

Mass Balance Modeling I

Intercomparison low- and mid-latitude glaciers)

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Baumann

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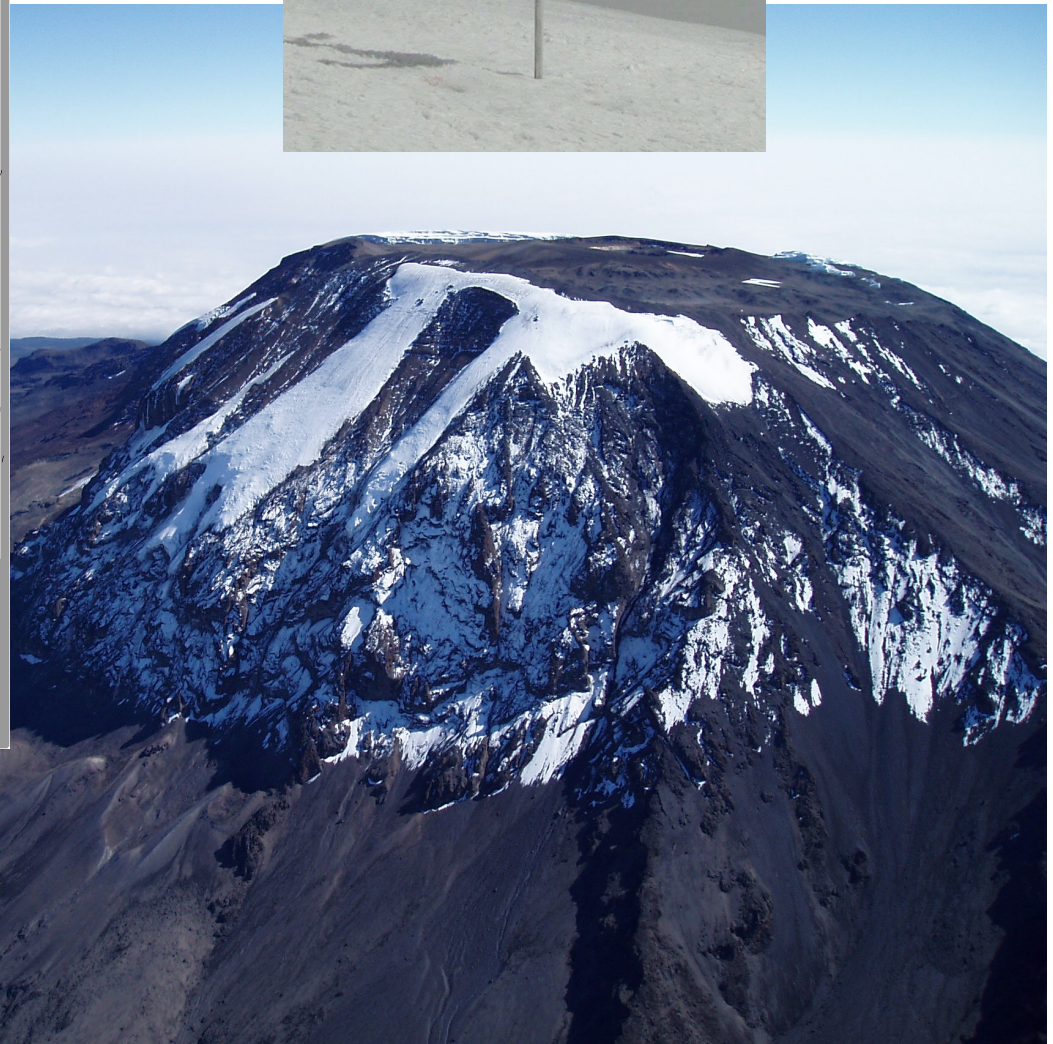
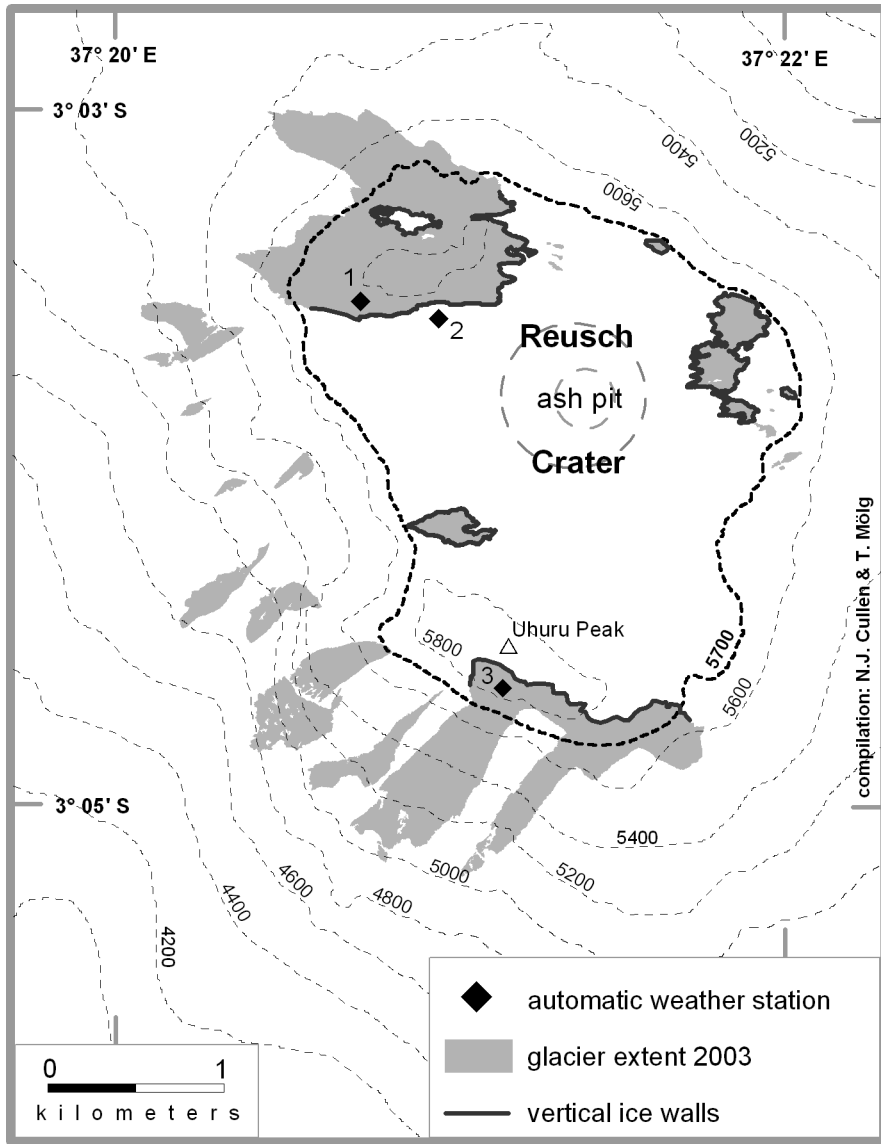
Outline

- Glacier sites
- Model
- Climate characteristics
- Energy and mass balance fluxes
- Sensitivity tests

