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The Cryosphere Discussions

# *Interactive comment on* "Surface and snowdrift sublimation at Princess Elisabeth station, East Antarctica" *by* W. Thiery et al.

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On the Antarctic ice sheet, strong katabatic winds blow throughout the year and a large but unknown fraction of the snow which falls on it is continuously removed. Recent experimental work has revealed that snow drift sublimation can lead to significant mass losses during strong winds, which can be an important factor in the surface mass balance of the Antarctic ice sheets. This manuscript calculated the sublimation from snow surface and drifting snow utilizing the AWS data installed on the Dronning Maud Land, and argued what caused the differences, particularly in the Princess Elisabeth station. All the methodologies and discussions are organized properly and carefully described. So, I believe this article is worth publishing. However, I am glad if the authors can clarify and improve some of the points listed below before the publication.



Generally, although the manuscript is well written, I do have a feeling it slightly lacks the punch. Probably it is because that the revealed outcome, why the sublimation at Princess Elizabeth was lower, was not so surprising. We can easily speculate that the windward mountainous topography prevents strong katabatic winds and, thus, frequency of drifting snow reduces and strong inversion was occasionally formed. Needless to say, I do not deny the meaning of the precise calculations and sensitivity evaluations on this manuscript, but authors would like to conclude just the Princess Elisabeth station (AWS 16) is located on a unique place? Preferably, not only such local issue but also more universal one which is applicable to other places is introduced. For instance, many attempts have been made to estimate the sublimation rate in the Antarctica, as is also shown in the manuscript. The methodologies are different, thus errors included may differ more or less. Nevertheless, I believe it is worth comparing each other. It would be also useful to attest that the sublimation amount obtained this study is reasonable. Takahashi estimated the sublimation rates over -200mm w.e. yr-1, whereas this study area was only 18 to 52 w.e. yr-1. Such difference can be explained reasonably with the meteorological factors? Discussions like this will be useful for the next stage, such as the total estimates of sublimation from all over the Antarctica. Further, in Fig. 1, it looks like AWS 6 locates on the shoulder of the plateau and AWS 5 is further downstream. I am anxious that Coriolis force may change the wind direction. However, if we can assume the air at AWS 6 flows down to AWS 5, it is worth comparing wind speeds, air temperatures, RHs and the evaluated sublimation amounts at both stations. It may reveal how the sublimation progresses along the katabatic flow.

Specific comments

Page 1495, line 3: "SEB" should be shown as "surface energy balance" here.

Page 1498, line 23: I am not so sure that the sublimation from the snow surface never happens in the drifting case.

Page 1499, line 15: Please explain why the roughness length was set to 1 mm; 0.1

mm was used for the surface roughness in the SMB calculations (page 1497, line 20).

Page 1504, line 14: Assuming that the ERds is negligible, is the precipitation amount obtained as the residual processes reasonable? Since the precipitation is hard to measure directly, particularly in the drifting, comparisons with the other studies and detailed discussions are significant.

Page 1504, line 23: Sum of SUs + Suds increased much from 2009 to 2010 in AWS 16. This trend was also shown at other AWS stations?

Page 1501, line 21 & Fig. 2: Although the SEB model does a good job in general, there exists a trend that Tmodel becomes higher than the Tobserved, particularly at low temperatures. Do you have any explanations?

Table 1: I suppose the snow density shown here is the measurements at a specific time and place. It doesn't change much during the observation period and its variation does not give large effect on the following calculations?

Fig. 10: Although the wind directions are shown with different colors in addition to the notices with arrows, distinction between the katabatic and the synoptic is not clear.

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Interactive comment on The Cryosphere Discuss., 6, 1491, 2012.