



Supplement of

Water mass modification of the warm Atlantic Inflow towards the Arctic across the Iceland-Faroe Ridge

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Supplementary information

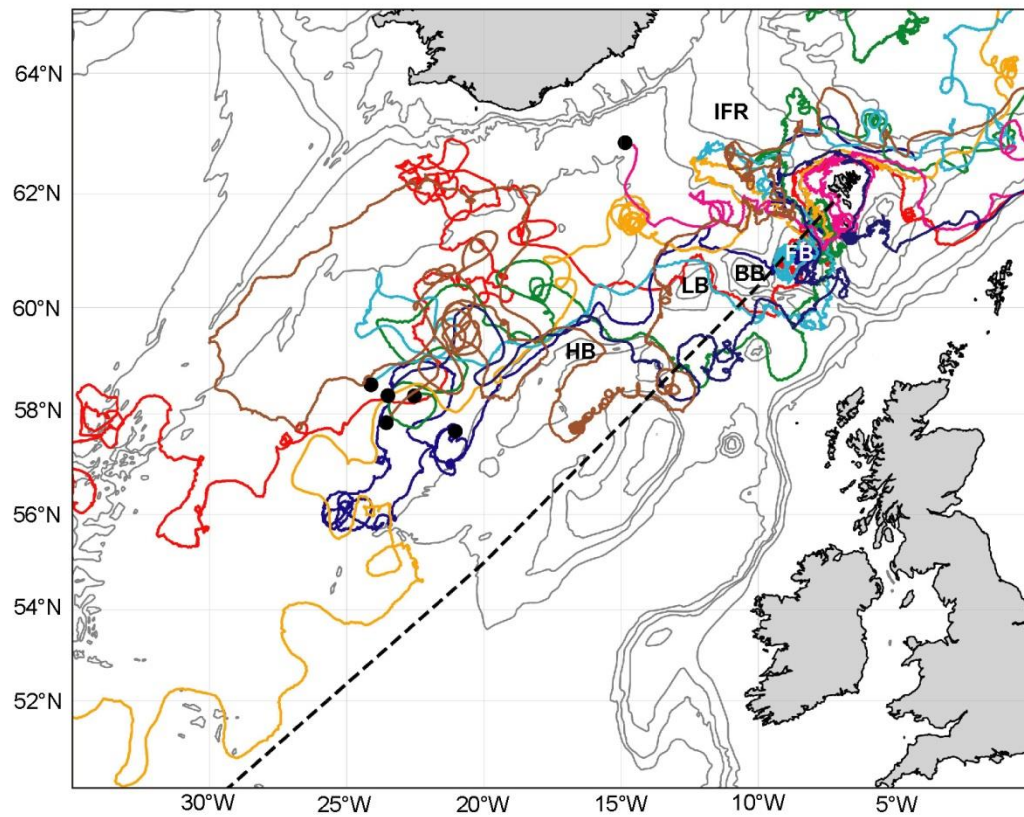


Figure S1. Eight of the 101 drifters crossing the IFR (shown with coloured lines) crossed the dashed black line, and entered the bank area between the Iceland Basin and the Rockall Trough area. Black dots show where the drifters were deployed if they fall inside the map area (two are deployed outside). Thin grey lines show bottom contours for 200 m, 500 m, 1000 m and 2000. IFR: Iceland-Faroe Ridge. HB: Hatton Bank. LB: Lousy Bank. BB: Bill Baileys Bank. FB: Faroe Bank.

