

Report from the SMHI monitoring cruise with R/V Aranda



Survey period:	2018-11-08 - 2018-11-15
Principal:	Swedish Meteorological and Hydrological Institute (SMHI), Swedish Agency for Marine and Water Management (SwAM).
Cooperation partners:	Finnish Environment Institute (SYKE)

SUMMARY

The cruise, which is part of the Swedish national marine monitoring programme, covered the Skagerrak, the Kattegat, the Sound, the Baltic Proper and the Gulf of Finland.

In large parts of the deep water in the Baltic Proper the oxygen concentration was close to zero. Anoxic conditions, when hydrogen sulphide can form, were found in both the Western and the Eastern Gotland Basin from 80-90 meters depth. In the Bornholm Basin the oxygen concentration went down to 0.4 ml/l and in the Arkona Basin the lowest measured value was 3.3 ml/l.

Nutrients in the surface water varied, and both in the Baltic Proper and the western sea areas, concentrations ranged from below normal for the season to above normal. The silicate concentrations in the surface water were still above normal in the Baltic Proper but in the Skagerrak and the Kattegat there were normal concentrations.

The sea surface temperature was generally normal for the season, in the Skagerrak and the Kattegat close to 10°C and in the Baltic Proper from just below 8°C in the north western parts to about 11°C at BSCIII-10 in the south east. The salinity in the sea surface was normal for the season or above normal, except for the Sound, where it was below normal.

The next cruise is planned to start the 4th of December.

RESULTS

The November cruise was conducted aboard the Finnish research vessel Aranda. It started in Helsinki the 8th of November and ended at the same port the 15th. The winds during the cruise were weak to fresh and shifted from southeast to southwest during the cruise. At the first visit at Anholt E the wind speed was 16 m/s. The weather was overcast during most of the week.

During the first part of the cruise, a scientist from FMI participated. He changed one of FMI's wave buoys close to Östergarnsholm and conducted maintenance on scientific equipment for Uppsala University in the area. Close to the station BY15 in the Eastern Gotland Basin a new APEX-float was launched. Additional water samples for isotopic analysis were taken for DTU Aqua during the cruise, and additional samples of phytoplankton were collected for Uppsala University.

In Lysekil, a photographer went aboard to photograph the sea, the light and the atmosphere, as well as the work on board.

This report is based on data that have passed a first quality control. When data are published at the National Oceanographic Data Centre some values might have changed after further quality controls have been performed. Data from this cruise will be published as soon as possible on the data centre's webpage, normally within a week after the cruise.

Downloadable data can be found here: <http://www.smhi.se/klimatdata/oceanografi/havsmiljodata> (only available in Swedish).

The Skagerrak

The sea surface temperature was normal for the season in the Skagerrak, just above 10°C at sea and slightly below 10°C at Släggö. The change in temperature from the surface down to 30-60 meters depth was small.

The salinity in the surface was slightly above normal at the most western stations, about 34 psu, and was almost constant from surface to bottom. For the other stations the salinity in the surface was normal for the season, 26.2-29.5 psu, and rose with increased depth.

A weak halocline and thermocline was found at about 40 meters depth at the stations closest to the coast.

Concentrations of nutrients in the form of dissolved inorganic nitrogen, DIN (the sum of nitrate, nitrite and ammonia), in the surface water were above normal for the season at Å17 and Å15, normal at Å13 and below normal at Släggö and P2. The concentrations ranged from 0.8 µmol/l by the coast to 3 µmol/l at open sea. From about 20 meters and below the concentrations were normal for the season at all stations. Concentrations of dissolved inorganic phosphorus, DIP (only in the form of phosphate), were for the season normal in the surface water, 0.2-0.3 µmol/l. Deeper down in the water column the concentrations were below normal or normal for the season.

The silicate concentrations were normal for the season at all stations, with concentrations ranging from 1.5 to just above 5 µmol/l in the surface water, highest at P2 and lowest at Å17.

Fluorescence measurements by the CTD showed some phytoplankton activity from the surface down to the thermocline, which was very clear at Å14 and Å13.

The oxygen concentrations in the bottom water were good at all stations and were slightly above normal for the season at Släggö and normal at the other stations. The concentrations in the bottom water varied between 5.15 and 5.35 ml/l at all stations.

