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Cruise Report
S/V KOMMANDOR JACK cruises 02 & 03

Tórshavn - Tórshavn - Leith
12. July – 19. July – 29. July 2001
Technical Report 2-01

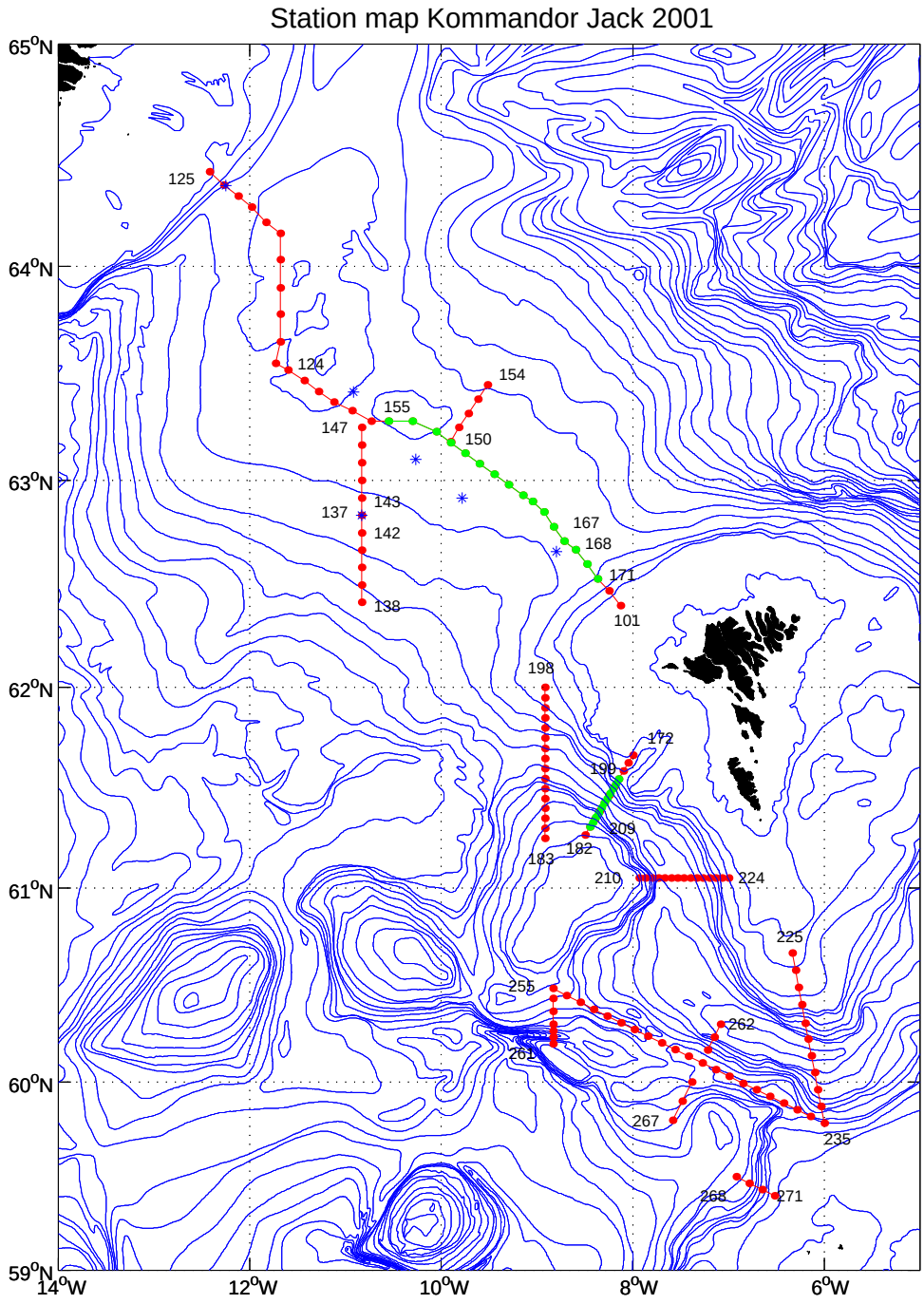

Figure 1: Overview over the measurements carried out during the 2001 student cruise with SV KOMMANDOR JACK. Red dots indicate single CTD stations, green double CTD stations and blue stars indicate mooring positions.

Stationlist:

STATION NO.	DATE	TIME	POSITION Latitude	Longitude	DEPTH in m	PRESSURE in dbar	COMMENTS
101	14.07.2001	05:54	62° 23.82‘N	08° 07.26‘ W	134	128.4	
102	14.07.2001	07:17	62° 27.81‘ N	08° 15.52‘ W	218	209.0	
103	14.07.2001	08:32	62° 31.95‘ N	08° 21.95‘ W	462	447.8	
104	14.07.2001	09:54	62° 35.97‘ N	08° 29.31‘ W	499	486.3	
105	14.07.2001	11:27	62° 40.01‘ N	08° 36.46‘ W	502	470.7	
106	14.07.2001	12:46	62° 43.06‘ N	08° 43.06‘ W	508	487.0	
107	14.07.2001	14:06	62° 46.95‘ N	08° 49.71‘ W	501	471.7	
108	14.07.2001	15:26	62° 51.10‘ N	08° 56.11‘ W	428	414.8	
109	14.07.2001	16:36	62° 54.11‘ N	09° 03.17‘ W	412	398.8	
110	14.07.2001	17:34	62° 56.18‘ N	09° 09.28‘ W	425	405.0	
111	14.07.2001	18:38	62° 58.91‘ N	09° 17.55‘ W	509	489.4	
112	14.07.2001	19:55	63° 01.64‘ N	09° 27.12‘ W	515	498.9	
113	14.07.2001	21:05	63° 04.77‘ N	09° 36.15‘ W	509	493.5	
114	14.07.2001	22:17	63° 07.91‘ N	09° 45.17‘ W	490	476.4	
115	14.07.2001	23:32	63° 11.02‘ N	09° 54.62‘ W	488	464.1	
116	15.07.2001	00:47	63° 14.16‘ N	10° 03.27‘ W	436	421.3	
117	15.07.2001	02:07	63° 17.10‘ N	10° 18.01‘ W	350	325.6	
118	15.07.2001	03:30	63° 16.92‘ N	10° 32.97‘ W	410	398.2	
119	15.07.2001	04:52	63° 16.93‘ N	10° 49.46‘ W	423	410.4	
120	15.07.2001	05:56	63° 19.96‘ N	10° 55.68‘ W	431	416.4	
121	15.07.2001	07:05	63° 21.92‘ N	11° 06.53‘ W	428	414.6	
122	15.07.2001	08:11	63° 25.05‘ N	11° 16.91‘ W	333	323.8	
123	15.07.2001	09:08	63° 27.82‘ N	11° 26.57‘ W	356	341.4	
124	15.07.2001	10:10	63° 30.81‘ N	11° 36.40‘ W	366	354.2	
125	15.07.2001	16:40	64° 26.11‘ N	12° 24.75‘ W	207	192.6	
126	15.07.2001	17:48	64° 22.61‘ N	12° 15.14‘ W	452	424.8	Mooring No. 1
127	15.07.2001	20:33	64° 18.27‘ N	12° 06.34‘ W	440	423.0	
128	15.07.2001	21:50	64° 16.03‘ N	11° 58.43‘ W	424	406.3	
129	15.07.2001	22:53	64° 11.84‘ N	11° 49.69‘ W	377	368.0	
130	16.07.2001	00:05	64° 09.03‘ N	11° 40.66‘ W	317	295.8	
131	16.07.2001	01:24	64° 01.92‘ N	11° 41.36‘ W	345	323.1	
132	16.07.2001	02:48	63° 53.92‘ N	11° 40.63‘ W	351	314.3	
133	16.07.2001	04:05	63° 46.79‘ N	11° 40.48‘ W	373	354.3	
134	16.07.2001	05:31	63° 38.89‘ N	11° 40.92‘ W	396	384.0	
135	16.07.2001	06:43	63° 32.77‘ N	11° 43.59‘ W	402	389.5	
136	16.07.2001	09:43	63° 24.98‘ N	10° 54.97‘ W	435	422.2	Mooring No. 2
137	16.07.2001	14:42	62° 50.04‘ N	10° 49.91‘ W	510	487.4	Mooring No. 3
138	16.07.2001	20:10	62° 24.83‘ N	10° 50.37‘ W	720	711.8	
139	16.07.2001	21:28	62° 29.93‘ N	10° 49.81‘ W	658	649.2	
140	16.07.2001	22:41	62° 34.99‘ N	10° 49.96‘ W	629	618.1	
141	16.07.2001	23:58	62° 40.01‘ N	10° 50.04‘ W	606	585.2	
142	17.07.2001	01:15	62° 45.11‘ N	10° 49.96‘ W	577	558.2	
143	17.07.2001	02:49	62° 55.24‘ N	10° 49.42‘ W	473	450.0	
144	17.07.2001	03:52	63° 00.21‘ N	10° 49.54‘ W	437	421.0	
145	17.07.2001	04:53	63° 05.10‘ N	10° 49.55‘ W	452	438.8	
146	17.07.2001	05:55	63° 10.07‘ N	10° 49.66‘ W	416	402.9	
147	17.07.2001	06:56	63° 15.06‘ N	10° 49.32‘ W	395	382.1	
148	17.07.2001	09:07	63° 06.04‘ N	10° 15.76‘ W	478	469.8	Mooring No. 4
149	17.07.2001	12:36	62° 54.97‘ N	09° 46.97‘ W	495	459.2	Mooring No. 5
150	17.07.2001	16:04	63° 15.32‘ N	09° 48.95‘ W	459	476.1	
151	17.07.2001	17:07	63° 19.19‘ N	09° 43.22‘ W	493	467.3	
152	17.07.2001	18:10	63° 22.97‘ N	09° 37.02‘ W	508	494.7	

