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Interactive comment on "Sensitivity of the surface energy budget to drifting snow as simulated by MAR in coastal Adelie Land, Antarctica" *by* Louis Le Toumelin et al.

Anonymous Referee #1

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This paper examines the effects of snowdrift on Antarctica in a regional climate model with and without snowdrift physics included, and verified with local observations in Adelie Land. Overall it is an interesting paper with useful results, showing that the inclusion of snowdrift physics considerably reduces the bias with observations. I recommend publication provided that the following issues are satisfactorily addressed.

1. In places, the grammar is quite poor. For instance, there are many errors in the use of plural/singular. I strongly recommend to have the manuscript proofread and checked by a native speaker or the like.

2. In the model description section, I totally miss how snowdrift affects the momentum

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balance of the boundary layer. I suspect that the enhanced drag of saltating particles is included (as it should be), but is the bouyancy effect of the suspending particles also included? I recommend adding information on how the model handles these physics, since the authors do show results on wind speeds, which are interesting (see below).

3. The effects on wind speed. These are quite interesting and this should be considerably expanded. With snowdrift, wind speed reduces at the surface (due to drag of saltating particles), but increases higher up (owing to stronger cooling associated with enhanced snowdrift sublimation, and the consequent reinforced katabatic forcing). However, a detailed analyses, including a 2D framework, is lacking. Now this is mentioned casually in two sentences (lines 345-347), but this topic warrants an in-depth discussion. One possibility is to include high-level winds in a panel of Fig. 7, and add a discussion on the snowdrift-induced effects of surface drag and katabatic forcing as mentioned above. Another option is to look at the momentum budget of the boundary-layer, and evaluate the friction and bouyancy/katabatic forcing terms. This will shed more light into the (spatial, vertical) variations in e.g. wind speed changes caused by the inclusion of snowdrift.

4. The changed momentum budget and wind speed feed back on the magnitude of snowdrift transport, saltation and suspension. In essence, the stronger winds in the boundary layer in the case of snowdrift will enhance snowdrift (sublimation, suspension), etc. This feedback is worth exploring, as it may vary in sign depending on distance to the surface; this model provides the perfect means to do so.

5. The comparison with other models should be greatly expanded. In section 4.3 there's a very brief discussion on RACMO, but this is insufficient. Readers would like to know in much more detail how your model results agree or differ from those obtained by RACMO, including the underlying physics. Otherwise this is "just" another model that studies the effect of snowdrift. Much can be learned by differences among models, especially about governing processes.

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