Mortersatsch



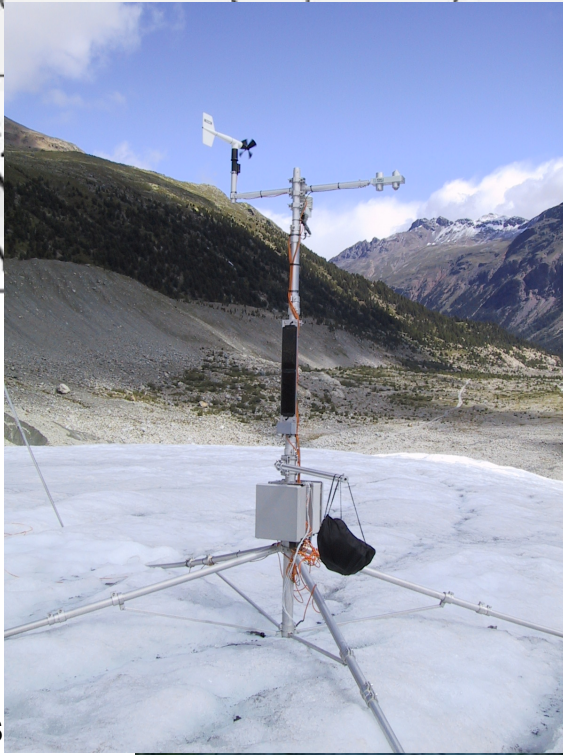
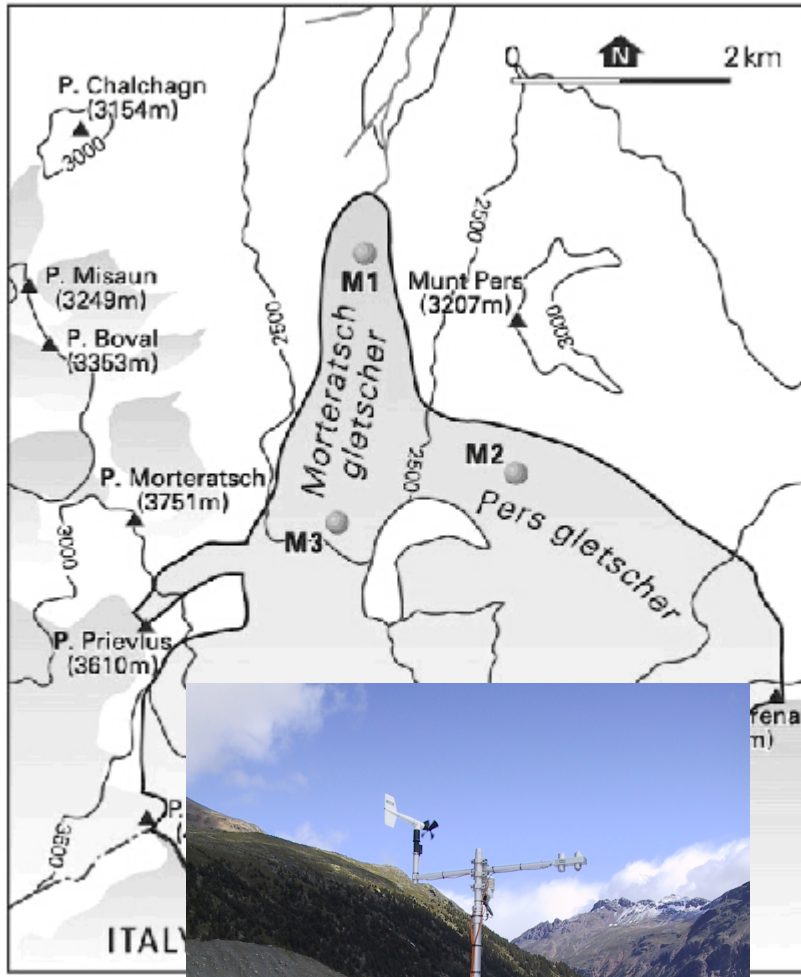
Kilimanjaro



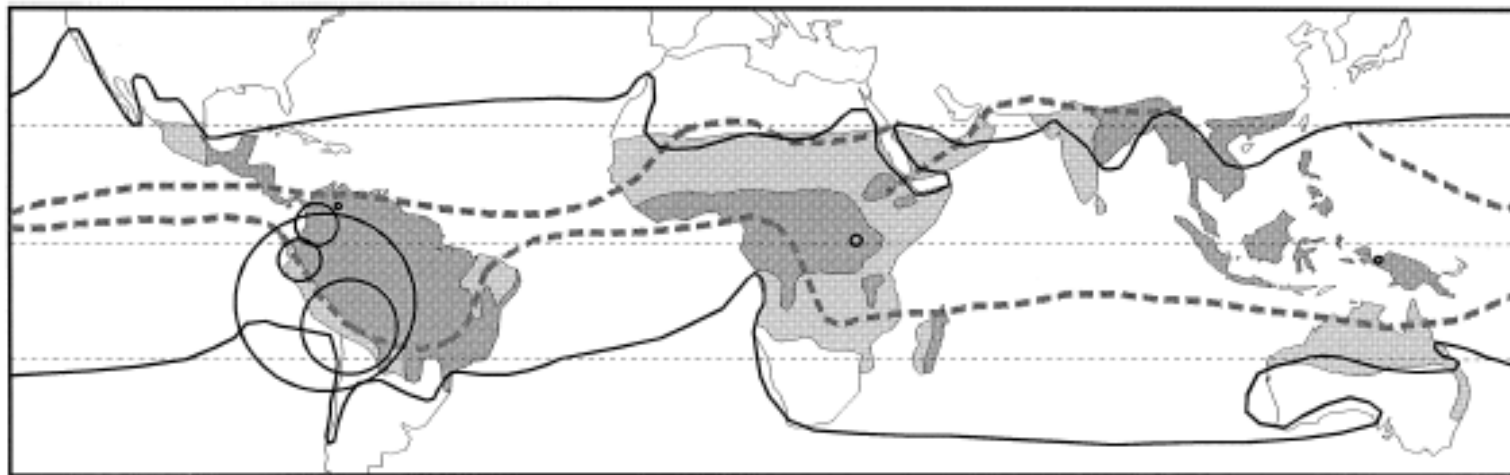
Kilimanjaro

2100 m a.s.l., 46° N

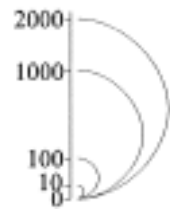
Morteratsch



Karhaus S



Glaciated area
in [km²]