STATION NO.	DATE	TIME	POSITION Latitude	Longitude	DEPTH in m	PRESSURE in dbar	COMMENTS
153	17.07.2001	19:16	63° 27.00‘ N	09° 30.91‘ W	543	524.6	
154	17.07.2001	20:25	63° 30.99‘ N	09° 25.31‘ W	574	550.0	
155	18.07.2001	00:16	63° 17.05‘ N	10° 33.02‘ W	412	393	
156	18.07.2001	01:43	63° 17.21‘ N	10° 18.71‘ W	349	313.2	
157	18.07.2001	03:20	63° 14.15‘ N	10° 02.66‘ W	462	434.2	
158	18.07.2001	04:29	63° 11.23‘ N	09° 52.99‘ W	488	473.7	
159	18.07.2001	05:44	63° 07.24‘ N	09° 44.37‘ W	494	480.5	
160	18.07.2001	06:49	63° 05.17‘ N	09° 35.10‘ W	507	485.9	
161	18.07.2001	07:50	63° 01.73‘ N	09° 26.29‘ W	515	500.8	
162	18.07.2001	08:15	62° 58.82‘ N	09° 17.89‘ W	510	495.4	
163	18.07.2001	09:56	62° 55.86‘ N	09° 08.66‘ W	425	412.4	
164	18.07.2001	10:49	62° 53.85‘ N	09° 02.98‘ W	413	402.0	
165	18.07.2001	11:51	62° 51.06‘ N	08° 56.31‘ W	426	418.0	
166	18.07.2001	13:09	62° 47.04‘ N	08° 50.07‘ W	497	487.4	
167	18.07.2001	14:29	62° 43.02‘ N	08° 43.19‘ W	509	493.5	
168	18.07.2001	16:00	62° 40.00‘ N	08° 48.00‘ W			Mooring No. 6 no CTD
169	18.07.2001	17:25	62° 40.28‘ N	08° 36.01‘ W	504	/	no samples
170	18.07.2001	18:35	62° 36.33‘ N	08° 28.98‘ W	500	/	no samples
171	18.07.2001	19:42	62° 32.00‘ N	08° 21.77‘ W	464	/	no samples
172	20.07.2001	23:59	61° 40.04‘ N	08° 00.29‘ W	197	175.9	
173	20.07.2001	00:59	61° 37.49‘ N	08° 03.18‘ W	265	241.2	
174	20.07.2001	01:48	61° 35.17‘ N	08° 06.24‘ W	308	288.8	
175	20.07.2001	02:42	61° 32.81‘ N	08° 09.26‘ W	278	253.8	
176	20.07.2001	03:52	61° 30.44‘ N	08° 13.00‘ W	405	389.1	
177	20.07.2001	04:58	61° 28.27‘ N	08° 14.97‘ W	628	616.4	
178	20.07.2001	06:10	61° 25.59‘ N	08° 18.41‘ W	826	807.0	
179	20.07.2001	07:21	61° 23.07‘ N	08° 21.05‘ W	656	643.9	
180	20.07.2001	08:29	61° 20.99‘ N	08° 23.66‘ W	445	424.7	
181	20.07.2001	09:24	61° 18.37‘ N	08° 27.10‘ W	340	333.3	
182	20.07.2001	10:10	61° 15.81‘ N	08° 29.92‘ W	216	204.6	
183	20.07.2001	21:10	61° 15.19‘ N	08° 54.97‘ W	299	289.7	
184	20.07.2001	21:58	61° 18.07‘ N	08° 55.09‘ W	326	313.9	
185	20.07.2001	22:45	61° 21.03‘ N	08° 55.21‘ W	327	319.8	
186	21.07.2001	23:40	61° 24.02‘ N	08° 55.34‘ W	359	334.9	
187	21.07.2001	00.34	61° 27.00‘ N	08° 55.07‘ W	416	388.8	
188	21.07.2001	01:33	61° 29.99‘ N	08° 55.26‘ W	501	462.0	
189	21.07.2001	02:35	61° 32.96‘ N	08° 54.98‘ W	666	635.8	
190	21.07.2001	03:43	61° 36.09‘ N	08° 54.73‘ W	827	812.0	
191	21.07.2001	04:49	61° 39.15‘ N	08° 54.70‘ W	866	856.0	
192	21.07.2001	05:59	61° 42.30‘ N	08° 54.81‘ W	865	761.0	
193	21.07.2001	07:07	61° 45.00‘ N	08° 55.32‘ W	753	741.6	
194	21.07.2001	08:09	61° 48.21‘ N	08° 54.90‘ W	637	624.4	
195	21.07.2001	09:02	61° 51.15‘ N	08° 54.91‘ W	559	542.5	
196	21.07.2001	09:53	61° 54.11‘ N	08° 54.86‘ W	509	500.0	
197	21.07.2001	10:44	61° 57.18‘ N	08° 54.98‘ W	463	443.7	
198	21.07.2001	11:50	62° 00.03‘ N	08° 54.55‘ W	437	392.3	
199	21.07.2001	21:12	61° 32.87‘ N	08° 09.09‘ W	282	270.8	
200	21.07.2001	21:59	61° 31.36‘ N	08° 10.51‘ W	262	257.2	
201	21.07.2001	22:54	61° 29.91‘ N	08° 12.51‘ W	424	417.7	
202	21.07.2001	23.42	61° 28.52‘ N	08° 14.27‘ W	596	588.2	
203	22.07.2001	00:36	61° 26.98‘ N	08° 16.34‘ W	737	678.4	
204	22.07.2001	01:31	61° 25.36‘ N	08° 18.09‘ W	821	759.5	
205	22.07.2001	02:30	61° 24.44‘ N	08° 19.64‘ W	840	801.2	

STATION NO.	DATE	TIME	POSITION Latitude	Longitude	DEPTH in m	PRESSURE in dbar	COMMENTS
206	22.07.2001	03:30	61° 22.34‘ N	08° 21.55‘ W	581	573.0	
207	22.07.2001	04:23	61° 21.24‘ N	08° 23.47‘ W	466	457.0	
208	22.07.2001	05:13	61° 19.90‘ N	08° 25.23‘ W	373	363.0	
209	22.07.2001	5:57	61° 18.38‘ N	08° 27.12‘ W	340	333.0	
210	22.07.2001	13:24	61° 02.99‘ N	07° 55.94‘ W	218	206.0	
211	22.07.2001	14:09	61° 03.02‘ N	07° 52.00‘ W	474	463.7	
212	22.07.2001	15:08	61° 02.90‘ N	07° 48.28‘ W	785	773.0	
213	22.07.2001	16:28	61° 02.58‘ N	07° 44.87‘ W	940	917.0	
214	22.07.2001	17:27	61° 03.13‘ N	07° 39.87‘ W	931	915.6	
215	22.07.2001	18:29	61° 03.46‘ N	07° 36.55‘ W	909	877.4	
216	22.07.2001	19:36	61° 02.83‘ N	07° 32.26‘ W	888	867.4	
217	22.07.2001	20:41	61° 03.35‘ N	07° 28.14‘ W	866	836.2	
218	22.07.2001	21.36	61° 03.46‘ N	07° 24.21‘ W	843	817.8	
219	22.07.2001	22:35	61° 03.39‘ N	07° 19.48‘ W	785	756.2	
220	23.07.2001	00:25	61° 02.90‘ N	07° 15.75‘ W	689	672.9	
221	23.07.2001	01:23	61° 02.95‘ N	07° 11.86‘ W	537	525.7	
222	23.07.2001	02:17	61° 02.87‘ N	07° 07.86‘ W	388	375.5	
223	23.07.2001	03:05	61° 02.68‘ N	07° 03.72‘ W	267	258	
224	23.07.2001	03:52	61° 02.88‘ N	07° 00.24‘ W	244	233	
225	23.07.2001	07:37	60° 40.12‘ N	06° 20.24‘ W	233	223.9	
226	23.07.2001	08:23	60° 34.86‘ N	06° 17.98‘ W	279	265.2	
227	23.07.2001	09:54	60° 29.51‘ N	06° 15.80‘ W	287	274.9	
228	23.07.2001	11:05	60° 24.26‘ N	06° 13.72‘ W	387	370.2	
229	23.07.2001	12:17	60° 18.66‘ N	06° 11.96‘ W	624	610.5	
230	23.07.2001	13:39	60° 03.33‘ N	06° 09.98‘ W	1186	1114.3	
231	23.07.2001	15:10	60° 08.05‘ N	06° 07.48‘ W	1204	1170	
232	23.07.2001	16.39	60° 02.88‘ N	06° 05.38‘ W	1100	1068.1	
233	23.07.2001	18:25	56° 57.61‘ N	06° 03.39‘ W	988	956.6	
234	23.07.2001	19:57	59° 52.28‘ N	06° 01.48‘ W	752	725.3	
235	23.07.2001	21:19	59° 46.86‘ N	05° 99.85‘ W	260	345.8	
236	23.07.2001	22:31	59° 49.00‘ N	06° 07.74‘ W	483	474.9	
237	23.07.2001	23:46	59° 51.77‘ N	06° 16.37‘ W	430	383.5	
238	24.07.2001	01:05	59° 53.31‘ N	06° 24.58‘ W	423	414.0	
239	24.07.2001	02:20	59° 55.23‘ N	06° 33.47‘ W	342	332.5	
240	24.07.2001	03:29	59° 57.56‘ N	06° 42.03‘ W	354	340.0	
241	24.07.2001	04:37	59° 59:37‘ N	06° 51.57‘ W	479	471.0	
242	24.07.2001	05:42	60° 0164‘ N	06° 59.85‘ W	457	442.0	
243	24.07.2001	06:47	60° 37.81‘ N	07° 84.41‘ W	499	484.6	
244	24.07.2001	07:50	60° 06.09‘ N	07°.01.65‘ W	518	491.1	
245	24.07.2001	08:55	60° 08.02‘ N	07° 24.95‘ W	528	466.0	
246	24.07.2001	10:07	60° 10.14‘ N	07° 33.14‘ W	549	518.6	
247	24.07.2001	11:24	60° 12.00‘ N	07° 41.00‘ W	647	613.6	
248	24.07.2001	12:36	60° 14.47‘ N	07° 51.03‘ W	607	572.3	
249	24.07.2001	13:43	60° 16.67‘ N	07° 59.81‘ W	543	491.7	
250	24.07.2001	14:47	60° 18.47‘ N	08° 07.80‘ W	545	535.4	
251	24.07.2001	15:55	60° 20.66‘ N	08° 15.55‘ W	534	521.0	
252	24.07.2001	17:04	60° 22.84‘ N	08° 24.34‘ W	576	538.5	
253	24.07.2001	18:12	60° 24.87‘ N	08° 32.12‘ W	532	512.3	
254	24.07.2001	19:17	60° 26.93‘ N	08° 41.16‘ W	423	410.8	
255	24.07.2001	20:18	60° 29.14‘ N	08° 50.14‘ W	265	249.2	
256	24.07.2001	21:08	60° 26.15‘ N	08° 49.68‘ W	345	327.8	
257	24.07.2001	22:06	60° 22.21‘ N	08° 49.44‘ W	471	455.6	
258	24.07.2001	23:01	60° 18.29‘ N	08° 49.29‘ W	690	672.1	
259	24.07.2001	00:16	60° 16.00‘ N	08° 49.72‘ W	799	775.7	