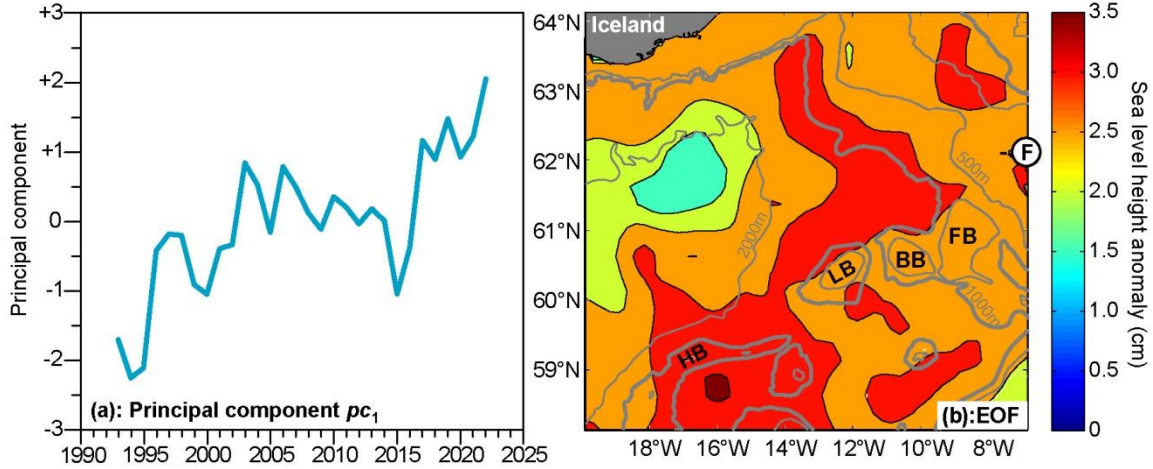


Figure S2. EOF-analysis of annually averaged Sea Level Anomaly data for the 1993–2022 period. **(a)** The principal component (temporal variation) of the first EOF-mode, pc_1 . **(b)** Spatial structure of the first EOF-mode. Grey lines on the maps show bottom contours for 200 m, 500 m, 1000 m and 2000 m with a thicker 1000 m contour. IFR: Iceland-Faroe Ridge. HB: Hatton Bank. LB: Lousy Bank. BB: Bill Baileys Bank. FB: Faroe Bank. In contrast to Fig. 4a,b in the main manuscript, the data have not been modified by subtracting the spatial average at each time step. Since all the points in (b) are positive, this shows a general sea level rise over the whole area although of different magnitude.

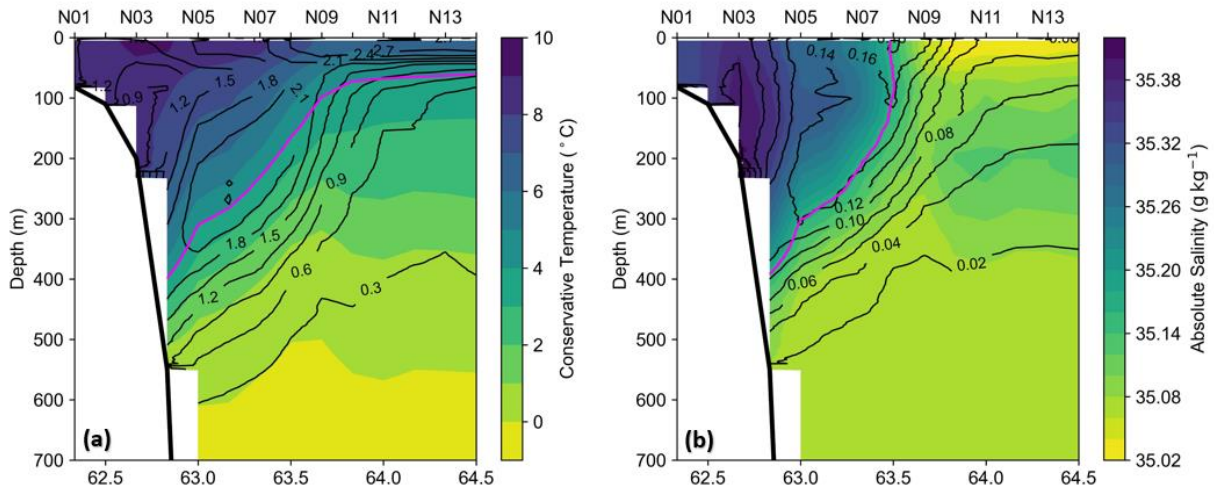


Figure S3. Average water mass characteristic at the N-section. Mean Conservative Temperature **(a)** and Absolute Salinity **(b)** in colours for the period from 1993 to May 2024 from 99 cruises where all 14 standard stations were occupied. Black contour lines show the standard deviation. Magenta lines show the 4 °C isotherm and the 35.165 g kg⁻¹ isohaline (corresponding to the 35.0 isohaline in practical salinity units), used by Hansen et al. (2023) to define the deep and northern boundary of Atlantic water on the section.

