



Physical Experiment of Englacial R-Channels

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In 1972, Röthlisberger presented a theoretical study describing the evolution of pressurised en- and subglacial channels. The existence of these so-called R-channels has later been confirmed through field observations. To our knowledge, however, no physical experiment has ever been conducted to actually measure the properties of such channel flow in the laboratory. Here, we present a setup for such a laboratory experiment and preliminary results.

The aim of our experiment is to measure the Darcy-Weisbach friction factor, the heat exchange rate between water and channel wall, and the Reynolds number. For our experiment, we produce transparent ice blocks of 1.6m length and a cross section of up to 25x25cm. A small metal tube is frozen into the ice block and removed before the experiment to create an initial R-channel. Pipes attached to flanges frozen into the ice block allow us to let water flow under pressurised conditions. Water pressure and temperature are measured at the inlet and outlet of the ice block whilst the evolution of the channel diameter is captured by photographic imaging. A magnetic flow meter measures the discharge. During a typical experiment, the diameter of the R-channel evolves from 1 to 6cm with flow speeds of up to 2m/s, the Reynolds number is around 10^4 , and the friction factor increases from about 0.024 to 0.12. This means that the channel evolves from hydraulically smooth to rough.