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Interactive comment on “Sensitivity of Greenland Ice Sheet surface mass balance to surface albedo parameterization: a study with a regional climate model” by J. H. van Angelen et al.

Anonymous Referee #2

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This paper presents a study with the RACMO2 model of how various factors influence Greenland ice sheet surface albedo, and the impact on ice sheet surface mass balance. Before publication it is recommended that the authors consider major and minor concerns listed below.

Major comments

1) Despite many references to the “old” RACMO albedo scheme, there are no comparisons with this scheme. Instead, the authors compare a series of simulations with the settings used for an Antarctic study. It would be more logical and interesting to compare the new simulations with the old simulations using the density dependent albedo.

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Furthermore, the naming convention of the simulations can be improved. For example, “CONTROL” is typically used to name baseline simulations, but here it is the name used for the simulations with the most changes.

2) Consider formulating hypotheses about expected results from the model simulations shown table 1. This will help the reader understand what to expect from this paper and why the different model simulations parameterizations were chosen.

3) Discuss the relative merits of AWS and MODIS in providing “ground truth” and explain why these two different albedo products were used for validation.

4) The manuscript lack a discussion section.

5) Consider revision of Figure 4. It is easy to misinterpret because of the two y-axis scales. At first glance, it appears as if the most amount of black carbon has the least impact on albedo. Instead, I propose the authors either split this figure up into two panels, or only use one y-axis scale where they show the snow albedo factoring in 0ppv, 0.05ppv, 0.1ppv black carbon concentration etc

6) Clarify the evaluation method. The methods states that evaluation will focus on year 2007 and S9. Yet, Figure 6 shows many years, and Figure 9 shows an average 1991-2010 for several stations.

Minor comments

P 1534.L 21. Clarify your evaluation methods. Here the “second” method is mentioned, but there is no clear mentioning of the “first” method.

P 1534.L 24. Explain why you regrid to EASE grid

P 1536. Equation 1: Explain that the terms $\Delta\alpha$ and so on refers to the change in albedo due to these factors.

P 1536. L 19: Provide an assessment of RACMO cloud cover simulation if possible

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Interactive
Comment

P 1536. Equation 2: State the unit dimensions of the variables. Explain what d stands for in this context.

P 1537. Equation 3: Provide context for this equation. Is it an empirically derived equation? If so, what data was used? Also, provide information about unit dimensions.

P 1537. L 19: Clarify if this refer to snow grain diameter or radius?

P 1538. L 20-23: Explain why these constraints were used

P 1538. L 24: What value was used in areas not expected to become snow free. What is meant by "coming years"

P 1539. L 15-17: Explain why you did not use GC-Net station data from the ablation zone or near equilibrium line to evaluate your work?

I concur with reviewer Box that conclusion section should not be used to discuss future work.

Interactive comment on The Cryosphere Discuss., 6, 1531, 2012.

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