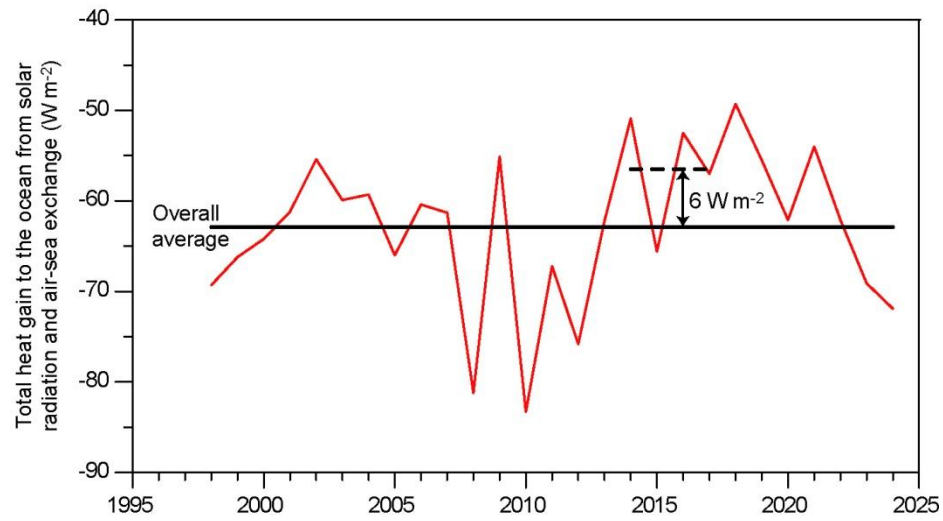


Figure S4. The red curve shows the annually average heat gain to the ocean at a location north of Faroe Bank (62° N, 10° W). The continuous black line is the average over the whole 1998–2024 period. The dashed black line is the average over the 2014–2017 period. The data are from ERA5, downloaded from the Copernicus Climate Change Service.

