

Energy Mass-Balance Modeling of Tropical Glaciers

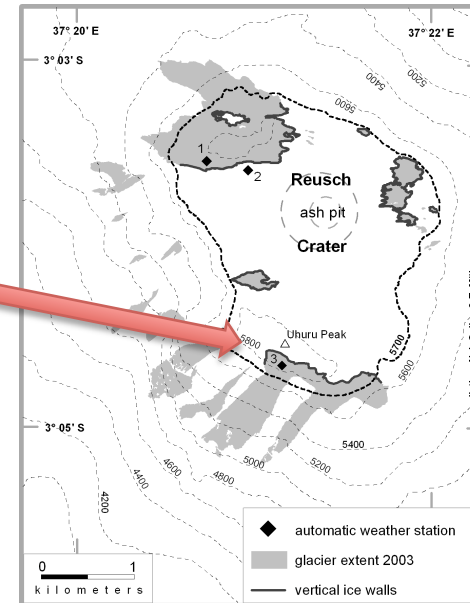


Michal, Raymond and Romain

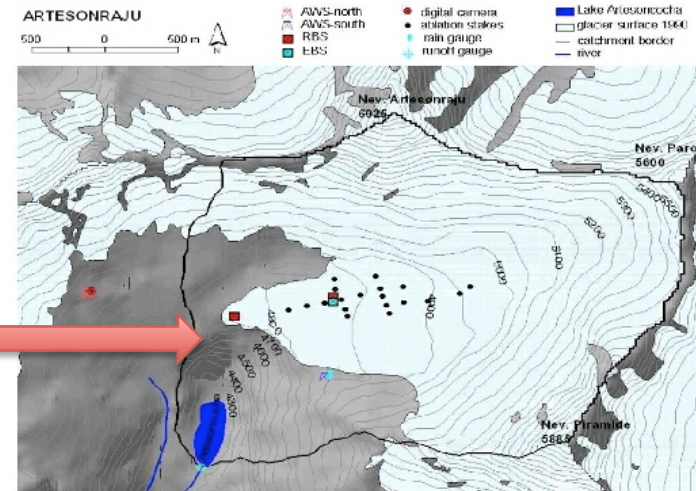
Our tropical glaciers



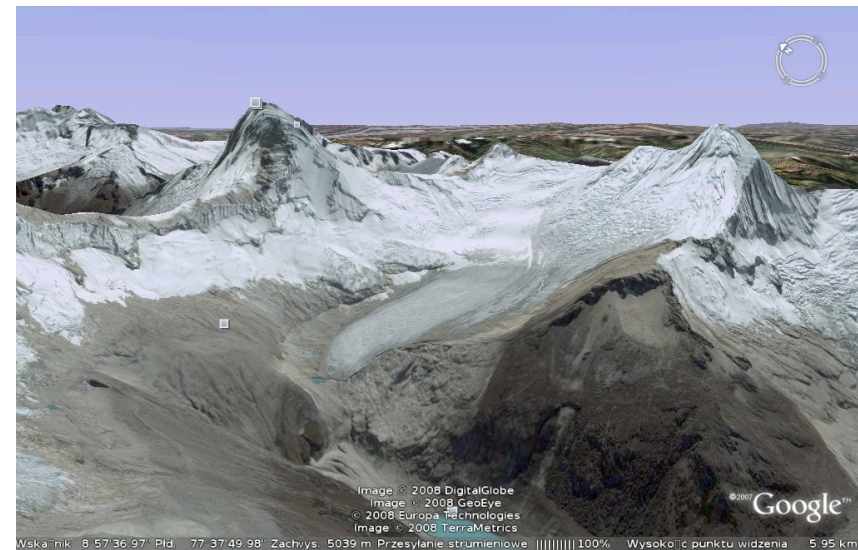
Kilimanjaro



Artesonraju

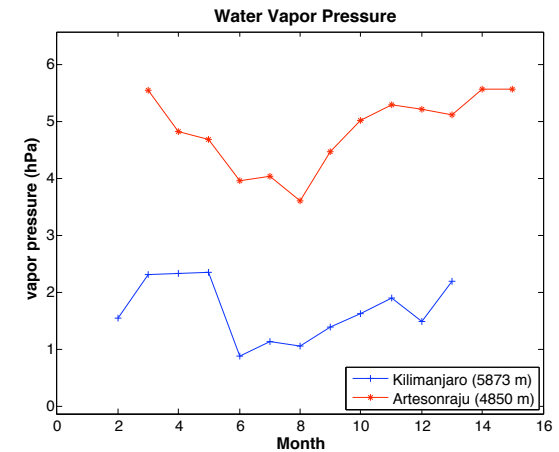
