Table S1. Selected mooring sites of traditional (Aanderaa) current meters with number of deployments (Depl), total number of days with good data (Days), position and bottom depth (Botm), and magnitude (Speed) and direction (Dir) of the velocity at 40 m depth.

Site	Depl	Days	Position		Botm	Speed	Dir
			Latit.	Longit.	m	cm s^{-1}	°
CF	1	60	61.157	-8.190	119	17.9	134
CW	7	831	61.717	-7.483	148	6.6	340
CS	6	854	61.200	-6.500	140	12.6	166
CE	14	2035	61.788	-6.200	120	12.3	196

Table S2. Selected ADCP sites with number of deployments (Depl), total number of days with good data (Days), position and bottom depth (Botm), and magnitude (Speed), direction (Dir), and stability (Stab) of the velocity at the depth indicated in column "Depth". The stability is the magnitude of the average velocity vector divided by the averaged velocity magnitude for each day so that a completely uni-directional flow (discounting tides) will have a stability of 100%.

Site	Depl	Days	Position		Botm	Depth	Speed	Dir	Stab
			Latit.	Longit.	m	m	cm s^{-1}	°	%
EB	2	456	61.6034	-4.3366	787	200	12.1	202	68
SA	4	1106	61.0000	-5.8567	293	200	3.3	196	48
SB	15	4312	60.7830	-5.3000	786	200	3.2	173	18
SX	2	693	60.8612	-5.4958	546	200	8.9	226	58
SY	3	951	60.7183	-5.0983	897	200	7.4	169	35
SC	16	5003	60.5660	-4.7663	1071	200	7.7	112	33
SD	31*	4519	60.4410	-4.3620	801	200	19.5	67	67
SE	38*	5235	60.2830	-4.3010	447	200	22.7	56	94
ZQ	1	257	60.8335	-6.3925	169	100	5.6	235	55
ZA	2	684	60.3883	-6.1600	417	200	0.5	213	3
ZB	2	599	60.2283	-6.1667	1139	200	9.2	68	42
ZC	1	256	60.0683	-6.1683	1080	200	22.7	92	79
ZE	1	145	59.9060	-6.1670	775	200	16.4	119	79
FG	1	364	61.4710	-8.2208	561	200	8.2	301	43
FB	20	6762	61.4159	-8.2833	809	400	2.6	350	17
FC	15	4007	61.3935	-8.3160	836	300	10.8	126	68

*Includes ADCP data from the North West Approaches Group.

Table S3. Correlation coefficients between weekly averaged along-channel velocities from all pairs of simultaneous ADCP deployments over the Faroese slope. The terms „Upstream" and „Downstream" refer to a flow direction from the FSC towards the FBC. Each deployment is characterized by the site (Figure 2 in manuscript), the selected depth, and the along-channel direction („tow." = „toward"). „Days" indicates the number of values before averaging. None of the correlation coefficients are statistically significant.

Upstream ADCP	Downstream ADCP	Period (yyyymmdd)	Days	Corr. coeff.
EB 193 m tow. 218°	SB 192 m tow. 218°	19990706-20000616	346	+0.22
SB 196 m tow. 218°	ZA 197 m tow. 270°	20110612-20120517	340	+0.00
SB 196 m tow. 218°	ZB 200 m tow. 270°	20110905-20120517	255	+0.03
SB 191 m tow. 218°	FG 192 m tow. 304°	20080608-20090515	341	+0.11
ZA 197 m tow. 270°	FB 417 m tow. 304°	20110613-20120517	339	-0.16
ZA 197 m tow. 270°	FC 376 m tow. 304°	20110613-20120517	339	-0.15
ZA 197 m tow. 270°	FB 346 m tow. 304°	20130608-20140515	341	-0.07
ZA 197 m tow. 270°	FC 342 m tow. 304°	20130608-20140515	341	-0.04

