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Supplement of

Why did deep convection persist over four consecutive winters (2015–2018) southeast of Cape Farewell?

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SUPPLEMENTARY MATERIAL

S1. METHODS FOR ESTIMATING THE MIXED LAYER DEPTH

In this paper, mixed layer depth (MLD) was estimated using the threshold method described in section 3.1. Our estimates were compared to those based on the method of Pickart et al. (2002), which like ours is adapted to slightly slanted tracer profiles in the mixed layers as those often observed in the central subpolar gyre (Straneo et al. 2002). Pickart et al. (2002) requires a first guess for the mixed layer that we have taken equal to the MLD estimate obtained with our threshold method (section 3.1 of this paper). Then, the mean and standard deviation of the σ, S and θ were estimated from the surface to the initially defined MLD. Finally, the two–standard deviation envelopes overlaid on the original profile were plotted on the σ, S and θ profiles. The mixed layer depth was determined as the location where the profile permanently crossed outside of the two–standard deviation envelope.

S.2. FIGURES IN SUPPLEMENTARY MATERIAL

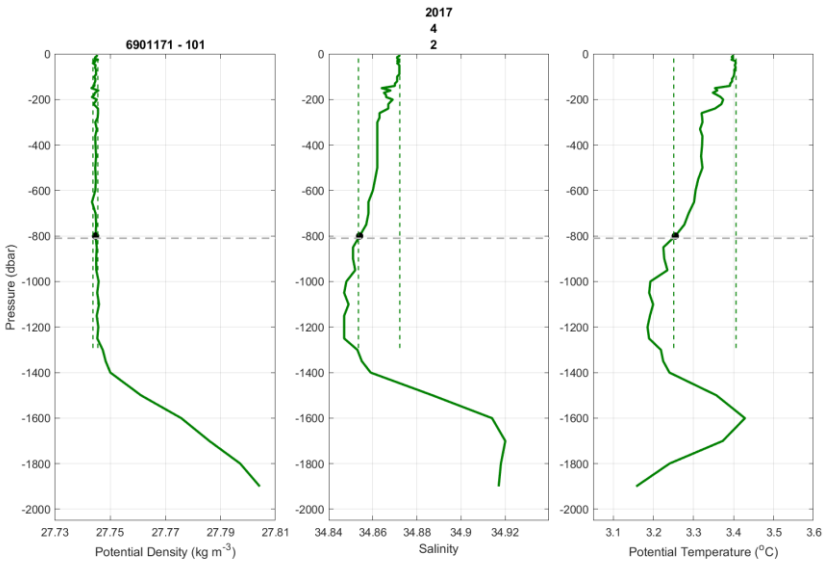


Figure S1. Comparison of MLD estimated for float 6901171 – 101 by our method (black point) and by Pickart et al.'s method (horizontal discontinuous gray line). The continuous colored lines are the vertical profiles of σ, S and θ measured by the Argo float. The dashed colored lines are the two–standard deviation envelope considered in the Pickart et al.'s method.

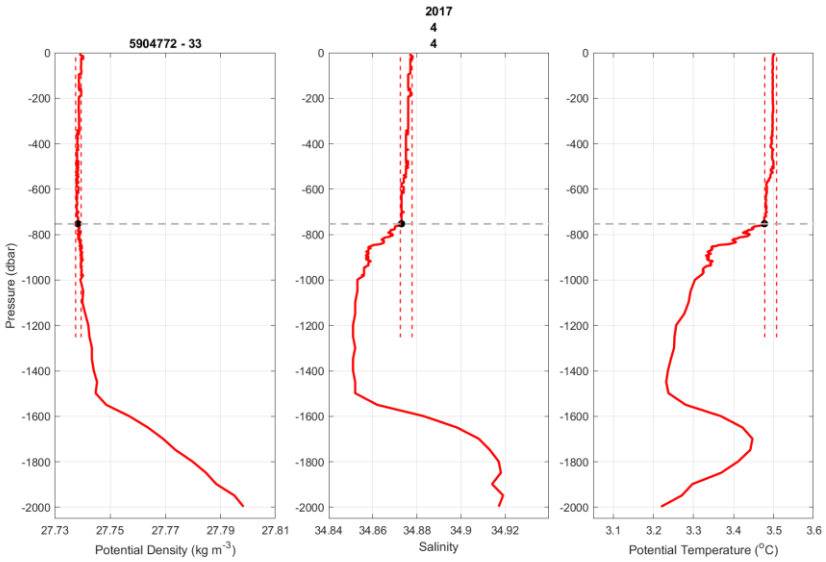


Figure S2. The same as Fig. S1 but for profiles 59004772 – 33.

