Glaciers of Kilimanjaro

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ABSTRACT

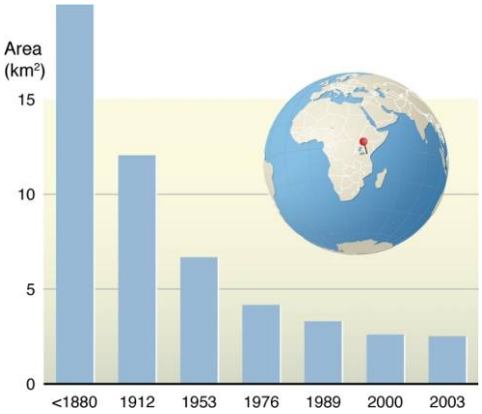
It is well known that the earth's polar ice caps are melting. However, it is not as well known that many alpine glaciers around the world are also shrinking. This shrinking is perhaps most dramatic in equatorial alpine glaciers such those that crown Mount Kilimanjaro. Though shrinkage of Mount Kilimanjaro's ice cap is undeniable, I wanted to explore the potential of thermography to more accurately estimate the extent of the ice cover. I wanted to understand whether thermography could help determine how much ice is not visible to the naked eye.

INTRODUCTION

Recent history has seen extreme change to the ice fields of Kilimanjaro. Indeed, over the past century, the ice fields on Africa's highest mountain are estimated to have shrunk by 80 percent. Some scientists project that within twenty years we will see the end of a year-round ice cap on Mount Kilimanjaro. The change over the past ten years has been particularly dramatic. The Landsat satellite captured these images of Kilimanjaro seven years apart: February 17, 1993 and February 21, 2000. The change is obvious and significant yet do the satellite images reflect that actual extent of the ice?

Figure 1. Landsat Image of Kilimanjaro February 17, 1993 (photo courtesy of NASA).

Figure 2. Landsat Image of Kilimanjaro February 21, 2000 (photo courtesy of NASA).



Most East African glaciers have disappeared while larger glaciers - particularly on Kilimanjaro - have been fragmented. Changes in glacial area and volume are being used as significant indicators of global warming and evidence of climate change.

Figure 3. Melting ice on Mount Kilimanjaro, East Africa (Credit to Hugo Ahlenius, UNEP/GRID-Arendal); http://maps.grida.no/go/graphic/melting-ice-on-mount-kilimanjaro-east-africa

