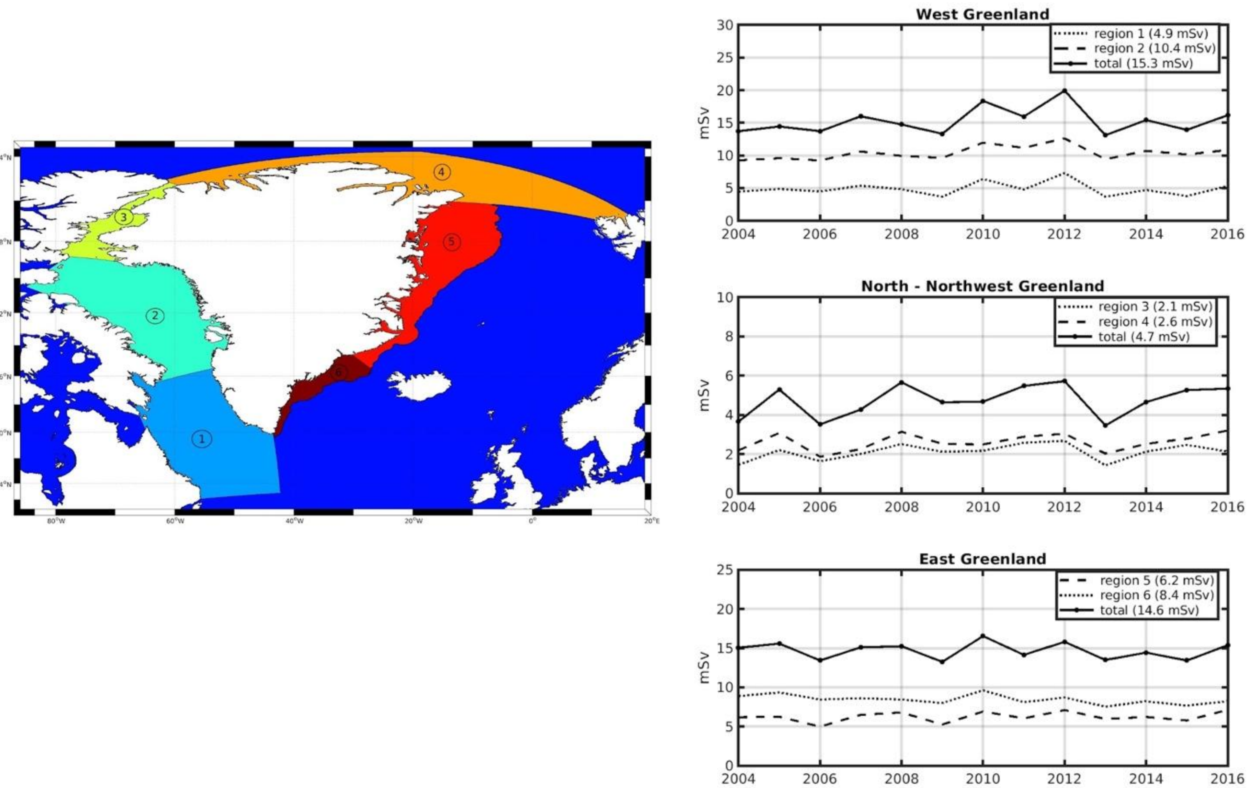
Supplementary Material

Supplementary description of the HR runs

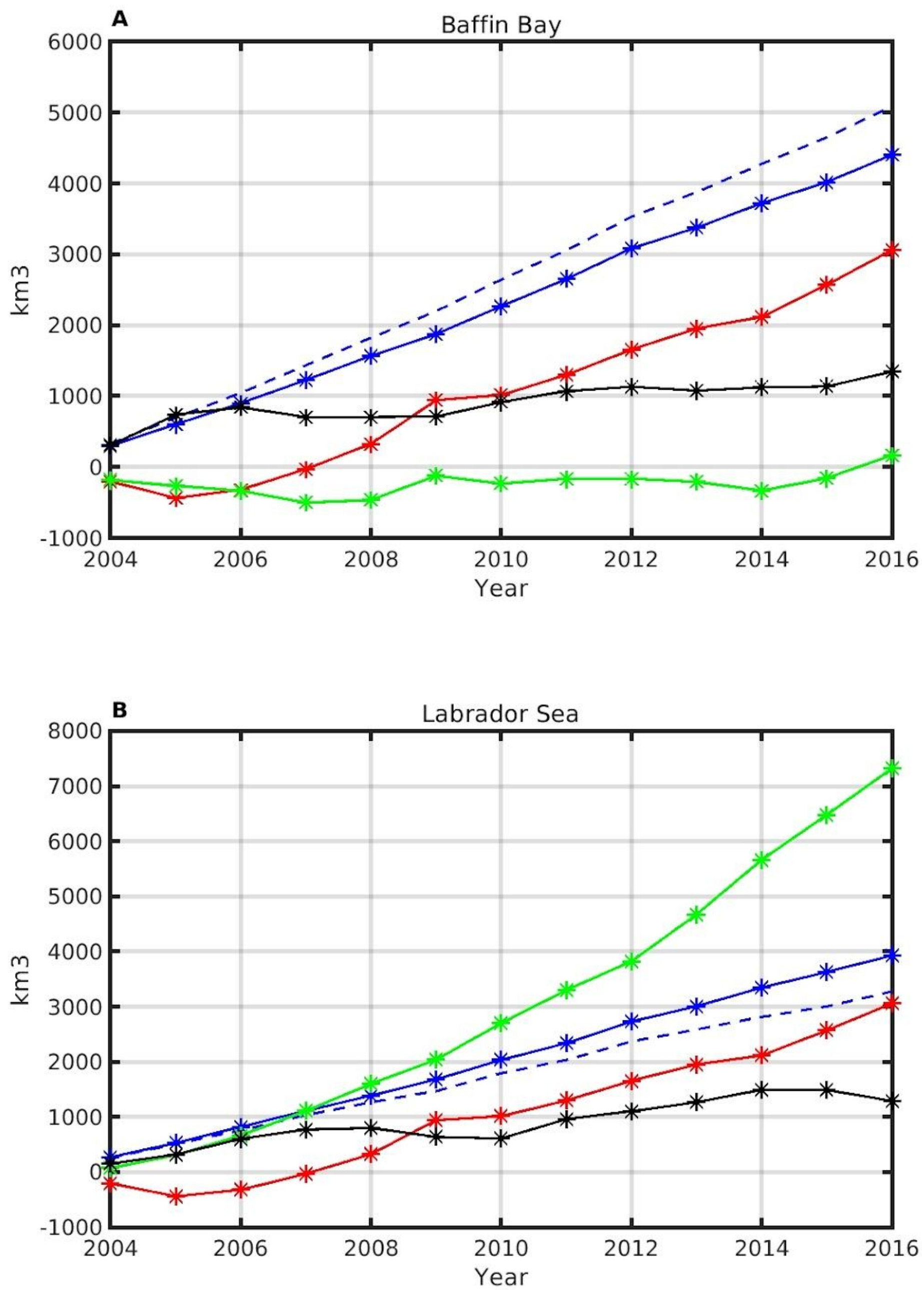
To estimate the additional freshwater added by the updated Greenland sources to the surrounding basins in the Greenland vicinity, we have defined 6 sub-domains around Greenland roughly following the contours of the main basins and shelf regions (Supplementary Figure 1). The total freshwater release from Greenland to each of the sub-domains is presented as a difference between the two experiments. As expected, the largest freshwater fluxes are found east and west of Greenland, with these two regions contributing with almost the same amounts, while the major sources are located along the northwestern coast of Greenland, collecting into Baffin Bay, and in southeast Greenland. A major part of the eastern Greenland sources flows southward with the East Greenland Current, then turning west and north to join the West Greenland Current and possibly feeding the central Labrador Sea. Large fluxes are also found on the East Greenland shelf. After 13 years, the cumulative input of freshwater over the whole domain is about 3000 km^3 larger in the sensitivity than in the control experiment.

