

CRUISE REPORT



R/V Aranda

Combine 2
27.5.2025 – 10.6.2025

Cruise 03/2025

This report is based on preliminary data and is subject to changes.

Objectives of the cruise

The objectives of the cruise were:

- 1) Monitoring of the Northern Baltic Proper, Åland sea and the Southern part of the Bothnian Sea. Measured parameters were temperature, salinity, oxygen hydrogen sulfide, inorganic nutrients, pH. There was also the benthic monitoring or sediment condition and sediment invertebrates. We also took samples for microplastics monitoring.
- 2) Group from Syke studying the sinking speed of marine particles
- 3) Group from Syke/NORCE studying the carbon chemistry in the Gulf of Bothnia.
- 4) Group from Syke scanning sheep wrecks using the echo sounding equipment
- 5) Retrieval of a benthic lander for a Syke / GTK project
- 6) Retrieval of hydrophones for Syke
- 7) Group from IL carrying out measurements of air quality and particles in the air
- 8) Different deployments / retrievals / servicing of buoys for FMI

Table 1 The scientific crew

Name	On board	Organization
Kristian Spilling	27.5.–10.6.	Syke
Harri Kankaanpää	27.5.–1.6.	Syke
Tommi Kontto	27.5.–1.6.	Syke
Panu Hänninen	27.5.–1.6.	Syke
Jere Riikonen	27.5.–10.6.	Syke
Tanja Kinnunen	27.5.–10.6.	Syke
Anne-Mari Lehto	1.6.–10.6.	Syke
Anna Kangas	27.5.–10.6.	Syke
Josephin Lemke	27.5.–10.6.	Syke
Anna-Riina Mustonen	27.5.–10.6.	Syke
Ilkka Lastumäki	27.5.–10.6.	Syke
Jyri Tirroniemi	27.5.–10.6.	Syke
Mari Vanharanta	27.5.–1.6.	Syke
Mira Granlund	27.5.–10.6.	Syke
Riikka Mattson	27.5.–10.6.	Syke
Samu Elovaara	27.5.–10.6.	Syke
Siru Tasala	27.5.–1.6.	Syke
Pasi Ylöstalo	1.6.–10.6.	Syke
Tarja Katajisto	27.5.–10.6.	Syke
Meri Smedberg	27.5.–10.6.	FMI
Heini Jalli	27.5.–10.6.	FMI
André Welti	27.5.–10.6.	FMI
Linnea Mustonen	27.5.–10.6.	FMI
Abdirahman Omar	1.6.–10.6.	NORCE

We left Helsinki 27.5.2025 and sailed eastwards, sampling the easternmost stations before turning westwards again. We arrived in Hanko 1.6.2025 for an exchange of crew and sailed to Utö where we retracted a benthic lander. We continued north through the Archipelago Sea and sampling stations in the Bothnian Sea (BS) on the eastern side. We reached the northernmost points in Bothnian Bay (BB) and sampled the western points in BB and BS on our way south. We continued south into the Baltic Proper before moving eastwards again and we arrived in Helsinki 10.6.2025. according to the schedule. The route is depicted in Fig 1.

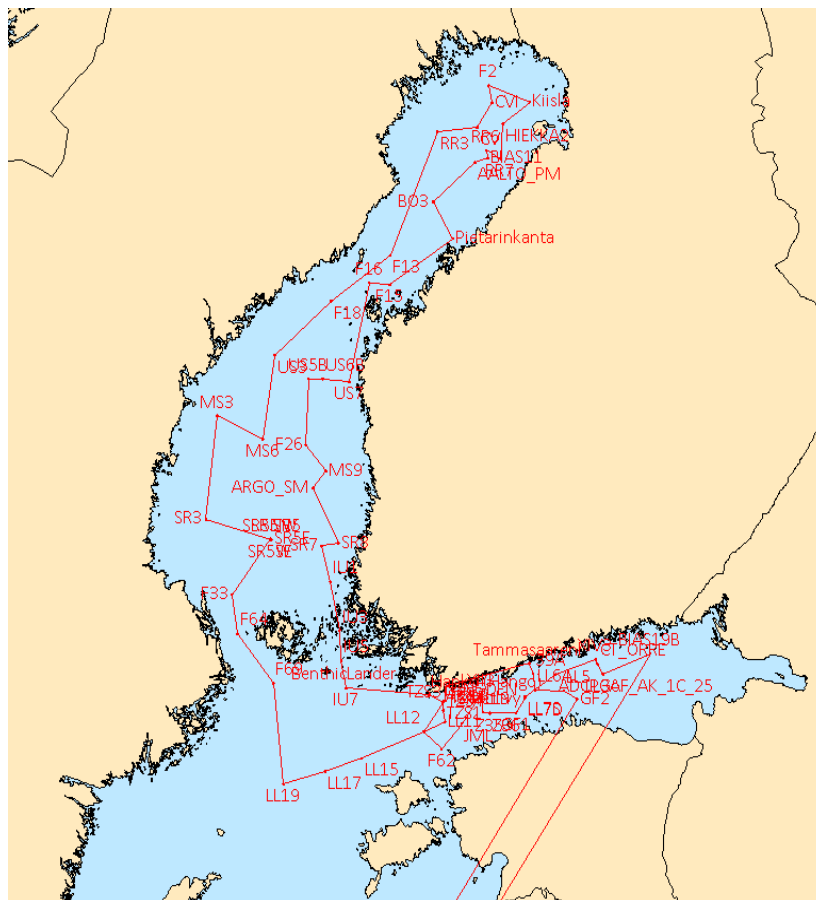


Fig 1 The Cruise route. We left Helsinki 27.5.25, had a stop over at Hanko 1.6.2025 and returned to Helsinki 10.6.2025

Observations

Most of the measured variables were within expected range, both in terms of spatial and depth distributions. Examples of water profiles can be seen in Annex 1, and the full list of stations in Annex 2. In addition, the full set of CDT profiles are found in Annex 3.

The one thing that was standing out was the extent of anoxic conditions in the Gulf of Finland with high concentrations of hydrogen sulfide (H_2S) and no benthic fauns. In addition, the salinity was relatively high (>10) in the bottom water in most stations suggesting that it has been an inflow of deep water from the main basin, Baltic Proper.

We had the flow through system going for the full duration of the cruise and the results are presented in Figs 2 and 3. These data are from approximately 3 m depth where the intake to the flow through system is. The variability in the measured variables: temperature, salinity, chlorophyll a (Chla), colored dissolved organic matter (CDOM), dissolved oxygen (O_2), partial pressure of carbon dioxide (pCO_2) and pH, were as expected for the time of year.

Inorganic nutrients from the surface of 5m depth are presented in Fig 4, and from the bottom most depth in Fig 5, which also includes pH, oxygen and hydrogen sulfide.

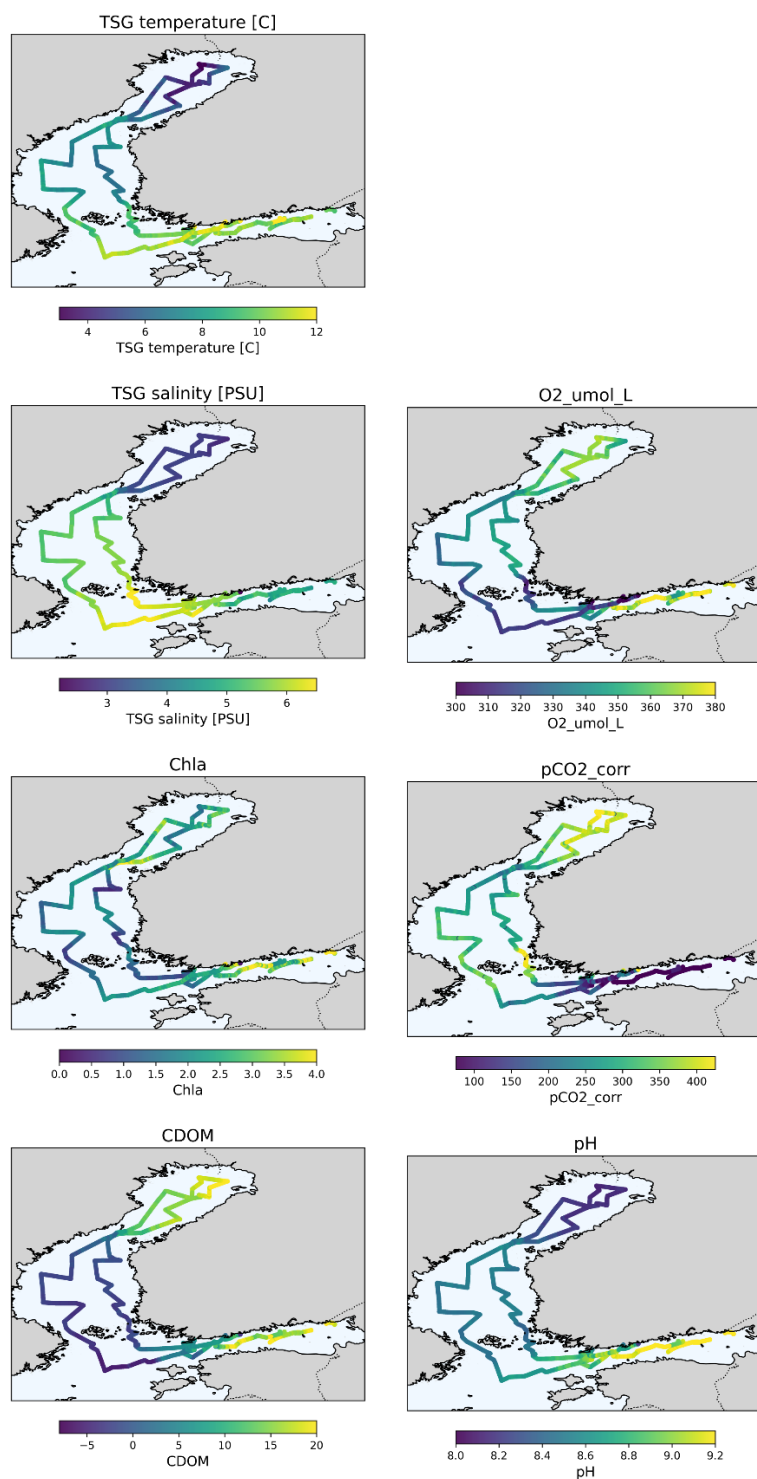


Fig 2. The data from the flow through system including: a) temperature, b) salinity, c) chlorophyll a (Chla), d) colored dissolved organic matter CDOM, e) dissolved oxygen (O2), f) partial pressure of carbon dioxide (pCO2) and g) pH. The water running through the flow through system is taken from ~3 m depth.

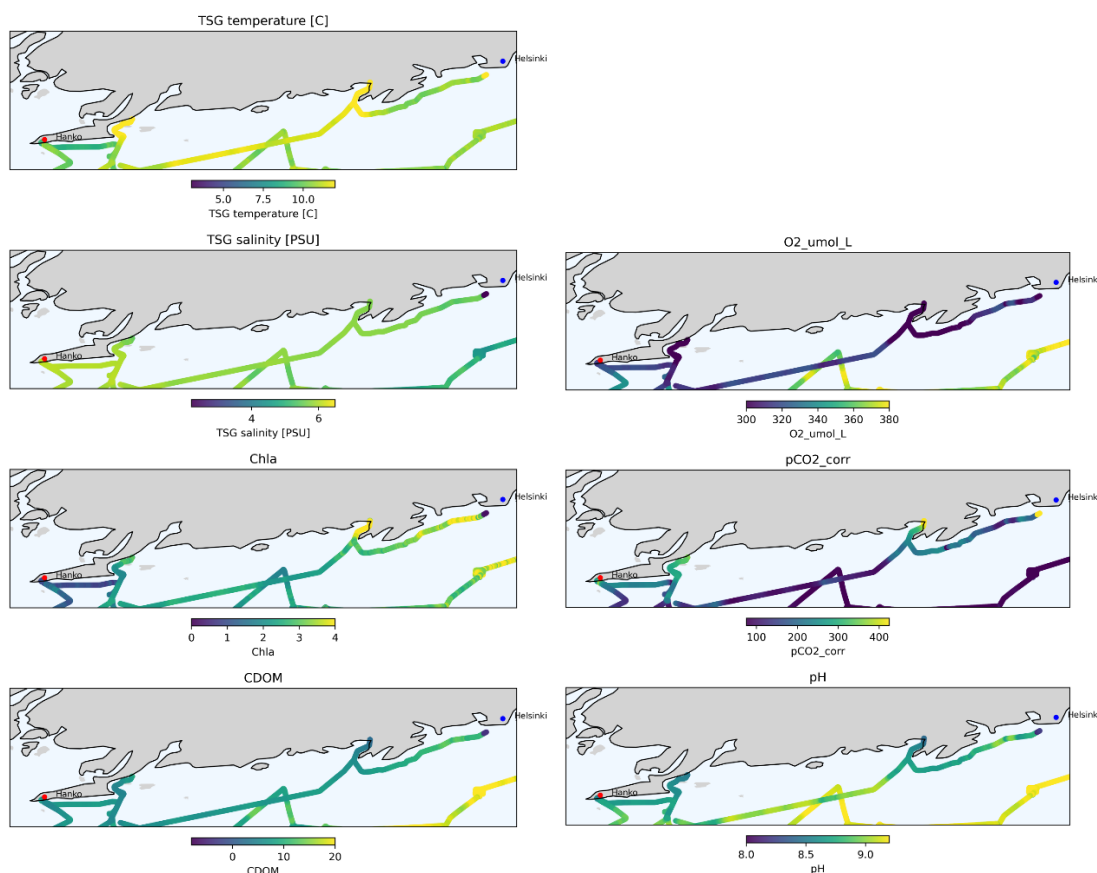


Fig 3. Same fluorescence data presented in Fig 1, but zoomed in on the southern Finnish coastline

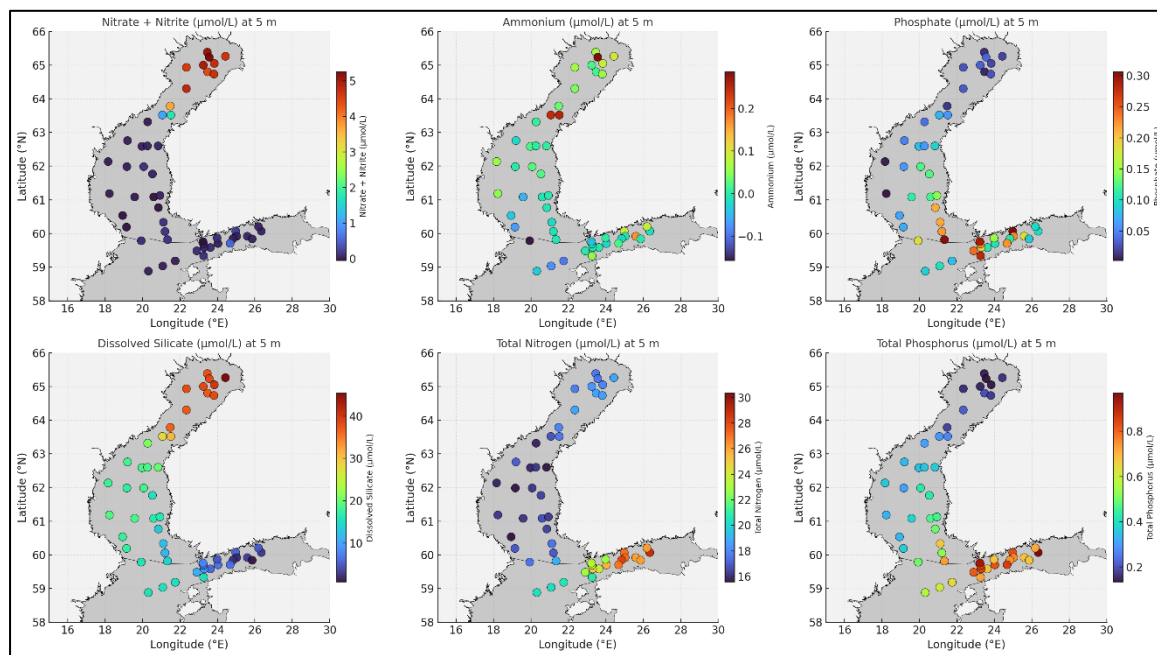


Fig 4. Inorganic nutrients measured from 5 m depth, all units in $\mu\text{mol L}^{-1}$.

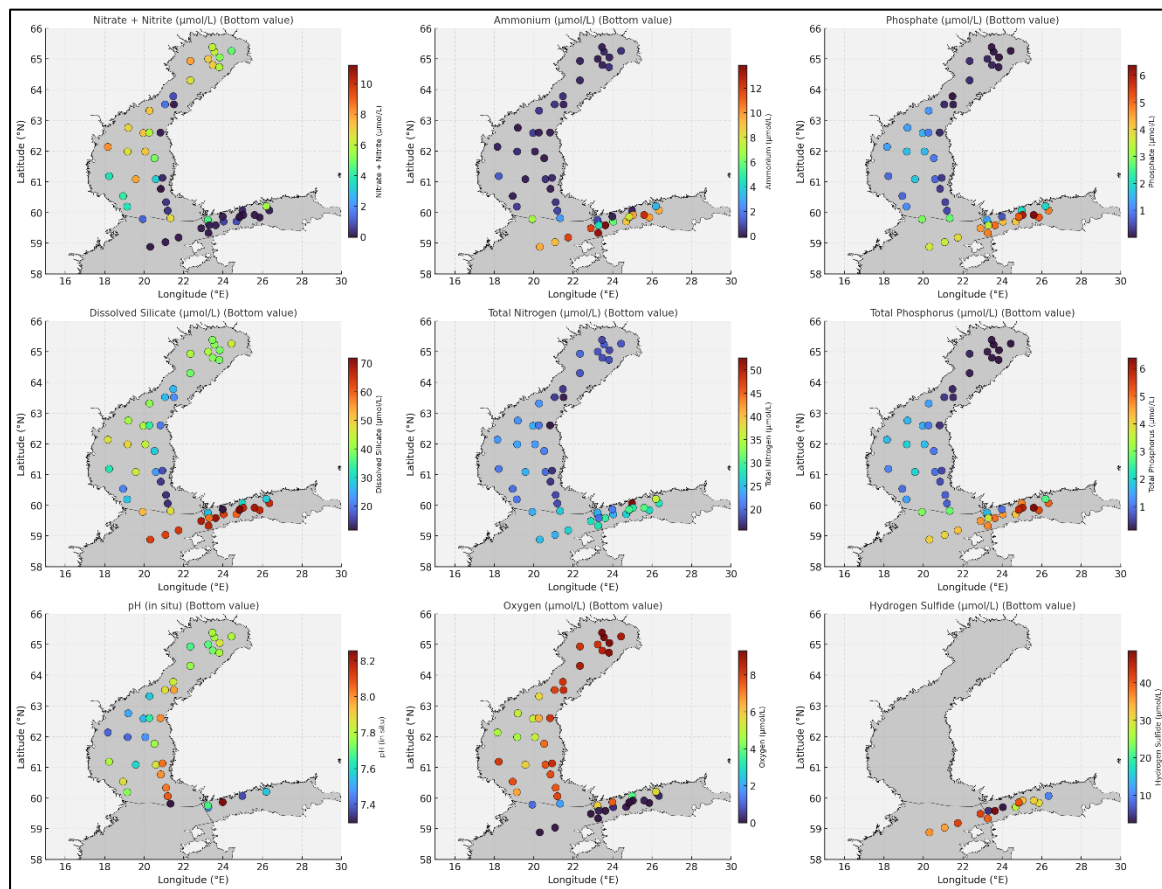


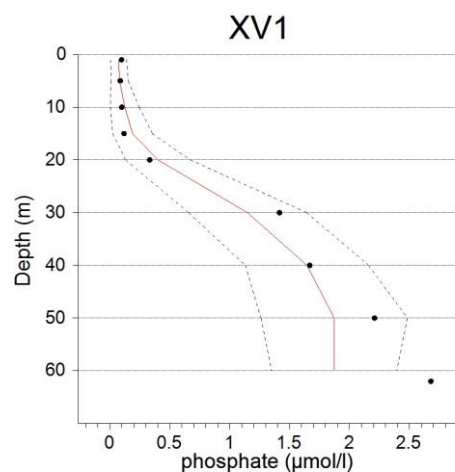
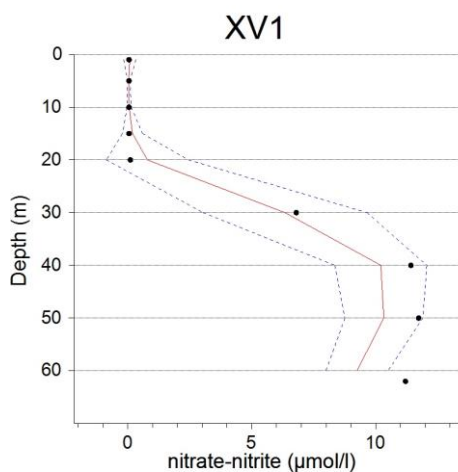
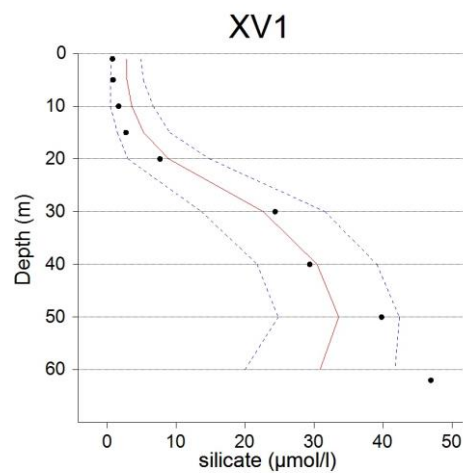
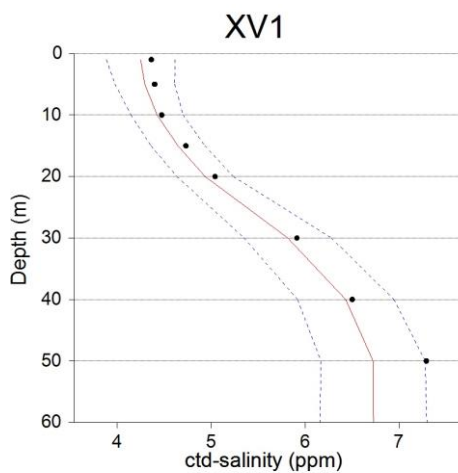
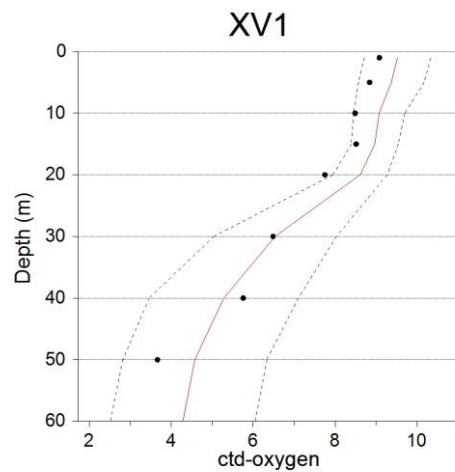
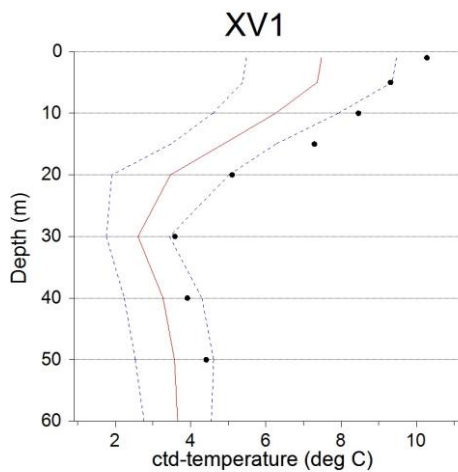
Fig 5. Inorganic nutrients measured from the bottom (max depth sampled at each station) in the upper two rows, and pH, oxygen and hydrogen sulfide in bottom most row; all units in $\mu\text{mol L}^{-1}$.