CURRENT IMAGE OF GLACIERS ON KILIMANJARO

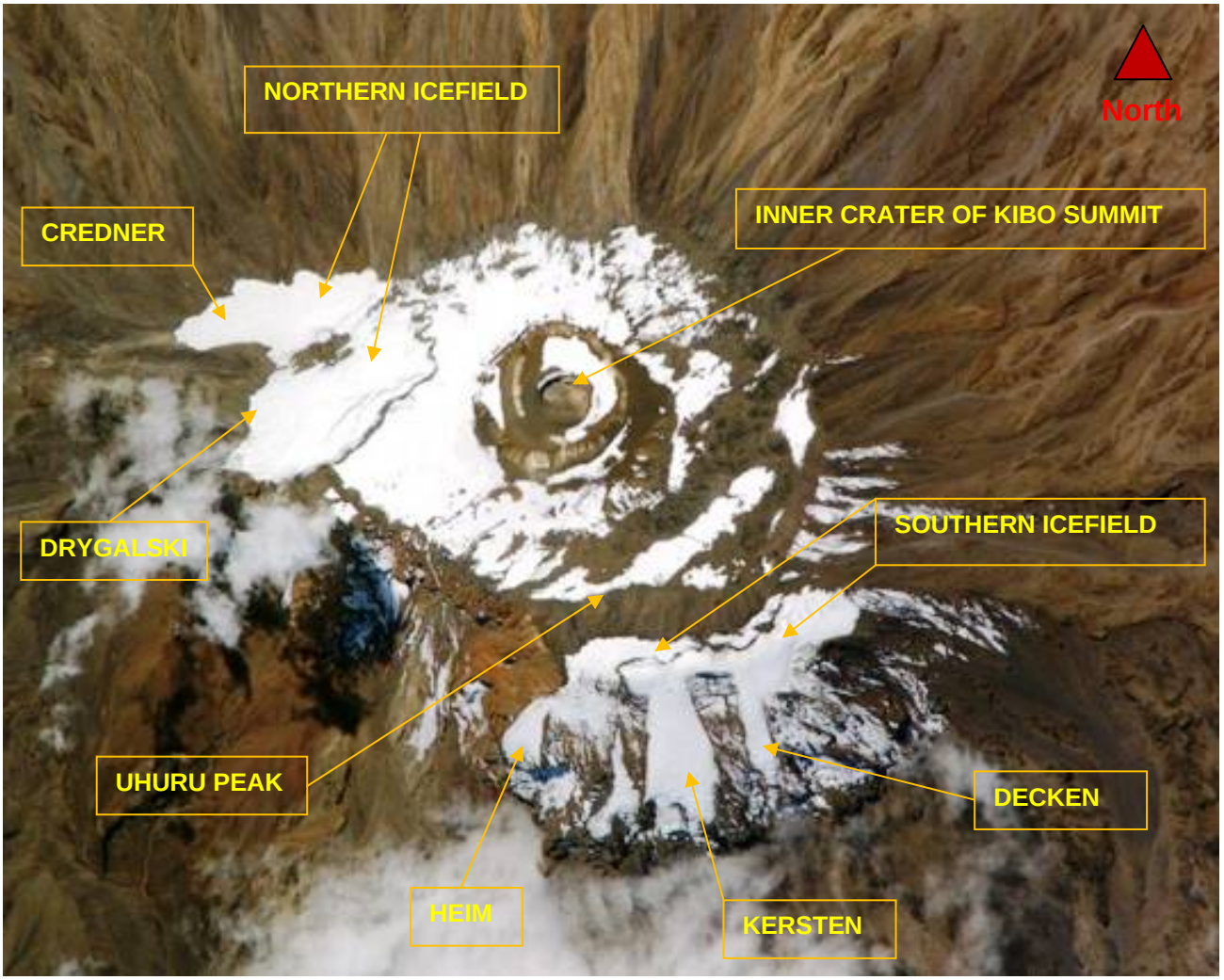
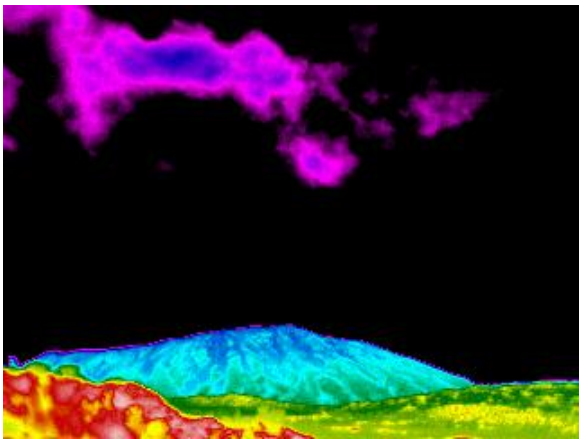
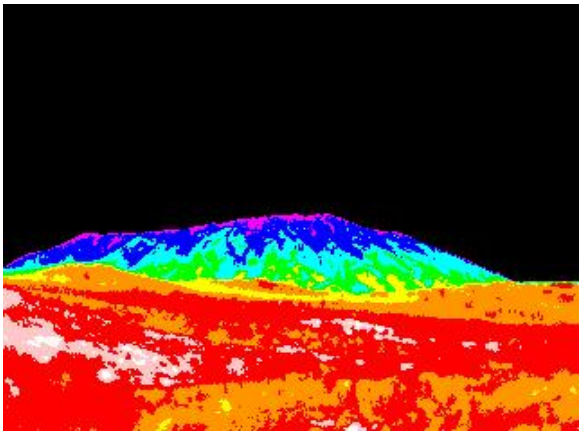


Figure 4. (Photo: credit to NASA)

PHOTO/THERMOGRAM IMAGE PAIRS OF KILIMANJARO FROM DISTANCE.
Kilimanjaro as seen from approx. 15km and 10km away



Figures 5 and 6. Photo/Thermogram pair of East Face of Mount Kilimanjaro from an approximate distance of 15km



Figures 7 and 8. Photo/Thermogram pair of SE Face of Mount Kilimanjaro from an approximate distance of 10km Clearly visible glaciers, ice fields and temperature zones.

BASE CAMP

Southern Ice Field and south face of Kilimanjaro seen from base camp.