The Kattegat and the Sound

The sea surface temperatures were between 9.7 and 10.1°C. This was slightly above normal for N14 Falkenberg, but normal at the other stations. From the surface down to about 10 meters the temperature was in general constant at the visited stations. The salinity in the surface water of the Kattegat was normal for the season, 19.5-23.9 psu. In the sound the surface salinity was 8.6 psu, which is slightly below normal, and below the halocline the salinity was about 28 psu. A very distinct halocline was found at W Landskrona at about 10 meters depth and at Fladen at about 20 meters depth.

The concentrations of DIN in the surface water were normal for the season in the Kattegat and the Sound. The DIP concentrations in the surface water were also normal for the season, except at Anholt E, where it was slightly above normal. Concentrations in the Kattegat were 0.3-0.4 µmol/l and in the Sound it was just below 0.6 µmol/l. In general the concentrations of both DIN and DIP rose slowly with depth, and were normal or below normal.

The silicate concentrations in the surface water were higher than normal for the season in the Sound, 15.9 µmol/l and at Anholt E, 7.9 µmol/l. At the other stations the concentrations in the surface water were normal. Deeper down in the water the concentrations were generally normal, but at Fladen the concentrations from 50 meters and deeper were below normal.

Fluorescence measurements by the CTD indicated some phytoplankton activity in the water above the halocline.

Oxygen concentrations in the Kattegat were normal for the season, and were 4.5-5.2 ml/l at the bottom. In the Sound the concentration was 3.9 ml/l at the bottom.

The Baltic Proper

The sea surface temperature was normal for the season at all visited stations, except at BSCIII-10 in the south eastern Baltic Proper where it was above normal. In the area it varied from 7.7 to 10.7°C. The lowest surface temperatures were found in the Western Gotland Basin, and the highest at BCSIII-10 and BY2. The temperature was in general constant from the surface down to 30-50 meter. A distinct thermocline was found in both the Eastern and the Western Gotland Basin and in the Bornholm Basin. In the Bight of Hanö and in the Arkona Basin the thermocline was less distinct, and the temperature below it varied more than at the other stations.

The salinity in the surface water was normal or above normal at all stations and varied from 6.6 psu in the north eastern parts to 8.1 at BY1 in the Arkona Basin. The halocline in the northern parts of the Baltic Proper was found at 50-80 meters depth. From about 150 meters depth, the salinity in the Eastern and the Western Gotland basin was above normal. In the Bornholm Basin, the Bight of

Hanö and the Arkona Basin the salinity was about 8 psu from the surface down to 30-40 meter. Below this the salinity increased to about 17 psu at the bottom of the Bight of Hanö and the Bornholm Basin, and to 13-15 psu in the Arkona Basin.

The concentrations of DIN in the surface water were normal or below normal for the season at most stations, 0.3-1.4 $\mu\text{mol/l}$. At BY32 and BY29 the concentrations in the surface water were higher than normal for the season, 1.6 and 2.9 $\mu\text{mol/l}$ respectively. Below the surface layer the concentrations were generally normal for the season. At BY10 the concentrations were below normal from the surface down to about 100 meters depth.

The surface water concentrations of DIP were normal for the season at all stations, except at BCSIII-10 where it was below normal and at BY32 where it was above normal. The concentrations varied from 0.2 $\mu\text{mol/l}$ in the southern parts of the Eastern Gotland Basin to 0.6 $\mu\text{mol/l}$ in the Bight of Hanö. Deeper down in the water column the concentrations were generally normal for the season, but in the Western Gotland Basin and at BY29, concentrations below normal were found from about 100 meters depth down to the bottom. At BCSIII-10 the concentrations from the surface down to 80 meters were below normal. High levels, slightly above 8 $\mu\text{mol/l}$ were measured close to the bottom in the Bight of Hanö.

At most stations the silicate concentrations in the surface water were above normal, from 7 to 16 $\mu\text{mol/l}$. The concentrations were almost the same down to the halocline. Below this the concentrations rose, which is normal, and were at northern stations in the Baltic Proper about 60 $\mu\text{mol/l}$. In the Arkona Basin the concentrations close the bottom were about 30 $\mu\text{mol/l}$ and in the Bornholm Basin and at BCSIII-10 the concentrations were slightly below 50 $\mu\text{mol/l}$ close to the bottom. In the Bight of Hanö concentrations of almost 70 $\mu\text{mol/l}$ were measured, which is above normal for the season.