--- ITCZ

— $\Delta T_d = \Delta T_s$

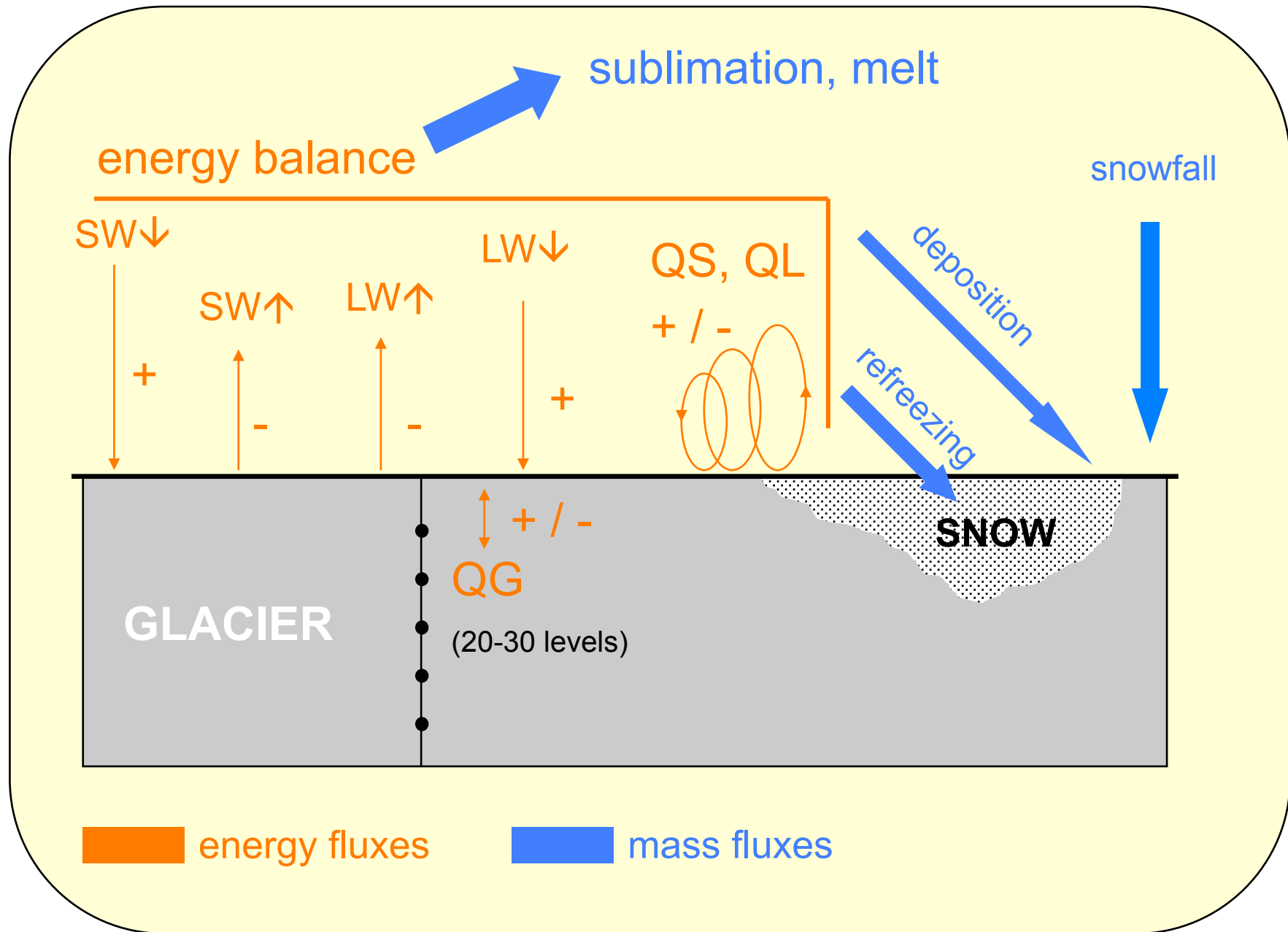


wet



wet - dry

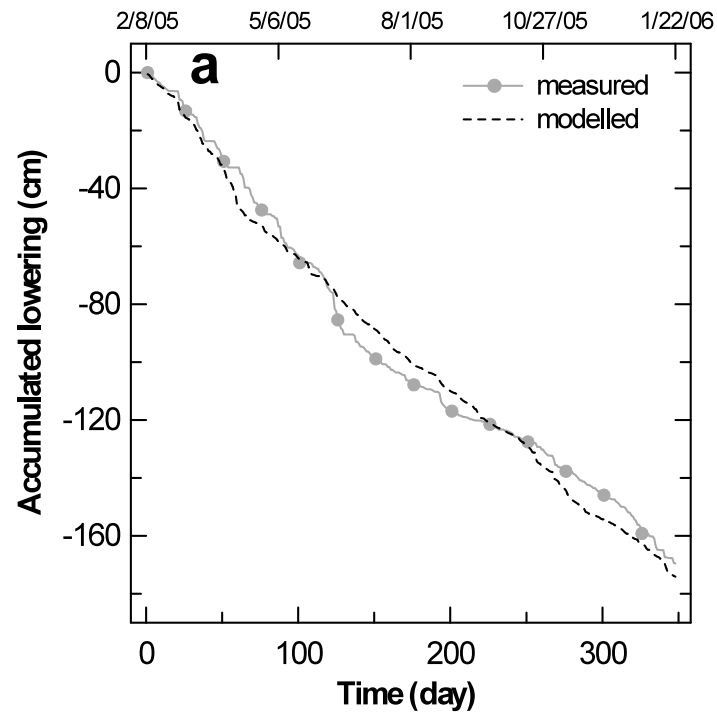
(Kaser & Osmaston 2002)