Figure 9. Photo showing location of base camp.

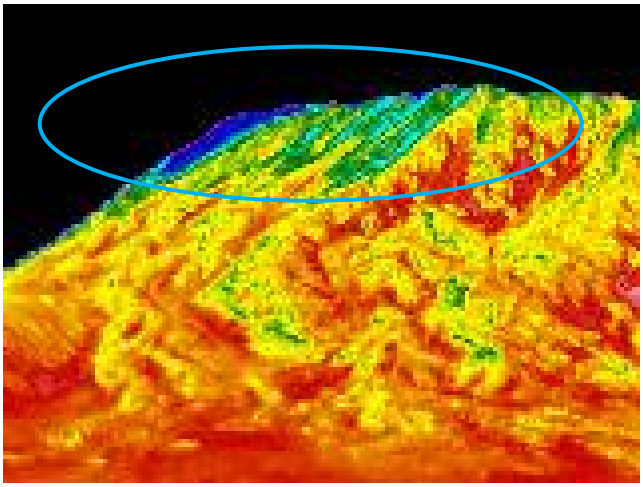
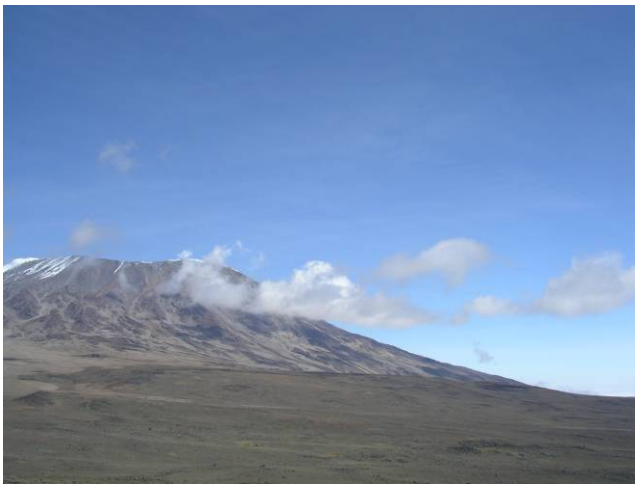
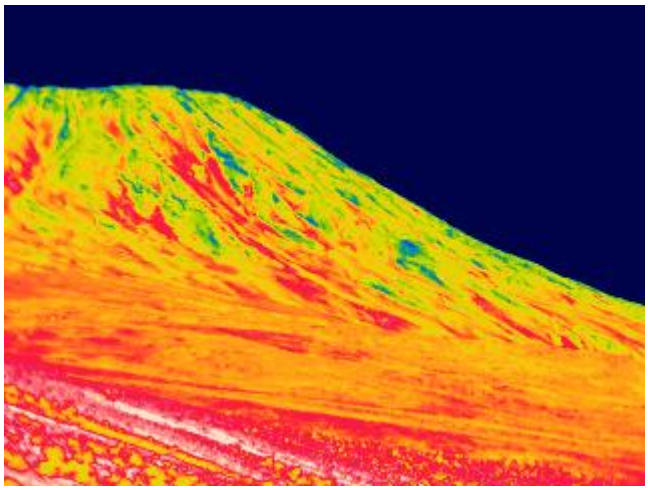


Figure 10. Thermogram of Southern ice Field taken from base camp.

RIGHT FLANK OF THE MOUNTAINS

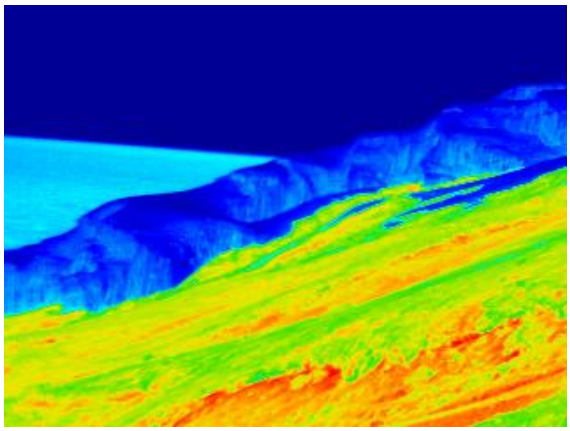
Right side of the mountain with many cooler areas.