STATION NO.	DATE	TIME	POSITION Latitude	Longitude	DEPTH in m	PRESSURE in dbar	COMMENTS
260	25.07.2001	01:15	60° 14.35‘ N	08° 50.17‘ W	1069	1011.1	
261	25.07.2001	02:16	60° 12.48‘ N	08° 50.09‘ W	728	729.9	
262	25.07.2001	08:15	60° 17.39‘ N	08° 04.73‘ W	1176	1152.4	
263	25.07.2001	10:12	60° 13.88‘ N	07° 08.92‘ W	1122	/	no samples
264	25.07.2001	11:31	60° 10.14‘ N	07° 12.50‘ W	867	/	no samples
265	25.07.2001	13:30	60° 00.08‘ N	07° 22.50‘ W	571	/	no samples
266	25.07.2001	14:54	59° 53.91‘ N	07° 28.75‘ W	740	/	no samples
267	25.07.2001	16:25	59° 47.65‘ N	07° 34.82‘ W	810	/	no samples
268	25.07.2001	19:40	59° 30.21‘ N	06° 55.11‘ W	993	/	no samples
269	25.07.2001	20:51	59° 28.08‘ N	06° 46.45‘ W	900	/	no samples
270	25.07.2001	21:46	59° 26.10‘ N	06° 38.63‘ W	483	/	no samples
271	25.07.2001	22:30	59° 23.94‘ N	06° 03.63‘ W	199	/	no samples

1. Aims of the cruise

S/V KOMMANDOR JACK cruises 02 & 03 were carried out by the Institut für Meereskunde of the University of Hamburg. Researchers and students from the Institut für Umweltphysik of the University of Bremen and from the Niels Bohr Instituttet for Astronomi, Fysik og Geofysik of the University of Copenhagen also participated.

The cruise had several 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 from the Norwegian Sea into the North Atlantic over the ridge system between Iceland and the Faroe Islands, through the Faroe-Bank Channel, and across the Wyville-Thomson Ridge and to study its short-time variability and
- to deploy and recover several temperature-pressure recorders in the overflow path.

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 and an analysis of historical data the observational programme was designed. Hydrographic stations were occupied along several sections crossing the overflow. It was originally planned to use RV POSEIDON for this cruise. However, due to a fire aboard this vessel in May, the former R/V VALDIVIA now S/V KOMMANDOR JACK was chartered for task.

The University of Hamburg financed the experiment.

The result from these preparations are summarised on a WEB site and can be found under www.dcess.ku.dk, together with some preliminary results from the cruise itself.

2. Narrative

Thursday, 12. July 2001
Tórshavn

Originally it was planned to sail on this day, but the departure had to be delayed. The damaged conducting cable of the CTD winch had to be replaced and was only due to arrive from Aberdeen the next morning. The scientific crew embarked during the early afternoon.

Friday, 13. July 2001
Tórshavn

During the morning the scientific crew received instructions on the emergency procedures and were able to watch a boat drill. Later the students were shown how to handle the scientific equipment, mainly the CTD and the rosette water sampler. The mooring equiment was loaded as well as some instrumentation from the Faroese Fisheries Laboratory, until finally during the early afternoon the new CTD wire arrived. It was spooled onto the winch and at last KOMMANDOR JACK sailed five minutes before midnight.

Saturday, 14. July 2001
Noon position: 62° 43’ N, 08° 43’ W, partly cloudy, NW 4 Bft, 11°C

During the night the connections to the cable were made, and already the first test proved positive. At about 6.30 hrs in the morning we started a CTD section along the Faeroe-Island ridge. Bottles were triggered at three depth levels and samples taken for the analysis of dissolved oxygen content and for salinity. All day the sky was blue and the sea calm, but unfortunately this did not prevent some of the students to become seasick. Nevertheless 15 stations were occupied this day which covered about one third of the distance to Iceland. In addition the self recording temperature-pressure recorders of the University of Copenhagen were tested by lowering them together with the CTD.

Sunday, 15. July 2001
Noon position: 63° 40’ N, 11° 40’ W, partly cloudy, S 3 Bft, 14°C

Station sampling continued until about 11:30 a.m. We then sailed directly to the western end of the section at the Icelandic shelf break to deploy the first of the six temperature-pressure recorder moorings. These moorings consist of two weights connected with a 300 m long steel wire. The instrument is attached to one of the weights. The idea behind the mooring deployment is to monitor the steadyness of the cold overflows in the various trenches in the ridge. Earlier surveys have indicated intermittent rather then continuous flows, which should show up in the temperature records. The plan is to recover the instruments durings next years student cruise.

From here the CTD section was continued, towards the east. Fortunately, most of the students had recovered from their seasickness and were now back to normal, thanks to the pleasant weather.

Monday, 16. July 2001
Noon position: 63º 25’ N 10º 55’ W, cloudy, SE 3-4 Bft, 11°C

Station samplings continued, and at about 8 a.m. we had finished the planned CTD-section along the Faroe-Iceland ridge, having taken altogether 36 profiles. Later two more moorings for monitoring the overflow were deployed and the students started to work up the data, making preliminary plots of the section, station profiles and echo sounder data. At 21 hrs we started a new CTD-section along 10° 50’ W, to look at the path of the overflow after having crossed the ridge. This evening the students had a planning meeting for the remainder of the cruise time. They decided to run a part of the section along the Faroe-Iceland ridge again to see a possible time variation of the overflow. Also a section to the north of the ridge was planned to estimate the size of the mesoscale features observed during the first run.

Tuesday, 17. July 2001
Noon position: 62° 55’ N and 9° 47’ W, cloudy, SE 4 Bft, 11°C

CTD station sampling continued along the north-south section, which ended just before breakfast. Two more moorings were deployed, and around 5 p.m. we started on the northward section which finished at 23 hrs. During the evening the students had a seminar where they discussed how to work up the first results. They split up in two groups, one

working on the aspects of the large scale circulation and the other on the meso-scale time and space variability.

Wednesday, 18. July 2001
Noon position: 62° 51’ N, 08° 57’ W, cloudy, NE 4-5 Bft, 11°C

The eastern part of the along ridge section was repeated, running the same station positions as during the first part of the cruise. The idea was to detect any temporal changes (within about three days) of the cold overflow in the deep eastern trench. During the afternoon the students mainly worked on the report (see below – preliminary results) and the last of the six temperature-pressure recorder moorings was successfully deployed. The last station during this leg (# 71) was finished at 21 hrs and Kommandor Jack set course to Tórshavn. Results of the leg were discussed during the later evening, with the assistance of a few beers.

Thursday, 19. July 2001
Tórshavn

Tórshavn was reached at 07 hrs and the first group of students disembarked at 08 to catch the flight to Copenhagen, the second group left during the early afternoon. The new group arrived around 19 hrs and Kommandor Jack sailed again from Tórshavn at 20 hrs, with course set to the Faroe-Bank Channel in the south.

Friday, 20. July 2001
Noon position: 61° 21’ N 08° 28’ W , cloudy, E 4-5 Bft, 12°C

After steaming to the Faroe-Bank Channel the first station was reached at 00:45 a.m. The night was spent taking CTD stations across the narrowest part of the Faroe-Bank Channel. The section was completed at about 11 a.m. and the afternoon was spent on dredging for moorings put out by the Fishery Institute of the Faroes during February this year. The students processed the data from the night and worked up the thermometer records from the first leg of the cruise. The dredging was not successful and we sailed to the western exit of the channel and at 22 hrs started a north-south CTD section there.

Saturday, 21. July 2001
Noon position: 61° 57' N, 08° 55' W, cloudy, ENE 4 Bft, 10 °C

The western section was run during the night and was completed at about 13:00 pm. Afterwards the collected data were evaluated. It took about 3.5 hours to get to the next position where we again dredged for the moorings of the Fishery Institute of the Faroes. Again, the dredging was not successful and from 22:00 hrs we started to re-occupy the central CTD-section.

Sunday, 22. July 2001
Noon position: 61° 21' N 08° 06' W, foggy, E 3 Bft, 11 °C

At about 7:30 a.m. we finished the repeat of the CTD section in the central Faroe-Bank Channel (FBC) and headed to the northern moorings of the Fishery Institute of the Faroes. The attempts to recover them were again without success, and at noon we went to the southern entrance of the FBC, where the next CTD section started. Within the 24 hours between the repeated CTD sections in the central FBC the temperature and salinity structure remained very similar. Both sections showed the same thickness of the overflow layer of about 200 metres.

Monday, 23. July 2001
Noon position: 60° 18' N 06° 11' W, overcast, S 5 Bft, 10°C

Just after midnight we had a close encounter with a patrol boat, which forced us to terminate the CTD station in a rather hastily way. The boat did not identify itself over radio, but after some time just disappeared in the dark. After this strange and dangerous incident we continued on the Faroe-Bank Channel entry section which we finished at around 4 a.m. We then steamed to the Faroe Shetland Channel (FSC) and occupied a section across it from the southern tip of the Faroese shelf to the European continental shelf. The last station on this section, which was also the first on the Wyville-Thomson Ridge section, was done at 09:30 p.m. and by that time the cloudy weather situation gave way to bright sunshine. The spectacular sun set was topped by the appearance of a school of whales, that came as close as 100 m to the ship.

Tuesday, 24.07.2001

Noon position: 60° 12’ N 07°41’ W, partly cloudy, SW 6 Bft, 12°C

After we finished the Faroe Shetland channel we went WNW along the Wyville-Thomson ridge, which we finished in the early evening at 19:30. Afterwards we went southward to cover a possible overflow path between the Wyville-Thomson ridge and the Ymer ridge which we made until the next morning.

Section plots from these two sections show a bulk of cold water in the FSC and a high salinity of >35.35 and partly also a temperature core at the SE corner, where the two sections meet. This high salinity core appears to continue all over the Wyville-Thomson ridge. The thickness of this high salinity water varies from 50- 300 metres in a depth of about 50 metres. A new station plan was suggested by the students in order to investigate a possible current associated with this high salinity water.

