Geophysical Research Abstracts,
Vol. 11, EGU2009-10809, 2009
EGU General Assembly 2009

The impact of solar radiation on vertical ice cliff recession on Kilimanjaro

M. Winkler (1), N. Cullen (2), G. Kaser (1), T. Mölg (1), and T. Pfeffer (3)

(1) University of Innsbruck, Institute of Geography, Innsbruck, Austria (michael.winkler@uibk.ac.at), (2) University of Otago, Department of Geography, Dunedin, New Zealand (njc@geography.otago.ac.nz), (3) University of Colorado at Boulder, INSTAAR, Boulder, CO (Tad.Pfeffer@Colorado.edu)

The glaciers on the summit plateau of Mount Kilimanjaro (5700m a.s.l., 3°04'S, 37°21'E) are characterized by nearly vertical ice cliffs at their margins. Recent studies have shown that glacier retreat on Africa's highest peak is closely linked to the recession of these cliffs. More than one year of distance measurements between an automatic weather station close to a south-facing cliff and the cliff itself reveal a strong linkage of the recession pattern and the annual cycle of solar radiation.

As the cliff is not hit by direct shortwave radiation from March to October, not enough energy is provided to raise the cliff's surface temperature to 0°C and make melting possible. Only sublimation occurs and the point measurements indicate recession rates at the order of 0.5cm/month. From November to February – if cloud cover allows - the cliff is hit by direct shortwave radiation all day and its surface temperature can reach the melting point during some hours of the day. Melting occurs, although air temperature is always below freezing point, and the cliff retreats 20-30 times faster, because melting is much more energy-efficient than sublimation.

A solar radiation model, using data of a free-standing automatic weather station, is run to find out why the majority of the cliffs is exposed either to the north or to the south, and to extrapolate the point measurements to the whole ice cliff. In addition, the impact of small scale differences in slope and aspect on the cliff recession is investigated using the radiation model. A multi-temporal photogrammetrical survey is carried out to quantify small scale recession differences in order to validate the solar radiation model results.