

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.

M. Pelto

mauri.pelto@nichols.edu

Received and published: 27 April 2015

Papasodoro et al (2015) provide a valuable long term assessment of the changes over a 60 year period on the Grinnell Ice Cap and Terra Nivea Ice Cap. They utilize the recently launched Pleiades 1A and 1B satellites to supplement ICESat, ASTER and Historic aerial photograph based DEM's to assess changes in the glaciers. Two points that deserve more attention and would increase the value of the paper are: 1) Greater attention to the value that Pleiades imagery brought to the project. An additional figure may be needed of a small region to best illustrate this. The conclusion needs a mention of the added value. 2) The lack of a consistent accumulation zone

C580

without which a glacier cannot survive should be emphasized. Including reference to Landsat 8 imagery, even if not used in a figure. The thinning rate from 2004-2014 on the upper areas of both ice caps where the accumulation should be indicate that there is not an accumulation zone most years including superimposed ice.

1670-22: Satellite images can show that this is true. Both 2012 and 2014 images (Fig. 1 and 2) illustrate the lack of retained snowcover. The imagery does not illustrate superimposed ice. However, superimposed ice cannot be retained if year after year there is now no snow or firn remaining. Further there can be no superimposed retained in an environment where ice thickness is being lost at more than a meter per year in the region where it would accumulate, and dynamic thinning is not capable of causing the change.

1681-10: How much of the area change is due to expansion of nunatak/bedrock areas amidst the GIC? This is where the Pleiades imagery could be illustrated to best advantage. For a specific nunatak how accurately can the area be determined using Pleiades versus the Aug. 2014 Landsat 8 ore aerial photographs?

1682-16: Elevation change rate sharply decreased should be rephrased. The rate elevation loss greatly increased.

1682-23: The change of -1.7 m in elevation at the highest of the icefield indicates the lack of an accumulation zone. This change in elevation would be useful to show in Figure 6. It is more important to show the increase in rate of ice loss in recent years compared to 1952-2014 than simply showing the long term trend. This comparison is shown in the small insets in Figure 4 and 5, but either need their own figure or be shown in Figure 6. Further as Pelto (2010) notes this is a clear indication that neither ice cap can survive current climate, let alone further warming.

1683-22: You can use AAR to estimate mass balance based on ELA identification from Satellite imagery. Not suggesting you need to do this, but it is not accurate to say mass balance cannot be estimated.

C581

1688-7: A key aspect of the paper is utilizing the Pleiades data, can you elaborate here on the advantages that were realized from these DEM's.

1684-13: The utility for Ground Control Point position determination is an important advance. At the same time that the nunatak expansion is illustrated, the GCP ability could be illustrated.

1688-23: In the areas noted by the three references Kerguelen, Southeast Alaska and Patagonia there is considerable loss by tidewater glacier calving. Further all of these areas have substantial accumulation areas remaining. In the case of GIC and TNIC the snowline is rising above the glacier and there is no calving loss. The ice losses are not sustainable with current climate, since there is no accumulation zone. That is vastly different from the other regions in terms of impact and should be emphasized.

Figure 7 Inset maps not needed if transects as on GIC are shown on previous diagram. Then the two glaciers can be combined in a single image for a more robust data set comparison.

Figure 8 Panel D should show mass loss/ice thickness change as that is a more robust measure of the change. Panel A,B, and C show a transition to persistent negative values at the same time, does ice thickness rate show same?

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

C582



Fig. 1. August 7, 2012 Landsat 8 image of Grinnell Ice Cap, red arrows indicate expanding nunatak areas. The lack of snowcover also apparent.

C583

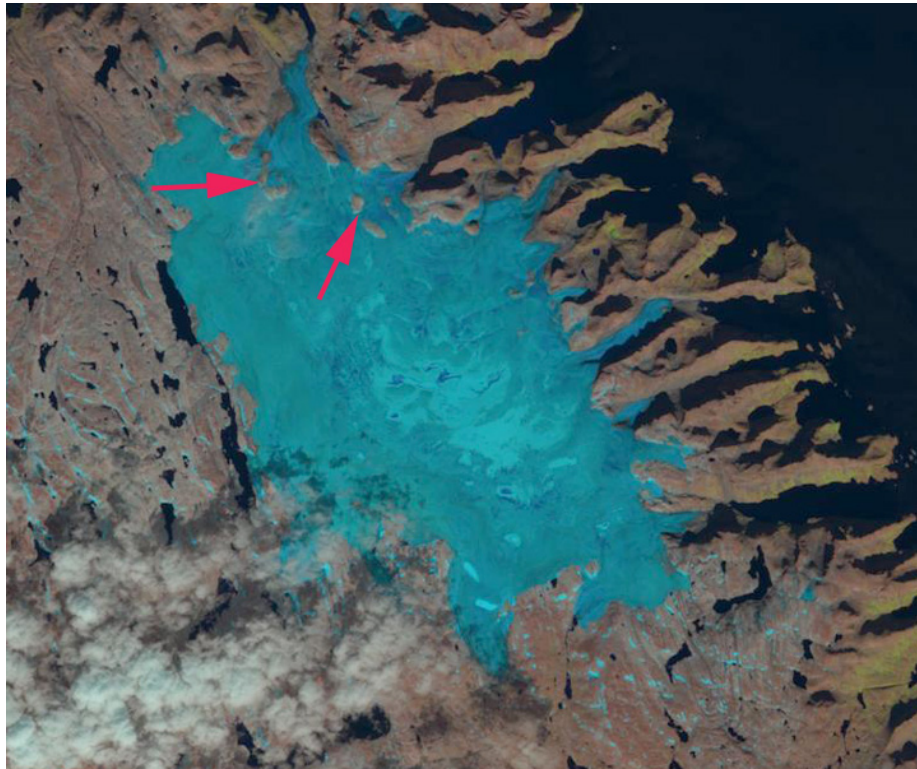


Fig. 2. August 14, 2014 Landsat 8 image of Grinnell Ice Cap, red arrows indicate expanding nunatak areas. The lack of snowcover also apparent.

C584