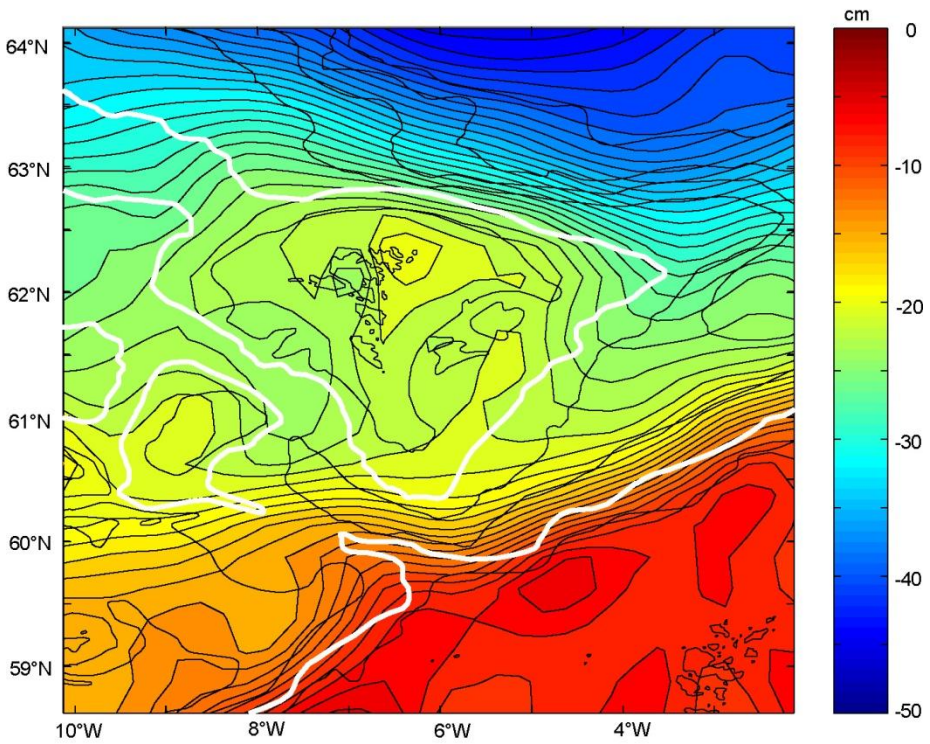

Figure S1. Mean Dynamic Topography (MDT) in the region. The bottom topography is shown by thin black lines with the 500 m bottom contour in white.

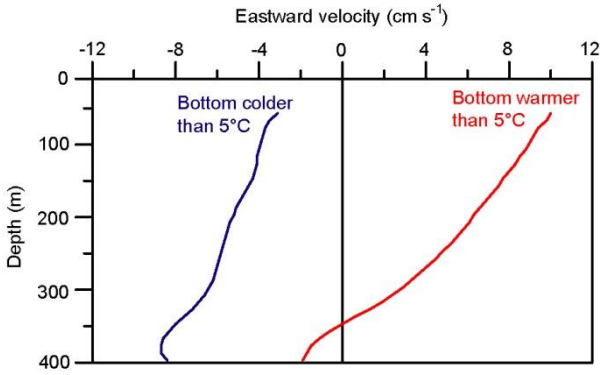

Figure S2. Average velocity profiles at site ZA (bottom depth 416 m) during the two deployments split into periods with bottom temperature below (blue, 389 days) and above (red, 295 days) 5 °C.

