Referee #2 Shungo Kawagata

Major comments

1_*R#2:* *The paper is fairly well-written, but too long. The presentation of the results and discussions are very tedious and can be shortened considerably.*

Answer: We thank the referee for the positive comments. We will shorten the manuscript as much as possible considering also the comments of the reviewer #1, especially the discussion about the ecological preferences of the benthic species.

2_*R#2:* *In Figure 1 (b), the longitudinal bathymetric profile should be redrawn to reflect the actual water depth. In particular, site MC3 is located at a deeper depth than sites MC1 and MC2 despite the shallowest water depth.*

Answer: We will modify the figure as requested.

3_*R#2:* *The agglutinated species composition (>150 microns) at site MC7 is similar to those of sites MC4 and MC5, but different from site MC6. The authors interpreted that the faunal similarity among sites might be caused by overflowing of the corrosive bottom water from the deep basin passing through the sills, but no explanations for the cause of faunal differences between site MC6 and others. (1) Is corrosive bottom water likely to overflow the basin without passing through site MC6, or flow out of the fjord through another path (e.g., channel)? (2) Another question arises about the possibility that basin species once carried outside the fjord have settled at the MC7 site. If so, a scenario overflowing from corrosive bottom water basins is no longer needed.*

Answer: As the results of the CCA (fig. 5) show, stations MC4, MC5 and MC6 are significantly similar, both in terms of fauna and environmental parameters. The agglutinated faunas of deep basins (MC4-MC5) and sill (MC6) stations only differ for the more abundant presence of *A. glomeratum* in this latter. We explain at lines 501-506 that the similarity with the deep basins fauna would be due to brine overflow, while the presence of *A. glomeratum* to the influence of the Atlantic Water especially during summer.

On the opposite, the fauna at station MC7 is significantly different from the others. The similarity between the agglutinated faunas of station MC7 and the deep basins and sill station is limited to the presence of *Reophax species*, but at this station the most abundant agglutinated species is *Lagenammina difflugiformis*, only marginally present in the deep basin stations. This species has been previously reported in wide environmental sets (e.g., Murray, 2006). It is often described as indifferent to organic matter supply (e.g., Alve et al., 2016; Jorissen et al., 2018) and sometimes has been reported in areas with hydro-sedimentary conditions characterized by more or less intermittent near-bottom currents (e.g., Fontanier et al., 2013). However, the most important difference concerning this station is determined by the prevalence of calcareous species and in particular the presence of two exclusive calcareous species: *Melonis barleanuum* and *Globobulimina auriculata*, indicating the strong influence of the Atlantic Water at this station.

With this in mind, we interpret the slightly different fauna of station MC6 as the result of intermittent pulses of BSW outflowing the fjord by-passing the sill during some periods of the year, and the presence of *A. glomeratum* as the evidence of seasonal influence of Atlantic waters.

We do not believe that the BSW outflow has a strong influence on station MC7. The presence of *Reophax* species at this station is more probably due to the widespread character of these agglutinated species (preference/tolerance for low quality organic matter). We do not think that a significant transport of individuals from the inner fjord to this station occurs; the common agglutinated species are quite big (up to 500µm!) and would be easily broken during transport. The silty nature of the sediments (average grain size value is about 14 µm) is clearly indicative of calm hydrodynamic environment at station MC7. Considering this, if transport happens via deep currents, it must be only minor. Moreover, no particular signs of reworking are visible on calcareous species and the same species are present in both large and small size fraction, comforting the absence of grain size sorting that could have happened via currents transport.

14_*R#2:* *The authors conclude that Agglutinated/Calcareous (A/C) proxies are possibly useful for changes in past fjord BSW intensity and sea ice production. However, the past A/C in sediments do not always reflect the marine environment at that time because agglutinated tests are more fragile than calcareous ones in general and are less likely to be preserved as fossils. How do the authors think about this?*

Answer: it is true that agglutinated tests are generally not well preserved in the fossil record. However, Rasmussen & Thomsen (2014, 2015) conducted a study on long cores from the deep basin of Storfjorden dating back to 14kyr and observed that the preservation of agglutinated tests in these environments is particularly good. This is even more reliable for shorter preservation times, as we suggest the application of the A/C proxy on historical sedimentary records (as specified in lines 31-39 and 607-609).

Minor comments

- **R*#2:*** n text, references and captions “and” and “&” are mixed.

We will modify as requested.

- **R*#2:*** In text, figures, Tables and captions “subsp.” is not required for “Elphidium excavatum subsp. clavatum”.

We will modify as requested.

- **R*#2:*** line 88: Publication year of “Haarpaintner et al., 2001” should be 2001a, 2001b or 2001c.

There was a tiping error. For this sentence the only reference is Polyakov et al. 2012.

