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Interactive comment on "Mapping the Antarctic Polar Front: Weekly realizations from 2002 to 2014" *by* Natalie M. Freeman and Nicole S. Lovenduski

Anonymous Referee #1

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This paper presents a potentially valuable new data set that uses microwave SST data to map the position of the Polar Front of the Antarctic Circumpolar Current. The position of the front is a valuable indicator of ACC meandering, and there will undoubtedly be quite a bit of interest in working with this data set.

Unfortunately, the presentation in the paper is lean on the details that readers will need in order to understand and use the data set.

To my mind, the core of a data paper is the methods section, which explains how the data set was generated. In this case, the methods section doesn't provide enough information. - In section 2.2.1, the SST gradient is defined for Delta T, but the units don't make sense. Perhaps it's supposed to be a gradient of T (i.e. nabla T)? This

should be explained carefully. - In section 2.2.2, continuity tests are discussed. The basic terms seem to be inadequately defined. For example d is used to represent differences, l latitude, and t temperature, but the scale over which d_l is calculated is not clear. d_tc is used but not clearly defined. The main definition of the algorithm, at the top of p. 4, considers multiple cases, but it's not clear what the role of each of the cases is. Why is the case sigma_l = d_l considered, since it's unlikely that any real world variables would be equal. In the event that they are equal, couldn't this be the limiting case for sigma_l < d_l, for example?

What sets sigma_l > 0.75 as a criterion for possibly adjusting the PF position? Why not a different limit? What are the units of 0.75.

Why is the condition d_l(west) < sigma_l < d_l(east) considered, but not the opposite (d_l(east)< sigma_l < d_l(west))? Later the text says that some regions are processed from east to west rather than west to east, so perhaps that is part of the explanation. But that still leaves me wondering why there is an asymetry in the mapping? Wouldn't the algorithm seem more robust if it applied criteria in both directions?

- Why are the particular regions in section 2.2.4 identfied to be analyzed from ea st to west, rather than west to east? What makes these regions different?

- The presentation of the algorithm in its present form makes the algorithm seem li ke it has been hacked together by adding extra cases until it works, and this does n ot inspire confidence that the algorithm will work reliably in all cases. Can it be simplified? The big concern is cases when d exceeds sigma, so why worry about the d<sigma cases at all? Why do Delta_t > 1 and d_t>sigma_t both need to be set as cri teria? Please explain for your readers.

- The validation in section 3 leaves open a number of questions as well. What do XBTs offer that satellite SST does not? Should the XBTs agree with SST, or are they measuring different quantities?

- Root-mean-squared differences between the XBT Polar Front and the SST Polar Front are computed. The manuscript reports "high RMSE values" in some regions. What makes the RMSE high—what would be a low RMSE value? The manuscript also says that the PF positions "give a reasonable PF location." What is the metric for deciding that the PF positions are reasonable? How much uncertainty should someone expect? I think Dong et al show the standard deviation of PF latitude, and that might be a helpful metric here for evaluating the range of variability.

- In section 4, the discussion of Figure 5 reports that the parameters of the PF are closely linked to the depth of the topography. What is the evidence for this? Some studies would argue that the gradient of topography should matter or that flow should follow contours of f/H. Can the manuscript be more specific about the role of topography? It's hard to draw firm conclusions by comparing Figure 5d (depth) with the other panels of Figure 5.

In general, why are the algorithms structured the way they are? Why use these particular temperature and latitude criteria?

- It's a bit unusual to define sigma to be twice the standard deviation, and I think readers are likely be confused by this. If twice the standard deviation is used, I would refer to that as 2 sigma.

Finally, the writing is a bit rough in places and should be edited carefully.

The data set itself is readable, and can be downloaded and plotted without difficulty.

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