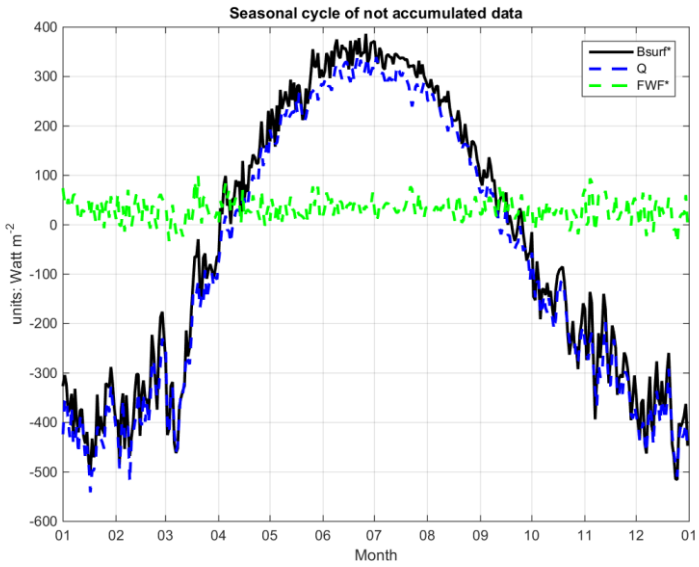


Figure S3. Mean (1993 - 2016) seasonal cycle of air-sea flux of buoyancy (Bsurf*), heat (Q) and freshwater (FWF*) averaged on the SECF region (pink box in Fig. 1). Data origin: ERA-Interim, accumulated every 24h.

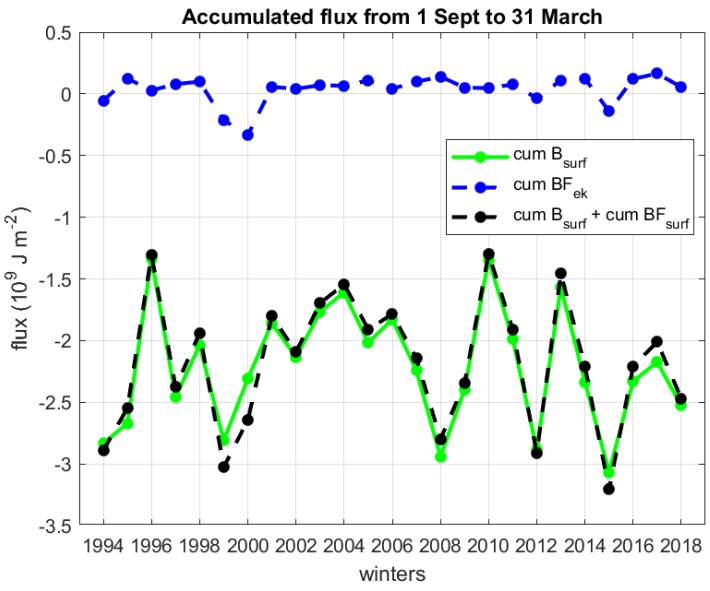


Figure S4. Time series of accumulated (from 1 September to 31 March the year after) buoyancy air-sea flux (B_{surf}) and buoyancy Ekman flux (BF_{ek}) and the sum of both. The year in the x-axes indicates the flux accumulated from 1 September y-1 to March y.

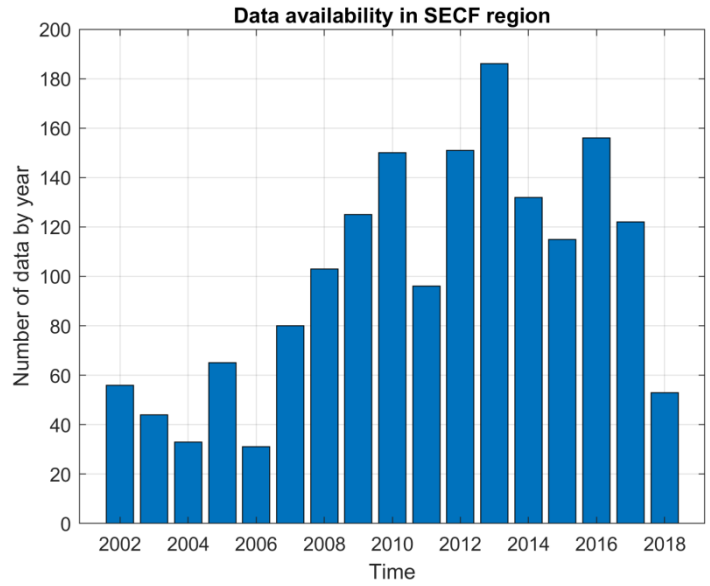
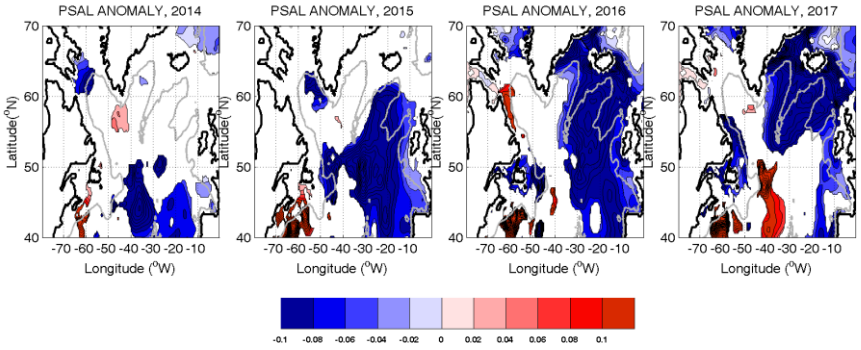


Figure S5. Number of Argo profiles by year used in Figure 5.



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35 **Figure S6**. Annual anomalies of salinity in the surface layer (20 – 100 m) estimated from ISAS
36 database. Reference period: 2002 – 2016. We represented only anomalies larger than one
37 standard deviation of the mean.

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39 **References**

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