The Faroese Fisheries Laboratory

Fiskirannsóknarstovan

The Front on the Faroe Shelf based on data logged by R/V Magnus Heinason 1999 - 2000

By

Karin Margretha H. Larsen,
Bogi Hansen and Leon Smith

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INTRODUCTION

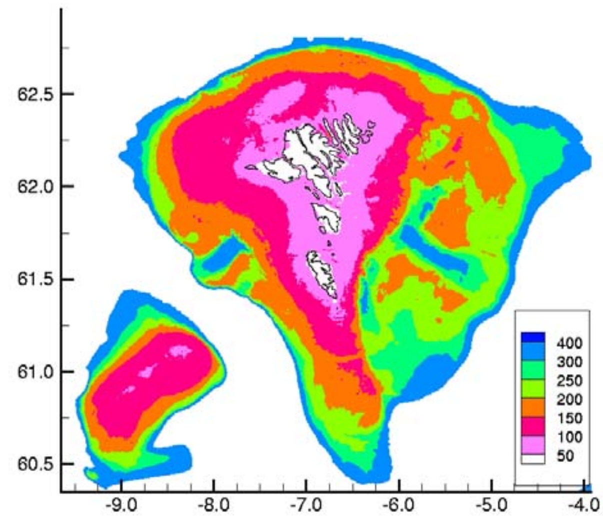


Figure 1. The Faroese plateau and the Faroe Bank.
By courtesy of Knud Simonsen.

The Faroe Islands are located on the Greenland-Scotland Ridge between Iceland and Scotland. They are situated on a plateau/shelf, which is shallower than about 200 meters having a width that is greatly varying around the islands (Figure 1). Because of strong tides, the shelf water is well mixed, while the off shelf water is stratified in the summer season. In winter the cooling is on the other hand more efficient on the shelf. This creates a temperature front on the edge of the shelf. The temperature difference across the front is expected to vary with season, while the location of the front is expected to have a tidal variation, since the strength of the tide determines, how deep a water column can be mixed from surface to bottom. Also the location of the front is expected to vary with topography, since a complex or steep topography can enhance the mixing of the water column.

The water inside the front occupies a special role in the Faroese marine ecosystem (Gaard *et al.*, 2000), and the exchanges of water and various properties across the front are also assumed to be very important from the biological point of view. Acquiring more detailed knowledge about the front is therefore a high priority and here we use surface temperature data measured by a research vessel logging system to map the front. From these observation we have analysed the temperature variation with season. We have looked at the location and width of the front and compared the location to the tidal cycle, topography and season of the year.

DATA MATERIAL AND METHODS

This report documents 92 crossings of the Faroese shelf front by the R/V Magnus Heinason in the period February 1999 – November 2000. The R/V Magnus Heinason is equipped with a logging system logging position, depth, temperature and time. From these data, straight tracks crossing the 50 and 200 meter depth contours and/or tracks with continuously increasing (or decreasing) depth between 50 and 200 meter have been selected.

Quality control and calibration

The logged data have been quality controlled by a standard procedure based upon data variation with time in relation to neighbouring data values (spikes). The editing has been done partly automatically (excluding extreme values) and partly manually using an interactive graphical software package developed by the Faroese Fisheries Laboratory (FFL), based upon MATLAB.

The logged temperature data have been calibrated against CTD data. On cruises where CTD stations were operated, CTD stations showing a homogeneous surface layer, and where the logged temperature at the same time showed a steady temperature, have been selected. In comparing the difference between the CTD temperature and the logged temperature, a few more stations, having a large difference from the mean, were excluded. For the remaining stations, logged temperature was plotted against CTD temperature from a shallow depth (3 to 5 meters) and this showed a linear relationship, Y=AX+B. Figure 2 is an example of such a plot. For all the cruises the coefficient 'A' was constant within +/- 1%. The coefficient 'B' on the other hand showed larger variations, and was determined for each cruise. Since it increased/decreased for large periods at a time, it was assumed constant within each cruise. For cruises without CTD stations, the coefficient 'B' was interpolated linearly from the closest CTD cruises. The calibrated logged temperature will typically have a relative accuracy of about 2%.

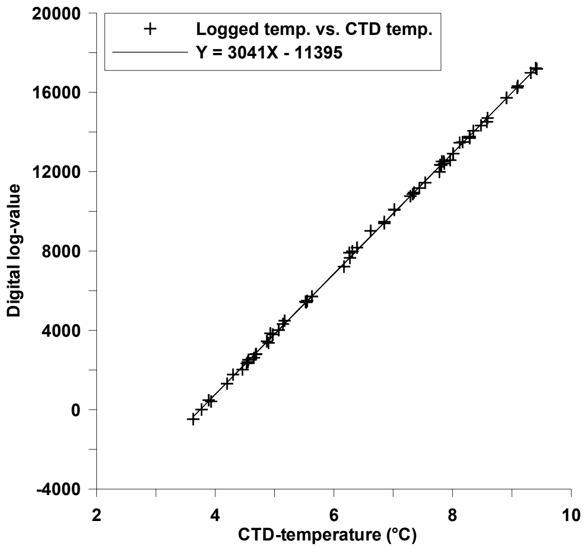


Figure 2. Calibration of logged temperature vs. CTD surface temperature on cruise 9932.