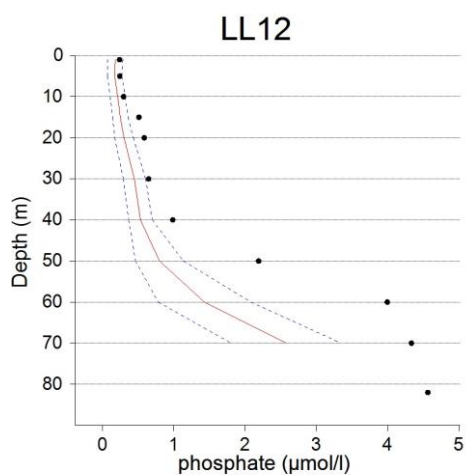
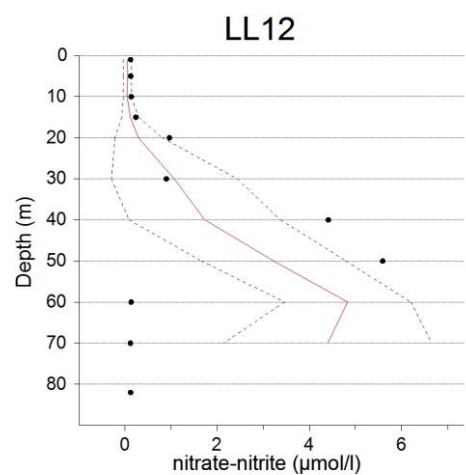
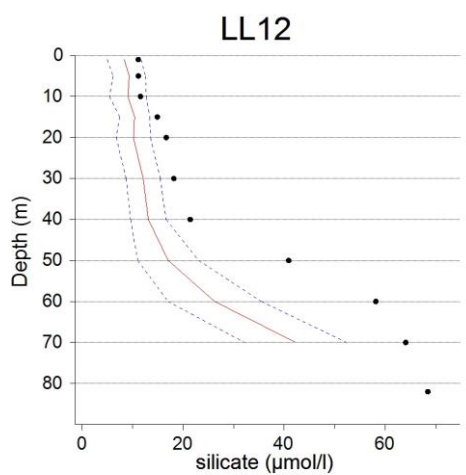
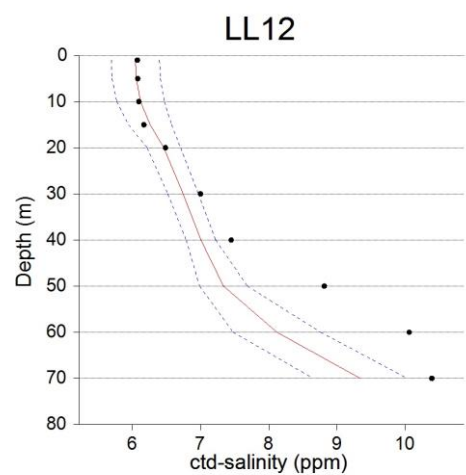
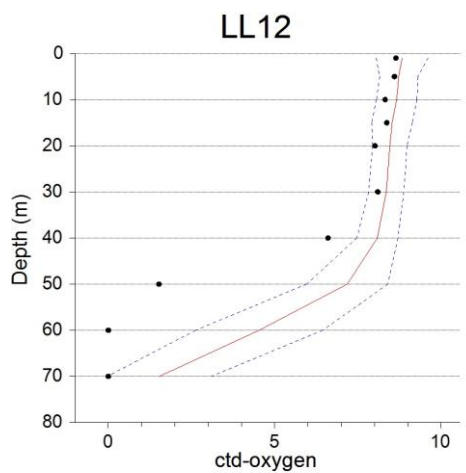
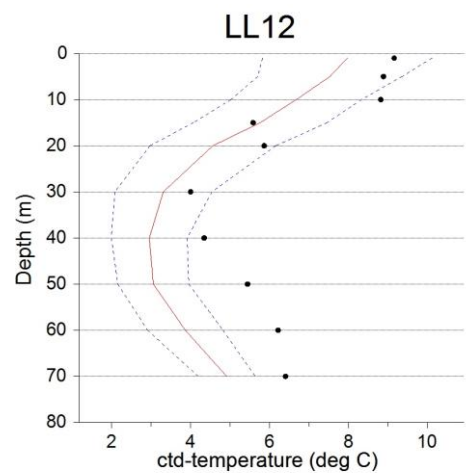
Conclusions

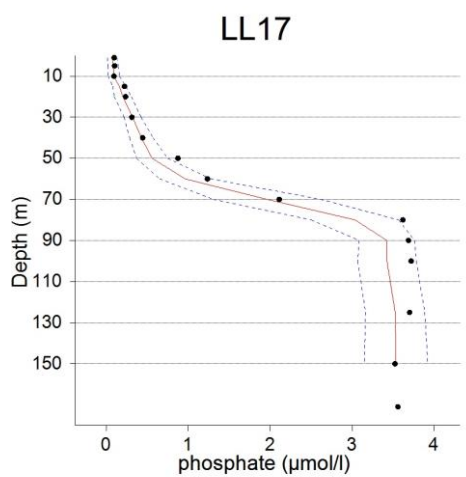
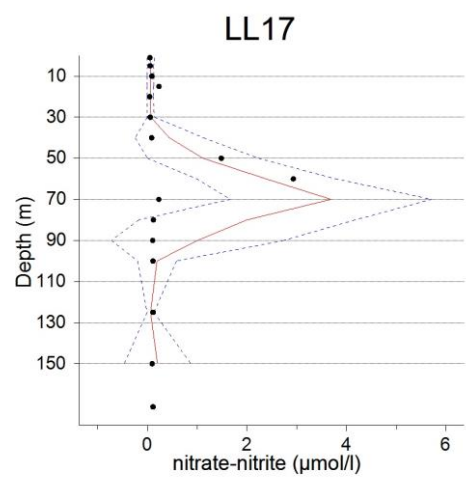
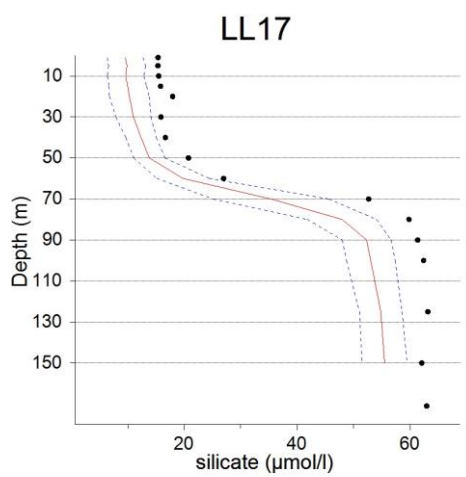
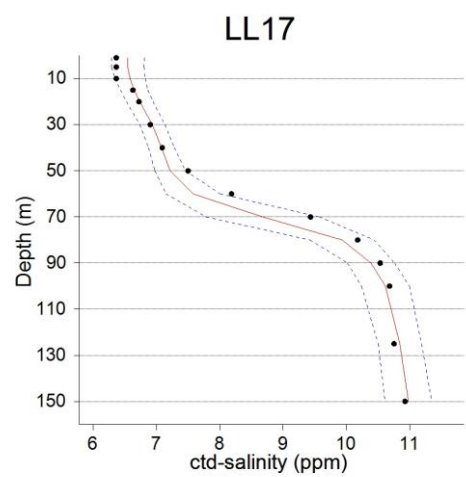
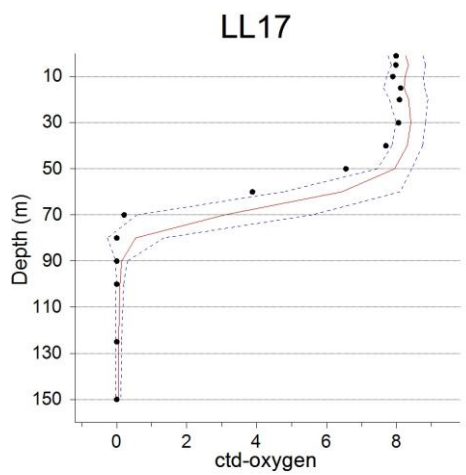
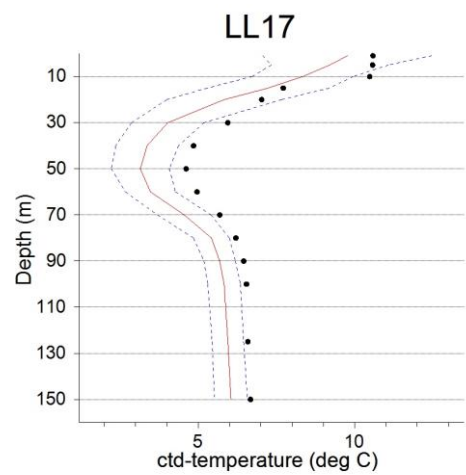
In the Gulf of Finland, the temperature, salinity, nutrients preliminary Chla concentrations were normal of the time of year. What stood out was the degree of anoxic bottom water and high concentrations of hydrogen sulfide (H_2S). In addition, the salinity was relatively high (>10) in the bottom water in most stations suggesting that it has been an inflow of deep water from the main basin, Baltic Proper.

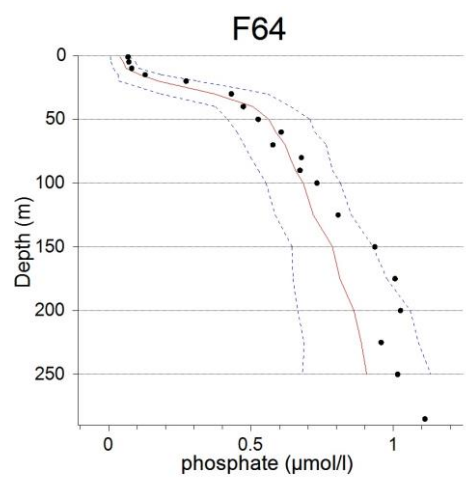
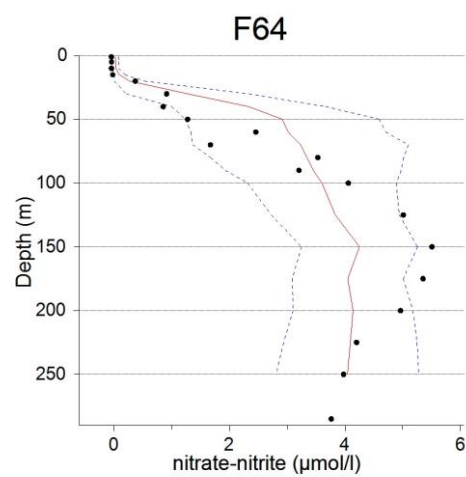
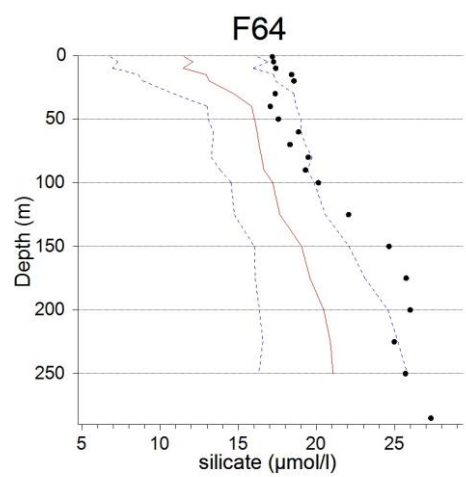
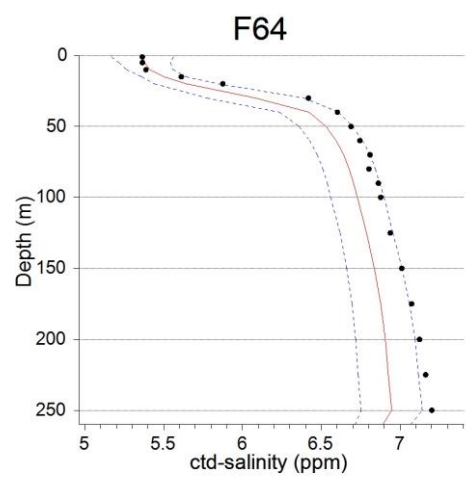
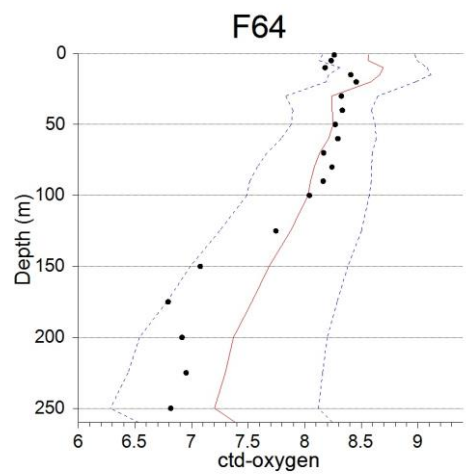
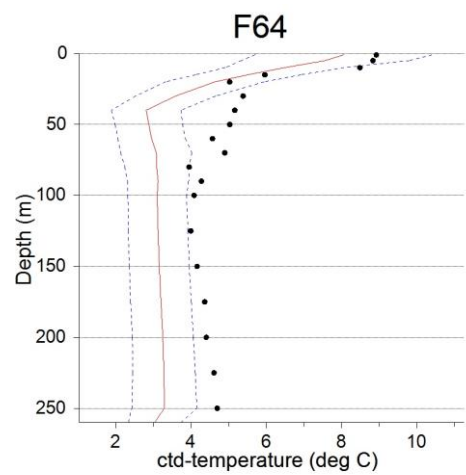
In the Archipelago Sea, Bothnian Sea, Bothnian Bay, Åland Sea and Northern Baltic Proper the inorganic nutrients, Chla fluorescence, Secchi and bottom oxygen conditions close to average, at least nothing standing out as out of the ordinary. The amount and biodiversity of benthic fauna was normal north of the Åland islands.

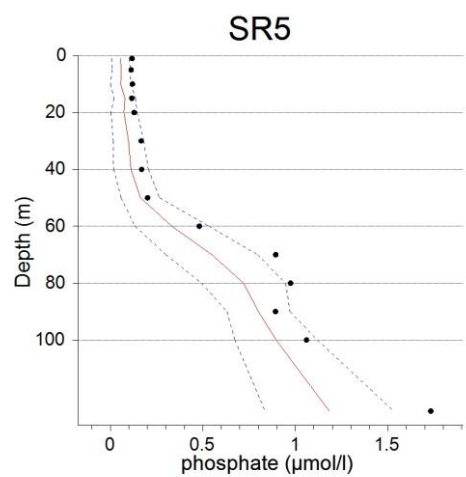
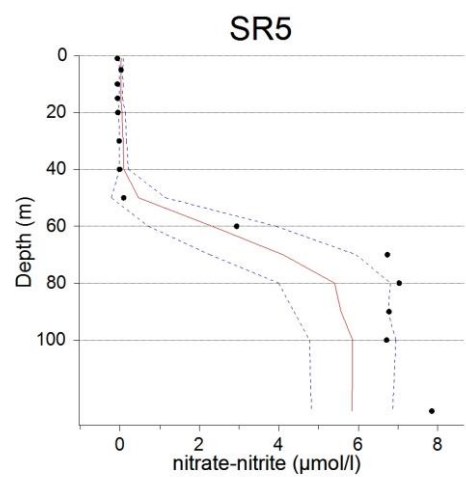
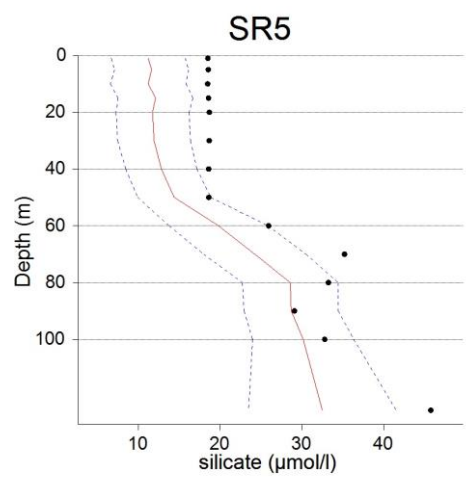
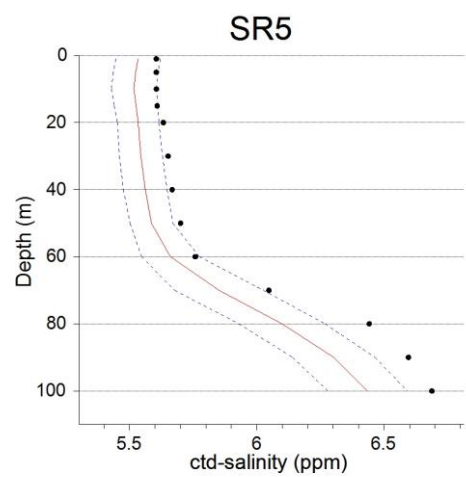
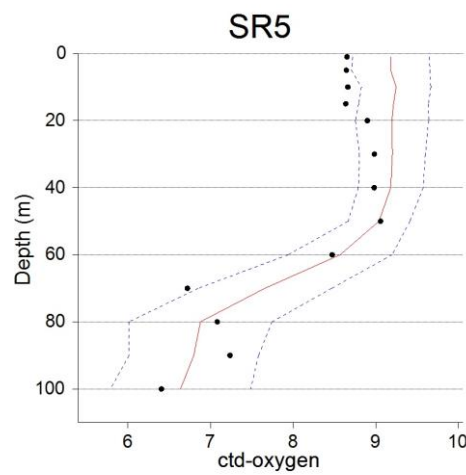
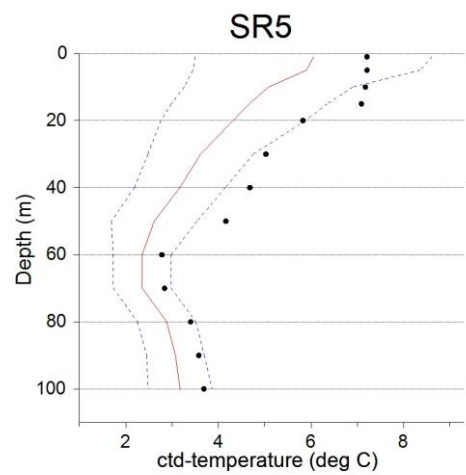
Annex 1. Selected variables at the stations XV1, LL12, LL17, F64, SR5, US5B, BO3 and F2. Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season since the year 2000.

