The Cryosphere Discuss., 2, S478–S481, 2009
www.the-cryosphere-discuss.net/2/S478/2009/
© Author(s) 2009. This work is distributed under
the Creative Commons Attribute 3.0 License.

The Cryosphere Discussions

Interactive comment on "Comparison of the meteorology and surface energy balance at Storbreen and Midtdalsbreen, two glaciers in southern Norway" *by* R. H. Giesen et al.

Anonymous Referee #1

Received and published: 15 January 2009

General comments

This paper presents 5 years of meteorological dataset and energy balance analysis on two glaciers in Norway. This dataset is impressively long, of good quality, and by itself is worth being published in The Cryosphere. The energy balance analysis is also well presented and brings valuable results to understand which energy fluxes are responsible for the melting on these glaciers along the melting season (Fig 10b is especially good). The comparison in between both glaciers is also interesting. The methods are clearly outlined, figures and tables are of good quality and appropriate, and the reference list is exhaustive enough. This well-written and well-organised paper brings

therefore a strong and valuable contribution to cryospheric science, and I recommend publication of this paper. Please, find below some comments and suggestions which can be taken into consideration in the final version of the paper.

Concerning the method, turbulent fluxes are derived from the upper level of measurement and the surface, although there are another level of measurement. I am wondering whether the upper level of measurement is not too high (5.7 m) in this case of small glaciers where katabatic winds are often shallow. How high is the wind maximum on both glaciers, in case of katabatic regime? And could you give a comparison of turbulent flux results while considering i.) the upper level of measurement and the surface and ii.) the lower level and the surface when all measurements are available? Actually, the justification of the choice of the upper level comes from the higher number of data gaps at the lowest level (p 881, line 15 and p 885, line 15), but over this very long time period (5 years!), I am sure that there are long periods with all measurements available. This point is all the more important that both glaciers are differently influenced by katabatic winds (see section 4.2) and therefore, the use of one level or the other could have a different impact on the results of the turbulent fluxes on both glaciers. The choice of the same z0v on both glaciers could be more justified by comparing results of z0v on Midtdalsbreen and on Storbreen even if near neutral conditions are not often encountered on Storbreen. But it is likely that over this long time period, there are enough near neutral datapoints to make this comparison. And how do you switch from roughness length for snow and for ice, on the basis of albedo measurements? Or on the basis of the results from the model which simulates the snow cover?

Although there are many limitations (as well explained in section 5.2 p 892) to thoroughly compare the results of the various energy balance studies listed in table 3 and the results of this study, I find it still interesting. But I think it would be useful to add in table 3 the values of the meteorological variables when they are available over the measuring period (T, RH, wind speed, etc.)

Specific comments

TCD

2, S478–S481, 2009

- p 875, line 7 : To which elevation does the annual mass balance turnover refer to? - p875, line 10 : Alfotbreen and Grasubreen could be indicated in the map (Fig 1). Which altitude are the stations? - p 877, line 13 : both stations are located in the ablation zones, but do you have data of the mean ELA? It is worth adding also this information in Tab. 1, as well as the mean elevation of the 0°C isotherm, in order to help comparing Hsen at both AWS locations. - p878, lines 18-23 : how do you know the exact tilt of the AWS masts on both glaciers? You seem to apply a tilt correction to incoming solar radiation only, but there is also an effect on the reflected solar radiation. Do you apply also a correction? - p 882, line 3 : one order of magnitude change in z0v affects the turbulent fluxes by 15%. Do you mean the sum Hsen + Hlat? Otherwise Hsen and Hlat are much more affected. And in summer, Hsen and Hlat are both positive, and consequently they must be more affected. - section 3.3.2 : an alternative good way to test the model performance could be to compare the appearance of ice at the glacier surface (simulated by the model) and the albedo measured by the AWSs. - section 4, p883, lines 12-19 : in the calculation of r and linear correlations, it is worth excluding periods with reconstructed values of Storbreen from Midtdalsbreen (p 879, lines 13-14). Did you do so? - Fig 8 : Why showing only 2 years, and not 5? - Table 2 and section 4.9: it could be useful to add winter accumulation data on tab 2 since Norwegian glaciers are very sensitive to accumulation/precipitation regime. Do you have rain in summer on glaciers, and how much? How much is the total annual precipitation recorded at Sognefjellhytta and Finsevatn. This information is worth appearing in the paper (even if it is uncertain – p 893, line 6) to accurately know if both glaciers are located in the same zone (transition zone between maritime and drier climate). - Fig 12 : the diurnal cycle of temperature is much stronger outside the glaciers than on glaciers during clear days. Any explanation for that? - Conclusion : the main difference in between both glaciers is the earlier disappearance of the snowpack on Midtdalsbreen (p 896, line 7) leaving a surface of low albedo. May be a sentence explaining this albedo feedback would be appropriate.

TCD

2, S478–S481, 2009

CC BY

Interactive comment on The Cryosphere Discuss., 2, 873, 2008.

TCD

2, S478–S481, 2009

Interactive Comment