Exponential fit

For all tracks, the temperature has been plotted against depth. Many of these plots show a smooth or S- shaped step variation (see Figure 3 and 4), with temperature increasing with depth. Therefore all plots have been fitted to an exponential function. A Fortran program has been written to make a "least square fit", finding the center depth (D0) of the step and fitting depths shallower than D0 to the function

$$F1(D) = A + B*EXP[C*(D – D0)],$$

while fitting depths deeper than D0 to the function

$$F2(D) = A + 2*B – B*EXP[–C*(D – D0)].$$

For some of the tracks, the program gave a good fit, but for others, the fit was poor because of e.g. irregularities or short tails in the temperature/depth plot. Many of the fittings have thus been adjusted manually. Figure 3 is an example of an exponential fit of the logged temperature, showing the functions F1(D) and F2(D).

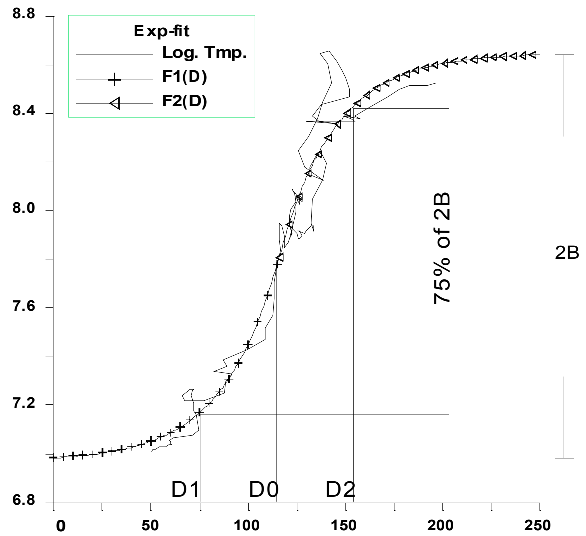


Figure 3. Temperature vs. depth plot and exponential fit of the plot. D0 is center depth of front, D1 and D2 are inner and outer depth at the mid 75% temperature increase.

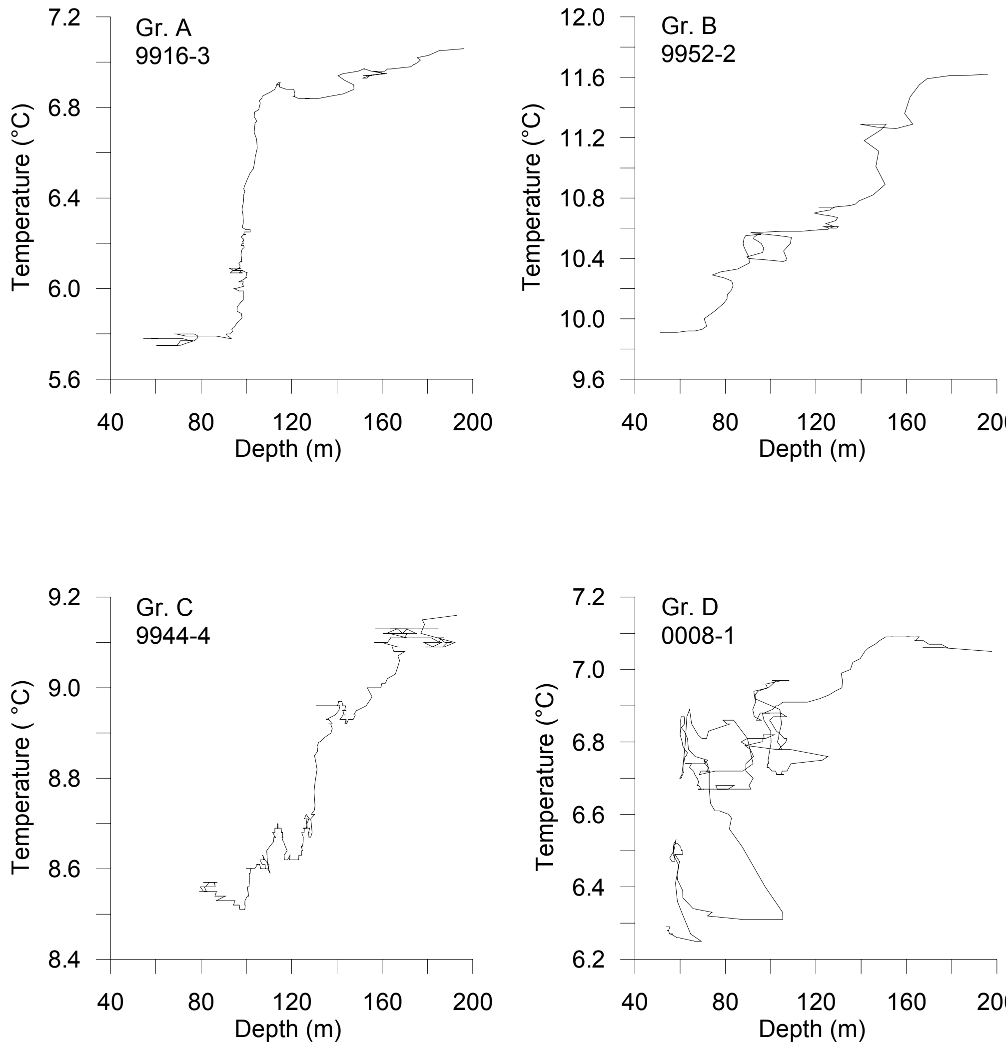
Classification

For further analysis the data have been sorted by data quality and by geographic location. Regarding data quality the tracks are grouped into 4 minor groups where each group has specific demands on the data quality, i.e. the straightness of the track, and the regularity of the temperature change vs. depth. The groups are listed in Table 1, with specification and number of tracks in each group. Figure 4 shows an example of a temperature vs. depth plot for each of the 4 groups.

