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Bar deposition in glacial outburst floods: scaling, post-flood reworking, and implications for the geomorphological and sedimentary record

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The appearance of a flood deposit in the geomorphological and sedimentary record is a product of both the processes operating during the flood, and those that occur afterwards and which overprint the deposit with a record of 'normal' processes. This paper describes the creation and modification of jökulhlaup barforms in the Skeiðará river, relating the changes to post-flood fluvial processes and glacier retreat. Large compound bars formed from the amalgamation of unit bars up to 1.5 km long. Nearly half of the total discharge of the November 1996 jökulhlaup on Skeiðarársandur was discharged through the Skeiðará river. The flood deposits have been extensively reworked since, up until 2009 when the channel was abandoned, effectively leaving the Skeiðará as a terrace, when retreat of Skeiðarárjökull directed meltwater to the adjacent Gígjukvísl river system. Large compound bars formed in the flood channel, with their location governed by the macro-scale topography of the flood channel, and their size by upstream channel width in accordance with bar-scaling theory. Jökulhlaup bars are therefore scale invariant and formed in a similar fashion to braid bars in non-jökulhlaup braided rivers. Post-flood fragmentation and reworking of the bars consistently increased the length-width ratio of preserved bar fragments from approximately two and one half to over five. When combined with earlier work on the Skeiðará jökulhlaup bars, and studies of jökulhlaup deposits elsewhere on Skeiðarársandur these observations increase our understanding of the preservation potential and final form of jökulhlaup deposits and provide the basis for an improved model for the recognition of jökulhlaup deposits in the geomorphological and sedimentary record.