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Combining lichenometry and photogrammetry criteria for glacier evolution research in the Tröllaskagi peninsula (northern Iceland): Gljúfurárjökull and Tungnahryggsjökull glaciers

José M. Fernández-Fernández (1), Nuria Andrés (1), Francisco J. López-Acevedo (1), Starri Heiðmarsson (2), and David Palacios (1)

(1) Physical Geography in High Mountain Areas Research Group, Department of Geography, Complutense University of Madrid, Madrid, Spain (josemariafernandez@ucm.es), (2) Icelandic Institute of Natural History, Akureyri, Iceland

The Tröllaskagi peninsula in northern Iceland (65° N) is a setting that is especially sensitive to climate change because of its location in an area where air masses meet ocean currents of a contrasting nature (humid tropical masses and dry arctic masses; and the warm Irminger current and the cold East Greenland current). The small Tröllaskagi glaciers are particularly sensitive to climate variation, especially to summer temperatures and winter accumulation, in particular when they lack surface debris cover (debris-free). The aim of this work is to study the evolution of glaciers at their different stages of advance and retreat within a context of deglaciation and climate warming. To this end, we selected the Gljúfurárjökull and Tungnahryggsjökull glaciers located in the centre of the peninsula (65º41'N, 18º44'W) at the headwaters of Skíðadalur and Kolbeinsdalur valleys.
In order to achieve this aim we carried out detailed geomorphological mapping of the numerous moraines located in the forelands. At each morainic formation, lichenometry techniques were applied to determine its age. To do this we performed high-precision on-site measurements of specimens of lichen of the Rizocarpon geographicum and Porpidia soredizodes species with photographic techniques (López-Acevedo et al., in prep.). That age was compared with the results of the photo interpretation of previously georeferenced aerial photographs on which were mapped the extension of the glaciers and the position of the fronts in 1946, 1985, 1994 and 2000; additionally, a SPOT satellite image from 2005 was used.
Applying previously published lichen growth rates of 0.41 and 0.44 mm yr-1 to the registered measurements enabled us to date various stages of advance and retreat. The joint use of dating and aerial photographs of different dates allowed us to validate lichenometric results and infer new lichen growth rates for different periods. The results of both techniques show a retreat of the glaciers of approximately 1 km from the end of the Little Ice Age to 2005, with special intensity during the first half of the 20th century (15.3 m yr-1 on average). The trend was reversed from the late 1970s to the mid-1980s, and lasted at least until the mid-1990s in Gljúfurárjökull and Western Tungnahryggsjökull, whose fronts in the 1994 photographs show a more advanced position than in 1985. Since then, the glaciers went on retreating in 2000 and 2005.

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