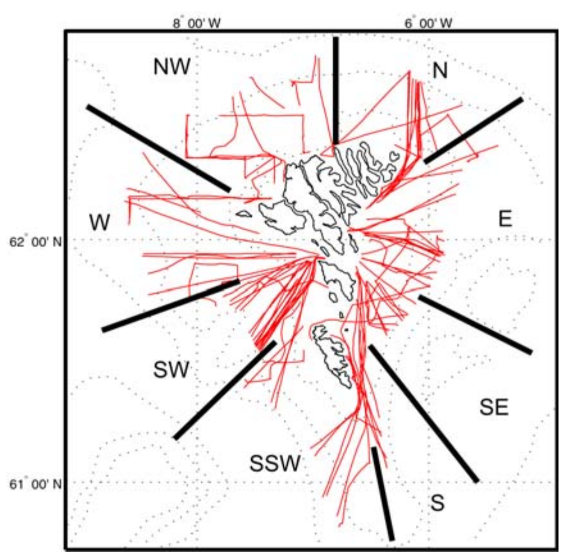
Table 1. The table lists group identity, specification for each group and number of tracks in each group.

Group	Specification	No. of tracks in group
A	1. Track is a straight line 2. Depth is continuously increasing 3. Temperature is continuously increasing	15
B	1. Track is a straight line 2. Temperature vs. Depth plot can have small irregularities 3. Fit of exp. function can be used to estimate mid-depth and width of the front.	27
C	1. Track can have small fluctuations 2. Temperature vs. Depth plot can have irregularities 3. Fit of exp. function can be used to estimate mid-depth of front.	16
D	1. Track can have fluctuations 2. Temperature vs. Depth plot can have large irregularities 3. Can not be fitted with an exp. function	34

The tracks have also been grouped into 8 geographic groups according to track direction from the shelf area and the topography of the shelf. For example north of the Faroes, the shelf is wide and slowly deepening, and covers several track directions. Therefore directions with only few tracks are grouped together with neighbouring directions, if the topography is similar. Figure 5 shows all the tracks covered in this report with lines and letters showing the different geographic groups.



<u>Figure 4.</u> Examples of temperature vs. depth plot from group A, B, C and D respectively. The tracks are randomly chosen within each group.



<u>Figure 5.</u> Trackplot of 92 tracks on the Faroese shelf. Thick lines are separation lines for direction groups. The letters are direction names.
The contour lines on this figure and figure 10 and 12 are from GEBCO 95 and are not as reliable as the contours on figure 1.

RESULTS

Temperature change across the front

In Table 3 is listed the temperature difference between absolute maximum and absolute minimum along the track. This difference is seen to vary from -0.48 to 2.16 degrees. In Figure 6, number of observations of temperature differences greater than 1.0 degree and lower than 0.5 degrees respectively are plotted against the month of observation. The figure shows, that temperature differences greater than 1.0 degrees most often occur from March to June, while temperature differences less than 0.5 degrees are most common from September to February.

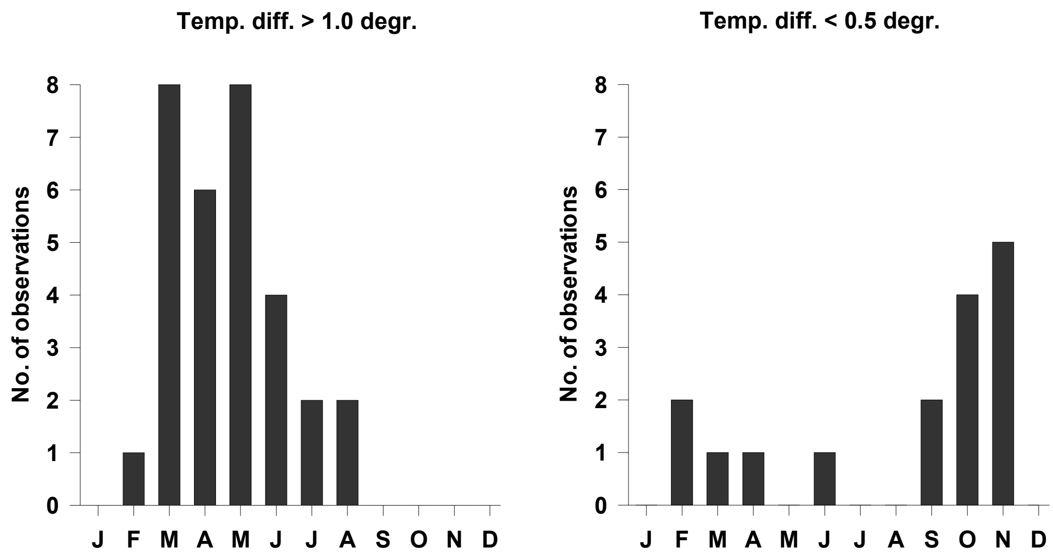


Figure 6. The left plot shows number of observations vs. month, where the cross frontal temperature difference exceeded 1.0 degree. Only crossings of type A, B and C are included. The right plot shows number of observations vs. month, where the temperature difference was less than 0.5 degrees. Here most observations are of type D, and only one, which did not have a straight track, was excluded.

Location of the front

For 7 directions the mean D0 depth (center of the front) is calculated for all tracks in group A, B and C (direction S is excluded because of few tracks in these groups). These are listed in Table 2 along with the mean D1 and D2 depths, which are a measure for the inner and outer edge of the front (see "Width of the front")

Table 2. The table lists for 7 directions the calculated mean for depths D0, D1 and D2 and their respective standard error. For D0 all tracks in group A, B and C are used, while only tracks from group A and B are used for calculation of the mean of D1 and D2. Also listed are the difference between D1 and D2 and the number of tracks included in the calculations of D0, D1, and D2.