Wednesday, 25.07.2001

Noon position: 60° 10’ N 07° 12’ W, partly cloudy, SW 4 Bft, 10°C

After covering the possible overflow path between the Wyville-Thomson ridge and the Ymer ridge during the early mornings, we steamed for about five hours. We got started with the new stations at about 8.30 am. The main task carried out during the period under review was basically the calibration of the temperature and pressure sensors. No salinity sampling was done during the section. The last station for the entire cruise ended around 11.45 p.m. The

reports by the two groups on the Faroe-Bank Channel overflow and the Atlantic Inflow and cold waters in the Wyville-Thomson Ridge area were reviewed and finally approved. A short celebration of the end of the successful measurements was carried out with some few cans of beer and coke, the Captain of Kommandor Jack gracing the occasion.

Thursday, 26. July 2001
Noon position: 58° 33' N 02° 53' W, sunny, calm, 13°C

During the night Kommandor Jack steamed across the continental shelf to reach the Fair Isle Passage at about 10 a.m. A short northward excursion to see the OLD MAN, a 162 m high pinnacle on the western side of Hoy Island was only partly successful, since it was hidden in the morning fog almost up to the top. However, the fog lifted soon and we were able to enjoy a spectacular tour through the passage, in bright sunshine and waters as calm as a mill pond. The day was used to pack the instrumentation and gear to be shipped to another expedition in the Greenland Sea, to make safety copies of our data sets and to clean up the laboratories. All work was done until tea and we afterwards just enjoyed the scenery, sparkled with all sorts of wildlife including whales, dolfins, seals, and an incredibly variety of sea birds.

Friday, 27. July 2001
Leith

At 08:00 a.m. Kommandor Jack went alongside in Leith, and the students went for a quick visit of the town, before catching the different planes home in the afternoon.

3. Cruise participants

Leg 1, 12. - 19. July 2001

Dagmar Hainbucher	Chief Scientist	IfM
Mai-Britt Kronborg	Scientist	NBIAFoG
Christian Mertens	Scientist	IUP
Detlef Quadfasel	Scientist	NBIAFoG
Abdul Mumem Al raei	Student	IUP
Maike Breiholz	Student	IfM
Silke Hinze	Student	IfM
Guðrið Eiriksdóttir Johansen	Student	NBIAFoG
Karin Margretha Husgard Larsen	Student	UIB
Mutiara Putri	Student	IfM
Voltaire Velazco	Student	IUP

Leg 2, 19. - 27. July 2001

Dagmar Hainbucher	Chief Scientist	IfM
Mai-Britt Kronborg	Scientist	NBIAFoG
Christian Mertens	Scientist	IUP
Detlef Quadfasel	Scientist	NBIAFoG
David Cudjoe Adukpo	Student	IUP
Ole Albrecht	Student	IfM
Henning P. Föh	Student	NBIAFoG
Felix Redmann	Student	IfM
Hendrik Sander	Student	IUP
Steffen Schulz	Student	IfM
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4. Technical information

CTD/Rosette

Altogether 170 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 10-15 m of the bottom. At all stations water samples were taken from three depth levels (10 m depth, mid-depth and 10 m above the bottom). The water samples were analysed onboard for salinity, using a Guildline Autosal salinometer, and during the first leg for dissolved oxygen content. One of the water bottles was also equipped with protected and unprotected reversing thermometers, providing temperature and pressure check values for the CTD sensors.

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 www.dcess.ku.dk.

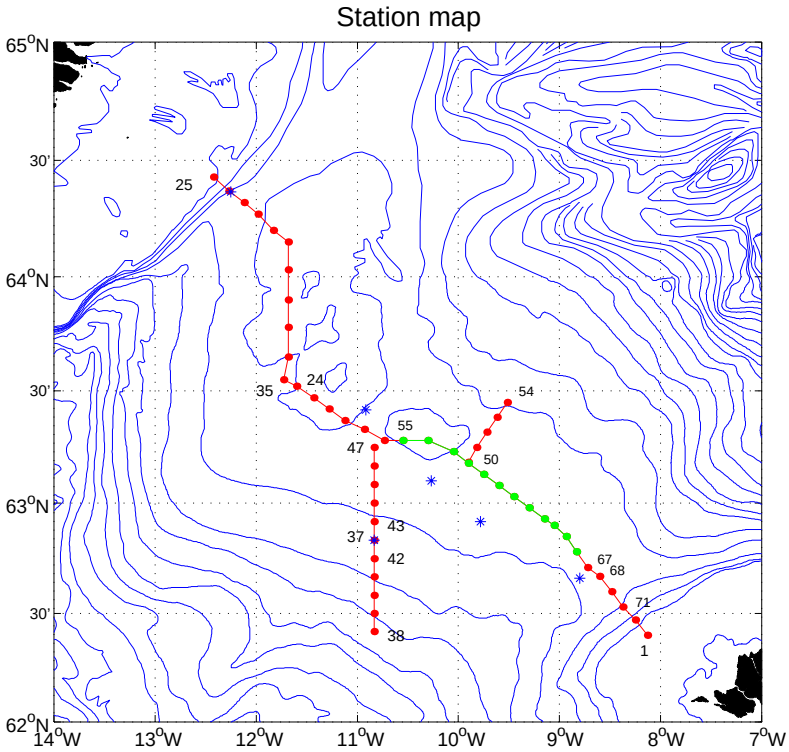

Figure 2: Station Map for leg 1 from 13 – 18 July, 2001.. The red dots represent single stations, the green dots stations that where occupied two times. Blue stars show the mooring positions.

Water masses and large-scale circulation (leg 1)

The North Atlantic Water at the surface is characterised by temperatures higher than 7° C and salinities above 35.15. 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 the North Atlantic Water in the upper layer and a southward transport of the overflow water. Along the ridge we found five eddies showing as peaks of large thickness of overflow water (fig. 3).

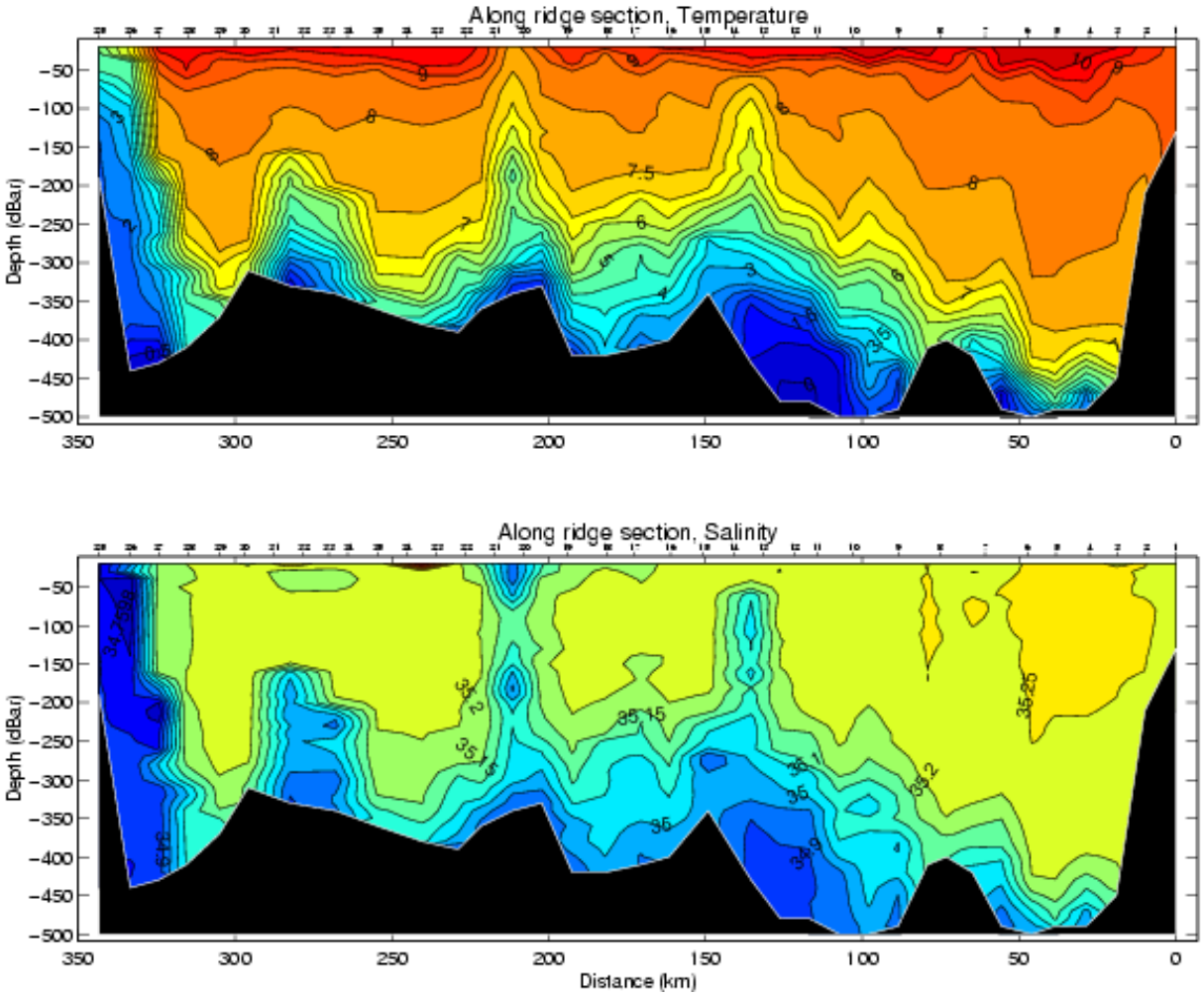

Figure 3: Potential Temperature (a) and Salinity (b) along the Faroe Ridge Section (Station 1 – 35) in 14 – 15 July, 2001.

A TS-diagram (fig. 4) of this area shows three main water masses: The southward flowing Norwegian Sea Arctic Intermediate Water (NSAIW), the Modified North Atlantic Water (MNAW) which flows northward, and the Modified East Icelandic Water (MEIW) in the western part of the section near Iceland. Mixing of the above mentioned water masses is seen to take place. The MEIW originates from the Arctic Ocean and is transported southward via the East Greenland and East Icelandic currents. In the TS diagram the temperature is higher than usually defined (1-3°C) , this is probably due to summer heating.