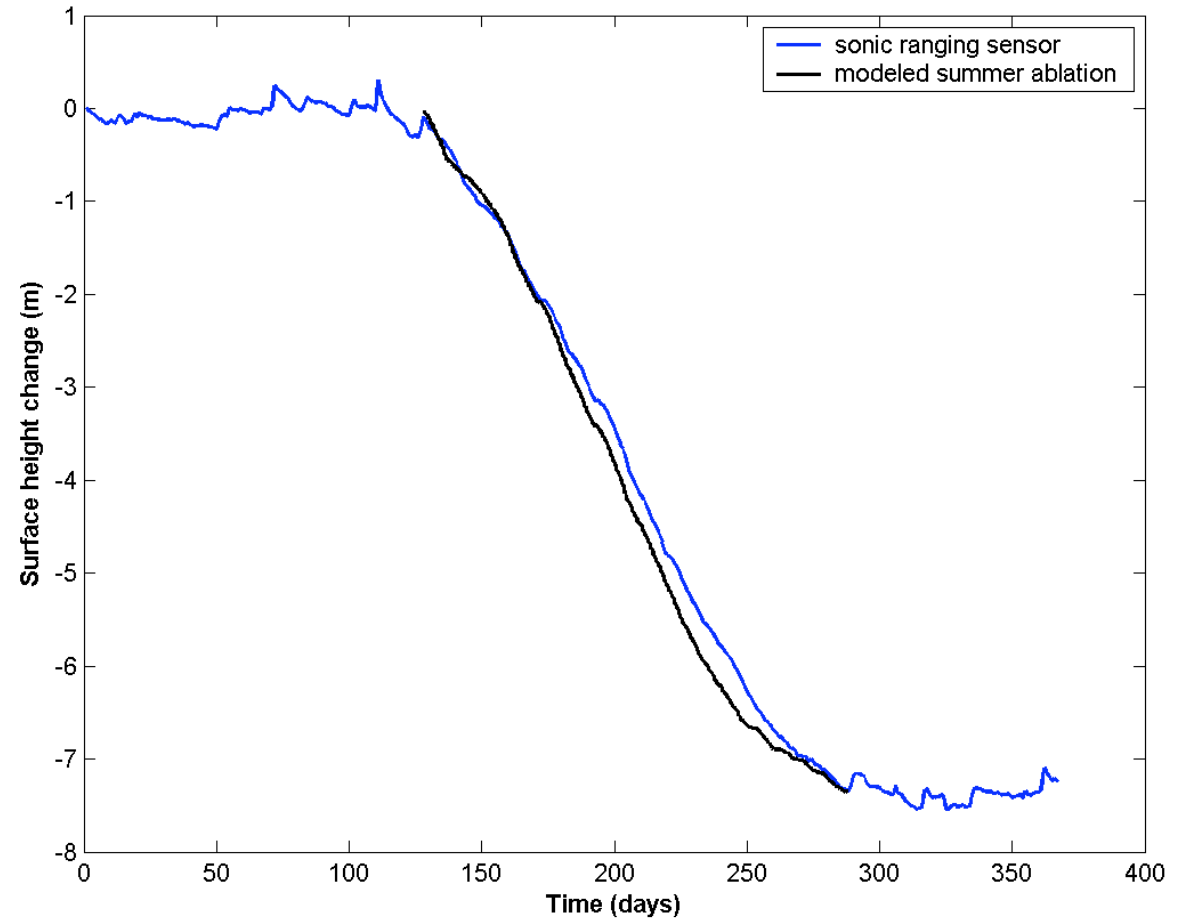
Mölg, unpublished

Validation: Mass balance modeling

Kilimanjaro

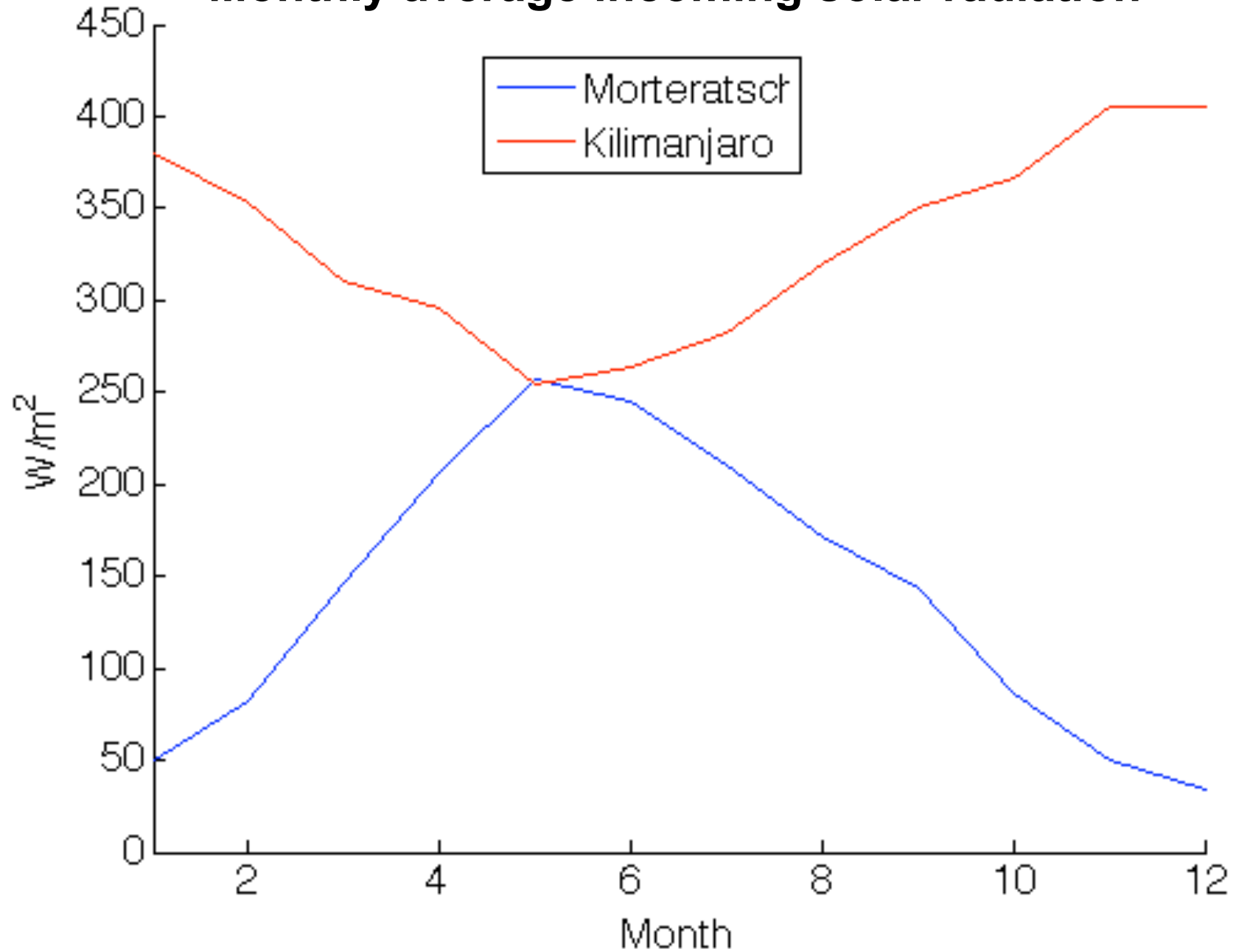


Mortieratsch

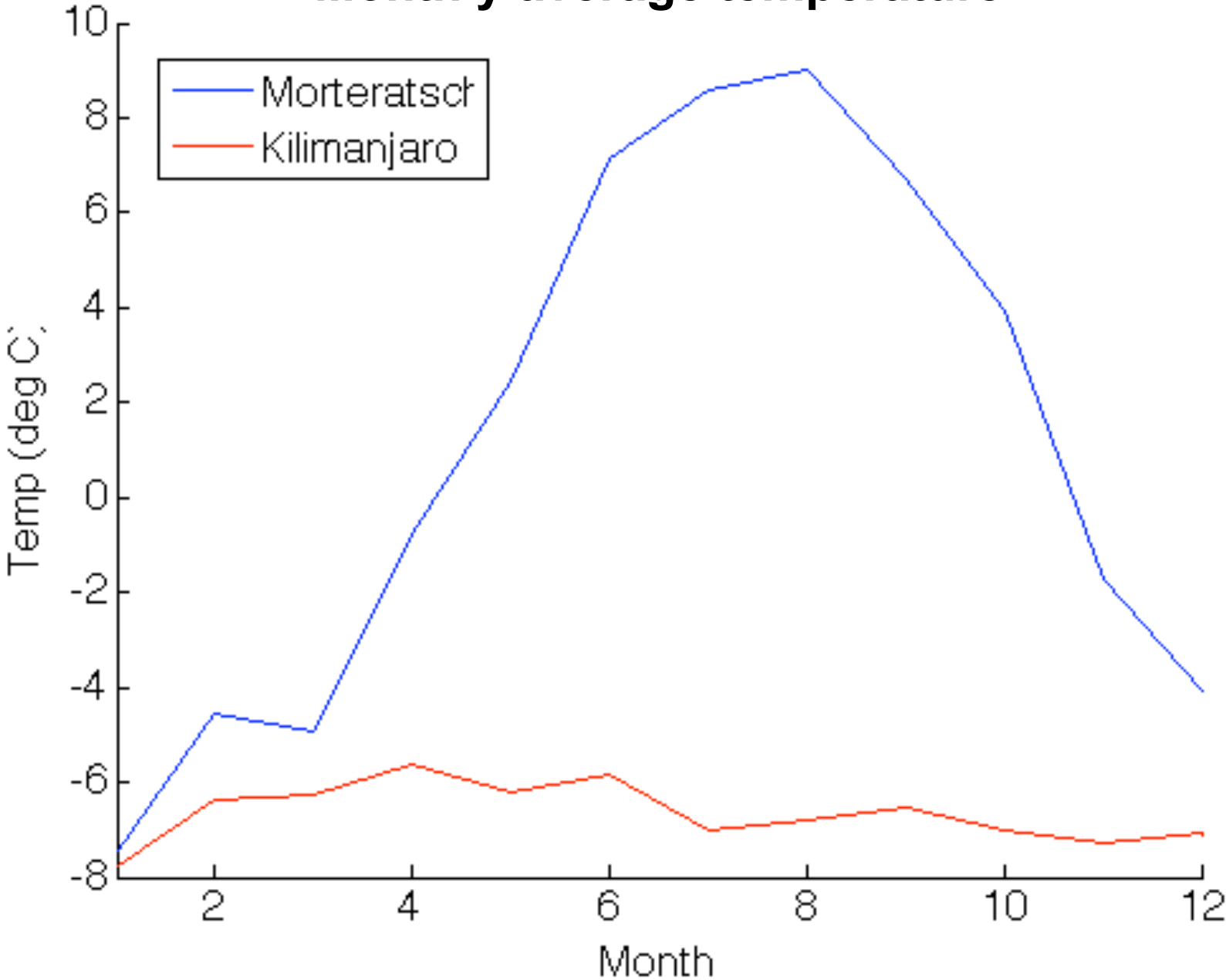


Climate Zone Characteristics

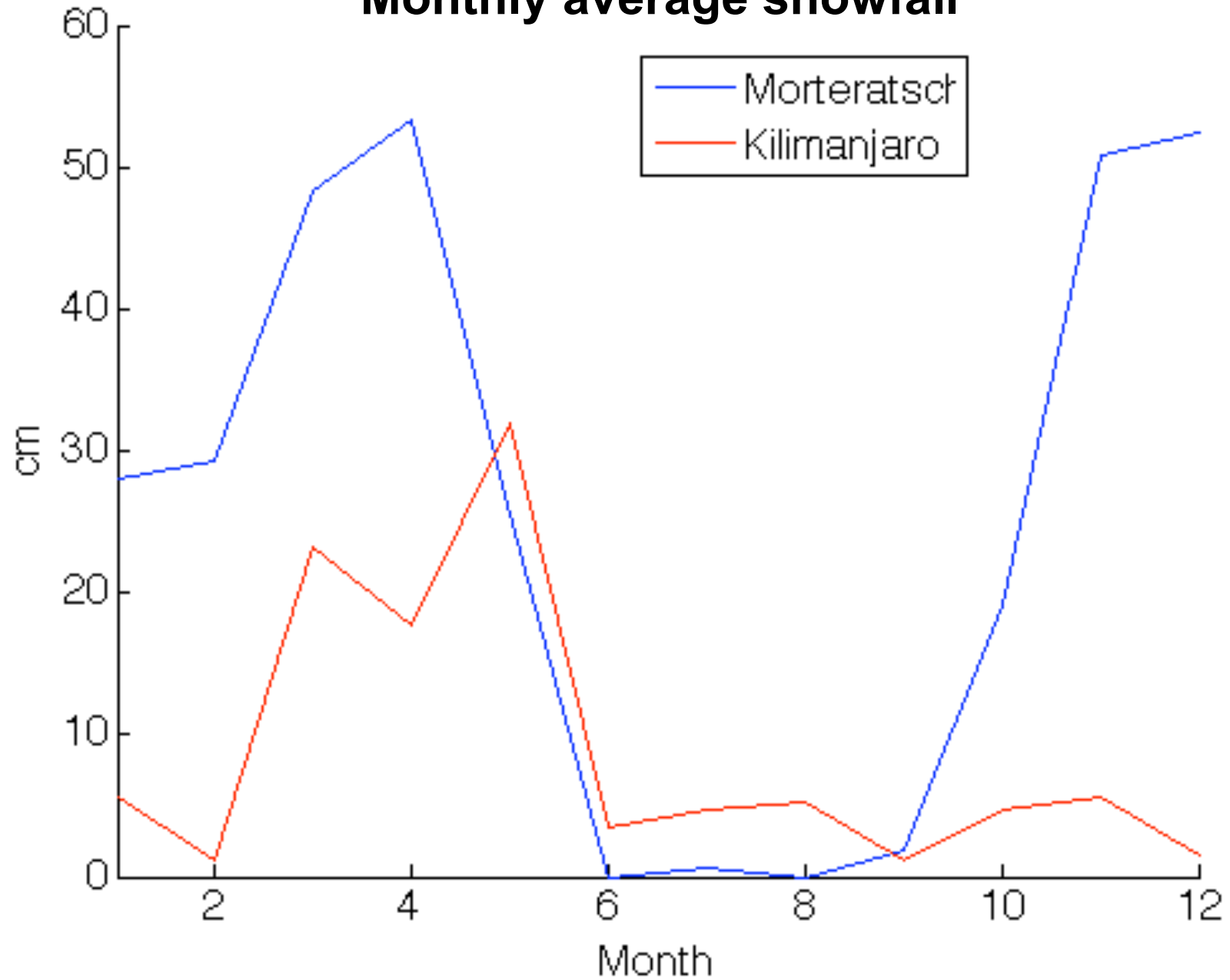
Monthly average incoming solar radiation