Direc-tion	Mean D0 (m)	Std. Err. for D0	Mean D1 (m)	Std. Err for D1	Mean D2 (m)	Std. Err for D2	D2-D1	No. of tr. D0	No. of tr. D1, D2
E	105	5	47	12	149	12	102	13	10
SE	87	3	52	12	108	8	56	8	6
N	114	6	70	10	164	18	94	8	6
NW	104	4	90	1	113	1	23	6	2
SW	141	6	103	16	177	10	74	10	8
SSW	163	6	153	10	203	12	50	6	4
W	153	8	111	15	178	16	67	5	4

To investigate a possible frontal movement with the neap-spring cycle, normalised depth anomaly from 58 tracks from groups A, B and C have been plotted in Figure 7 against the cube of the velocity averaged over the last 7 days before the event (including the day of the event). Since the mean depth is varying for each direction, the depth is normalised according to its direction. The velocity is a prediction calculated from an Aanderaa Current Meter time series – deployment 2985_010 (FFL, Technical Report No. 99-01). The time series is of approx. 6½ months duration and is made on a northwesterly location on the Faroese shelf. The correlation coefficient is calculated for this plot, and is only 0.06, and thus not significant.

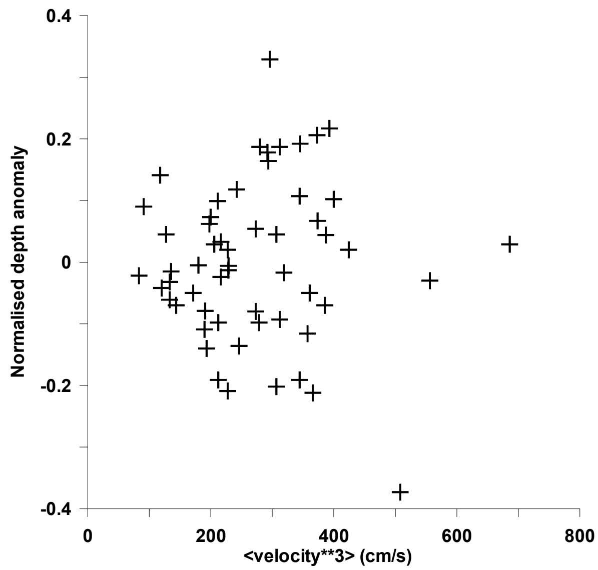


Figure 7. Normalised depth anomaly vs. the cube of predicted velocity averaged over 7 days. The predicted velocity is first calculated every 12 minutes. These values are cubed. Then the average for the day of the track and 6 days before the track is calculated. For normalising the depth, the mean depth in each direction is calculated. The normalised depth anomaly is then the actual depth minus mean depth divided by the mean depth for the actual direction. All tracks (58) from group A, B and C are included.

The same procedure has been made on 42 tracks from the months March, April, May and June when the temperature difference across the front is most pronounced. The depths have been renormalised to include these 42 tracks only, and are again normalised according to their direction. These results are plotted in Figure 8 and the calculated correlation coefficient for this plot is 0.09, so there is again no significant correlation.

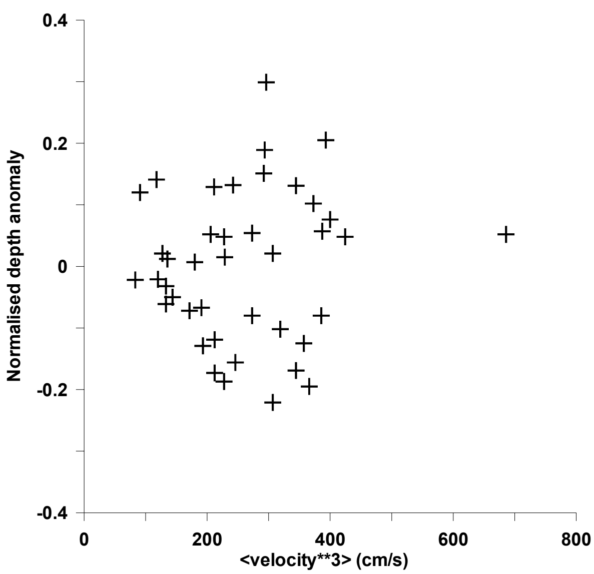


Figure 8. All tracks (42) from group A, B and C in the months March, April, May and June are included. For explanation of calculating the averaged velocity and normalised depth anomaly see text for Figure 7.

Width of the front

As an indication of the width of the front, the depths corresponding to the middle 75% of the exponential fit was found. These depths are shown as D1 and D2 on Figure 3. For this estimation only tracks in groups A and B are included. In these groups, the temperature profile is estimated to be good enough to also to fit the 'tails' of the exponential functions. Table 2 lists the mean of D1 and D2 for each direction.

DISCUSSION

Temperature change across the front

Figure 6 showed, that great temperature differences are most common in the spring. This might arise from that the shelf water is more effectively cooled during winter and early spring, while the offshelf surfacewater is more effectively warmed during spring, thus generating a large temperature difference across the front.

From the exponential fit, the B coefficient multiplied by 2 is an estimate for the temperature difference across the front (Figure 3). In Figure 9 this is plotted against month for all tracks in group A and B. We again find, that the largest differences occur from early spring to summer and are not found in the winter season, while small differences are most common from late summer and can occur until next spring.

