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Recent changes in Himalayan glaciers and inhomogeneous wastage distribution

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A claim in the IPCC report that Himalayan glaciers could disappear by 2035 turned out to be an error. However, it is not clear exactly how fast the Himalayan glaciers are shrinking because of high altitudes and remoteness hampering measurement from the ground. We update volumetric changes by differential GPS surveys for three benchmark glaciers in the Nepal Himalaya whose observations were continued since the 1970s. We reveal that one glacier in arid climate has been continuously shrinking (~500 kg m^{-2} yr^{-1}) while shrinking rates of two glaciers in humid climate have been accelerated (~800 kg m^{-2} yr^{-1}) during the last decade. Mass balance calculations using a energy-mass balance model with downscaled climate datasets shows that equilibrium line altitudes (ELA) of the two glaciers in humid climate are now approaching to the top of glaciers so that they will disappear sooner or later while ELA of the glacier in arid climate is remaining within the glacier. We further calculate ELA trend over the Asian region (25m^o-55^{o}N, 60^o-110^{o}E). The trend map shows that the acceleration or suppression of glacier wastage rates is inhomogeneously distributed over the Asian domain. It implies that we are unable to describe change in Himalayan ice resources with a few examples though it is better than nothing.

Keywords: Himalayas, mass balance, glacier fluctuation, ELA