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Interactive comment on "Area, elevation and mass changes of the two southernmost ice caps of the Canadian Arctic Archipelago between 1952 and 2014" *by* C. Papasodoro et al.

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Review of: Area, elevation and mass changes of the two southernmost ice caps of the Canadian Arctic Archipelago between 1952 and 2014

Overview: Papasodoro and coauthors present elevation and area changes for the two southern most ice caps on Baffin Island (Grinnell and Terra Nivea Ice Caps). They use exhaustive multitude of satellite and airborne datasets to reconstruct a sixty-two year record of glacier change. They show that both ice caps have experienced accelerated rates of elevation lowering and area loss in the most recent decades that they attribute to longer melt durations and loss of sea ice in Hudson Bay.

General Comments: The authors have done a very good job reconstructing glacier changes for the Grinnell and Terra Nivea Ice Caps that confirms and compliments earlier works. Despite their small size, changes in these ice caps provide a good climate proxy for Southern Baffin Island. The authors also analyze elevations generated from Pleiades Satellite imagery and show that they provide good ground control for older imagery.

Overall the paper is in pretty good shape. My two main suggestions for improvement are for the authors to strengthen the attribution section and to carefully review grammar.

Major comments: 1. P1674L23 The RGI outlines for the Grinnell and Terra Nivea Ice Caps come from the CanVec dataset… check dates and source imagery provided in that dataset 2. P1680L7 I'm not sure that a density of 850 kg/m3 is appropriate for icecaps without significant firn area. I would recommend using a density closer to that of ice unless you can demonstrate that there are likely changes in the firn structure over the period of study 3. P1686-1689 I would suggest removing any mention of Sea Ice and Arctic Amplification in the attribution section. The link between these two and rates of glacier change are complicated. Sea ice in Hudson Bay is likely responding to warmer spring temperatures but it is unclear how much changes in sea ice extent are in-turn modifying the summer temperatures over the ice caps. Glaciers are responding to warmer temperatures in summer, a period when we expect arctic amplification to be at a minimum. Gardner et al., 2007 and 2012 found that the vast majority of variance in the rate of glacier loss can be attributed to changes in lower-tropospheric temperature.

Specific Comments: P1668 Remove acronyms from abstract P1668 recommend using a different acronym for the Grinnell Ice Cap as GIC is traditionally used for "Glaciers and Ice Caps". P1668L7 changes -> change P1668L7 in-situ -> in situ P1668L19 "the proximity" -> "the proximity to TNIC." P1668 "In response to the currently observed warming in the Arctic" -> "In response to recent Arctic warming" P1669L2 in 2009 -> during the 2007-2009 period P1669 "An exception is a recent study (Way, 2015) which analyzed the changing rates of areal recession of both GIC and TNIC since the"