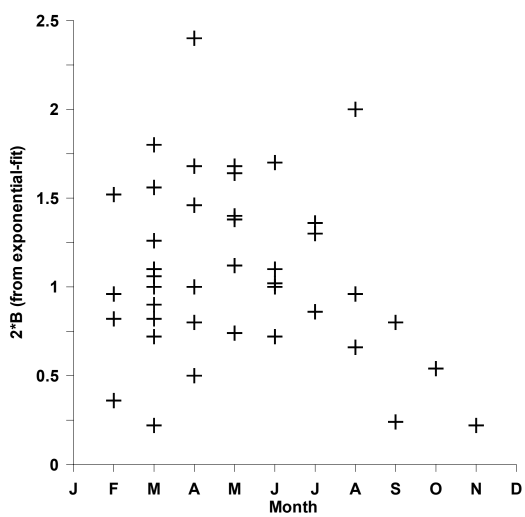


Figure 9. 2*B coefficient from exponential fit vs. month of observation. All tracks (42) in group A and B are included.

Location and width of the front

The location of the front according to depth is listed in Table 2 for 7 directions. It shows, that the center depth, D0, is much deeper for the 3 directions west, southwest and southsouthwest than for any other direction. For the two southern directions this probably is because of the narrow shelf at this location. Since the flow around the shelf is clockwise this might influence the location of the front at direction west, although the shelf is wider there. On the other hand the shelf is also narrow in the southeast direction, but here we find the shallowest center depth for the front.

In Table 2 is also listed the width of the front as D2-D1, that is: a depth range, which the front is covering. The smallest depth range is found in the direction northwest, which also is the widest and flattest area of the shelf. The largest depth ranges are found in the north and east directions, and these directions have the most continuously increasing bottom depth without large steps in the topography, that is covered by the tracks.

An example of the changing location of the front is from a Standard Hydrographic cruise – cruise 9940. On this cruise 4 standard sections are made, and on the standard section N at longitude 6° 05W we have 2 tracks that are almost the same (see Figure 10: the north and south going track), but with about 24 hours interval. Figure 11 shows the temperature vs. depth plot from these tracks, and we see, that on the first track (9940_3), the front is centred around 92m depth (Table 3) and on the second track (9940_4) the front is centred around 116m depth. From the ships logged position we have found, that there are 10 km between these locations. So one might wonder which mechanism has caused this large shift in position. One possibility is that the tidal currents have had a net northward component in this period. About 30km north of the front the FFL had an ADCP deployed at this time. From the ADCP data at 100m depth the tidal current (after subtraction of the mean southward current component) integrated over the time between the passing of the center of the front was only 18mm/s, directed northwards. Multiplied with the ADCP's record interval time, this only gives a northward shift of a few meters. On the other hand the ADCP data show, that the mean current on the days of the tracks was about 70% larger than the 2 days before the tracks. At this location the current has a very steady direction at around 100°, and thus has a strong easterly component. It is therefore possible that the increased speed has shifted the shelfwater eastwards from the plateau located west of the tracks (see Figure 10 or 1).

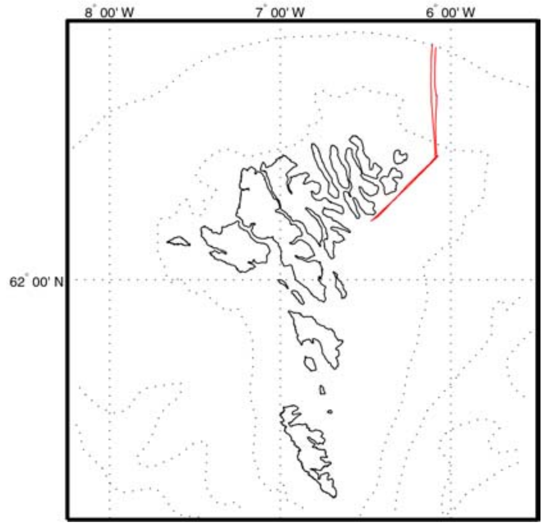


Figure 10. Trackplot of track 9940_3 and 9940_4

Another possibility is the wind. In the beginning of the northward section, the wind was approx. 2m/s from southeast. In the middle of the period the wind had increased to 10m/s from southeast and then remained unchanged for the rest of the period. According to the Ekman theory the surface layer is directed 45° to the right of the wind direction. We can therefore assume, that the surface layer has increased its northward component in the period of observation, but presumably not enough to have caused the shift in front location alone.

