

# A Century of Photogrammetry on Kilimanjaro

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## SUMMARY

In 1867, the “German father of photogrammetrie” Albrecht Meydenbauer (1834-1921) met the geographer and explorer Otto Kersten (1839-1900) who, five years earlier, had attempted the first climb of Kibo, the highest of three peaks of Kilimanjaro. Meydenbauer presented to him the technique he designed that allowed measurements to be made from photographs as he foresaw that it could be used as a useful surveying application during expeditions. Fascinated, Kersten proposed to rename the technique Photogrammetry, thus sealing an intimate link between this science and the highest mountain of Africa and tallest freestanding mountain in the world, where a glacier named after Kersten still remains. Forty five years later, in 1912, German explorers Eduard Oehler and glaciologist Fritz Klute returned to Kilimanjaro armed with a photogrammetric camera. This led to a 1:50,000 scale map being produced, the quality of which should be praised given the complexity of the terrain and the technical limitations of the emerging surveying technique at the time. The mapping of Kilimanjaro at a 1:50,000 scale was not repeated for another 50 years when a photogrammetric survey was conducted from aerial images captured in 1962. The rapidly changing topography associated with the glacier retreat and the fact that the slopes of Kibo attract about 40,000 climbers each year justify the need to develop a new topographic survey of this outstanding landmark, designated a UNESCO World Heritage Site in 1987. In this context, the application of the photogrammetric principles to the latest generation of very high resolution spaceborne optical sensors (VHRS) offers new surveying opportunities by enabling the topographic mapping of remote and hardly accessible areas at large scale with unprecedented spatial resolution. Recent hardware and software advances now allow dense point clouds to be generated, thus making the use of VHRS stereo imagery a viable technique to complete a large topographic survey at a small pecuniary and logistical cost. Thus, 100 years after Klute and Oehler completed the first ground based photogrammetric survey of Kibo, and 50 years after the most recent aerial photogrammetric survey, this paper illustrates the potential of a spaceborne photogrammetric survey technique by reporting on the last effort to map the topography of Kibo from GeoEye-1 stereo imagery, which has led to the creation of a new 50cm resolution Digital Elevation Model (DEM), namely KILISoSDEM2012.