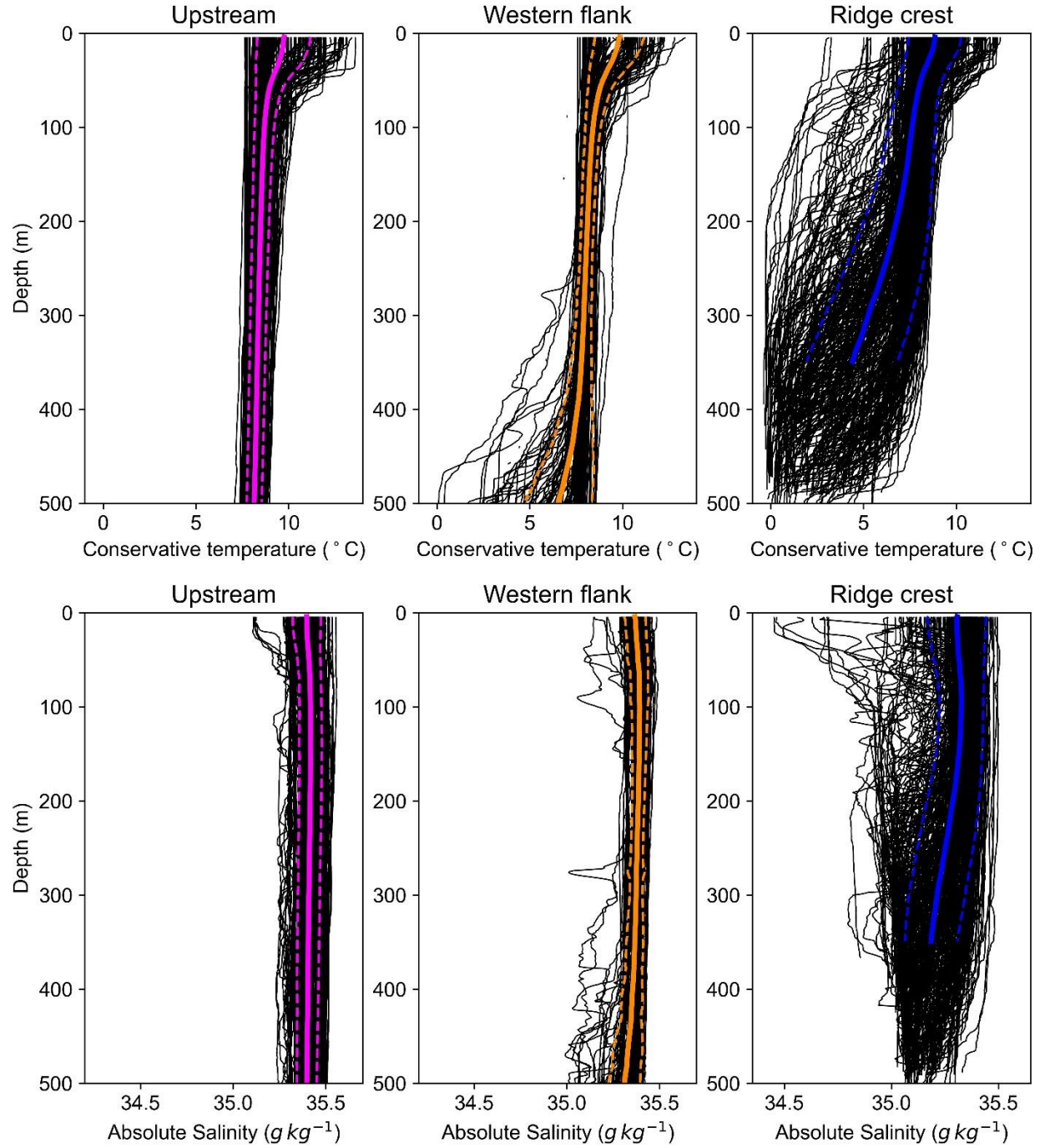


Figure S5. Individual profiles for the three regions in Fig. 9a in the main manuscript shown with black lines. The full coloured lines are the average profiles and the dotted coloured lines are ± 1 standard deviation. The colour code is the same as in Fig. 9. Upper panels show Conservative Temperature and lower panels Absolute Salinity. The left panels are for the upstream area, the middle panels are for the flank area and the right panels are for the crest area.

