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Climate Change in the Rwenzori Mountains: implications for the Bakonzo and other surrounding communities

Photographs showing the retreat of the terminus of the Elena Glacier over 1.5 years from June 2003 to January 2005 (photo credit: R. Taylor).

Glaciers that exist at the summit of the Rwenzori Mountains are very sensitive to changes in climate. Over the last century, dramatic increases in the burning of fossil fuels by industrialised countries have raised the concentration of carbon dioxide (CO₂) in the atmosphere. As CO₂ concentrations rise, the atmosphere is better able to trap energy from the sun which not only warms the Earth but affects other aspects of climate such as precipitation. Field surveys and satellite observations reveal a rapid decline in the area covered by glaciers on the Rwenzori Mountains¹ from 6.5 km² in 1906 to 1.0 km² in 2003 (Figure 1). The average rate of decline is ~0.7 km² per decade (Figure 2). If present trends continue, glaciers are expected to disappear from the Rwenzori Mountains within the next two decades.

The rapid decline in the area covered by glaciers in the Rwenzori Mountains reflects a rise in alpine air temperatures and/or reductions in alpine precipitation and cloud cover. At meteorological stations in western Uganda (Kasese, Kabale, Masindi and Mbarara), there is no evidence of a decline in rainfall over the 20th century. In contrast, average air temperatures observed at these stations have increased by approximately 0.5°C per decade since the 1960s. Similar temperature rises are assumed to have occurred on the upper slopes of the Rwenzori Mountains but there are no observations to confirm this assumption. The primary cause of the decline in the area covered by glaciers is therefore considered to be rising air temperatures which have amplified ice losses by evaporation and melting.

Field studies show that meltwater flows from the glaciers contribute only a tiny percentage (less than 0.5%) of the flow of the River Mubuku recorded

at the base of the Rwenzori Mountains². The higher discharge and cooler temperatures observed for the River Mubuku compared to other rivers draining the Rwenzori Mountains result primarily from heavy rainfall exceeding 2000 mm per year in upland Heath-moss and Montane Forest zones that comprise the dominant proportion of the River Mubuku's catchment. Consequently, the decline in the area covered by glaciers in the Rwenzori Mountains has had a minimal impact on the flow of the River Mubuku and other rivers draining the Rwenzori Mountains. However, a shift toward fewer but heavier rainfalls in the Rwenzori Mountains which is expected to have occurred in response to the observed rise in air temperatures, enhances the seasonality in river flow and gives rise to more frequent and intense floods. These changes in the river flow draining the Rwenzori Mountains are expected to become more prominent as warming continues in the 21st century.

The projected loss of the glacial ice, *Nzururu*, in the Rwenzori Mountains is of utmost importance to the traditional belief system of the BaKonzo since *Nzururu* is the father of the spirits, *Kitasamba* and *Nyabibuya*, who are responsible for human life, its continuity and its welfare. Longer droughts and more frequent and intense floods brought about by warming impair crop production, hydro-electric power (HEP) generation and transport via footbridges. Climate change adaptation strategies need to consider this shift toward more variable rainfall and river flow in the design of infrastructure such as bridges and reservoirs for HEP generation and irrigation. The decline in ice cover makes mountain guiding - a key source of income to the Bakonzo and other communities - more treacherous and requires improved mountain safety measures. The impact of the projected disappearance of glaciers on future tourism remains unknown.