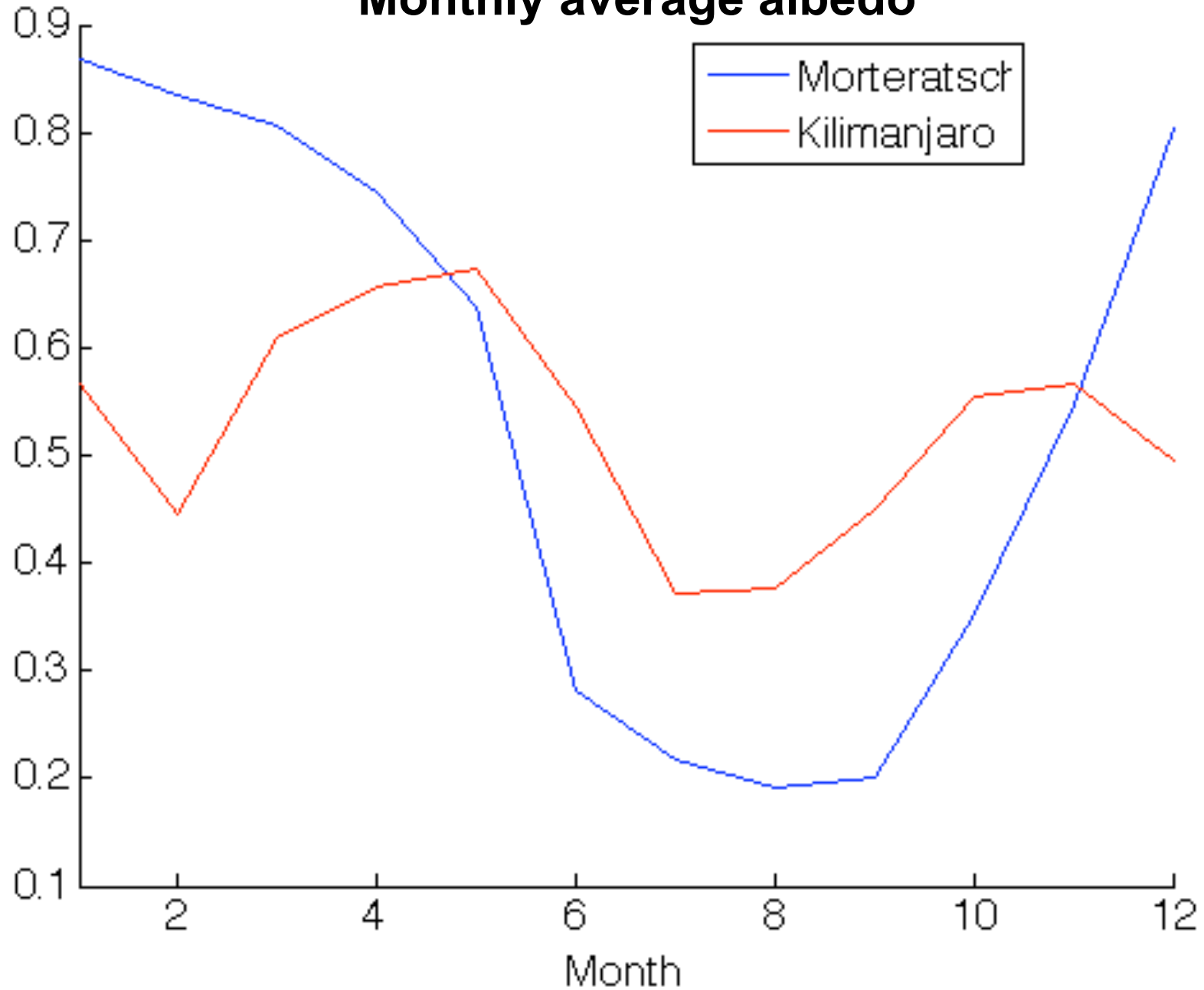
Monthly average temperature



Monthly average snowfall



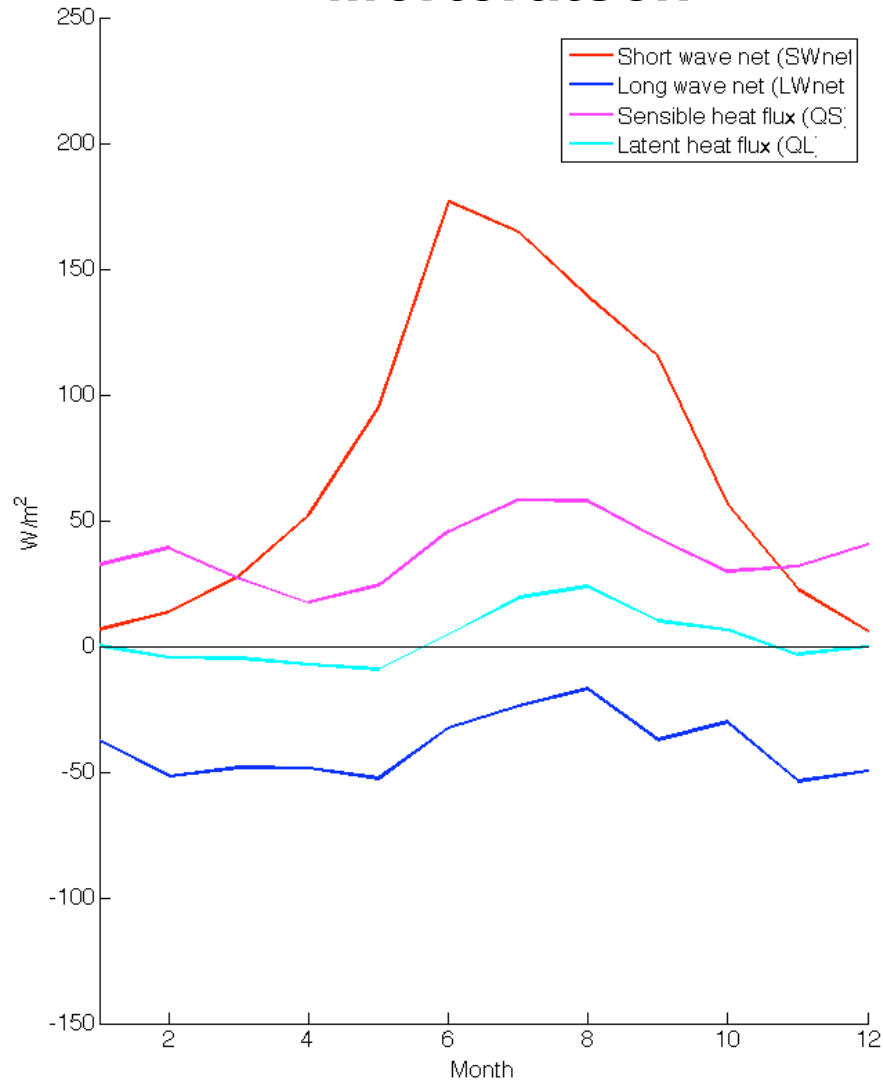
Monthly average albedo



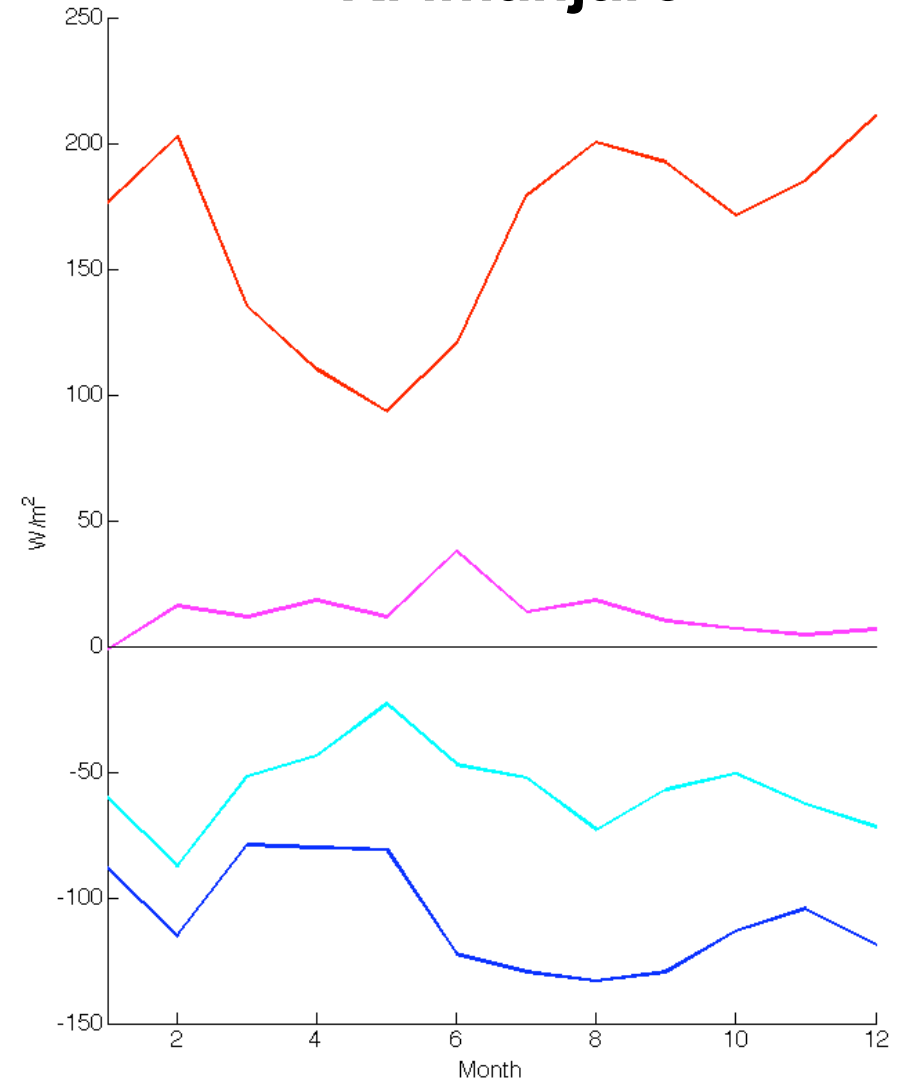
Energy and mass balance characteristics

Energy fluxes