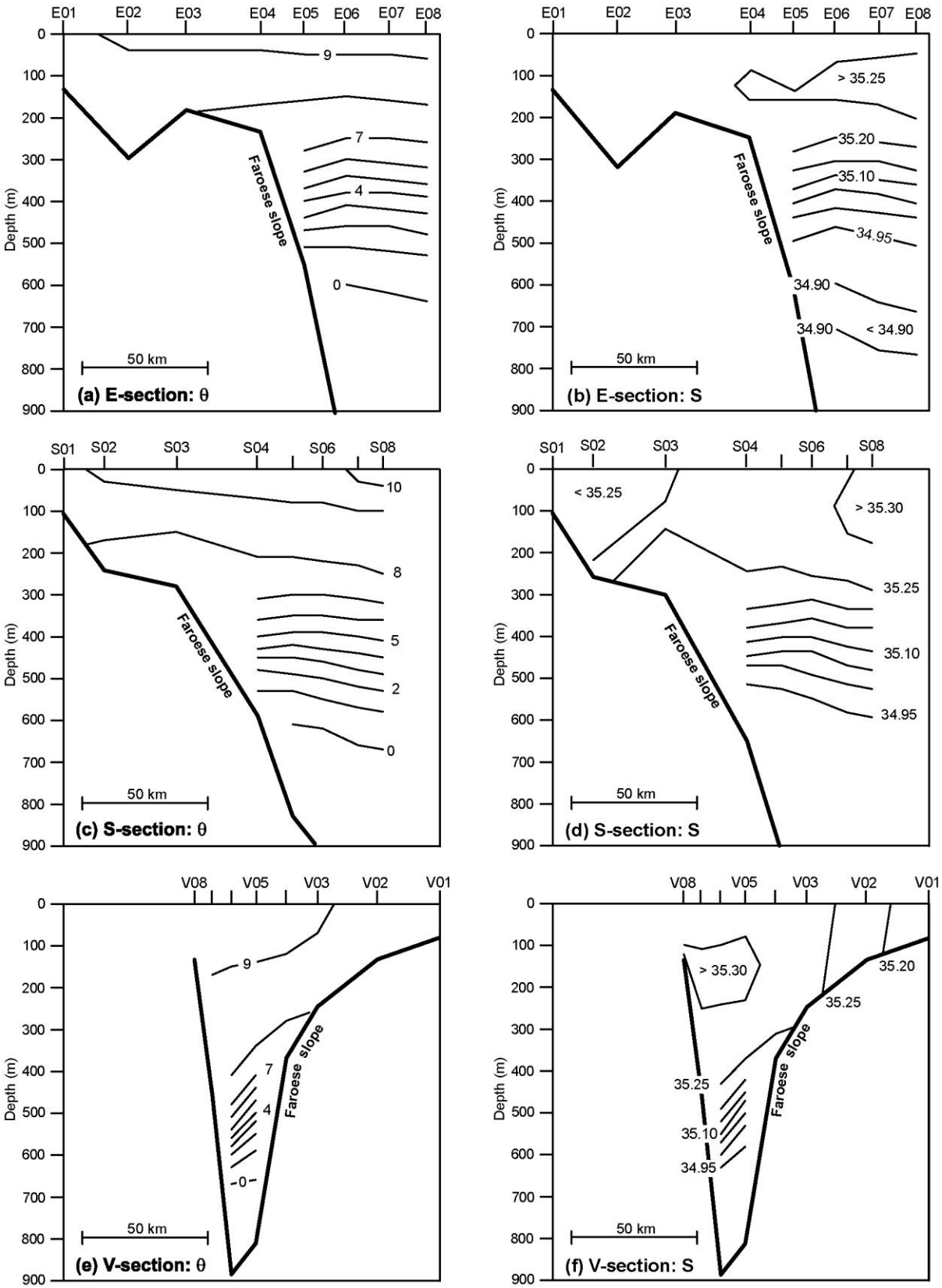

Figure S3. Average distributions of potential temperature (θ, **a**, **c**, **e**) and salinity (S, **b**, **d**, **f**) on three sections (Figure 2a in manuscript) showing the 8 closest standard stations to the Faroes for each section. Based on 47 cruises by R/V Magnus Heinason 1996-2015, on which all three sections were occupied within one week.

