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Interactive comment on "A representative density profile for the North Greenland snowpack" *by* C. F. Schaller et al.

Anonymous Referee #1

Received and published: 21 June 2016

Schaller et al. use a new technique for measuring snow that aims for pristine sampling of the top 2 meters for retrieval and analysis in the laboratory, and present a dynamic time warping (DTW) feature alignment method. The authors construct an average density profile for the North Greenland ice sheet and compare accumulation rates, melt layers and isotopic values in the area over several years. The sampling technique and CT system are very nice, the analysis is sophisticated and thoughtful. What isn't clear is how representative the product is, the density profile.

The authors include significance testing of their density alignment, which is a good idea. However, the actual numbers are marginal. The analysis uses artificial data to compare correlation coefficients for real versus fake data sets, but the resulting coefficients are not that much higher for real data. Why are the density profiles smoothed before covariance testing? Are the fake data sets also smoothed in evaluating sig-

nificance? Comparing example profiles in Figure 6, and the example representative profile in Figure 7 with its substantial one-sigma confidence interval, it's hard for the reader to judge what is being captured or how useful it is. The bottom two-thirds of the representative profile in Figure 7 is consistent with a straight line.

This is not the first time that DTW or other speech/biometric processing approaches have been adapted for stratigraphic alignment of environmental records, or even ice core records, and Schaller et al. may benefit by referring to these and other probabilistic approaches. DTW is most effective when aligning time series containing prominent features that are highly similar. Since the goal (based on the manuscript title) is an average profile, it would be useful to check consistency between the various record alignment combinations, e.g., the features matched between N2E_04 and N2E_05 with NEEM, should also match between N2E_04 and N2E_05 with each other.

Technical corrections, typos and style:

Abstract, line 5: suggest striking "based"

Section 2.2, line 29: "...a worldwide unique..." suggest striking "worldwide"

Section 3.1, line 22: "...could be fit to arbitrary many..."

Section 4.1, line 11.