Episodic and jerky landslide movements at the Tungnakvíslarjökull outlet glacier, south Iceland

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In general, landslides show various characteristics of spatio-temporal distribution of movement. Episodic movements are often connected to seasonal changes in precipitation. The Tungnakvíslarjökull landslide is located above the Tungnakvíslarjökull outlet glacier on the west flank of the Katla Volcano, which again is overlain by the Mýrdalsjökull ice cap in South Iceland. The landslide is a deep-seated gravitational slope deformation with a rotational movement. It has an approximately 1.5 km long head scarp. The downward deformation has been approximately 200 m in the past 70 years. The landslide is buttressed by the Tungnakvíslarjökull outlet glacier, which retreat promotes failure of the hillslope. Active volcanic structures, such as a growing cryptodome, have also been proposed to affect the landslide movement. The landslide subsided fastest in the early 2000s. Here we constrain further the temporal history of landslide motion using Synthetic Aperture Radar (SAR) data pixel tracking. The SAR pixel tracking shows a clear slow-down in 2011, coinciding with a decrease in seismicity. Two continuously recording GNSS instruments were installed in 2019 and 2020 in the landslide. The GNSS stations show movements of several decimeters per year, with most movement confined to late summer and fall each year. The lower GNSS station of the two has recorded several distinct instantaneous offsets of 5-15 cm each time. These "jerk-like" offsets are sometimes accompanied by regionally located seismic events occurring within seconds of the offsets. The upper station, however, moves more continuously. The landslide region experiences heavy rain in the fall season, however, there are also periods of intense rainfall in the spring when little movement is observed. One possibility explaining the lack of motion in the spring time that frozen surface layers in spring to mid-summer may hinder precipitation from entering the landslide mass. The continuous low-cost GNSS observations complement spatially dense deformation techniques, such as using InSAR, differential DEM, and feature/SAR pixel tracking.