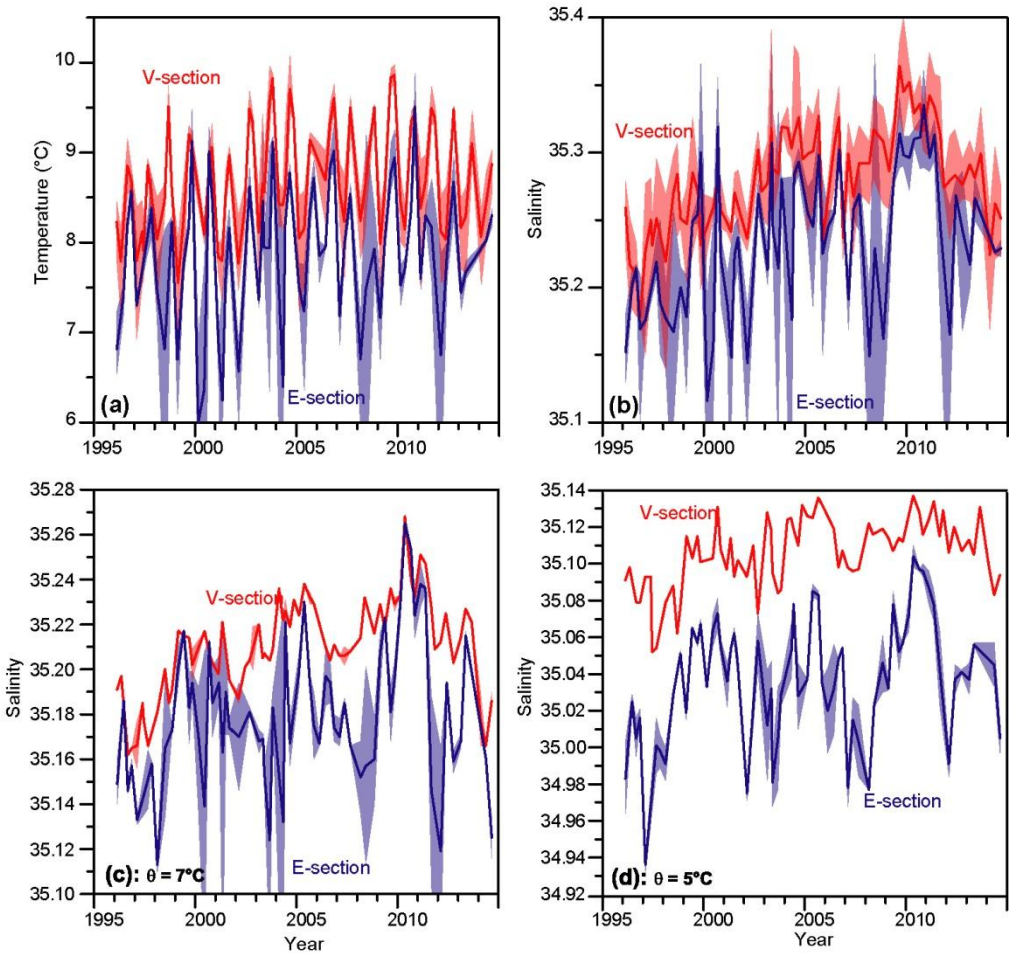

Figure S4. Water mass comparison between water over the Faroese slopes in the FBC (V-section) and the FSC (E-section), respectively (Figure 2a in the manuscript). The top two panels compare temperature (**a**) and salinity (**b**) averaged between 100 m and 200 m depth for three standard stations (V03, V04, V05 with bottom depths 239 m, 354 m, 807 m) on the V-section (red) with three stations (E04, E05, E06 with bottom depths 230 m, 539 m, 988 m) on the E-section (blue). The bottom panels show salinities at fixed potential temperatures 7 °C (**c**) and 5 °C (**d**) for the same stations. In each case, the average of the three stations for each cruise is shown by the thick red/blue line surrounded by a red/blue area indicating the range from minimum to maximum. To enhance visibility of differences, temperatures less than 6 °C and salinities less than 35.1 have been clipped in panels **a**, **b**, and **c**.

