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Earth Surface Dynamics Discussions

Interactive comment on "A two-sided approach to estimate heat transfer processes within the active layer of rock glacier Murtèl-Corvatsch" *by* M. Scherler et al.

Anonymous Referee #2

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General Comments

There are two main components to this paper. First, a detailed calculation of energy balance fluxes at a rock glacier in the Swiss Alps, based on an impressive multiyear series of micrometeorological measurements. Second, the simulation of energy fluxes and active layer temperatures at different depths using the COUP model. The main finding is that introducing a heat source/sink layer in the model to account for air flow driven heat transfer dramatically improves the fit to measured borehole temperatures. The authors also estimate freezing and thawing rates in the active layer and at the permafrost table from the residuals in the energy balance. These latter results must be treated with caution due to the simplifying assumptions applied in the methodology.

While this is an interesting study, greater clarity is needed in the explanations of the energy flux calculations. Other than the model development, it isn't clear what new insights into active layer processes are gained since much of the analysis consists of a general discussion of uncertainties in the two approaches which are not clearly quantified. I think the authors underplay their work and findings in this respect, and could improve this aspect of the paper in a revision.

Detailed comments

Equations 4-8 give the gradient form of the aerodynamic equations. It appears the bulk aerodynamic approach is applied, however, in which case surface values of temperature and humidity are needed, but it isn't clearly explained how these variables are measured. Both surface temperature and humidity are difficult to measure or model accurately and a quantification of the error range and its effect for both variables is really needed. There appears to be some confusion over symbols. The letter z is used for both height and 'surface roughness' (p 148, l22). I assume the latter is really the 'aerodynamic roughness', which should be defined as the standard symbol z_0, as this is required in bulk aerodynamic approach. What value of roughness was used and how was it calculated and estimated?

154, 6 The parameterization of the heat source/sink layer isn't clear. Explain what the form of the parameterization is and how it was implemented in the model. What are the 'values' that were 'adjusted experimentally'? What was the range of variation of these values and do they have any physical meaning or are they purely empirical?

150, 1-3, this sentence doesn't make sense to me, please clarify

150, 14, the correction factor needs justifying

151, 21-22, explain why gradients might be too high

152, 9, snow density was already defined in equation 9 as rho_s

156, 22-23, justify the use of a 15 degree slope

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Interactive Comment

158, 19-20 The explanation is completely opaque. Explain what was done here. How can one of the paper authors give a pers. comm. !?

Grammar, typos, etc

143, 1 '. . .expected from. . .'

144, 7 'anthropogenic'

145, 11 '. . .since then. . .'

145, 17 '. . .and a frozen. . .'

146, 13 and 20, data are plural

155, 11 close bracket after 'Table 3'

Figures 2-4 would be clearer if the vertical axis ranges were restricted to make the columns appear larger.

Interactive comment on Earth Surf. Dynam. Discuss., 1, 141, 2013.