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Lake water budget at Paiku Co, central Himalayas: Observations and modeling

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Since the late 1990s, lakes in the southern Tibetan Plateau (TP) have shrunk considerably, which contrasts with the rapid expansion of lakes in the interior TP. Although these spatial trends have been well documented, the underlying hydroclimatic mechanisms are not well understood. Since 2013, we have carried out a comprehensive water budget observation (lake bathymetry, water level, runoff, evaporation and precipitation) at Paiku Co, a large alpine lake in the central Himalayas. Bathymetry survey shows that Paiku Co has a maximum water depth of 72.8 m and the water storage is estimated to be about 10.85×109 m3. On seasonal scale, considerable lake level increase occurs in mid-June to early September, while significant lake level drop occurs in October to mid-January. Lake evaporation is determined by Bowen-ratio energy budget method and runoff of the three main rivers is observed. On decadal time scale, Paiku Co's lake level decreased by 3.7 m and water storage reduced by 6.8×108 m3 between 1972 and 2015, accounting for 6.3% of the total water storage. By contrast, glacial lakes within this basin expanded rapidly due to significant glacier retreating and thinning. The lake level decrease at Paiku Co reflects the climate drying in Himalaya region and the glacier melt was not sufficient to compensate the water deficit of Paiku Co caused by the decrease in precipitation.