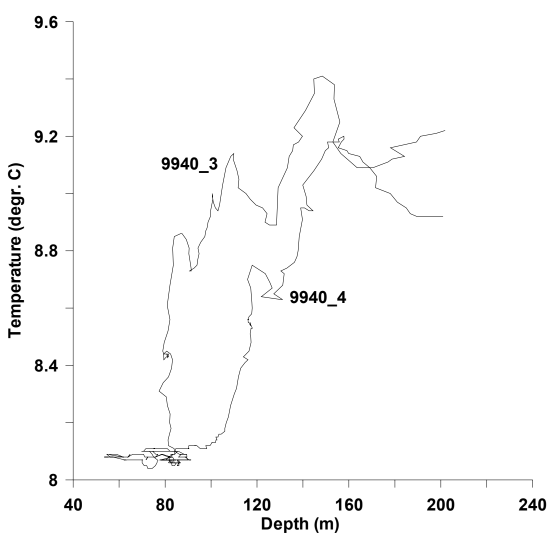


Figure 11. Temperature vs. depth from track 9940_3 and 9940_4

Irregular features

Some of the tracks have fairly smooth and regular temperature profiles, while others have irregular temperature profiles with changing temperature. Some of these profiles show that the temperature oscillates over the whole temperature range. These features are most likely to be meanders or eddies, but might also arise from tracks, which are not straight. In Table 3 is listed, which tracks have large meanders (LM: full temperature range) and small meanders (SM: less than half temperature range). It is also seen, that most of these tracks, which also have a straight track, are located at direction SW and SSW. All the other directions have only 1 or 0 tracks with both a large meander and straight track. Figure 12 shows the tracks of 6 events from the directions SW and SSW, while Figure 13 is the temperature vs. depth plot for one of these events. It is seen in Figure 12, that these tracks are all directed toward the 'Skeivi Banki', which is an area with quite complex topography. It is therefore reasonable to think, that these meanders are generated by the topography.

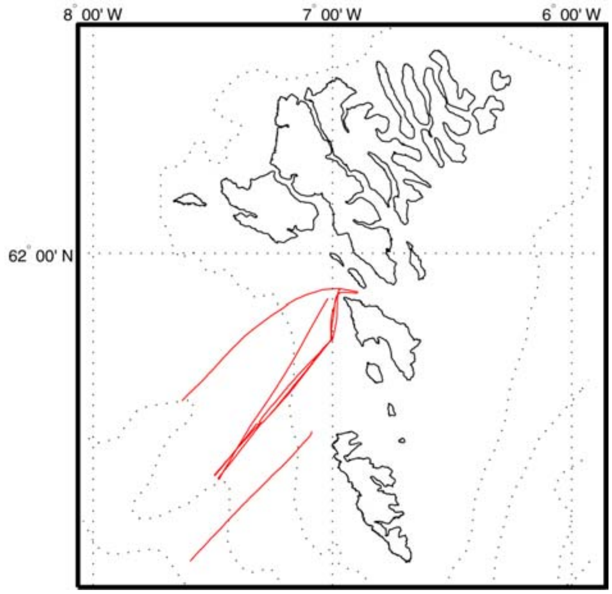


Figure 12. Trackplot of 6 tracks with large meanders.

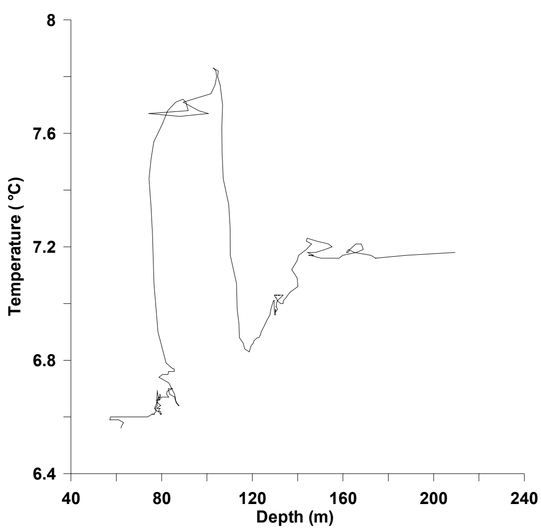


Figure 13. Temperature vs. depth plot of track 0032-1.

References

Gaard, E., Hansen, B., Olsen, B. and Reinert, J. 2000. Ecological features and recent trends in physical environment, plankton, fish stocks and sea birds in the Faroe plateau ecosystem. K. Sherman & H-R Skjoldal (eds.). Changing states of the Large Marine Ecosystems of the North Atlantic.

Hansen, B. and Larsen, K. M. H., 1999. Traditional Current Meter Observations in Faroese Offshore Waters 1977 - 1994. The Faroese Fisheries Laboratory. Technical Report 99-01.

Table 3. List of all tracks included in the report. “Cruise” is the R/V Magnus Heinason cruise number, where the first 2 digits indicate the year. “No.” is a tally for observed front-track on the cruise. “Day” and “Month” are date of track. “DIR” is direction of track (see. Classification). “Track Straight” is an indication of how straight the track is. “Depth Cont. inc.” is an indication of whether the depth is continuously increasing along the track. The column “Temperature” has 5 sub-columns describing the temperature: “Cont. inc.” indicates whether the temperature is continuously increasing with depth; “Steep inc.” indicates whether there is a steep temperature increase with depth. A number in the cell is depth in meters where the steep increase occurs; “Incl. LM” and “Incl. SM” indicates if there are large meanders or small meanders respectively on the temperature vs. depth plot; “Max. diff.” is maximum temperature difference across the front – it is negative if the on shelf water is warmer than the off shelf water. “Group” indicates quality classification (see Classification). The remaining columns are all describing the exponential fit, where “Fitting” tells whether the exponential fit is done automatically or manually. For description on the last 6 columns see: Exponential fit.