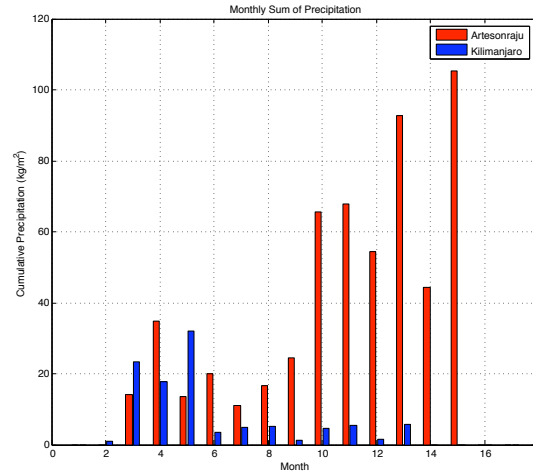
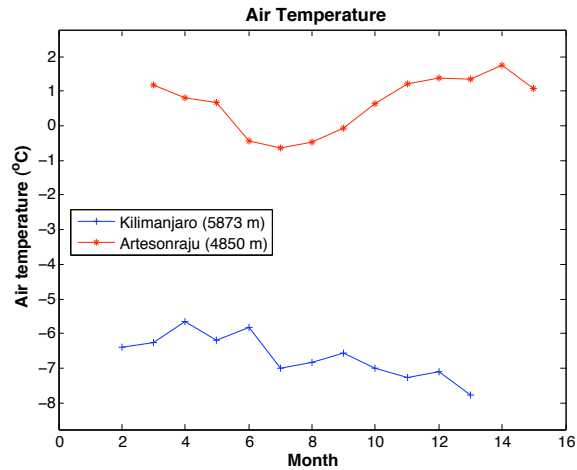


Data from the IRD and the Innsbruck University.



Climate Differences (1)

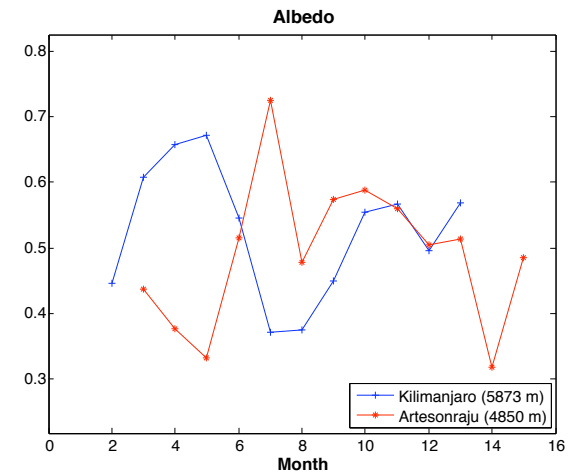
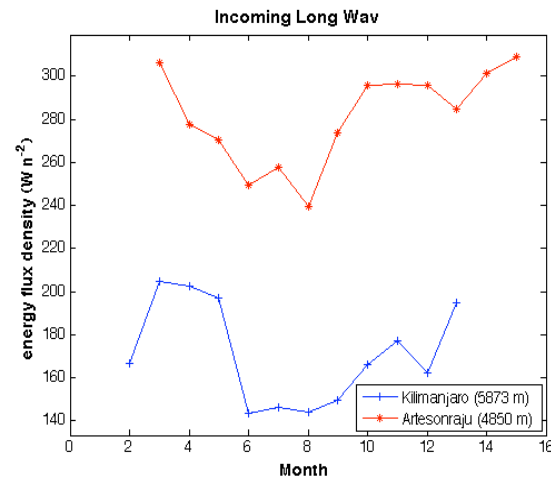
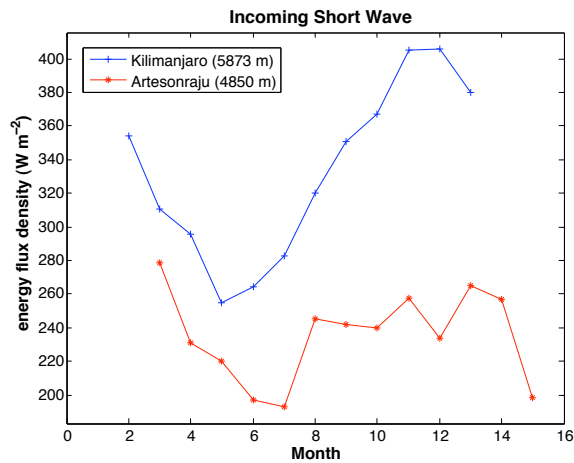
(input data)