Mortgeratsch

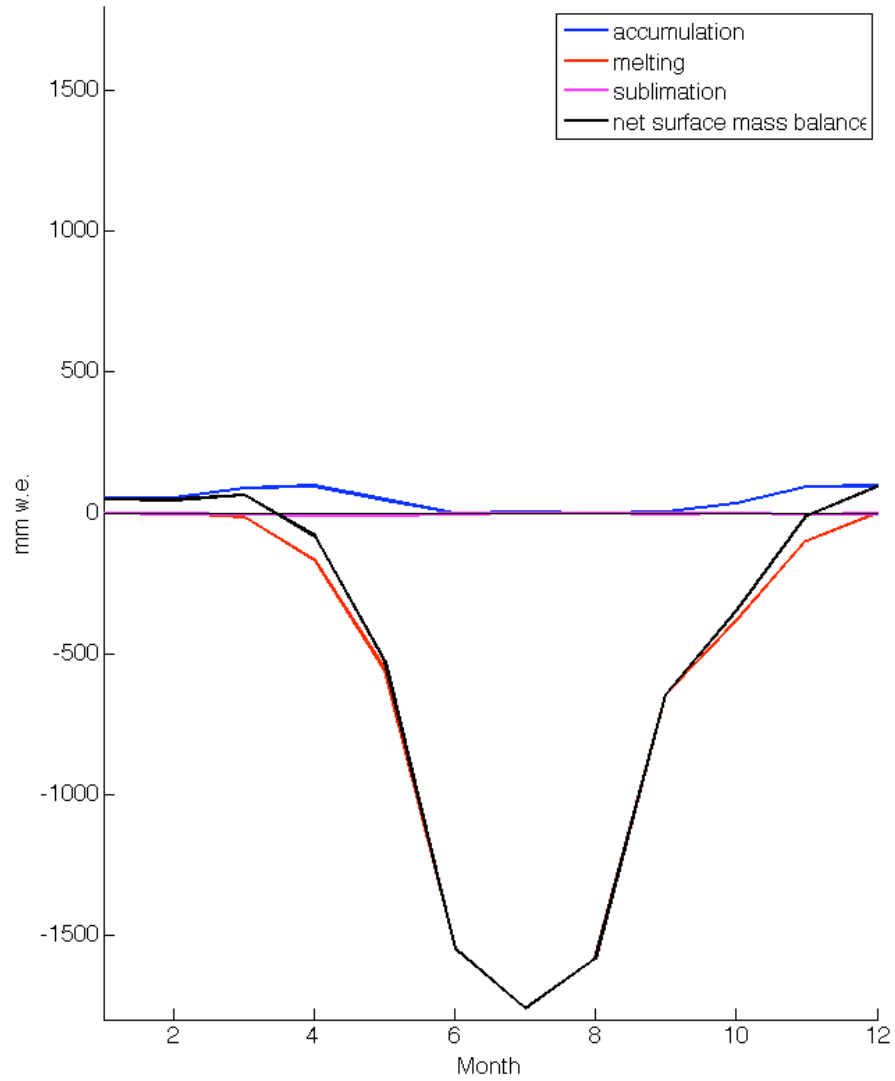


Kilimanjaro

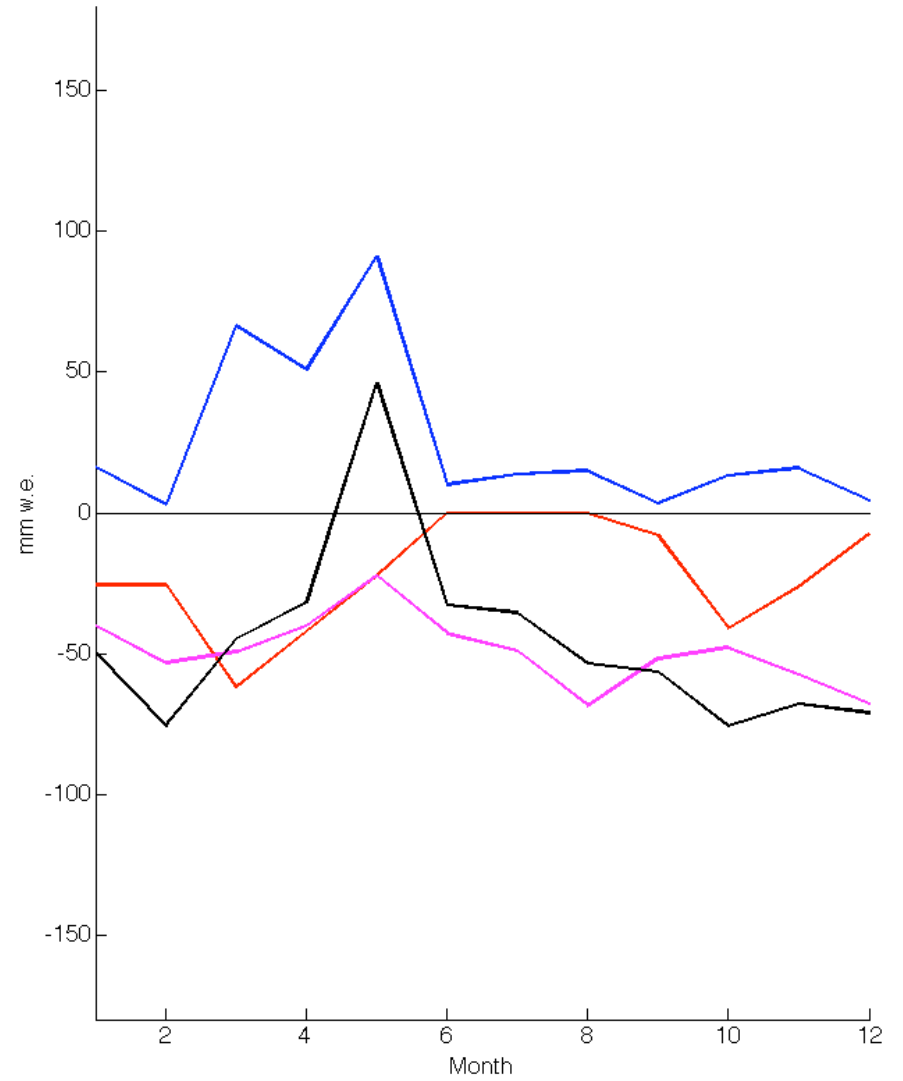


Mass fluxes

Mortieratsch

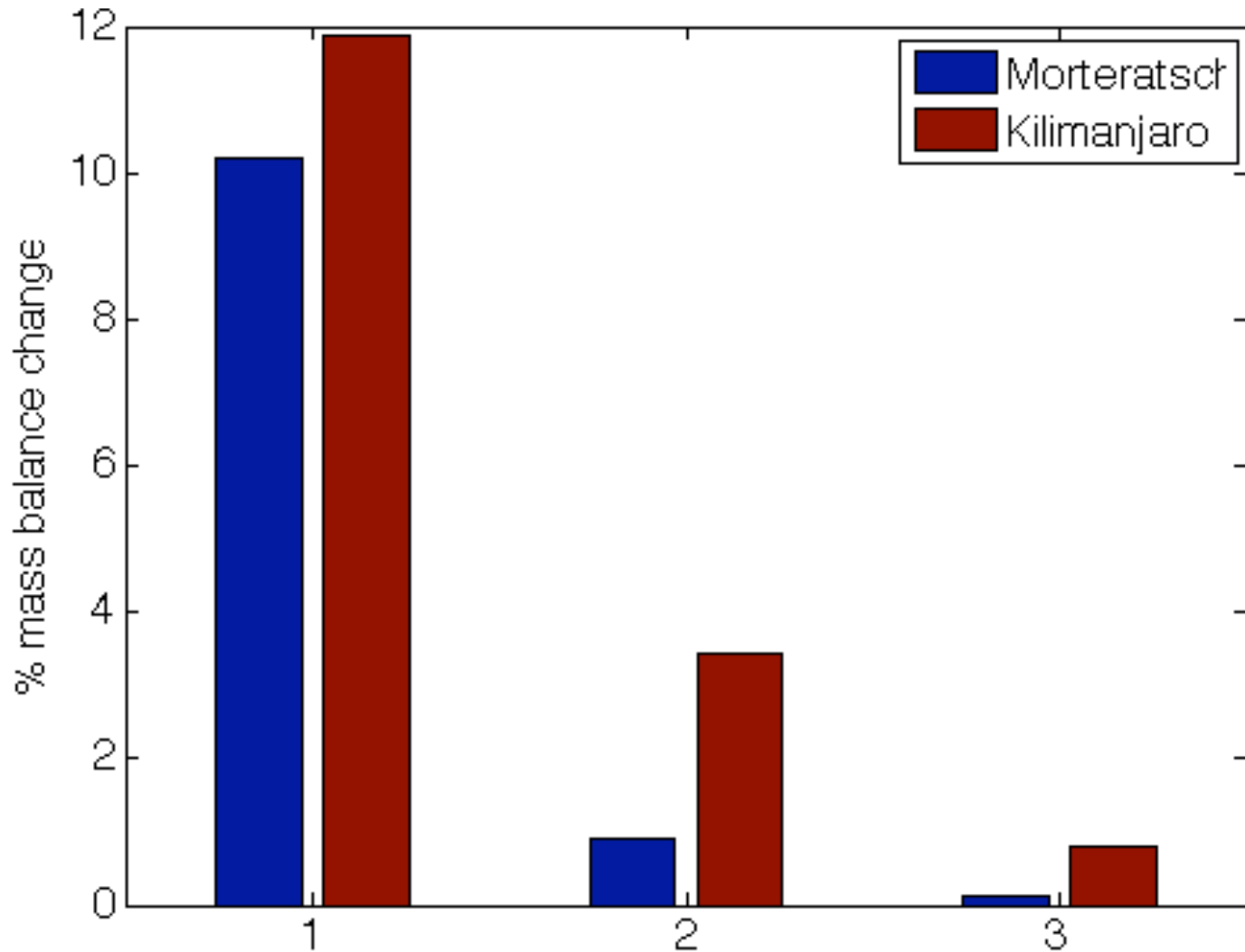


Kilimanjaro



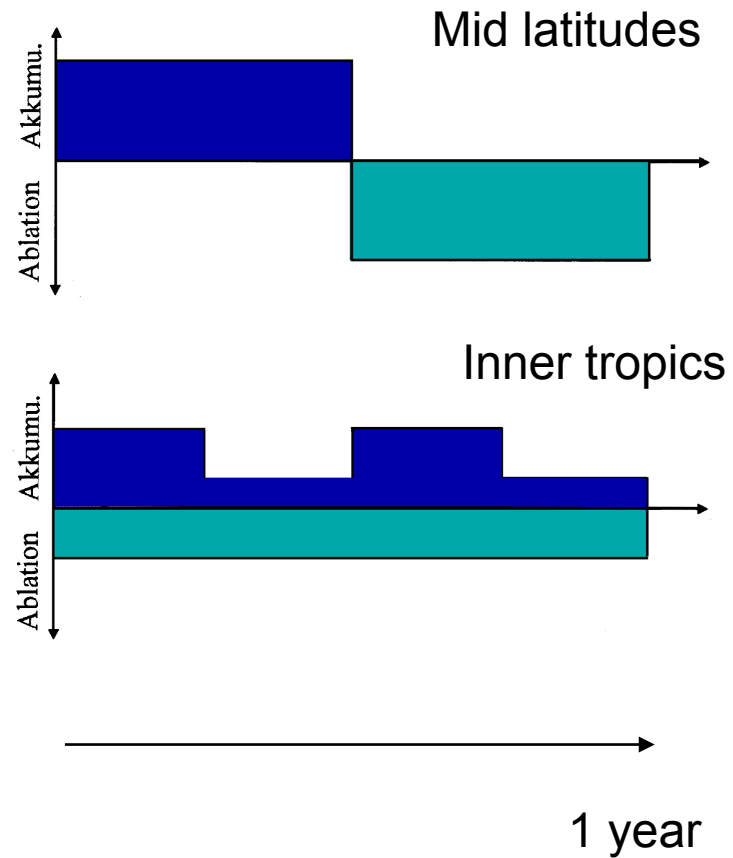
Sensitivity study

