Glacier and lake variations in the inland closed basins at high altitude on the Tibetan Plateau using remote sensing and GIS technologies

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ABSTRACT

As a contribution to studies of the impact of climate change on glaciers and lakes in high-altitude closed basins of the western Himalayas, we present spatial and temporal variations of glaciers and lakes in the Mapam Yumco Basin on the Tibetan Plateau, by means of Geographical Information System and Remote Sensing techniques. Our results show that both glacier and lake areas in Mapam Yumco Basin decreased from 1974 to 2003. Glaciers in the basin have receded due to the warmer climate, in total by ~ 7.53 km^2 (0.26 km^2 a^{-1} or 0.25 % a^{-1}) during 1974–2003 (c.f. ~ 0.07 % a^{-1} in nearby Yamzhog Yumco Basin, and 0.18% a^{-1}, the mean glacier recession rate over China since the 1960s). During the same period, lake area decreased by 34.16 km^2 (1.18 km^2 a^{-1} or 4.37 % of whole lake area in the basin) in total, where decreased by 1.43 km^2 a^{-1} on average (with lake shrinkage amounting to 1.70 km^2 a^{-1} in some areas and lake growth to 0.27 km^2 a^{-1} in others) during 1974–1990, by 1.55 km^2 a^{-1} (with lake shrinkage amounting to 2.15 km^2 a^{-1} in some areas and lake growth to 0.60 km^2 a^{-1} in others) during 1990–1999, while enlarged by 0.66 km^2 a^{-1} (with lake shrinkage amounting to 2.24 km^2 a^{-1} and lake growth to 2.89 km^2 a^{-1}) during 1999–2003 over the past three decades. It is suggested that both enlargement and reduction of lakes were accelerated, which might be an indicator for an accelerated water cycle process over the Tibetan Plateau in a warming climate.

Keywords*:* Alpine glacier; Inland lake; Spatial temporal variation; GIS; Remote Sensing; Mapam Yumco Basin; Yamzhog Yumco Basin; Tibetan Plateau

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