Large part of the deep water in the Baltic Proper had oxygen concentrations close to zero. Anoxic conditions, when hydrogen sulphide can form, were found in both the Western and the Eastern Gotland Basin from 80-90 meters depth. In the Bight of Hanö there were no hydrogen sulphide, but from 70 meters the oxygen concentrations were only 0.1 ml/l. In the Bornholm Basin, the lowest measured value, 0.4 ml/l, was from 80 meters depth at BY4. Acute hypoxia, < 2ml/l, was found in the Bornholm Basin and the Bight of Hanö from about 60 meters depth, in the Western Gotland Basin from about 60-70 meters depth and from about 70-80 meters depth in the Eastern Gotland Basin, except at BY15 where it was found at 60 meters depth. In the Arkona Basin, where there is not so deep compared to the other basins, the oxygen concentrations were 3.3 ml/l at lowest.

Fluorescence measurements from the CTD indicated generally low phytoplankton activity. In the Arkona Basin and the Bornholm Basin the measurements from the CTD showed some activity from the surface down to 10-20 meters depth.

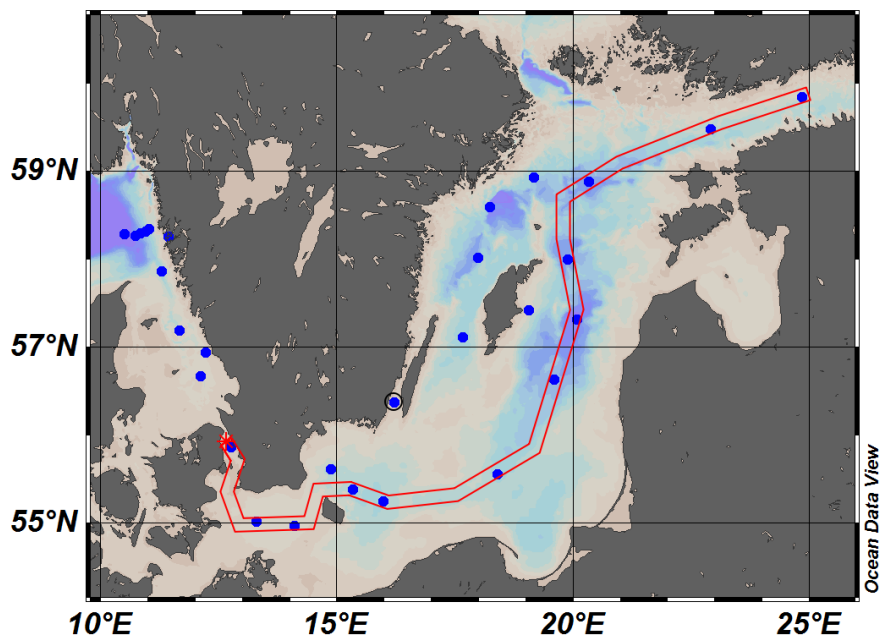
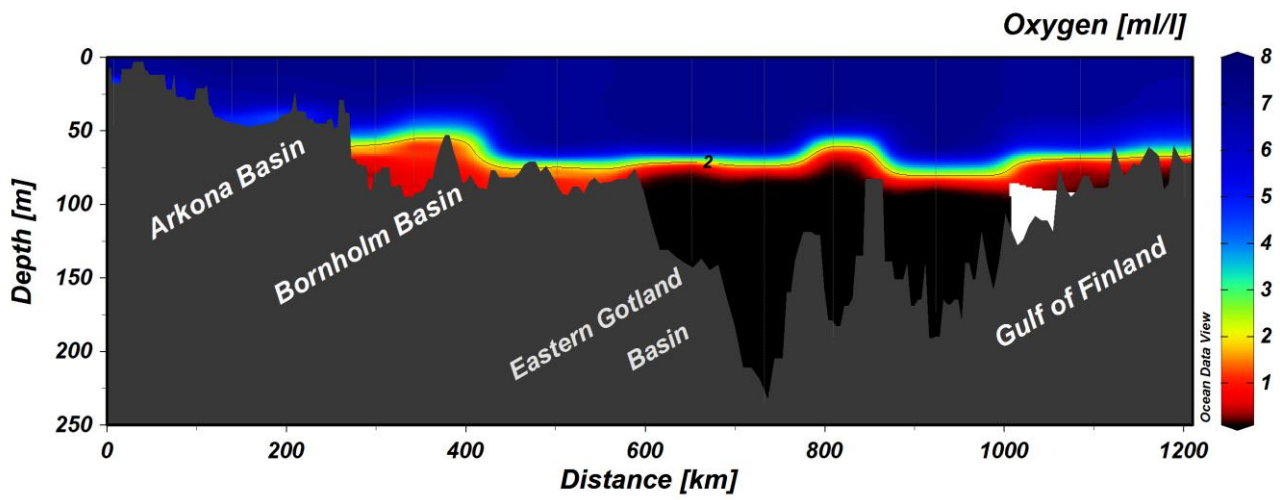
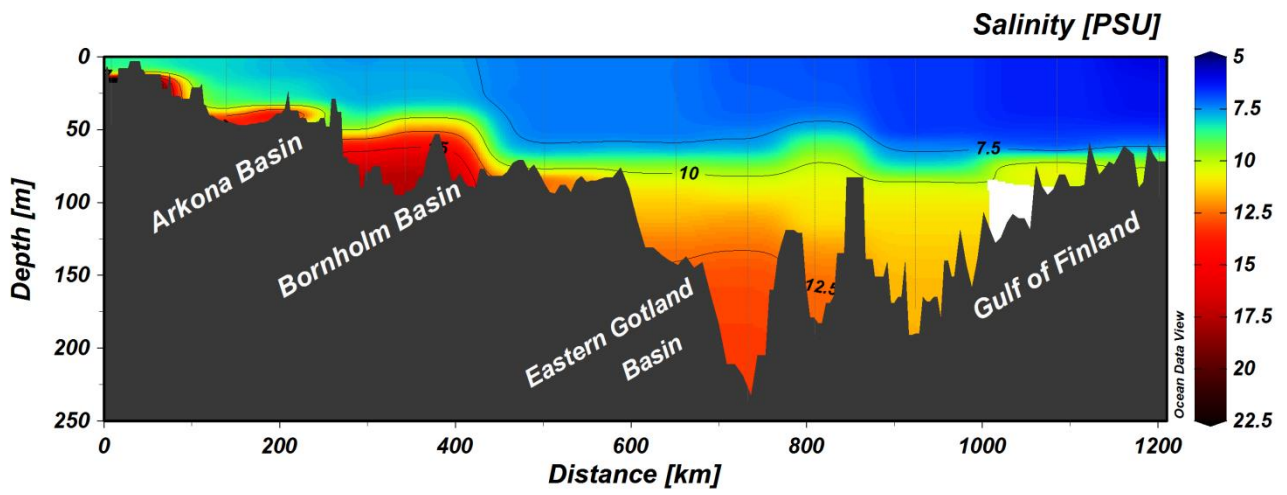


