

# Sources of Precipitation on East African Glaciers

## Kilimanjaro / Mt. Kenya

### Abstract

The importance of precipitation for the energy and mass balance of tropical glaciers is widely known and well documented (chapters 2 and 4). In order to better understand the different processes leading to accumulation on tropical glaciers in East Africa, air mass and precipitation sources were analysed for Kersten Glacier on Kilimanjaro and Lewis Glacier on Mt. Kenya. Simultaneous accumulation data from both glaciers were available for 1<sup>st</sup> October 2009 – 18<sup>th</sup> July 2010, which determined the study period. For the air mass analysis, an approach of calculating back trajectories was chosen. Trajectories were calculated at 3 different atmospheric levels; (i) at 250 m above model ground to capture surface airflow, (ii) at the particular summit level for each mountain and (iii) at 200 hPa to capture the overlying high-level flow. Precipitation events were identified from the accumulation data from both glaciers. The events were classified into “normal” and “significant” precipitation events and linked to the associated back trajectories. The resulting airflow for normal and significant summit precipitation was compared to non-precipitation airflow, and the findings were related to already known meso- and large-scale processes that lead to accumulation on the glaciers.

As a result, several large-scale processes were identified that could potentially contribute to summit precipitation. Apart from global-scale events, free-tropospheric summit level airflow that is directly incident on the mountains seems to be the most influential large-scale airflow parameter for the amount of accumulation measured. The two main indicators for this are that (i) the two summit level airflows are different on ~40 % of the days when precipitation occurred only on one mountain, and (ii) the two summit level airflows differ strongly during the June/July dry season, which shows large differences in the specific moisture measured directly at the glaciers that are not present during other seasons. Still, there are many findings that point towards the strong influence of meso-scale and local processes to trigger convection. Ultimately, a combination of favourable parameters on both scales is needed to produce precipitation – and thus accumulation – on the glaciers.