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Cruise Report
POSEIDON 303

Reykjavik - Tórshavn – Galway
11. 09. – 23.09. – 24.09. – 06.10.2003
Technical Report 2-03

Painted by Kari Guddal on Poseidon cruise 303

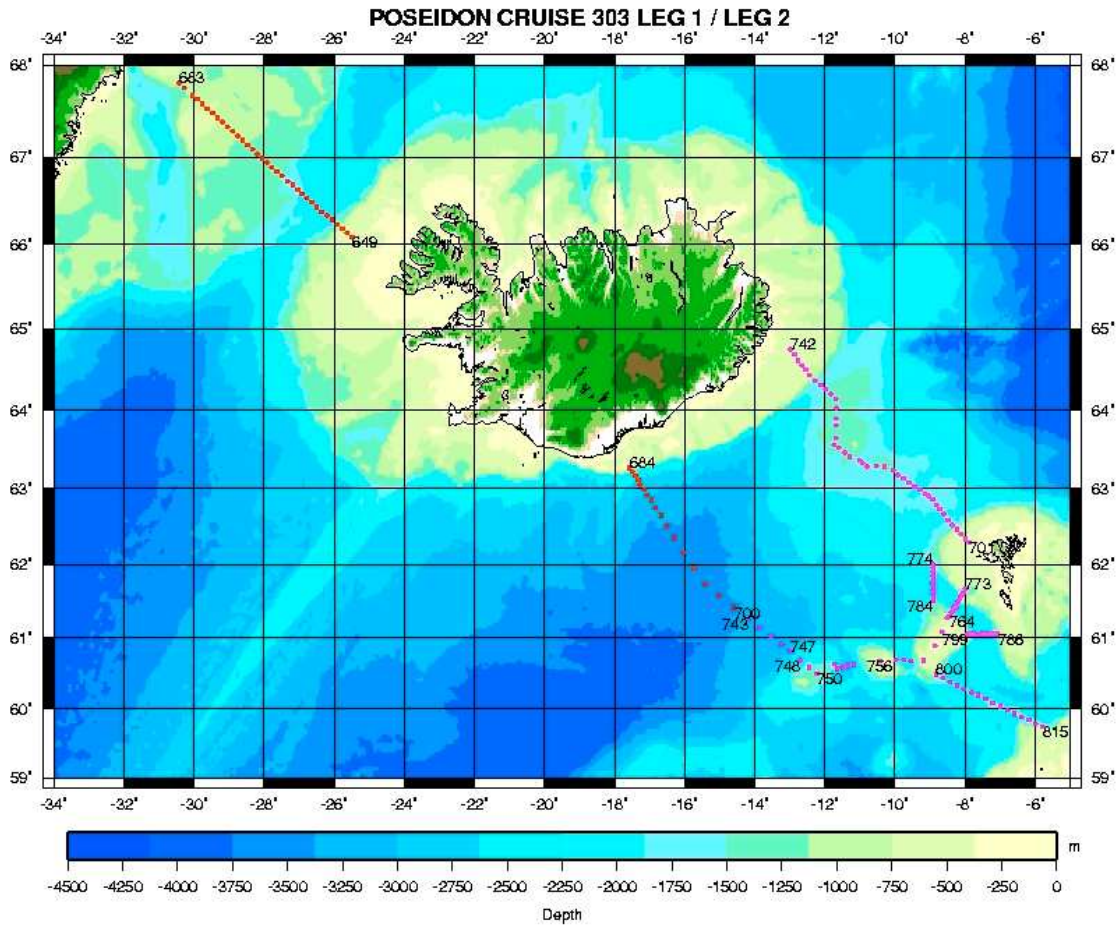

Figure 1: Overview over the measurements carried out during Leg 1 (red dots) and Leg 2 (magenta dots) of POSEIDON cruise 303.

List of CTD / lADCP Stations POSEIDON 303/1

Station	Date	Time (UTC)	φ (°N)	φ (‘N)	λ (°W)	λ (‘W)	Depth (m)	Max. pressure	Instrument	Region
649	14.09.2003	18:12	66	5.28	25	29.94	182	158.5	-	DS
650	14.09.2003	19:19	66	7.98	25	38.04	179	167.9	-	DS
651	14.09.2003	20:25	66	11.1	25	46.32	173	172.0	-	DS
652	14.09.2003	21:34	66	14.16	25	54.96	368	359.4	+	DS
653	14.09.2003	20:50	66	17.1	26	4.26	541	533.3	+	DS
654	15.09.2003	00:19	66	20.04	26	12.24	617	593.8	+	DS
655	15.09.2003	01:44	66	22.74	26	22.26	640	625.7	+	DS
656	15.09.2003	02:57	66	25.74	26	30.54	596	579.8	+	DS
657	15.09.2003	04:14	66	28.92	26	38.82	514	500.4	+	DS
658	15.09.2003	05:54	66	32.1	26	47.76	518	499.1	+	DS
659	15.09.2003	07:03	66	34.98	26	55.5	500	485.4	+	DS
660	15.09.2003	08:26	66	38.04	27	3.12	452	437.5	+	DS
661	15.09.2003	09:37	66	40.98	27	11.88	409	388.7	+	DS
662	15.09.2003	10:42	66	43.38	27	20.58	385	363.6	+	DS
663	15.09.2003	12:10	66	47.04	27	29.46	362	350.0	+	DS
664	15.09.2003	13:16	66	49.92	27	38.64	363	353.4	+	DS
665	15.09.2003	14:20	66	52.92	27	47.46	366	350.5	+	DS
666	15.09.2003	15:22	66	56.04	27	55.44	367	350.7	+	DS
667	15.09.2003	16:29	66	59.1	28	3.84	358	346.7	+	DS
668	15.09.2003	17:34	67	1.86	28	11.64	351	340.0	+	DS
669	15.09.2003	18:43	67	4.92	28	20.1	344	333.5	+	DS
670	15.09.2003	19:49	67	7.8	28	28.92	335	322.0	+	DS
671	15.09.2003	20:35	67	11.04	28	37.14	293	281.5	+	DS
672	15.09.2003	21:52	67	13.8	28	45.6	261	242.4	+	DS
673	15.09.2003	22:52	67	16.92	28	54.06	283	271.2	+	DS
674	15.09.2003	23:54	67	19.74	29	2.64	249	237.1	+	DS
675	16.09.2003	01:17	67	22.98	29	11.46	223	205.2	-	DS
676	16.09.2003	02:34	67	25.86	29	20.52	207	193.6	-	DS
677	16.09.2003	03:24	67	28.8	29	28.74	203	188.4	-	DS
678	16.09.2003	04:29	67	31.5	29	37.68	213	199.2	-	DS
679	16.09.2003	05:36	67	34.86	29	45.96	224	212.7	-	DS
680	16.09.2003	06:40	67	37.92	29	54.66	262	252.5	-	DS
681	16.09.2003	07:42	67	40.5	30	3	324	308.9	-	DS
682	16.09.2003	08:56	67	45.18	30	16.86	366	353.2	-	DS
683	16.09.2003	10:03	67	48.54	30	26.16	219	207.6	-	DS
684	18.09.2003	22:15	63	15.948	17	34.878	130	117.933	+	IB
685	18.09.2003	23:00	63	13.0038	17	30.0768	553	521.032	+	IB
686	19.09.2003	00:11	63	9.9756	17	24.8958	847	861.542	+	IB
687	19.09.2003	01:24	63	6.981	17	19.8822	1151	1156.031	+	IB
688	19.09.2003	02:47	63	3.0126	17	17.0322	1227	1228.010	+	IB
689	19.09.2003	04.26	62	58.896	17	9.828	1380	1383.40	+	IB
690	19.09.2003	06:04	62	54.942	17	4.878	1496	1499.1	+	IB
691	19.09.2003	07:52	62	51	16	57.3648	1607	1609.4	+	IB
692	19.09.2003	09:55	62	45.0054	16	50.0952	1745	1743.532	+	IB
693	19.09.2003	12:02	62	38.9916	16	41.0616	1874	1864.468	+	IB
694	19.09.2003	14:25	62	30.9828	16	31.0602	2044	2020.088	+	IB
695	19.09.2003	17:07	62	21.39	16	18.66	2086	2094.7	+	IB
696	19.09.2003	19.56	62	9.996	16	2.8752	2196	2199.60	+	IB
697	19.09.2003	23:08	61	57.0756	15	43.89	2256	2203.214	+	IB
698	20.09.2003	02:33	61	44.0478	15	25.908	2293	2293	+	IB
699	20.09.2003	06:10	61	35.043	15	1.8216	2099	2107	+	IB
700	20.09.2003	09:27	61	25.029	14	35.9046	2045	2041.675	+	IB

List of CTD / lADCP Stations POSEIDON 303/2

Station	Date	Time (UTC)	φ (°N)	φ (‘N)	λ (°W)	λ (‘W)	Depth (m)	Max pressure	Instrument	Region
701	25.09.2003	07:29	62	17.1684	7	52.6818	100	52.5	-	IFR
702	25.09.2003	08:57	62	20.334	7	59.76	107	101.2	-	IFR
703	25.09.2003	10:06	62	24.1926	8	7.4256	134	127.518	-	IFR
704	25.09.2003	11:15	62	28.041	8	14.1504	202	182	-	IFR
705	25.09.2003	12:26	62	31.3764	8	22.0584	468	433	+	IFR
706	25.09.2003	13:57	62	35.5008	8	29.2068	495	486.8	+	IFR
707	25.09.2003	15:21	62	39.9288	8	36.6216	496	492	+	IFR
708	25.09.2003	17:03	62	43.6518	8	44.0898	501	495.419	+	IFR
709	25.09.2003	18:10	62	47.4024	8	49.71	494	487	+	IFR
710	25.09.2003	19:20	62	51.6414	8	55.377	426	420.667	+	IFR
711	25.09.2003	20:34	62	54.3894	9	2.7018	409	400.409	+	IFR
712	25.09.2003	21:44	62	56.1936	9	8.1096	418	412.072	+	IFR
713	25.09.2003	23:11	62	59.0976	9	17.5044	505	497.64	+	IFR
714	26.09.2003	00:36	63	1.608	9	26.7864	510	504.471	+	IFR
715	26.09.2003	02:01	63	4.71	9	35.9622	506	492.306	+	IFR
716	26.09.2003	03:22	63	7.8774	9	45.7758	487	481	+	IFR
717	26.09.2003	04:30	63	10.6902	9	55.0824	481	475	+	IFR
718	26.09.2003	05:55	63	14.1312	10	3.2526	435	426	+	IFR
719	26.09.2003	07:22	63	17.2308	10	18.4446	348	338.808	+	IFR
720	26.09.2003	09:14	63	17.3244	10	32.448	340	392.558	+	IFR
721	26.09.2003	11:02	63	16.9944	10	47.694	419	409.208	+	IFR
722	26.09.2003	12:15	63	20.028	10	56.013	424	420.058	+	IFR
723	26.09.2003	13:14	63	22.0764	11	0.3888	423	414.203	+	IFR
724	26.09.2003	14:41	63	24.6204	11	17.5734	330	321.035	+	IFR
725	26.09.2003	15:46	63	27.6606	11	26.6382	348	345.1	+	IFR
726	26.09.2003	16:47	63	31.2108	11	36.4614	375	368.4	+	IFR
727	26.09.2003	17:40	63	33.3672	11	44.3322	397	388.771	+	IFR
728	26.09.2003	18:53	63	39.1896	11	41.7162	392	384.984	+	IFR
729	26.09.2003	20:17	63	48.198	11	41.3394	373	364.623	+	IFR
730	26.09.2003	21:23	63	53.9316	11	41.0442	346	335.79	+	IFR
731	26.09.2003	22:42	64	1.794	11	40.5774	338	329.463	+	IFR
732	27.09.2003	00:10	64	8.7594	11	41.7036	312	305.165	+	IFR
733	27.09.2003	01:17	64	12.0114	11	50.346	374	369.862	+	IFR
734	27.09.2003	02:25	64	16.0602	11	58.716	415	411.007	+	IFR
735	27.09.2003	03:34	64	19.0962	12	6.5376	436	428.90	+	IFR
736	27.09.2003	04:45	64	22.2402	12	17.1558	447	432.03	+	IFR
737	27.09.2003	05:52	64	26.166	12	26.7312	198	181.65	-	IFR
738	27.09.2003	06:41	64	30.00	12	32.8512	179	171.2	-	IFR
739	27.09.2003	07:25	64	33.177	12	39.5256	160	150.618	-	IFR
740	27.09.2003	08:11	64	36.8514	12	46.092	181	171.23	-	IFR
741	27.09.2003	09:03	64	41.2722	12	52.4886	194	186.39	-	IFR
742	27.09.2003	09:54	64	45.0642	12	59.6082	156	148.414	-	IFR
743	28.09.2003	09:07	61	15.0276	14	12.0702	1848	1841	+	IB
744	28.09.2003	11:07	61	8.0112	13	52.5228	1769	1778.86	+	IB
745	28.09.2003	13:41	61	1.0842	13	33.1452	1698	1700.36	+	IB
746	28.09.2003	16:07	60	54.0606	13	14.4048	1754	1765	+	IB
747	28.09.2003	18:24	60	48.2136	12	59.3628	1267	1270	+	IB
748	28.09.2003	20:40	60	41.0748	12	43.0032	647	641.23	+	LB
749	28.09.2003	22:23	60	35.1504	12	27.0414	391	387.899	+	LB
750	28.09.2003	23:41	60	29.982	12	14.0676	343	333.425	+	LB
751	29.09.2003	02:02	60	34.014	11	39.7062	953	955.137	+	LBBB
752	29.09.2003	03:22	60	35.091	11	31.3296	1222	1211.6	+	LBBB
753	29.09.2003	04:51	60	36.1182	11	21.2808	1248	1242	+	LBBB