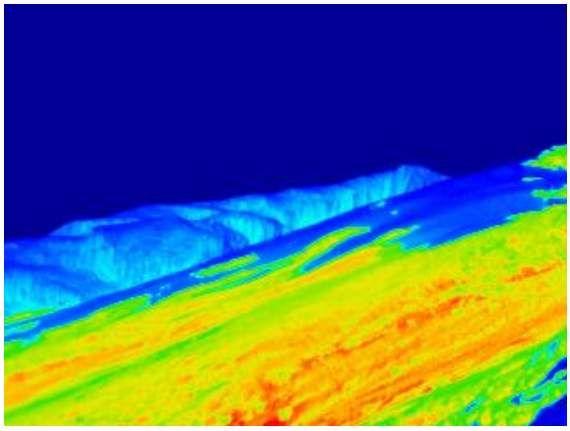


Figures 11 and 12. Photo/Thermogram. North face of mountain showing many cooler fields and depressions. Cool spots may indicate ice not visible to the eye.

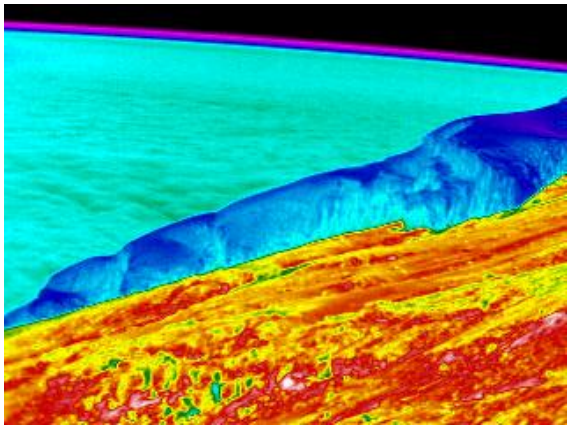
GLACIERS OF KILIMANJARO:
Though much diminished, the glaciers of Kilimanjaro are still spectacular.

Figures 13 and 14. Thermogram/photo pair of Southern Ice Field.

Figures 15 and 16. Thermogram/photo pair of Southern Ice Field.

Figures 17 and 18. Thermogram/photo pair of Southern Ice Field.