- **R*#2:*** line 89: “Polyakov et al., 2012” is missing in References.

We will add the reference as requested.

- **R*#2:*** line 108: “Fer, 2004” is missing in References.

We will add the reference as requested. Fer, I., Skogseth, R. and Haugan, P. M.: Mixing of the Storfjorden overflow (Svalbard Archipelago) inferred from density overturns, J. Geophys. Res., 109(C01005), doi:10.1029/2003JC001968, 2004.

- **R*#2:*** lines 109, 120: Publication year of “Skogseth et al., 2005” should be 2005a or 2005b.

We will correct with Skogseth et al., 2004

- **R*#2:*** line 204: “Pielou Index (1975)” needs author name(s) in the bracket.

We will modify as requested.

- **R*#2:*** line 434: “Rysgaard et al., 2011” is missing in References.

We will add the reference as requested. Rysgaard, S., Bendtsen, J., Delille, B., Dieckmann, G. S., Glud, R. N., Kennedy, H., Mortensen, J., Papadimitriou, S., Thomas, D. N. and Tison, J. L.: Sea ice contribution to the air-sea CO2 exchange in the Arctic and Southern Oceans, Tellus, Ser. B Chem. Phys. Meteorol., 63(5), 823–830, doi:10.1111/j.1600-0889.2011.00571.x, 2011.

- **R*#2:*** lines 536, 841: “Schroder-Adams” should be “Schröder-Adams”.

We will modify as requested.

- **R*#2:*** line 540: “Jennings et Helgadottir, 1994 ” should be “Jennings and Helgadottir, 1994 ”.

We will modify as requested.

- **R*#2:*** line 662: Fer et al. (2004) is missing in the text.

The reference is cited at line 107. We will cite it again here, as suggested.

- **R#*2:*** line 683: Haarpaintner et al. (2001c) is missing in the text.

We will add this reference at line 68.

- **R#*2:*** line 704: Hunt and Corliss. (1993) is missing in the text.

We will modify as requested.

- **R#*2:*** line 750: Swap “Lloyd et al. (2007)” and “Lloyd (2006)”.

We will modify as requested.

- **R#*2:*** lines 650, 660: Separate author’s name with “and”.

We will modify as requested.

- **R#*2:*** Figure 4: In legend “Adercotryma glomerata” should be “Adercotryma glomeratum”, “Cribrostomoides crassimargo” should be “Labrospira crassimargo”.

We will modify as requested.

- **R#*2:*** Figure S1: What does the difference in the color of the profile line at each sampling point indicate?

Different replicates of profiles. We will specify in the caption.

- **R#*2:*** Figure S4: For the taxonomy, SEM image of *Globocassidulina subglobosa* seems to be of *Cassidulina reniforme*.

We agree with the referee #2. We revised the taxonomy of those specimens and we assigned to all of them the name of *C. reniforme*. For that reason, we will modify the figure 6, 7 and 9 based on the new assignment of the all individuals to the same species. This modification does not change anything significant to the interpretation of data.

References

Alve, E., Korsun, S., Schönfeld, J., Dijkstra, N., Golikova, E., Hess, S., Husum, K. and Panieri, G.: Foram-AMBI: A sensitivity index based on benthic foraminiferal faunas from North-East Atlantic and Arctic fjords, continental shelves and slopes, Mar. Micropaleontol., 122, 1–12, doi:10.1016/j.marmicro.2015.11.001, 2016.

Fontanier, C., Metzger, E., Waelbroeck, C., Jouffreau, M., Lefloch, N., Jorissen, F., Etcheber, H., Bichon, S., Chabaud, G., Poirier, D., Grémare, A. and Deflandre, B.: Live (stained) benthic foraminifera off walvis bay, namibia: A deep-sea ecosystem under the influence of bottom nepheloid layers, J. Foraminifer. Res., 43(1), 55–71, doi:10.2113/gsjfr.43.1.55, 2013.

Jorissen, F., Nardelli, M. P., Almogi-Labin, A., Barras, C., Bergamin, L., Bicchi, E., El Kateb, A., Ferraro, L., McGann, M., Morigi, C., Romano, E., Sabbatini, A., Schweizer, M. and Spezzaferri, S.: Developing Foram-AMBI for biomonitoring in the Mediterranean: Species assignments to ecological categories, Mar. Micropaleontol., (January), doi:10.1016/j.marmicro.2017.12.006, 2018.

Murray, J. W.: Ecology and Application of Benthic Foraminifera, Cambridge University Press, Cambridge, New York., 2006.

Skogseth, R., Haugan, P. M. and Haarpaintner, J.: Ice and brine production in Storfjorden from four winters of satellite and in situ observations and modeling, J. Geophys. Res. C Ocean., 109(10), 1–15, doi:10.1029/2004JC002384, 2004.