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Subglacial processes in the terminus region of Findelengletscher, Switzerland, inferred from bed geometry, borehole hydrology, glaciofluvial sediment transport and proglacial landform investigation

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The nature of the subglacial hydrological system of temperate glaciers is of great importance for rates and processes of glacier flow and subglacial erosion. The subglacial hydrology of Findelengletscher, Switzerland, was the subject of numerous investigations from the early 1980s to the late 1990s. Glacier retreat has since begun to expose a sizeable overdeepened basin in the region of former study that was not fully appreciable from then-available radio-echo sounding data. We combine present day proglacial and ice thickness survey data with information on past ice thickness to reconstruct the morphology of the basin and consider its likely former influence on subglacial hydrology and significance for the interpretation of hydrological and subglacial process measurements. The recently deglaciated area also provides insight into subglacial conditions at the time, including the accumulation of a thick (i.e. > 5 m depth) fine-grained till layer on the overdeepening adverse slope that indicates an inefficient subglacial drainage system morphology. The measured relation of suspended sediment concentration with discharge in the proglacial stream indicates that subglacial drainage system morphology remains inefficient, and the recent (2016) observation of basal ice facies consistent with formation by glaciohydraulic supercooling indicates maintenance of adverse slope morphology close to the supercooling threshold by stabilising feedbacks during recent retreat. Further retreat is in time likely to be accompanied by a reduction in overdeepening depth because present thinning is expected to lead to a reduced hydraulic gradient and ice surface slope.