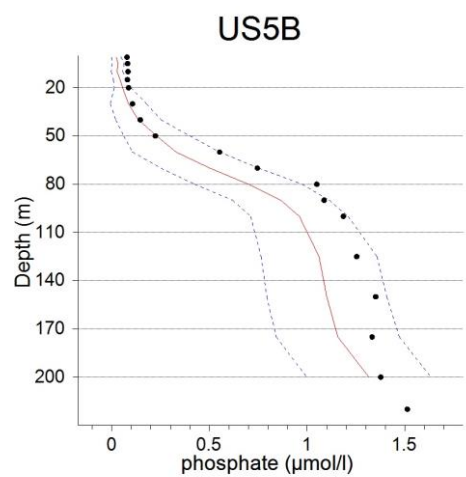
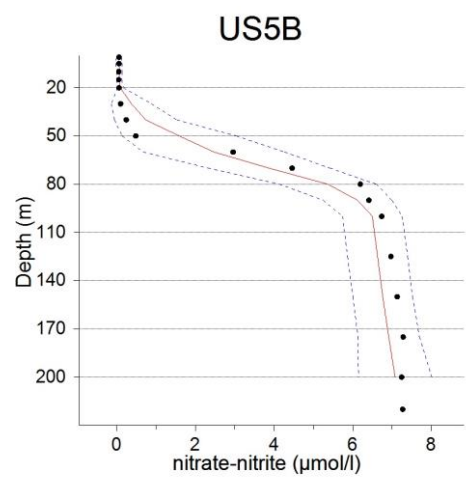
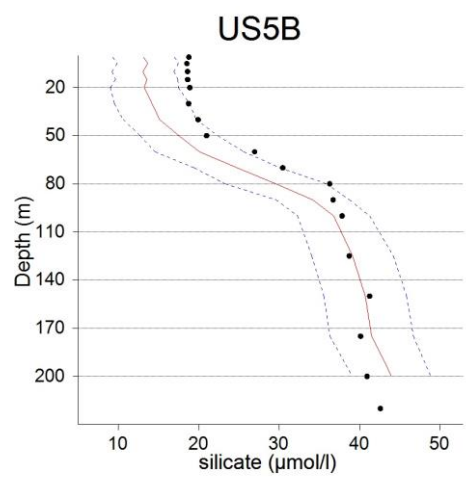
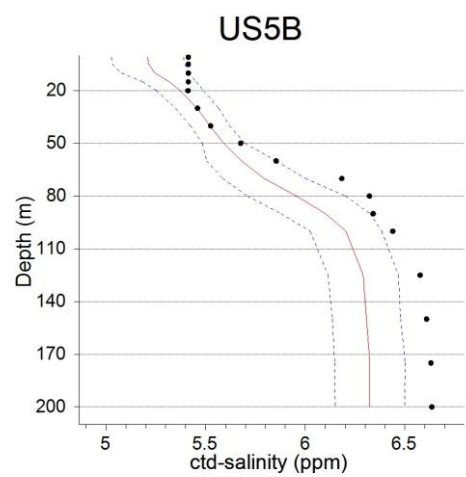
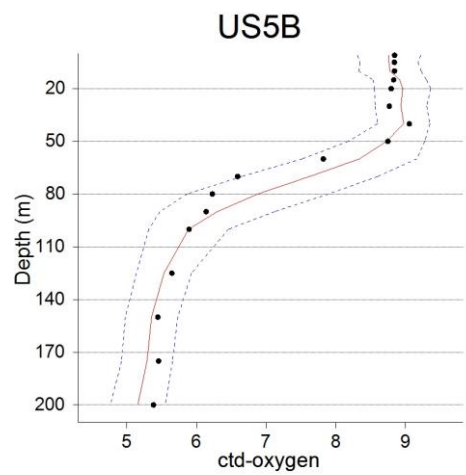
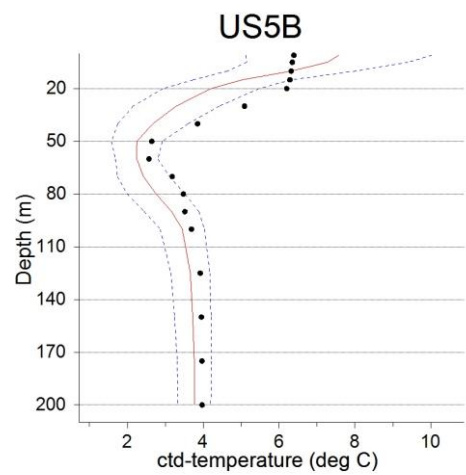


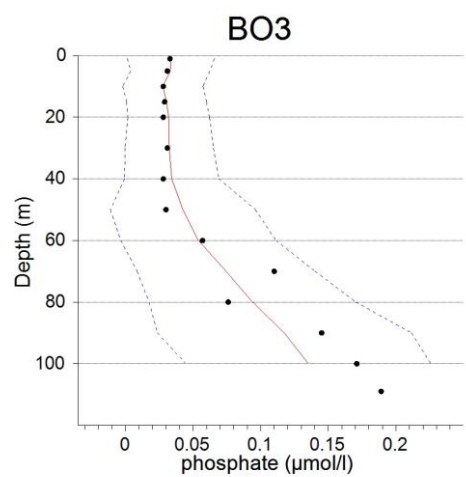
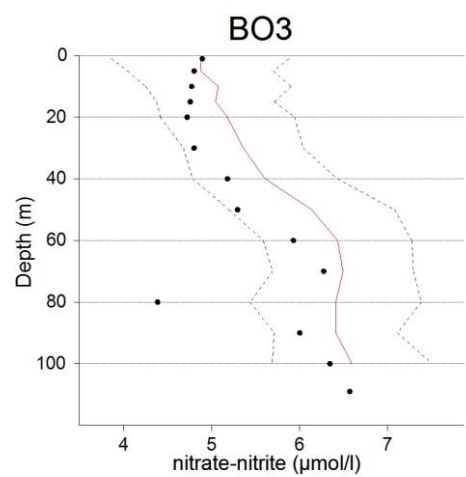
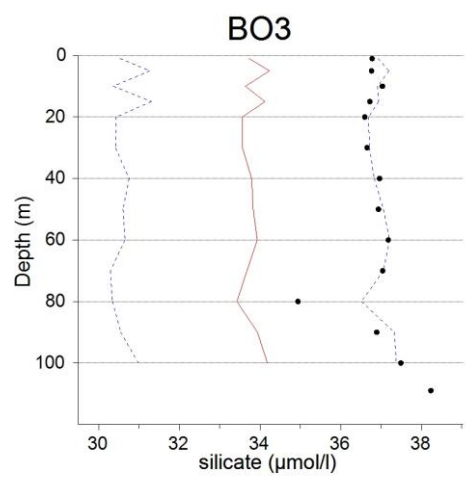
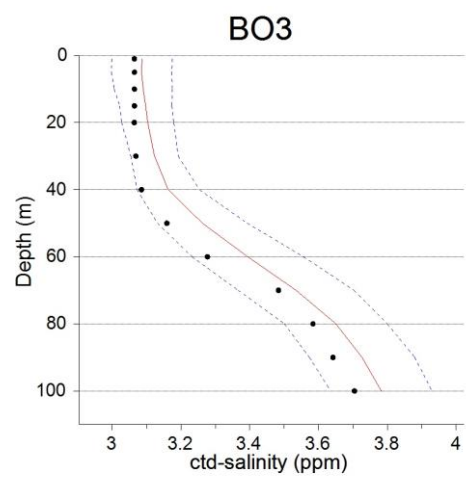
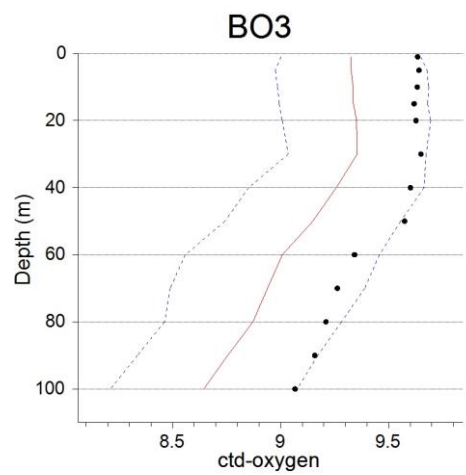
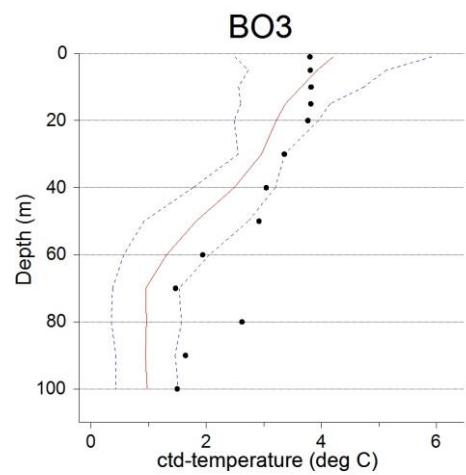


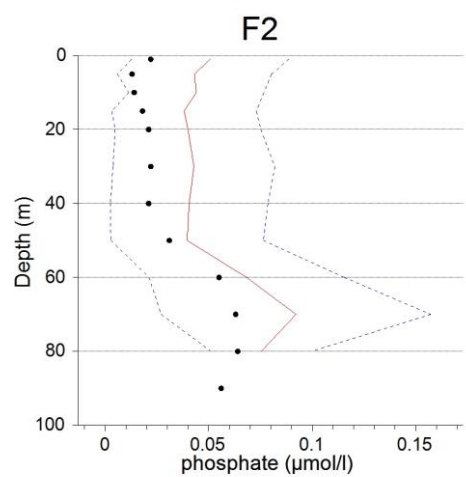
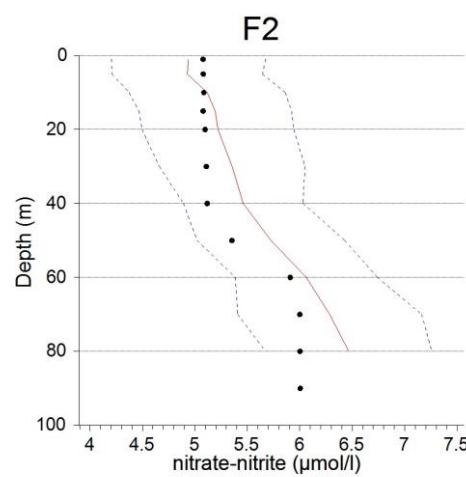
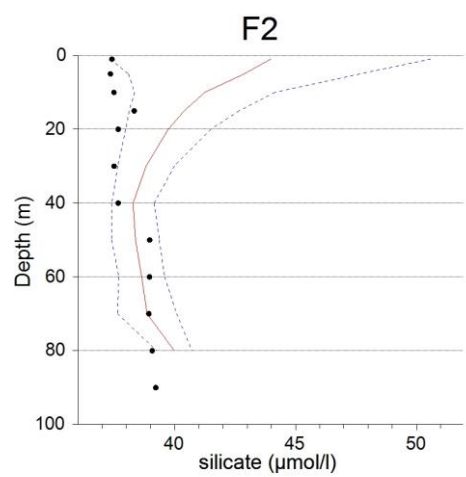
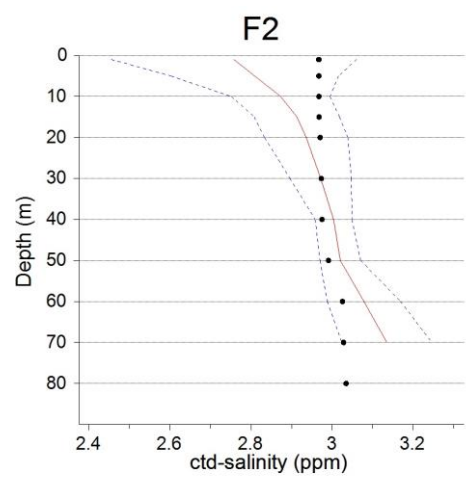
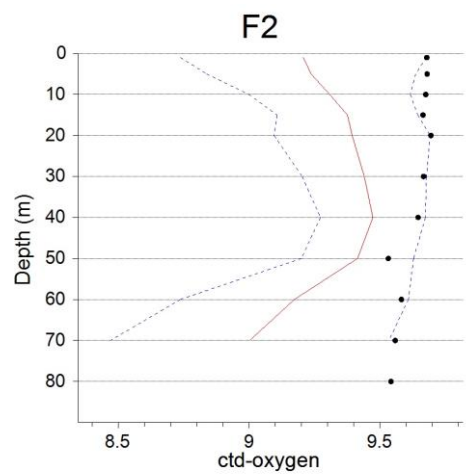
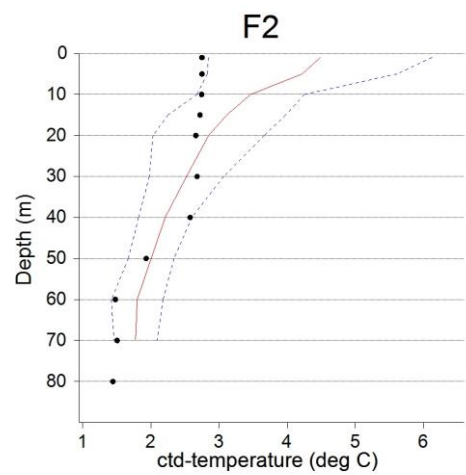












Annex 2. List of sampled stations of the cruise

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
Tammasaarenl	Tammasaarenl	60.15475	24.90028		2025-05-27	07.07											
2025010086	39A	60.06683	24.98022	43	2025-05-27	08.16	x	x	x	x				x			x
2025010087	LL6A	59.91680	25.03013	73	2025-05-27	10.13	x	x	x	x				x	x		x
2025010088	LL5	59.91687	25.59710	68	2025-05-27	17.46	x	x	x	x				x	x		x
2025010089	GF2	59.83855	25.85678	85	2025-05-27	23.11	x	x	x	x				x	x		x
2025010090	XV1	0.00000	0.00000	63	2025-05-28	08.24	x	x	x	x		x		x	x		x
2025010091	BIAS19B	60.25020	27.24362	68	2025-05-28	11.44											
2025010092	LL3A	60.06723	26.34602	68	2025-05-28	15.54	x	x	x	x		x		x	x		x
2025010093	CT_ORRE	60.15983	26.22732	66	2025-05-28	18.26	x		x								x
2025010094	XIV3	60.20312	26.19277	76	2025-05-29	06.41	x	x	x	x					x		x
2025010095	ADCPGoF_AK_1C_25	60.06668	25.42760	0	2025-05-29	11.36											x
2025010096	LL7S	59.85855	24.83843	77	2025-05-29	15.06				x	x				x		x
2025010097	LL7D	59.84643	24.83792	102	2025-05-29	17.43	x	x	x	x		x			x		x
2025010098	GF1	59.70495	24.68207	84	2025-05-30	03.07	x	x	x	x		x		x	x		
2025010099	Smetlivy	59.69567	24.17485		2025-05-30	05.25											x
2025010100	Z36	59.68967	24.16932	70	2025-05-30	07.40											x
2025010101	Z35	59.68895	24.16898		2025-05-30	11.37											x
2025010102	LL9	59.70003	24.03005	67	2025-05-30	17.04	x	x	x	x		x		x	x		x
2025010103	XII3	59.86417	23.98570	35	2025-05-30	21.11	x	x	x	x					x		x
2025010104	JML	59.58183	23.62682	80	2025-05-31	00.18	x	x	x	x					x	x	x
2025010105	F62	59.33335	23.26335	96	2025-05-31	03.50	x	x	x	x					x		x
2025010106	LL12	59.48348	22.89687	83	2025-05-31	06.39	x	x	x	x		x			x	x	x
2025010107	LL11	59.58343	23.29655	67	2025-05-31	14.35	x	x	x	x					x	x	x
2025010108	AMN	59.69047	23.25727	55	2025-05-31	21.05	x	x	x	x					x	x	
2025010109	LANGDEN	59.75678	23.23160	47	2025-06-01	04.31	x	x	x	x		x			x	x	x
Hanko (Hango)	Hanko (Hango)	59.82162	22.94895		2025-06-01	07.39											
2025010110	BenthicLander	59.81613	21.33990	46	2025-06-01	19.32											
2025010111	IU7	59.81518	21.33663	92	2025-06-01	19.59	x	x	x	x		x			x		
2025010112	IU5	60.05812	21.19835	90	2025-06-01	23.50	x	x	x	x					x	x	
2025010113	IU3	60.33323	21.11368	50	2025-06-02	04.06	x	x	x	x					x	x	
2025010114	IU1	60.76688	20.84668	33	2025-06-02	07.54	x	x	x	x					x		x
2025010115	SR7	61.08345	20.59647	78	2025-06-02	12.18	x	x	x	x					x	x	x
2025010116	SR8	61.12645	20.93000	48	2025-06-02	15.10	x	x	x	x					x		x
2025010117	ARGO_SM	61.59970	20.30932	123	2025-06-02	19.10	x										

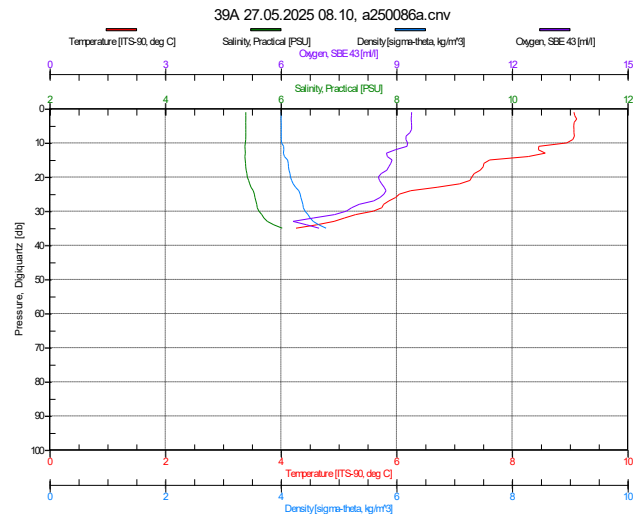
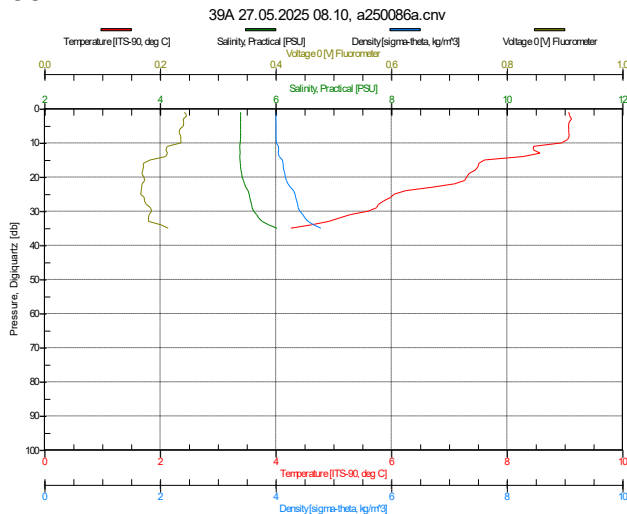
INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
2025010118	MS9	61.76683	20.53047	101	2025-06-02	21.17	x	x	x	x			x	x			
2025010119	F26	61.98348	20.06297	138	2025-06-03	00.43	x	x	x	x			x	x			
2025010120	US5B	62.58615	19.96883	221	2025-06-03	06.07	x	x	x	x		x	x	x			x
2025010121	US6B	62.60017	20.26295	81	2025-06-03	11.15	x	x	x	x			x	x			x
2025010122	US7	62.59997	20.82975	28	2025-06-03	14.10	x	x	x	x				x			x
2025010123	F16	63.51685	21.06285	48	2025-06-03	21.31	x	x	x	x		x	x	x			
2025010124	F15	63.51658	21.51318	48	2025-06-04	01.28	x	x	x	x			x	x			
2025010125	Pietarinkanta	63.98380	22.83190	19	2025-06-04	06.51											
2025010126	BO3	64.30202	22.34313	110	2025-06-04	10.05	x	x	x	x		x	x	x			x
2025010127	AALTO_PM	64.68408	23.23862	82	2025-06-04	15.47											
2025010128	BIAS11	64.73082	23.52437	76	2025-06-04	17.40											
2025010129	RR6	64.80025	23.47983	87	2025-06-04	18.44	x	x	x	x			x	x			x
2025010130	RR7	64.73363	23.81290	40	2025-06-04	21.13	x	x	x	x				x			
2025010131	HIEKKA2	65.04998	23.83335	22	2025-06-05	00.35	x	x	x	x			x	x			
2025010132	Kiisla	65.26108	24.42858	27	2025-06-05	03.42	x	x	x	x				x			
2025010133	F2	65.38367	23.46265	91	2025-06-05	08.16	x	x	x	x		x		x			x
2025010134	CVI	65.23368	23.56287	69	2025-06-05	11.02	x	x	x	x			x	x			x
2025010135	CV	65.00022	23.24623	87	2025-06-05	14.54	x	x	x	x			x	x			x
2025010136	RR3	64.93367	22.34597	94	2025-06-05	23.01	x	x	x	x			x	x			
2025010137	F13	63.78352	21.47953	65	2025-06-06	07.55	x	x	x	x				x			x
2025010138	F18	63.31422	20.27288	103	2025-06-06	13.44	x	x	x	x			x	x			x
2025010139	US3	62.75887	19.19568	176	2025-06-06	19.34	x	x	x	x			x	x			x
2025010140	MS6	61.98355	19.16378	73	2025-06-07	02.58	x	x	x	x			x	x			
2025010141	MS3	62.13450	18.16288	84	2025-06-07	06.48	x	x	x	x			x	x			x
2025010142	SR3	61.18322	18.23002	73	2025-06-07	15.06	x	x	x	x			x	x			x
2025010143	SR5	61.08333	19.57967	126	2025-06-07	20.53	x	x	x	x		x	x	x			
2025010144	SR5SE	61.08265	19.58503	124	2025-06-07	23.40											
2025010145	SR5E	61.08472	19.58653	123	2025-06-08	00.33											
2025010146	SR5N	61.08540	19.57927	123	2025-06-08	01.20											
2025010147	SR5W	61.08487	19.57483	123	2025-06-08	01.52											
2025010148	SR5NW	61.08838	19.57137	121	2025-06-08	02.34											
2025010149	F33	60.53318	18.93770	135	2025-06-08	07.56	x	x	x	x				x			x
2025010150	F64	60.18897	19.14252	286	2025-06-08	11.32	x	x	x	x		x	x	x			x
2025010151	F69	59.78325	19.93033	193	2025-06-08	19.35	x	x	x	x			x	x			
2025010152	LL19	58.88082	20.31070	166	2025-06-09	03.45	x	x	x	x			x	x			
2025010153	LL17	59.03330	21.07947	172	2025-06-09	08.21	x	x	x	x		x	x	x			x

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	pH	ox	nu	ph	zo	be	chl	oil	tox	secchi
2025010154	LL15	59.18348	21.74658	131	2025-06-09	13.36	x	x	x	x			x	x			x
2025010155	LL12	59.48347	22.89653	83	2025-06-09	18.48											
2025010156	TZS1	59.77665	23.26017	55	2025-06-09	21.19		x	x								
2025010157	TZS2	59.83600	23.29008	40	2025-06-09	21.41		x	x								
2025010158	TZS3	59.85557	23.27092	37	2025-06-09	21.51		x	x								
2025010159	TZS4	59.88620	23.27512	18	2025-06-09	22.05		x	x								
2025010160	TZS5	59.91822	23.33140	20	2025-06-09	22.32		x	x								
Tammasaarenl	Tammasaarenl	60.16180	24.90158		2025-06-10	09.06											

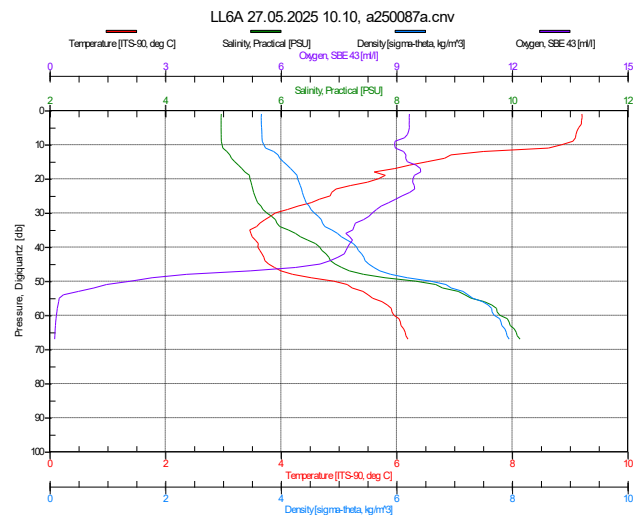
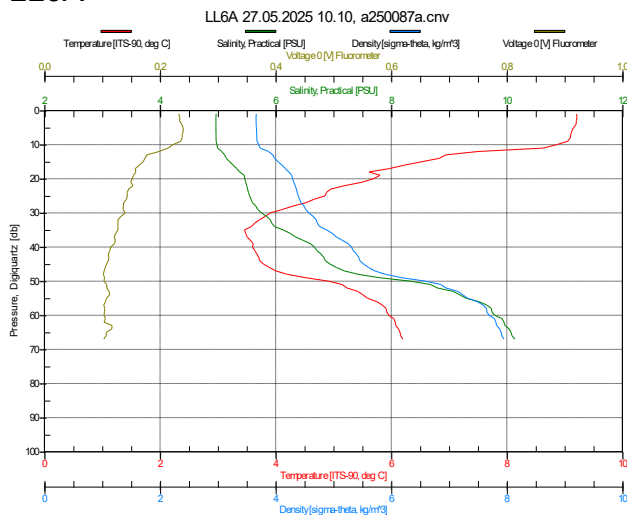
Parameters: ox = oxygen, nu = nutrients, ph = phytoplankton, zo = zooplankton, be = benthos, chl = chlorophyll a, oil = dissolved oil, tox = phytotoxins.