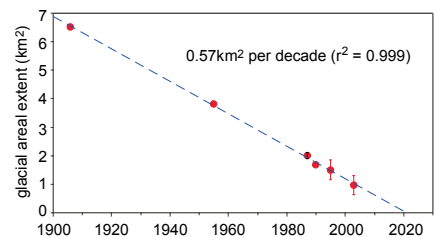
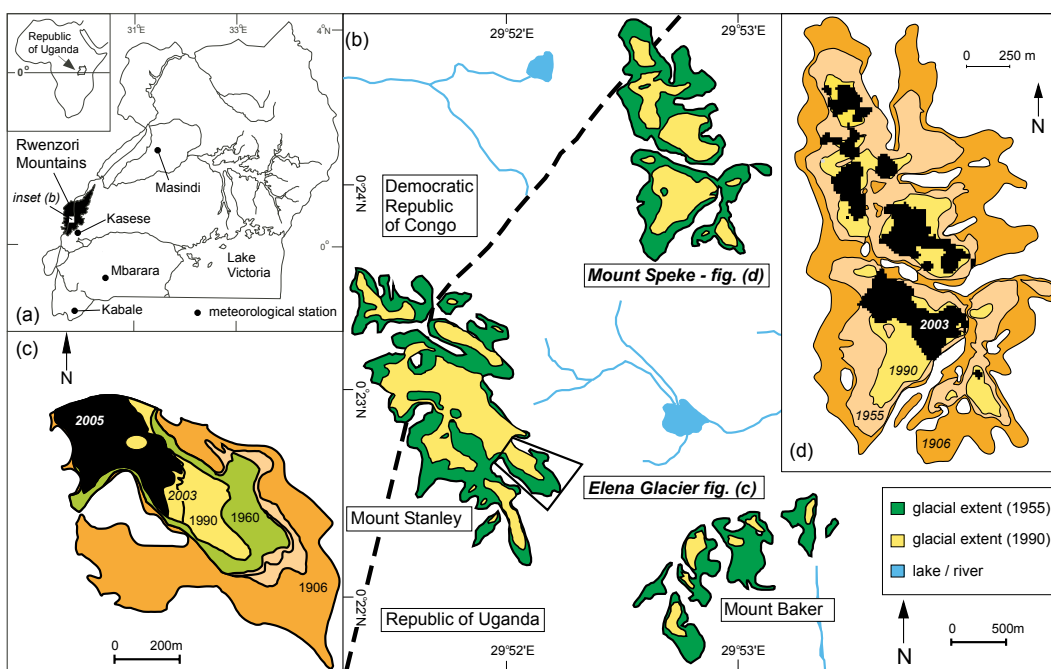


Figure 2. Estimated changes in glacial areal extent on Rwenzori Mountains, 1906 to 2003.



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Figure 1. (a) Map of Uganda showing the location of the Rwenzori Mountains and meteorological stations, (b) Main Rwenzori peaks showing the extent of glacial cover in 1955 and 1990. Changes in areal extent of the (c) Elena and (d) Speke Glaciers from 1906 to 2005.

References

- 1) Taylor, R.G., Mileham, L., Tindimugaya, C., Majugu, A., Nakileza, R., Muwanga, A., 2006. Recent deglaciation in the Rwenzori Mountains of East Africa due to rising air temperatures. *Geophysical Research Letters* Vol. 33, L10402.
- 2) Taylor, R.G., L. Mileham, C. Tindimugaya and L. Mwebembezi, 2009. Recent glacial recession and its impact on alpine riverflow in the Rwenzori Mountains of Uganda. *Journal of African Earth Sciences*, Vol. 55, pp. 205-213.

Contact details

Dr. Bob Nakileza, Mountain Resource Centre, Makarere University (nakilezab@yahoo.com), Dr. Richard Taylor, University College London (richard.taylor@ucl.ac.uk).





Eribinduka ly'obuthuku oko bithwa by'eRwenzori: ebitsibu ebisamalire abakonzo n'abandi bandu abikere hakuhi n'ekyithwa

Ebisosano ebikakanganaya erikeha ly'esyonzururu oko muthwe-muthwe w'akathwa Elena omo mwaka mughuma n'ekyitsweka erilhwa omo mughesera w'omukagha 2003 erihika omughesera w'erimbere 2005 (Ebisosano ekyatherawa na: R. Taylor).

