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Preliminary results of the relation between ice viscosity and water content using a inverse method

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ABSTRACT

One of the outstanding problems of the modelling of temperate ice dynamics is the limited knowledge on the rheology of temperate ice and, in particular, on how the rate factor depends on the liquid water content. Though it is well known that the rate factor depends strongly on the water content, in practice the only available experimentally-based relationship is that by Duval (1977), which is only valid for water contents up to 1%. However, actual water contents found in temperate and polythermal glaciers are sometimes substantially larger.

It is possible, though logistically and computationally difficult, to estimate the spatial distribution of the water content from GPR data. If a relationship between rate factor and water content spanning the entire range of water content found in temperate ice were available, it would be possible to infer the spatial distribution of the rate factor, which would substantially improve the modelling of glacier dynamics.

We use an inverse method to infer, from glacier geometry and surface velocities, the spatial distribution of the rate factor. This distribution can be compared with that obtained from GPR data with the aim to obtain a rate factor-water content relationship.