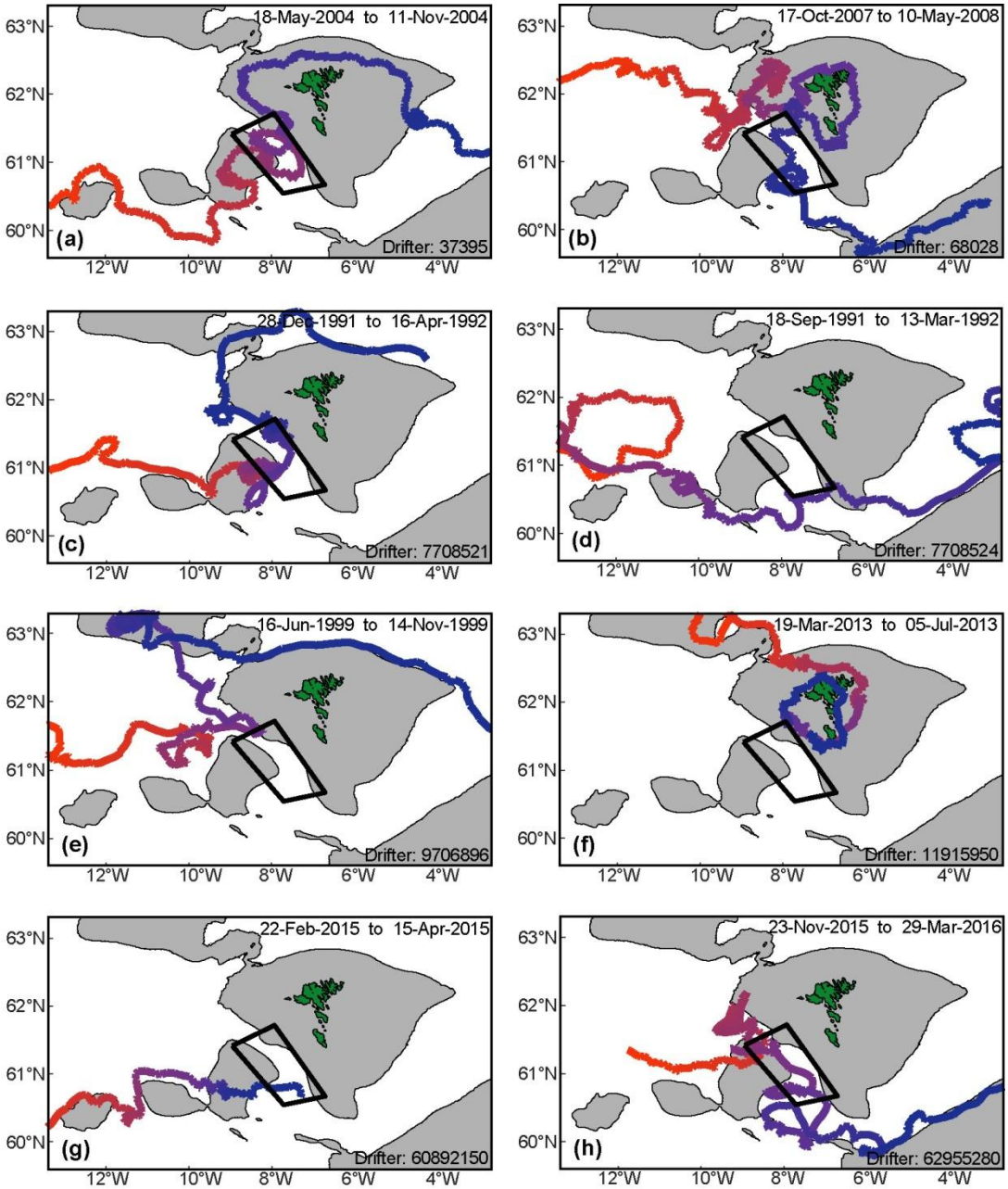

Figure S5. Tracks of all the surface drifters that entered the Faroe Bank Channel, here defined by the black polygon shown on each panel. The tracks are colour-coded with time so that they are red in the beginning, turning to blue at the end.