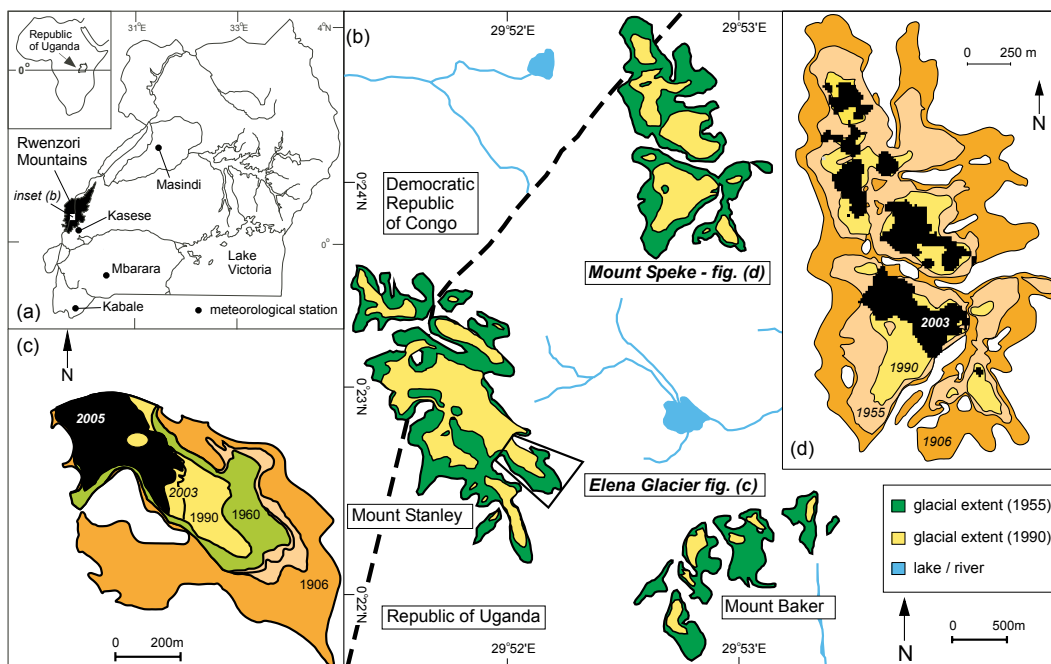
Omo myaka kyikumi eyilhabire, hali eriyongera linene ly'erikolesya amagutha awakalhwa omo kyithaka ng'epitaroli n'ekolhu omo bihugho ebiri ebulaya na Amerika y'endatha. EJapan, eChina, eIndia ne Brazil nabyo byabiriyungu oko bihugho ebyo. Erihisibwa ly'amagutha aya likongera emyuka eyithuwene nga CO2 eyikahethukira omo kyanya n'eriyathobongolha emambule eyiri ahakathikathi k'eryuba n'ekithaka eyikakehaya ekyihuhania ekyikalhwa oko ryuba. Ekyi kyikaletsa eryongera ly'ekyihugho erihuha. Esonzururu esikalhangirika mwa nguka oko muthwe-muthwe w'ekyithwa ky'eRwenzori sisiriyisunza eribinduka ly'obuthuku ng'obulio munabwire. Omo myaka kyikumi eyamalhaba enyuuma, erisamalira ndeke ly'omuthwe-muthwe w'ekyithwa kyino omo meso n'omo byuma likakanganaya erikeha lya lhuba-lhuba ly'esyonzururu esy'ebirika esihuhirire esiri oko hithwa Stanley, Speke na Baker esyabya oko syokilometre 6.5 omo mwaka wa 1906 erisuba oko kilometre 1 omo mwaka wa 2003. Ekyi kyikalingirirana n'embindi y'ekilomita ey'osyonkuka sy'ebirika esikabulirana obuli myaka 20. Emibere eyirho munabwire yamalholha embere, esonzururu sikalengekanibawa eritsweka oko kyithwa ky'eRwenzori omo myaka 20 eyikasa embere.

Amaghetse awakalhwa omo syonzururu n'eriyongera okwayo awakasenda omo lhuusi lhwu Bujuku na Mubuku omo bithwa by'eRwenzori ni make. Ali ahisi oko 0.5 okwa kyikumi esy'amaghetse awosi awakasenda ngoko kyabya kyahandikirwe oko seghesegehe y'ekyithwa Rwenzori oko nzira eyikalhwa eKasese yikaya eFort portal. Amaghetse amanene awali omo lhuusi Mubuku amalengalanganibwa n'esindi syonyuusi (Nyamughasana, Rukoki, Rwimi) akalhwa omo mbulha nene eyiri ahigulhu oko millimetre 2000 obuli mwaka eyikawa omo musithu eyikalhwa olhuusi lhwu Mubuku. Busana n'ekyi, erikeha ly'esyonzururu oko kyithwa Rwenzori liwithe butsubu buke oko lhuusi Mubuku. Busana n'eriyongera ly'erihuhwa ly'obuthuku, embulha yikaghetse yikakeha. Eyikawa yikawa n'omutsundo munene omo biro bike. Ekyi kyikakanganaya kyithi omo myaka eyamunabwire obuthuku bw'ekyanda omo mwaka bukaghetse bukayongera kandi n'emigheri yikakanya busana n'embulha eyikawa n'omutsundo munene kandi iyawa biro bike.

