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Long-term legacy of delayed climate mitigation in global glacier response

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Mountain glaciers have a delayed response to climate change and are expected to continue to melt long after greenhouse gas emissions have stopped, with consequences both for sea-level rise and water resources. In this contribution, we use the Open Global Glacier Model (OGGM) to compute global glacier volume and runoff changes until the year 2300 under a suite of stylized greenhouse gas emission characterized by (i) the year at which anthropogenic emissions culminate, (ii) their reduction rates after peak emissions and (iii) whether they lead to a long-term global temperature stabilization or decline. We show that even under scenarios that achieve the Paris Agreement goal of holding global-mean temperature below 2 °C, glacier contribution to sea-level rise will continue well beyond 2100. Because of this delayed response, the year of peak emissions (i.e. the timing of mitigation action) has a stronger influence on mit-term global glacier change than other emission scenario characteristics, while long-term change is dependent on all factors. We also discuss the impact of early climate mitigation on regional glacier change and the consequences for glacier runoff, both short-term (where some basins are expected to experience an increase of glacier runoff) and long-term (where all regions are expecting a net-zero or even negative glacier contribution to total runoff), underlining the importance of mountain glaciers for regional water availability at all timescales.

[1] https://www.uibk.ac.at/acinn/graduate-seminar/index.html.en