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Subglacial Water Reservoirs, Jökulhlaups and Volcanic Eruptions

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ABSTRACT

Water may accumulate in a reservoir that forms beneath a depression in a glacier surface. The water reservoir will grow unstable. The accumulation will cause a jökulhlaup from the reservoir. Water may also accumulate beneath a slightly inclined or a convex glacier surface. The reservoir will remain stable. A jökulhlaup will not result under these conditions.

A depression in the glacier surface may be created by melting above a permanent geothermal area. The depression at Grímsvötn in Vatnajökull is a well known example. Jökulhlaups at Skeidarársandur originate at Grímsvötn. An ice cauldron which is situated 10 km north-west of Grímsvötn is an other example. Jökulhlaups in the river Skaftá drain from a reservoir which is situated beneath the ice cauldron.

A depression may also be created by a subglacial volcanic eruption. The eruption will cause considerable subglacial melting. A depres-

sion is formed in the glacier surface if the meltwater drains towards the glacier rivers. The subglacial waterways around the depression may become sealed. Meltwater would then be trapped beneath the depression. A dome-shaped subglacial water reservoir will be formed at the bed of the glacier. Jökulhlaups will occur from the reservoir. Pillow lava and hyaloclastic materials are piled up within such a reservoir during subglacial volcanic eruptions.

SYMBOLS

- g acceleration of gravity
- z vertical coordinate for glacier elevation
- z_b glacier bed-rock elevation
- H_i glacier thickness
- z_o datum level for glacier elevation
- z_s glacier surface elevation
- $z_w = z_b + H_w$, elevation of the top surface of a subglacial water layer