- Temperatures are lower at the Kilimanjaro.
- Precipitations are higher at the Artesonraju.
- Cold and dry at Kilimanjaro.
- Wet and warmer at Artesonraju.

Climate Differences (2)

(input data)



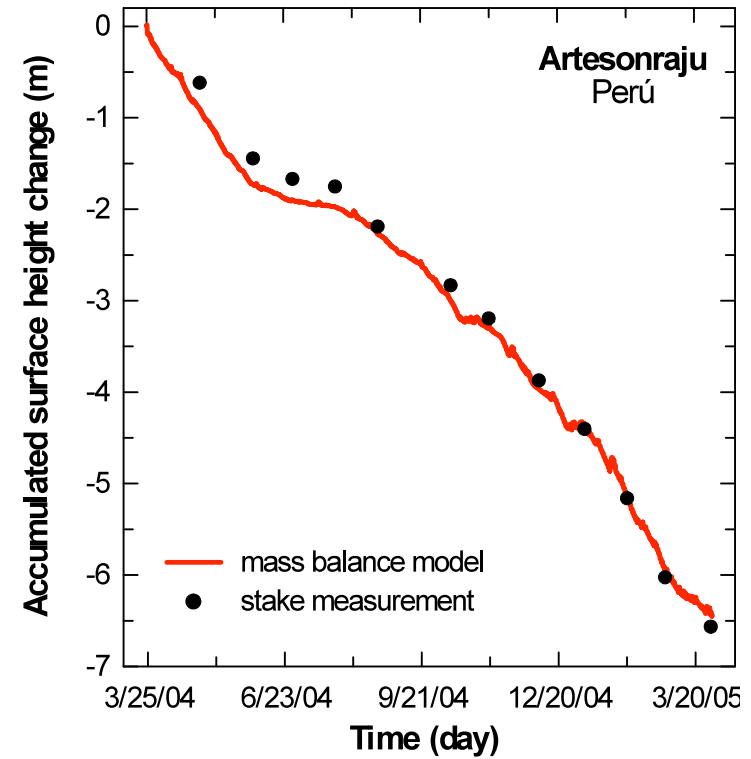
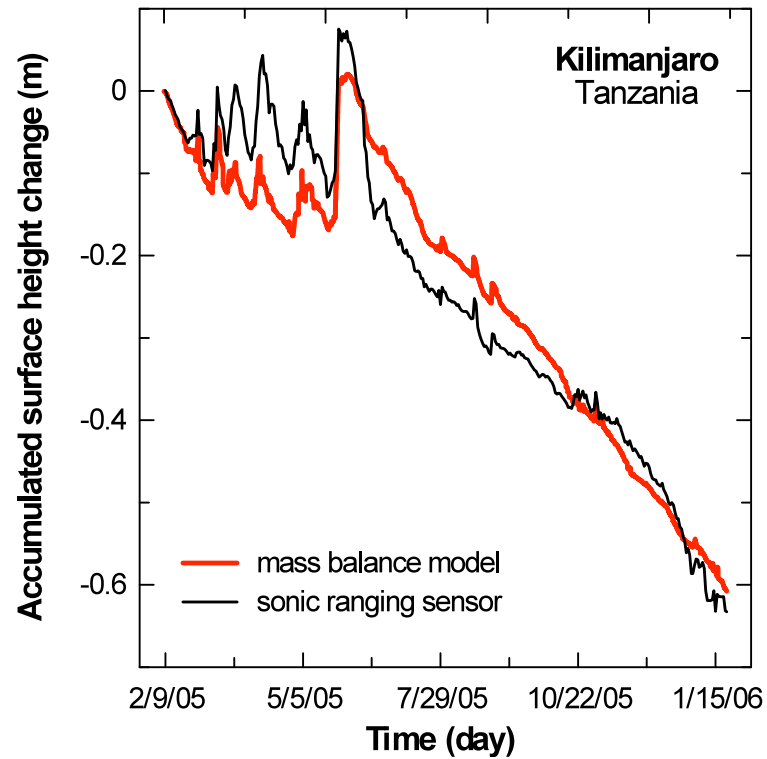
→ Incoming shortwave radiations are higher at the Kilimanjaro.