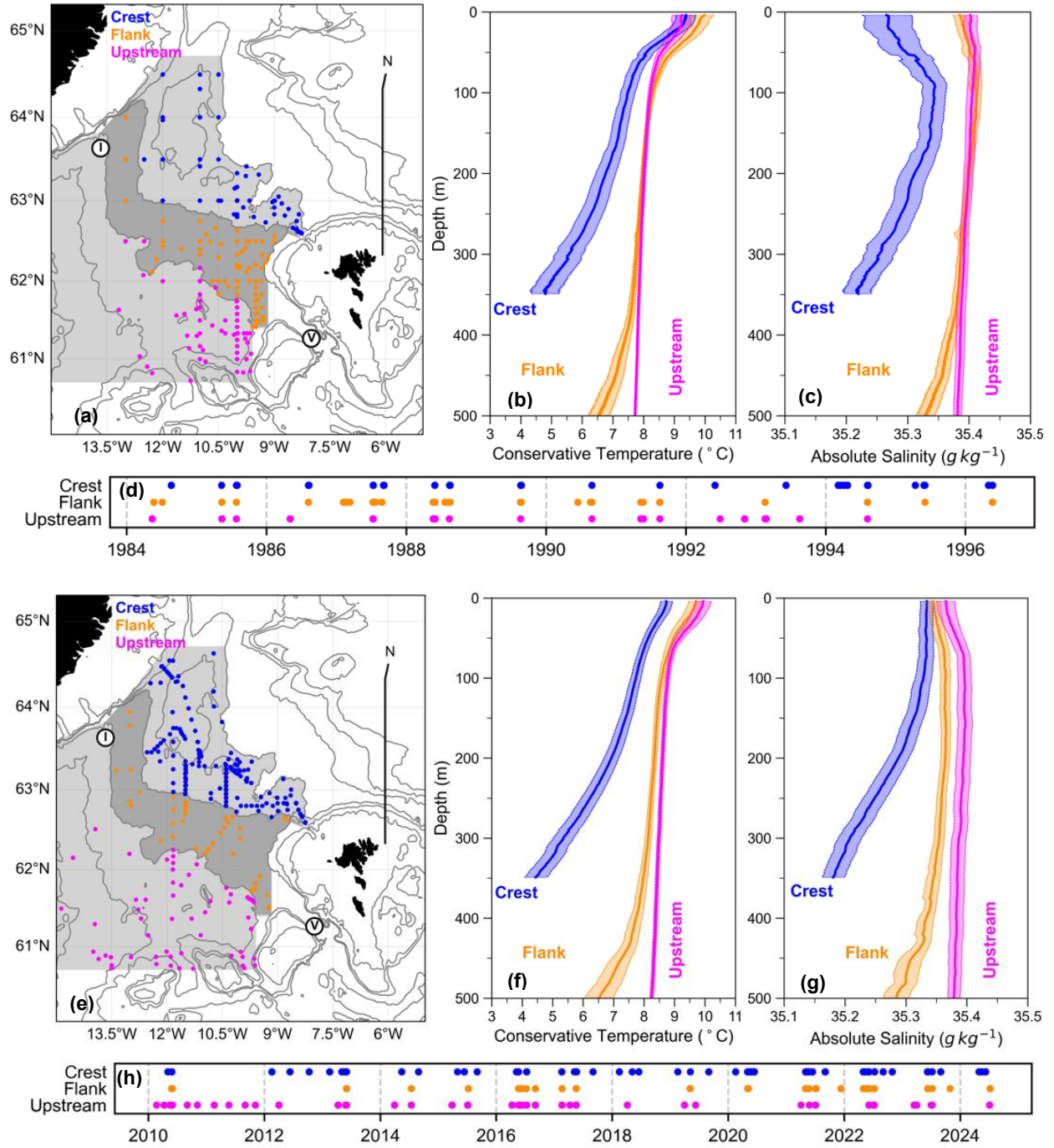


Figure S6. (a) Map of the IFR area divided into three regions. In each region, CTD locations (period 1984–1997) are shown with coloured dots: i) Upstream of the IFR (magenta); ii) The flank of the IFR (orange); iii) The ridge crest (blue). The number of CTD stations in the Upstream, Flank and Crest regions is respectively 69, 84 and 86. Mean temperature (b) and salinity (c) profiles for the three regions in (a). (d) Time of observation for the CTD profiles in (a). (e) Same as (a), but for the period 2010–2024. The number of CTD stations in the Upstream, Flank and Crest regions is respectively 88, 54 and 254. Mean temperature (f) and salinity (g) profiles for the three regions in (e). (h) Time of observation for the CTD profiles in (e). In (a) and (e) the borders of the three regions are shown with grey shading. White circles with black letters show the locations of standard stations I and V and the N-section is shown with a black line north of the Faroes. Thin grey lines show bottom contours for 200 m, 400 m, 500 m, 1000 m, 1500 m and 2000 m. In panels (b,c) and (f,g) semi-transparent areas around each profile show the average ± 1 standard error. For more details, see Fig. 9 in the manuscript.