Station	Date	Time (UTC)	φ (°N)	φ (‘N)	λ (°W)	λ (‘W)	Depth (m)	Max pressure	Instrument	Region
754	29.09.2003	06:21	60	37.3224	11	10.776	1027	1020	+	LBBB
755	29.09.2003	07:46	60	38.2608	11	43.794	505	504.663	+	LBBB
756	29.09.2003	10:23	60	40.7508	10	26.5476	146	137.448	-	FB_cen
757	29.09.2003	12:00	60	41.5326	9	58.2762	541	537.5	+	FB_cen
758	29.09.2003	13:37	60	41.196	9	45.093	639	639.89	+	FB_cen
759	29.09.2003	15:00	60	40.7646	9	32.8176	551	546	+	FB_cen
760	29.09.2003	17:00	60	40.8504	9	10.68	135	128	-	FB_cen
761	29.09.2003	19:07	60	53.1156	8	51.3918	100	93.607	-	FB_cen
762	29.09.2003	20:43	61	4.9896	8	39.9276	109	100.315	-	FB_cen
763	29.09.2003	22:10	61	15.9972	8	30.6684	210	192.342	-	FB_cen
764	29.09.2003	22:58	61	17.8434	8	26.9808	336	331.40	+	FB_cen
765	29.09.2003	23:50	61	20.8794	8	23.673	428	427.134	+	FB_cen
766	30.09.2003	00:38	61	22.6926	8	20.32980	636	627.128	+	FB_cen
767	30.09.2003	01:48	61	25.4412	8	18.83740	804	786	+	FB_cen
768	30.09.2003	03:25	61	24.8442	8	14.925	641	640	+	FB_cen
769	30.09.2003	04:41	61	29.7384	8	12.8886	443	449	+	FB_cen
770	30.09.2003	05:42	61	33.012	8	9.1218	277	272	+	FB_cen
771	30.09.2003	06:27	61	34.9398	8	6.0042	308	303	+	FB_cen
772	30.09.2003	07:25	61	37.065	8	3.4806	281	268.877	+	FB_cen
773	30.09.2003	08:06	61	40.0812	8	0.3228	204	183.606	-	FB_cen
774	30.09.2003	11:39	62	0.2748	8	55.3458	435	425.173	+	FB_ex
775	30.09.2003	12:57	61	57.3348	8	54.5952	454	450.219	+	FB_ex
776	30.09.2003	13:56	61	54.1146	8	55.3266	506	500.109	+	FB_ex
777	30.09.2003	14:59	61	50.853	8	55.0482	555	549	+	FB_ex
778	30.09.2003	16:10	61	47.8608	8	54.4434	650	644	+	FB_ex
779	30.09.2003	17:24	61	45.0834	8	55.5882	745	738.085	+	FB_ex
780	30.09.2003	18:38	61	42.0222	8	55.3194	862	856.417	+	FB_ex
781	30.09.2003	20:00	61	39.0372	8	55.0938	859	852.3	+	FB_ex
782	30.09.2003	21:15	61	36.063	8	55.2312	814	806.204	+	FB_ex
783	30.09.2003	22:28	61	33.0552	8	54.8778	661	656.779	+	FB_ex
784	30.09.2003	23:33	61	29.8908	8	54.6222	493	490.083	+	FB_ex
785	01.10.2003	01:58	61	25.9554	8	17.898	803	790.038	+	FB_ex
786	01.10.2003	08:54	61	3.183	7	4.4076	266	259.180	+	FB_en
787	01.10.2003	09:33	61	3.0906	7	8.0616	385	378.662	+	FB_en
788	01.10.2003	10:22	61	3.0612	7	11.844	528	522.7331	+	FB_en
789	01.10.2003	11:15	61	3.3798	7	22.0638	689	670.585	+	FB_en
790	01.10.2003	12:23	61	3.162	7	19.5978	787	773.819	+	FB_en
791	01.10.2003	13:32	61	3.1392	7	23.145	834	819.892	+	FB_en
792	01.10.2003	14:44	61	2.973	7	27.5052	858	845.9	+	FB_en
793	01.10.2003	15:53	61	2.997	7	31.5942	874	863.05	+	FB_en
794	01.10.2003	16:58	61	2.8938	7	35.931	897	886.617	+	FB_en
795	01.10.2003	18:19	61	2.8626	7	39.6594	922	910.626	+	FB_en
796	01.10.2003	19:29	61	2.9346	7	43.8612	932	920.606	+	FB_en
797	01.10.2003	20:39	61	2.9964	7	47.9958	804	798.579	+	FB_en
798	01.10.2003	21:44	61	3.0774	7	51.957	470	466.742	+	FB_en
799	01.10.2003	22:32	61	2.994	7	55.9074	213	208.63	-	FB_en
800	02.10.2003	03:47	60	29.1348	8	50.3988	262	250	+	WTR
801	02.10.2003	05:04	60	25.9092	8	37.8264	471	465	+	WTR
802	02.10.2003	06:32	60	22.887	8	25.8816	566	559	+	WTR
803	02.10.2003	07:37	60	19.7394	8	13.3632	516	508.319	+	WTR
804	02.10.2003	08:55	60	17.0178	8	2.0358	542	535.068	+	WTR
805	02.10.2003	10:18	60	13.8864	7	48.6132	607	607.211	+	WTR
806	02.10.2003	14:30	60	11.3796	7	38.2134	575	--------	-	WTR
807	02.10.2003	16:35	60	8.1924	7	24.7224	530	--------	-	WTR
808	02.10.2003	17:58	60	4.7958	7	12.9276	502	--------	-	WTR
809	02.10.2003	19:17	60	2.0022	6	59.8086	472	--------	-	WTR

Station	Date	Time (UTC)	φ (°N)	φ (‘N)	λ (°W)	λ (‘W)	Depth (m)	Max pressure	Instrument	Region
810	02.10.2003	20:25	59	58.9992	6	47.7972	447	441	-	WTR
811	02.10.2003	21:32	59	56.0034	6	35.8458	330	317.253	-	WTR
812	02.10.2003	22:43	59	53.1534	6	23.7744	423	408.629	-	WTR
813	02.10.2003	23:40	59	50.2356	6	11.0004	473	469.338	-	WTR
814	03.10.2003	00:53	59	47.1342	5	59.4492	359	355.005	-	WTR
815	03.10.2003	02:02	59	44.2146	5	47.553	332	335.401	-	WTR

WTR: Wyville Thomson Ridge
IB: Iceland Basin
LB: Lousy Bank
LBBB: Lousy Bank – Bill Bailey’s Bank
IFR: Iceland Færoe Ridge
FB_en: Færoe Bank Channel entry
FB_ex: Færoe Bank Channel exit
FB_cen: central Færoe Bank Channel

+: CTD/lADCP, -: CTD

1. Aims of the cruise

RV POSEIDON cruise 303, legs 1 - 2 were carried out by the Institut für Meereskunde of the University of Hamburg. Students from the Institut für Umweltphysik of the University of Bremen and from the Niels Bohr Institutet for Astronomi, Fysik og Geofysik of the University of Copenhagen also participated.

The cruise had two main objectives:

- to educate undergraduate students in the handling of oceanographic instrumentation and in the collection and analysis of field data,
- to map the cold overflow to the North Atlantic and the warm inflow to the Nordic Seas over the ridge system between Greenland and Scotland, through Denmark Strait, across the Iceland Faroe Ridge, through the Faroe-Bank Channel, and across the Wyville Thomson Ridge and to study its variability.

The planning and preparation of the cruise involved the participating students and was carried out during seminars at the participating universities. Following a review of the recent literature, an analysis of historical data and the experience made during previous student cruises the observational programme was designed. Hydrographic stations were occupied along several sections crossing the in- and overflow. The University of Hamburg financed the experiment.

2. Narrative

Leg 1

Thursday 11.9. 2003:
Noon position: Reykjavik
Air temperature: 11.1° C, wind: S 3 Bft, air pressure: 989.5 hPa

The scientific crew of RV POSEIDON cruise 303 arrived on Monday evening, 10.9.2003. In the morning of 11th we started with the installation of our equipment. This work continued until the late evening hours. During the afternoon the students from Bremen and Copenhagen arrived at Poseidon. Due to the bad weather and the bad weather forecast we decided to postpone the departure to the next day.

Friday 12.9.2003:
Noon position: Reykjavik
Air temperature: 12.9 °C, wind: S 3 Bft, air pressure: 1002. hPa

In the morning the students got a safety instruction by the first mate. Additionally, we calibrated the compass of the lADCP. This had to be done on land in order to avoid incorrect data biased by the iron hull. Finally, at 12:30 we left to Denmark Strait where we wanted to repeat the section of Poseidon cruise 294. The weather forecast was still bad, but during the afternoon the weather became better. Some of the students got seasick as soon as we left the harbour. Until the late evening hours we worked on the CTD and lADCP to get them running.

Saturday 13.9.2003:
Noon position: 66° 10,3'N 24°22,3' W
Air temperature: 10.1 °C, wind: ENE 7 Bft, air pressure: 984 hPa

At 8:00 we reached the first station of our Denmark Strait section, but the weather and the swell was so bad that we had to return to the western Icelandic coast where we found shelter in a fjord. According to the forecast the low pressure system should be weakened by Monday and we decided to stay in the fjord until Sunday. In shelter of the coast the students recreated from their seasickness and were again able to take part in the social life onboard.

Sunday 14.9.2003:
Noon position: 66° 13,64'N 23°57,14' W
Air temperature: 8 °C, wind: NNE 6 Bft, air pressure: 997 hPa

In the morning wind and swell had already weakened and we sailed back to our first station of the Denmark Strait section. The students had a seminar in the morning discussing the objectives of the cruise. We reached the first station (Nr.649) at 18:00. During the night the measurements were carried out without any problems and additionally, we had a wonderful sight of Mars and on polar lights.

Monday 15.9.2003:
Noon position: 66° 47,0' N 27° 29,60'W
Air temperature: 5.4°C, wind: SW 4 Bft, air pressure: 1006 hPa

The weather was fine and work was proceeding without any problems, but we were running a little behind schedule. Early in the evening we reached the 18th station (666). An iceberg was spotted at far distance and a family of Orcas were sighted in the morning. Due to the rough sea the ship was rolling hard, which kept everyone awake during night, even those who were not on shift.

