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The Cryosphere Discussions

Interactive comment on "Climate of the Greenland ice sheet using a high-resolution climate model – Part 2: Near-surface climate and energy balance" *by* J. Ettema et al.

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This paper presents results from the regional climate model RACMO2 for studying the near-surface climate of the GrIS at high resolution with a particular focus on the SEB. The paper is well written, the results are well explained and the topic is appropriate for being published in TC.

Section 4 about SEB is really innovative compared to previous works and is worth publishing. However, only a discussion of annual values of the energy fluxes is presented here and consequently, the differences between summer and winter are masked. For example, deposition in winter versus sublimation in summer or positive net radiation

in summer versus negative net radiation in winter. Therefore, I think that it is more relevant here to show and discuss only DJF values and JJA values (which condition the amount of melt) than annual values of the surface energy fluxes. I think that it is not difficult for the authors to adapt the current text (valid for an annual climatology) to DJF climatology and add some comments for JJA climatology. In addition, a figure showing the weight (i.e. the importance in % of melt energy) of each JJA surface flux in the SEB as well as the standard deviation of these fluxes should be very interesting for understanding which fluxes drive the melt events in summer. Finally, nothing is said about the variability around the climatological mean and extremes (in temperature and wind speed) while this will allow to better evaluate the climatic conditions over the Greenland ice sheet.

Therefore, I suggest to accept this paper for publication with the suggestions made here (if they do not ask a too big job for the authors).

Some minor remarks:

1. Abstract, pg 604: Some general considerations about SEB miss in the abstract although the discussion about the SEB is the more relevant in this paper.
2. Eq 4, pg 608: What is the altitude of 0 in $\theta_0(0)$? Is it the surface, 2m, or 10m ? What is the altitude of the free troposphere ? 500 hPa ? More explanations should be useful here.
3. Sect 3.1, pg 610-611: As shown by Fettweis et al. (2010, Cli. Dyn.), the variability of Z_{500} drives the both near surface climate daily and interannual variabilities over the GrIS. Therefore, the standard deviation of the annual and daily Z_{500} from RACMO2 should be compared with the one from Reanalysis in additional plots. This will allow to evaluate if RACMO2 is able (I am sure it is the case) to capture the natural climate variability over GrIS. In addition, similar plots (SLP and Z_{500}) as Fig1 using ECMWF reanalysis should be useful here to evaluate the ability of

RACMO2 to simulate the large scale circulation.

4. Pg 611, line 24: It is surprising to distinguish the ice sheet mask in the wind speed contour of Fig 2. There are differences of about 4-5 m/s between tundra pixels and neighbourhood ice sheet pixels. In the MAR model, there is also a decrease over tundra but it is no so abrupt and it does not occur everywhere over tundra because in winter, the tundra is covered by snow and no distinction between ice sheet and tundra should occur. Perhaps, a part of this drop in wind speed could be due to differences between surface schemes used over ice sheet and tundra. Could the authors confirm this ?

5. Sec 3.2, pg 612-613: the discussion is interesting and well written. However, it is very difficult to see the wind direction in Figs 2 and 3. Perhaps, less vectors (one every 10 grid points) and larger arrows should be more readable.

6. Sec 3.2: A plot showing the maximum (DJF and JJA) 10m wind speed should be interesting here to evaluate the extremes of the Greenland climate.

7. Pg 614, lines 8-14: a plots showing the variability of T2m is needed here and will help to understand the comments made here. In addition, a plot showing the absolute (DJF and JJA) minimum and maximum (or better the percentile 5% and 95%) of T2m over 1958-2008 should be useful here.

8. Pg 614, lines 24-25: the GrIS temperature parametrisation from Fausto et al. (2009, J. of Glaciology) adding a dependence of longitude could be also compared here.

9. Pg 618, line 28: Where is Dronning Louise Land ?

Interactive comment on The Cryosphere Discuss., 4, 603, 2010.