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The Cryosphere Discussions

Interactive comment on "Near-surface climate and surface energy budget of Larsen C ice shelf, Antarctic Peninsula" *by* P. Kuipers Munneke et al.

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We would like to thank Mr. Lampkin for his thorough and helpful assessment of our discussion paper. Below, we reply on the comments and suggestions for improvement he offered us in his review. 'Q' here denotes the queries from the reviewer, 'A' is the response from the authors.

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SPECIFIC COMMENTS

Q: page 2668 SECTION 2.1 and 2.2: much of the information related to instrument performance specifications and operations length can be put in a table.

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A: We will try to design a table with all information and see which implementation is better for the final, revised version.

Q: page 2669 line 12: why not use a combination of information from the periods before and after periods of substantial riming (perhaps interpolating the data over these periods) unless the variance pre and post riming periods was substantially high. The specified constant value may be reasonable given riming events occur under periods with low wind speeds. . .a possible sensitivity analysis of modeled fluxes based on the use of a 1 m-s constant value may be warranted. (line 15) This also has implications for the correction of air temperatures during calm periods, which I assume are coincident with riming events as well.

A: We find it difficult to come up with something more sophisticated than just a constant value. It would of course be possible to relate mean wind speed and its variability to e.g. surface pressure, temperature, or longwave radiation, and then fill the data gaps. However, one should bear in mind that it's only a total of 13 days in a two-year period, most of which in wintertime, when the effect on melt, which is a focus of this paper, is small. We will try to incorporate a sensitivity estimate on the fluxes using a different constant value for the data gaps.

Q: page 2670 lines 5-7: awkwardly stated, should revise.

A: We will rephrase this section

Q: page 2670 line 16: a constant sub-surface grain size of 100um was used though there can be variation in grain size, particularly during new snow fall events of an order of magnitude. How might this affect estimated shortwave radiation penetration? Was the use of this value derived from previous literature or based on estimates of grain size distributions from the snow pits excavated during the field campaigns? Kuipers et al. (2009) demonstrate grain size and density analysis of firn in the upper few cm and indicate a range I grain sizes (between 100-500um). Though this analysis was conducted in Greenland at Summit, I might expect a grain size distribution biased towards

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the higher end of the spectrum due to frequent summertime melting.

A: The original idea behind section 3.3 was to illustrate the effect of subsurface absorption of solar radiation on the energy budget and the melt partition in a schematic way. We did not attempt to present a very detailed snow microphysical model here because the description of other processes (percolation, refreezing, densification) is only schematic: the simulation of surface temperature slightly improves when subsurface radiation penetration is allowed, which is the motivation to include it in the optimal model settings. We will try to stress that this paragraph should be regarded as an illustrative part of the manuscript, not as an attempt to include all snow physics as realistically as possible. The choice for 100 um snow grains is based on figures 7 and 8, where the match with observations seems best. But given the uncertainties in the observations and the simplicity of the snow physics in the model, even this is open for a different interpretation.

Q: no mention of solar loading and treatment of solar loaded thermistor data in the analysis?

A: There might be some solar loading, but we have tried to minimize its impact on the thermistor data by using a white plastic housing. Revised manuscript will discuss this.

Q: I thought the results regarding the potential overestimation of melt through the use of 2-m measured temperatures was quite interesting, but perhaps the correlation between 2-m temperature and melt becomes more substantially as a temporally integrated relationship between antecedent melt and temperature.

A: The surface temperature, and thus the melt, is determined by the entire surface energy balance, not only by the longwave balance. This is why an approach like the positive degree-day method can at most provide an approximate relation between 2-m temperature and melt. In the determination of relations between 2-m temperature and melt, there will always be scatter. It is likely that the relation between these quantities improves as one considers longer periods or cumulative values over a longer period.

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Q: Several figures require some revisions so axis labels and figure annotations are legible. I would suggest rescaling in some cases. The most significant issues of this kind are related to the following figures: -Figure 2 -Figure 3 -Figure 5 -Figure 6 -Figure 7 -Figure 9

A: We will adapt the font sizes of the figures mentioned.

Interactive comment on The Cryosphere Discuss., 5, 2665, 2011.