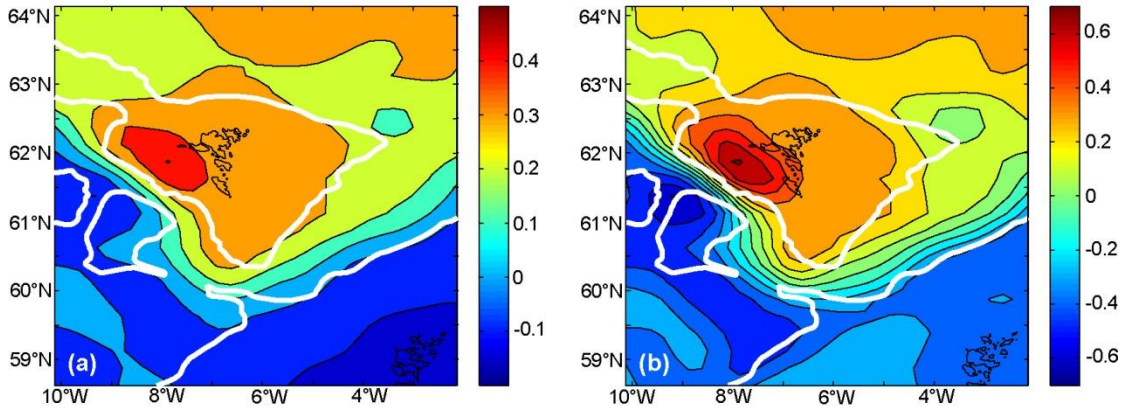

Figure S6. The difference between using SLA and SLA*. **(a)** Correlation coefficient between ΔSLA_{FBC} and SLA at all grid points of the region. **(b)** Correlation coefficient between ΔSLA_{FBC} and SLA* at all grid points of the region.

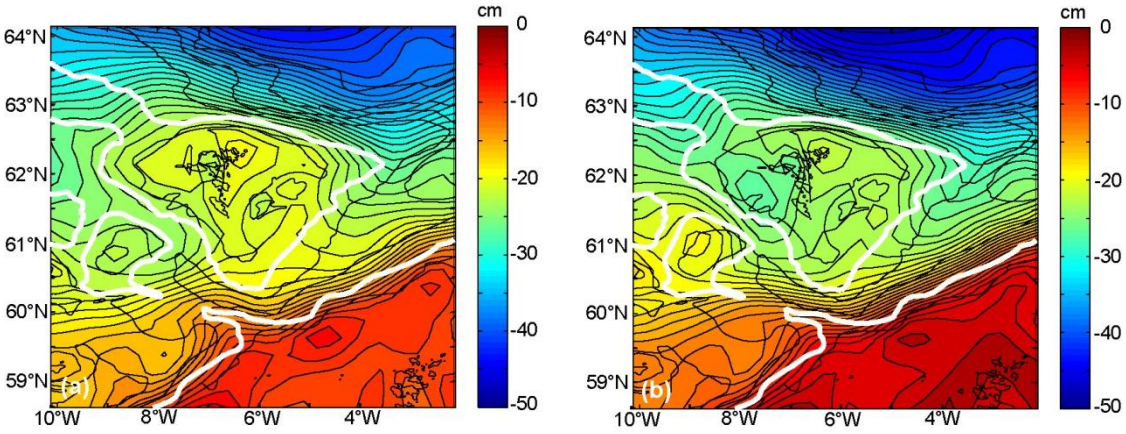

Figure S7. (a) Average MDT+SLA* when $\Delta h_{FBC} \geq +1$ standard deviation. **(b)** Average MDT+SLA* when $\Delta h_{FBC} \leq -1$ standard deviation. The thick white lines indicate the 500 m bottom contour.

