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Mapping the loss of Mt. Kenya's glaciers: an example of the challenges of satellite monitoring of very small glaciers

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Since the last complete glacier mapping of Mt Kenya in 2004, strong glacier retreat and glacier disintegration have been reported. Here we compile and present a new glacier inventory of Mt. Kenya to document recent glacier change. Glacier area and mass changes were derived from an orthophoto and digital elevation model extracted from Pléiades tri-stereo satellite images. We additionally explore the feasibility of using freely available imagery (Sentinel 2) and an alternative elevation model (TanDEM-X-DEM) for monitoring very small glaciers in complex terrain, but both proved to be inappropriate; Sentinel-2 because of its too coarse horizontal resolution compared to the very small glaciers and TanDEM-X-DEM because of errors in the steep summit area of Mt. Kenya. During 2004-2016 the total glacier area on Mt. Kenya decreased by 121.0×10^3 m^2 (44%). The largest glacier (Lewis) lost 62.8×10^3 m^2 (46%) of its area and 1.35×10^3 m^3 (57%) of its volume during the same period. The mass loss of Lewis Glacier has been accelerating since 2010 due to glacier disintegration which has led to the emergence of a rock outcrop splitting the glacier in two parts. If current retreat rates prevail, Mt. Kenya's glaciers will be extinct before 2030, implying the cessation of the longest glacier observation record of the tropics.