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The Cryosphere Discussions

Interactive comment on "Multi-decadal marine and land-terminating glacier recession in the Ammassalik region, Southeast Greenland" *by* S. H. Mernild et al.

Anonymous Referee #1

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This manuscript examines a variety of glacier types in a region of the southeast coast of Greenland. Glaciers both originating from the Greenland Ice Sheet (GrIS) and glaciers and ice caps (GIC) are examined from 1972-2011 using satellite imagery from Landsat. Areal changes of GIC are investigated using an automated classification approach and frontal changes of GrIS are digitized manually. The novelty of the manuscript lies in the investigation of GIC, as several papers have already shown the changes of GrIS glaciers on the southeast coast – this study however adds to the number of GrIS outlets and investigates the land terminating margin of the GrIS as well. It is a well known fact that automated classification of Landsat imagery can be extremely difficult on glacier ice with presence of debris and snow, and several groups are working on

the methods. It is therefore of utmost importance that a rigorous validation of the classification is undertaken. No validation whatsoever is presented in the manuscript and a rather small uncertainty is presented along with the classification. The results from the automated classification are the backbone of the study and must be validated before this manuscript can be published. A rough look at the classification presented for the 8 GIC in figure 8, reveals that the classification is indeed flawed. I have looked at the Mittivakkat glacier, as this is the largest glacier in the region and large changes have previously been reported for this particular glacier (eg. Mernild et al 2011a). I have zoomed in on an area where change is occuring - there is a large part of the glacier in the southeastern sector which according to the classification dissapears between 1999 and 2011, see figure below. The circle diameter is app. 1200m. Taking a closer look at the Landsat imagery used for classification and that from 2000 it is clear that snow pixels are classified as glacier ice. With this in mind the results from the classification cannot be published in its present form.

Below are some further concerns and questions regarding the manuscript, excluding the results section. P. 532 L8: which reconstruction of ocean water temperature are these (SST or deep water?) L17: better explain areal recession rate, how can it be decreasing while frontal retreat rates are increasing. L19: how do you measure an areal recession in percent. Is this a percentage of entire glacier area. How is this calculated for GrIS glaciers? P. 533 L20-23: This postulation is simply not true. There are several publications investigating GrIS and contribution to sea-level rise using satellite imagery and other remotely sensed imagery - several of which are mentioned in the manuscript elsewhere. P. 534 L2: What is meant by "at least", how many have been identified? It would also be appropriate to define the Ammassalik region. L4: Place reference to the studies that has documented land terminating changes (eg. Yde & Knudsen, 2007). L8-9: With "several hundreds" local glaciers in the Ammassalik region you must justify the selection of the 35 GIC. How have they been choosen? P.535 L4: Nowhere in the "Data and methods" are the ocean data mentioned. L11: This is the first time in the manuscript a DEM is introduced. And

the use of it is not mentioned in the methods section. L19: What is the sense of filling gaps with imagery with four years apart (almost half a decade) in the period with the fastest observed changes? How has this affected the results? P.536 L1: The standard deviation measured over parts of Greenland is 12,9m, however much larger uncertainty occurs since the ASTER GDEM V2 has not been filtered for lacking correlation in areas of poor contrast. There are also much higher uncertainties in the elevation in steep terrain. L2-16: In the automated classification no validation has been done. How is the accuracy of the classification determined? And more importantly how does the classification perform in in ice marginal areas with supraglacial debris and snow? Your determine the uncertainty to be half a pixel, is that realistic with an automated classification? What about mixed pixels? P10: What is meant by "cleaning up manually"? Is the classification altered? L19: Howat & Eddy (2011) are not using the "centerline method", they use a box method. L19-21: How is the "expected error" measured / calculated? Do you just assume that the automatic classification and the manual digitization are precise within half a pixel? P.542 L10: With "several hundreds" local glaciers, how were the 35 glaciers chosen. It would be interesting to see a plot of the glacier distribution with size, aspect, elevation etc. L23: Why is the "mean elevation height" calculated as the average of max and mean, with the ASTER GDEM, you should be able to calculate the true mean elevation height. P.543 L11: The five glaciers that have disappeared receive much attention and are used in the final statement in the conclusion - but how reliable are your measurements? The glaciers are very small. The smallest being 0.018 km2 in 1986 and 0.016 km2 in 1999. This is a glacier 125 m times 125 m, being just one pixel off in the classification equals ca. 40 % change in total glacier size. This exercise requires high confidence in the automated classification.

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/6/C278/2012/tcd-6-C278-2012-supplement.pdf

Interactive comment on The Cryosphere Discuss., 6, 531, 2012.