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Worldwide dataset of glacier thickness observations compiled by literature review

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The volume of glaciers and ice caps is still poorly known, although it is expected to contribute significantly to changes in the hydrological cycle and global sea level rise over the next decades. Studies presenting worldwide estimations are mostly based on modelling and scaling approaches and are usually calibrated with only few measurements. Direct investigations of glacier thickness, a crucial parameter for ice volume calculations, are rather sparse but nevertheless available from all around the globe.

This study presents a worldwide compilation of glacier thickness observation data. Literature review revealed mean and/or maximum thickness values from 442 glaciers and ice caps, elevation band information and point measurements for 10 and 14 glaciers, respectively. Resulting in a dataset containing glaciers and ice caps with areas ranging from smaller than 0.1 km2 (e.g. Pizolgletscher, Switzerland) to larger than 10'000 km2 (e.g. Agassiz Ice Cap, Canada), mean ice thicknesses between 4 m (Blaueis, Germany) and 550 m (Aletschgletscher, Switzerland) and 64 values for ice masses with entries from different years. Thickness values are derived from various observation methods and cover a survey period between 1923 and 2011.

A major advantage of the database is the included metadata, giving information about specific fields, such as the mean thickness value of Aletschgletscher, which is only valid for the investigation area Konkordiaplatz and not over the entire glacier. The relatively small collection of records in the two more detailed database levels reflects the poor availability of such data.

For modelling purposes, where ice thicknesses are implemented to derive ice volumes, this database provides essential information about glacier and ice cap characteristics and enables the comparison between various approaches. However, the dataset offers a great variety of locations, thicknesses and surface areas of glaciers and ice caps and can therefore help to compare, calibrate and validate existing models and analyses to improve the broader understanding of sea-level rise contribution from glaciers and ice caps worldwide.