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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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This paper discusses the surface energy budget in a part of Antarctica, where surface melting can be observed, and where ice shelves have shrunk considerably in the recent past. It is therefore of special importance to understand the near surface climate and surface energy balance in this region, which was nicely addressed in this paper.

The paper would benefit from a more detailed discussion in some places, such as discussing the implication of the subsurface solar radiation for different seasons (see comments below). Also, it would be interesting to see a discussion about the snow conditions (from the many available snow profiles), which would add very useful information for understanding of the surface energy balance.

Specific Comments:

- P2666, L4-5: Remove "including melt energy", because that is already included in the SEB.
- P2666, L16: "reduction in latent heat flux" could also mean that the latent heat fluxes become smaller, when in the case of Föhn their magnitude actually increases, but they just become more negative. I am not sure what the best way is to write this, but please consider making it more clear.
- P2667, L1: remove "lively".
- P2667, L6–10: You can remove these two sentences.
- P2667, L25: consider replacing "solves" with "calculates".
- P2668, L3: remove "the other station".
- P2668, L17: replace "observed" with "measured".
- P2668, L27: It is not clear what has been interpolated. Was there a data-gap so the data needed to be interpolated. Or was there some sort of spatial interpolation. Please clarify.
- P2669, L8ff: If wind speeds and conditions at the two AWSs are similar, so I expected the riming to occur at both sites at the same time, which seems to be the case for only a few days. Could it be that while one of the sensors is completely rimed, the other has heavy rime on it, but is still slightly moving? Is there something in the literature about wind speeds and conditions at which those sensor start riming. It would be helpful to write something about the uncertainties that are caused by riming (e.g. slower turning wind vanes) and to estimate the associated uncertainty, if possible.

- P2670, L8: It is not clear, in which part of the model the iteration happens. Is it in the calculation of surface/ subsurface temperature? And what does it mean "until the energy budget is closed": is that when the modeled surface temperature is close to the one estimated using $LW\uparrow$. In that case, I am not if the $LW\uparrow$, which is used for getting the surface temperature right, should be used to verify the surface temperatures. Please explain in more detail.
- P2670, L16: Where do the 100 μm come from? Also, it would be interesting if you showed the average density profile and discussed how those 60 pits differ. it is a lot of pits and a lot of very interesting data, that I am sure is worth discussing more in detail.
- P2670, L23: Remove the first sentence of this paragraph, because it is again repeated on L25.
- P2672, L14–17: See comment to P2670, L8.
- P2672, L22: 1 Wm^{-2} can be considered as zero, so you can remove "almost".
- P2673, L16ff: It would be interesting to see if the effect that the thicker cloud has on the net shortwave radiation is larger through increased albedo or through reduced incoming shortwave radiation. Also, it would be interesting to see what fraction of the albedo change is caused by the increased melt (and changing of the surface properties) and what fraction by the thicker cloud cover. Consider doing some simple model experiments to show the relative influences of these different processes.
- P2674, L5: An older reference might be more appropriate for the discussion that radiation penetrates deeper into ice than into snow.
- P2674, L13: This is not always necessary the case. Imagine a cold snowpack, where the incoming shortwave radiation penetrates into the snowpack only to

slightly warm up the snow (not bringing it to melting point). Without partitioning the melt, the energy gets concentrated at the surface, increasing the surface temperature to the melting point, and causing melt. Please discuss why in the case of your location, this is not the case (e.g. already warm snowpack). This could also have different effects in spring (when the snowpack is colder) than in summer, when the snowpack in warmer.

- P2674, L26ff: I is not clear why you assume that subsurface melt does not lead to surface lowering. Please explain.
- P2675, L3: Considering that you have around 60 pit-observations in January 2011, it is not clear why you need to use a constant (with depth) snow density. You should have quite a good idea about density, which you could use for the comparison with the sonic ranger.
- P2675, L7: It would be interesting if you explained why you have low density snow at the surface. I would think that the melting surface has a higher density than the underlying surface. For this discussion it would be useful to show the snow density profiles that you have obtained. See comment to P2670, L16.
- P2677, L20–21: It is not only the dries, but also the warmer air that favors sublimation.
- P2678, L7–9: The implications of subsurface solar radiation should be discussed more in detail. See also comment to P2674, L13.
- P2678, L14: Summer is not necessary calmer. Figure 5 and Table 1 show the opposite, summer is actually windier than winter. Please correct or rephrase.
- Figure 5: Could be removed, because it does not have any necessary information and is not important for understanding the paper.

- Figure 7: It would be interesting to see the same figure for the surface temperature.

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