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Understanding Glacier Recession on Kilimanjaro: A Field Methods Approach

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Over the last 100 years the areal extent of Kilimanjaro's ice fields has been severely reduced. The remaining ice fields are only 80 % of their first observed size and appear likely to soon disappear from the mountain for the first time in 11000 years. Although the recession of Kilimanjaro's ice fields is well documented the climatic controls of this recession remain uncertain. On a global scale, air temperature is considered to be the most important factor controlling glacier retreat but this has not been well demonstrated for Kilimanjaro. Instead, a combination of changes in air temperature, air humidity, precipitation, cloudiness and incoming shortwave radiation is considered to govern the fluctuations of glaciers on Kilimanjaro. Using this working hypothesis a field program using automatic weather stations has been initiated to investigate glacier recession on Kilimanjaro, which is designed to obtain information about three different glacial regimes on the mountain: (1) the summit horizontal glacier surfaces, (2) the summit vertical ice walls/cliffs and (3) the slope glaciers below the summit. Data from the horizontal glacier surface has already been successfully used to describe and model mechanisms of energy and mass exchange at the ice-atmosphere interface at these different locations. The additional data from sites (2) and (3) will be invaluable towards improving knowledge of the important climatic controls of glacial recession at a local scale as well as in the validation of our larger scale modeling studies. The objective of the regional scale modeling is to assess the links between glacier recession and changes in larger-scale atmospheric circulation. We also propose to investigate the impact of basal melting due to geothermal heat as a mechanism for glacier recession on Kilimanjaro using a scattered network of low cost temperature instruments.