Figure 1. Transect showing dissolved oxygen and salinity from the Sound, through the Baltic Proper, to the Gulf of Finland.

PARTICIPANTS

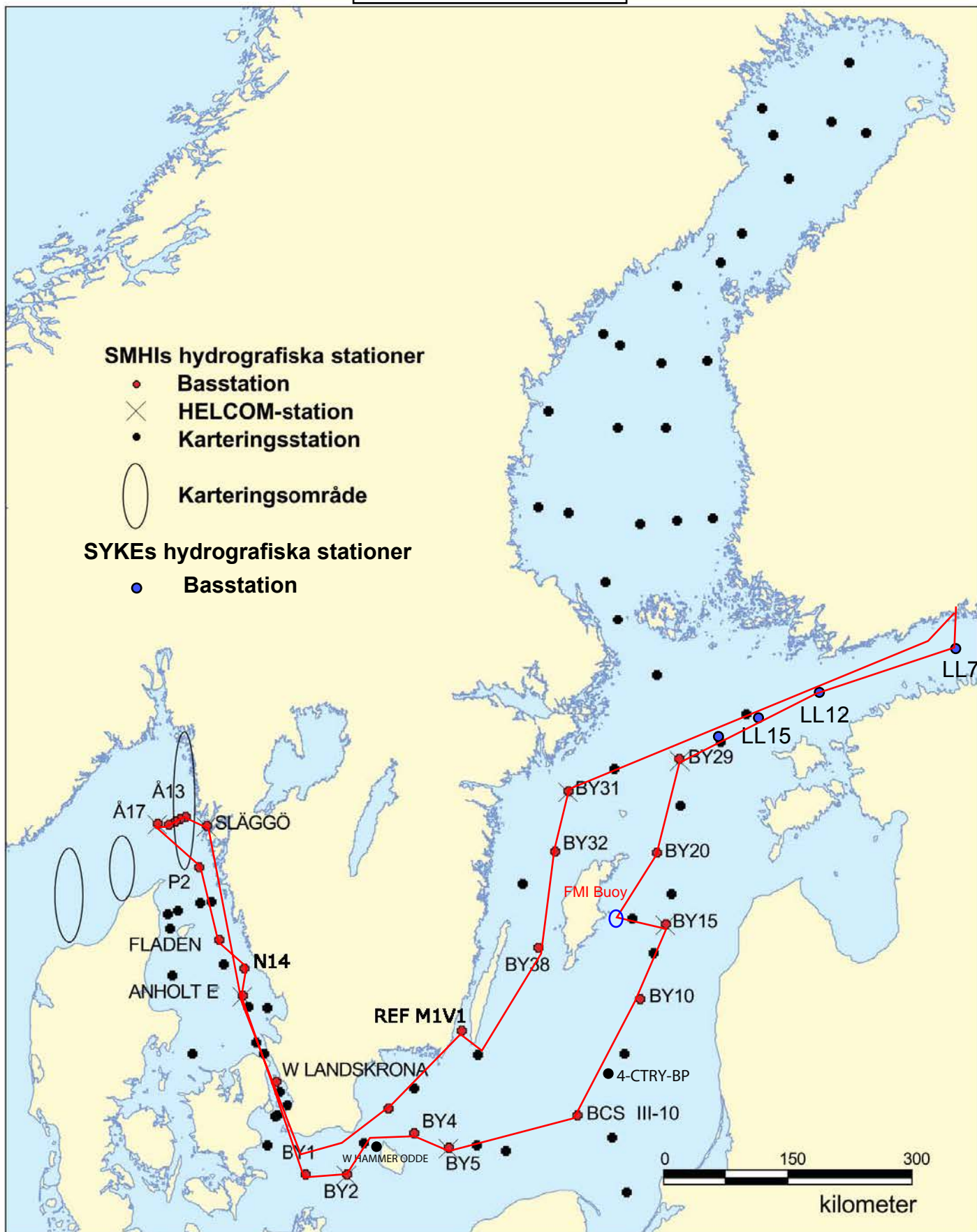
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Henrik Petersson	Lysekil-Helsingfors	Henrik Petersson Photography

APPENDICES

- Track chart
- Table over stations, sampled parameters and number of sampling depths
- Map showing bottom oxygen concentrations
- Vertical profiles for regular monitoring stations
- Monthly average surface water plots for regular monitoring stations

TRACKCHART

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Series: 0117-0148

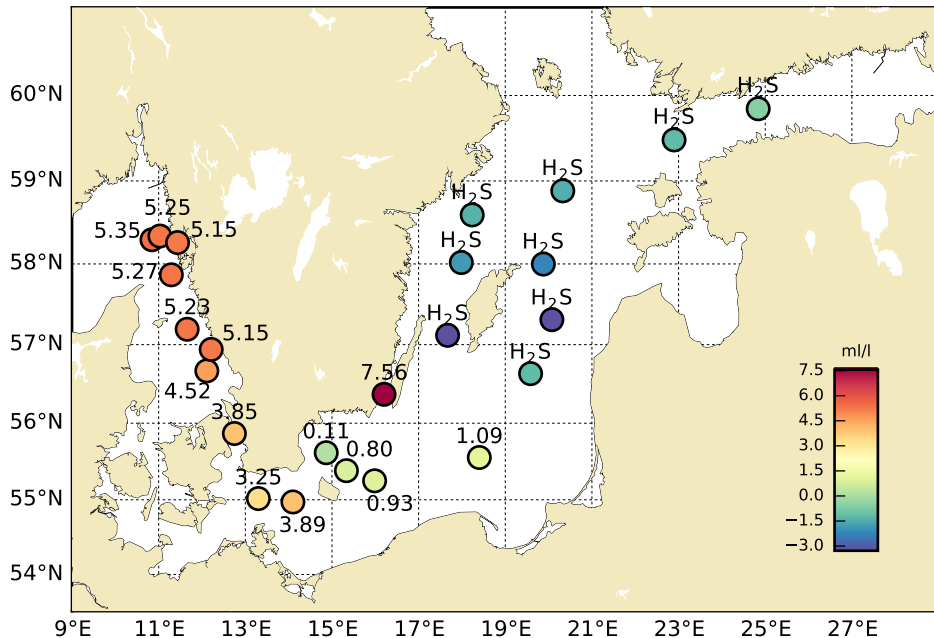


Bottom water oxygen concentration (ml/l)

