**The Cryosphere
Discussions**

Interactive comment on "A minimal, statistical model for the surface albedo of Vestfonna ice cap, Svalbard" *by* M. Möller

Anonymous Referee #1

Received and published: 13 April 2012

GENERAL COMMENT ——

This study presents a novel approach for modeling spatial variability of albedo through statistical functions. The predictors are well chosen from the physical understanding of albedo controls, and the underlying statistical methods build on work published by the author in recent years. Therefore the methodological framework of this study is sound. The validity of the model is shown by the small difference in performance between the IAM (using all data for calibration) and the FAM (testing on independent data). In my opinion this paper is a valuable addition to the field of albedo parameterization, and should be published after a few points have been addressed. I hope my comments below are helpful in this respect, and I would like to congratulate the author for this work.

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MAIN COMMENTS ——

(A) My only concern with the method is that in the cross-validation procedure persistence and periodicity have not been considered, i.e., the leave-out-window is always one data point. For instance, the paper cited for the cross-validation method (Marzeion et al., 2012) considered persistence in the record. Please discuss why you did not account for autocorrelation and seasonality in your albedo record. Also, this would be a good opportunity to spend one or two sentences on the cross-validation method, and direct the reader to recent gaciological applications (Marzeion paper as you do, but also Hofer et al. (2010) on which Marzeion builds, or Koppes et al. (2011)). I am rather sure that many croypsphere researchers are not familiar with this method.

Hofer, M., Molg, T., Marzeion, B., and Kaser, G.: Empirical-statistical downscaling of reanalysis data to high-resolution air temperature and specific humidity above a glacier surface (Cordillera Blanca, Peru), J. Geophys. Res., 115, D12120, doi:10.1029/2009JD012556, 2010.

Koppes, M., Conway, H., Rasmussen, L. A., and Chernos, M.: Deriving mass balance and calving variations from reanalysis data and sparse observations, Glaciar San Rafael, northern Patagonia, 1950–2005, The Cryosphere, 5, 791-808, doi:10.5194/tc-5-791-2011, 2011.

(B) The paper has an unusual structure, which makes it a bit hard to follow - even if it is very well written otherwise. In particular, there is no obvious "results" section, so at least you should re-name your section 4 "Model description and Results". Or put the model description in section 3 ("Data and model") and save section 4 for results.

(C) In connection with equation (10), how do you use the term "logistic function"? To my knowledge logistic regression is a special type of generalized linear regression models (GLMs), and the logit model is often used to predict probabilities of an event. Please clarify in a brief sentence (and perhaps a reference) for the readers what your logistic function is (advantages, etc.).

(D) You say that initial MODIS albedo data are daily, from which you construct monthly values. Are the daily data sampled at the same time of day by the satellite throughout the year? Or is there more than one overpass per day (Aqua and Terra?)? Please clarify in section 3.2.

(E) Precipitation from ERA-interim; Could you briefly indicate in section 3.3 how confident you are in these data? Precipitation from reanalysis data sets is usually problematic. I realize you cite your own work in this respect, but one sentence would probably be appreciated by readers.

(F) Figure 7: It is hard to see the main message in this figure. Wouldn't it be easier for the reader if you show the deviation as histogram for each parameter instead of the scatter plots? Also, why is observed albedo shown? As I understand the point of interest here is the deviation from the reference model, not from the observed albedo.

MINOR POINTS ——

983/16: "(e.g., Brock ...)"

983/17-18: I am not sure if you can cite work in preparation. Maybe "Sauter, pers. comm."

983/19: delete "distribution and" (spatio-temporal variability already implies a distribution)

983/23: "it varies mainly with terrain elevation." - At this part of the paper a reference would be good.

984/5: replace "inappropriate" by "difficult". It is not inappropriate to do high-resolution calculations, if the data basis permits.

985/13: Please specify "They".

994/6: "slightly" (typo)

996/12-13: "should be fairly constant" (add fairly); There are also errors in the input data that could account for the non-constant parameters, even if all responsible driving forces would be captured by the input variables.

Table 1 caption: "deviations of xxxx air temperature"; Please add the time scale for xxxx (daily?).

Figure 1: For convenience it would be good to add a scale bar and label the contours.

Figure 2: "versus xxxx surface albedo"; Please add the source for xxxx (MODIS?).

Figure 3: "Table 2" (typo)

Figure 4+5 captions: You must explain what the boxes, vertical lines and crosses represent. Not all readers might be familiar with this type of plot.

Figure 8 caption: Define the colors (it is quite clear in connection with Fig. 7, but each figure needs to be self-explanatory).

Figure 9: I would remove the y-axis break. Simply start the y-axis at 0.02 or 0.03.

Interactive comment on The Cryosphere Discuss., 6, 981, 2012.

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