-> “A recent study (Way, 2015) analyzed changing rates of glacier recession for the GIC and TNIC since the” P1670L1 “data we used” -> “data used to determine glacier change.” P1670L2 delete “new” P1670L5 delete “archive” P1670L6 delete “possible” P1670L7 delete “factors” P1670L11 “rising at” -> rising P1670L12 “extent near” -> extent to P1670L15 “range to” -> “range as” P1670L17 “cloudiness” -> “cloud” P1670L20 “reached” -> “is” P1670L22 “formed by in situ” -> “formed by” P1670L23 “showed no firn”, “found no firn” P1670L24 delete “net” P1670L25 rate of surface lowering my melt -> amount of melt P1670L26 very close -> close P1671L13 DEM extraction on glacier -> glacier DEM extraction P1671L20 especially accumulation area -> especially over the low contrast accumulation area P1671L21 “and limit” -> and reduces the P1672L2 delete “due to the more humid surface” P1672L2 delete “This is particularly true for the present images, since the ice caps were nearly winter snow free. Thereby, this is a good qualitative primary concern bout the ice caps’ fate (Pelto, 2010) P1672L6 “These stereoscopic” -> Stereoscopic P1672L7 “generation of recent DEMs -> DEM generation P1672L8 “GIC.” -> GIC (Section 3.2). P1672L9 “Archives aerial photos covering” -> “Historic aerial photos for” P1672L11 delete “in this study,” P1672L17 delete “mainly due to the late summer acquisition date.” P1672L19 “elevation on the GIC and were thus -> GIC elevations and were” P1672L23 define “CDED” P1673L3 An exhaustive validation of CDED for Baffin Island (340 map sheets) is provided in Gardner et al., 2012. They get a bias of +1.1 m and a std of 5. 1m P1673L7 “using the derived hillshade in order to exclude obvious false elevations” -> using a derived hillshade to exclude blunder in elevations P1673L13 in order to calculate -> To calculate P1673L16 “This DEM” -> “The DEM” P1673L18 “with an horizontal” -> “with a” P1673 did you do any filtering of the ICESat data for cloud returns? Did you apply the Gaussian centroid bias? P1673L6 were used for recent elevation change calculations -> used to estimate recent elevation changes P1674L12 front of an outlet glacier -> front of one of the outlet glaciers P1674L23 check original RGI source... CanVec P1675L3 “we rather” -> we P1675L9 August 2014 -> August of 2014 P1675L10 is briefly -> is P1675L12 “In order to” -> “To” P1675L14 station for -> station for the period P1675L24 but only allows reducing the vertical -> but can reduce the vertical P1676L1 can be easily corrected on ice-free terrain with a good reference dataset -> can be corrected over ice-free terrain provided a good reference dataset is available P1676L17 is thus expected -> is expected P1676L24 The typical -> A typical P1677L18 “Quantitatively, 66% of the GIC area was extracted with data gaps concentrated at the highest elevation in the texture-less accumulation areas” -> “66% of the GIC area was extracted with data gaps concentrated at the highest elevation in the texture-less accumulation areas” P1677L22 DEM-based mass balance -> DEM based volume change P1677L4 To evaluate the corrections constancy -> to evaluate the constancy of the corrections P1677L5 DEMs -> DEM P1677L10 delete “for such small zones.” P1677L11 “Furthermore, the” -> “The” P1677L11 DEM -> DEMs P1677L12 subtracted -> differenced P1677L14 These results prove -> these results confirm P1679L1 delete “are useful to” P1679L4 delete “ using different DEMs in order” P1679L5 “and mass balances” -> “ “from the DEMs” P1679L7 delete “first” P1679L7 delete “in order” P1679L8 changes -> change P1679L8 “, of elevation” -> “and elevation P1679L9 “The no value pixels were assigned to the mean dH of the corresponding elevation band. Total volume change for an ice cap (dV) was then assessed by summing volume changes from all elevation bands (n) as follows:” -> “No value pixels replaced with the mean dH of the corresponding elevation band. Total volume change for each ice cap (dV) was then determined by summing volume changes from all elevation bands (n) as follows:” P1679L18 “Sensibility” -> “Sensitivity” P1680L7 a mean density of “850 kg/m3” is very low for an ice cap that has little to no firn area. I would recommend a value closer to that of pure ice. P1681L25 “has shrunk” = “shrank”, apply through entire document P1682L6 delete “ “, a less pronounced rate when compared to” . . . start new Sentence P1681L15 “(Fig. 5, uppser left map)” -> (Fig. 5a) P1681L26 “with a reasonable” -> “with reasonable”

P1686/7 Lower tropospheric warming from advection of continual air masses in summer have been previously implicated in accelrated CAA glacier melt rates (Gardner et al, 2007 and Gardner et al., 2012) P1686 Not sure if there is a clear link for changes in sea ice to be driving glacier melt rates. More thought need to given to link Arctic

Amplification and Sea Ice to glacier changes. I would suggest that the authors revisit this section in its entirety. Figure 3 add “no data” to legend

Interactive comment on The Cryosphere Discuss., 9, 1667, 2015.