

***Interactive comment on* “Relationship between Holocene climate variations over southern Greenland and eastern Baffin Island and synoptic circulation pattern” by B. Fréchette and A. de Vernal**

Anonymous Referee #1

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GENERAL COMMENTS

This study presents Holocene pollen and dinocyst records, and associated climate inferences, from southwestern Greenland and eastern Baffin Island. These records make an excellent contribution to understanding the climate history of a data-poor region in the Arctic. This study is unusual in its approach of presenting both terrestrial and marine results, and presenting results from two regions with somewhat different climate trajectories through the Holocene. It is encouraging to see that marine and terrestrial records within each region agree very well, and the differences between the

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two regions are interesting from a climatic perspective. The authors offer two possible explanations for the contrasting climate histories of the two regions: One invokes the possibility of more vigorous North Atlantic circulation during the early Holocene, which would import more warm Atlantic surface water to eastern Baffin Bay via the West Greenland Current while importing more cold Arctic water to western Baffin Bay via the Baffinland Current. The other explanation invokes NAO-like shifts in synoptic circulation patterns. My overall assessment is that this paper makes an important contribution to understanding the paleoclimatic history of the Arctic, and represents a great deal of careful work. There are a few questions (below) that I suggest the authors consider and possibly discuss briefly in the revised manuscript.

SPECIFIC COMMENTS

The title and final sentences of the paper imply that NAO-like changes in atmospheric circulation are the likely causes of the spatial patterns observed in the paleo-data, yet more of the paper's discussion is devoted to the possible explanatory role of changes in surface ocean currents. Do the authors mean to imply linkages between the two? If so, I suggest they clarify this in the discussion. Or if not, consider either changing the title to emphasize Greenland-Baffin differences (but not specifically the role of synoptic circulation) or adding more discussion of synoptic circulation (causes of dominant patterns, impacts on regional climate patterns, etc).

The RDA shows a strong correlation between winter air temperatures and pollen assemblages in the training set data. Is this surprising? Why might this be? How do the authors reconcile this with the fact that Qipisarqo and Akvaqiaq have very different winter temperatures today but very similar vegetation?

Regarding the discussion of *Alnus* migration/colonization: What is the distance between the sites on either end of the transect? Wouldn't 3500 years be a very slow migration over this distance, and what could explain that?

Some proxies from the Baffin region – for example, Agassiz ice cap melt layers and

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lake proxies (biogenic silica, midges) from some sites on Baffin Island – show strong early Holocene warming. How can the pollen and dinocyst data be reconciled with those other records? Is it possible that the records presented here, which begin at 8 ka, do not capture peak early Holocene warmth on Baffin Island? In other words, could the major difference between Baffin and West Greenland be in the timing of maximum Holocene warmth, rather than necessarily its amplitude?

I couldn't find an explanation in the text for ages given throughout the manuscript – ie are they calibrated years BP or 14C years BP? Perhaps I missed this. Otherwise, I suggest stating this early in the text, and using a consistent formatting for ages throughout the text. The authors use "5000 years BP" in some places and "5000 years" in other places. I think the former (or even 5000 cal yr BP) is more clear and therefore preferable.

TECHNICAL CORRECTIONS

Minor suggestions for revising the text:

Title: Consider modifying the title to emphasize regional differences and not synoptic circulation patterns?

Abstract: The abstract does not mention the dinocyst records. I think the fact that marine and terrestrial proxies reinforce each other is a special strength of this study, so I suggest including the dinocysts in the abstract.

Abstract, line 5: "THIS west-east gradient"

Page 885, line 22: "types WERE square-root transformed... dinocysts WERE logarithmic"

Page 885, line 24: "signal-to-noise RATIO"

Page 886, line 3: "Continental climate WAS RECONSTRUCTED USING the Modern Analogue Technique (MAT) AND a modern database..."

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Page 886, line 8: "interpolated to THE 828 pollen sites"

Page 887, line 11: "was used to estimate long term TRENDS in"

Page 887, line 18, "are strongly correlated ($r=0.86$)"

Page 889, line 2: Clarify what is meant by "the increase of Betula onwards." (= increasing abundances of Betula throughout the late Holocene?) (same comment for page 890, line 5)

Page 890, line 1: "THE first RDA axis... This increasing trend THUS LIKELY RECORDS a slight winter warming..."

Page 892, lines 1-3: check spelling of Newfoundland and Qipisarqo

Page 892, line 6: "which SUMMARIZES available records"

Page 892, line 27: "consistent feature across THE mid- to high latitude"

Page 893, line 1: perhaps use "difference" instead of "opposition"?

Page 894, line 10: "positive NAO-LIKE synoptic PATTERNS can be proposed"

Figure 4: What is the dotted horizontal line?

Interactive comment on Clim. Past Discuss., 5, 879, 2009.

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