ICE CAMOFLAGED BY ROCKS AND DEBRIS AT GLACIAL FRINGE

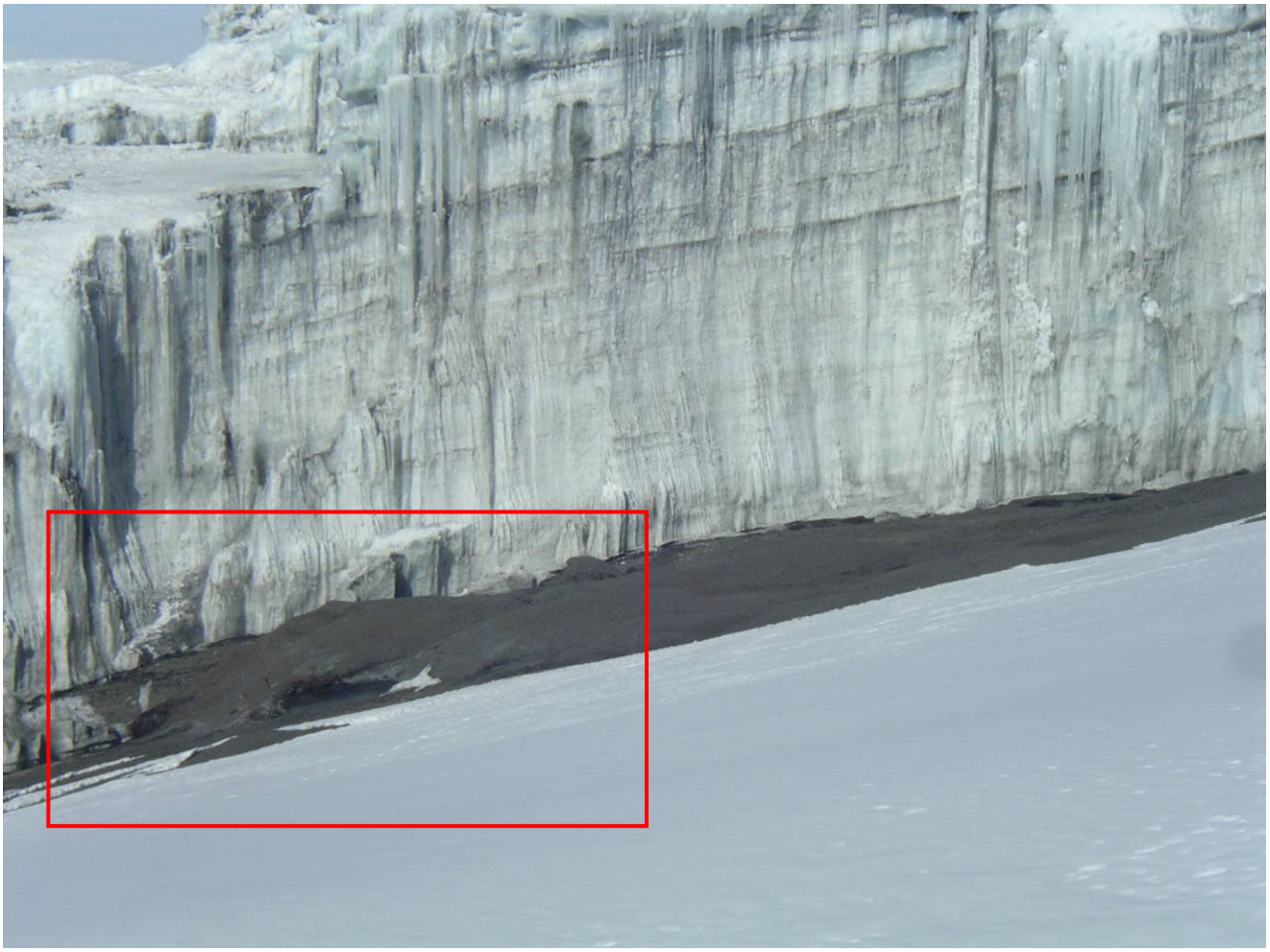


Figure 19. Photo showing glacial fringe including vertical face of glacier, horizontal ice and snow and debris deposit covering snow and ice.

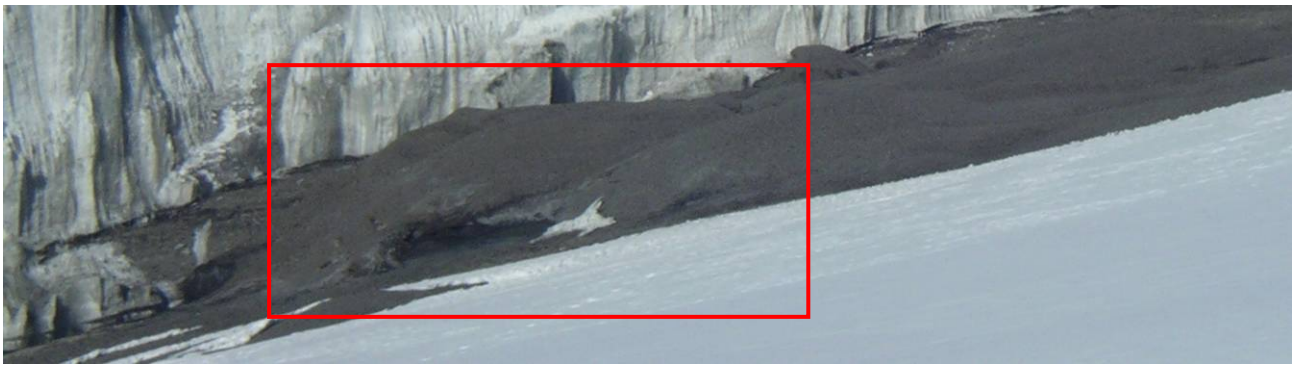


Figure 20. Detail showing debris at glacial fringe.

