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Interactive comment on "Ocean properties, ice–ocean interactions, and calving front morphology at two major west Greenland glaciers" *by* N. Chauché et al.

Anonymous Referee #1

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General Comments: This manuscript presents oceanic properties in front of two major west Greenland glaciers, and infers several modes of glacier-ocean interaction from the ocean data. The oceanographic data collected near the ice front and time lapse videos are valuable and makes an excellent contribution to the scientific understanding of glacier-ocean interaction. The article is well written in general except some minor issues. My major concern is on the interpreting of various water masses that are deduced from limited summer ocean data. My recommendation is to accept this paper but ask for a revision addressing the following issues.

Specific comments:

1. There are too many abbreviations in this manuscript. SPMW, BEW, GRW, MW, DMRW, SW — as mentioned in other comments, these are confusing names. I need to refer to Table 3 all the time. J. Mortensen and D. Sutherland already gave good suggestions, and I don't repeat. RG, RF, SG, SF —- I don't feel "Rink Glacier" or "Store Glacier" are too long.

2. BEW. Is BEW the same with "polar water" by Straneo et al. (2010). There is not enough explanation on the formation and advection of BEW. Identification of BEW in Baffin Bay doesn't insure it advected to RF, or advected without changing properties. And the local formation of sea ice does not guarantee the produced high salinity water to reach exact hydrostatic equilibrium at 200m, right? It might sink to the sea floor like what Antarctic bottom water does? What is the insulation effect of BEW? It is not explained in section 4.2.3.

3. The text, especially section 3 and 4, are not referred to figures as needed, which would make readers get lost in the text. For example, p.5587,l.25, a layer of intense turbidity was also observed just above the seabed, could refer to fig.7?

4. Section 4.1. For each water mass, I suggest first define this water mass, with reference to Fig. 2 and/or Fig.3; then explain the formation or source of this water; and then describe other characteristics, such as actual values, depth, variability.

5. Runoff mixing. I agree that the plume does not always rise to sea surface, and that strong plumes that touch the surface might sink back to a hydrostatic equilibrium layer. This is consistent with modeling results by Xu et al. (2013). However, I don't understand why the blue dash runoff mixing line (Fig.3) starts from about 200m depth. If freshwater is discharge at sea floor, it mixes immediately with seawater (where SPMW exist). In this case, blue dash line should go through the point of SPMW. Do you suggest that freshwater is discharged at 200m? or 75m in STORE 2010?

6. Section5.1. I feel it is not necessary to group 4 data into 3 categories of ice-ocean interaction modes in 0-200m. In fact, RF 2010 might not belong mode 2, because

data presented in this manuscript does not prove that BEW had entered Rink Fjord and was removed by runoff mixing. Also submarine melting is not excluded from the top 200 m, because the coldest measured temperature was 0 oC, much higher than seawater freezing point -1.9 oC! I suggest simply describe these processes, and state that different water level/ glacier / year is dominated by what process.

Technical comments:

p.5580 Abstract l.8-11: "the consistent presence of 2.8oC SPMW adjacent to both ice fronts below 400m throughout all surveys indicates. . ." How the presence of warm water can "indicate" some melting mechanisms.

Fig.1 Would you zoom in more on Rink and Store glacier and mark the locations of casts? It would help understanding Fig. 4, 5 and 7.

p. 5584 l.11: "The instrument also logged on recovery, which at a slower ascent rate of 0.3–0.5ms-1 provided 40 samples per 5m bin". Do you use data collected at both descending phase and ascending face? Normally CTD profilers are designed to collect data at descending phase. But if your CTD profiler is designed for both directions, then forget this comment.

Fig. 2 It is hard to find the purple dots (Store 2010 plume) among those red dots in the turbidity subplot. Would you choose another color instead of purple, or put purple on top, or use bigger dots?

You convert turbidity into percentage of the maximum value of each fjord. Is this a good method? After you do so, it is hard to compare between different fjords in Fig. 2c, and you put those fjords together.

p. 5585 l. 21-23: refer to Fig. 3

l.23: "The strength of the melting is depending on temperature difference but also on the dynamic of the water at the interface." Irrelevant, delete it.

Did you also explain runoff-mixing line (blue dash line in Fig. 3) somewhere?

p.5587 l.2:" All identified water bodies were observed within 200m of the respective glacier calving margin". Again, BEW is not observed at RF or SF 2009.

p. 5588 l.6. Reference (As et al. 2012) is not found in your reference list?

p. 5589 l.10-12: The logic is a bit odd. From my understanding, you first defined meltwater mixing line in fig3, then found that the water layer between 200-500m overlaps with the meltwater mixing line, so you defined this layer as MW. But I saw talk about meltwater mixing line after you have defined MW?

Fig. 3: "500m" "400m" "450m" are the depths of SPMW, right? Then move these words to under SPMW. It is a misleading to put them on isopycnal lines.

You forget to mark MW in subplot Rink 2009?

Fig 4, caption, line2: "The north side of the fjord is on the left and it is looking toward the ice front". Delete this sentence. It is from Fig5.

Fig4 and Fig5: Those contour lines are hard to read. Some of the lines do not make a loop, so it's hard to tell which side of the lines are high value areas. Could you maybe make the lines smoother, and a bit detach from the edge and other lines? I think it will be good enough to point out the approximate location, but not identify the exact edge.

Fig.7: This is Store 2010?

Interactive comment on The Cryosphere Discuss., 7, 5579, 2013.