Tuesday 16.9.2003
Noon position: 67° 33,63'N 30°19,80'W
Air temperature:3° C, wind: ENE 5 Bft, air pressure: 1009 hPa

The last station of the Denmark Strait section was completed at about 11:00, and during the morning hours the shifts enjoyed the view of the Greenland coast and icebergs in the rising sun. The students started work on the data analysis of the Denmark Strait section and in the afternoon they got courses in navigation and how to tie knots. We started steaming south-eastward to the other side of Iceland, where we are planning to continue with a section through the Iceland Basin.

Wednesday 17.9.2003
Noon position: 64°08,04'N 26°04,44'W
Air temperature.: 9.6°C, wind: NE-E 6Bft, air pressure: 1008 hPa

We were still steaming to our next section in the Iceland basin. The students continued with the data analysis of the Denmark Strait section and additionally, they prepared the detailed positions for the next stations of the Iceland basin section. During the morning

the ship crew exercised a fire alarm drill and the scientific crew saw a video about fire prevention onboard. During night the weather got worse.

Thursday 18.9.2003
Noon position: 63° 12,90'N 20°49,7'W
Air temperature: 4,7°C, wind: N-E 7 Bft, air pressure: 1015 hPa

During the day we were still steaming to the next section. The day was spent with seminars and the Denmark Strait data analysis. We arrived at 23:00 and began the work at the first station (Nr. 684) of the Iceland basin section.

Friday 19.9.2003
Noon position: 62° 44,96'N 16° 50,32'W
Air temperature: 8,3°C, wind: W 4Bft, air pressure: 1021 hPa

Work proceeded without any problems during the day. The data analysis of the Denmark Strait section (first draft) was finished and the students started with writing down their results.

Saturday 20.9.2003
Noon position: 61°24,68'N 14°35,10'W
Air temperature: 10.3°C, wind: SW 7 Bft, air pressure: 1013 hPa

The weather was getting worse again and we had to stop the measurements at approximately 14:00 after we arrived at the position of station 701. In the evening the wind reached 9 Bft occasionally and wave heights increased to 8 m. We decided to steam to the Faeroe Islands, as the weather forecast for the next day was not promising.

Sunday 21.9.2003
Noon position: 61°01,37'N 8°12,11'W
Air temperature: 10.7°C, wind: W to SW 8 to 9 Bft, air pressure: 995 hPa

The weather and the forecast were still bad and we decided to run into Tórshavn port as it seemed more than unlikely that we will be able to run one more station. The students were still busy with their data report and in the evening a final seminar was carried out.

Monday, 22.9.2003
Noon position: Tórshavn
Air temperature: 7,4°C, wind: N to W 6 Bft, air pressure: 996 hPa

We arrived at Tórshavn at 9:00 in the morning. After cleaning the laboratories and the cabins the students left the ship for exploring the tourist attractions of the town and the neighbourhood. In the evening the end of leg 1 was celebrated with a spontaneous party visited also by members of the ship crew.

Tuesday, 23.9.2003
Noon position: Tórshavn
Air temperature: 3.7°C, wind: NW 3 Bft, air pressure: 1010

The students departed for their flights at 8:30. In the morning we changed the batteries of the lADCP and therefore, a new calibration of the lADCP compass had to be carried out. The weather was nice and we spent the rest of the afternoon with fishing and enjoying the sun.

Leg 2

Wednesday, 24.09.2003
Noon position: Tórshavn
Air temperautre: 10,8°C, wind: W 4 Bft, air pressure: 1005,5 hPa

The second student group arrived during the day. RV Posidon departed Torshavn at 20:00, heading for station number 701, at the Iceland-Faeroe Rigde, the expected arrival time is 08:00, 25.09. After the departure the students had a safty-instruction meeting. The weather forecasts for the next couple of days is good.

Thursday, 25.09.2003
Noon position: 62°27,18' N 008°13,27'W
Air temperature: 8°C, wind: E 4-5 Bft, air pressure: 1011 hPa

We arrived at station 701, the first station on leg 2, at 08:00. At station the students received an introduction to the equipment used for measuring, including a demonstration of the rosette. After the introduction the scientific crew started with the watch schedule. The work proceeded all day although the wind increased to 7 Bft occasionally and the swell let the ship roll hard during stations. In the evening the students had a meeting where they discussed the goals and the expectations of the work onboard. The first tasks were delegated to the students.

Friday, 26.09.2003
Noon position: 63°17,00' N 010°48,30'W
Air temperature: 6,3°C, wind: varying directions 2 Bft, air pressure : 1020,4 hPa

The wind had decreased and so had the sea and in the morning we had a nice sunrise. The good mood at the start of the day lasted, and also the work progressed on schedule. At the evening meeting the students discussed the weather forecast and its influence on the schedule. But so far everything looks promising.

Saturday, 27.09.2003
Noon position: 64°38,64' N 013°02,05'W
Air temperature: 7,2°C, wind: SSW 3 Bft, air pressure : 1015,2 hPa

This morning we finished the first section of leg 2 and we were rewarded with a wonderful view on the Icelandic coastline. The vessel is now proceeding to the next station, which is the station, where the previous group had to cut off due to bad weather conditions. The expected arrival time to the next station (743) is 08:00, 28.09. Meanwhile we were analysing the data we got so far. Additionally, the students had a navigation course, and a course on knots. In the evening whales were sighted.

Sunday, 28.09.2003
Noon position: 61°08,51' N 013°53,31'W
Air temperature:10,2°C, wind: SSW 4 Bft, air pressure : 1004,5 hPa

After a night without shifts, everybody was joining breakfast in the mess. The measurements started again at 10:30 on the Iceland basin section. Work proceeded without any problems. Also the weather forecasts for the next days look fine. At 11:00 we had our traditional “church” and enjoyed a glass of Sherry before lunch. The students were all busy the whole day occupying all computers onboard in order to proceed with the data analysis.

Monday, 29.09.2003
Noon position: 61°41,1' N 010°20,3'W
Air temperature:10,5°C, wind: NW 3 Bft, air pressure : 999,9 hPa

Though it was a rainy morning it became one of the best days so far, weather regarding, with sunshine, light winds and smooth waters and some of us even had the chance to see a group of whales passing by in the afternoon. The altimeter is now and then suffering from functional problems and the ship’s ADCP had problems with data transmission which also lead to a malfunctioning daughter of the gyro compass in the laboratory. But altogether work proceeded satisfying.

Tuesday, 30.09.2003
Noon position: 61°56,67' N 008°44,64'W
Air temperature: 10,0°C, wind: ESE 4 Bft., air pressure : 1012,4 hPa

In the morning we finished the Iceland basin section on the shallow banks of Bailey and continued with our measurements on the Faeroe Bank Channel. At night we saw some kind of pipefish, which was attracted to the light from the vessel. The weather was again sunny and nice. The students show now appearance of fatigue from all the work and unfamiliar life onboard.

Wednesday, 01.10.2003
Noon position: 61°03,11' N 007°13,39'W
Air temperature:11,0°C, wind: W 4 Bft., air pressure : 1011,4 hPa

During the night we finished the first (central) of the three sections of the Faeroe Bank Channel and steamed for the next located at the exit. Meanwhile, we found out that the lADCP data of the deepest stations of the central section were incorrect. So, we decided to rerun the deepest station in order to recover some lADCP data for this specific area. Later on, we continued as planned. In the morning the AB's shortened the conducting wire for the CDT by 600 meters, as it was used up and during night on the steaming distance we changed once again the batteries of the lADCPs. It was a cloudy day, but we didn't mind anyway, we had plenty work to do indoor, at the computers.

Thursday, 02.10.2003
Position: 60°23,64' N 007°47,90'W
Air temperature:10,5°C, wind: SW 7 Bft., air pressure : 999,1 hPa

In the morning the wind increased and before noon we had to stop running stations, due to safety, when the vessel was taking water on deck. Unfortunately a little bird which was

resting on deck didn't notice the danger and was flushed into the sea. In the afternoon weather permitted us to continue the station work. From here on we did the stations only with the CTD running , no bottles, no lADCP, thus minimising the risk of damaging the rosette, due to the bad weather we experienced.

Friday, 03.10.2003
Noon position: 58°41,65' N 005°32,55'W
Air temperature: 11,1°C, wind: WNW 7-8 Bft., air pressure : 1001,2 hPa

We finished this leg's last station at 05:30 and this in pretty bad weather, having a combined sea and swell that exceeded by far, what we had expected from the weather forecasts received. So the students who were asleep were bumping around in their bunks, for the first time on this leg, experiencing the North Atlantic Sea's true nature. After breakfast some of the students worked on making a post buoy which should carry our greetings to friends and family ashore. We reached the Hebrides around 15:00 and in the evening we launched the post buoy and watched its disappearance in the horizon behind.

Saturday, 04.10.2003
Noon position: 55°35,33' N 008°45,74'W
Air temp:9,7°C, wind: NNW 7 Bft., air pressure : 1016,6 hPa

The whole day the students were working on their final report. The weather was still quite windy, and we experienced a rough sea again. In the late evening the last and final edition of the student's report was finished, and was celebrated with some beers. The cleanup of this cruise started already in the night by saving all data on CD and removing the files from the computers.

Sunday 05.10.2003
Noon position : Approaching to Galway.

The whole morning everybody was busy packing and cleaning the laboratories. Shortly, after lunch we arrived at Galway harbor and POSEIDON cruise 303 ended.

3. Cruise participants

Leg 1, 11.- 23. September 2003

Dagmar Hainbucher	Chief Scientist	IfM
Detlef Quadfasel	Scientist	IfM
Stiig Wilkenskjeld	Scientist	IfM
Brian Hansen	Student	NBIAFoG
Waleid Hassan	Student	IUP
Marco Langer	Student	IUP
Sisse Lundholm	Student	NBIAFoG
Christian Meißner	Student	IUP
Horst Wohlrab	Student	IfM

Dagmar Hainbucher	Chief Scientist	IfM
Detlef Quadfasel	Scientist	IfM
Martin Vogt	Student	IfM
Martin Endrulat	Student	IfM
Kari Guddal	Student	NBIAFoG
Stephanie Preißler	Student	IfM
Kirstin Rolle	Student	IfM
Gitte Sveigaard Holmsberg	Student	NBIAFoG
Katrin Uhlmann	Student	IfM
Nina Wilkens	Student	IfM

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4. Technical information

CTD/Rosette

Altogether 167 full depth standard hydrographic stations were occupied during the cruise, employing a SeaBird SBE911plus CTD-O2 sonde, attached to a SeaBird carousel 12 bottle water sampler. Profiles were run to within 5-10 m of the bottom. At mostly all stations water samples were taken from 3 depth levels evenly distributed within the water column. The water samples were analysed onboard for salinity, using a Guildline Autosal salinometer. One of the water bottles was also equipped with reversing digital thermometers, providing temperature and pressure check values for the CTD sensors.

Lowered Acoustic Doppler Current Profiler

Vertical profiles of horizontal currents were made with a lADCP-2 system attached to the rosette water sampler. The system consists of two ADCPs of the Workhorse type (WHM300) manufactured by RD Instruments. They operate at a frequency of 300 kHz. The data were analysed with software provided by the University of Bremen, Germany.

Surface temperature and salinity

Underway temperature and salinity measurements were made with a SeaBird thermo-salinograph installed in the ship's port well.

Current measurements

Underway current measurements were taken with a RDI 150 kHz acoustic Doppler Current Profiler, covering approximately the top 200 m of the water column. The transducers were installed in the starboard ship's well.

5. Preliminary results

The results presented here were compiled by the students during the course of the cruise and can, in a slightly different form, also be seen on their WEB page under www.ifm.uni-hamburg.de. The data used for producing these results are not calibrated.

Water mass exchange through Denmark Strait

The conditions in the Denmark Strait can be described as follows:

There are three principal water masses associated with two main currents.

1. The Irminger Current is characterised by relative warm and saline water and flows northward at the eastern part of the Greenland-Iceland section (western coast of Iceland). Near the surface we found high temperatures of 9° C to 10° C and in the deeper parts of the Irminger Current (up to 400m depth) the temperature varied from 6° C to 8 ° C (fig. 2a). The salinity of the Irminger Current was high, varying from 34.9 to 35.2 psu (fig. 2b).

2. The East Greenland Current can be divided into two layers: the upper layer and the overflow. The upper layer (up to 200m) is characterised by a low temperature ranging from 0° C to 2° C and a low salinity between 33 and 34.5 psu, while the temperature of the overflow varies between the freezing point and 0° C (fig. 2a), and the salinity is about 34.8 psu (fig. 2b).