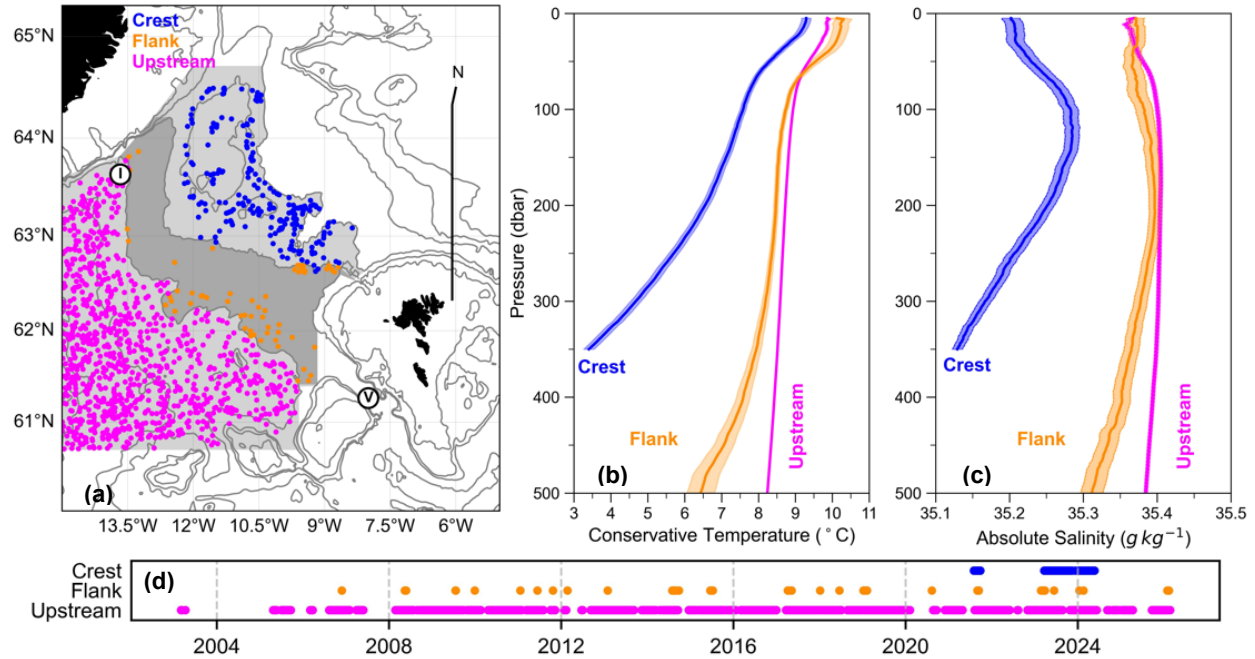


Figure S7. (a) Map of the IFR area divided into three regions. In each region, locations of Argo profiles are shown with colored dots: i) Upstream of the IFR (magenta); ii) The flank of the IFR (orange); iii) The ridge crest (blue). The number of Argo profiles in the Upstream, Flank and Crest regions is respectively 959, 60 and 197. Mean temperature (b) and salinity (c) profiles for the three regions in (a). (d) Time of observation for the Argo profiles in (a). In (a) the borders of the three regions are shown with grey shading. White circles with black letters show the locations of standard stations I and V and the N-section is shown with a black line north of the Faroes. Thin grey lines show bottom contours for 200 m, 400 m, 500 m, 1000 m, 1500 m and 2000 m. In panels (b,c) semi-transparent areas around each profile show the average ± 1 standard error. For more details, see Fig. 9 in the manuscript.