→ Incoming longwave radiation lower at Kilimanjaro.

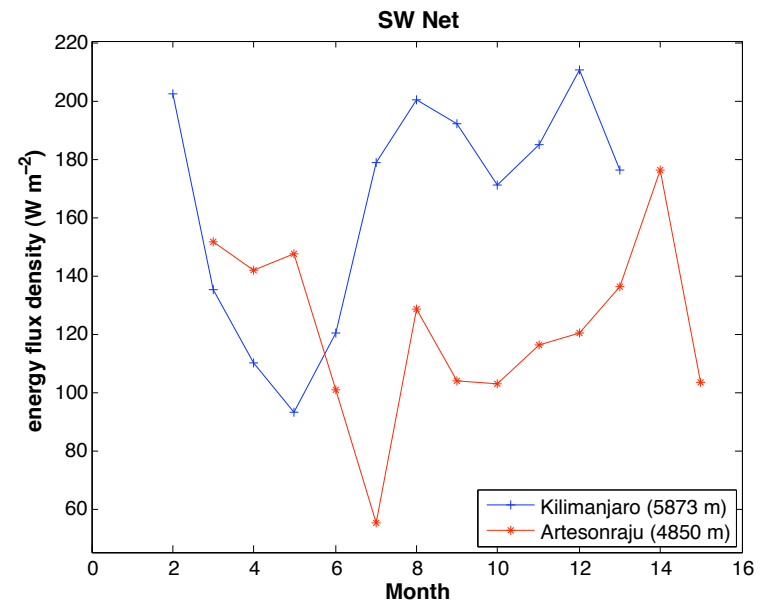
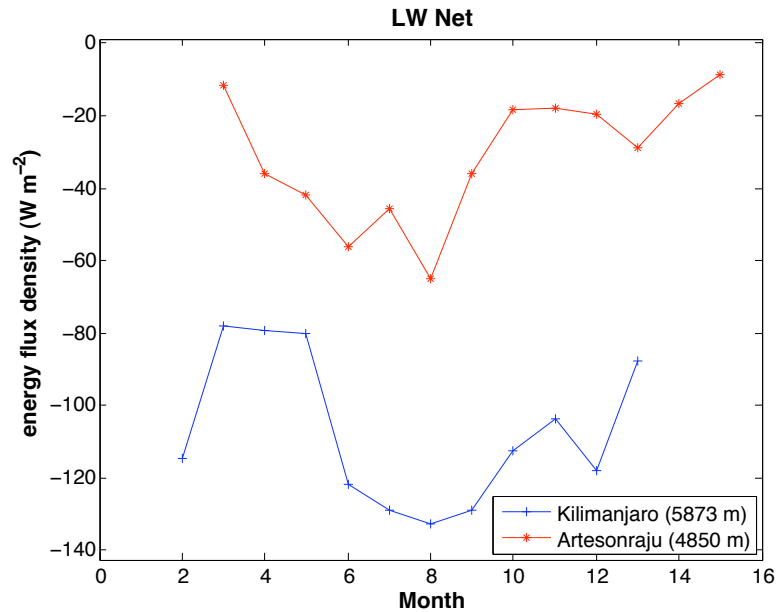
→ Strong variations in the albedo due to snowfall.

