4.1. Investigation of sub-annual movement variations at the Dösen rock glacier (Hohe Tauern range, Austria)

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Abstract: At the Dösen Rock Glacier long-term and inter-annual variabilities of rock glacier velocity (RGV) between 1954 and 2022 have been analyzed comprehensively. Yet intra-annual fluctuations are not represented by the available datasets and hence poorly understood. We aim to complement the existing records by introducing and interpreting a new dataset of intra-annual RGV comprising the period from August 2021 to August 2022. Geodetic monitoring at the Dösen Rock Glacier is based on the repeated localization of 34 objects points distributed across the landform using a total station (1995-2012) and GNSS-equipment (2013-2022). Landform wide RGV amounted to 51cm/a (n=11) during the last inter-annual period from 08/2021 to 08/2022, which is substantially higher than the mean of 36cm/a (n=11) during the era of geodetic measurements. To assess the movement pattern for summer and early fall 2022, annual campaigns performed on 17.08.2021 and 17.08.2022 were complemented by additional field measurements conducted on 07.07.2022 and 28.09.2022. This allows for an evaluation of three sub-annual periods. Normalized RGVs of 51cm/a (n=11) from 08/2021 to 07/2022; 48cm/a (n=11) from 07/2022 to 08/2022; and 58cm/a (n=11) from 08/2022 to 09/2022 were calculated. Individual point velocities during those periods are higher at the center and lower at the margins. During the investigated periods single point values range from no solid evidence for displacements to RGV of up to 76cm/a. The present study analyses spatial and temporal patterns, variability, and anomalies of RGV with a focus on the entire landform as well as individual points. It revealed a general acceleration during summer, peaking in early autumn. From a single point perspective, the evolution is complex and suggest an asynchronous velocity rhythm with varying onset, stabilization and ceasing of high velocities in the upper and lower zones of the investigated landform. The results emphasize the need for permanently installed monitoring solutions resolving displacements with a higher temporal resolution.