Impact of the choice of surface mass balance models and their calibration on large-scale glacier change projections

Lilian Schuster¹, David Rounce², and Fabien Maussion¹
¹University of Innsbruck, Department of Atmospheric and Cryospheric Sciences (ACINN), Austria (lilian.schuster@student.uibk.ac.at)
²Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA, United States

A recent large model intercomparison study (GlacierMIP) showed that differences between the glacier models is a dominant source of uncertainty for future glacier change projections, in particular in the first half of the century. Each glacier model has their own unique set of process representations and climate forcing methodology, which makes it impossible to determine the model components that contribute most to the projection uncertainty. This study aims to improve our understanding of the sources of large scale glacier model uncertainty using the Open Global Glacier Model (OGGM), focussing on the surface mass balance (SMB) in a first step. We calibrate and run a set of interchangeable SMB model parameterizations (e.g. monthly vs. daily, constant vs. variable lapse rates, albedo, snowpack evolution and refreezing) under controlled boundary conditions. Based on ensemble approaches, we explore the influence of (i) the parameter calibration strategy and (ii) SMB model complexity on regional to global glacier change. These uncertainties are then put in relation to a qualitative selection of other model design choices, such as the forcing climate dataset and ice dynamics model parameters.