



## **Recent glacier changes in High Mountain Asia: response to climate and precipitation changes on the Tibetan Plateau**

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Glacier surface elevation changes are derived from ICESat laser altimetry data for the years 2003-2008 over the entire High Mountain Asia (HMA) and analysed in the light of a suggested step-increase in precipitation on the Tibetan Plateau (TP) around the year 2000. As a proxy for precipitation patterns we use MERRA-2 reanalysis data and the water volume changes of endorheic lakes between 1990 and 2015, estimated from Landsat images and elevation data from ICESat and the SRTM DEM. The pattern of glacier changes is driven by spatially greatly varying glacier sensitivity, in particular to precipitation availability and changes. Areas of suggested precipitation increase and lake growth match the areas where we see evidence for ice volume gain from ICESat elevation data. Glaciers in the Eastern Pamirs, Kunlun Shan and central TP were thickening by 0.1-0.7 m a<sup>-1</sup> during the ICESat period. The anomaly has a crisp boundary in the Eastern Pamir that continues just north of the central Karakoram. The precipitation anomaly found and reflected in the glacier changes possibly extended to the northern slopes of the Tarim Basin, where glaciers were nearly in balance in 2003-2008. Glaciers in the south/east of the TP were thinning, with increasing rates towards southeast. While absolute lake volume growth was greatest in the eastern TP, the fewer, smaller lakes in the more arid northern TP grew more relative to their original size. In the extremely arid northern TP, the suggested precipitation increase and its timing just prior to the ICESat period can thus explain the observed glacier thickening. Towards southeast, where aridity and elevation decrease, increased glacier melt from warming temperatures may have compensated for the precipitation increase.