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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

Anonymous Referee #1

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This paper examines how well three commonly-used parametrisations of incoming longwave radiation (ILR) perform in a glacier environment. The authors conclude that the parametrisations work reasonably well, providing that variations in cloud cover and humidity are accounted for. ILR parametrised using coefficients derived by fitting to local data (not surprisingly) fitted the observations better than that derived using published coefficients for other sites. An attempt to parametrise cloud cover in terms of global radiation showed some skill, but a large degree of scatter.

The paper provides useful practical guidance to those developing models of glacier mass balance. The methodology is sound and clearly presented. The authors focus their attention on only three parametrisations of ILR, while many more are to be found in the literature, including some that have been developed specifically for polar or glacial

environments (e.g. Koenig-Langlo and Augstein, Meteorol. Z., 1994 - interestingly included in the reference list but never mentioned in the text). Some discussion as to why these three parametrisations were chosen for testing would be useful.

That aside, I believe that the paper is a useful contribution to the field of modelling glacier mass balance. It is suitable for publication once the authors have attended to the following (mostly minor) points:

1.) p491, l7: Vaisala humidity sensors can exhibit larger errors at lower temperatures (Anderson, J. Atmos, Ocean. Tech., 1994) but this is probably not an issue with these melt-season measurements.

2.) p494, l4-5: replace "to derive" with "of deriving".

3.) p494, l10: insert "observed" before "cloud fraction".

4.) p496, l15: insert ", i.e. equation 5" after "Kimball et al. (1982)"

5.) p498, section 4.4: An attempt is made to parametrise cloud fraction in terms of atmospheric transmissivity, defined as the ratio of global radiation to top-of-atmophere radiation. The relationship is found to be very scattered. Part of this scatter may be due to the fact that the transmissivity index used is likely to have some dependence on solar zenith angle as well as cloud cover (and the other contributory factors noted in lines 9-11). This could be investigated by analysing only a subset of the measurements within a small range of solar zenith angle.

6.) p499, section 4.5: An alternative approach to using global radiation to estimate cloud fraction, then using this cloud fraction in a parametrisation for ILR, would be to develop a parametrisation for ILR that used transmissivity directly as an independent variable. Missing out the intermediate step of computing a parametrised cloud fraction might then lead to an improved parametrisation of ILR. This would certainly be worth investigating.

7.) References: As noted above, Koenig-Langlo and Augstein (1994) appears in the

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references but is not referenced in the text.

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