In the hydrographic section the three water masses can easily be distinguished. In the salinity and the density distributions, the sharp boundary between the Irminger Current and the East Greenland Current can be identified. This boundary is located over the continental slope of Iceland at the eastern part of the deeper passage. In the upper 200m the distribution of the salinity and temperature are highly variable due to the high stirring and mixing activities, which result from the meso-scale eddies passing through the Denmark Strait. These eddies can be clearly identified from the density distribution of the section.

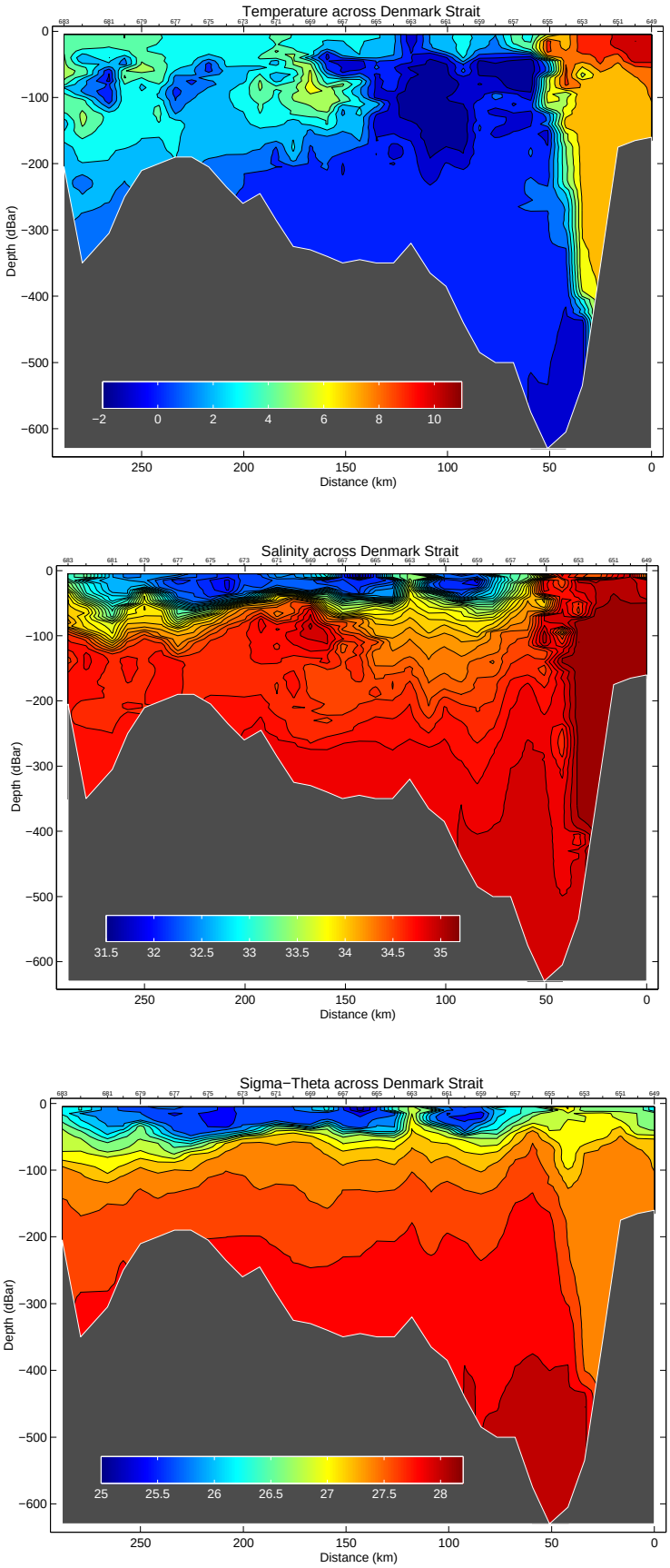

Figure 2: a) Temperature-distribution along the Denmark Strait section.
b) Salinity- distribution along the Denmark Strait section.
c) Potential density-distribution along the Denmark Strait section.

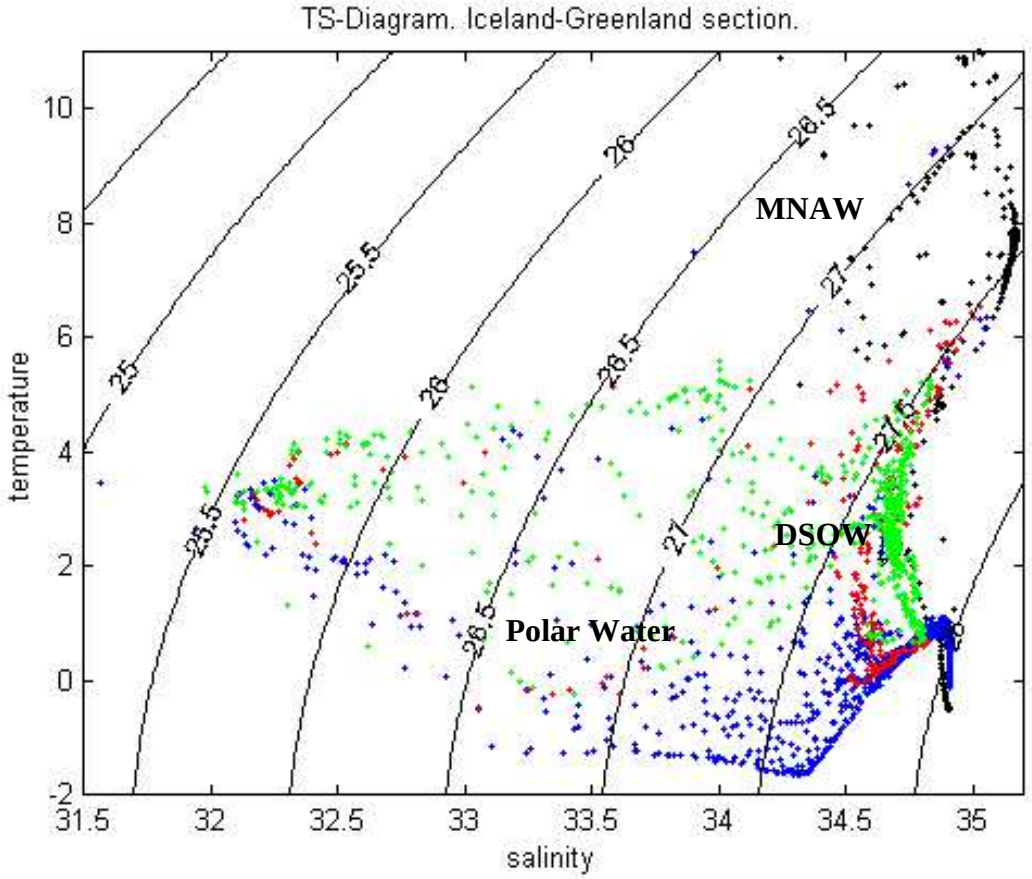

Figure 3: TS-Diagram for the main three water masses in Denmark Strait
black: stations 649 - 653 blue: stations 654 - 667
red: stations 668 - 672 green: stations 673 - 683

Figure 3 shows the TS diagram for the Denmark Strait. The Modified North Atlantic Water (MNAW) has a temperature of 6-8° C and a salinity of about 35 psu. The Polar Water is characterised by a temperature of about -1° C down to the freezing point and a salinity lower than 34.5 psu. The Denmark Strait Overflow Water (DSOW) is described by a temperature between -0.5° C and 0.5° C and a salinity between 34.7 and 35 psu.

The calculation of the geostrophic velocity (fig. 4) is carried out by defining a level of no motion at the bottom. It seems that there is a strong shear at the eastern part of the section, while the western part has a very low shear. However the assumption of zero level is not valid for the Denmark Strait, since there is a strong barotropic flow component (fig. 5).

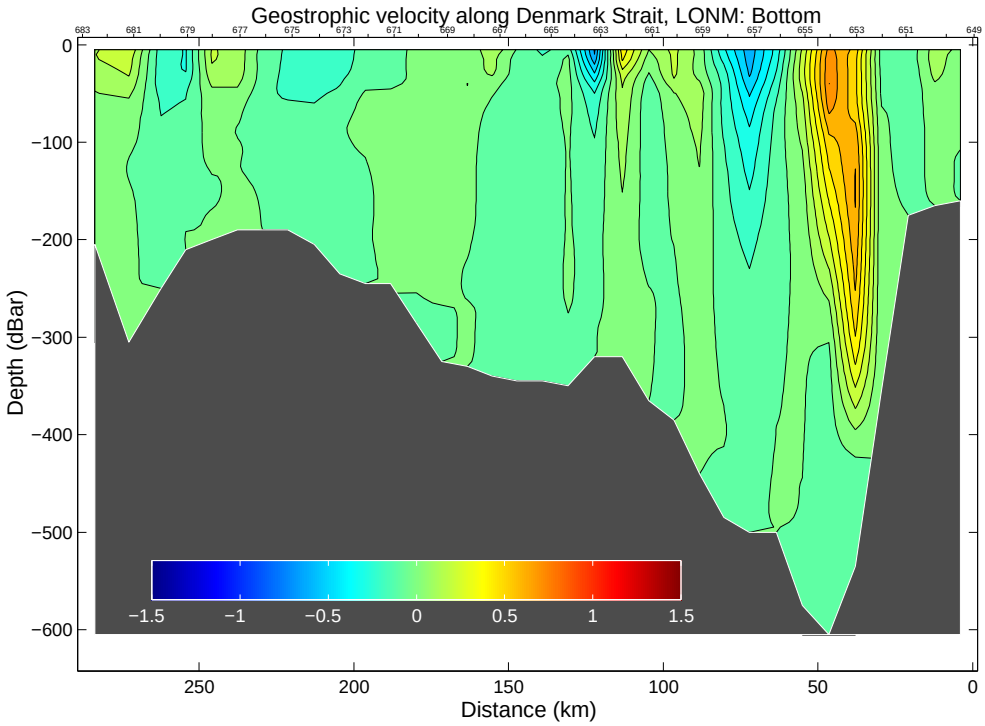

Figure 4: Distribution of geostrophical velocity over the cross-section (zero level at the bottom, m/s)

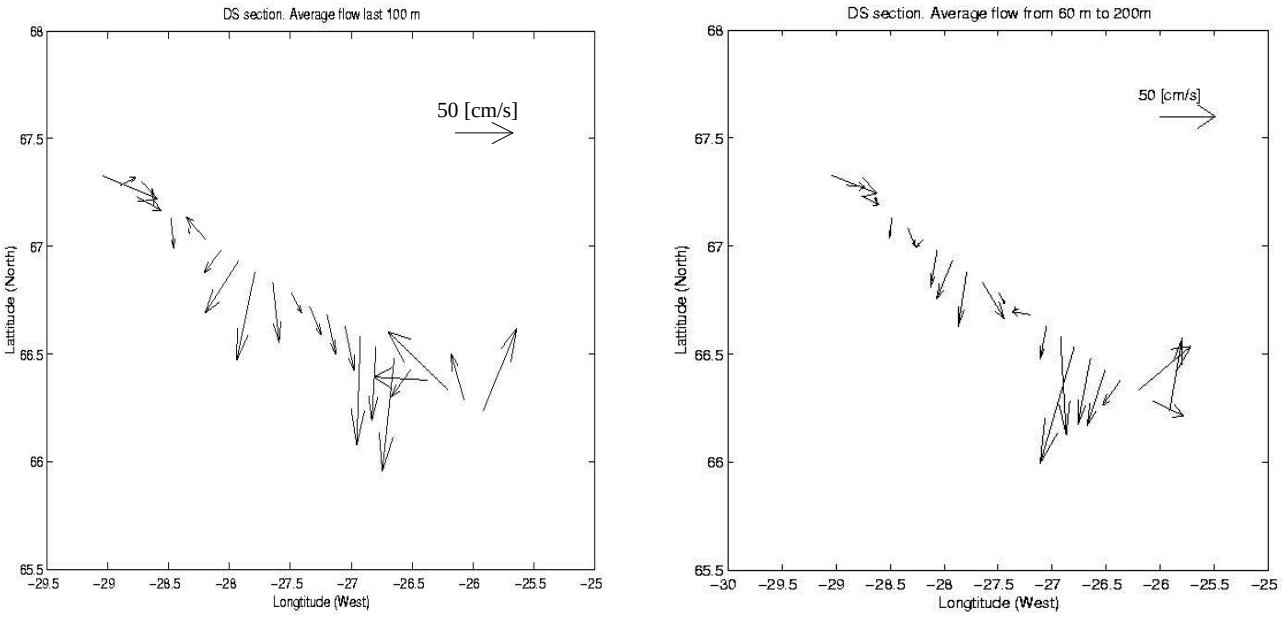

Figure 5: average current-velocity in the Denmark Strait
a) Last 100m to the bottom *b) from 60m to 200m*

Conclusions:

- Water in the Denmark Strait consists of three basic water masses and mixtures between them.
- The boundary between Polar- and Atlantic Water is located to the east of the strait.
- There is evidence for strong eddy-activity (salinity-variability).