A comparison (not shown) between the amount of freshwater added from Canada and that added from Greenland to the Baffin Bay-Labrador Sea region clearly shows that Greenland is the major external freshwater source for these ocean basins. Separate freshwater budgets (S_{ref}=34.8) for these two subregions have been formed (Supplementary Figure 2). Baffin Bay behaves primarily as a conduct that exports the excess of coastal (mainly Greenland) runoff to the North Atlantic (basically 3000 km^3 excess of freshwater are exported through Davis Strait to the Labrador Sea, to be compared with the 5000 km^3 of additional coastal runoff released to Baffin Bay over the 13 years of the simulation), with relatively small regional accumulation (1000 km^3). In contrast, the Labrador Sea fresh water content increases relatively little compared to the large input of fresh water, mainly supplied by the East Greenland Current (Supplementary Figure 2, bottom panel). Indeed, the local sources of fresh water release from Greenland is equivalent to the input from Davis Strait but they only represent 40% of cumulated transport of fresh water through the Denmark Strait. This large freshwater input mainly circulates around the Labrador Sea to be ultimately advected by the NAC.

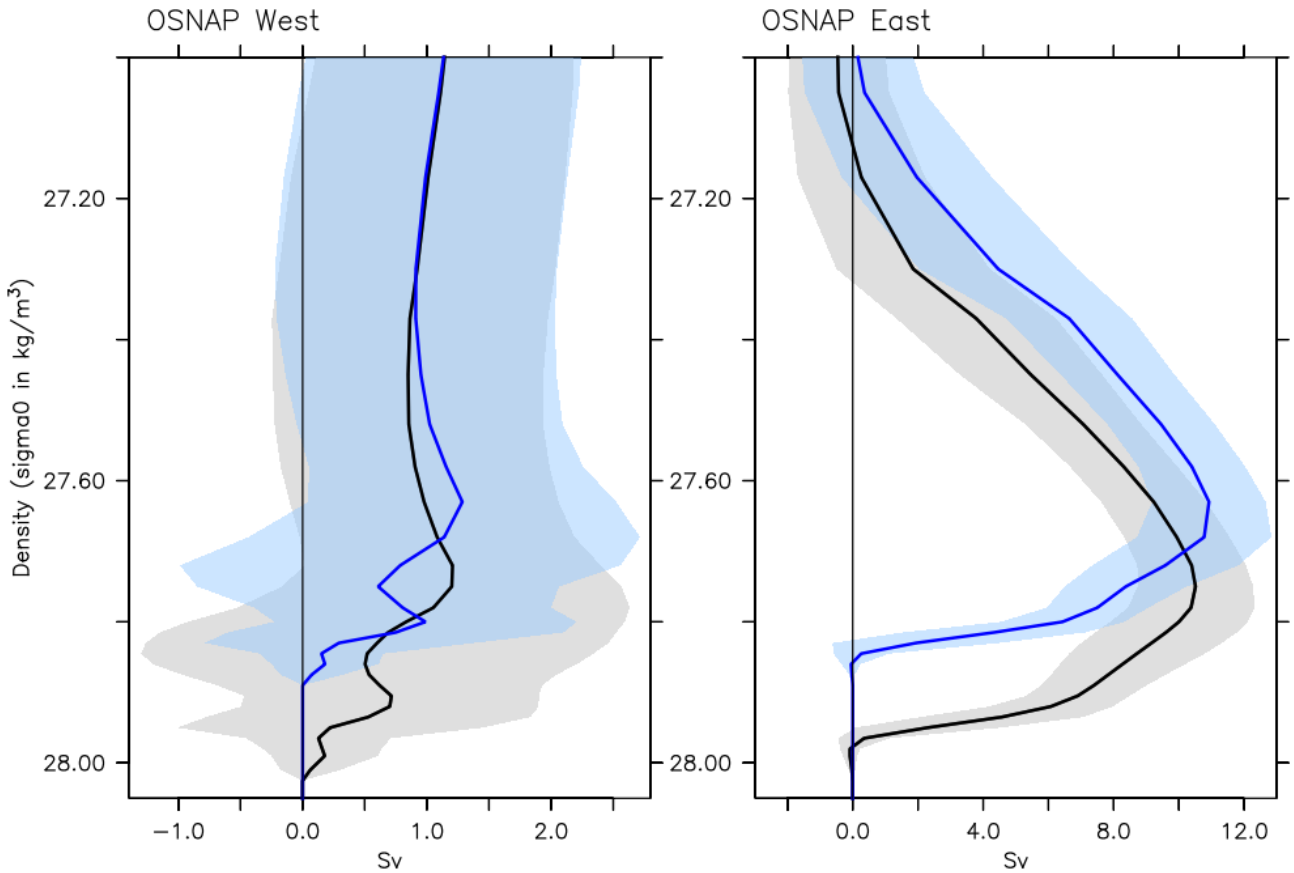
The difference of SSS between the sensitivity and the control experiments is shown in the Supplementary Movie 1. It nicely illustrates the teleconnections between the different subregions. The largest decrease in SSS is found in the Baffin Bay, with an enhanced signal on the shelves, followed by the northeastern Labrador Sea shelf and Nares Strait and on the East Greenland shelf. On the East Greenland shelf, even if there is a large decrease of the SSS, part of the Greenland freshwater discharge seems to be advected outward to the Nordic Seas basins. Indeed, it seems that the Jan Mayen Current and the East Icelandic Current advect some freshwater into the Iceland and southern Norwegian Seas and contribute to the decrease of the SSS in these regions. A major outlet for the East Greenland freshwater is the Denmark Strait where freshwater is conveyed southward by the East Greenland Current to the Labrador Sea (see section above). A moderate signature of increased SSS is also detected in the Norwegian Current.