					Track	Depth	Temperature											D1	D2
Cruise	No.	Day	Month	DIR	Straight	Cont. inc.	Cont. inc.	Steep inc.	Incl. LM	Incl. SM	Max. diff.	Group	Fitting	A	B	C	D0	75%	75%
0008	4	1	3	E	+	(-)	(-)	-	-	+	0,92	B	manual	6,00	0,50	0,030	110	27	172
0032	2	11	5	E	(+)	+	+	-	-	+	1,65	A	automatic	6,97	0,84	0,035	116	76	155
0032	3	13	5	E	+	-	(-)	-	-	(+)	1,77	B	automatic	6,97	0,82	0,054	91	65	116
9908	1	21	2	E	-	(-)	(-)	-	-	-	0,65	C	manual	6,30	0,40	0,050	66		
9912	5	1	3	E	+	(+)	(+)	-	-	+	0,82	B	manual	5,95	0,45	0,030	95	3	142
9912	6	3	3	E	+	-	(-)	-	-	(+)	0,85	B	manual	5,95	0,41	0,040	110	0	168
9912	7	3	3	E	+	(+)	+	+ 80/90	-	+	1,18	A	automatic	5,78	0,55	0,099	84	69	98
9928	6	27	4	E	-	(-)	(+)	+ 100	-	(+)	1,11	D							
9932	2	6	5	E	+	+	(+)	+ 90	-	-	1,05	D							
9936	2	2	6	E	+	(+)	(+)	-	-	(+)	0,85	B	automatic	7,83	0,36	0,050	124	96	151
9936	4	9	6	E	+	(+)	+	-	-	(+)	0,63	C	manual	7,70	0,40	0,015	100		
9940	1	11	6	E	+	(-)	(-)	-	-	+	0,90	D							
9944	2	22	6	E	(+)	(-)	-	-	-	+	0,62	D							
9944	3	22	6	E	(-)	-	(+)	-	-	+	0,45	C	manual	8,55	0,25	0,050	140		
9948	3	5	7	E	+	(+)	+	-	-	-	1,14	B	manual	8,78	0,65	0,030	95	0	133
9952	2	6	8	E	+	+	+	-	-	(+)	1,71	B	manual	9,80	1,00	0,025	125	48	233
9956	2	15	8	E	-	(-)	-	-	+	-	0,99	D							
9976	1	25	9	E	+	(+)	(+)	-	-	-	0,25	B	manual	10,11	0,12	0,200	113	85	124
0012	1	9	3	SE	(-)	(-)	(+)	-	-	-	0,85	C	automatic	5,91	0,40	0,042	106		
0026	1	19	4	SE	+	(+)	(+)	+ 80	-	-	0,47	A	automatic	5,87	0,25	0,120	77	65	88
0026	2	24	4	SE	+	(+)	(+)	(+ 80)	-	+	0,69	A	automatic	5,90	0,40	0,029	81	33	128
9912	1	27	2	SE	+	+	+	(+ 60)	-	-	0,89	B	manual	5,90	0,48	0,050	90	0	133
9912	2	27	2	SE	(+)	(+)	(+)	-	-	-	0,27	C	manual	6,60	0,14	0,060	85		
9936	3	2	6	SE	+	+	-	-	+	-	0,32	D							
9950	1	30	7	SE	+	+	(+)	+ 80/90	-	-	0,90	A	automatic	9,69	0,43	0,120	86	74	97
9952	1	6	8	SE	(+)	(+)	(+)	+ 80	-	-	1,07	A	automatic	9,72	0,48	0,097	79	64	93
9956	1	13	8	SE	+	+	+	-	-	-	0,76	A	automatic	9,89	0,33	0,083	93	76	109

Table 3. Continued.

					Track	Depth	Temperature										D0	D1	D2
Cruise	No.	Day	Month	DIR	Straight	Cont. inc.	Cont. inc.	Steep inc.	Incl. LM	Incl. SM	Max. diff.	Group	Fitting	A	B	C	D0	75%	75%
0028	1	29	4	N	+	+	(-)	-	-	+	0,80	C	manual	6,00	0,43	0,120	124		
0032	4	25	5	N	(+)	+	(+)	-	-	(+)	1,37	A	automatic	6,93	0,69	0,045	116	85	146
0032	5	25	5	N	-	+	(+)	-	-	(+)	1,28	C	manual	7,10	0,60	0,050	90		
9908	2	24	2	N	+	+	(-)	(+ 90)	-	+	1,44	D							
9916	1	12	3	N	+	+	(-)	-	-	+	1,37	B	manual	5,70	0,78	0,025	112	29	174
9932	3	6	5	N	(+)	+	-	(+)	+	-	0,83	D							
9932	4	25	5	N	(+)	+	(-)	-	-	+	1,18	B	manual	7,40	0,70	0,030	125	55	218
9940	3	13	6	N	(+)	+	(+)	+ 80	-	+	1,35	A	automatic	8,06	0,55	0,100	92	78	105
9940	4	14	6	N	(+)	+	+	-	-	(+)	1,16	A	automatic	8,02	0,50	0,074	116	97	134
9948	1	3	7	N	+	+	+	-	-	-	1,27	B	manual	8,68	0,68	0,035	135	73	206
9964	1	10	9	N	(+)	+	-	-	-	-	-0,06	D							
9988	2	9	11	N	(+)	(+)	-	-	-	+	-0,48	D							
0008	1	25	2	S	(+)	-	-	-	-	+	0,84	D							
0008	2	25	2	S	+	(+)	(-)	-	-	+	0,35	B	manual	6,67	0,18	0,070	160	147	186
0016	1	17	3	S	+	(+)	(-)	-	-	+	0,63	D							
0016	4	18	3	S	(+)	-	-	(+ 60)	+	-	0,45	B	manual	6,25	0,11	0,200	112	98	191
9992	1	12	11	S	+	-	-	-	-	+	0,15	D							
0028	2	30	4	NW	(+)	(+)	(+)	+ 100/110	-	(+)	1,69	B	manual	6,25	0,84	0,150	102	90	113
0032	6	28	5	NW	(+)	(+)	(+)	-	-	-	1,66	C	manual	6,98	0,68	0,056	119		
9916	2	16	3	NW	-	(+)	(-)	+ 95	(+)	-	1,16	C	manual	6,20	0,60	0,200	98		
9916	3	16	3	NW	(+)	(+)	+	+ 100	-	-	1,31	A	automatic	5,71	0,63	0,120	101	89	112
9928	3	25	4	NW	-	(+)	(+)	+ 110	-	(+)	1,62	C	automatic	6,26	0,87	0,120	110		
9928	4	25	4	NW	-	(+)	-	+ 95	-	+	1,41	C	manual	6,50	0,50	0,200	96		
9928	5	26	4	NW	+	(+)	-	+ 100	+	-	1,18	D							
9944	1	20	6	NW	-	-	-	+ 110	+	+	0,94	D							
0008	3	26	2	SW	+	(+)	-	+ 90	-	+	0,93	D							
0016	6	22	3	SW	(+)	+	-	+ 150	-	+	0,84	D							
0020	1	30	3	SW	+	(+)	(+)	-	-	-	1,14	B	automatic	6,37	0,53	0,065	135	113	156
0020	2	4	4	SW	+	+	+	-	-	(+)	0,83	B	manual	5,90	0,50	0,020	145	13	212
0024	2	17	4	SW	+	+	(+)	(+ 150)	-	-	1,33	B	manual	5,95	0,73	0,030	140	114	207
0032	1	6	5	SW	(+)	(+)	-	+ 80/110	+	-	1,27	D							
0068	1	15	9	SW	+	+	-	+	+	-	1,11	D							

