

Surface morphology and dynamic of debris-covered and rock glaciers in the Tröllaskagi Peninsula (northern Iceland).

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The Tröllaskagi peninsula is located in north central Iceland, between the meridians of 19°30'W and 18°10'W, limited by the Skagafjörður fiord to the west and the Eyjafjörður fiord to the east, jutting out into the North Atlantic to latitude 66°12'N and linked to the central Icelandic highlands to the south. There are over a hundred debris-covered and rock glaciers at its valley heads, some of which have been studied in detail regarding their dynamics and activity (vid. summary in Andrés et al. 2016).

This work analyses block displacements and changes in the surface morphology of the Fremri-Grjótárdalur rock glacier (65°43'N 19°W, 1,245 m) and the Hóladalsjökull debris-covered glacier (65°42'N; 18°57'W, 1,330 m), located in the centre of Tröllaskagi peninsula. A Digital Photogrammetric WorkStation -Digi3d.NET- (DPWS Digi3d) has been used in this study to compare the evolution of these landforms in aerial photographs taken at different years (1946, 1980, 1985 and 1994) and a 2000 orthophoto.

In our study, we have obtained high-accuracy multitemporal stereo-models (RMSExyz between 0.153 and 0.251 m) by using DPWS Digi3d. The 3D digital stereo-photogrammetric restitution of aerial photographs from the years 1980 and 1994 allows us to compare high resolution digital elevation models (derived from contour lines at 2 m interval) and obtain location differences of geomorphological surface features (ridges, transverse and longitudinal furrows, front and lateral crests, flow lines, thermokarst depressions) and many control points in large blocks.

The results obtained of surface horizontal and vertical displacements of large blocks for the period 1980-1994 at the Hóladalsjökull debris-covered glacier show an average velocity of 0.33 m yr⁻¹ and -0.72 m respectively. However, the results obtained of the displacement of lateral and front crests reveal an advance of 14.84 m for the period 1946-2000 (0.27 m yr⁻¹). Between 1980 and 1994 these features have only been displaced by 2.8 m, indicating a velocity lower than 0.20 m yr⁻¹. The limited advance of the crests seems to be related to a process of surface lowering, as they show a decrease of their average altitude by 0.6 m (0.04 m yr⁻¹). The results obtained at the Fremri-Grjótárdalur rock glacier show that the horizontal displacement of blocks is very low, less than 0.2 m yr⁻¹, with a decrease in their average altitude by 0.37 m. The low rates of block displacement and monitored features, as well as the important process of surface lowering observed in these landforms, may indicate that widespread melting is the most important activity occurring at the debris-covered and rock glaciers in Tröllaskagui. Beside the slow movement at the Hóladalsjökull debris-covered glacier and the lack of movement at Fremri-Grjótárdalur, no changes have occurred in their surface morphology in the last 54 years, except for the formation of some depressions due to collapse in the former.

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References

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