Annex 3. CTD profiles of the cruise (2 graphs per station: Chla fluorescence left and O2 right in addition to temperature, salinity and density plots). The full list of stations with coordinates are presented in Annex 2.

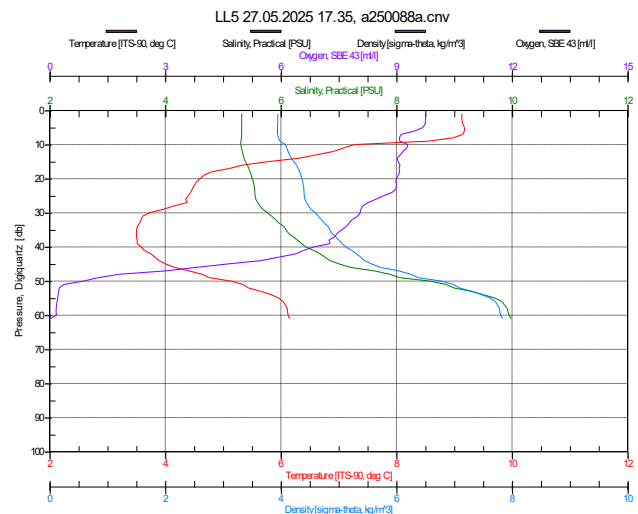
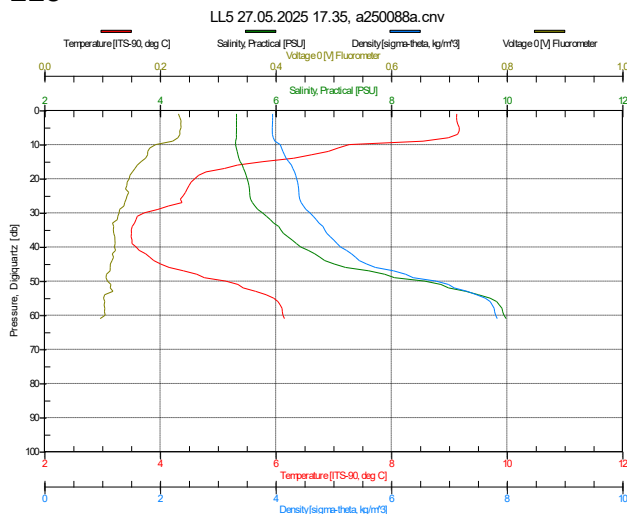
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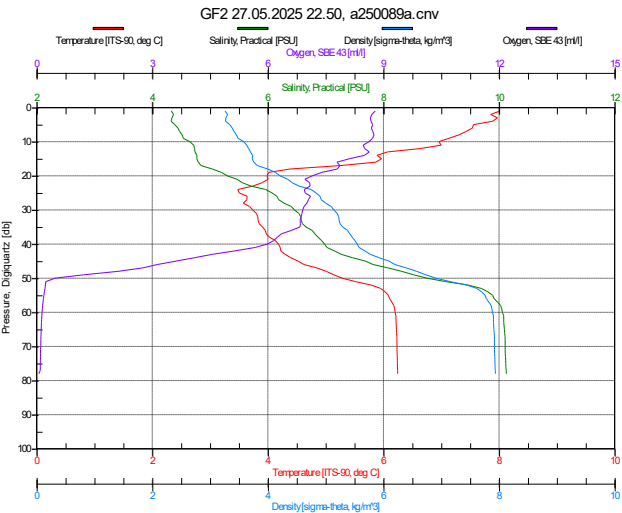
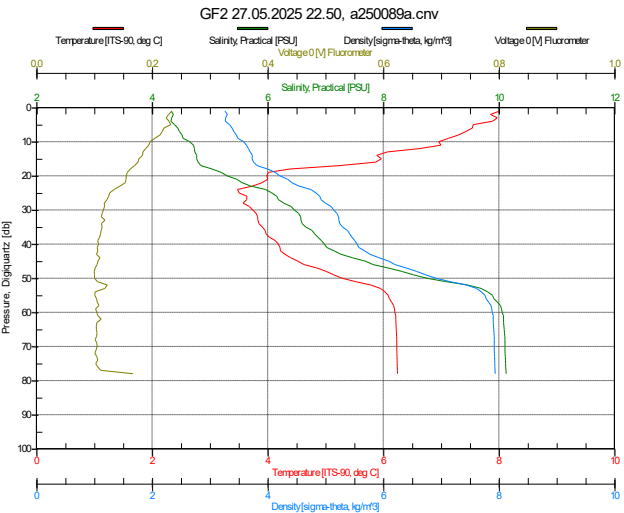
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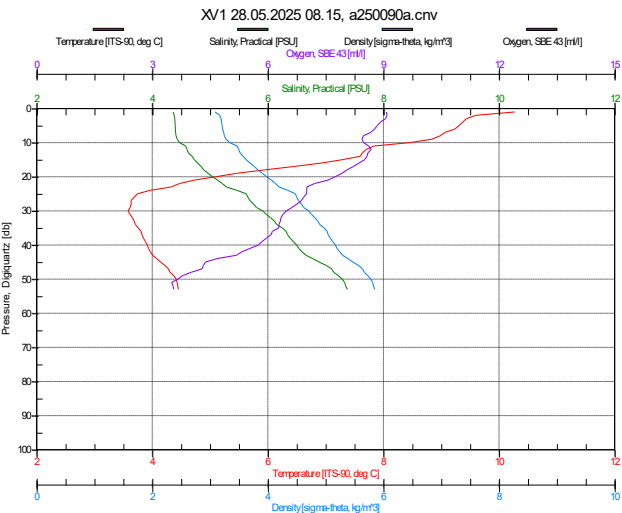
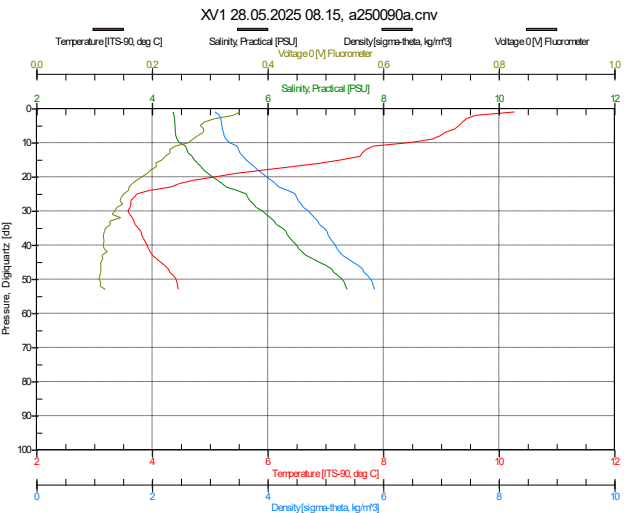
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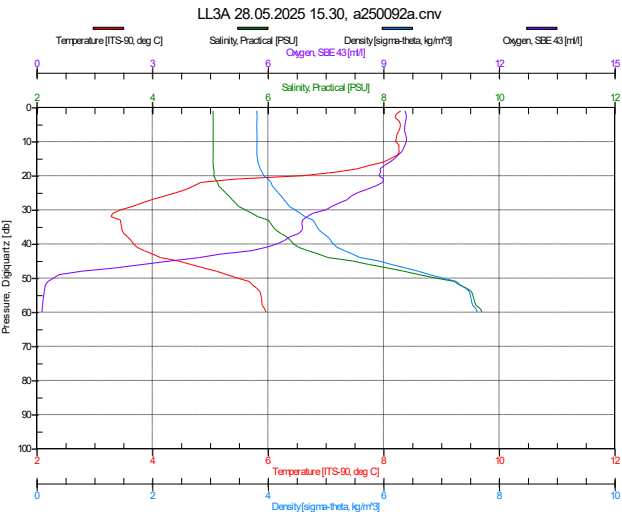
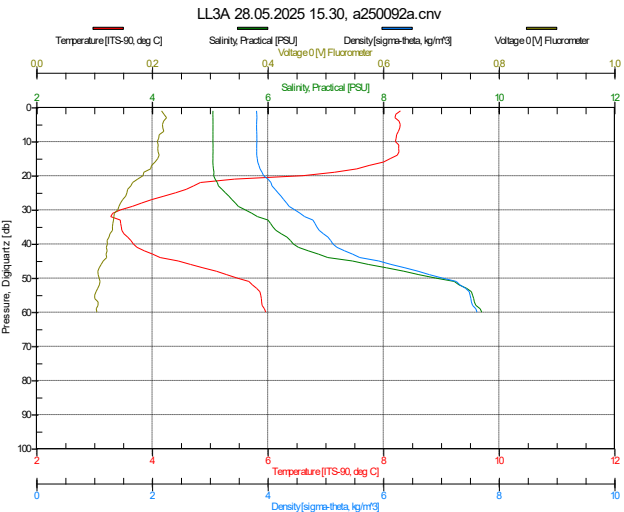
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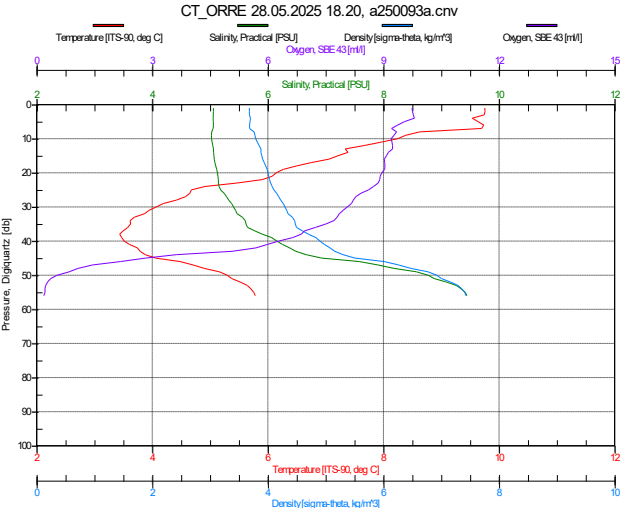
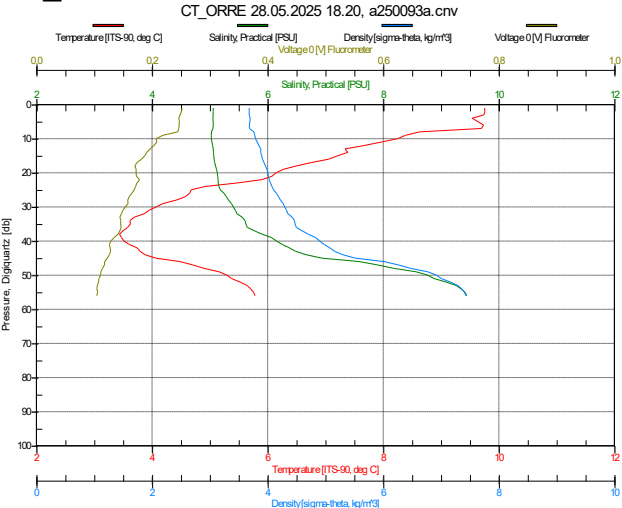
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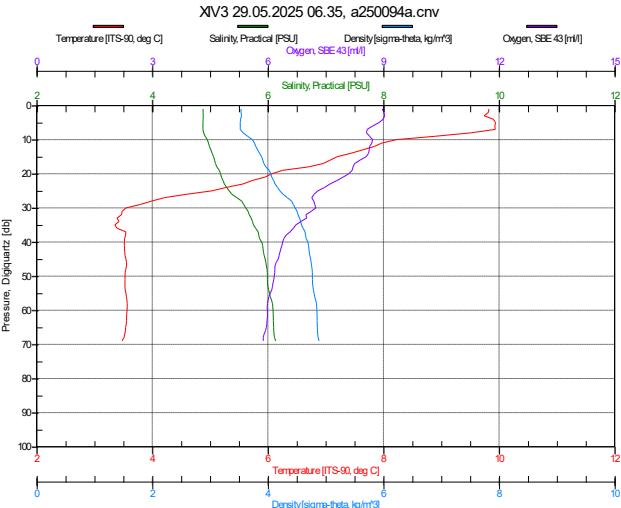
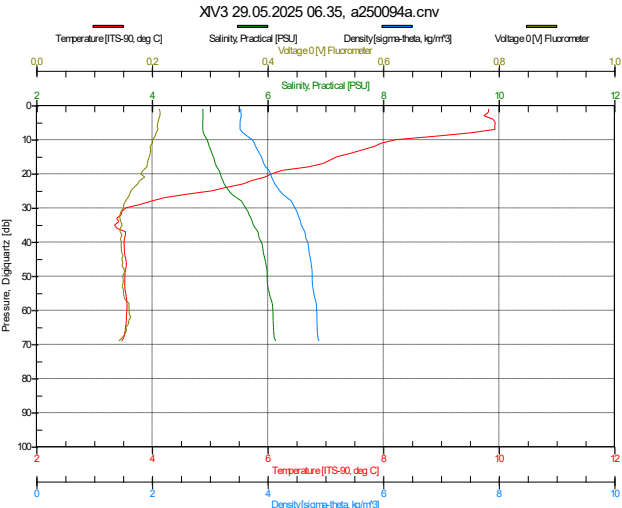
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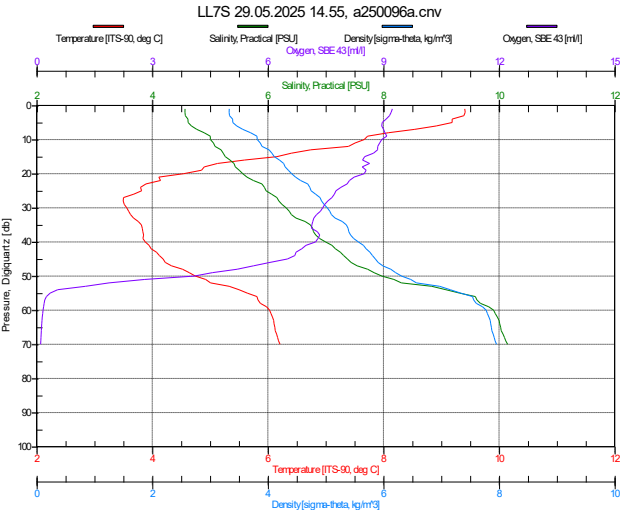
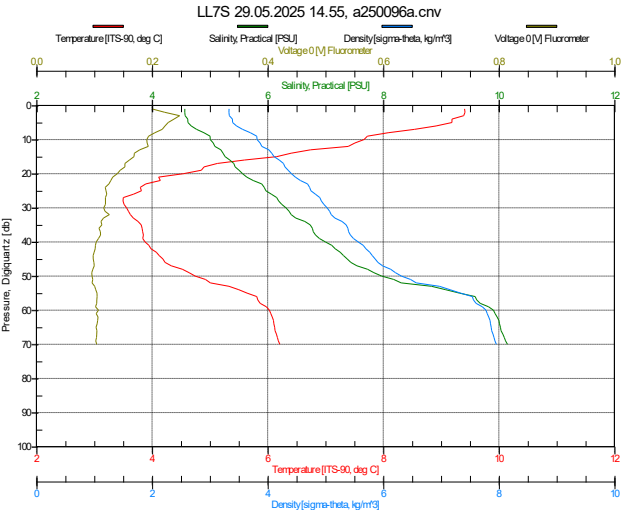
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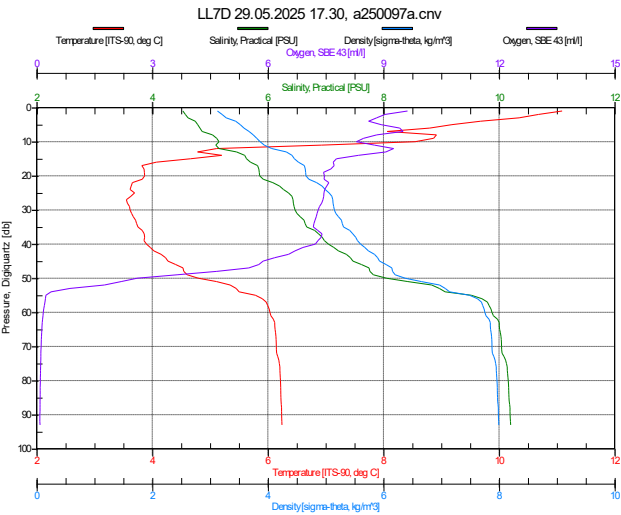
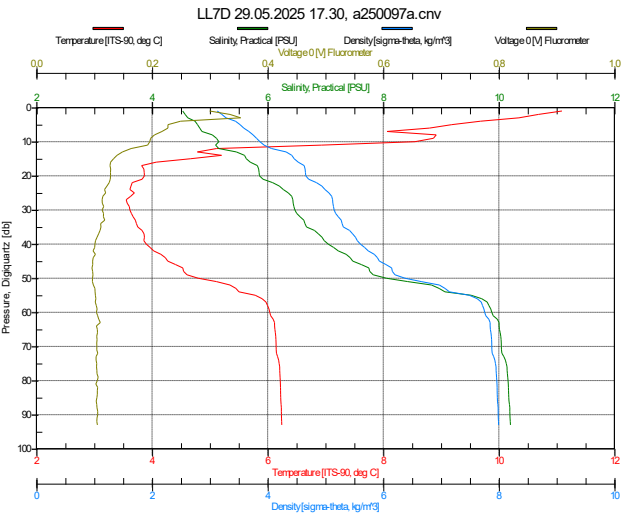
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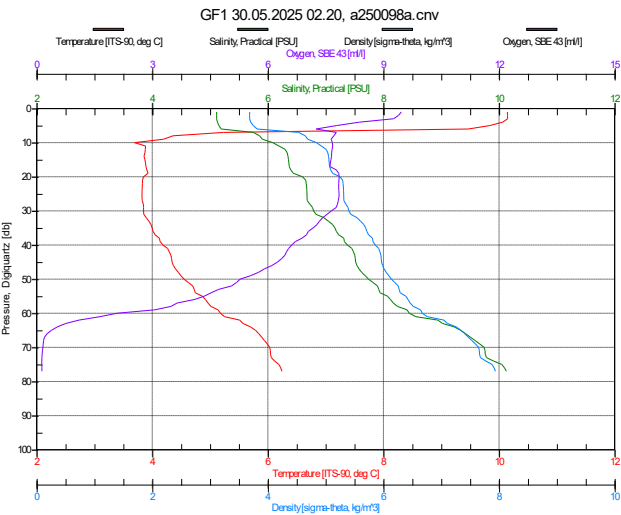
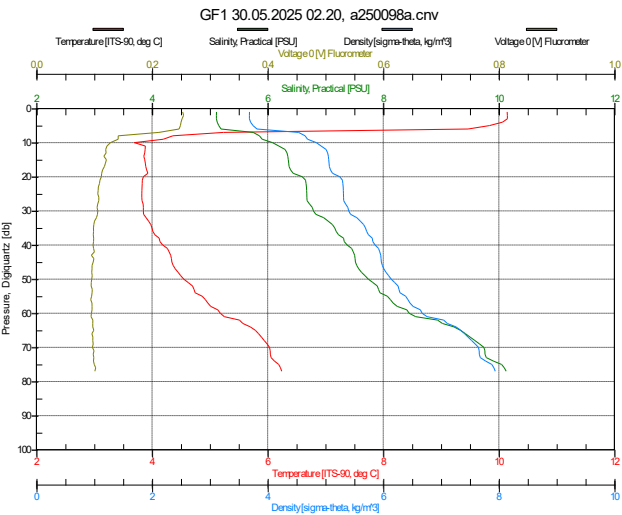
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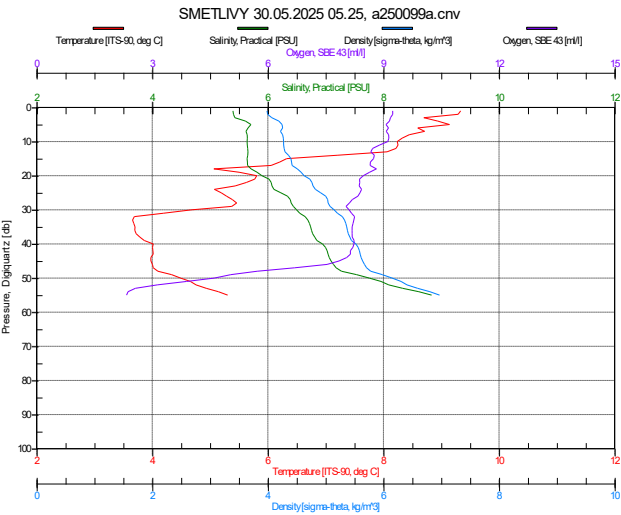
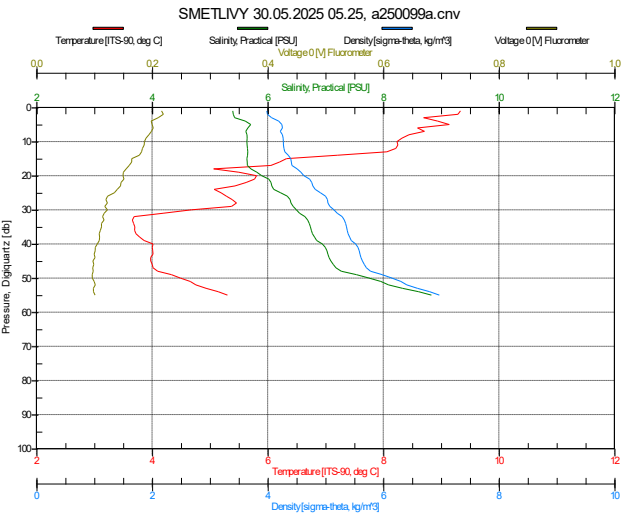
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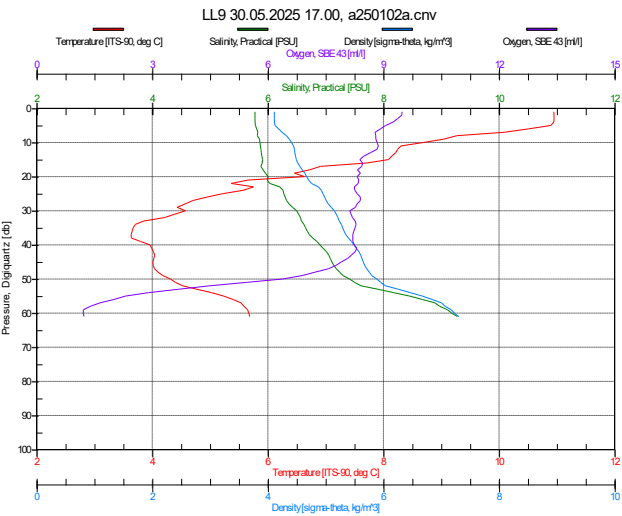
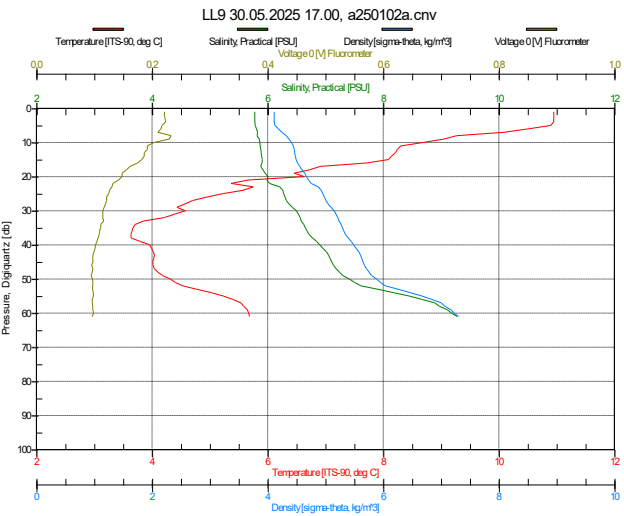
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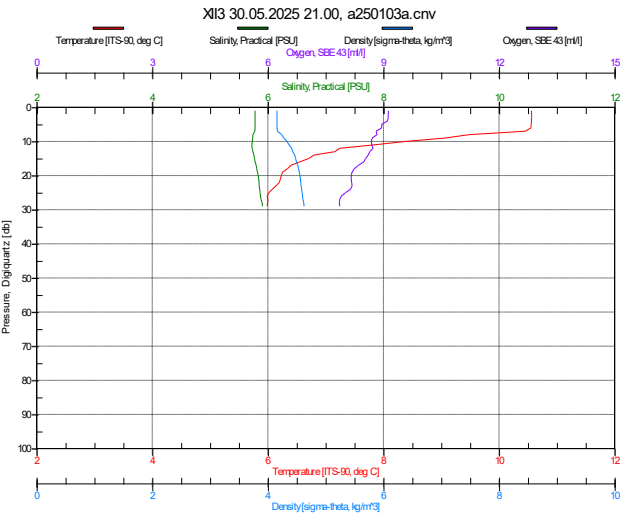
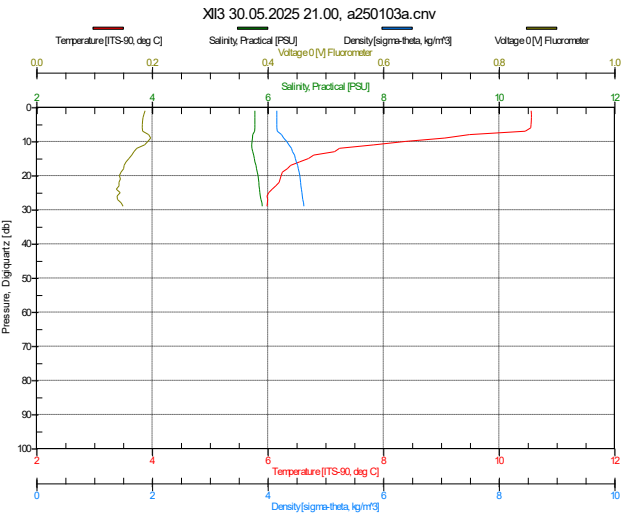
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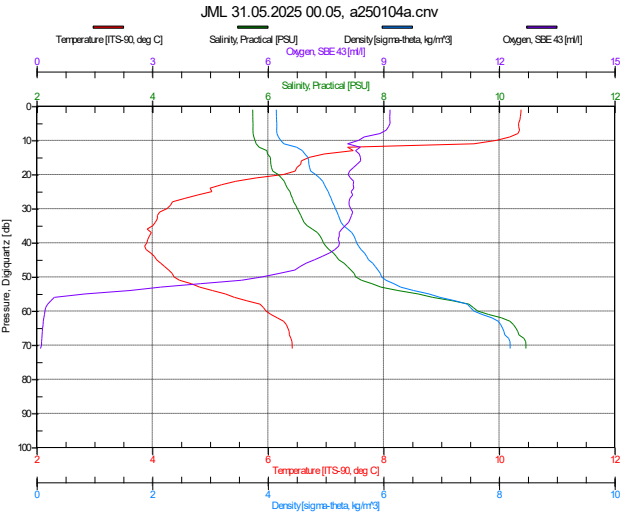
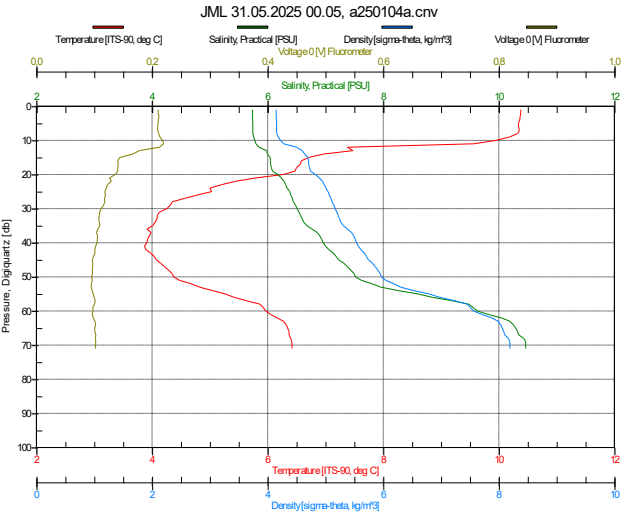
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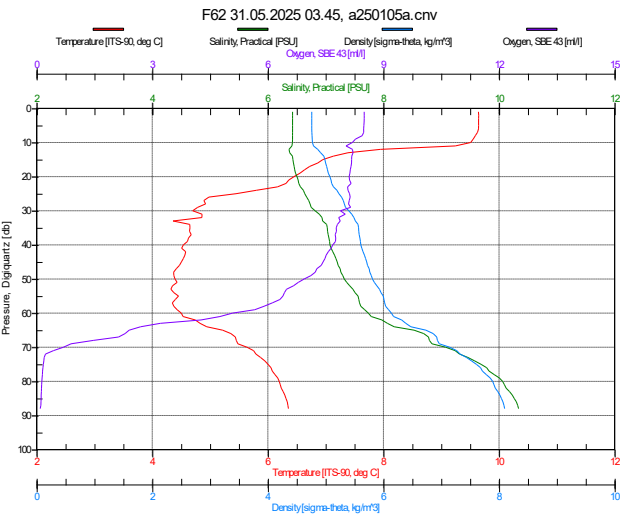
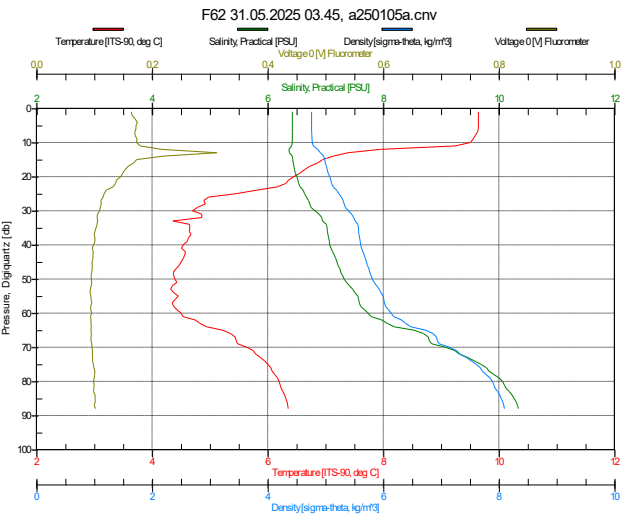
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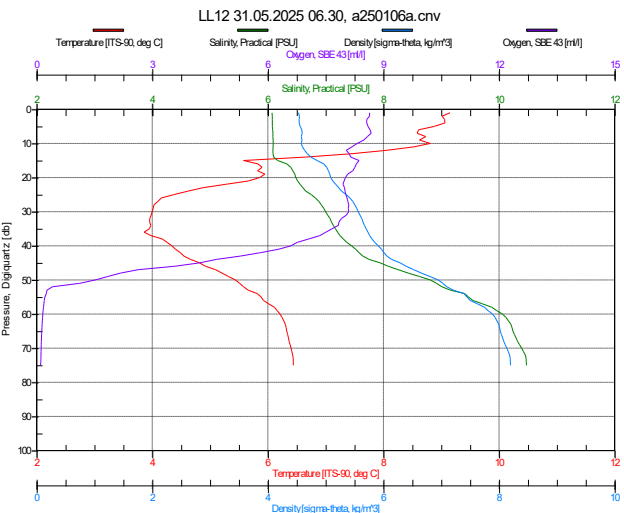
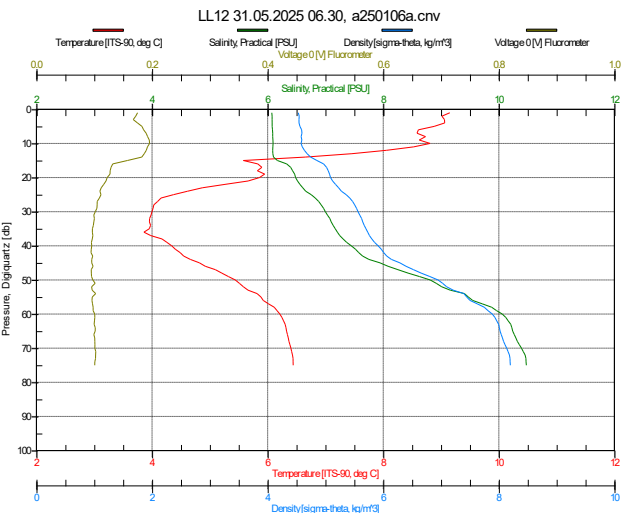
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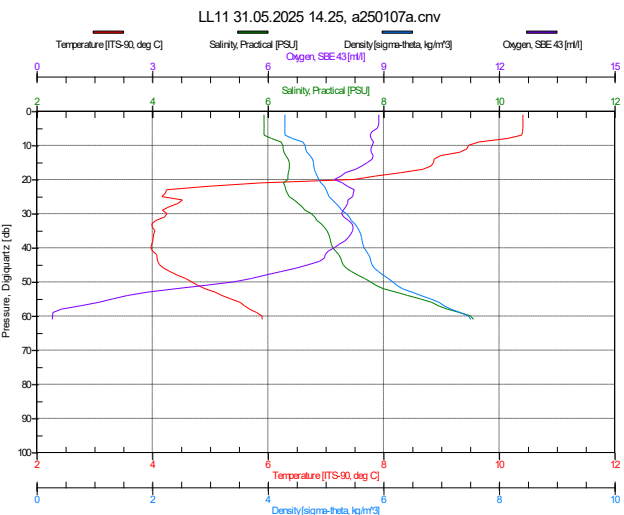
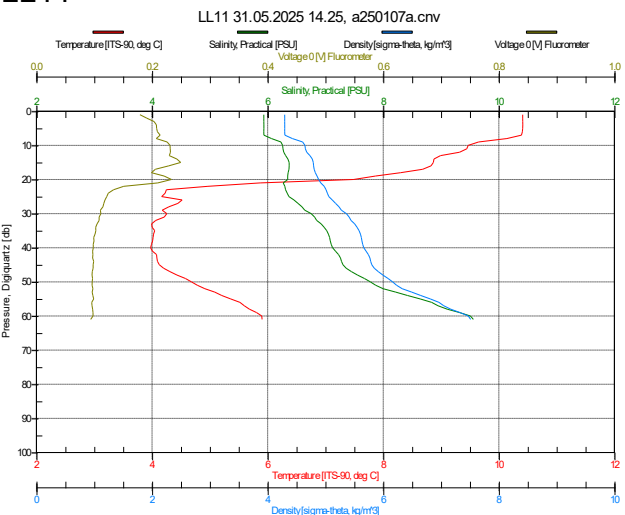
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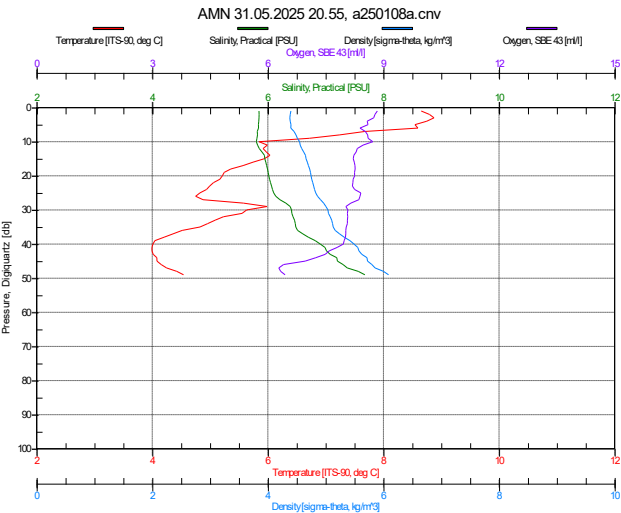
