Institut für Geographie
Universität Innsbruck
Innrain 52
A-6020 Innsbruck

Mölg, T., D.R. Hardy, and G. Kaser (2003): Solar-radiation-maintained glacier recession on Kilimanjaro drawn from combined ice-radiation geometry modeling. Journal of Geophysical Research, 108(D23), 4731, doi:10.1029/2003JD003546.

Abstract

In the context of investigating modern glacier recession on Kilimanjaro, which began around 1880, this study addresses the glacier regime of the vertical ice walls that typically form the margins of Kilimanjaro‘s summit glaciers. These walls have suffered a continuous lateral retreat during the 20th century. To evaluate the role of solar radiation in maintaining glacier recession on Kilimanjaro, a radiation model is applied to an idealized representation of the 1880-ice cap. The combined process-based model calculates the spatial extent and geometry of the ice cap for various points in time after 1880. Support for input data and fundamental assumptions are provided by an automatic weather station that has operated on the summit’s Northern Icefield since February 2000. Even in a simple climatic scenario only forced with an annual cycle of clouds, the basic evolution in spatial distribution of ice bodies on the summit is modeled well. The Northern and Southern Icefields form in characteristic east-west orientation, which verifies the basic idea behind the model. Forcing the model with further climate-related phenomena improve the results. It then additionally reproduces the Eastern Icefield, the third big ice entity on the summit. This study qualitatively demonstrates that solar radiation is the main climatic parameter maintaining modern glacier recession on Kilimanjaro summit, but also suggests that retreat on the inner ice cap margin might have been supported by a secondary energy source. The need for additional field measurements is emphasized in order to better understand the complex processes of glacier-climate interaction on Kilimanjaro.