Ship: Aranda

Date: 20181108-20181114

Series: 0117-0147



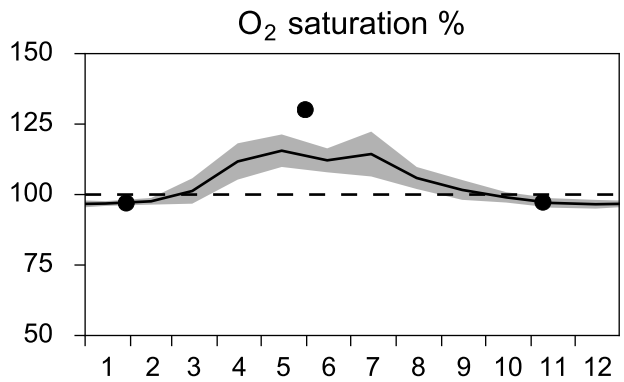
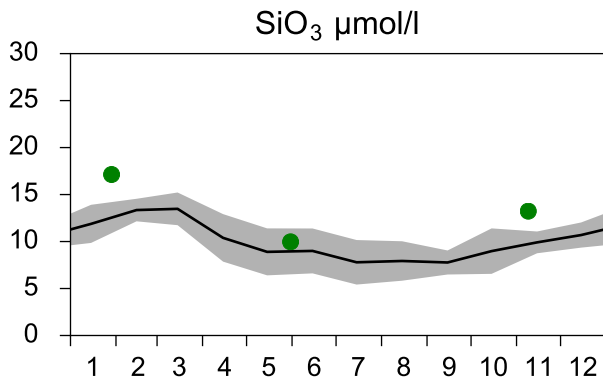
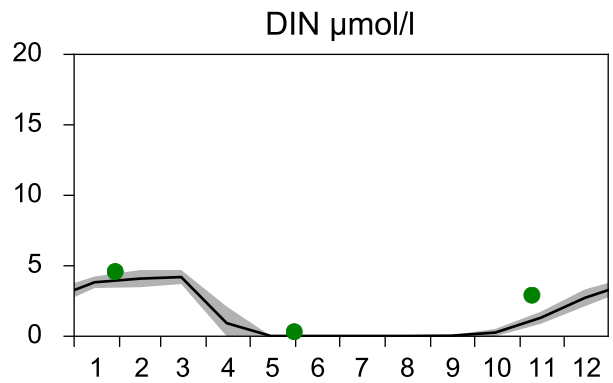
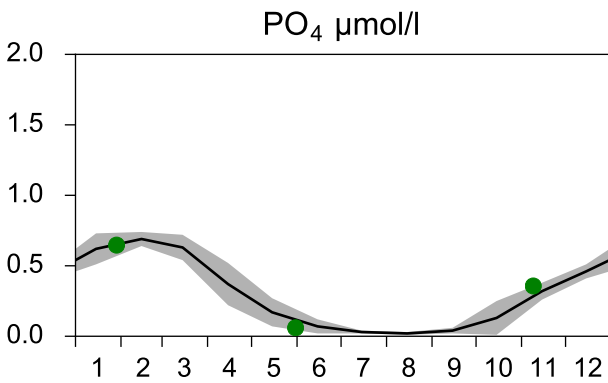
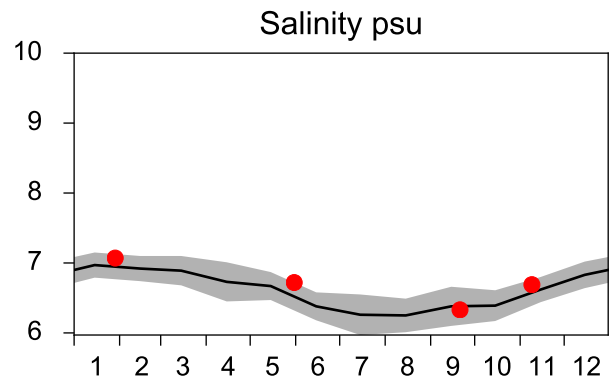
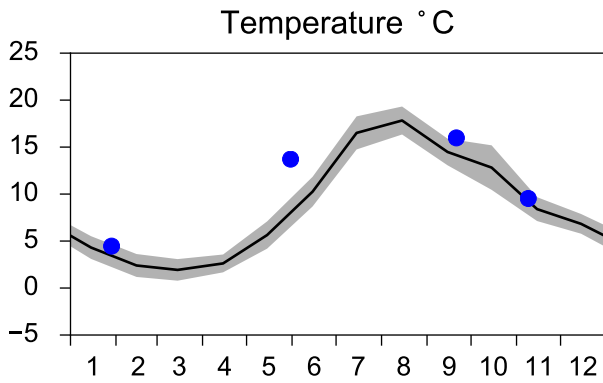
STATION BY29 / LL19 SURFACE WATER (0-10 m)

