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The Open Global Glacier Model

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Mountain glaciers are one of the few remaining sub-systems of the global climate system for which no globally applicable, open source, community-driven model exists. Notable examples from the ice sheet community include the parallel ice sheet model or Elmer/Ice-Sheet (http://elmerice.elmerfem.org/elmer-ice-sheet). While the atmospheric modeling community has a long tradition of sharing models (e.g. the Weather Research and Forecasting model) or comparing them (e.g. the Coupled Model Intercomparison Project or CMIP), recent initiatives originating from the glaciological community show a new willingness to better coordinate global research efforts following the CMIP example (e.g. the Glacier Model Intercomparison Project or the Glacier Ice Thickness Estimation Working Group).

In the recent past, great advances have been made in the global availability of data and methods relevant for glacier modeling, spanning glacier outlines, automatized glacier centerline identification, bed rock inversion methods, and global topographic data sets. Taken together, these advances now allow the ice dynamics of glaciers to be modeled on a global scale, provided that adequate modeling platforms are available. Here, we present the Open Global Glacier Model (OGGM, http://oggm.org/), developed to provide a global scale, modular, and open source numerical model framework for consistently simulating past and future global scale glacier change.

Global not only in the sense of leading to meaningful results for all glaciers combined, but also for any small ensemble of glaciers, e.g. at the headwater catchment scale. Modular to allow combinations of different approaches to the representation of ice flow and surface mass balance, enabling a new kind of model intercomparison. Open source so that the code can be read and used by anyone and so that new modules can be added and discussed by the community, following the principles of open governance. Consistent in order to provide uncertainty measures at all realizable scales.

As an application example, OGGM results have shown that glacier mass loss commitment from current climate, around 0.8° higher than pre-industrial period (1850-1879), represents more than half of the end of the 21st century, 1.5° global warming, glacier mass loss.