

Recent transformations in the high-Arctic glacier landsystem Hørbyebreen, Svalbard.

Marek Ewertowski (1), David Evans (2), David Roberts (2), and Aleksandra Tomczyk (1)

(1) Faculty of Geographical and Geological Sciences, Adam Mickiewicz University, Institute of Geoecology and Geoinformation, Poznan, Poland (marek.ewertowski@gmail.com), (2) Durham University, Department of Geography, Durham, United Kingdom

The Hørbyebreen is a polythermal valley glacier in the Petuniabukta area, central part of Spitsbergen. Since the end of the Little Ice Age, a debris-free glacier margin retreated by more than 3 km exposing complex landform assemblages including ice-cored moraines, flutes, eskers and geometric ridge networks.

Glacier recession and landforms' development in the terrestrial parts of the foreland were quantified using time-series of orthophotos and digital elevation models (generated based on 1961, 1990, 2009 aerial photographs) and high resolution satellite images from 2013. Additionally, detailed analyses of a case study area were performed based on unmanned aerial vehicle (UAV) imagery (3 cm resolution) captured in 2014. A time-series of 1:5,000 geomorphological maps of the whole foreland, together with 1:300 map of a sample area of complex geometric ridge networks and results of sedimentological analysis, enable us to assess the evolution of glacial landform assemblages.

The two main areas of the Hørbyebreen foreland were identified as: (1) the outer moraine ridge and (2) the inner zone between the contemporary ice edge and the outer moraine ridge. The outer moraine ridge was relatively stable and subject to mainly vertical transformation between 1960 and 2009. The most prominent changes were observed within the inner zone. In 1960 it was covered by glacier ice, whereas in 2009 this area exhibited a wide range of subglacial and englacial landforms, including a network of rectilinear ridges which we interpret as crevasse infills created by the injection of pressurized englacial meltwater. Other prominent features in this zone include controlled moraine, indicative of sub-marginal debris entrainment by the polythermal snout, and complex esker network. This landform assemblage is diagnostic of a variable process-form regime in which the glacial geomorphology of polythermal conditions is supplemented with surge signatures and therefore is likely to be the most representative landsystem model for terrestrial-terminating Svalbard glaciers. The research was funded by Polish National Science Centre (project granted by decision number DEC-2011/01/D/ST10/06494).