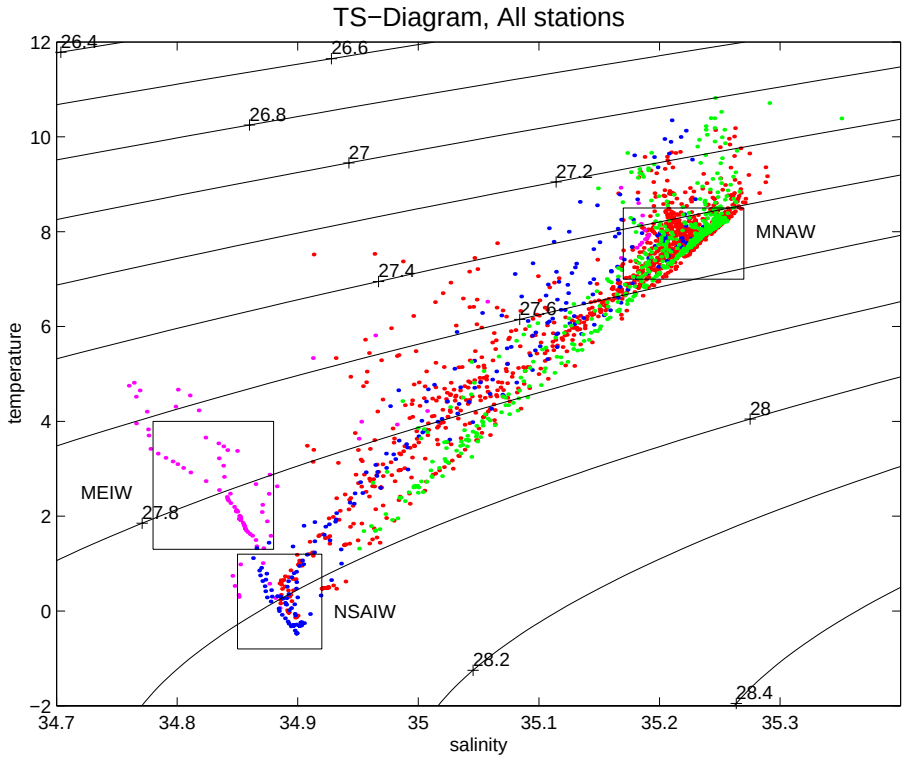

Figure 4: TS-Diagram of all observations. Red represent characteristics from the along ridge section (station 1-35, except 25,26,27). Pink represents the three western most stations (station 25-27), while blue and green represents the rest of the stations north and south of the ridge. The water masses in this area are MNAW (Temperature : 7.0 – 8.5°C and Salinity : 35.10 – 35.30), MEIW (Temperature : 1.0 – 3°C and Salinity : 34.70 – 34.90), and NSAIW (Temperature : -0.5 – +0.5°C and Salinity : 34.87 – 34.90), following the definition of Hansen and Østerhus (2000).

The cold overflow water is characterised with temperatures below 2°C and salinities below 35.0 (fig.4). This water is most often seen on the ridge in the deeper parts, but in one case it is also seen to be hugged onto the western side of the deepest trench. In this trench the thickness of the overflow water is approximately 150 m (fig 3).

In the north on the north-south section (fig. 5) the MNAW is seen as a relative thin layer compared to further south, where it has a thickness of approximately 600 m. North of the ridge overflow water is seen to pile up. As seen in the along ridge section overflow water crosses the ridge mainly through the deeper trenches.

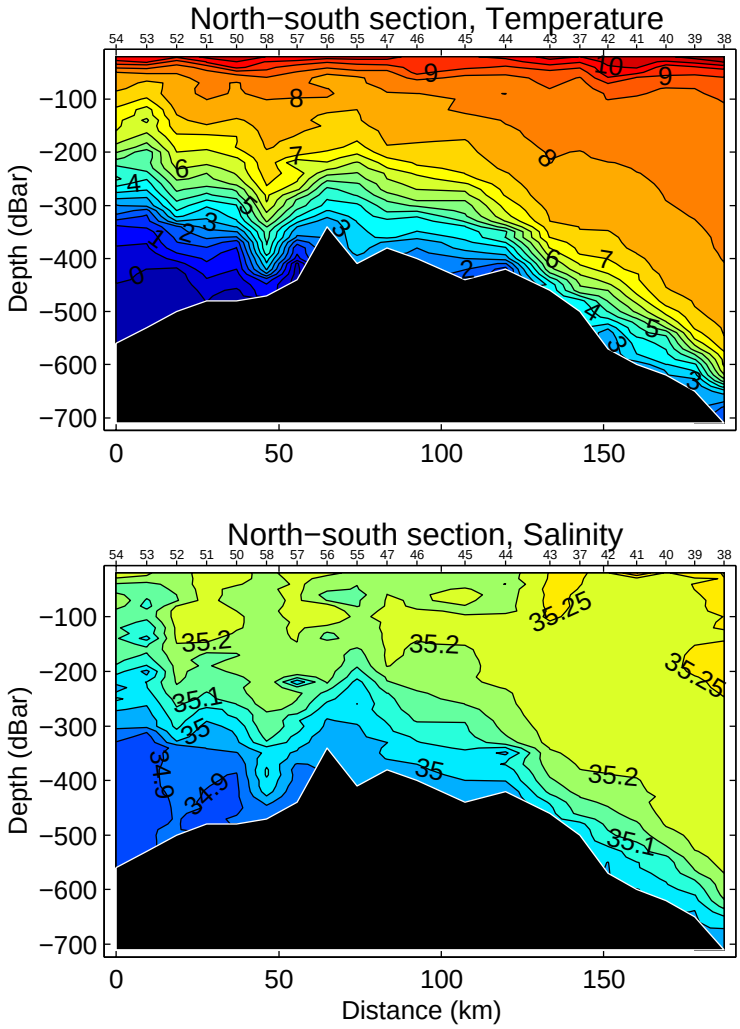

Figure 5: Potential Temperature (a) and Salinity (b) across the Faroe Ridge Section (Station 54-50 in north, Station 15-19 on the ridge, and station 47-38 in south) in 16 – 17 July, 2001.

Conclusions:

- Compared to previous studies our observations show a very large layer thickness of overflow water at the ridge. Likewise the layer of the downslope branches of overflow water is also thicker.

- The observed slope of the interface between the upper layer and the overflow layer in both sections indicates that the surface current crosses the ridge with an angle towards north, and not as an anticyclonic current following the topography. This can also be seen in the current patterns derived from satellite-tracked drifters (see “The regional conditions on www.dcess.ku.dk”).

Time and mesoscale variations (leg 1)

At the Iceland-Faroe Front we can expect to observe meanders and eddies. Eddies arise from unstable meanders and are typically on the order of 15 to 70 km wide and can have effects down to 400 m. South of the front cyclonic eddies with cold cores and upwelling in the centre may form, while north of the front anticyclonic warm core eddies with downwelling may form.

On the along ridge section (fig. 3) the domes of cold water can be indications of cyclonic eddies south of the front. The peak centred at station 23 reaches to the surface and will show up on a satellite picture. The other domes may be intermediate eddies. On the north-south section (fig. 5) a warm depression is centred at station 58. This could be an anticyclonic eddy.

The stations plotted in green on the station map have been run twice with 3 days interval to observe time variations. The temperature distribution has changed a lot indicating variability within a few days in this region (fig. 6).

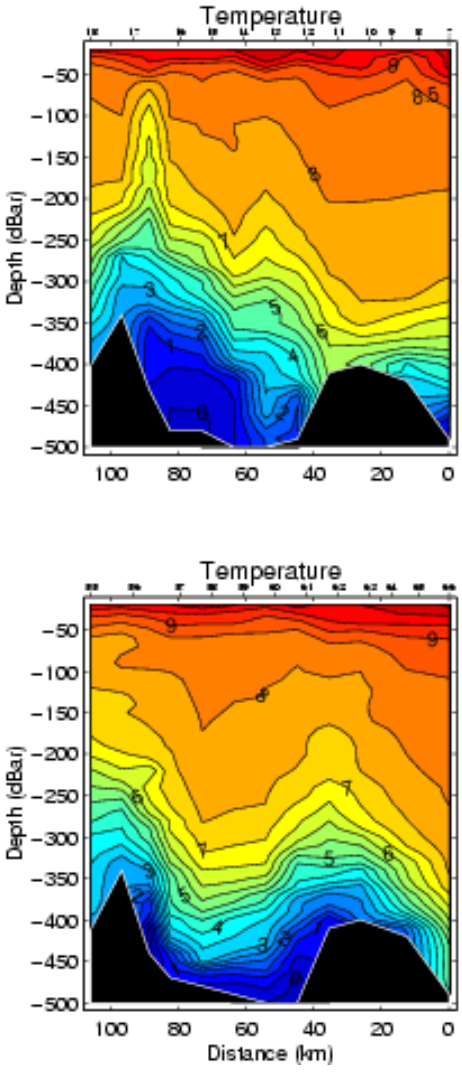

Figure 6, repeated sections: Temperature distributions from the green section on the section plot. Upper axis shows station numbers.

The upper figure of figure 6 shows the first along ridge section and we observe between station 12 and 17 a big blob of cold overflow water (< 2° C), which is about 150 meters thick. The lower figure shows the same section taken 3 days later. Now the overflow is spread out over the passage, and has a height of about 50 meters. The cold dome observed at station 16 on the upper figure can no longer been seen on the lower figure, but instead we observe 2 smaller domes. This indicates that these eddies have moved. One could speculate that these eddies are a mechanism for carrying the overflow water across the ridge - the cyclonic eddies upwell the cold water above sill level, and when these eddies move across the ridge, the overflow water is heavier than the ambient water and sinks.

