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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.

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Many thanks to J. Mortensen for the detailed comments on our Discussion Paper received on 22 Nov 2013. We are delighted that the data presented are found to be very interesting and would like to briefly clarify the comments subsequently made.

Regarding the fjord bathymetry: The bathymetry used in Figure 1 (IBCAO) indicates that no sills or obstructions shallower than 450 m are preventing outer water from entering the main part of both fjords at depth (thick blue line in Figure 1). However, given the opportunity for resubmission, we will clarify this situation by inclusion of a new figure detailing longitudinal bathymetric profiles derived from a combination of our own

soundings compiled with published/released data.

We highlight in the caption to Figure 1 (p5603) that the variation between the IBCAO bathymetry and observation has been made only for the inner part of the fjord. We have observed unobstructed depths greater than ∼450 m (and up to 900 m), all the way to Store Glacier ice-front. At Rink Glacier, great depths have been observed in the main fjord (>1100 m). However, recent multibeam fjord bathymetry (Dowdeswell, 2013, Figure 7) shows that the shallowest sill present in Rink fjord (south of Karrat Island) which prevents intrusion of deep offshore water is at ∼400 m. As noted, we will provide a new figure based on long-profiles of the fjord bathymetry illustrating this.

Water masses analysis: We agree that we cannot speculate on the seasonal evolution of the water masses present, but this is not the aim of the paper. Nevertheless, the temporal and spatial stability of the >400 m thick layer of SPMW indicates that it is a relatively persistent feature over the long-term. The physical process forming the BEW (winter sea ice built up) and GRW (surface ice melt/runoff) are though seasonally constraining the temperature and salinity characteristics of these waters. Hence, we assume that over the annual cycle these two water-masses will form and be present to a greater or lesser extent (dependent on the amplitude of the winter/summer anomalies) with relatively similar characteristics.

We neither try to define new water masses; instead we wish to incorporate as best as possible the numerous names that can be found in the literature concerning the different waters masses (e.g. sub-tropical; sub-polar; Atlantic etc) described around Greenland (Christoffersen et al., 2012; Mortensen et al, 2011; 2013; Straneo et al., 2011; 2012). Likewise, we agree also that the presence of MW near the front of the glaciers does not preclude provenance from outside the fjord. However the observation of water at ∼3°C in direct contact with each ice-front indicates that at least some melting must be occurring yielding some local MW production. Furthermore, at Rink Fjord, MW is present during both survey ∼100 m below the depth of the 400m sill and has been observed almost to the surface of the fjord (Figure 2, Rink 2009) when at the

same time MW is only observed between 200 m and 400 m depth near Store Glacier ice-front (Figure 2, Store 2009). The larger thickness of this layer and the absence of warm $\sim$3°C water above 700 m depth in Rink fjord is again indicative that at least some of this water must have a local origin, as per Figure 6.

Estuarine Circulation: In part of the background section, we used the term "estuarine circulation" to reflect the single cell circulation forced by fresh water output near the surface which is assumed in the reduced model developed by (Motyka et al., 2003). That we refer to this term in our background, does not mean that we agree with the model nor believe that a more complex, stratified circulation pattern is at work here as per reference to J. Mortensen's own work. Since use of the terms appears to bring confusion/ambiguity, then we shall remove it.

We hope this helps clarify the paper and again thank J. Mortensen for his constructive comments.

Reference: Dowdeswell, J. A., Hogan, K. A., Ó Cofaigh, C., Fugelli, E. M. G., Evans, J. and Noormets, R.: Late Quaternary ice flow in a West Greenland fjord and cross-shelf trough system: submarine landforms from Rink Isbrae to Uummannaq shelf and slope, Quaternary Science Reviews VL -, (0 SP - EP - PY - T2 -), 1–46, 2013.

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