Water mass exchange through the Iceland Basin Section

Stations 684-699 and 743-747, the IB section, cover a distance of 330 sm and were taken across the northern part of the Iceland Basin.

A steep continental slope forms the western boundary of the IB section, followed by an abyssal plain in the central part with the deepest area being about 2400 meters. The Iceland Faroe Rigde forms the northern borderline of the whole basin and is situated parallel to the IB section. The IB section is limited in the east by the steep slope to the shelf of Lousy Bank.

The deep overflow waters in the Iceland basin enter mainly from two areas: across the Iceland Faroe Ridge, which has a sill level between 420 and 520 meters and across the Faroe Bank Channel which has a sill depth of 840 meters.

From the topographical structure, the basin's geographical location, earth rotation and the basin width exceeding the Rossby radius, a south-westward boundary current of overflow water along the Icelandic coast and a north-eastward flow of Modified North Atlantic Water in the eastern part can be expected.

The relevant water masses in the Iceland basin are (Hansen and Østerhus, Progress in Oceanography/45 [2000],109-208):

Name	Potential temperature	Salinity	Origin
MNAW	>7°C	>35.2	North Atlantic
OW	<3°C	~34.98	Nordic Seas
LBW	~3°C	~34.9	Labrador Sea
SURF	>10°C	<35.3	Iceland Basin

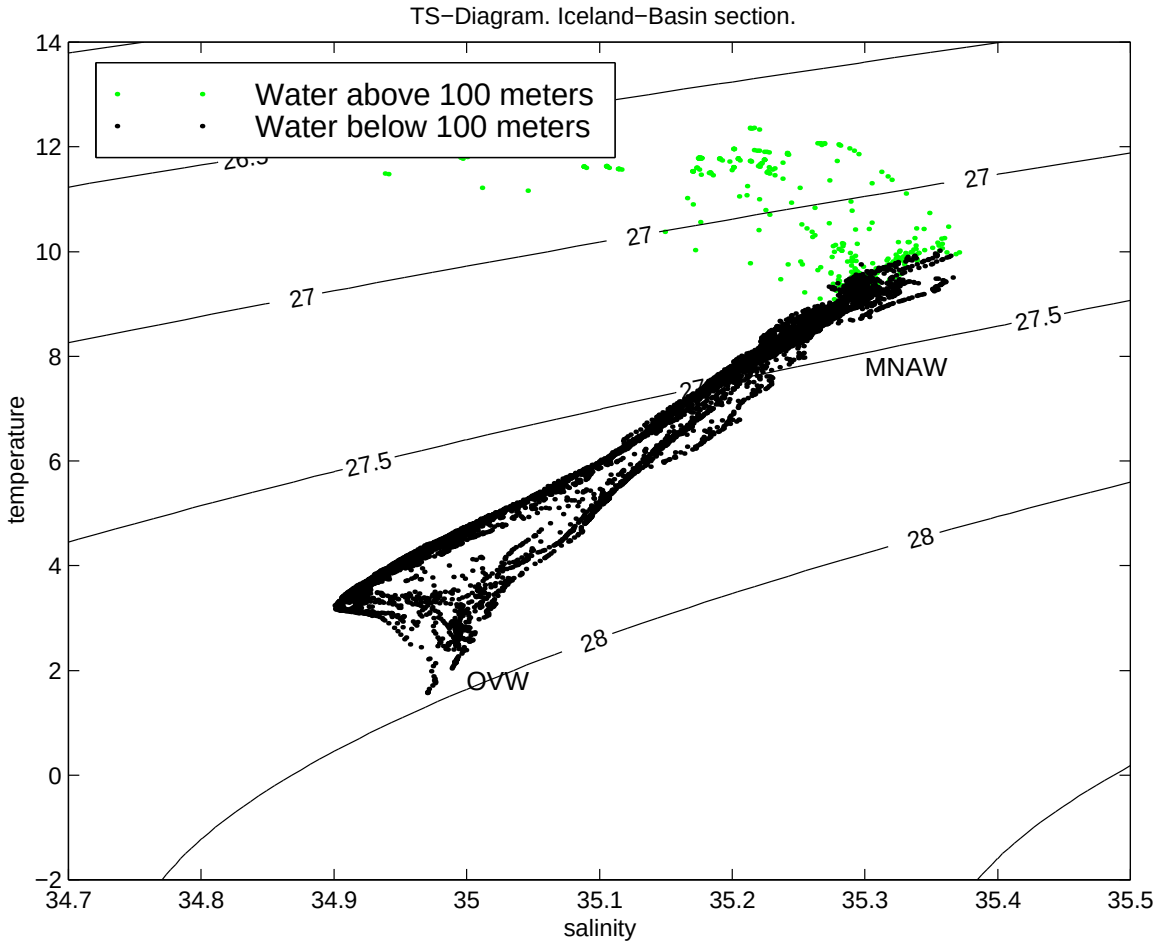

Figure 6: TS-Diagram of the Iceland Basin Section.

From the TS-Diagram (fig. 6) it is obvious that in the basin there are mainly three water masses:

1) cold and fresh Labrador Seawater (LBW)
2) the warmer and saline Modified North Atlantic Seawater (MNAW) and
3) cold overflow water from the Nordic Seas (OW).
4) However, there is a fourth, less saline and relatively warm water mass present in the surface, which is due to rain, continental runoff and seasonal warming.

The main structure of the spreading indicates that mixing is only taking place between OW and LBW or LBW and MNAW or OW and MNAW. Hence, there is only little water inside the triangular frame of mixing.

Comparing the water characteristics of the measurements along the IFR and the FBC with the overflow water of the IB, overflow water with the same characteristics can be found in all three sections. But, in the IB there is no water with potential temperatures below 1.0 °C due to the fact that the overflow water in the IB has already mixed with MNAW during its sinking down into the deep basin. Additionally, comparing the water characteristics of the IB section with the WTR section yield the conclusion that no deep water from the Wyville Thomson Ridge entered the Iceland Basin.

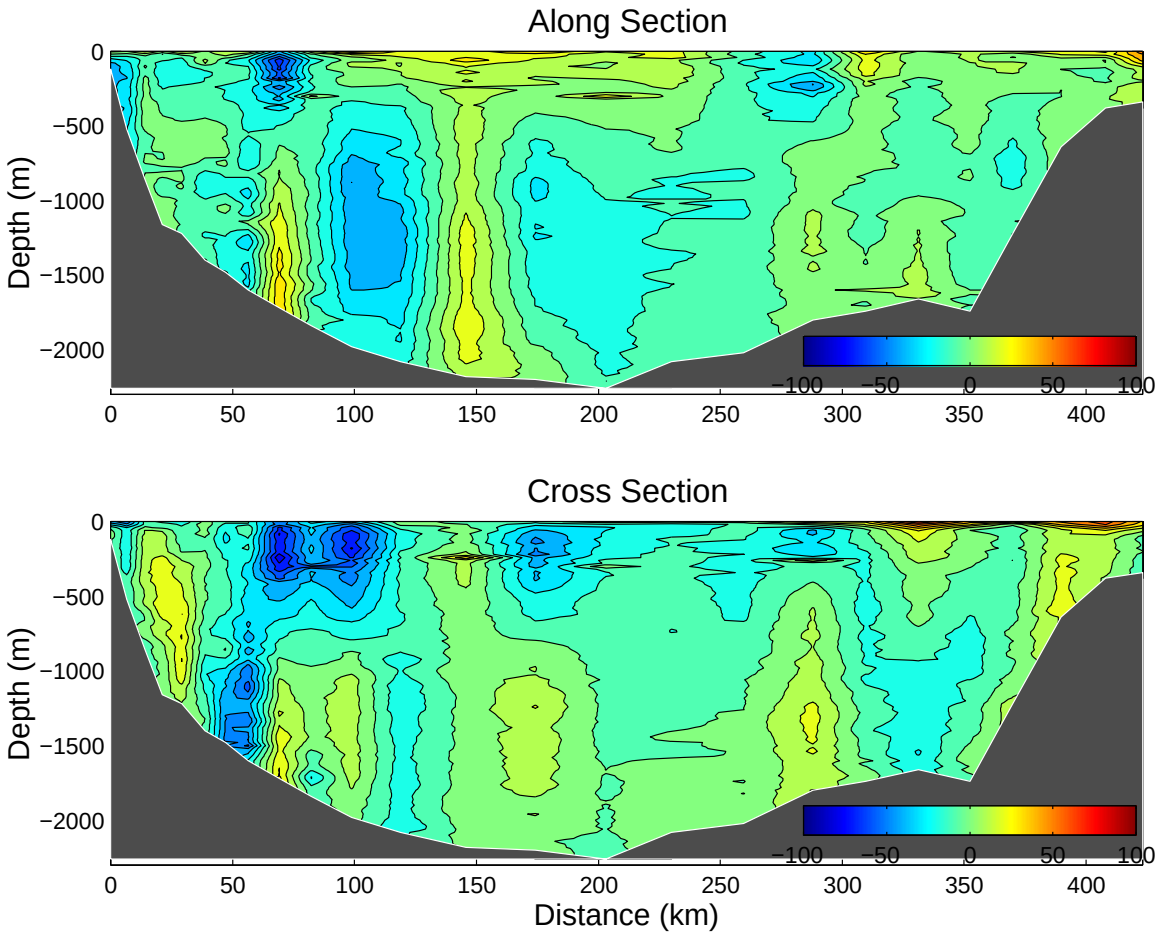

Figure 7: Velocity derived from lADCP data of the Iceland Basin section (cm/s).

The lADCP data (fig. 7) enables a view on the shear in the interior of the IB section. In the western part of the basin, the south component (cross section) is compared to the rest, distinctly strong. A weaker northward flow exists in the eastern part of the section. In the along section a westerly flow is indicated along the western part of the section and together with the findings of the cross section it confirms the existence of a deep boundary current due to geostrophic shear. In general, eddies are overlying the main flow.

