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A new glacier model resolving ice dynamics applied to the Alps

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Most regional and global glacier models rely on empirical scaling laws to account for glacier area and volume change with time. These scaling methods are computationally cheap and are statistically robust when applied to many glaciers, but their accuracy considerably lowers at the glacier or catchment scale. The nearest alternative in terms of complexity – glacier flowline modelling – requires significantly more information about the glacier geometry. Here we present a new open source glacier model applicable at regional to global scale implementing i) the determination of glacier centerlines, ii) the inversion of glacier bed topography, and iii) a multi-branch flowline model handling glacier tributaries. Using the HISTALP dataset as climatological input we apply the model in the Alps for 1800 to present and present new estimations of present-day and past glacier volume. The relatively large number of independent data available for validation in this region allow a critical discussion of the added value of our new approach. In particular, we will focus our discussion on two contradictory aspects inherent to any geoscientific model development: while our model clearly opens wide-ranging possibilities to better resolve the glacier processes, this new playground is associated with an increase in complexity, the number of calibration parameters, and... uncertainty?