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The Cryosphere Discussions

Interactive comment on "On the use of incoming longwave radiation parameterizations in a glacier environment" *by* J. Sedlar and R. Hock

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Reviewer 2:

We thank you for your extensive comments, criticims and suggestions to this manuscript. We have entirely re-analyzed and re-written the manuscript based largely on your suggestions.

Our response to some of your main points and how we have incorporated them into the revised version of the manuscript:

1) The comparison of different coefficients found in the literature for the K94 all-sky parameterization has been considerably de-emphasized. We do not compare it anymore in the figures and tables where we compare an expanded suite of published parameterizations. However, to put the inte-rmodel differences where coefficients are fitted

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into perspective, we compare in the discussion these differences to those which arise for one of the parameterizations (Konzelmann et al., 1994), when coefficients are taken from the literature from other sites. Since adoption of coefficients from the literature is widespread in case of lack of data for parameter fitting we provide some indication of how good this procedure can be in comparison to using different parameterizations. However, we only include a few sentences on this aspect and hence largely reduced its overall weight in the paper.

2) We have now updated the parameterization suite to include 7 clear-sky emissivity parameterizations consisting of 0 to 2 independent variables commonly found in the literature; all-sky emissivity parameterizations have been expanded to 3, eliminating the general cloud factor used in Kimball et al. (1982). All coefficients have been fit to the Storglaciären data set.

3) We have removed the section regarding the general cloud factor used in Kimball et al. (1982). Instead we use 3 commonly used all-sky emissivity parameterizations, all fit to the Storglaciären data set. The clear-sky and all-sky emissivities are combined to identify inter-model bias and the dependency of longwave calculations on the independent variables applied.

4) All emissivity parameterization coefficients have been fit to the Storglaciären data set to allow an unbiased inter-model analysis.

5) We have removed multiple variations of the cloud factor parameterization, replacing them with a single non-linear parameterization.

6) We have added physical constraints to the parameterizations for cloud fraction (nparam = 0 as tau $>$0.82) and cloud factor (F = 1 as tau $>$0.8[hourly] & 0.75 [daily]).

7) We attempted to use direct, incident solar radiation at the surface to normalize observed shortwave radiation. However the ratio tau exceeded 1 for more than half of hourly observations since the observed broadband solar radiation includes the diffuse

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component. We have therefore limited the cloud fraction and cloud factor parameterization development to cases when solar zenith angles were less than 80° and observed shortwave radiation is greater than 15 W/m2. We also utilize a digital terrain model to identify potential for times of shading on the pyranometers.

8) We have included a discussion regarding the limitations regarding the use of shortwave radiation to predict cloud cover.

9) We adopted the suggested title.

Interactive comment on The Cryosphere Discuss., 2, 487, 2008.