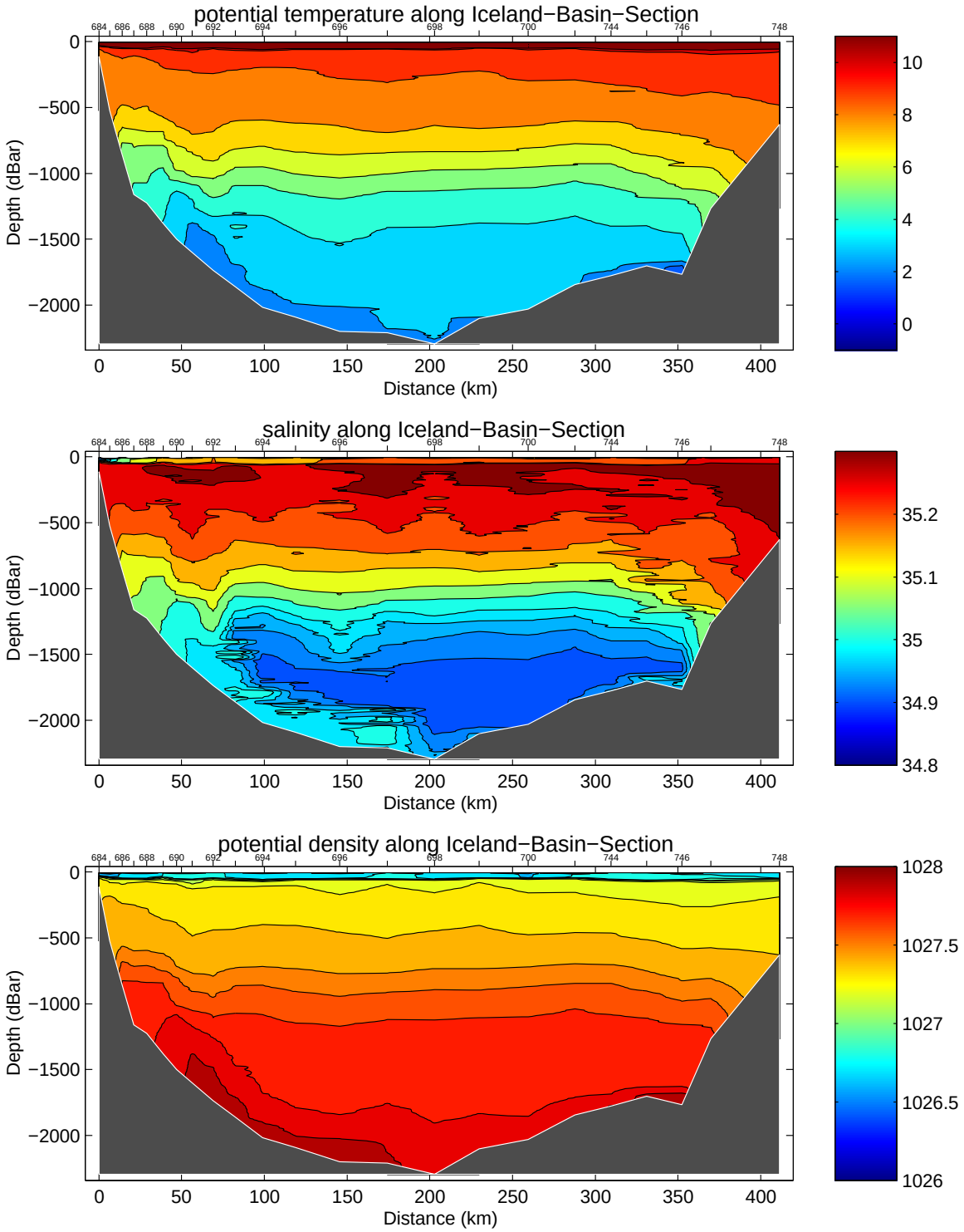

Figure 8: a) Potential temperature, b) salinity and c) potential density across the Iceland Basin section.

The distribution of temperature, salinity and density (fig.8) show that the upper 600 meters of the IB section consist of warm, saline, well mixed MNAW. On the eastern side the MNAW is dominant, indicated by the isolines in the upper layers sloping downwards. Only, a weak density gradient in the upper layers can be seen in the potential density profile indicating that the water is not very strongly stratified. This is due to wintertime

convection and strong winds which mix the upper layers and hereby create a homogeneous water column. A sharper gradient exists between the surface water and the underlying LBW. The LBW can be clearly identified in the salinity and temperature distribution in 1500 to 2000m where a low saline and higher temperature plume exists. From the potential temperature and the potential density distribution overflow water can be identified at the Icelandic continental slope in depths below approx. 1500 m. Surprisingly, some water with overflow characteristics is also located at the eastern slope of the section at a depth of approx. 1700 meters. This might be overflow water flowing through the gully at the exit of the FBC, according to the theory by Hansen and Oesterhus.

Conclusion:

The sloping isopycnals combined with the water mass distribution confirms the existence of a deep boundary overflow current running southward off the Icelandic coast and the northward flow of MNAW on the eastern part of the Iceland Basin section.

Water mass exchange across the Iceland Faroe Ridge

42 stations with a distance in between of about 3-5 sm were taken between Faroe and Iceland on top of the ridge. There are five trenches from which the deepest one is approximately 500 m. It is known that there is an inflow in the upper layer of warm and saline North Atlantic Water heading north into the Nordic Seas and an outflow of cold, relatively fresh overflow water going southwards. Especially, in the eastern part of the Iceland Faroe Ridge section the interface between these two water masses is sloping down towards the east, which indicates a northward geostrophic transport of North Atlantic Water and a southward transport of the overflow water.

The water masses (fig. 9) of the upper layers (MNAW) are characterised by temperatures higher than 7° C and salinities from 35.18-35.35 reaching down to 200m. On the eastern part of the ridge the upper layer mass is fairly homogeneous in temperature and salinity. Water masses of the lower layer, deeper than 300 m (overflow water) are colder and less saline and flow southwards. The interface between the two main masses is sloping down towards the Faroe Islands, which indicates a northward geostrophic transport of the upper layers and a southward flow of the lower layers. The overflow water is mainly concentrated on the western side of the deeper trenches. At the western part of the ridge close to the Icelandic coast, it exists a third water mass coming from the north of Iceland, the East Iceland Water. This water originates from the low salinity polar water, carried in the East Greenland Current. The EIW re-circulates into the Nordic Seas due to a pressure gradient towards the north. On the Faroe shelf the water is well mixed and homogeneous in temperature, salinity and density. This is caused by wind at the surface, strong tidal currents and the resulting bottom friction. Generally, salinity is low in the lower and upper layers. (The first 20m of salinity data was cut off due to inaccuracies.) In the middle there is a layer of high salinity with patches of even higher values.

The overflow water across the Iceland- Faroe-Ridge behaves mainly as expected from the influence of the geostrophic balance, with hugging the western side of the trenches, except of one case where it is leaning towards the eastern side of the trench (stations 718-723). The isolines in this area are doming. This strongly indicates the existence of an anticylonic eddy. The radius of the eddy is about 50 km, which matches the calculated Rossby radius of approximately 37 km in this area.

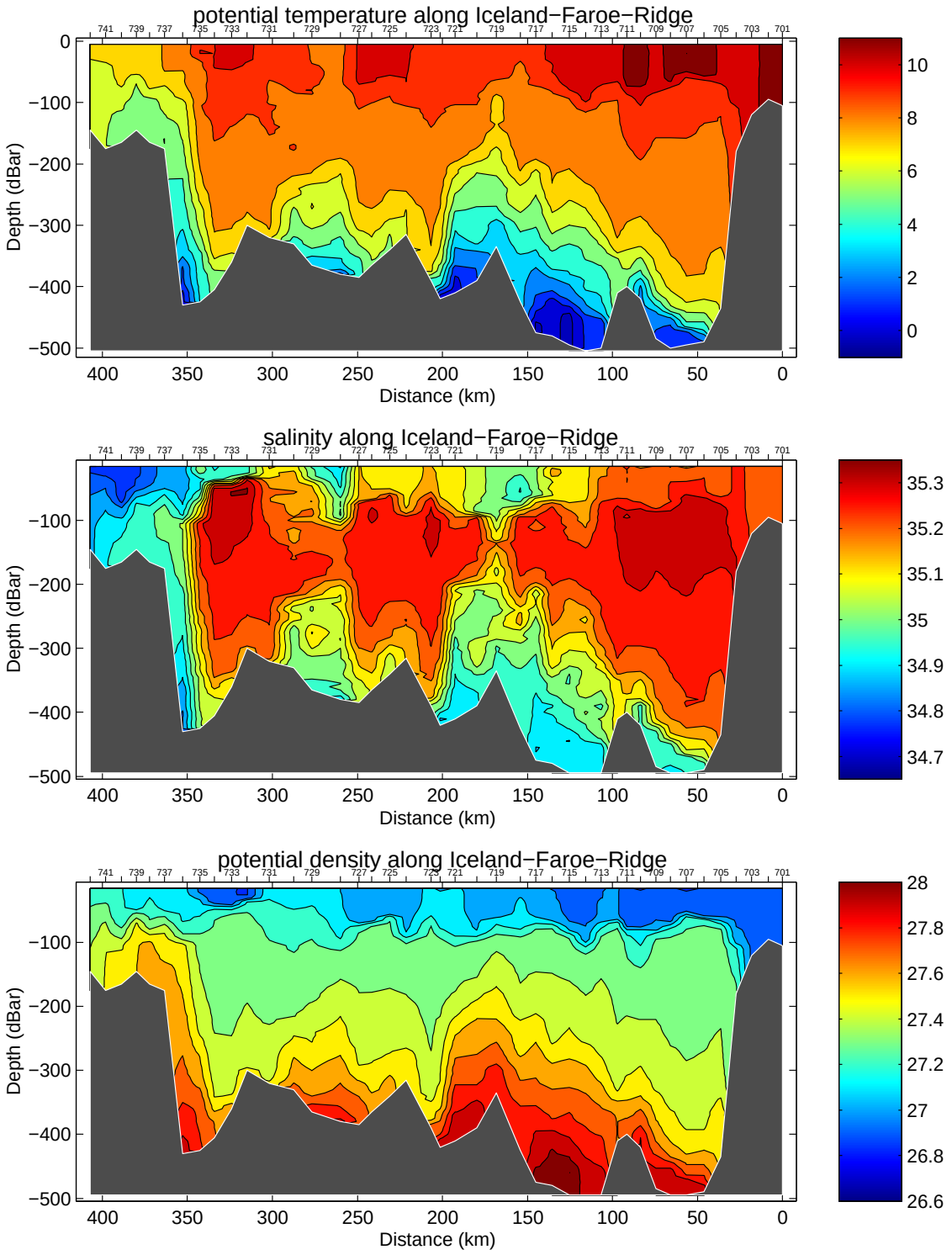

Figure 9: a) Potential temperature, b) salinity and c) potential density of the Iceland Faroe Ridge section

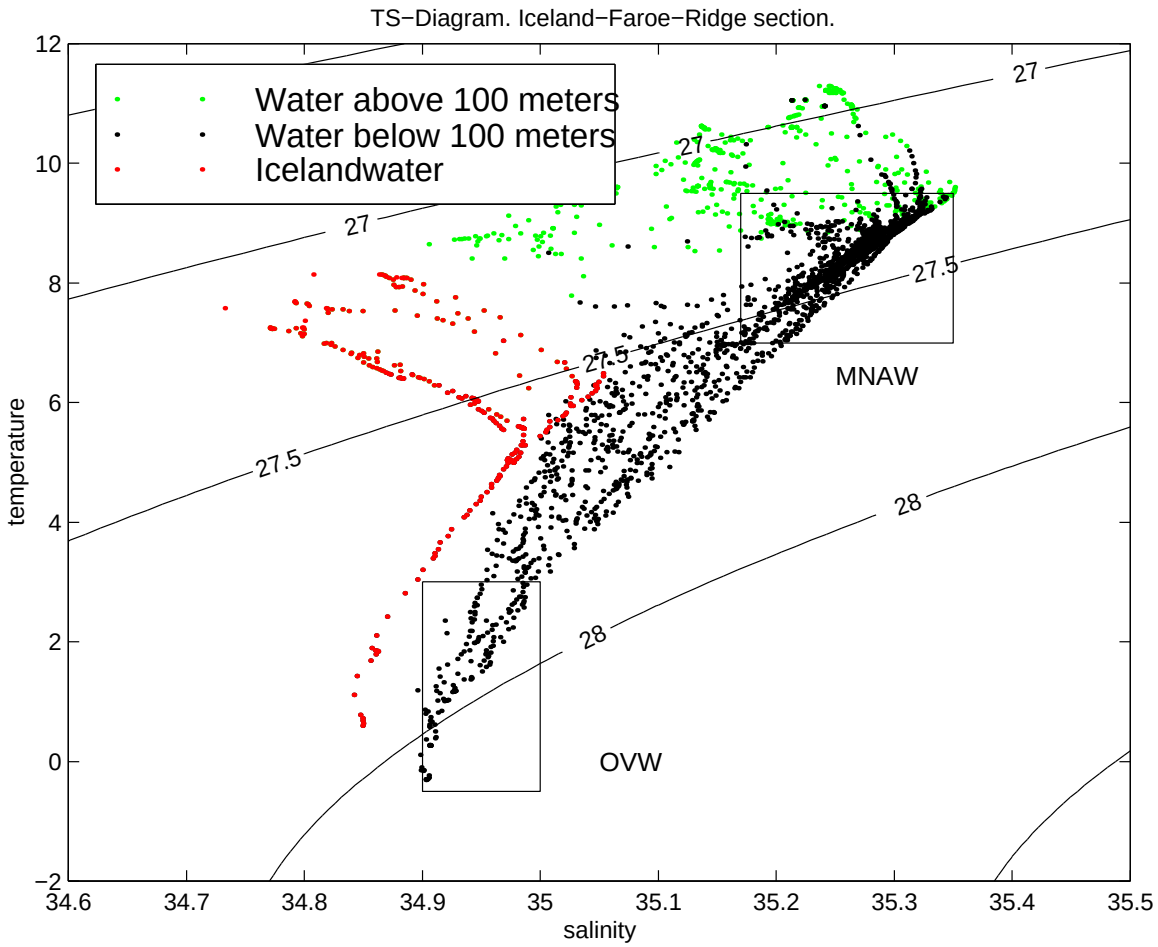

Figure 10: TS-diagram of the Iceland Faroe Ridge Section. The box in the upper right corner indicates the MNAW (Modified North Atlantic Water) with a temperature of 7-8.5 degrees and a salinity of 35.15-35.35. The lower box indicates the deep OW (Overflow Water) with a temperature of -0.5 – 3° C and a salinity of 34.9 – 35. The stations 736- 742 are plotted in red and indicate East Icelandic Water (EIW), which is defined by lower salinity. The green dots represent the upper hundred meters .

