

Does the East Greenland Current exist in northern Fram Strait?

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In this manuscript a hydrographic/velocity survey and a high-resolution numerical model are used to investigate the circulation of Atlantic Water in Fram Strait, in particular to elucidate the recirculation from the West Spitsbergen Current to the East Greenland Current and to verify the existence of the East Greenland Current north of Fram Strait.

I think this manuscript is an important and valuable contribution to better understand the circulation in and north of Fram Strait. Despite continuous monitoring by moored instruments over several years, the circulation in this region is not well understood, in particular the western side of the strait. Lack of data on the Greenland shelf and north of the mooring transect have hampered previous investigations. The manuscript is for the most part well written and the figures are clear and easy to understand. I have a few comments that I hope the authors will take into consideration.

General comments:

I have two major concerns about the north-south section along the prime meridian (Fig. 5):

- the section is hardly synoptic
- the resolution is very coarse

The result is a very smooth section that is incapable of resolving eddies (e.g. page 15, line 6). Knowing the importance of the eddy field, this section is probably not a very good depiction of the circulation in Fram Strait. The section is useful as an indication of the northernmost presence of Atlantic Water, but the authors should take care not to make overinterpretations.

Another important source of error in the absolute geostrophic velocity calculation may stem from the tidal model. For example, a substantial component of the total error in the sections of Håvik *et al.* (2017) resulted from inaccurate bathymetry in the tidal model. Have you taken this into consideration?

Specific comments:

Page 1, line 11 and elsewhere:

For physical distance “farther” is more appropriate than “further”.

Page 1, line 24:

The Norwegian Atlantic Current is also northward-flowing.

Page 2, line 17:

Some of the Atlantic Water transport into the Arctic Ocean likely flows through the Yermak Pass or around the Yermak Plateau as well (e.g. Koenig *et al.*, 2017).

Page 2, line 25:

Some of the upper part of the AW may also be transformed into a less saline surface layer instead of subducting beneath the PSW (e.g. Rudels *et al.*, 2015).

Page 2, line 32:

Please clarify which model suffers from a cold bias.

Page 3, line 14:

The reference to early observations of the EGC is a repeat from page 1, line 26.

Page 3, line 21:

Investigating the structure of the AW recirculation as a major objective of this study is not reflected in the title, only the second objective of investigating the EGC in northern Fram Strait.

Page 3, line 25 and elsewhere:

Is 0°EW a common way to refer to the prime meridian?

Page 3, line 32:

“Data” are usually considered plural.

Page 6, line 18:

Something is missing at the end of this sentence after “Svalbard”.

Page 6, line 20:

It should be fields in plural.

Page 6, line 22:

A comma after unidirectional would make the sentence more clear.

Page 7, line 1:

The offshore branch of the WSC may be obscured by the presence of an eddy.

Page 7, line 12:

Southernmost should be written in one word.

Page 8, line 5:

It should be: “...southern limit of **the** Fram Strait recirculation...”

Page 9, line 31:

It should be: “...model average (Fig. 4) **are** similar to...”

Page 10, line 26:

The citation should not be in parentheses.

Page 10, line 27:

It is difficult to appreciate an increase in depth from Figure 6, in particular when isopycnals are missing from the θ -S plot.

Page 11, line 32:

It should be: **The** mean southward core velocity...

Page 12, line 4:

It should be: “...implying that **a** recirculation...”

Page 12, line 12:

It is not obvious why “missing” transport should be AAW, please clarify.

Page 12, line 15:

How large fractions of AW and AAW are denser than 27.8 kg/m³?

Page 12, line 26:

It should be: "...noted an increase in **the** shelfbreak EGC transport..."

Page 13, line 9:

Is there a more effective way to demonstrate that the southward flow north of 79°N is indeed a broad flow rather than a meandering shelfbreak current than showing the mean velocity field?

Page 13, line 34:

Please repeat briefly which aspect of the EGC evolution can explain the distribution of Atlantic-origin water on the Greenland shelf.

Page 14, line 21:

Please elucidate how the PSW Jet can impact exchanges between the EGC and the marine terminating glaciers.

Page 14, line 23:

It appears that AW may be ventilated also within the EGC as it flows toward Denmark Strait (Våge *et al.*, 2018). As such, it is not correct to state that AW is last in contact with the atmosphere in Fram Strait.

Page 15, line 7:

It should be: "...structure of the flow field **it** is important..."

Page 15, line 13:

Can you use moored velocity records from Fram Strait (e.g. von Appen *et al.*, 2016) to support the conjecture that the boundary currents are weaker than the eddies?

Figure 6:

Please label the panels a-c and refer to specific panels when discussing the figure in the text. Contours of constant potential density would add information to the figure.

Figure 7:

Errorbars, in particular in transport, should be added to the figure.

Figure 9:

Instead of, or perhaps in addition to, Atlantic Water layer thickness, I think it would be effective to show AW and AAW fractions. This would clearly show how the composition of the EGC and the water masses in Fram Strait evolve along the circulation pathways.

References

- Håvik L, Pickart RS, Våge K, Thurnherr AM, Beszczynska-Möller A, Walczowski W, von Appen WJ. 2017. Evolution of the East Greenland Current from Fram Strait to Denmark Strait: Synoptic measurements from summer 2012. *Journal of Geophysical Research: Oceans* : doi:10.1002/2016JC012228.
- Koenig Z, Provost C, Sennéchaël N, Garric G, Gascard JC. 2017. The Yermak Pass Branch: A major pathway for the Atlantic Water north of Svalbard. *Journal of Geophysical Research: Oceans* **122**: 9332–9349, doi:10.1002/2017JC013271.
- Rudels B, Korhonen M, Schauer U, Pisarev S, Rabe B, Wisotzki A. 2015. Circulation and transformation of Atlantic water in the Eurasian Basin and the contribution of the Fram Strait inflow branch to the Arctic Ocean heat budget. *Progress in Oceanography* **132**: 128–152, doi:10.1016/j.pocean.2014.04.003.
- Våge K, Papritz L, Håvik L, Spall MA, Moore G. 2018. Ocean convection linked to the recent ice edge retreat along east Greenland. *Nature Communications* **9**: doi:10.1038/s41467-018-03468-6.
- von Appen WJ, Schauer U, Hattermann T, Beszczynska-Möller A. 2016. Seasonal cycle of mesoscale instability of the West Spitsbergen Current. *Journal of Physical Oceanography* **46**: 1231–1254, doi:10.1175/JPO-D-15-0184.1.