Mass balance model sensitivity



1) Surface roughness +1 mm	2) Density of fresh snow + 20 kg/m ³	3) Thermal diffusivity + 0.2 x 10 ⁻⁶ m ² /sec
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Summary mass fluxes



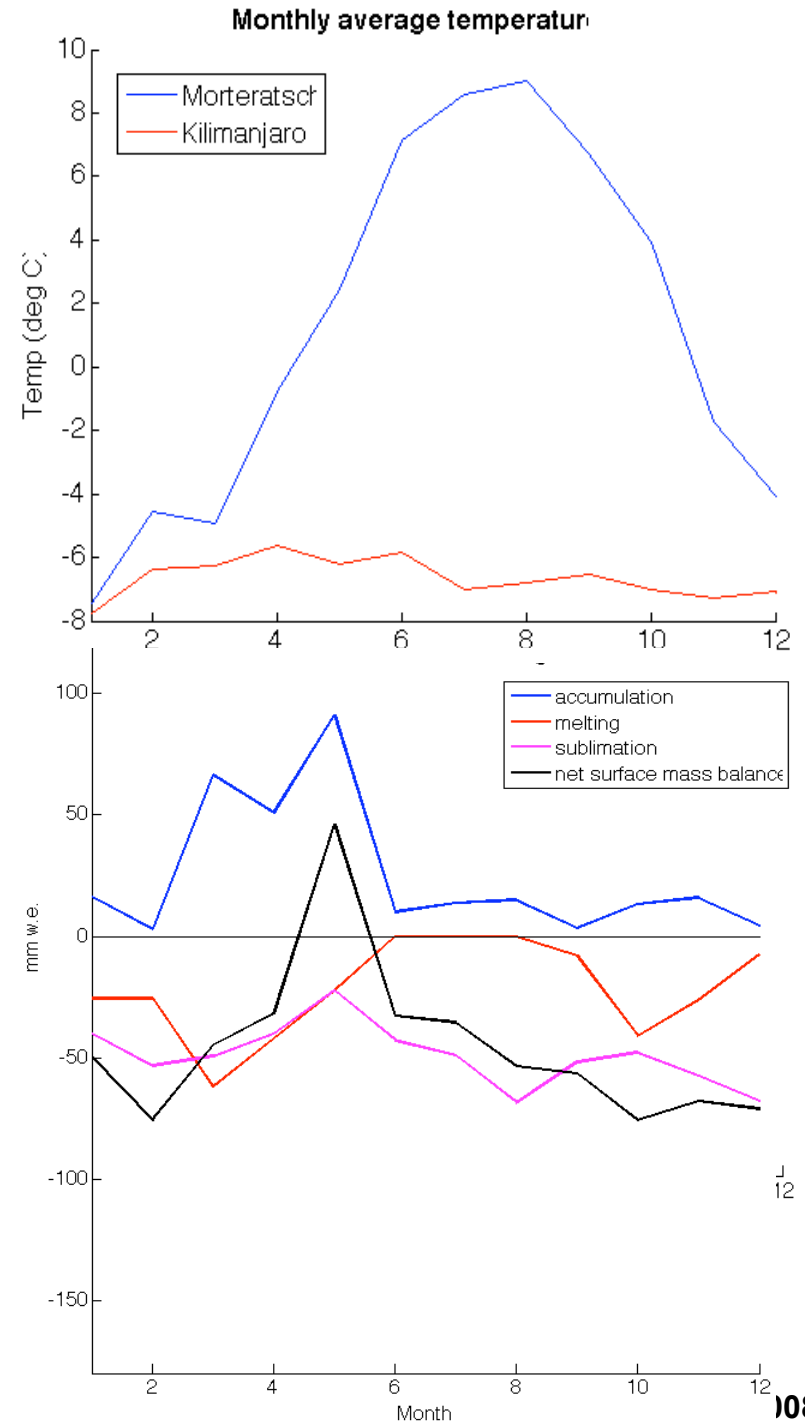
(Kaser & Osmaston 2002)

