

Sea-Level Contributions from Glaciers

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Glaciers other than the ice sheets in Greenland and Antarctica cover an area of 705,000 km² and include approximately 210,000 individual glaciers. Worldwide these glaciers are losing mass at an accelerating pace with profound implications for global sea-level rise. Although only making up less than 1% of the Earth's global ice volume (<0.5 m sea-level equivalent), these glaciers contributed almost just as much to sea-level during the first decade of this century as the Greenland and Antarctic ice sheets combined, and are expected to remain significant contributors for decades to come.

Modeling future glacier changes on a global scale is challenging due to scarcity of data for model initialization and calibration, and biases in climate data in complex mountainous terrain. Here we project the mass changes of all glaciers over the 21st century based on transient climate projections. We compare six glacier models published in the literature including a range of different modeling approaches. Using forcing from 8 to 15 GCMs and 4 different emission scenarios, the glacier models project multi-model mean net mass losses of all glaciers between 7 cm and 24 cm sea-level equivalent by the end of the 21st century. Projected mass losses vary greatly depending on the choice of the forcing climate and emission scenario. Insufficiently constrained model parameters likely are an important reason for large differences found among these studies even when forced by the same emission scenario, especially on regional scales. A "Targeted Activity" under WCRP's Climate and Cryosphere (CliC) program, seeks to understand these differences, and for the first time, provides a framework for a coordinated intercomparison of global-scale glacier mass change models with the ultimate goal to foster model improvements and reduce uncertainties in global glacier projections and associated contributions to sea-level rise.

Keywords: glaciers, glacier mass balance, projection