 mm, terminated by a pair of distinct creep events with durations of up to 8 days and amplitudes of up to 2.3 mm, after which slip ceases until the next episode. Maximum slip rates on the surface fault are 0.54 mm/hour at the onset of a creep event. The decay time constant of the two pairs of creep events we have observed varies from 3 to 5 hours, similar to those observed by Altay and Sav, (1982) who operated a creepmeter here from 1980-1989. The decadal creep rate observed by these authors was 7.35$\pm$0.9 mm/yr, whereas our currently observed least-squares creep-rate is 5.4$\pm$1 mm/yr based on 19 months of data. Since most of the annual of the creep occurs in large creep events (80%), we anticipate that our rate will change with elapsed time, and our uncertainty will decrease accordingly.

As expected, the 2014-2016 observed creep rate is somewhat lower than the regional creep on the fault deduced from Insar analysis and GPS observations ($\approx$7-8 mm/yr), but both the amplitude of creep events, and the rate is consistent with creep being confined to the uppermost 3-5 km of a fault subjected to remote displacement rate of $\approx$2 cm/year.