Leg 2

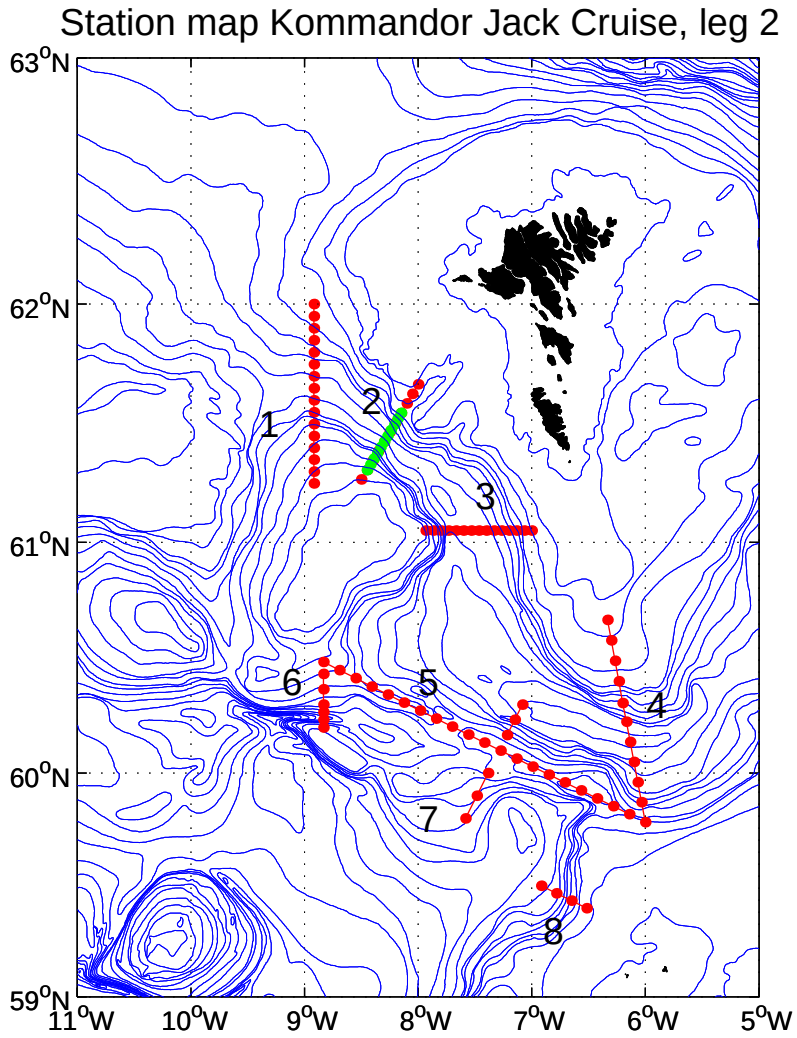

Figure 7: Station Map for leg 2 from 19 – 27 July, 2001. The red dots represent single stations, the green dots stations that where occupied twice.

The Faroe-Bank Channel Overflow (leg 2)

CTD measurements of the deep water coming from the Nordic Seas and flowing through the Faroe-Bank Channel (FBC) were made along three sections: at the entry (no. 3), exit (no. 1) and twice over the sill (no. 2).

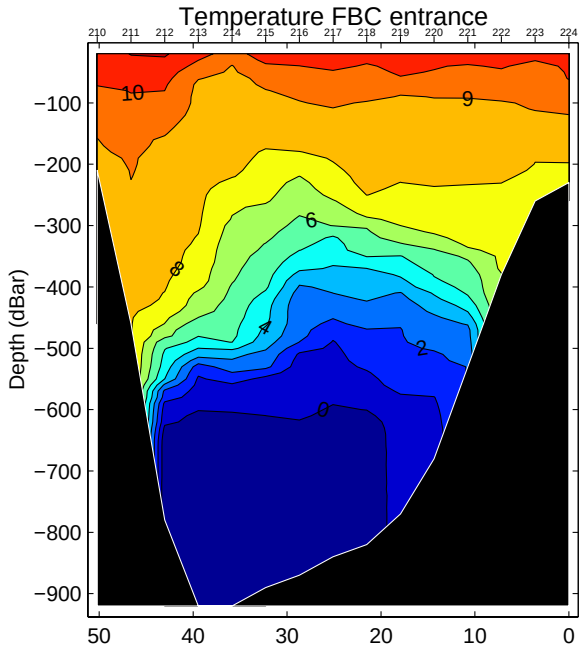

Figure 8: The Faroe-Bank Channel Entrance Section (No.3): Temperature section across the FBC-Entrance; the contour interval is 1 °C.

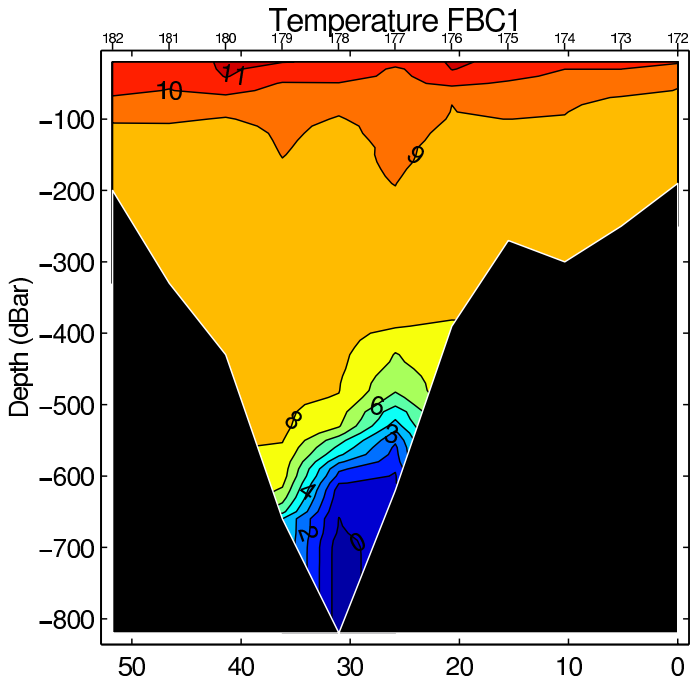

Figure 9: Faroe-Bank Channel Central Section (No.2): Temperature section across the FBC-Central; the contour interval is 1°C

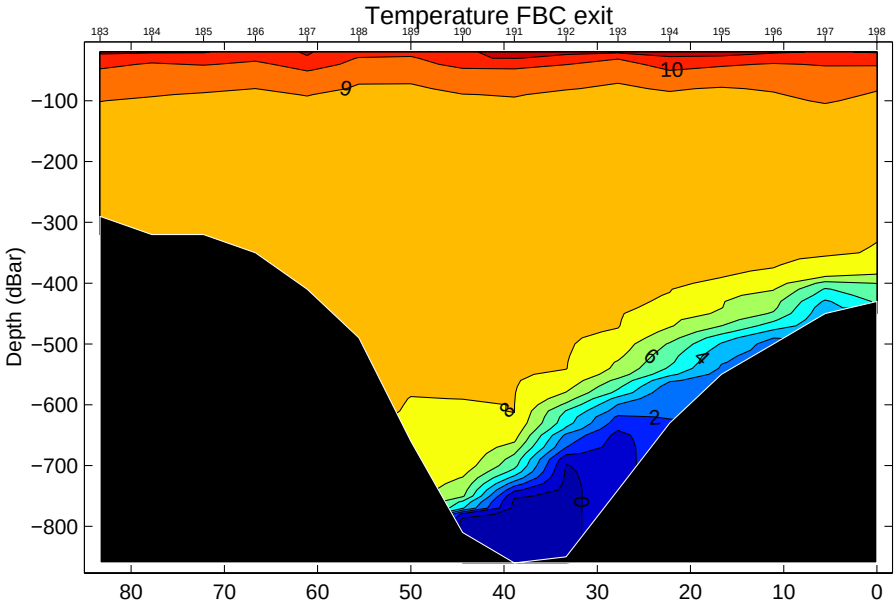

Figure 10: Faroe-Bank Channel Exit Section (No.1): Temperature section across the FBC-Exit; the contour interval is 1 °C

All three sections show a two layer system, both in temperature and salinity, indicating a correlation between these two parameters. This can be seen in the T-S diagram (fig. 11). In a two-layer system the geostrophic currents can be inferred by the slope of the interface.

The cross section of the Faroe Shetland Channel (FSC, no. 4), shows a cold and dense flow along the northern side of the channel. At section no. 3 (fig. 8) the flow is concentrated at the western end and a partly southward recirculation exists in the east. This structure is due to the topography of the FBC, which turns nearly 180°. Over the sill (no. 2, fig. 9) and after passing it (no. 1, fig. 10), the flow is again forced to the right and becomes broader at the exit.

The sections also show an increase of the interface depths from the entry (no. 3, fig. 8) to the exit (no. 1, fig. 10). This behavior of the overflow is due to Bernoulli's law (see section on Dynamics of the flow in passages and straits, www.dcess.ku.dk). Not all of the cold water can pass over the sill, it constrains the flow. This is the reason for the recirculation at section no.3.

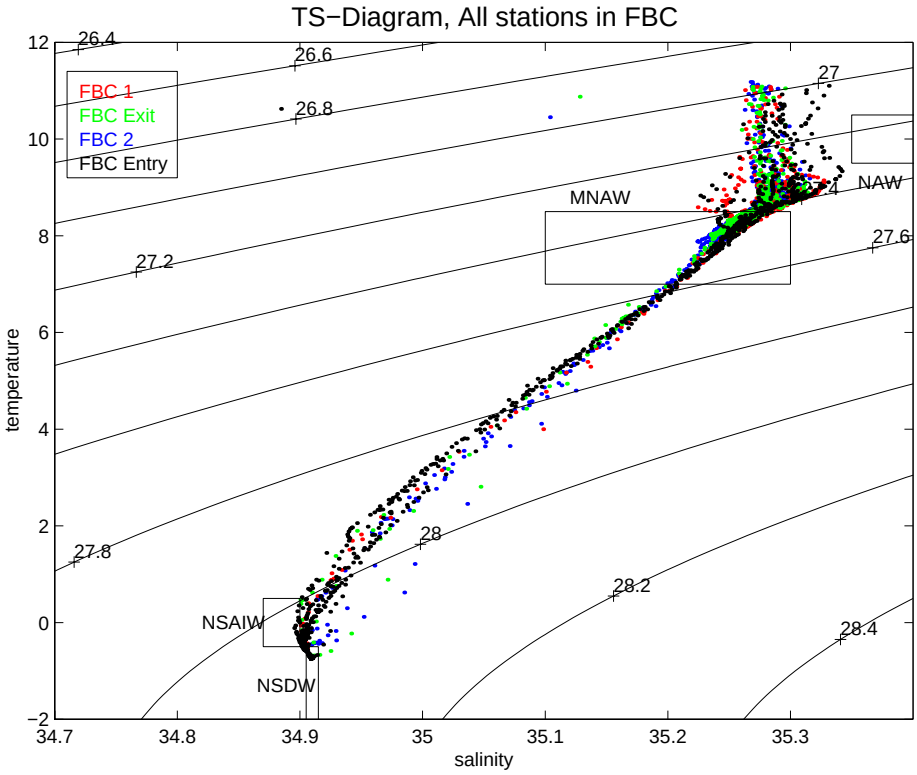

Figure 11: T-S Diagram of the FBC sections

An estimate of the Rossby number gives 0.3, so it can be concluded that there still exists a geostrophic balance. In the geostrophic calculations, the flow speed in the overflow are of about 1 m/s over the sill (no. 2), 0.5 m/s at the entry (no. 3) and 0.7 m/s at the exit (no. 1). This indicates, compared to ADCP measurements (see section on The Regional Conditions, www.dcess.ku.dk), that the geostrophic velocity is a good first order approximation.

