

# **On the characteristics of sea ice divergence/convergence in the Southern Beaufort Sea**

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## **Review**

### **Summary**

This manuscript presents an analysis of the drift of 11 buoys deployed on sea ice in the Southern Beaufort Sea shortly before the annual ice extent minimum in 2009. The authors group these 11 buoys into 5 triplets, with two 4-buoy triplet pairs. By analyzing changes in the shape and area of the triangles formed by these triplets, the authors identify periods of convergence and divergence during which the response of the buoy triplet respond differently depending on their proximity to the ice edge and the coast. Unfortunately, the manuscript is written in such a way to defy further summarization. As well as incoherent punctuation and ambiguous use of terminology, the authors repeatedly fail to clarify confusing references to the positions at different times of specific triplets, which makes it difficult to follow the intended line of reasoning. It would help if the figures were legible but poor design and an absence of error bars increase the challenge for the reader. I also have serious concerns about the suitability of the authors analytical approach for such highly elongated triplets, which I apparently share with at least one other reviewer. On face value, this manuscript has the potential to make a significant and interesting contribution to our understanding of ice transport and deformation in the Beaufort Sea, but in its current state it has serious problems that will take significant effort to rectify.

### **General comments**

#### **1. Use of highly elongated triangles for calculating changes in area**

Reading the discussion on this paper so far, it appears I share the same concern as the other reviewer regarding the use of such highly elongated triplets for calculating divergence. In particular, triplets with such configuration are prone to turning “inside out” and violating the implicit assumption that ice does not pass between the vertices of the triangle formed by the triplet. Indeed, the authors note themselves on p4292 lines 12-13 that the beacons in triplet C became “interchanged”, demonstrating that such behavior is relatively commonplace.

#### **2. Reference to position of triplets with respect to “distance from the continental coastline and pack ice edge”**

At the risk of sounding obtuse, this is a highly confusing reference frame to use. First, the ice edge evolves through the study period while the coastline is remains fixed and, second, due to the shape of ice edge, some triplets can be further from the

coastline, yet closer to the ice edge than others. Why do the authors try to use both reference frames? To make matters worse, in some cases the text contains references to the westernmost or southernmost ice edges. The authors could help the reader by clarifying which triplets they are referring to, but they consistently fail to do so. Moreover, despite the repeated references to variations in convergence/divergence with distance from these edges, the reader is not presented with any table or graph providing the actual distances.

### 3. Use of punctuation

I recommend the authors review some basic rules of punctuation usage, such as when and how to use semi-colons and parentheses and how to construct sentences without requiring ambiguous uses of commas. For guidance on parentheses in particular, I encourage the authors to read the following EOS article:

*Robock, A. (2010), Parentheses Are (Are Not) for References and Clarification (Saving Space), Eos Trans. AGU, 91(45), 419–419, doi:[10.1029/2010EO450004](https://doi.org/10.1029/2010EO450004).*

### 4. Use of elongated and stretched

The authors use elongated and stretched interchangeably throughout the manuscript. Elongated is the more appropriate term and I recommend the authors use it in favor of stretched in all cases.

## **Specific comments**

### **P4282**

Line 4: replace “true” with “important”

Lines 7-9: The use of the word “defined” here is very confusing. Please clarify what is defining what, or use a different word.

Lines 9-11: Between “illustrate” and “demonstrate” there’s some redundant text that could be removed here

### **P4283**

Line 25: Replace “thickness” with “thickening”

### **P4284:**

Lines 21-26: These lines would be much better written as three separate sentences rather than forced into a awkward semi-colon separated list. Also, the authors should explain the meaning and significance of terms such as elliptic or hyperbolic.

Line 22: replace “less than 100 km” with “between 1 km and 100 km”

### **P4286**

Lines 10-24: The last paragraphs of the introduction read like they were taken straight out of a grant proposal. It does not behoove the authors to appear to be trying to sell something to the reader.

**P4287**

Lines 16-17: Changes in aspect ratio do not necessarily imply changes in area. In fact in the previous sentence the authors just explained this.

Lines 23-25: How can an increase in area be related to non-divergent flow?

**P4291**

Lines 16-19: There is some serious punctuation abuse in this sentence. Between the parentheses, parenthetical commas, and commas in series, it is difficult to read this sentence in one sitting. Consider re-writing without parentheses and using as many separate sentences as necessary.

**P4295**

Lines 19-22: This is not appropriate use of punctuation. Rewrite without colons and semi-colons. E.g.:

*Comparison of centroid velocities highlights intervals when sea ice in the SBS is governed either by non-local mechanisms, in which case it moves as consolidated aggregate, or local mechanisms when it moves as a fractured ice cover governed by local interactions.*

Line 24: Why are these not listed in chronological order?

**P4304**

Line 20: What is the parenthesized “(closest to)” supposed to refer to?

**Figure 1a:**

This figure present highly important information for the reader, yet the key details are rendered too small to be of much use. To make better use of space and avoid the problem of having some beacons form parts of multiple triplets, I recommend the following changes:

- 1) Plot the trajectories for the triplet centroids rather than the individual beacons
- 2) Instead of using different symbols to indicate the triplet configurations on specific dates, connect appropriate beacon locations with colored (perhaps dashed) lines corresponding to the appropriate triplet.
- 3) Less text should be needed in the legend, so the authors should now be able use a larger fontsize.

**Figure 1b:**

I recommend the authors choose a different color scale for the ice concentration to avoid clashing with the colors used for the beacon drift paths.

**Figure 2:**

There is a lot of white space in this figure that could be minimized to allow the key details to be larger. Also I recommend the authors use scale bars that do not include tickmarks and labels to the left of the zero.

**Figure 3:**

Error bars would be helpful for understanding the significance of the variability in this figure

**Figure 4:**

This figure wastes a lot of white space and reproduced at such low resolutions that zooming in to see the details does not help greatly

**Figure 6:**

Same comment as for Figure 4

**Figure 8:**

The text is too small in this figure

**Figure 9:**

Same comment as for Figure 1b