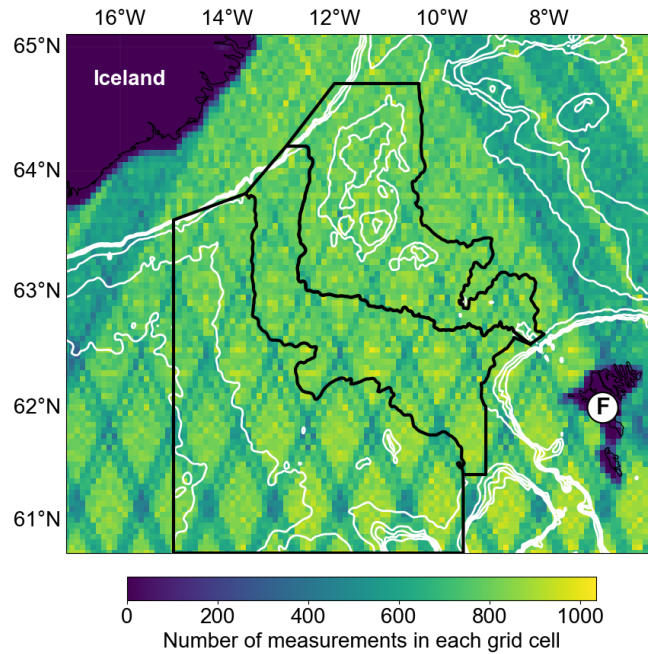


Figure S8. SWOT data. Number of measurements in each grid cell. The grid used is 0.05 degrees latitude and 0.1 degrees longitude. The white lines show bottom contours for 300m, 350 m, 400 m, 500 m, 1000 m, 1500 and 2000 m. Black lines show the same areas as in Fig. 9 in the main manuscript. An F in a white circle shows the Faroe Islands.

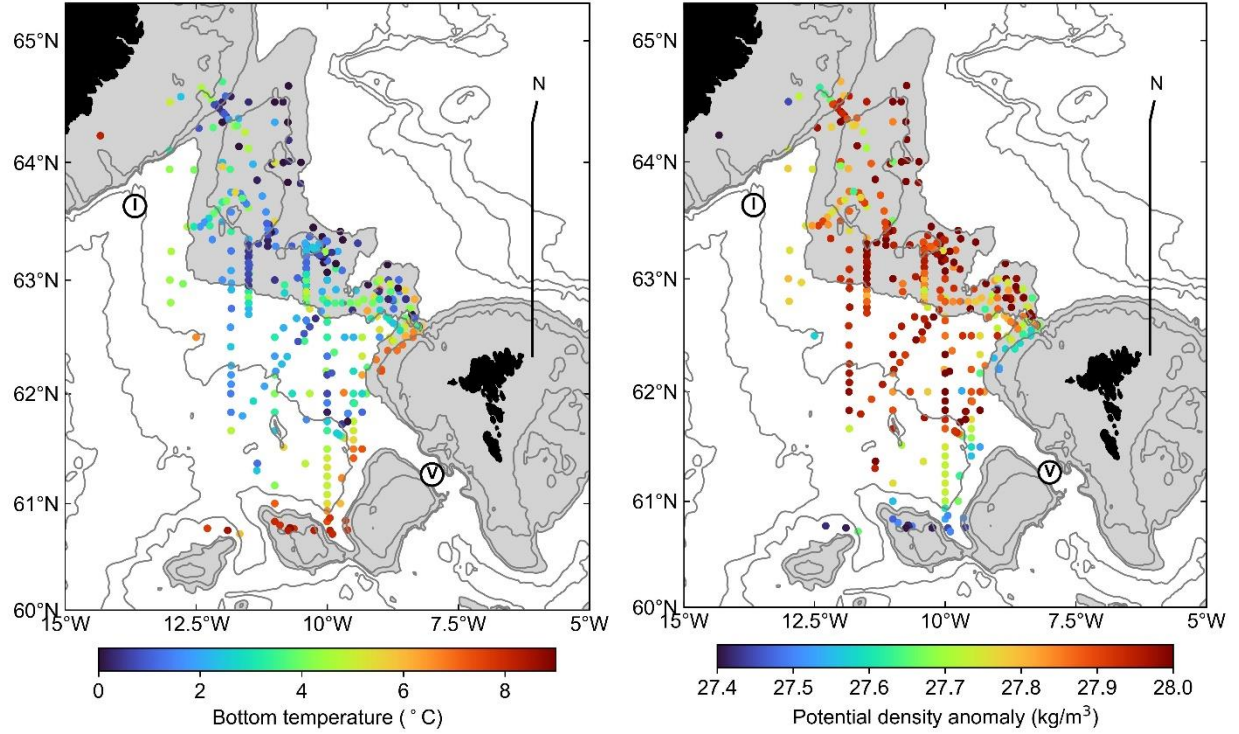


Figure S9. Bottom temperature (a) and bottom potential density anomaly (b) from all CTD profiles in Fig. 9a in the main manuscript, where temperature is measured less than 50 m above the seabed. Thin grey lines show bottom contours for 200 m, 400 m, 500 m, 1000 m, 1500 m and 2000 m. Areas shallower than 500 m are grey. White circles with black letters show the locations of standard stations I and V and the N-section is shown with a black line north of the Faroes.