Table 3. Continued.

					Track	Depth	Temperature											D1	D2
Cruise	No.	Day	Month	DIR	Straight	Cont. inc.	Cont. inc.	Steep inc.	Incl. LM	Incl. SM	Max. diff.	Group	Fitting	A	B	C	D0	75%	75%
9912	4	1	3	SW	(+)	+	+	-	-	-	0,75	A	automatic	6,05	0,36	0,037	114	76	151
9916	4	26	3	SW	+	+	+	-	-	-	1,16	A	automatic	5,94	0,55	0,048	111	82	139
9924	2	20	4	SW	+	+	-	-	-	-	0,61	C	manual	6,35	0,30	0,060	145		
9932	1	1	5	SW	+	+	(+)	+ 170	-	-	0,92	B	manual	6,80	0,37	0,150	164	123	204
9940	2	13	6	SW	+	+	+	+ 160	-	-	1,10	A	automatic	8,48	0,51	0,120	156	144	167
9944	4	26	6	SW	-	(+)	+	-	-	-	0,65	C	automatic	8,51	0,30	0,056	131		
9944	5	29	6	SW	+	+	-	+ 150	-	+	1,33	D							
9960	1	29	8	SW	+	+	(-)	-	(+)	-	0,85	D							
9964	2	14	9	SW	(+)	+	-	(+ 160)	(+)	-	0,51	D							
9972	1	17	9	SW	+	+	(-)	+ 170	-	(+)	0,76	B	manual	9,76	0,40	0,300	168	156	179
9984	2	29	10	SW	+	+	-	-	-	-	-0,11	D							
9984	3	29	10	SW	+	+	-	-	-	-	-0,07	D							
0016	2	17	3	SSW	(+)	-	(-)	(+ 150)	-	+	0,79	C	manual	6,26	0,35	0,200	150		
0016	3	18	3	SSW	(-)	-	(-)	(+ 140)	-	+	1,12	C	manual	6,24	0,50	0,200	140		
0024	1	6	4	SSW	+	(+)	+	-	-	-	2,16	B	manual	6,20	1,20	0,040	170	126	225
0036	1	1	6	SSW	+	(+)	-	+ 180	-	-	1,69	B	manual	7,45	0,85	0,150	182	172	195
9912	3	28	2	SSW	(+)	+	(-)	+ 170	-	+	1,61	B	manual	6,35	0,76	0,100	173	162	217
9924	1	10	4	SSW	+	-	(-)	-	-	(+)	1,49	D							
9928	1	23	4	SSW	(+)	(+)	+	-	-	+	0,96	D							
9936	1	28	5	SSW	+	(+)	(-)	+ 160	-	+	1,19	B	manual	7,50	0,56	0,120	162	150	173
9950	2	3	8	SSW	+	-	-	-	+	+	1,51	D							
9984	1	22	10	SSW	+	(+)	-	(+ 180)	(+)	-	0,29	D							
9992	2	15	11	SSW	+	-	-	-	-	+	-0,22	D							
0004	1	11	2	W	+	(+)	-	+ 140	-	+	0,86	B	manual	6,95	0,41	0,150	145	135	158
0028	3	1	5	W	-	-	-	+ 110	+	-	1,93	D							
0072	1	3	10	W	+	+	+	+ 150	-	-	0,56	A	automatic	10,06	0,27	0,100	148	134	161
0084	1	2	11	W	+	(+)	-	-	-	+	0,20	D							
9912	8	9	3	W	+	+	(+)	-	-	+	1,63	B	manual	5,80	0,90	0,030	150	71	226
9928	2	24	4	W	(+)	(+)	-	+ 180	-	+	1,46	C	manual	6,80	0,60	0,300	184		
9948	2	3	7	W	+	(+)	-	-	-	+	1,43	D							
9960	2	30	8	W	-	-	-	-	+	-	1,04	D							
9976	2	6	10	W	+	(+)	-	-	-	+	0,28	D							
9988	1	5	11	W	+	(+)	(+)	-	-	(+)	0,21	B	automatic	9,18	0,11	0,043	136	103	168