



Glacier volume and area change by 2050 in high mountain Asia

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We estimate individual area and volume change of 67021 glaciers on and around the Tibetan Plateau over the period 2000-2050 under temperature and precipitation change projections from the Region Climate Model RegCM 3.0 forced by the IPCC A1B scenario. The procedure is based on a novel surface mass balance parameterization fitted to observational data and a volume-area scaling approach. We use combined Shuttle Radar Topography Mission data and the Randolph Glacier Inventory 2.0 to extract the surface topography of each individual glacier. All the glaciers are then categorized into maritime, sub-continental and extreme continental types based on regional climate conditions, which have different mass balance profiles and sensitivities to temperature and precipitation change. For each glacier and in every year we then construct its mass balance given the forcing from RegCM 3.0 and thence its future glacier area and volume. We show that the method predicts that 35% of the glaciers in Karakoram and the northwestern Himalaya are advancing, which is consistent with the observed slight mass gain of glaciers in these regions in recent years. However, we find that 76% of all the glaciers will retreat, most of which are of the maritime type, losing their combined volume at annual averaged rate of 0.27% a⁻¹. We project total glacier area loss in high mountain Asia to be 30-32% of extent in the year 2000 by 2050, and they will contribute 1.3-1.4 cm to global sea level rise.