Atlantic Inflow and Cold Overflow waters in the Wyville Thomson Ridge Area (leg 2)

Overflows and deep water

In section 4 the properties of the bottom water are the same as in the sections no. 1 - 3. The interface's small upward slope to the north indicates a flow towards the Faroe-Bank Channel.

Over the Wyville-Thomson Ridge (section 5) which is only 500 – 600 m deep, there is only a small amount of cold water observed. However most of this water does not flow through the deepest part. In section 6 there is no water colder than 5°C between Faroe-Bank and Ymir Ridge. The water hugs on the northern slope. Also in section 7 across the Wyville-Thomson Ridge we do not see any overflow, since the cold water is several hundred meters below the top of the ridge.

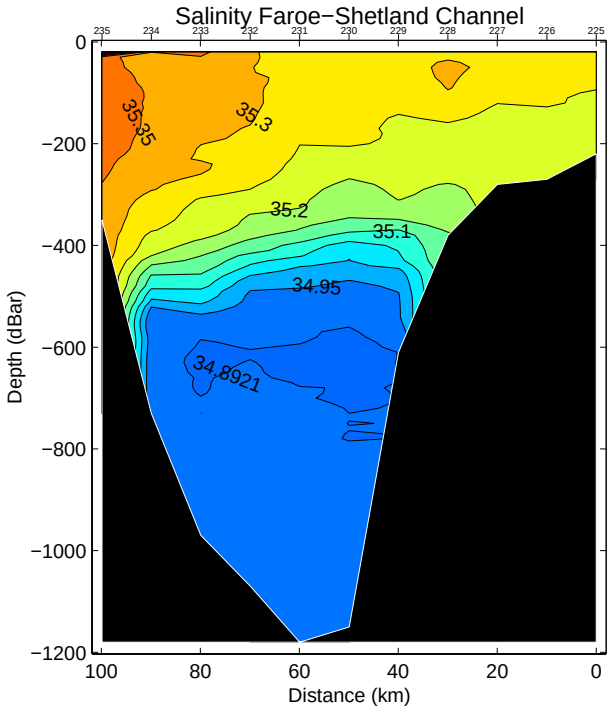

Figure 12: Salinity profile across the Faroe-Shetland Channel (no. 4). Right side is north.

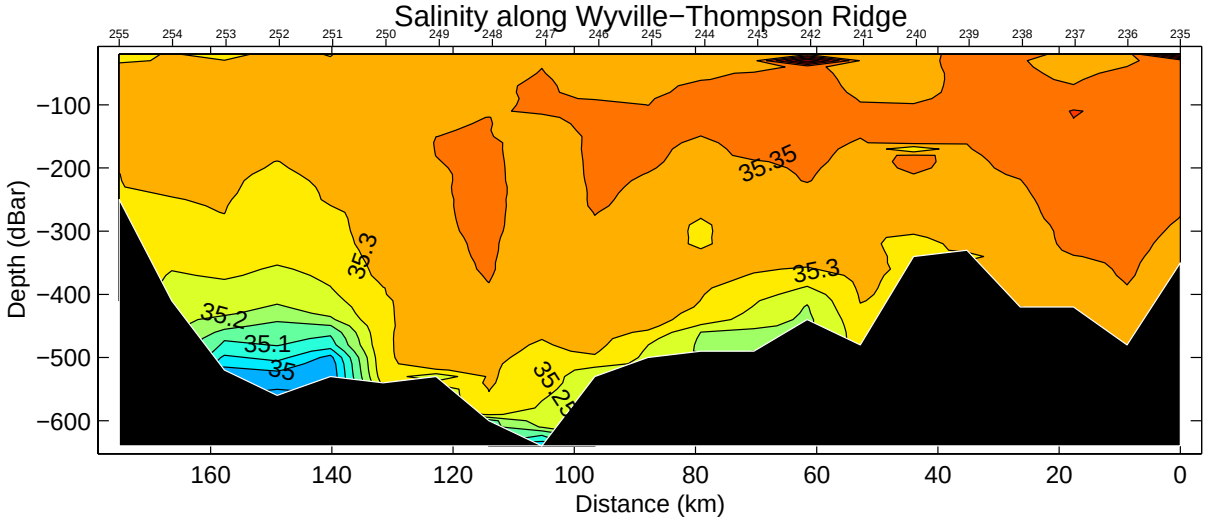

Figure 13: Salinity profile along the Wyville-Thompson Ridge (no. 5). Right side is east.

Atlantic inflow

In the southern part of the Faroe Shetland Channel (no. 4, fig. 12) we find a core of high salinity water near the surface. This is due to the continental slope current. Over the Wyville-Thomson Ridge (no. 5, fig. 13) we find a much larger tongue of high salinity water. This cannot be due to the Continental Slope Current because this current is flowing close to the coast. But an easterly current could be an explanation. This is also supported by the drifter data showing the surface currents in the Faroe Island region (s. Chp. SCAFI, www.dcess.ku.dk). The observation of high salinity water in the southern part of section 6 (fig. 14) is also consistent with the interpretation. This high salinity is not observed further

north. Section 7 (fig. 15) across the Wyville-Thomson Ridge shows the boundary of this high salinity core just north of the Wyville-Thomson Ridge.

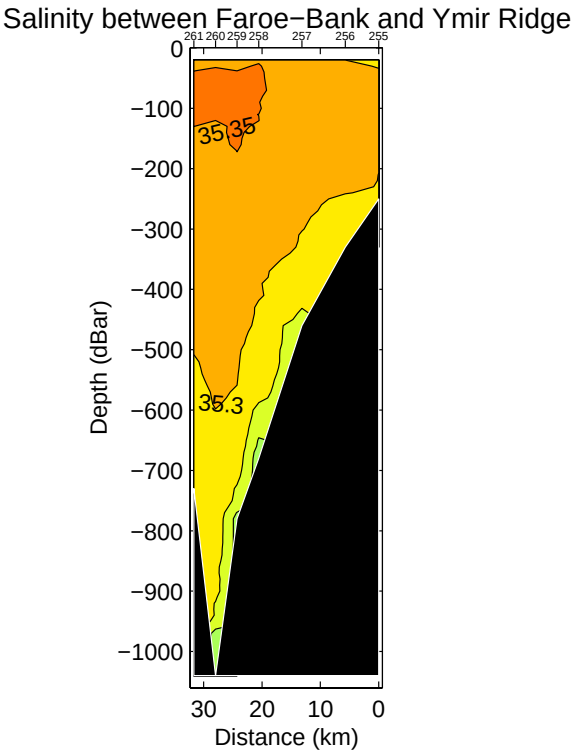

Figure 14: Salinity profile across the gab between the Faroe Bank and the Ymir Ridge. (no. 6). Right is north.

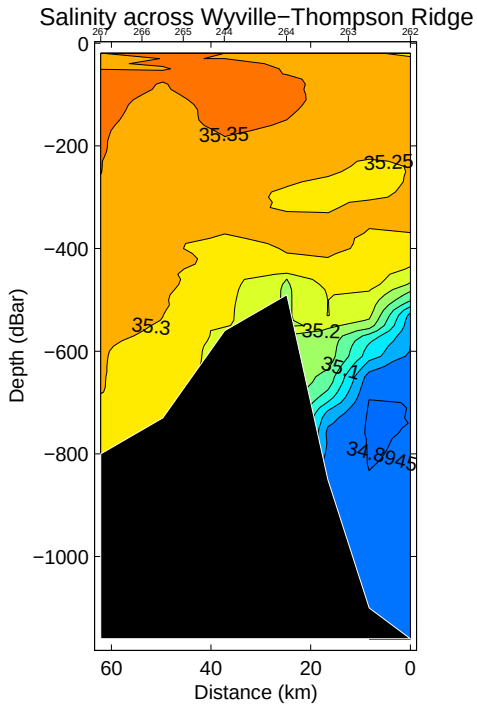

Figure 15: Salinity profile across the mid-east part of the Wyville-Thompson Ridge. (no. 7). Right is north.

T-S-diagram of the Wyville-Thomson Ridge-area (fig.16)

We can see a distinct difference between the deep and intermediate water masses in the Faeroe Shetland Channel and on the Wyville-Thomson Ridge.

The main inflow at the bottom of the Faroe Shetland Channel is a mixture of NSAIW and NSDW. We assume a mixing of the lower part of the bottom water with the MEIW (s. leg 1), which then is mainly flowing through the Faroe-Bank Channel. This mixed water is observed only in the Faeroe Shetland Channel and Faroe-Bank Channel. Over the Wyville-Thomson Ridge the MNAW is mixed directly with the overflow water without influence from the MEIW.

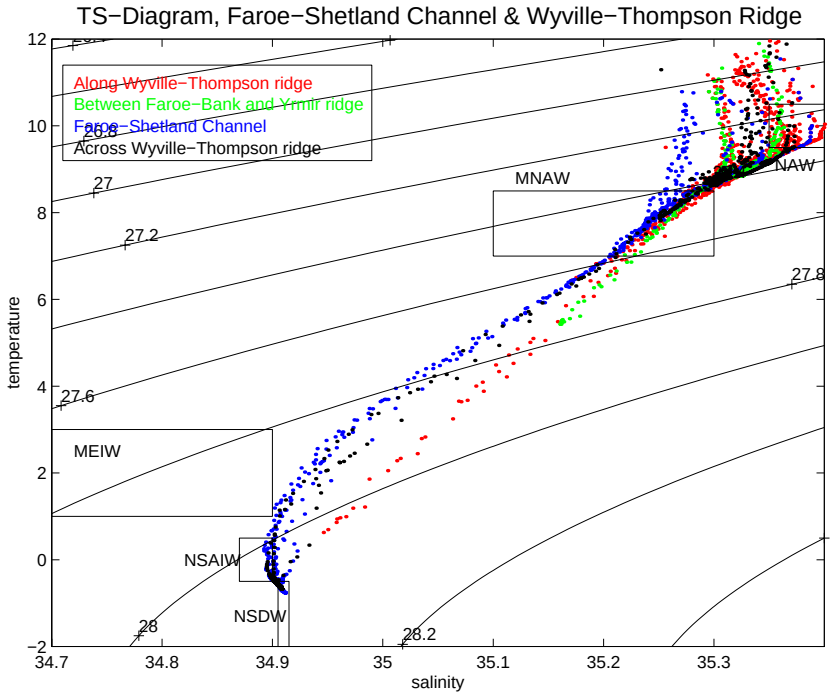

Figure 16: TS-diagram for the sections no. 4-7. NAW: North Atlantic Water, MNAW: Modified North Atlantic Water, MEIW: Modified East Icelandic Water, NSAIW: Norwegian Sea Arctic Intermediate Water, NSDW: Norwegian Sea Deep Water.