Energy / mass balance

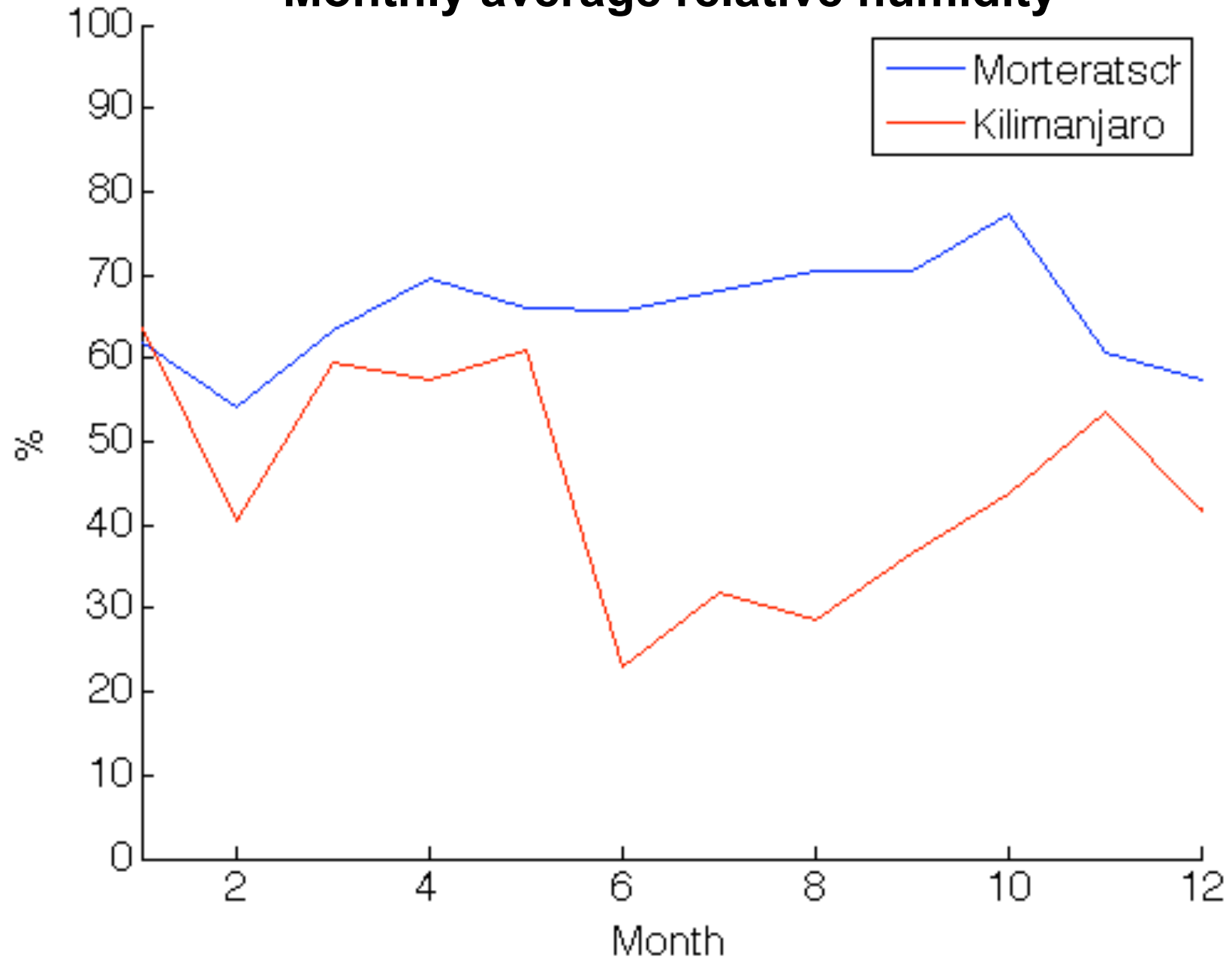
vs.

Degree-day model

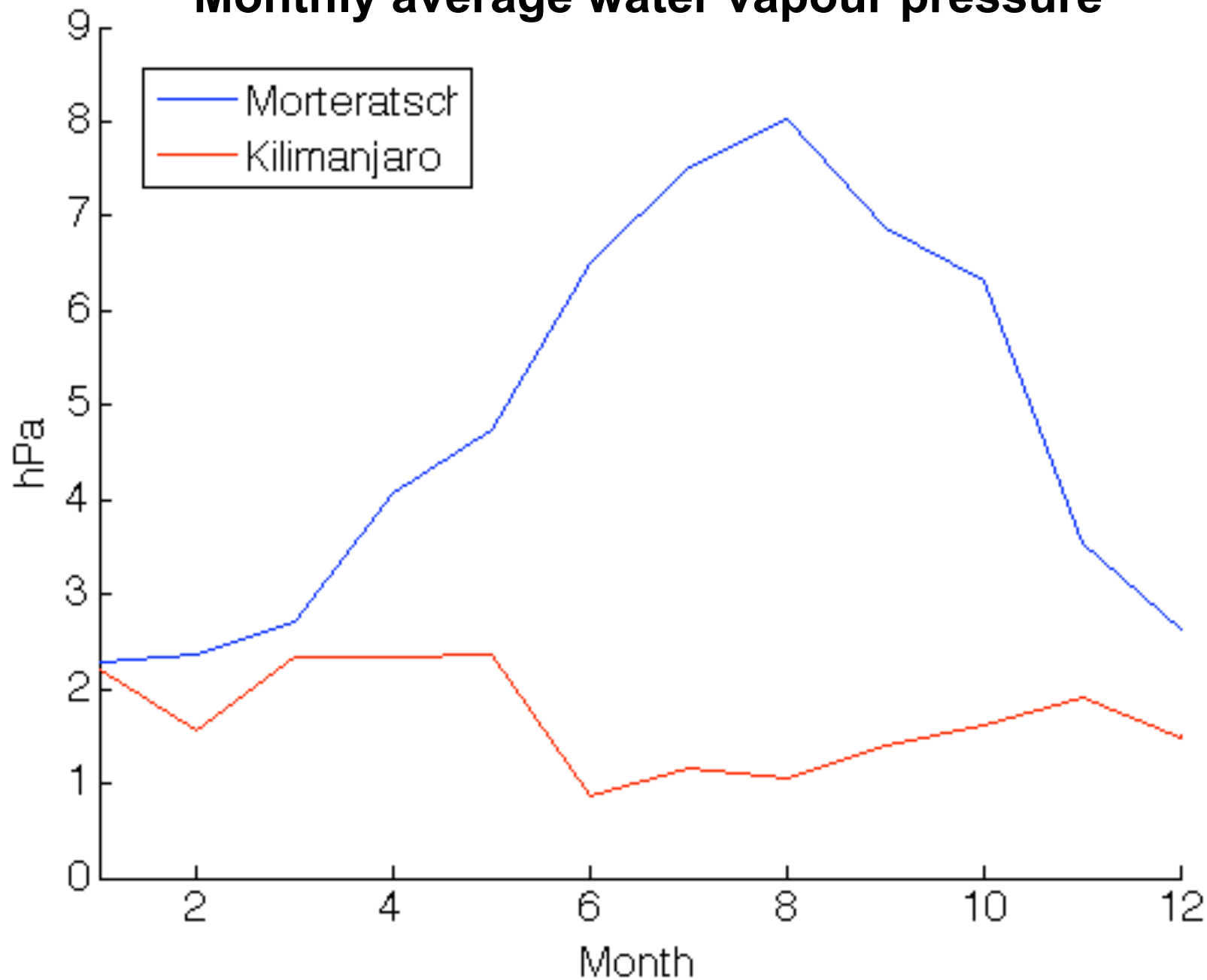
- Morteratsch ✓
 - Strong seasonal cycles
 - Temperature ~ melting
- Kilimanjaro ✗
 - Humidity important
 - Large albedo variation
 - Sublimation > melting



Monthly average relative humidity



Monthly average water vapour pressure



Monthly average wind speed

