

## ***Interactive comment on “Surface mass budget and meltwater discharge from the Kangerlussuaq sector of the Greenland ice sheet during record-warm year 2010” by D. van As et al.***

**J. Box (Referee)**

jbox.greenland@gmail.com

Received and published: 21 September 2011

Overall Assessment The study that makes a nice set of physical interpretations after a somewhat tedious model description and validation description. By page 14,. "In the lower(or upper) ablation zone", the paper becomes fruitful. It is very nice that the study makes "Evaluation of the calculations] ... [using three independent methods."

The following key points should be mentioned in abstract and (if not already) conclusions: "we can fully attribute the 2010 melt excess at low elevation to high temperatures" ... "low albedo allowed for higher solar radiation absorption rates, roughly contributing half to the melt increase. During warm episodes in the future we can expect a

C983

melt response of at least the same magnitude."

The following major comments appear in "stickies" inserted using Acrobat. I past the comment text here for convenience. Several minor comments and copious text edits (owe me a beer) appear in the .pdf document.)

Major Comments The (usually upwind) proximity of Greenland's largest land mass seems an important factor to consider in discussion of heat sources.

You need to specify which MODIS product you used, MOD34 or MOD10A1? I have a clean version of MOD10A1 data I am willing to share. I also share the following text from a manuscript in preparation: "Daily surface albedo retrievals from the MODIS sensor flown on the Terra platform (the MOD10A1 product; Hall et al. 2006) are available from the National Snow and Ice Data Center (NSIDC). Surface albedo is retrieved for cloud-free pixels using the first seven visible and near-infrared MODIS bands following the algorithm described by Klein and Stroeve (2002) and Klein (2003). +Hall, D.K., G.A. Riggs, and V.V. Salomonson (2006), updated daily. MODIS/Terra Snow Cover Daily L3 Global 500m Grid V005, April 2000 - October 2010. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media. +Klein, A. G., and Julienne Stroeve. 2002. Development and Validation of a Snow Albedo Algorithm for the MODIS Instrument. *Annals of Glaciology* 34:45-52. +Klein, A. G., Dorothy K. Hall, and George A. Riggs. 1998. Improving Snow-Cover Mapping in Forests Through the Use of a Canopy Reflectance Model. *Hydrologic Processes* 12(10-11):1723-1744. "

I recommend you use MOD10A1 because it has the highest temporal resolution.

Incorporate the following for MODIS background and validation: + Stroeve, J.C., Box, J.E., Haran, T., 2006: Evaluation of the MODIS (MOD10A1) daily snow albedo product over the Greenland ice sheet, *Remote Sensing of Environment*, 105(2), 155-171 + Stroeve, J, J.E. Box, A. Nolin, S. Liang, C. Schaaf, F. Gao, 2005: Accuracy assessment of the MODIS 16-day albedo product for snow: comparisons with Greenland in situ measurements, *Remote Sensing of the Environment*, 94(1), 46-60.

C984

re: "we can fully attribute the 2010 melt excess at low elevation to high temperatures" ignores the importance of changing albedo and increasing downward longwave. Fettweis (2007) showed that only the increase of the longwave downward flux explains the recent warming over the Greenland ice sheet and that the decrease of surface albedo amplifies the impacts of this warming + Fettweis, X. (2007), Reconstruction of the 1979–2006 Greenland ice sheet surface mass balance using the regional climate model MAR, *The Cryosphere*, 1, 21-40, doi:10.5194/tc-1-21-2007.

Also, Box et al. (2006) note albedo changes in Greenland's changing melt regime. + Box, J.E., D.H. Bromwich, B.A. Veenhuis, L-S Bai, J.C. Stroeve, J.C. Rogers, K. Steffen, T. Haran, S-H Wang, 2006: Greenland ice sheet surface mass balance variability (1988-2004) from calibrated Polar MM5 output, *Journal of Climate*, Vol. 19(12), 2783–2800.

Suggestions + suggest to connect the red dots in Fig. 2 with solid red line segments. + avoid using "reflected" or "reflects" to refer to non-radiative concepts + downward instead of downwelling; upward instead of upwelling or reflected

Please also note the supplement to this comment:

<http://www.the-cryosphere-discuss.net/5/C983/2011/tcd-5-C983-2011-supplement.pdf>

---

Interactive comment on *The Cryosphere Discuss.*, 5, 2319, 2011.