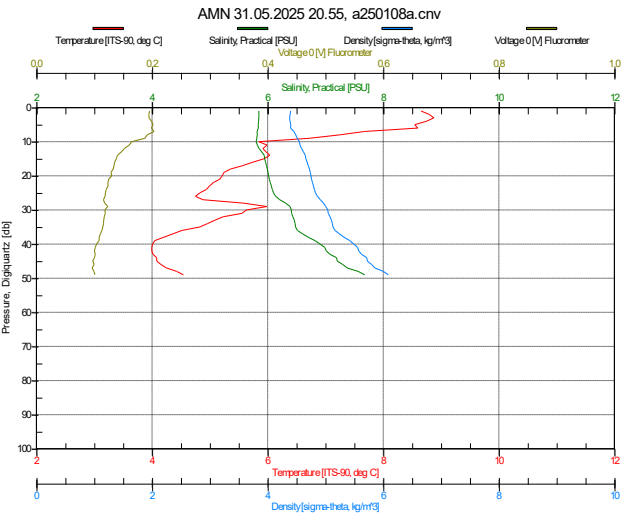
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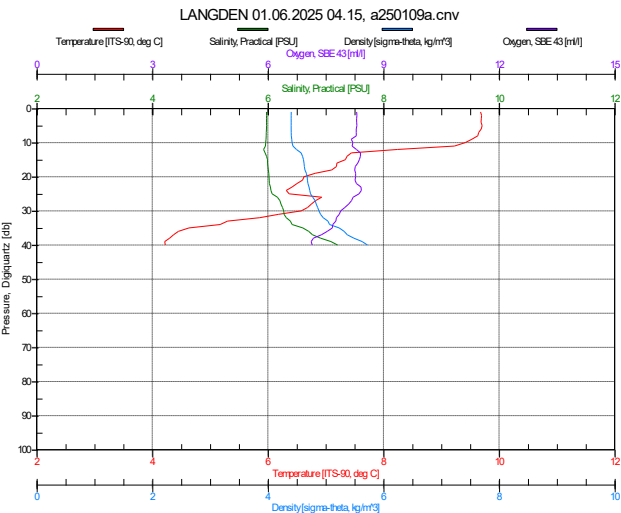
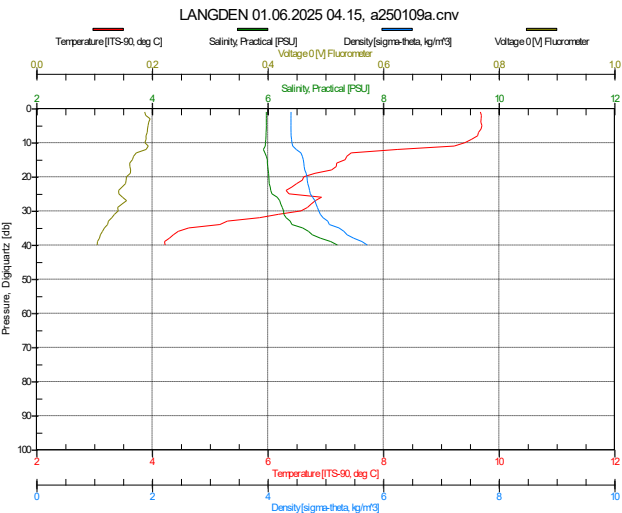
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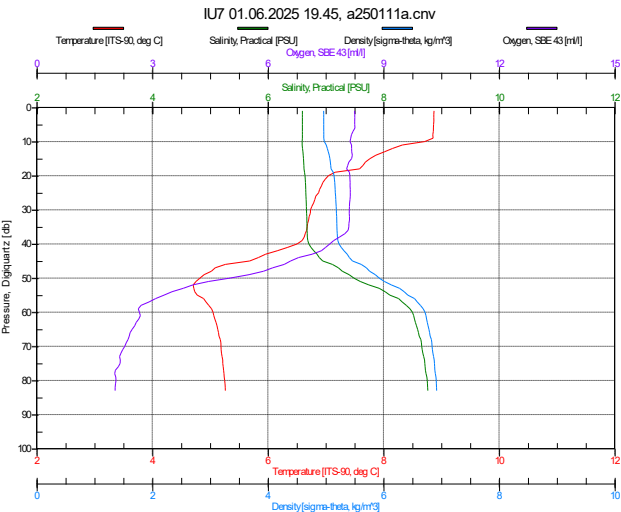
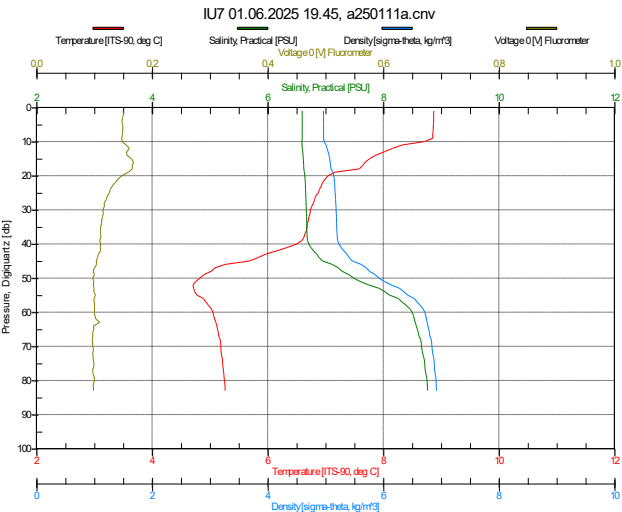
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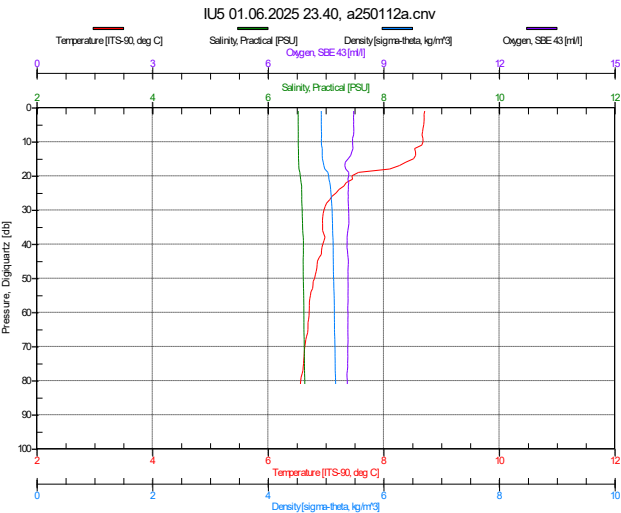
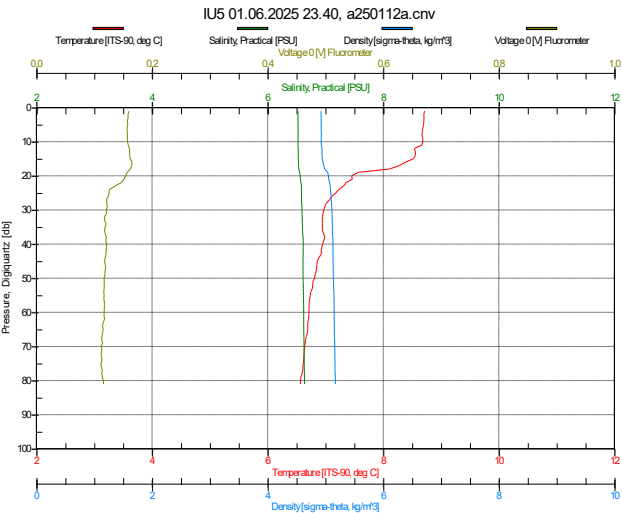
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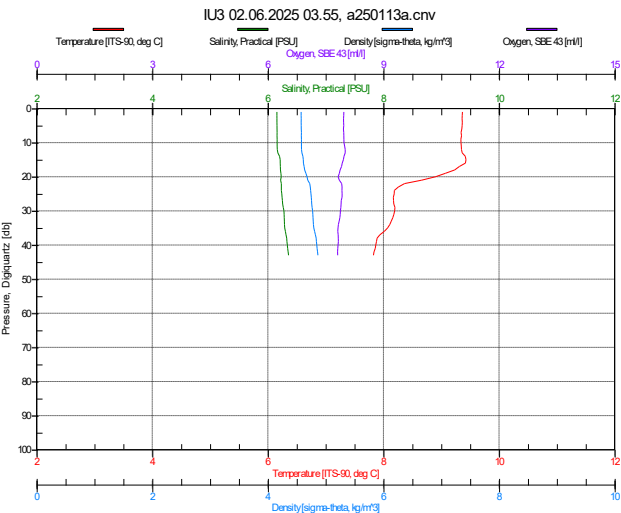
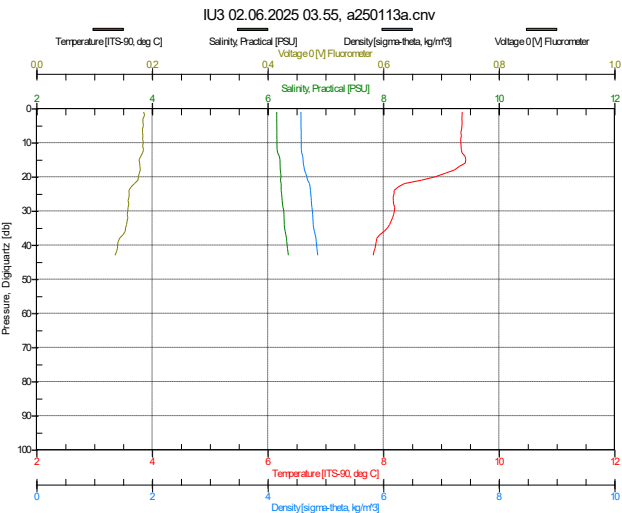
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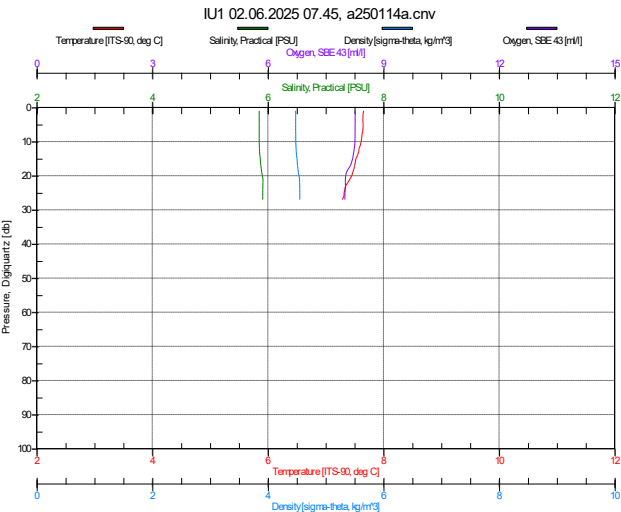
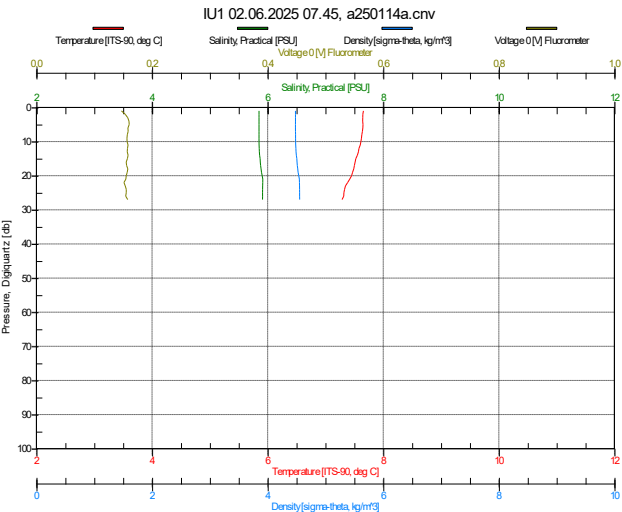
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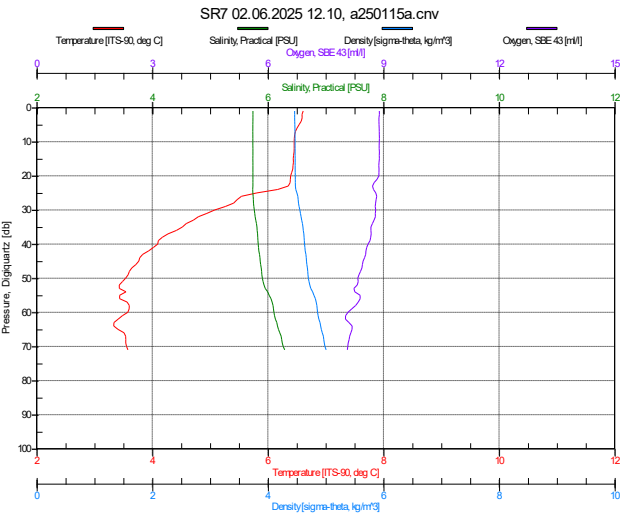
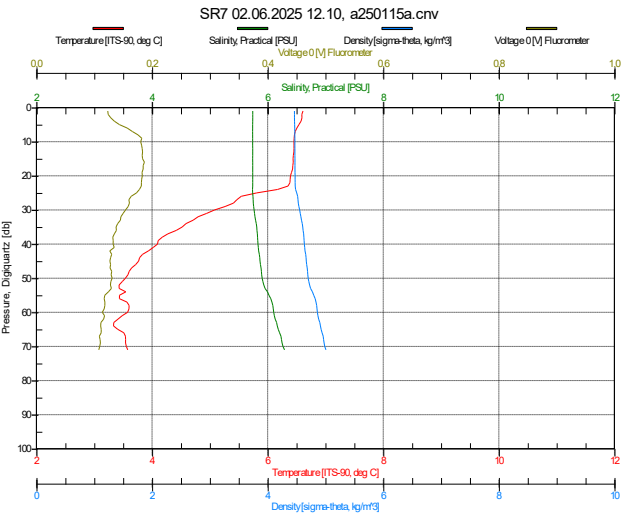
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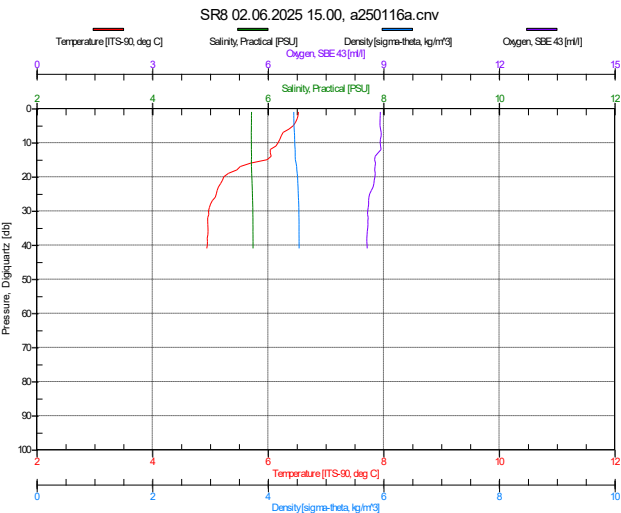
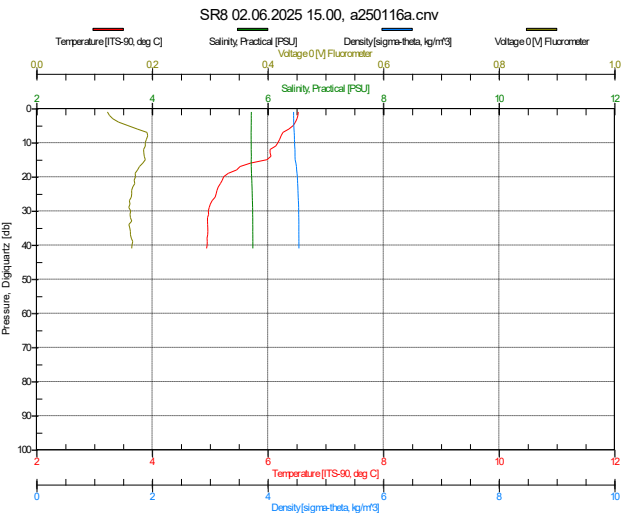
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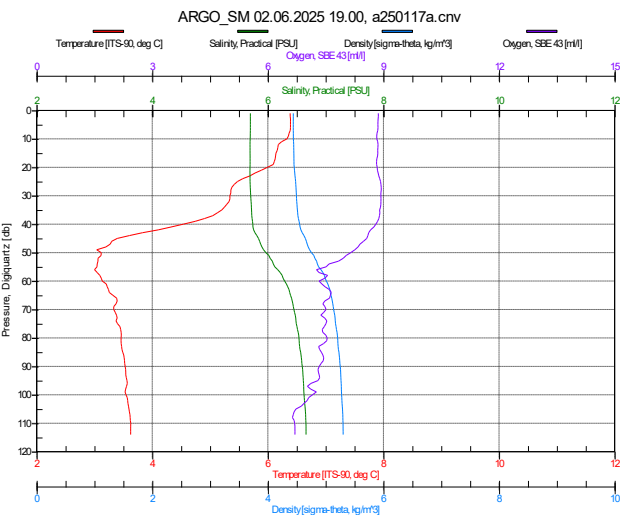
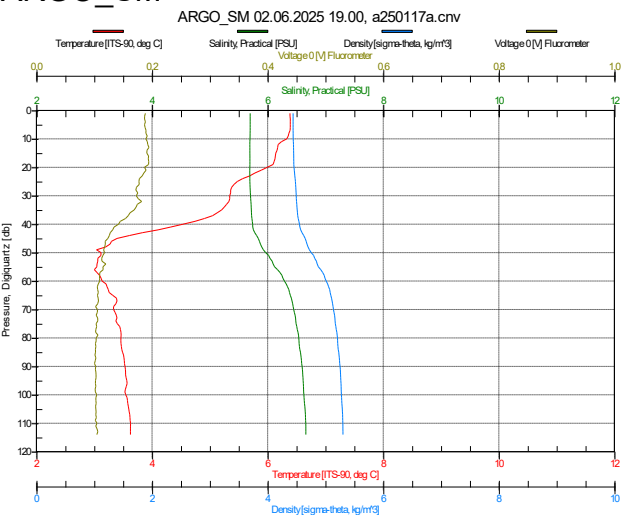
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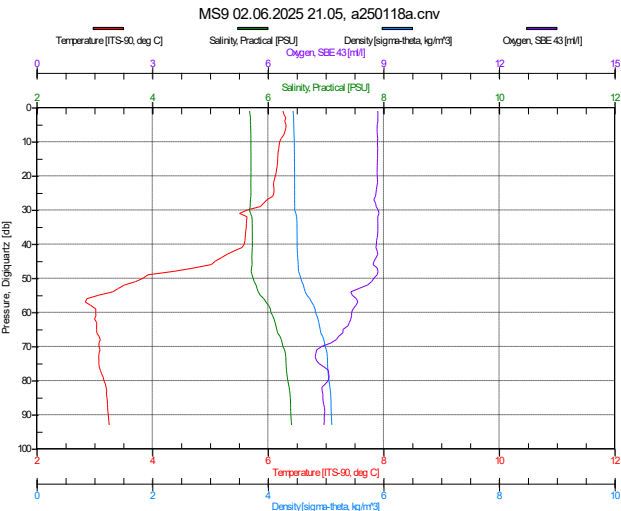
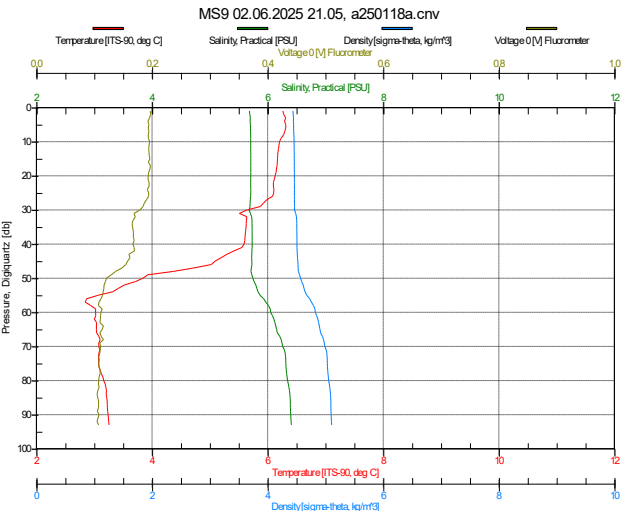
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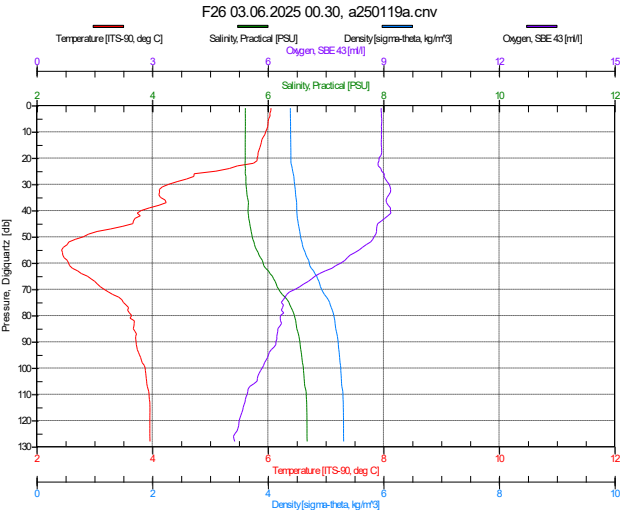
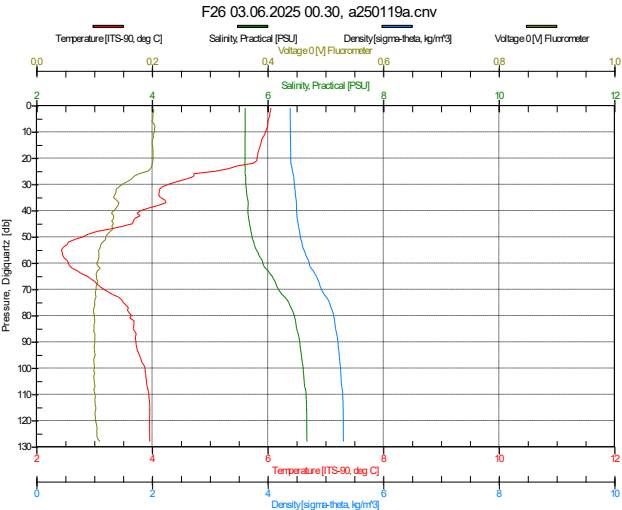
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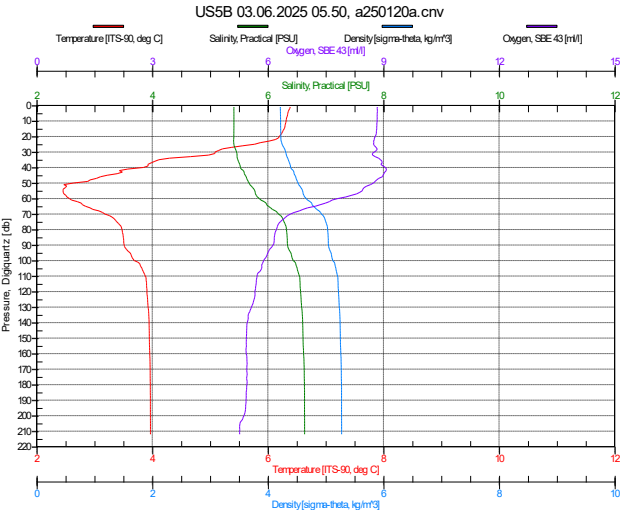
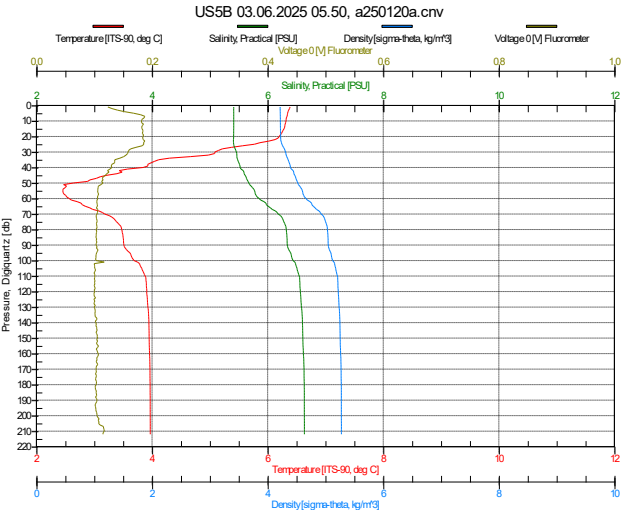
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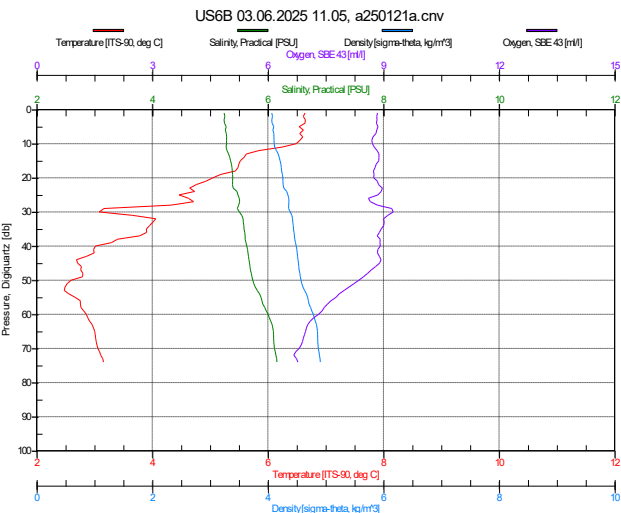
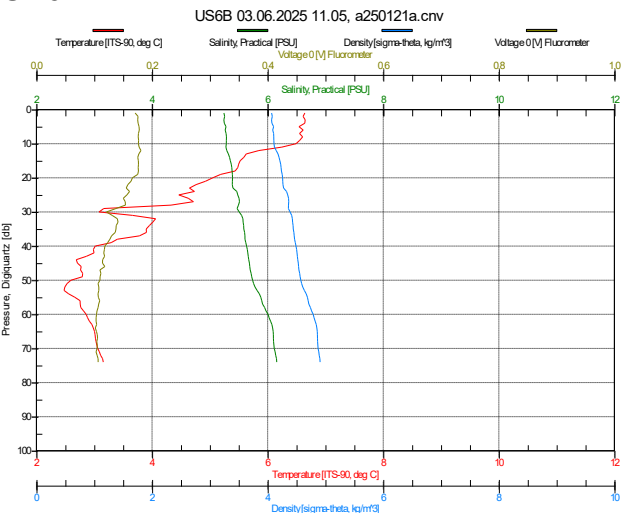
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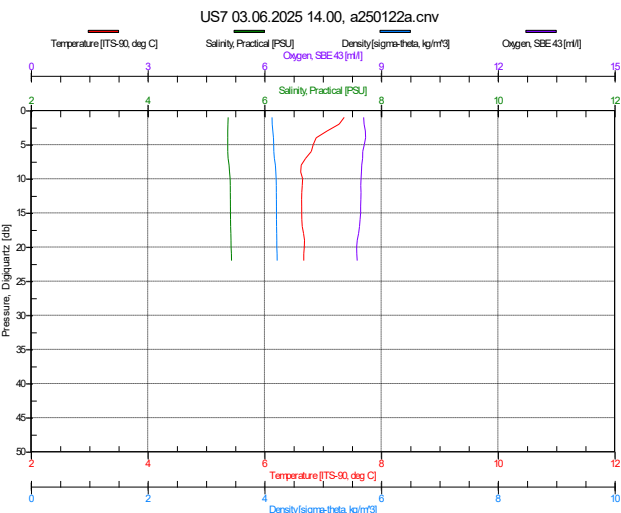
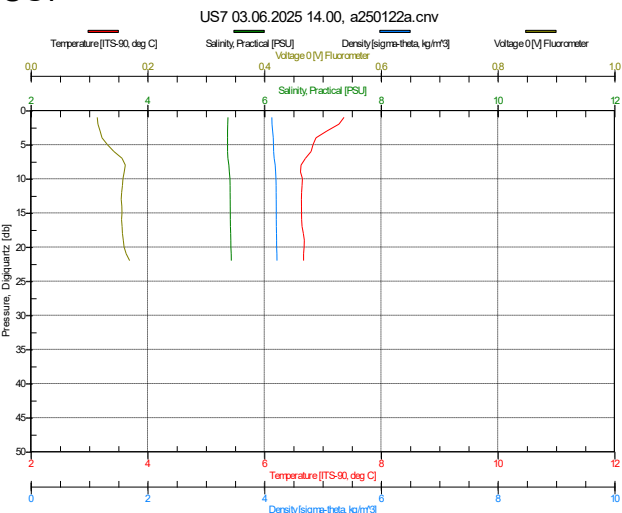
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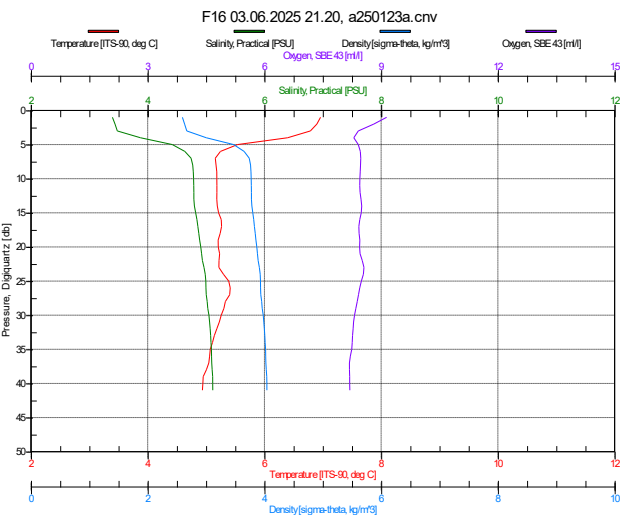
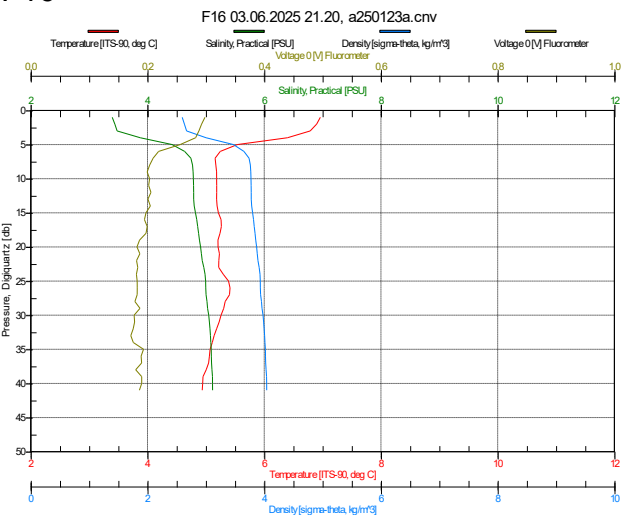
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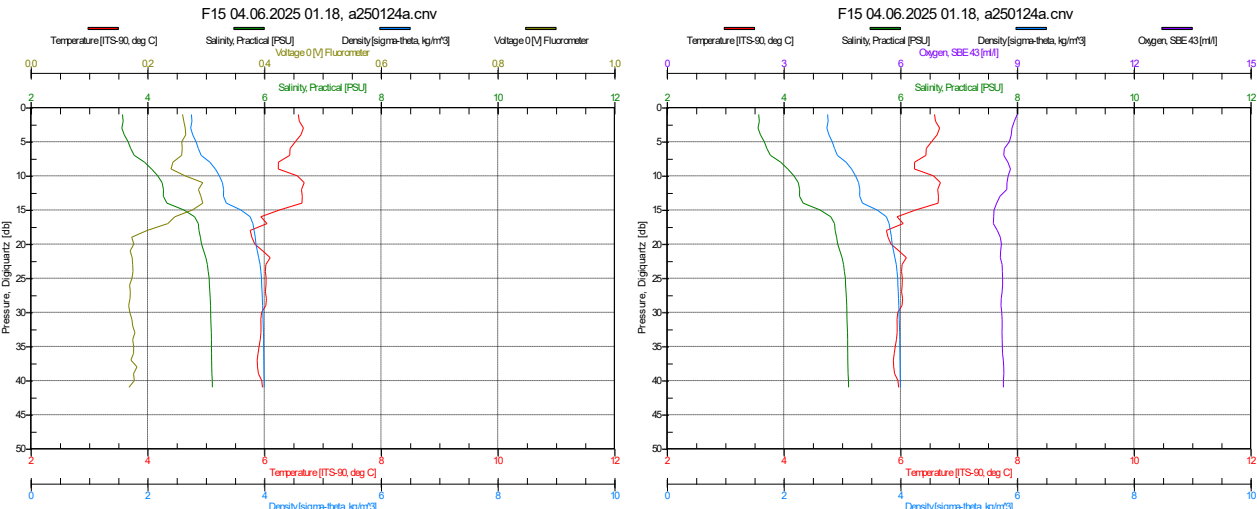
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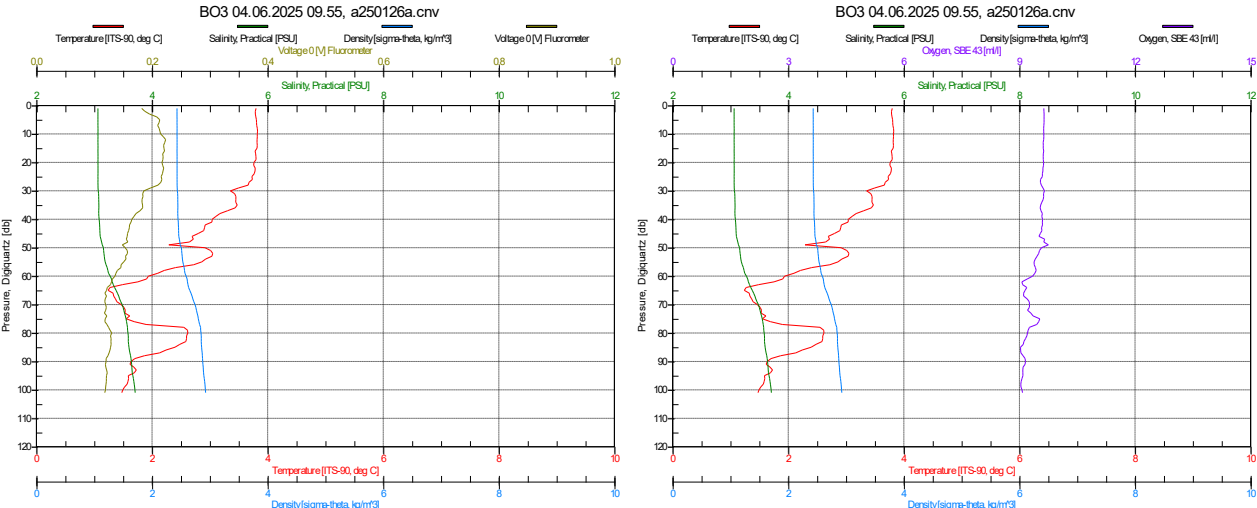
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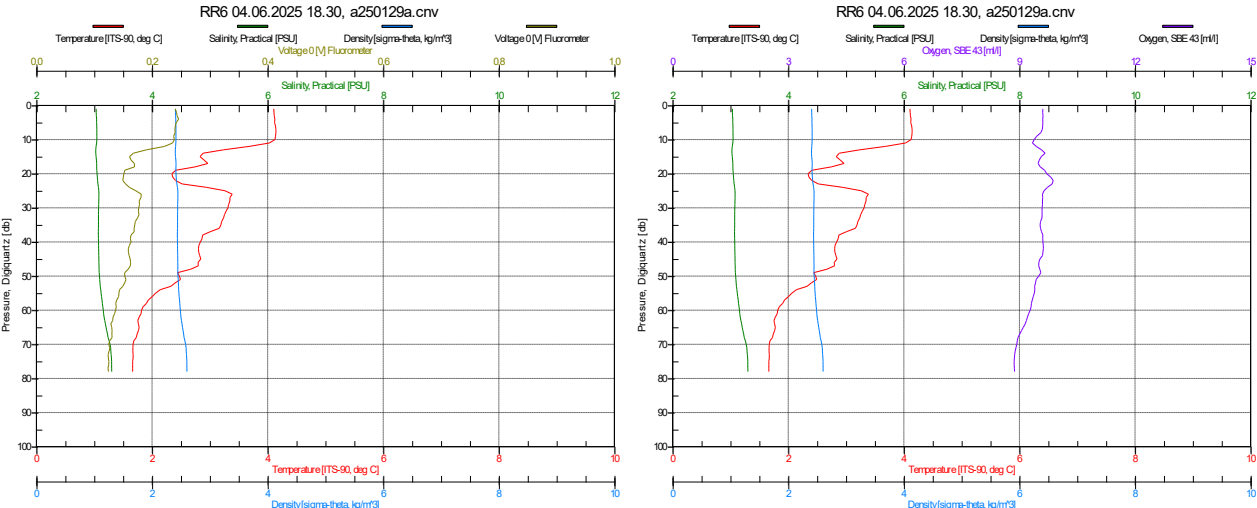
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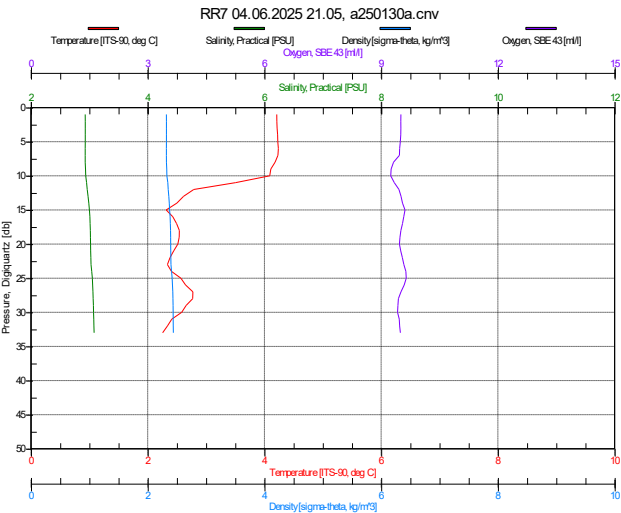
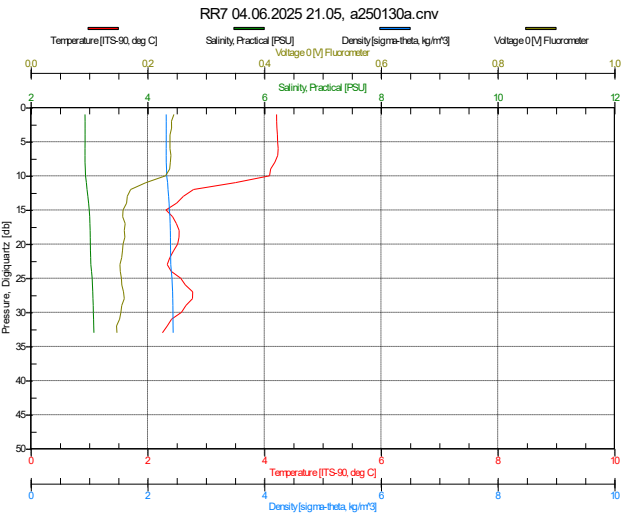
BO3