MNAW is the main water mass in the upper layer flowing northwards. OW is the main water mass in the lower layer flowing south. The low salinity water (EIW) was mainly located close to the Icelandic coast (fig. 9). The water in the upper hundred meters is modified by interactions with the atmosphere like rain, continental runoff and seasonal warming.

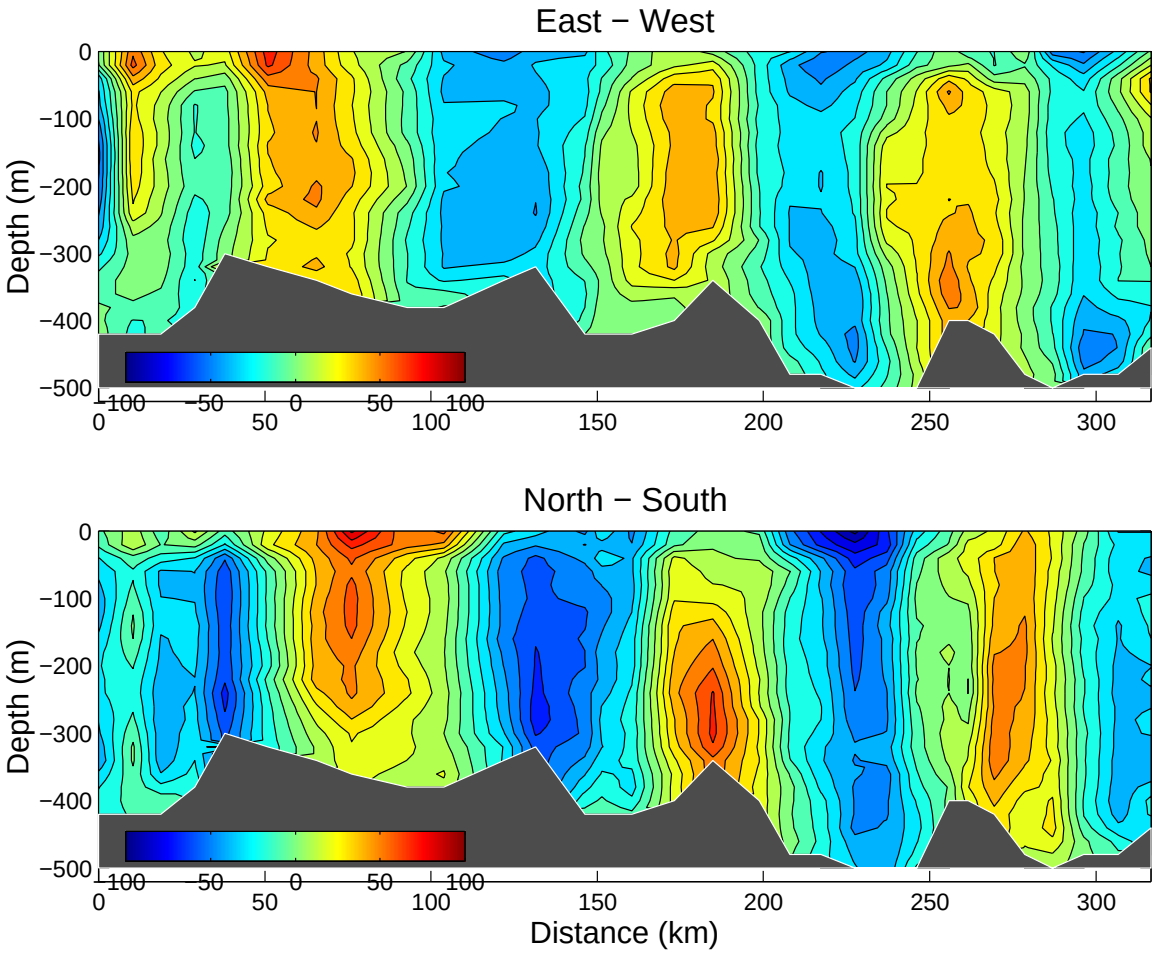

Figure 11: a) East-West component of the velocity distribution across the Iceland-Faroe-Ridge (cm/s) . Red indicates the eastward and blue the westward flow. b) North-South component of the velocity distribution across the Iceland-Faroe-Ridge (cm/s). Red indicates the northward and blue the southward flow.

The velocity distribution does not fit the expectations of a northward flow in the upper layer and a southward flow in the lower layer. Instead of a vertical structure, clear horizontal structures with very strong barotropic currents from the bottom to the top were found. The fact that these structures are so evenly distributed makes it unlikely that they are energetic eddies. It is more likely that the structures are caused by tides. Figure 12 shows the currents plotted versus time to detect possible periodic structures. The result looks very similar to a tidal vector profile. The structure repeats itself every six hours and the U and V components of the currents are in phase.

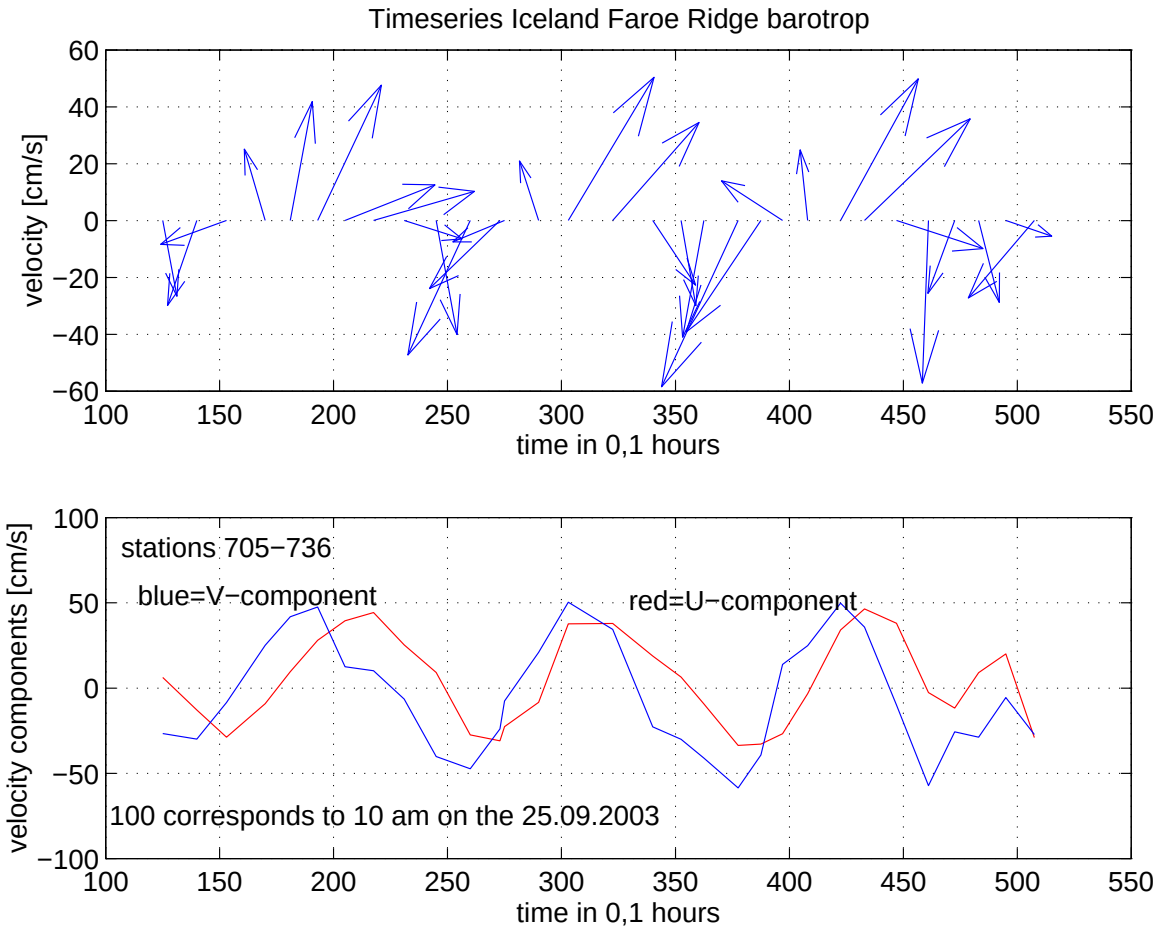

Figure 12: Velocity vectors plotted versus time. U is the East-West component (red) and V the North-South component (blue) of the currents.

Conclusions

- The water on the ridge consists of three basic water masses (MNAW, OW and EIW) and mixtures between them.

- As in other studies the sloping interface between the two main water masses (MNAW and OW) was also detected.

- There is evidence for eddy activity carrying overflow water across the ridge.

- East Iceland Water exist on the western side of the ridge.

- Strong tidal oscillations are overlaying the geostrophic transport.

Water mass exchange through the Faroe Bank Channel

CTD/lADCP measurements were made along three sections in the Faroe Bank Channel: the entrance section in the south-east of the channel, the central section over the sill and the exit section in the north-west. Fig. 13 – 16 show the temperature and salinity distribution of the entrance and exit sections. Generally, a two layer system in temperature and salinity can be identified in the Faroe Bank Channel consisting of a layer

of cold and fresh water (Overflow Water from the north) in the deep and a layer of warm and saline water (North Atlantic Water from the south) above. In between the two layers mixing takes place and the upper layer can also be modified by freshwater at the surface.