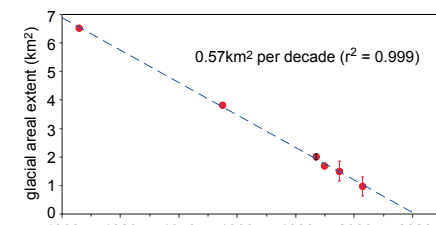
Eritswika eryalhuba-lhuba ly'esyonzururu oko kyithwa ky'eRwenzori likakanganaya eryongera ly'erihuhwa ly'ekyihugho erithesuba enyuuma kandi n'erikeha ly'ebithu omo kyanya kutse ebyosi bibiri. Sihali kaminyikalho kosi akakakanganaya erikeha ly'embulha omo myaka y'enyuuma, ebhandikirwe oko myanya eyikalebereraya obuthuku eyiri eKasese, eKabale, eMasindi n'eMbarara byamasamalirwamo. Esonzururu esiri oko kathwa ka Speke na ka Elene musyongera kake kutsibu erikwamana n'embulha nene eyawa omo myaka ye ngagha. Ekyikongera eritsweka ly'esyonzururu ly'eriyongera ly'obuhuhu erikaletshwa n'obuthuku bw'ekyihugho kyosi eribinduka eryongera erihuha. Ekyihuhania ekya buli mwaka omo Kasese, Kabale, Masindi n'eMbarara kyabiriyongera erihika 0.5oC, omo buli myaka ikumi eritsuka n'emyaka ey'engagha. Eriyongera erisosire eri likalengekanibawa eribya irinemubya omo bipindi ebiri oko muthwe-muthwe w'ekyithwa aliriyoyo ekyi sikyiri kyasamalirwa n'erighumbiwa.

Erikwamirira obunene bw'esyonzururu esikatsweka oko kyithwa ky'eRwenzori ni ky'omubongo munene oko mikalire n'emirwa ya Bakonzo kusangwa Nzuruu akalengekanibawa eribya iya thatha w'emiriimu Kithasamba na Nyabibuya abakaletha obuyingo, n'eribya libuya. Ekyanda eribya kyiri kandi n'emigheri erikanyirira busana n'erihuhana ly'ekyihugho ni kyitsibu oko bulime, emighendere (ebilhalhu), n'erikolha amasalhali w'amaghetse. Hakendiyisunza erighalhiya ebindu ng'eriseserera ebyalya n'erithekaho emibere eyowene ey'eribika amaghetse erighendaghetshana n'embulha eyikehire n'esindi nyuusi esikaghetshana sikakeha.

Esonzururu erikeha kyikaleka erihethuka ebithwa iryakalha. Abakonzo n'abandi bandu bakaghetse oko babungi abakasa bakasyahethukira oko muthwe-muthwe w'ekyithwa Rwenzori. Hakendisondekanibwa emibere y'eryuwania emiyirindire y'ababungi abakahethukira oko muthwe w'ekyithwa. Sikyasibwe obunene bw'obutsibu obwangaletshwa oko by'oburambure bw'oko kyithwa Rwenzori busana n'esyonzururu eritsweka.



Ekyisosano 1 (a) Emapu y'eYuganda eyikakanganaya ahali ekyithwa Rwenzori n'emyanya eyiri mw'ebiyuma ebikalebereraya emibere y'obuthuku, (b) Erikananga esyonzururu kusithekire oko muthwe-muthwe w'ekyithwa Rwenzori (Elena na Speke) n'emibere y'esyonzururu esyo ngokusyabya omo mwaka wa 1955 na 1990. Erisamalira ly'omo mwanya erikakanganaya eribinduka ly'esyonzururu oko muthwe-muthwe y'ebithwa, (c) Elena na, (d) Speke ahakathikathi k'omwaka 1906 na 2005 (erikwamana n'ebisakangirwe bya Taylor, 2006; 2009).



Ekyisosano 2. Erikananga erikeha ly'esyonzururu okwa kyithwa Rwenzori erilhwa 1906 erihika 2003 (erikwamana n'ebisakangirwe bya Taylor, 2006)

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 1) Taylor, R.G., Mileham, L., Tindimugaya, C., Majugu, A., Nakileza, R., Muwanga, A., 2006. Recent deglaciation in the Rwenzori Mountains of East Africa due to rising air temperatures. *Geophysical Research Letters* Vol. 33, L10402.
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Contact details
 Erimanya ebilhabire oko bino, bulhaya: Dr. Bob Nakileza, Mountain Resource Centre, Makere University (nakilezab@yahoo.com) kutse Dr. Richard Taylor, University College London (richard.taylor@ucl.ac.uk).

Eribindulha omwatsi oyu erilhwa w'om'Olhungu erihira w'om'Olhukonzo lyakolebawa na CELAK- Kasese.
 Eriholererya ly'oko kyithwa Rwenzori lyakolhwa na University College London (UK), Makere University, na Ministry eya maghetse n'ebithumbireko. Eby'erikolesya n'esymbulho byahereribawa na Uganda Wildlife Authority na Royal Geographical Society (UK).