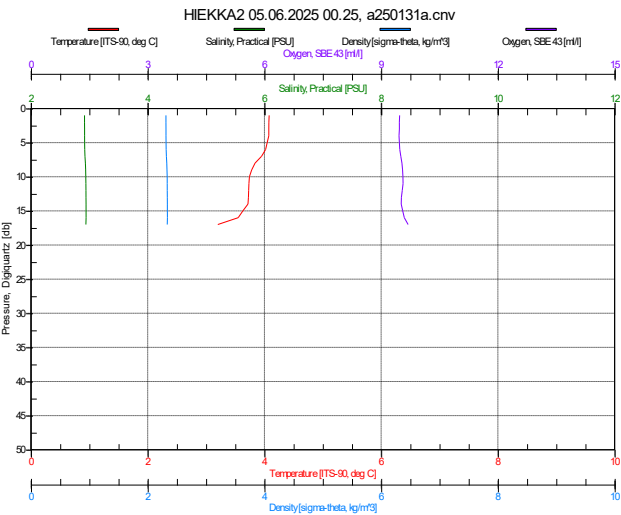
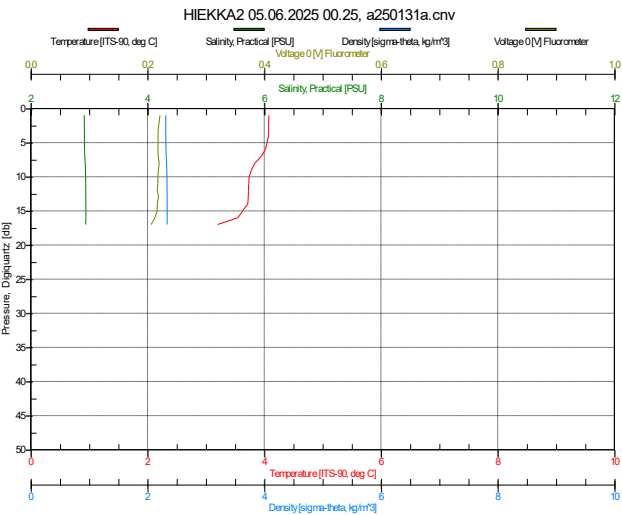
RR6