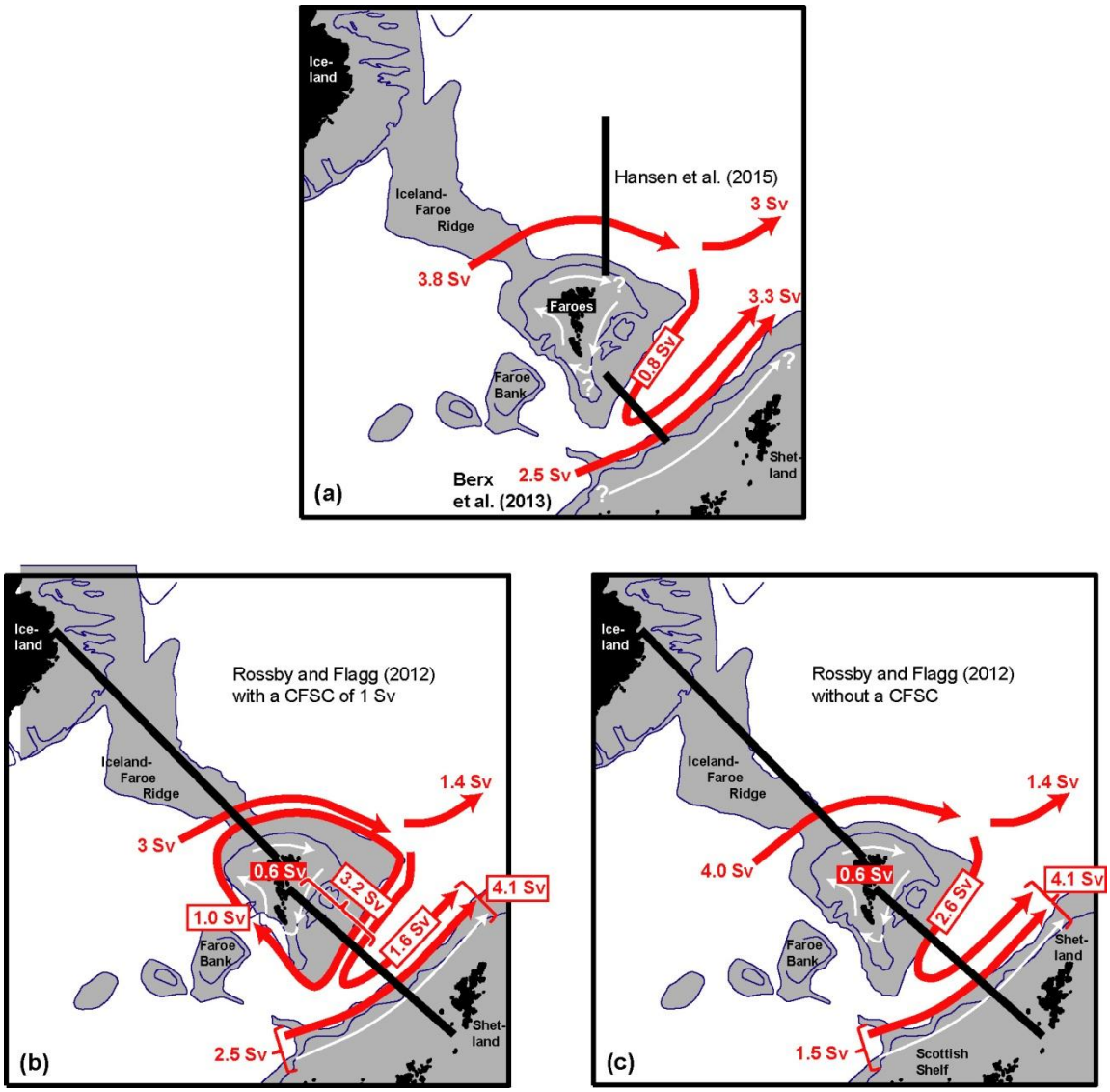

Figure S8. Atlantic inflow between Iceland and Scotland (thick red arrows) March 2008 to March 2011 in three recent studies using two different methods. **(a)** According to Berx et al. (2013) and Hansen et al. (2015). **(b, c)** According to Rossby and Flagg (2012) with (**b**) and without (**c**) a Circum-Faroe Slope Current (CFSC) of 1 Sv. Rossby and Flagg (2012) find a closed circulation on the Faroe Shelf of 0.6 Sv (white arrows), which is not included in the estimates by Berx et al. (2013) and Hansen et al. (2015). In addition, Rossby and Flagg (2012) assume a closed CFSC of 1 Sv (**b**), which implies an inflow to the FSC from the West of 2.5 Sv in close agreement with Berx et al. (2013). Without the CFSC (**c**), the inflow from the West is reduced to 1.5 Sv including flow over the Scottish Shelf that is not included in Berx et al. (2013).