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The Cryosphere Discussions

Interactive comment on "Rapid Wastage of the Hazen Plateau Ice Caps, Northeastern Ellesmere Island, Nunavut, Canada" *by* Mark C. Serreze et al.

Anonymous Referee #2

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Overview: This paper documents the important and timely phenomenon of disappearing ice caps in the Canadian high arctic. A time series of area measurements is compiled primarily from previously published observations, with a small contribution of new measurements to document shrinkage and predict the timing of the demise of the plateau ice caps. Some previously published surface mass balance measurements are reported but not discussed. The area changes documented in this study are linked through qualitative comparison to annual temperature 850hPa radiosonde temperatures from Alert. A major shortcoming of this paper is the under-utilization of available long term records from other arctic glaciers to determine if the rate of glacier change over the hazen plateau is representative or anomalous of the broader scale glacier changes occurring in the Canadian high Arctic. A more rigorous quantitative analysis of the complete time series of changes to the Hazen plateau ice caps should be made

in order to contribute to the broader understanding of the rates of climate change in the Canadian high arctic and the current and future rate of contribution of ice caps and glaciers in this region to global sea-level rise.

Comments: L58-60: A major shortcoming of this paper is lack of new geophysical data generated for this study, as such, there is no needs for a methods section. The distinction between which data were produced by the authors for this paper, and data/information from previously published material needs to be more clear.

- While the authors illustrate the rate of shrinkage of the hazen plateau ice caps though plots of the time series, there is no attempt made to determine if the rapid changes as determined from this study are occurring at anomalous relative to those documented for other high arctic glaciers.

L49: It would be more informative if the actual elevations of the ice cap are rather than just the maximum surrounding area (ie. ". . .ice caps are in an area with maximum elevations s between 750-900 m;. . .") as stated.

Extent of LIA glacier cover (Wolken et al.) should be included in the analysis to provide a longer term perspective to the changes discussed in this study.

L53-54: the authors should clarify what form of precipitation this statement (". . ., with a late summer and early autumn maximum..") refers to ie. Rain or snow, or a combination of both, as they can have opposite impacts on the mass balance of small ice caps with no firn to absorb liquid precip. L83: Presumably these ice caps are stagnant. However, the authors refer to the ice caps ". . .extending its margins,.." which may be misinterpreted as advancing via flow, which is almost certainly not the case. It is most likely that the" extended" margins are actually perennial snow packs which would be of lower density material than the original ice cap. This should be clarified L83: ". . .thickening slightly . . ." how was 'thickening' determined? L91: "Assuming that the 1982 melt season had largely ended by early August. . ." unless there is temp data to support this claim, there is no reason to assume that the melt season ended in early

august. High arctic glaciers at these elevations commonly experience melting into late august.

L94 and 103: it is more informative (and more common in glaciology) to report mass balance as an annual (ie a-1) value even when measurements span multiple years. 192 " While arguably it might be better to look at the 925 hPa level," the authors need to explain why this is the case. L178/179: the studies referenced refer to loss of ice mass or surface mass balanace, not specifically area change. This is an important distinction (and should be discussed) because area reductions of the larger dynamic ice caps are also a function of dynamic response time whereas the margins of small plateau ice caps respond immediately to surface ablation and would shrink at faster rates relative to the dynamic ice masses. Figure 5: it would be helpful to integrate the annual and multi year average surface mass balance measurments and/or area change values from all studies (this one and all referenced herein) into fig 5 in order to show the relationship between temp change and ice cap response. L54: the serreze and barry 2015 is listed as 2014 in the refs. Figure 2. scale and north arrow unreadable – too small. Figure 1. need to indicate location of Environment Canada weather stations from which data is used. Alert is identified, but should be stated in the caption that it is one location of the long term temp data. Eureka (from which precip data is obtained) is not on the map at all.

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