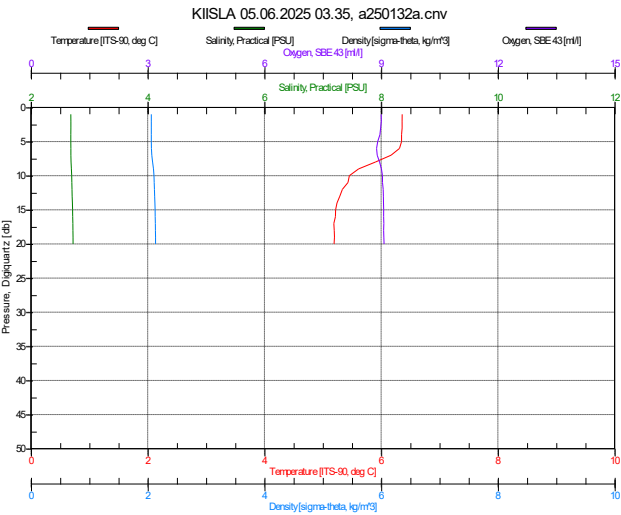
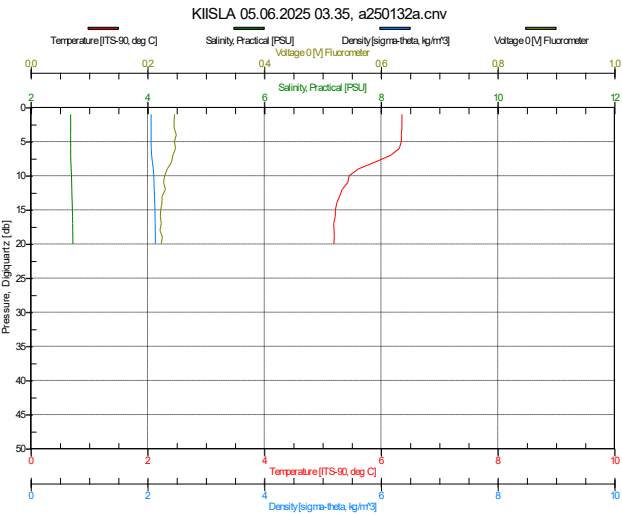
RR7



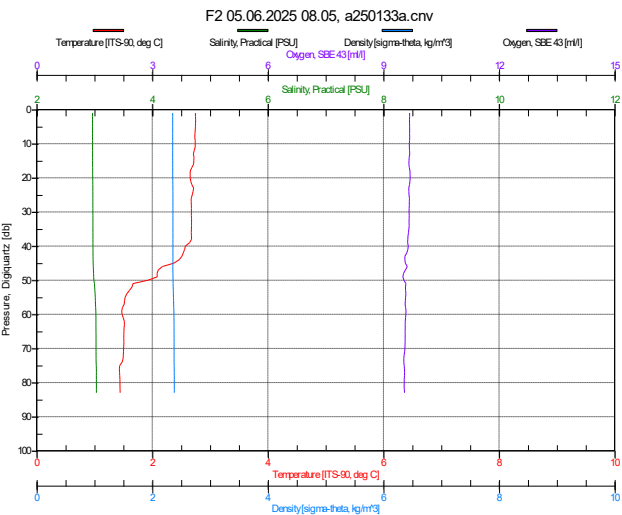
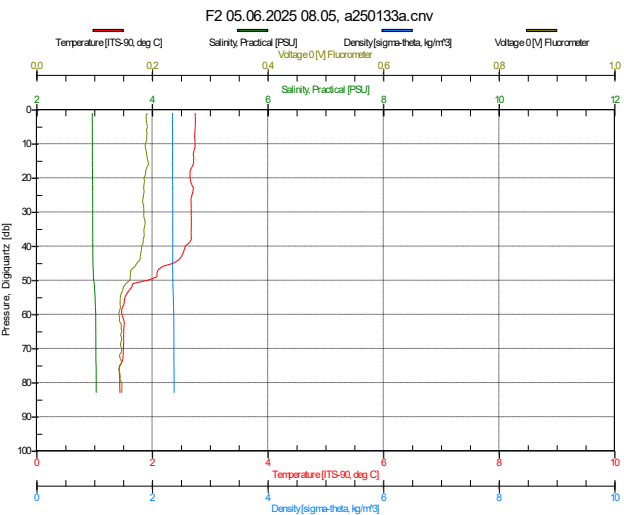
HIEKKA2



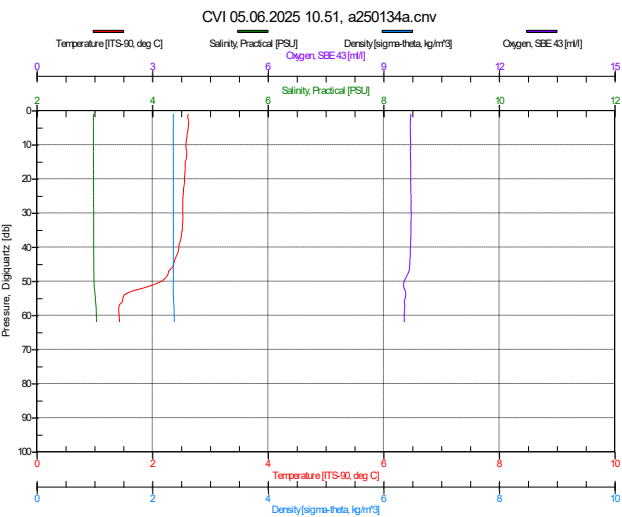
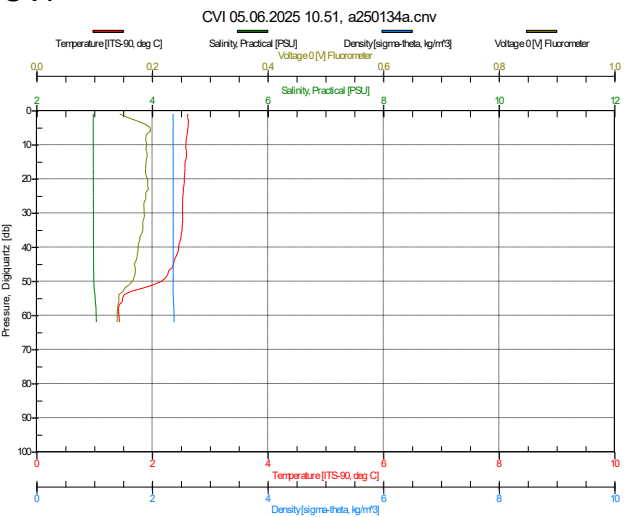
KIISLA



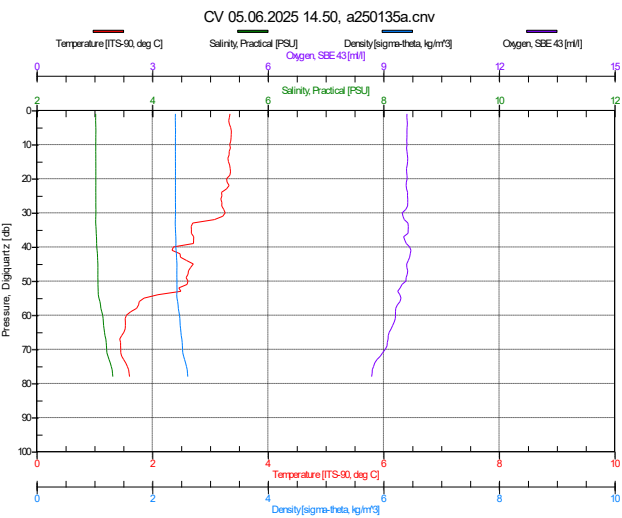
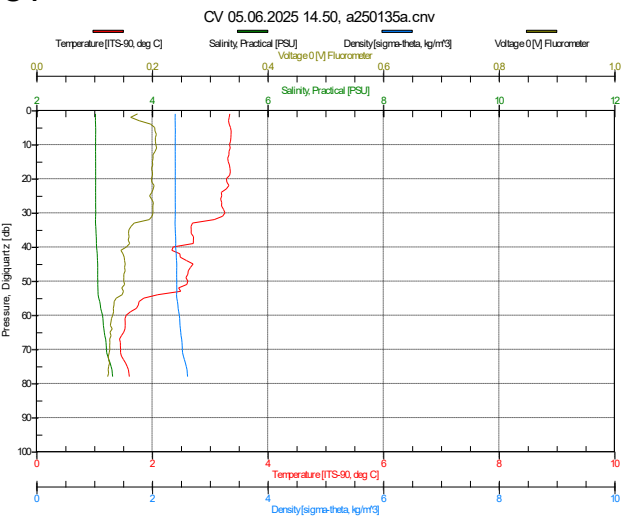
F2



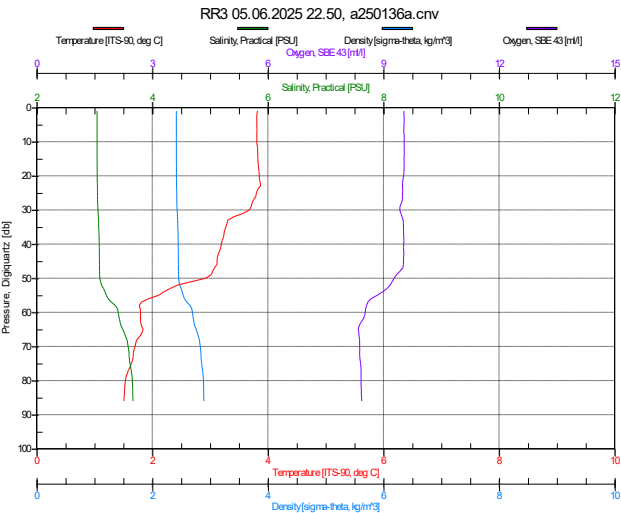
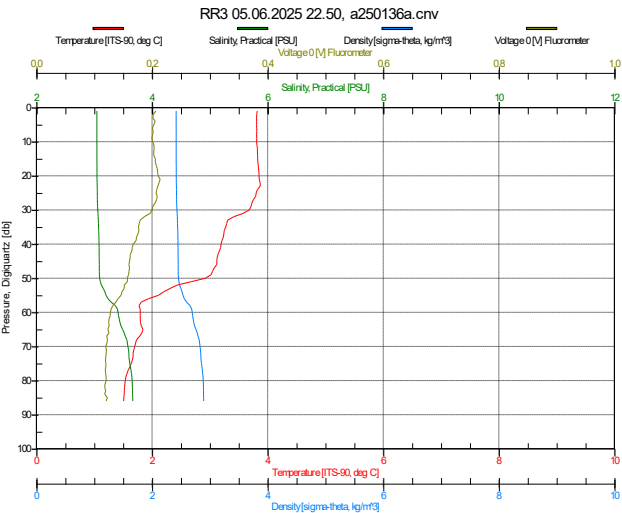
CVI



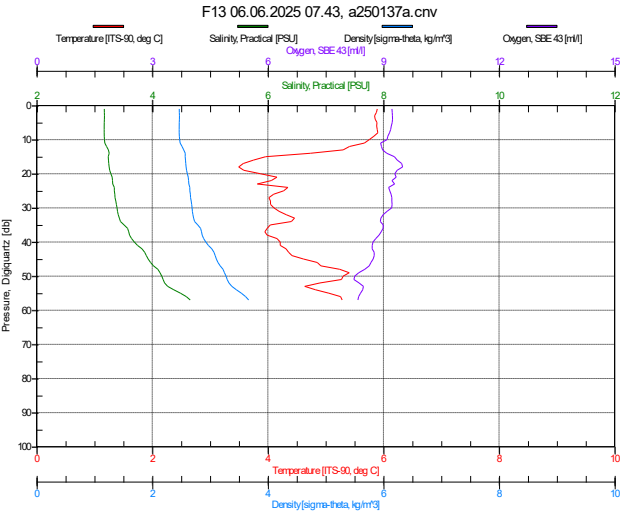
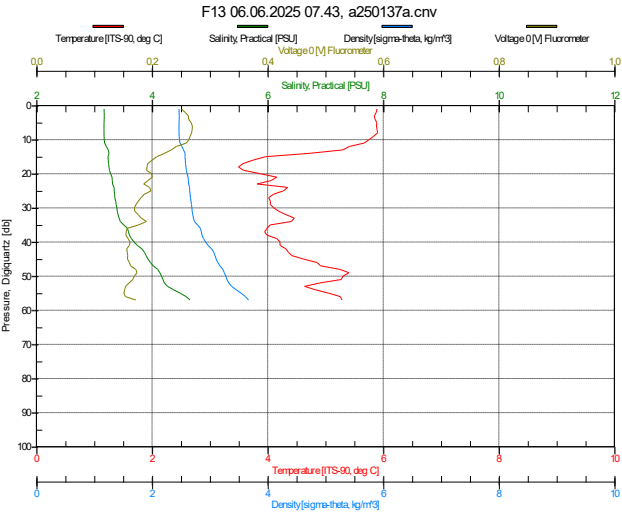
CV



