

Using LiDAR Digital Topographic Data to Determine Fault Slip Rates Along the Fish Lake Valley Fault Zone

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The Fish Lake Valley fault zone, together with its southern continuation in Death Valley (the Death Valley fault zone), is the largest and most continuous fault system in the eastern California shear zone (ECSZ). This Death Valley-Fish Lake Valley fault system (DV-FLVFZ) extends 310 km northward from its intersection with the Garlock fault (Figure 1). Both geologic and geodetic observations suggest the DV-FLVFZ accommodates the majority of deformation in the ECSZ north of the Garlock fault. In this study, we will address questions of the spatial and temporal constancy of seismic strain accumulation and release by determining long-term slip rates at time scales of 10³ to 10⁵ years from different locations on the DV-FLVFZ. Our recent acquisition of ~420 km² (collected in a one-kilometer to four-kilometer-wide, along-strike swath) high-resolution (one-meter horizontal, 10- to 15-centimeter vertical) digital LiDAR topographic data (Figure 1) will allow us to map deformed Pleistocene and Holocene landforms in unprecedented detail. Dating of these offset landforms by terrestrial

cosmogenic nuclide (TCN) and optically stimulated luminescence (OSL) techniques will yield slip rates at a variety of time scales. The slip rates that we will generate by combining with TCN and OSL geochronology will fill in one of the last major missing pieces of the slip rate “puzzle” in the ECSZ. These data, in combination with published rates, will also provide a synoptic view of the cumulative slip rates of the major faults of the ECSZ north of the Garlock fault. Comparison of these longer-term rate data with short-term geodetic data will allow us to determine whether or not strain storage and release have been spatially and temporally constant along this part of the Pacific-North America plate boundary during Holocene to late Pleistocene time.

Figure 1. One-meter resolution LiDAR image of the Furnace Creek alluvial fan complex in central Fish Lake Valley, California. The alluvial fan is offset by the right-lateral Fish Lake Valley fault zone. The star on inset index map indicates the approximate location of the Furnace Creek site. FLVFZ = Fish Lake Valley fault zone. SAF = San Andreas fault. Modified from Frankel et al. [in prep].

