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

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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 landystem model for terrestrial-terminating Svalbard glaciers. The research was founded by
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