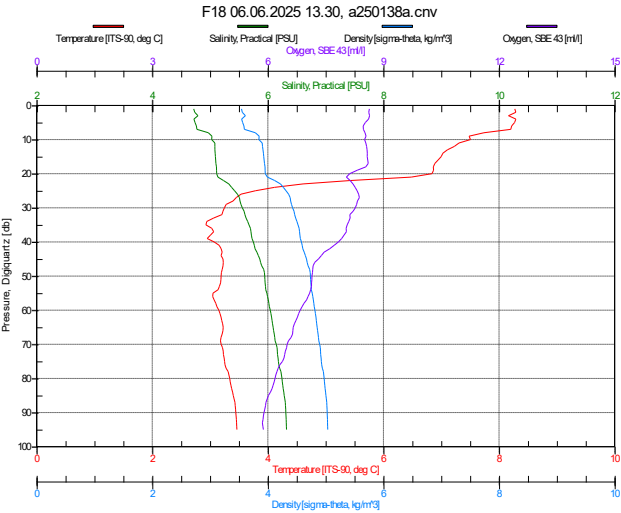
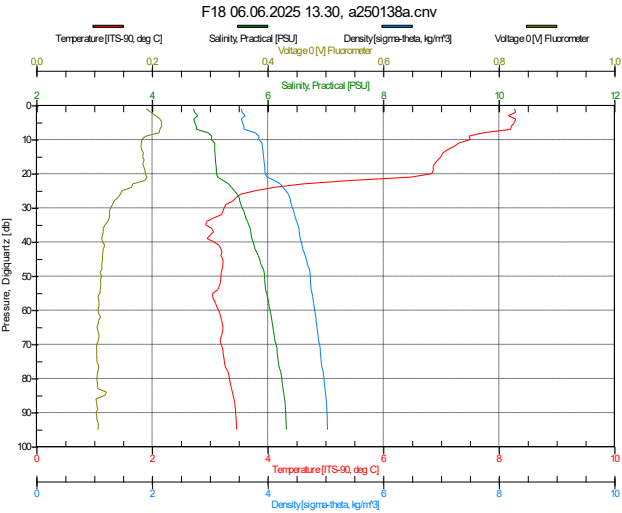
RR3



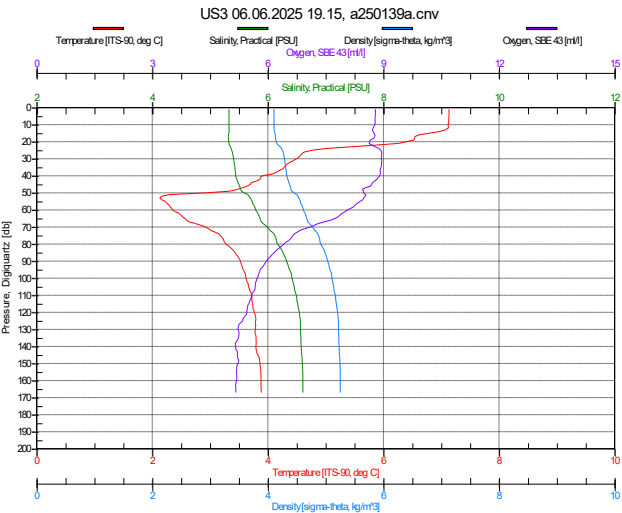
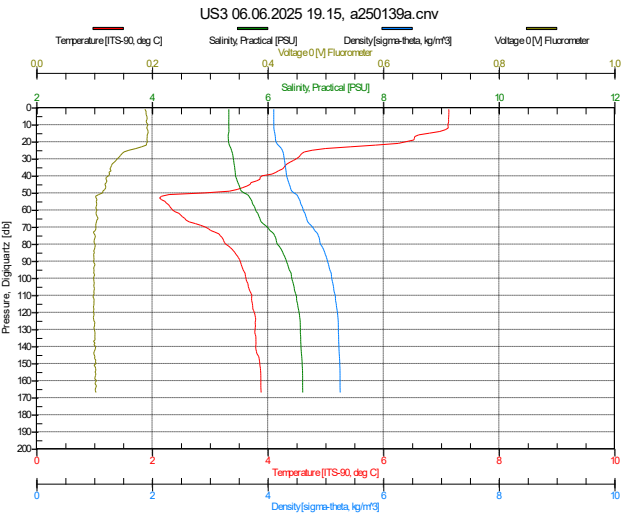
F13



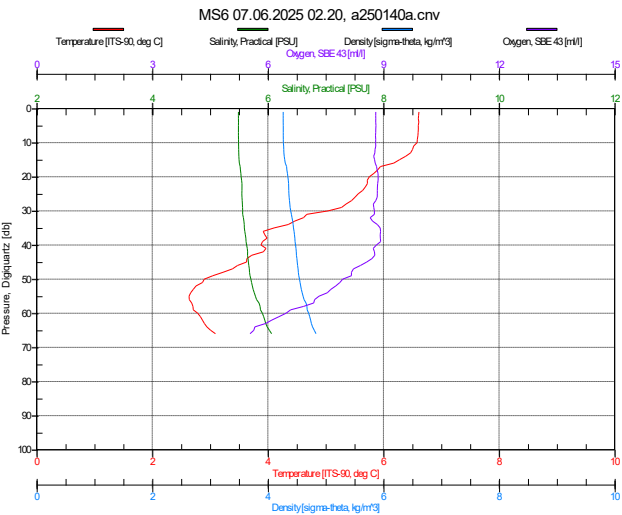
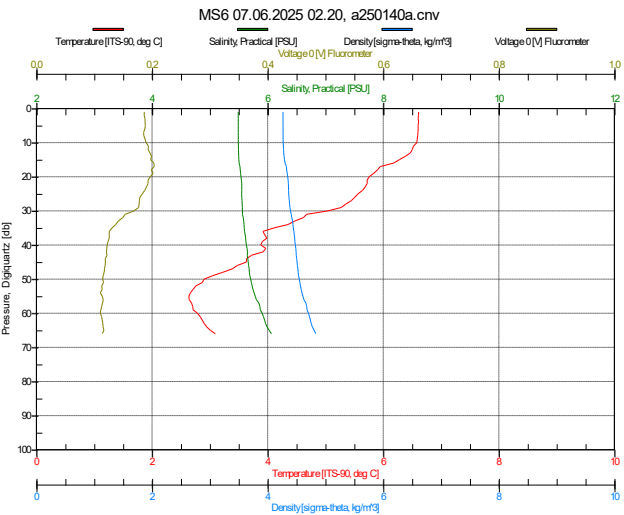
F18



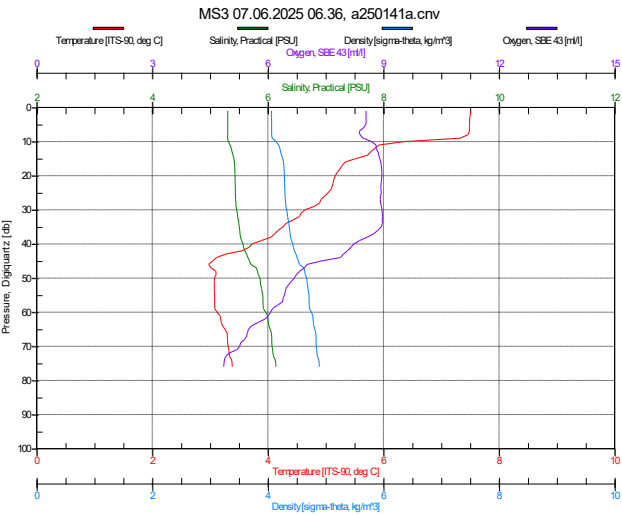
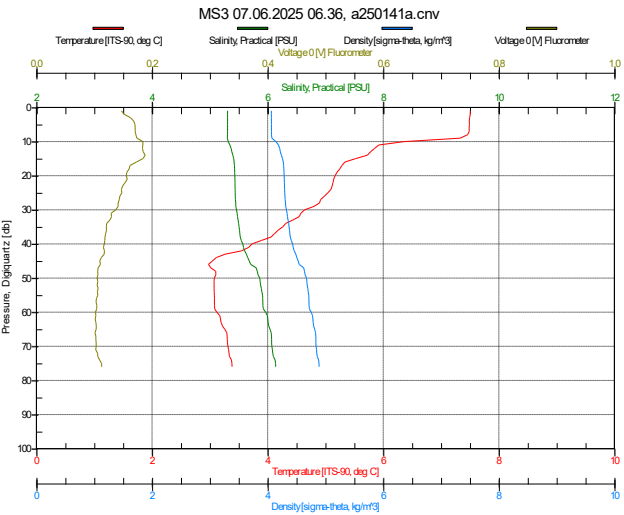
US3



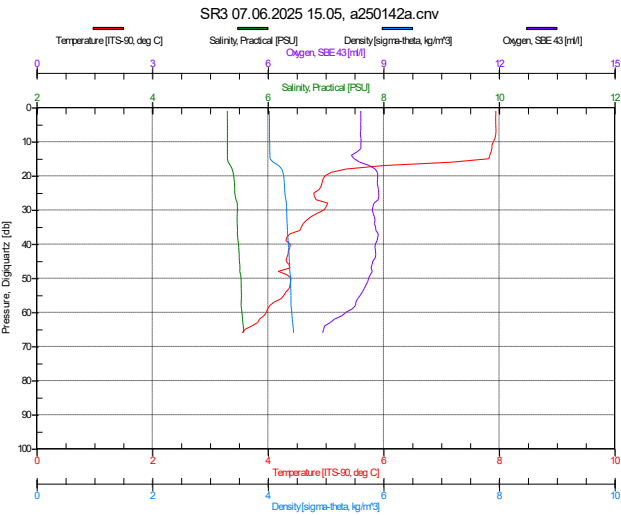
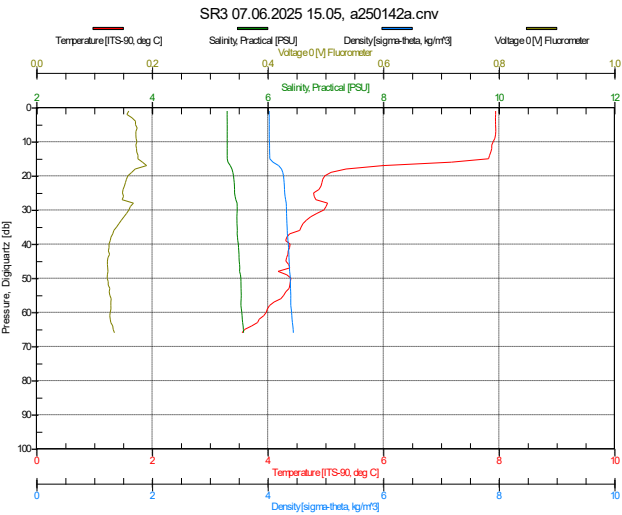
MS6



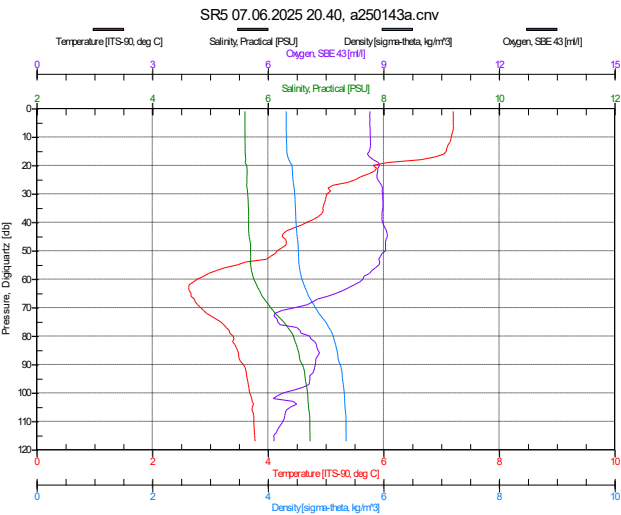
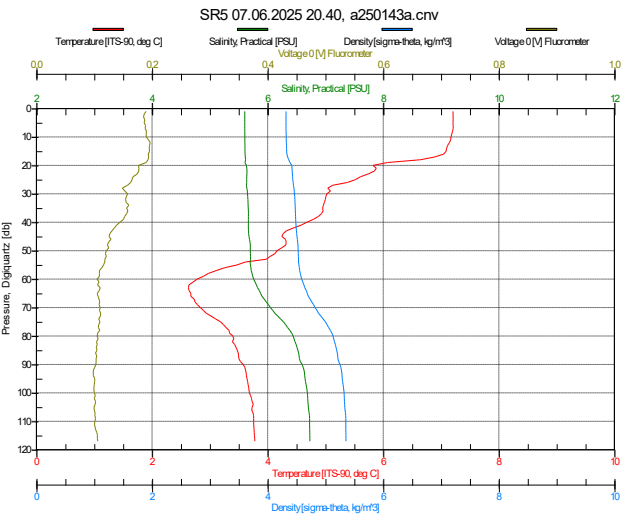
MS3



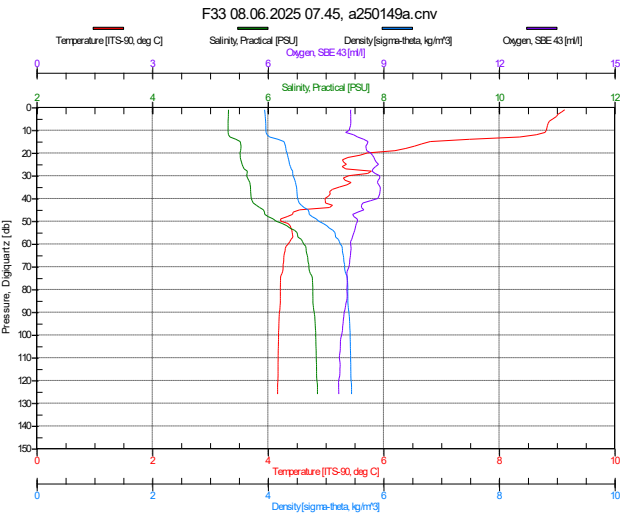
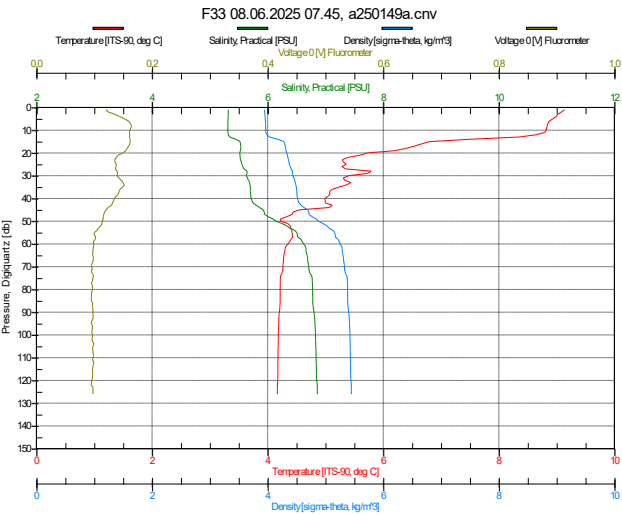
SR3



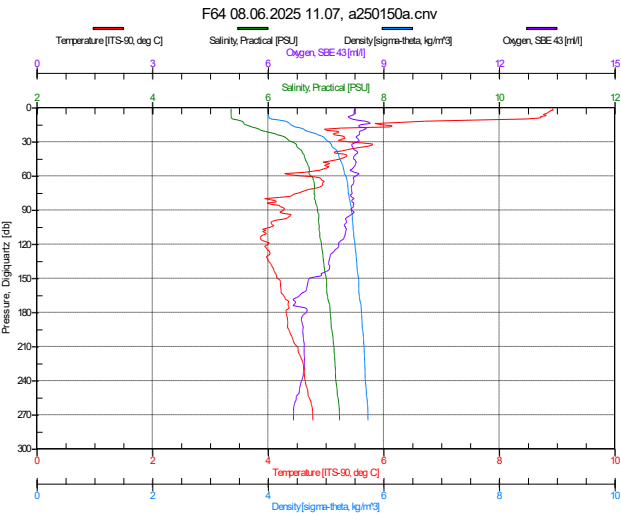
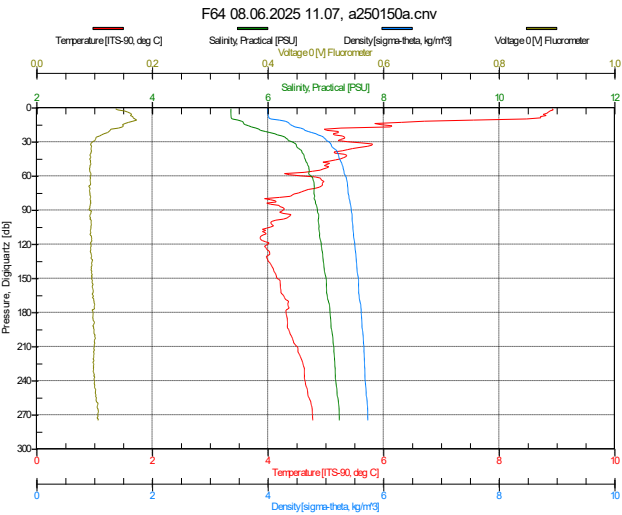
SR5



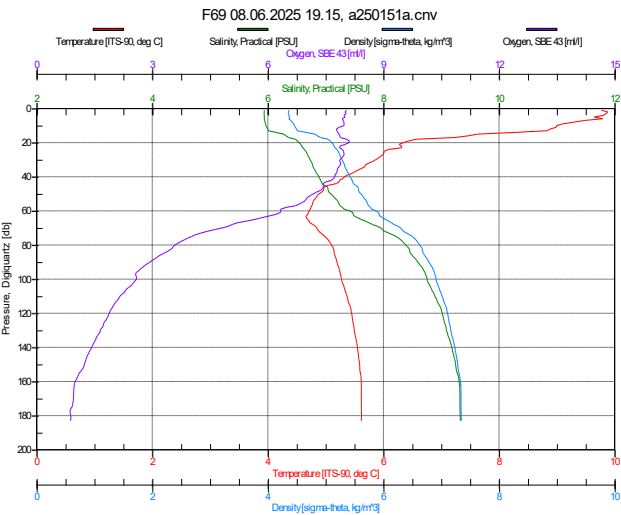
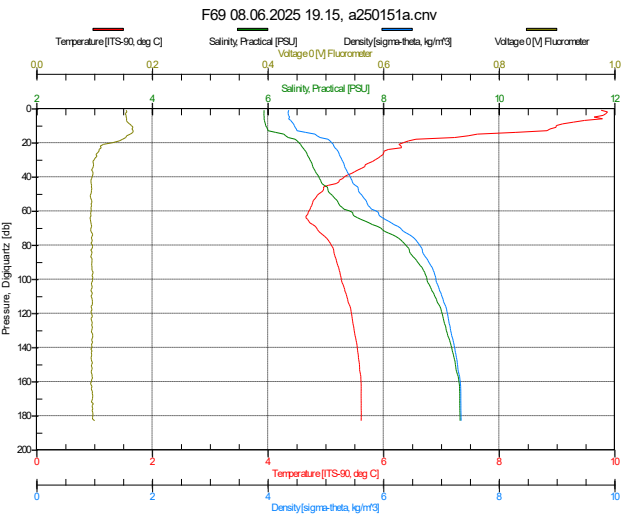
F33



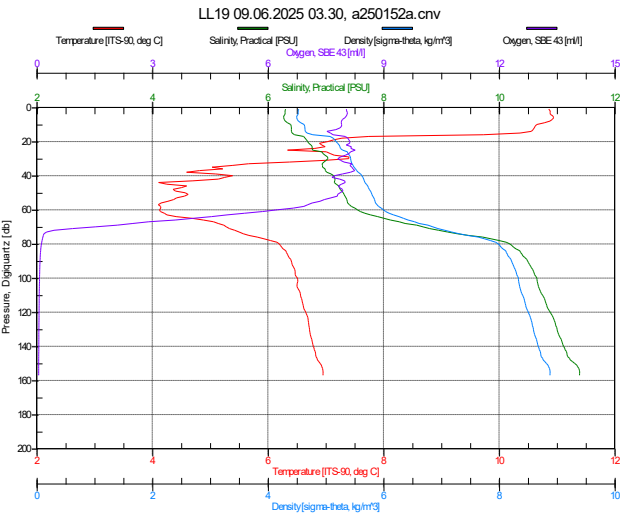
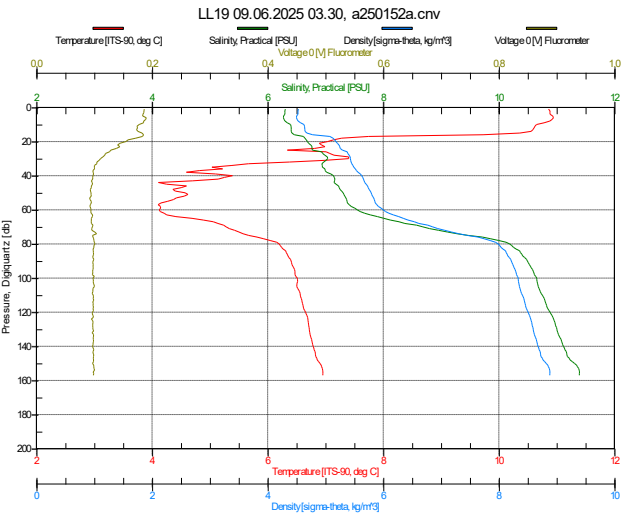
F64



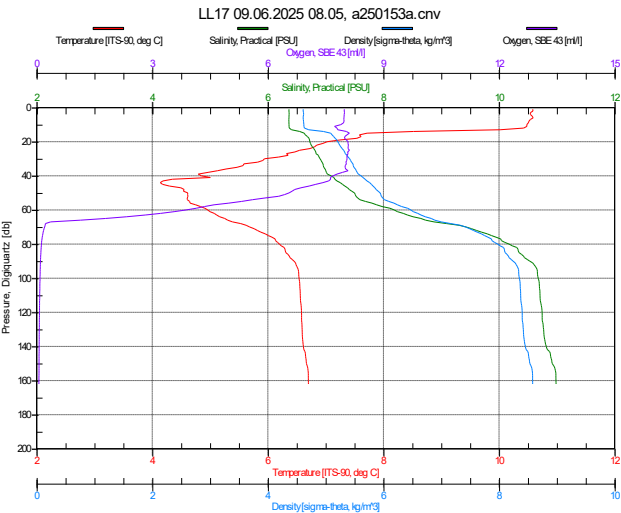
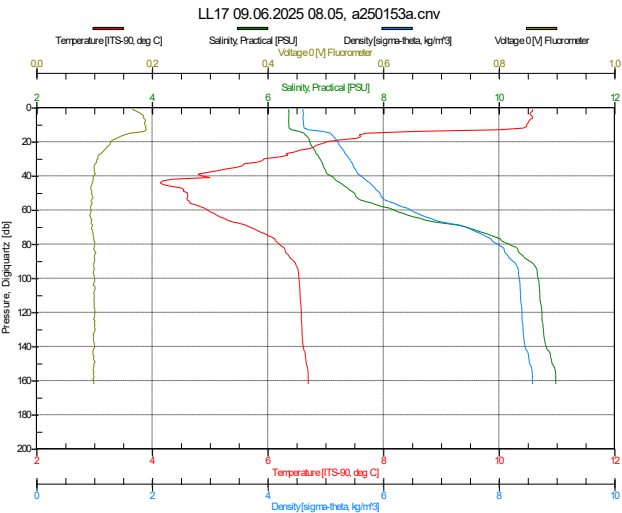
F69



LL19



LL17



LL15