Annual Cycles

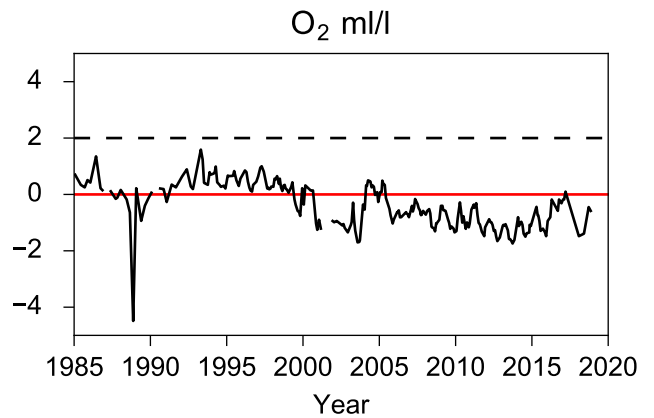
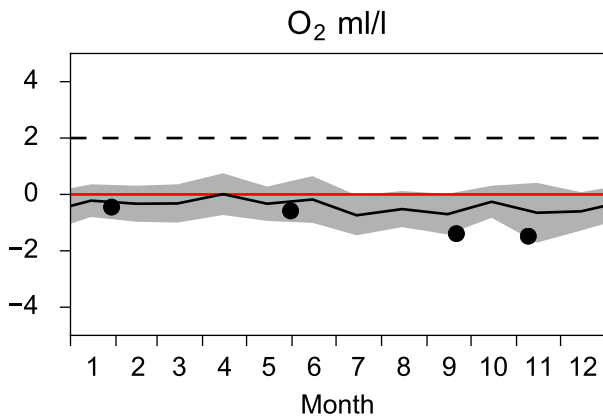
— Mean 2001-2015

■ St.Dev.