6. Acknowledgements

We like to thank captain James Patterson and his crew of SV KOMMANDOR JACK for their support of the measurement programme and for the patience with the students, most of whom had been on a research vessel for the first time in their career. Financial support for the cruise was provided by the Universities of Hamburg, Bremen and Copenhagen.

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Technical Reports

1-84 Baudner, H., K. Jancke and D. Quadfasel: CTD-data obtained in the Red Sea during 21-30 May 1983, RV SAGAR KANYA.

1-85 Meincke, J. and E. Mittelstaedt: Forschungsschiff METEOR, Reise Nr. 69 NORDOSTATLANTIK 84, NOAMP III. Berichte der wissenschaftlichen Leiter.

2-85 Verch, N. and D. Quadfasel: Hydrographic observations in the Norwegian Trench during 23 March - 17 April 1983, VALDIVIA cruise 10.

3-85 Backhaus, J., J. Bartsch, D. Quadfasel and J. Guddal: Atlas of monthly surface fields of air pressure, wind stress and wind stress curl over the North Eastern Atlantic Ocean for the period 1955-1982.

1-86 Hainbucher, D., J. Backhaus and T. Pohlmann: Atlas of climatological and actual seasonal circulation patterns in the North Sea and adjacent shelf regions: 1969-1981.

2-86 Quadfasel, D. and M. Ungewiß: Large-scale hydrographic structure of the upper layers in Fram Strait during the Marginal Ice Zone Experiment, 1984.

3-86 Quadfasel, D., E. Schelenz and N. Winkel: Marginal Ice Zone Experiment 1984. CTD-data obtained from RV VALDIVIA.

1-87 Quadfasel, D. and N. Verch: Seasonal variability of temperature in the Red Sea: XBT-sections from MCS "UBENA" in 1985 and 1986.

2-87 Quadfasel, D. and D. Grawunder: NORDMEER 86 - RV VALDIVIA cruise 48. CTD-observations in the Greenland Sea.

3-87 Verch, N., D. Quadfasel and S. Selchow: Hydrographic observations in the Tyrrhenian Sea during 26.2-25.3.1986. RV SONNE cruise 41 (HYMAS).

4-87 Boehlich, M. and J. Backhaus: Atlas simulierter Strömungen in der südwestlichen Ostsee für sommerliche Bedingungen.

1-88 Schauer, U.: VALDIVIA-Fahrt Nr. 61 (25.07.-23.08.1987)

2-88 Quadfasel, D.: VALDIVIA Reise 67 (1.2.-26.2.1988) Grönlandsee

3-88 Backhaus, J., J. Bartsch, P. Damm, D. Hainbucher, T. Pohlmann, D. Quadfasel and G. Wegner: Hydrographische Bedingungen und Zirkulation in der Nordsee im Winter und Frühjahr 1987/88 - Eine physikalische Hintergrundstudie zur extremen Planktonblüte im Frühjahr 1988.

4-88 Radach, G., J. Berg, B. Heinemann and T. Zachmann: Berichte über die Arbeiten des Teilprojektes P4 "Mathematische Modelle von Energie- und Stofftransporten durch die unteren tropischen Stufen des pelagischen Ökosystems der Nordsee.

5-88 Quadfasel, D., and M. Ungewiß: MIZEX 87 - RV VALDIVIA cruise 54. CTD observations in the Greenland Sea.

6-88 Backhaus, J.: On the circulation around the Faroe Islands and the adjacent continental slope: Experiments with a three-dimensional barotropic model.

1-89 Verch, N., M. Ungewiß, K. Schulze and D. Quadfasel: MINDIK - RV METEOR cruise 5. CTD observations in the Red Sea and Gulf of Aden.

2-89 Verch, N., M. Petzold, P. Mahnke and D. Quadfasel: Hydrographic bottle data obtained in the Red Sea and Gulf of Aden during RV METEOR cruise 5 - MINDIK 1987.

3-89 Schönfeld, W., B. Heinemann, G. Radach and P. Damm: Die ECOMOD - Datenbank, ein Hilfsmittel mariner Ökosystem-Forschung. Datenbericht 1988.

4-89 Meincke, J., and D. Quadfasel: "VALDIVIA"-Reise 78 - Grönlandsee. Fahrtbericht.

5-89 Ambar, I., J. Backhaus, A. Fiuza, P. Mahnke and D. Quadfasel: Hydrographic observations in the Tejo-estuary during September 1985.

6-89 Damm, P.: Klimatologischer Atlas des Salzgehaltes, der Temperatur und der Dichte in der Nordsee, 1968 - 1985.

7-89 Schauer, U.: VALDIVIA - Reise 86. Arktisfront. 9.8.89 - 5.9.89 Bodø-Hamburg. Fahrtbericht.

8-89 Quadfasel, D.: "Valdivia" Reise 87, Faroe-Shetland Kanal, 14.-24. September 1989, Fahrtbericht.

9-89 Latarius, K. and G. Gerdts: VALDIVIA cruise 72, 1.-22. July 1988. CTD observations in the North Sea and Irish Sea.

1-90 Frische, A. and D. Quadfasel: SULU SEA RV SONNE Cruise 58. Hydrographic observations in the South China Sea and Sulu Sea.

2-90 Moll, A. and G. Radach: Wärme- und Strahlungsflüsse an der Grenzfläche Wasser-Luft berechnet bei Feuerschiff FS ELBE 1 in der Deutschen Bucht: 1962-1986.

3-90 Bohle-Carbonell, M., P. Damm and A. Frische: VALDIVIA Reise 92. Deutsche Bucht - Skagerrak, 12. Februar - 2. März 1990.

4-90 Quadfasel, D. and B. Rudels: Some new observational evidence for salt induced convection in the Greenland Sea.

5-90 Quadfasel, D.: "Valdivia" Reise 104, Islandsee, 15.-31. Oktober 1990, Fahrtbericht.

6-90 Moll, A. and G. Radach: ZISCH Parameter Report. Compilation of measurements from two interdisciplinary STAR-shaped surveys in the North Sea (Vol. I: Graphic Reports).

7-90 Moll, A. and G. Radach: ZISCH Parameter Report. Compilation of measurements from two interdisciplinary STAR-shaped surveys in the North Sea (Vol. II: Data Lists).

8-90 Hähnel, M.: VALDIVIA Reise 100, Arktisfront, 17. Juli bis 18. August 1990, Fahrtbericht.

1-91 Hähnel, M. and F. Schirmer: ADCP-Workshop 1991 in Hamburg, Vortragszusammenfassungen.

1-92 Latarius, K.: Current measurements in the Greenland Sea and West Spitsbergen Current obtained with satellite-tracked drifters during spring 1987 to summer 1989.

2-92 Dippner, J.: Mesoscale variability of the German Bight - an atlas of circilation, sea surface density and sea surface heights.

1-93 Quadfasel, D.: Valdivia Reise 131, Hamburg-Aberdeen-Stornoway-Bodø, 11. Januar-25. Februar 1993, Fahrtbericht.

1-94 Quadfasel, D.: Valdivia Reise 141, Hamburg-Tromsoe-Tromsoe-Hamburg, 7. Februar - 1. April 1994, Fahrtbericht.

2-94 Rudels, B., H. Friedrich and K. Schulze: Valdivia Reise 136, 15. Mai - 17. Juni 1993, Grönlandsee, Fahrtbericht.

1-95 Vajen, T., K. Herklotz, H. Haak and J. Bock: Ozeanographisches Seminar Wintersemester 1994/95. Hydrographie und Zirkulation der südostasiatischen Gewässer. Literaturstudie über den Indo-Pazifischen Einstrom.

1-96 Quadfasel, D.: Cruise Report, VALDIVIA cruise V160, TASC'n TEACH, 5.-16. July 1996, Hamburg - Torshavn - Reykjavik.

1-97 Quadfasel, D.: Cruise Report, VALDIVIA cruise V164, TASC'n TEACH II, 12.-21. May 1997, Hamburg - Torshavn.

2-97 Quadfasel, D.: Cruise Report, VALDIVIA cruise V165, ESOP II - ACSYS, 21. May - 9. June 1997, Torshavn - Longyearbyen.

3-97 Moll, A.: ECOHAM1 User Guide - The Ecological North Sea Model, Hamburg, Version 1.

4-97 Backhaus, J.: Fahrtbericht VALDIVIA Reise V167. ACSYS, ARKTIEF, SFB 313, ESOP II. Longyearbyen – Hamburg, 2. Juli – 27. Juli 1997.

5-97 Quadfasel, D., J. Meincke, J. Backhaus, Th. Knutz, M. Koch und B. Dümcke: Arbeits- und Erfahrungs-bericht über den Einsatz von drei verankerten Autonomen Profilierenden Geräteträgern im Projekt ACSYS vor Spitzbergen im Sommer 1997.

1-98 Quadfasel, D.: Cruise Report, SONNE cruise SO127 BENGALWOCE, Port Klang – Malé, 17 December 1997 – 7 January 1998.

2-98 Quadfasel, D.: Cruise Report, VALDIVIA cruise V171, ACSYS, Teach and SFB 512, Hamburg - Torshavn – Reykjavik, 15. June – 2. July 1998.

3-98 Hainbucher, D. and Wei Hao: Cruise Report, Dong Fang Hong 2 AMBOS/AMREB cruise 1, Qingdao – Qingdao (P.R. China), 23.09..98 – 0.8.10..98

1-99 Karstensen, J.: The extended OMP analysis. An analysis package for MATLAB, Version 1, Hamburg.

2-99 Moll, A. und L. Ehlers: Zeitschriften-Verzeichnis, Institut für Meereskunde, März 1999.

3-99 Hainbucher, D. and Wei Hao: Cruise Report, Dong Fang Hong 2 AMBOS/AMREB cruise 2, Qingdao – Qingdao (P.R. China), 27.04..99 – 12.05.99

1-00 Backhaus J.O., Hegseth E.N., Wehde H., Hatten K., Logemann K., Nedderhut H., Arndt C.: Cruise Report: Phyto - Convection, VALDIVIA cruise 176, Hamburg - Thorshavn, 26.Feb - 20.Mar 1999, VALDIVIA cruise 178, Thørshavn - Reykjavik, 08.Apr - 26.Apr 1999.

01-00 Hainbucher, D.: Cruise Report, POSEIDON cruise POS 264, Thørshavn 25. August - 10. September 2000.