A fresh fault scarp identified in an urban district by LiDAR survey: A case study on the ISTL active fault system, central Japan

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A light detection and ranging (LiDAR) survey was conducted in a densely built-up area in central Japan. The urban district of Matsumoto City is located in a 3-km2basin along one of the highest seismic risk fault systems on land in Japan, the Itoigawa-Shizuoka Tectonic Line active fault system (ISTL). A digital elevation model (DEM) at a 0.5-m-grid interval was obtained from LiDAR data that had been processed to remove the effects of laser returns from buildings, clouds and vegetation. The high-resolution DEM confirmed the existence of a continuous scarp, up to ˜2 m in height, cutting across an alluvial fan surface in the urban district. Pre-existing borehole data and archaeological studies indicate that the scarp was formed during the most recent known faulting event, which was associated with historical earthquakes in the 8th or 9th century. The existence of the fault scarp strongly suggests that the urban district is within a pull-apart basin related to a fault step-over between the left-lateral strike-slip Gofukuji and southern portion of East Matsumoto Basin faults. The Gofukuji fault has the highest earthquake probability of all onshore active faults in Japan. Consequently, accurate interpretation of fault geometry is crucial to provide estimates of future surface deformation and to allow modeling of basin structure and strong ground motion. Thus, the LiDAR mapping survey has been shown to be effective for detailed mapping active faults in urban districts in addition to its current use in forested areas.