The scale dilemma of mountain glacier research

Sauter Tobias, Nicholson Lindsey,

Prinz Rainer, Kaser Georg

The scale dilemma of mountain glacier research

Sauter Tobias, Nicholson Lindsey,
Prinz Rainer, Kaser Georg
tobias.sauter@fau.de
www.tobiassauter.info

INTRO

- Local mass and energy fluxes on glaciers are determined by the microclimates
- It is essential to identify the atmospheric processes and to represent them in a suitable resolution in order to understand the evolution of the mountain glaciers
- The need for high-resolution information inevitably leads to a dilemma between costs and benefits.

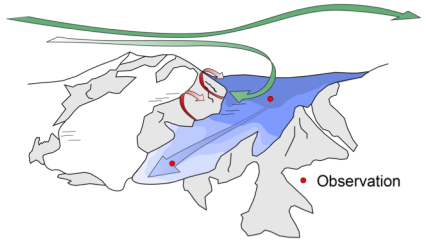
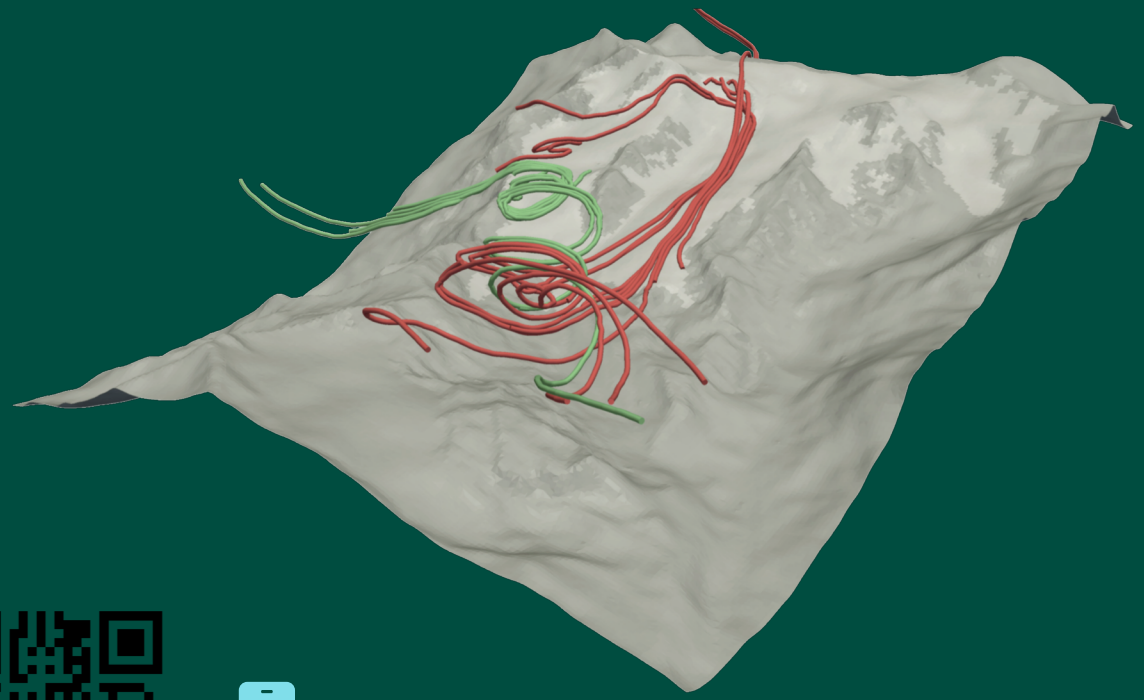


Figure 1. Complex interactions between topography, wind systems and microclimates on glaciers.

OPEN ISSUES

- How large are the biases in the quantification of the mass balances of mountain glaciers if small-scale processes are neglected?
- Do we have to consider the influence of topography on microclimates?
- Under which circumstances is the use of high-resolution models for the glacier mass balance justified?
- How can one infer which temporal and spatial scales are relevant?
- On which scales are process-resolving simulations meaningful?
- Are there time scales where small-scale (subgrid) information become irrelevant?

Knowledge about **microclimates** on mountain glaciers is crucial for **distributed mass balance studies**



Take a picture to download the full paper

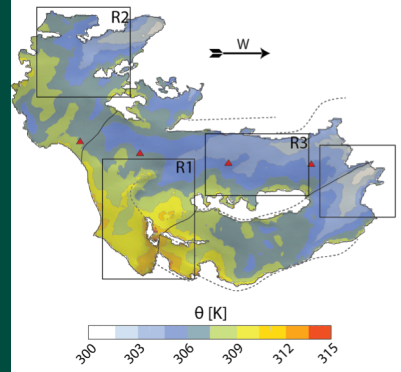


Figure 2. Temperature variations on a mountain glacier simulated by Large-Eddy simulation.

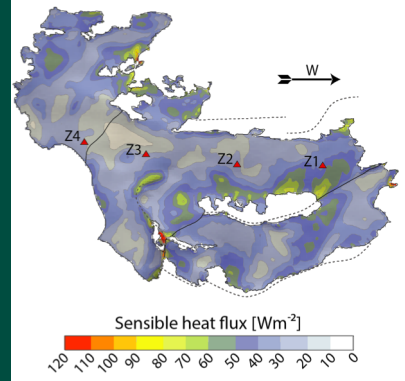


Figure 3. Sensible heat flux variations on a mountain glacier simulated by Large-Eddy simulation.

	Large-eddy simulations	Bulk approach
West	33.8	26.9 (-20.3)
East	31.2	26.0 (-16.6)
North	33.8	27.4 (-19.3)
South	33.0	33.8 (+2.2)

Table 1. Comparison of the glacier-wide averaged surface heat fluxes (W m^{-2}) from the LES and the bulk approach using different temperature fields as predictor. The mean relative differences are given in the brackets.

universität innsbruck
FAU FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG