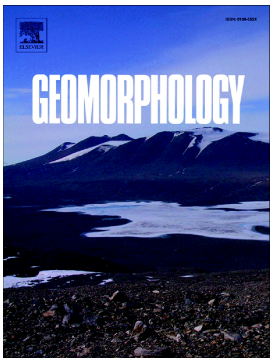

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Review paper solicited for Geomorphology

Short-term geomorphological evolution of proglacial systems

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ABSTRACT

Proglacial systems are amongst the most rapidly changing landscapes on Earth, as glacier mass loss, permafrost degradation and more episodes of intense rainfall progress with climate change. This review addresses the urgent need to quantitatively define proglacial systems not only in terms of spatial extent but also in terms of functional processes. It firstly provides a critical appraisal of prevailing conceptual models of proglacial systems, and uses this to justify compiling data on rates of landform change in terms of planform, horizontal motion, elevation changes and sediment budgets. These data permit us to produce novel summary conceptual diagrams that consider proglacial landscape evolution in terms of a balance of longitudinal and lateral water and sediment fluxes. Throughout, we give examples of newly emerging datasets and data processing methods because these have the potential to assist with the issues of: (i) a lack of knowledge of proglacial systems within high-mountain, arctic and polar regions, (ii) considerable inter- and intra-catchment variability in the geomorphology and functioning of proglacial systems, (iii) problems with the magnitude of short-term geomorphological changes being at the threshold of detection, (iv) separating short-term variability from longer-term trends, and (v) of the representativeness of plot-scale field measurements for regionalisation and for upscaling. We consider that understanding of future climate change effects on proglacial systems requires holistic process-based modelling to explicitly consider feedbacks and linkages, especially between hillslope and valley-floor components. Such modelling must be informed by a new generation of repeated distributed topographic surveys to detect and quantify short-term geomorphological changes.