



Dynamic of debris-covered and rock glaciers in Tröllaskagi Peninsula (Iceland): The cases of Hofsjökull and Júllogil.

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Hofsjökull debris-covered glacier and Júllogil rock glacier are located in the Hofsdalur valley headwalls, in Tröllaskagi, a mountainous peninsula located in central north Iceland, limited by Skagafjörður fjord to the west and Eyjafjörður fjord to the east. These debris-covered and rock glaciers are 3,000 and 1,100 meters long respectively, occupy an area of 3,795 and 0,696 km² and they have a debris-free ice area in their headwalls. The summits are between 1,200 and 1,350 meters of altitude. The glacier fronts ends between 862 and 884 meters in the case of Hofsjökull debris-covered glacier and between 916 and 924 meters in Júllogil rock glacier. The main aim of this research was to determine the dynamic of these debris-covered and rock glaciers in the period of 1946-2017 from the changes observed in their surface morphology. The methodological approach consisted of a combination of geomorphological mapping, photogrammetric techniques and Geographical Information System (GIS) analysis. First, a Digital Photogrammetric WorkStation has been used to obtain high-accuracy multitemporal orthophotos from historical aerial photographs taken at different years (1946, 1980, 1985 and 1994) with 0.2 m resolution. The RMSE_{xyz} of the orthorectification of the aerial photographs range between 0.17 and 0.31 meters. Second, the largest blocks located on the debris-covered and rock glacier surfaces have been identified in 1980, 1985 and 1994 orthophotos and digitized in the GIS software. Finally, spatial analysis tools have been used to obtain the displacement of the blocks for these periods.

The visual inspection of the orthophotos revealed that these debris-covered and rock glaciers have presented very little morphological variations during the period of 1946-2017, both in the glacier limits and the main internal surface structures (ridges and furrows). The obtained results of surface horizontal displacements of the large blocks for the period 1980-1994 at Hofsjökull debris-covered glacier show a mean velocity of 0.22 m yr⁻¹, with a block elevation difference of -0.36 m, and the Júllogil rock glacier show an average velocity of 0.15 m yr⁻¹ and a block elevation difference of -0.63 m. These landforms are in a situation of stability and their dynamics are fundamentally related to subsidence processes, having lost their sources of ice accumulation. They are almost static landforms, whose origin seems to be related to paraglacial processes after a rapid deglaciation of the valleys and their stagnation ice is preserved for being above the permafrost level.

Keywords: Debris-covered glaciers, rock glaciers, Iceland, Tröllaskagi, photogrammetry.

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