Supplementary Figure 1. On the left side, the 6 sub-domains where individual freshwater flux anomalies are computed: 1: Labrador Sea, 2: Baffin Bay, 3: Nares Strait, 4: North Greenland, 5: East Greenland shelf, 6: southeast Greenland shelf. On the right side: freshwater released (in mSv) from Greenland for (top panel) the western coast, (middle panel) the northern coast and (bottom panel) the eastern coast of Greenland.



Supplementary Figure 2. Fresh water content anomaly (black) and its different sources in Baffin Bay (top panel) and the Labrador Sea (bottom panel): contribution of the surface flux (blue), including its component due to the fresh water released from Greenland (dashed blue), the transport through Davis Strait (red), the transport through the CAA passages (top) or the Denmark Strait (bottom) (green). All southward transports are counted as positive values.



Supplementary Figure 3. MOC (in Sv) along the OSNAP section, west on the left and east on the right, computed in density (sigma 0, expressed in kg/m^3) space. The thick black line stands for the average over the period 2004-2014 in control simulation, the thick blue line for the same average in melt simulation.

Supplementary Movie 1: SSS anomalies (sensitivity minus control experiment) in HR simulations expressed in PSU and averaged over each year of simulations as indicated in the title.

Mean OSNAP East	+ 11.3 ± 1.2 Sv
Mean OSNAP West	+ 0.87 ± 0.56 Sv
Difference OSNAP East	- 0.57 ± 1.68 Sv
Difference OSNAP West	+ 0.22 ± 0.84 Sv
Difference AMOC 45°N	- 0.24 ± 1.31 Sv (z-coordinate : - 0.13 ± 1.0 Sv)

Supplementary Table 1: Maximum MOC value at OSNAP sections (east and west) in the LR simulations computed in sigma 0 density space. The first two rows show the mean values in the Control simulations. The three last rows show the differences between Melting minus Control simulations. All numbers are computed over the period 2004-2014 and for the 14 members that were providing all the necessary variables to correctly compute those transports. The uncertainty is showing the inter-member spread in terms of standard deviation of the 14 members.