Validation of the Model

(thomas.moelg@uibk.ac.at)



Output (1)

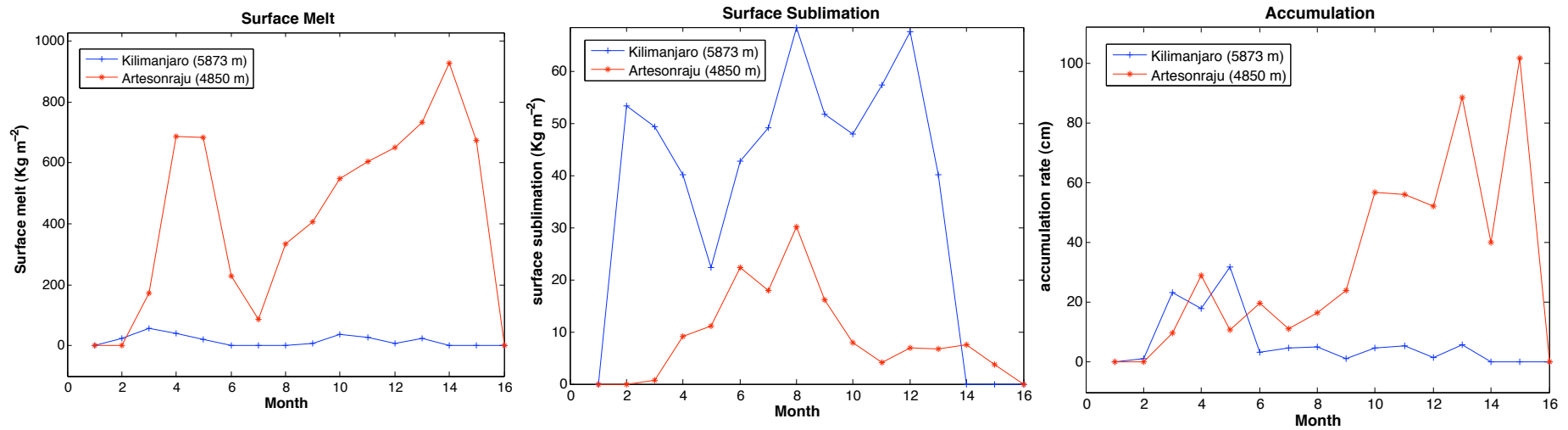


→ LW Net lower at Kilimanjaro due to a drop in temperature with elevation.

→ SW Net higher at Kilimanjaro due to a lower cloudiness.

→ Net radiation balance is higher at Artesonraju than Kilimanjaro.