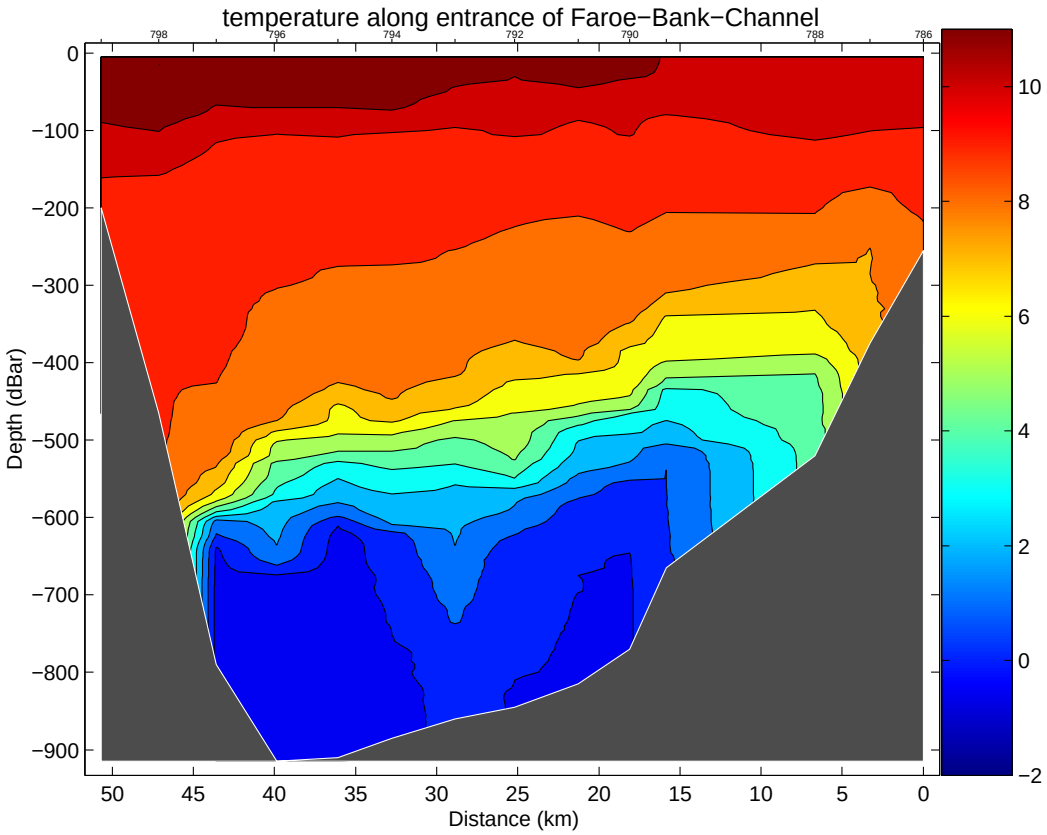

Figure 13: Potential temperature (°C) distribution of the Faroe Bank Channel entry section (FB_en)

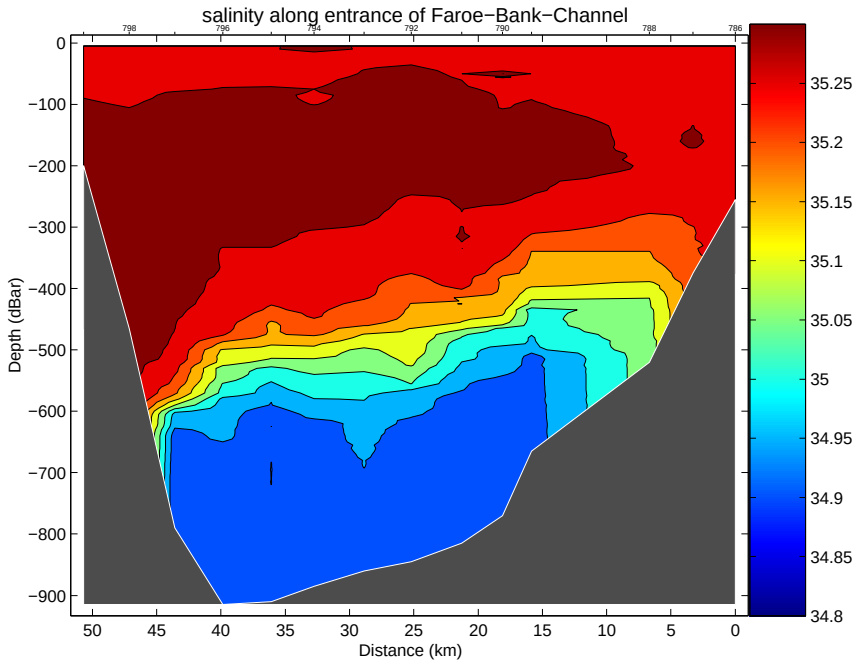

Figure 14:Salinity distribution of the Faroe Bank Channel entry section (FB_en)

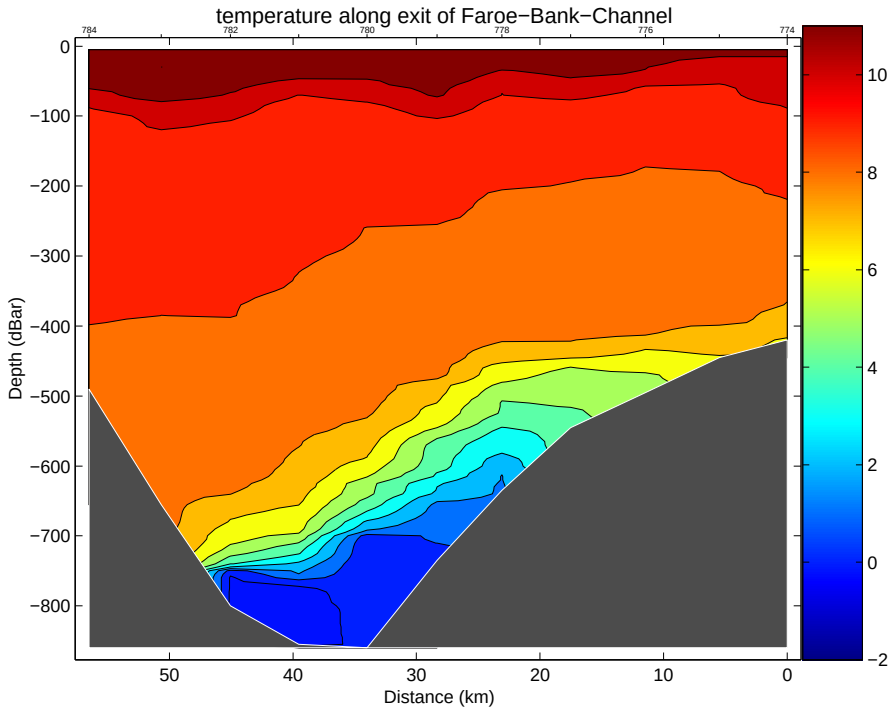

Figure 15: Potential temperature (°C) distribution of the Faroe Bank Channel exit section (FB_ex)

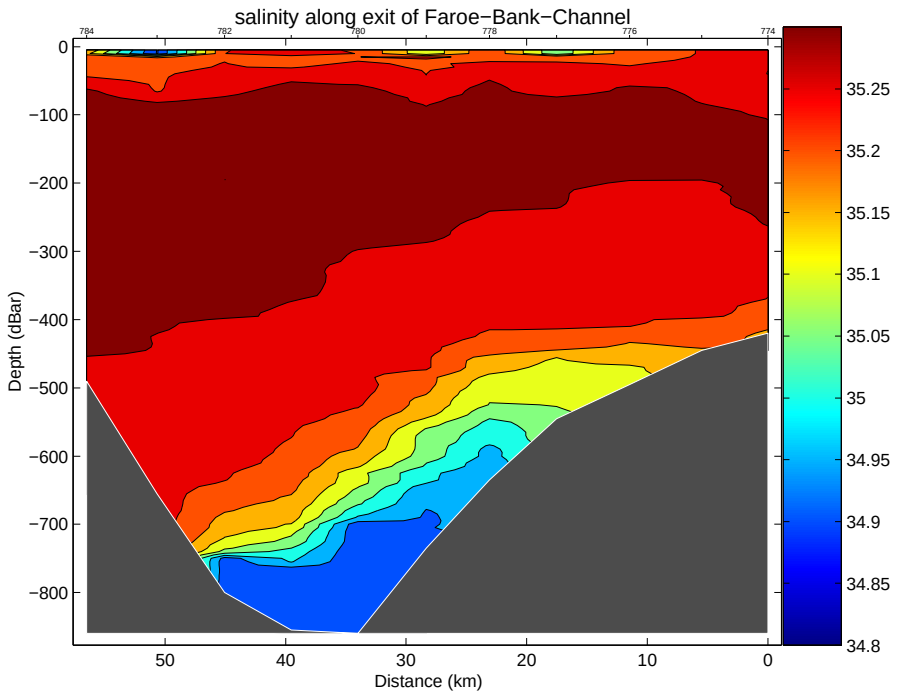

Figure 16: Salinity distribution of the Faroe Bank Channel exit section (FB_ex)

Water mass exchange across the Wyville Thomson Ridge

The Wyville Thomson Ridge is the boundary between the Faroe Shetland Channel in the north and the Rockall Channel in the south and has a sill depth between 450 and 600m. Fig. 17 shows the temperature, salinity and density distribution of the WTR section. The surface layers are dominated by the Continental Slope Current which transports warm and saline Atlantic water to the north. The maximum temperature of the water mass can be found in the eastern corner of the section. A small portion of overflow water coming from the north spills over the ridge on the western, deeper side of the section. But the major part of the overflow water is blocked by the ridge and has to flow through the deeper Faroe Bank Channel.

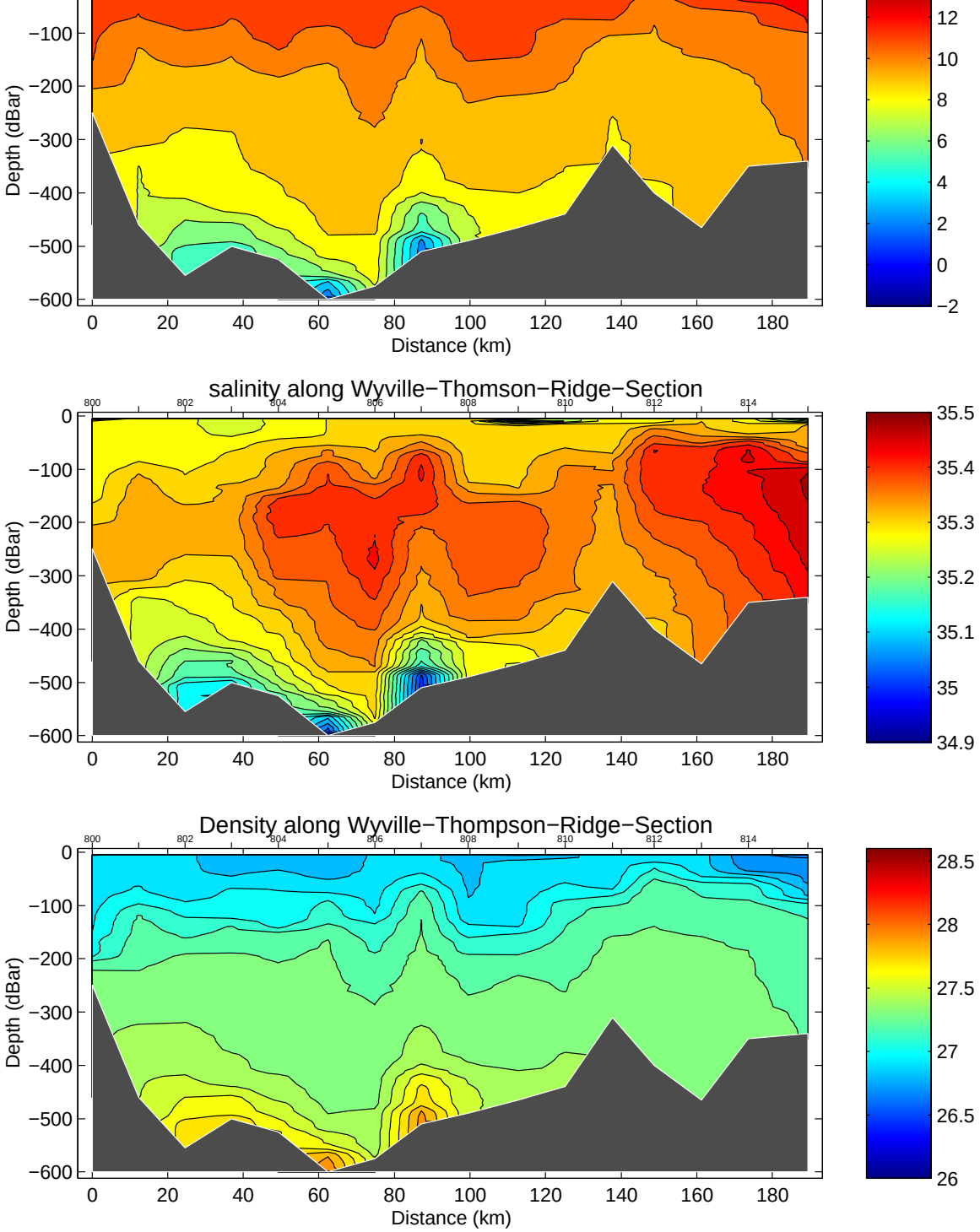

Figure 17: a) Potential temperature), b) salinity and c) density distribution of the Wyville Thomson Ridge section.

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