Inventory and genesis of glacial lakes in Switzerland since the Little Ice Age

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The deglaciation since the end of the Little Ice Age (LIA, ~1850) has given way to >700km² of “new” landscape in Switzerland. Glacial lakes are a conspicuous feature of this new landscape – with relevance for natural hazards, hydropower and landscape planning. In this study, we compiled an inventory of glacial lakes for Switzerland for the year 2016. Using existing data, we investigated the evolution of glacial lakes in Switzerland for six time periods since the LIA. Additionally, we compiled information constituting a basis for hazard assessment for all ice-contact lakes in 2016 and all lakes >0.5 ha, i.e. surface outflow, dam type and material, and lake freeboard.

We found that a total of 1230 lakes formed over the period of ~170 years, 982 still existing in 2016. The largest lakes are >0.4 km² (40 ha) in size, while the majority (>90%) are smaller than 0.01 km². Annual increase rates in area and number peaked in 1946-1973, decreased towards the end of the 20th century, and reached a new high in the latest period 2006-2016. For a period of 43 years, we compared modelled overdeepenings from previous studies to actual lake genesis. For a better prioritisation of formation probability, we included glacier-morphological criteria such as glacier width and visible crevassing. About 40% of the modelled overdeepened area actually filled with water. The inclusion of morphological aspects clearly aided in linking a lake formation probability to a modelled overdeepening.
Fig. 1: Glacial lake distribution in Switzerland and its evolution over time.