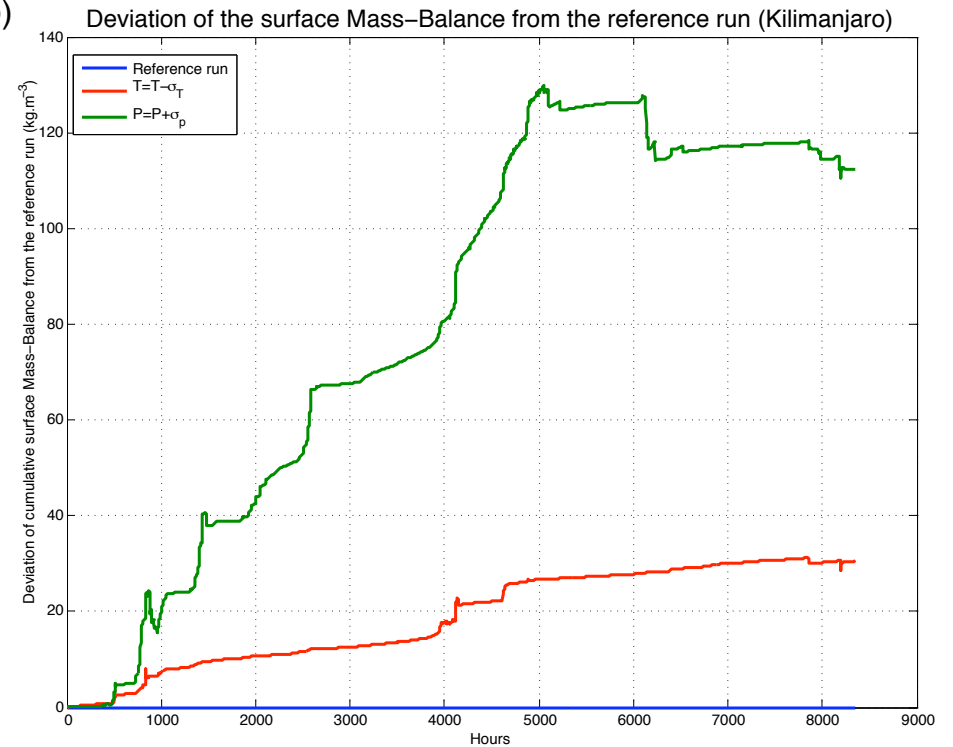
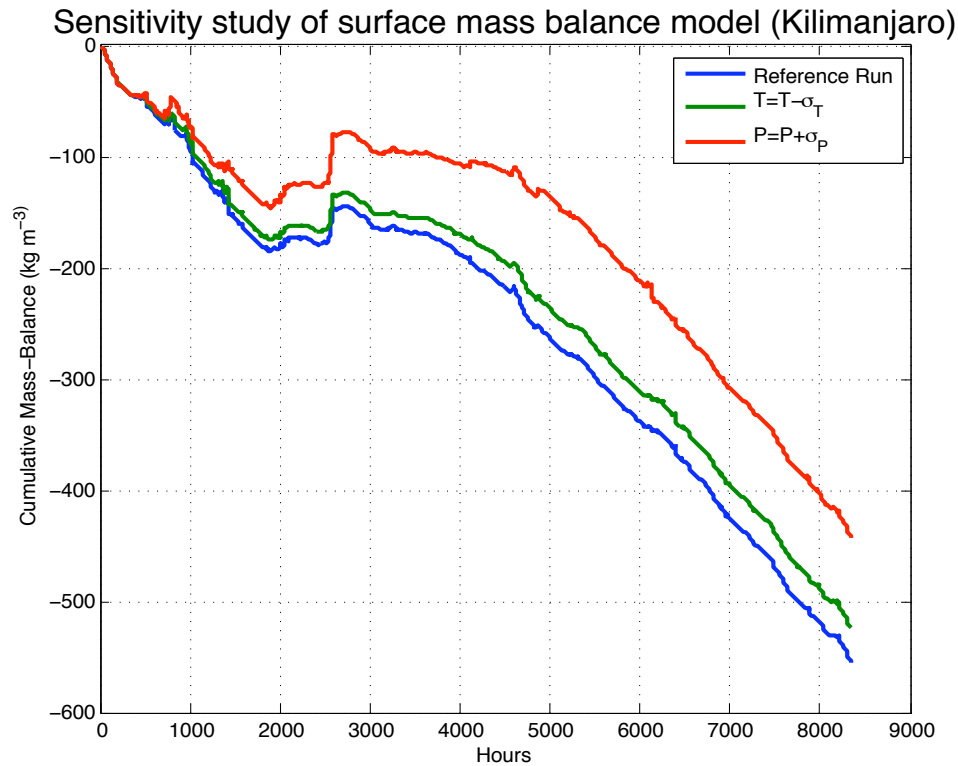
Output (2)



→ The difference between the melting and accumulation of the two glaciers are due to the location of the AWS.

→ Surface sublimation is much higher at Kilimanjaro.

Sensitivity Study



→ Temperature run: $T = T_{\text{ref}} - 0.3 \text{ K}$

→ Precipitation run: $P = P_{\text{ref}} + 29 \%$

Conclusion

- Most of the differences can be explained by the altitudinal locations of the AWS.
- This cause difference in humidity, cloudiness and precipitation which lead to dryer conditions at Kilimanjaro.
- Temperature does not play a major role in the energy balance.
- Surface sublimation has a major effect in the mass budget of the tropical glaciers.

