Comment on os-2021-40

Anonymous Referee #1

Referee comment on "Defining Southern Ocean fronts using unsupervised classification"
by Simon D. A. Thomas et al., Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2021-40-RC1, 2021

The authors developed a new method for detecting oceanographic fronts by employing
PCA, GMM, and I-metric. By utilizing B-SOSE, they have demonstrated that their new
methods successfully detect fronts, which vary in time and space. In general, I think their
scientific discussions are sound. I think this manuscript is well-written. However, for
readers who do not know much about these analyses methods, some parts of the text are
difficult to follow. I suggest that minor revision before publications.

Minor comments

Section 2.1 For those people who do not know much about ECCO, it would be great if
authors can elaborate a bit about what other ECCO products are available and why
authors choose B-SOSE.

Lines 117-126: This part of the text is difficult to follow without reading Pauthenet et al.,
2017 carefully. A bit more explanation (e.g., equations (1) in Pauthenet et al., 2017) and
something similar to Fig. 4 in Pauthenet et al., 2017 would be helpful for better
understanding.

Line 147-170: If I am not wrong, I think PCA is used just to compress the data (reduce its
number of dimensions), rather than to investigate the structure of its covariance matrix.
This point is not stressed in this paper. The authors should clarify this point if this is
correct.

In addition, it becomes easier to understand if the authors can elaborate on (1) why GMM
is used rather than PCA (advantages and disadvantages) and (2) the difference (or

relations) between vertical modes of temperature and salinity obtained from PCA analysis and figure 5. For me, this manuscript was initially very confusing because it took me a while to understand that PCA is only used to compress the data but main analysis was conducted using GMM.

Abstract and Summary :

Authors conduct analysis using Sobel edge operator but they do not argue how it can be useful in the abstract and conclusion. A sentence describing how it can be useful and comparisons with GMM is going to be useful.