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Imbalance and accelerated melting of glaciers and ice caps

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Most glaciers and ice caps (GIC) are out of balance with the current climate. In order to return to equilibrium, these GIC must retreat to higher elevations, losing mass and making a 21st-century sea-level contribution comparable to that of ice sheets. Here, we present data for 140 GIC from 1970–2009 and show that most glaciers and ice caps are farther from balance than previously believed. For the first decade of the 21st century (2000–2009), GIC in this data set have a mean accumulation-area ratio (AAR, the fractional glacier area where accumulation exceeds ablation) of 35%, far below the mean equilibrium value of 56%. If these AARs are assumed to be representative, the Earth's GIC are committed to the future loss of ∼40% of their volume, simply to be in balance with the climate of the past decade. Accounting for geographic sampling biases, estimated volume losses are somewhat reduced, but are still substantially larger than previous published values. Extrapolation of recent trends suggests that if recent climate trends continue for the next several decades, the Earth's GIC will ultimately lose more than half their volume.