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Geodetic mass balance of Gangjula Glacier, Bhutan Himalaya from 2004 to 2013

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Himalayan glaciers have been retreating over the recent decades but few in-situ observations are available in the Bhutan Himalaya. Initial observation by stake method has been conducted on Gangjula glacier, Bhutan Himalaya for one year from 2003 to 2004. Also performed was differential global positioning system (DGPS) survey in 2004. After seven years gap, we re-surveyed the glacier surface using DGPS in 2011 and continued the survey every year since then. The DGPS data were processed using Global Navigation Satellite System (GNSS) software and data having errors equal to 1m or more both horizontally and vertically are excluded. Exact location of bench marks installed in 2004 was obtained using precise point positioning (PPP) in 2011. The data of other years are shifted by referring the bench mark locations. Digital elevation model (DEM) of 1m resolution for different years has been generated by using inverse distance weighted method and then elevation change between two different years is obtained. Elevation change within 50m elevation band is averaged and then the area-weighted mass balances are calculated by multiplying the elevation change with density of ice (900kg/m^3) divided by number of years. Mass balance since 2003 ranges from -1000 to -2000mm water equivalent (mm w. e.), and it is significantly accelerated for the last two years.

Keywords: glacier mass balance