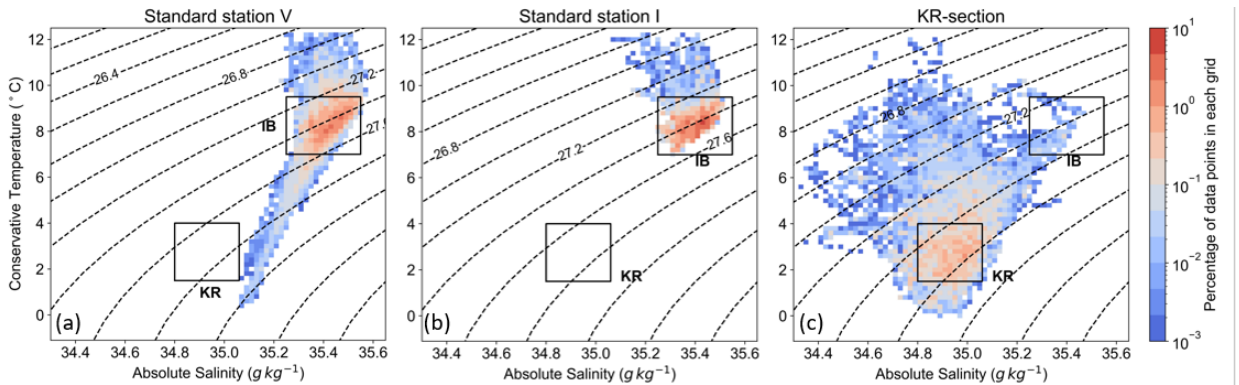


Figure S10. T-S diagrams for (a) standard station V for the uppermost 500 m, (b) standard station I for the uppermost 500 m and (c) for Krossanes section, standard stations KR2 to KR6 the uppermost 100 m. (a) and (b) are used to find the typical properties for the Atlantic water before it enters the IFR-area (called IB). (c) is used to find the typical properties of the Arctic water that enters the IFR-area and meets with the IF-inflow (called KR). The typical properties are found by drawing a box that captures most of the measurements. The colour scale is the same for all the panels and shown to the right.

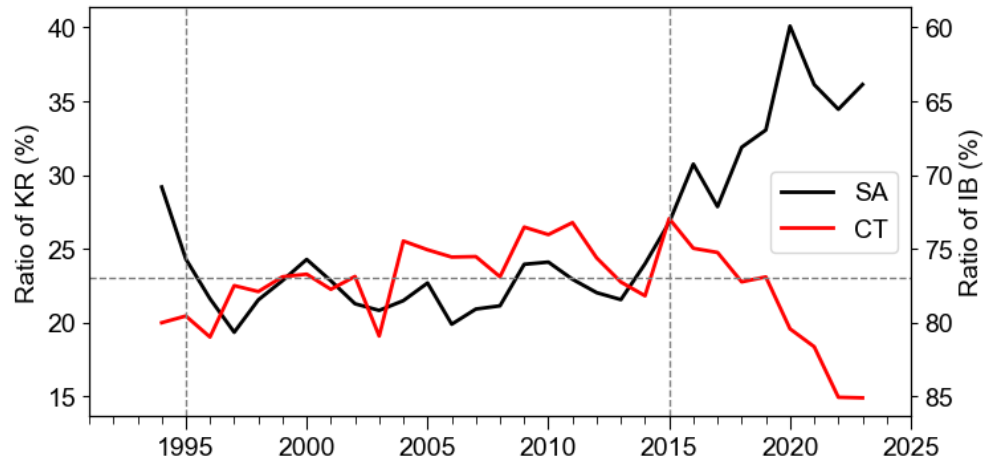


Figure S11. The ratio of the KR water mass to the IB water mass that mixed together give the same properties as the water at the N-section. The red curve shows the mixing ratio for Conservative Temperature and the black curve the mixing ratio for Absolute Salinity. The dashed horizontal line indicates the mean ratio of 23 % KR-water to 77 % IB-water.