



## **Automatic identification of supraglacial debris expansion using Google Earth Engine: A new tool for glacier monitoring**

Will Smith and Stuart Dunning

Department of Geography, Newcastle University, Newcastle upon Tyne, United Kingdom (w.d.smith2@newcastle.ac.uk)

As glacial environments lose ice mass due to increasing atmospheric temperatures, more bedrock is exposed with decreasing binding permafrost. Debris supply rates increase and large failures (debatably) become more commonplace. This suite of increased subaerial supply, along with thinning and frontal retreat allowing englacial debris emergence, results in expanding extents of supraglacial debris cover. These debris additions affect glacial dynamics through melt regime modification, and potential chemical and physical changes to supraglacial, englacial and subglacial hydrology. Here we present a first tool that identifies supraglacial debris additions and debris cover expansion through efficient cloud based processing. We use the Google Earth Engine platform to quantify supraglacial debris expansion, utilising the large collection of optical satellite imagery from Landsat 4, 5, 7, and 8. This array of data allows investigation of debris expansion and its slope v's glaciological causes from 1982 until the present day to be undertaken.