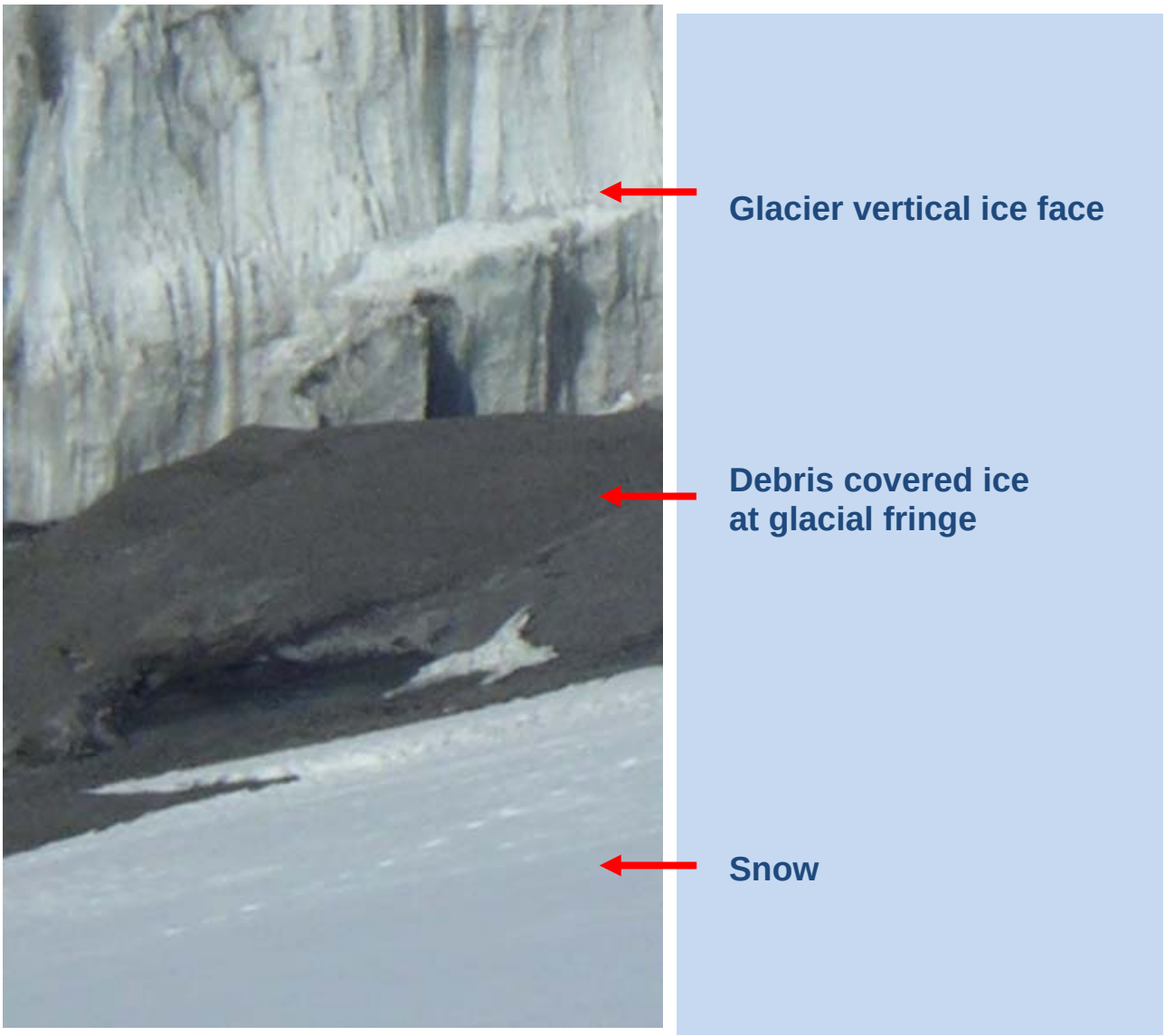


Figure 21. Photo showing detail of debris covered ice at glacial fringe.

Figure 21. Spectacular view and another example of the vertical face of a glacier and debris covered ice at fringe (Kenya's Mount Meru in the background)

Figure 22. Detail of debris covered ice at glacial fringe.

SUMMARY

Limited explorations of the glacial fringe show that snow and ice are not always visible to the naked eye and long distance thermographs of the mountain show cool spots without visible ice or snow. Cool spots may indicate invisible snow or ice. It may be worth exploring the potential of ground-base or low altitude thermography to better estimate the true extent of ice cover of Mount Kilimanjaro.

ABOUT THE AUTHOR

Marek Witoszek lives in Vancouver, British Columbia where he is the owner of Entire Building Services Ltd. He is a level II Thermographer with eight years of experience in the field. He is also an inveterate adventurer and continues to explore the world.

Marek is planning further explorations - of Mount Kilimanjaro and beyond. To find out more about Marek's trip to Mount Kilimanjaro, Tanzania and upcoming plans please feel free to e-mail Marek at vitosh@shaw.ca