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Abstract title:

Global glacier mass changes and their contributions to sea-level rise from 1961 to 2016

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Glaciers distinct from the Greenland and Antarctic Ice Sheets cover an area of approximately 706,000 km^2 globally with an estimated total volume of 170,000 km^3, or 0.4 m of potential sea-level rise equivalent. For the previous IPCC reports, mass-change estimates were based on the multiplication of averaged or interpolated results from available observations of a few hundred glaciers with regional glacier areas. These past approaches were challenged by the small number and heterogeneous spatio-temporal distribution of *in situ* measurement series and their often unknown representativeness for the respective mountain range. Here we show that glaciers have lost more mass than previously reported on a global scale. Our new approach, based solely on glaciological and geodetic observations, suggests that glaciers contributed 27 ± 22 mm to global mean sea-level rise from 1961 to 2016. Regional specific mass-change rates for 2006–2016 range between −0.1 and −1.2 m water equivalent (w.e.) per year, resulting in a global sea-level contribution of 335 ± 144 Gt per year or 0.92 ± 0.39 mm per year. The current glacier mass loss is thus equivalent to the sea-level contribution of the Greenland Ice Sheet, clearly exceeds the loss from the Antarctic Ice Sheet, and accounts for 25 to 30% of the total observed sea-level rise. Current mass loss rates indicate that glaciers could virtually disappear in some mountain ranges in this century while heavily glacierised regions will continue contributing to sea-level rise beyond 2100.