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Imbalance and accelerated loss of glaciers in South America and the Antarctic Peninsula

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The majority of glaciers and ice caps (GIC) are out of balance with present day climate conditions. In order to return to equilibrium, these GIC must lose mass and retreat to higher elevations. Here, we present mass balance and accumulation-area ratio (AAR, the fractional glacier area where accumulation exceeds ablation) data from 20 observed GIC in South America and the Antarctic Peninsula from 1992–2012. During the first decade (1992–2002), GIC in this data set had a mean AAR of 44 %, whereas during the past decade (2003–2012) the mean AAR was 41 %; both AAR ratios are far below the global average steady-state AAR. For the same decades the mean annual mass balances were -560 $\pm$ 150 and -670 $\pm$ 80 mm w.e. yr-1, respectively. If these observed AARs are representative, and accounting for regional under-sampling errors, then our calculations suggest that South American and Antarctic Peninsula GIC are committed to a future loss of $\sim$22 % on average of their area and $\sim$30 % of their volume, simply to be in balance with the climate of the past decade. These volume losses may potentially cause a global mean sea level rise of 4 mm sea-level equivalent (SLE) from South America and between 11–27 mm SLE from the Antarctic Peninsula (if all the ice bodies were ice caps or mountain glaciers, respectively), assuming that the total GIC volume for South America was $\sim$13 mm SLE and for the Antarctic Peninsula (excluding the mainland ice) between $\sim$35–90 mm SLE.