● 2018

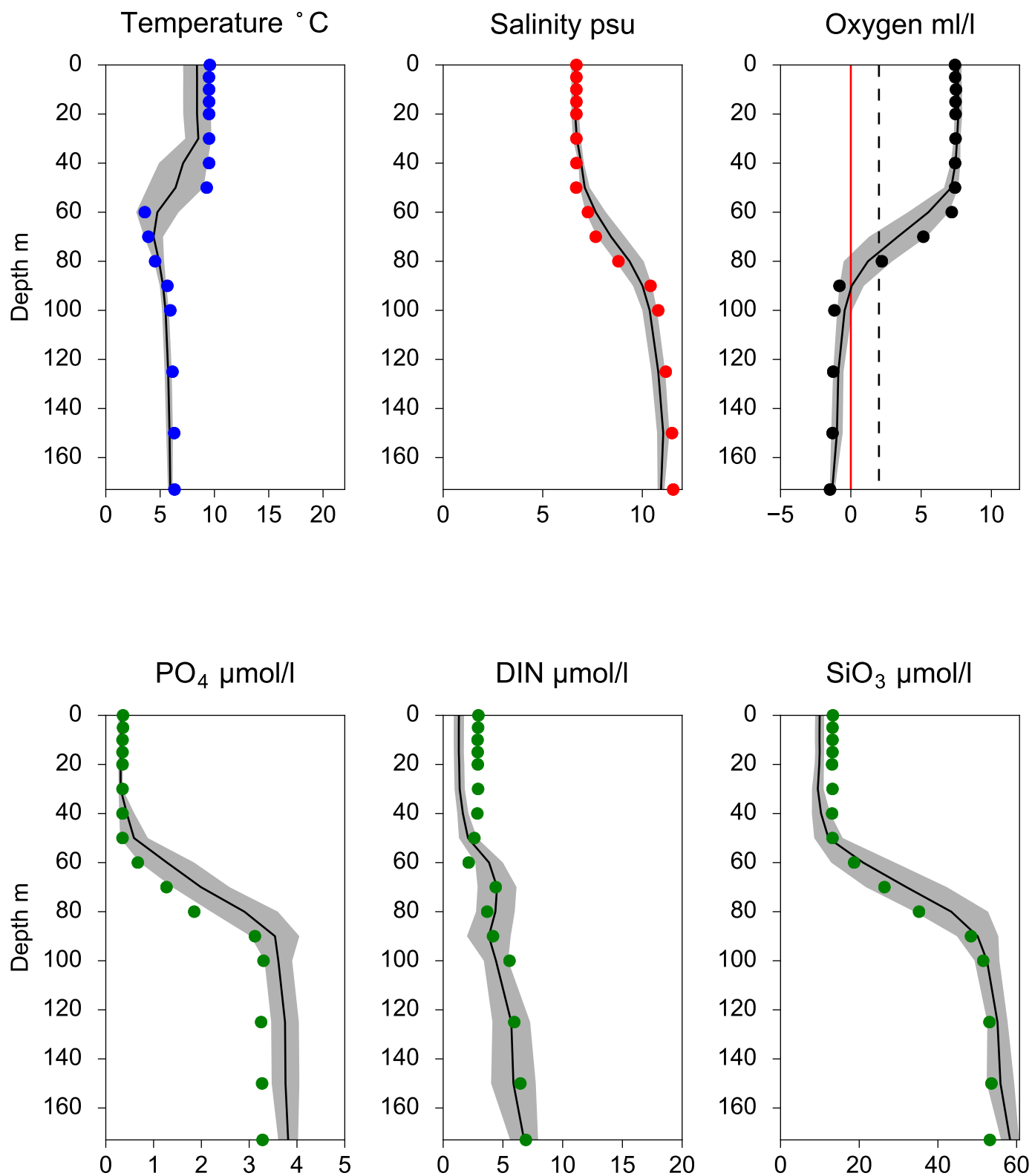


OXYGEN IN BOTTOM WATER (depth >= 150 m)



Vertical profiles BY29 / LL19 November

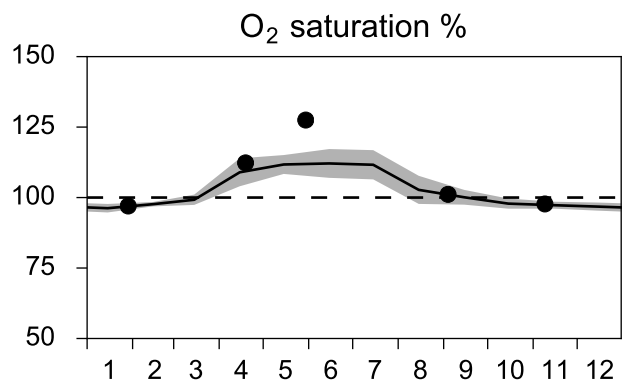
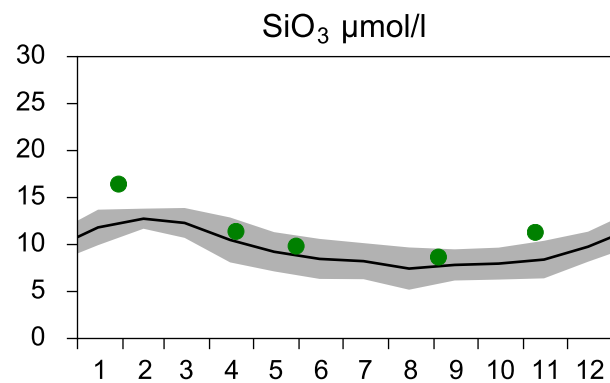
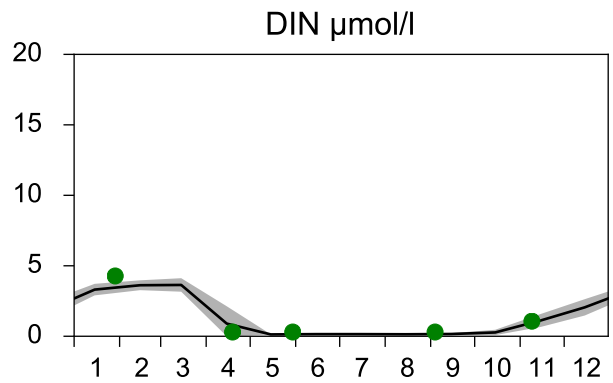
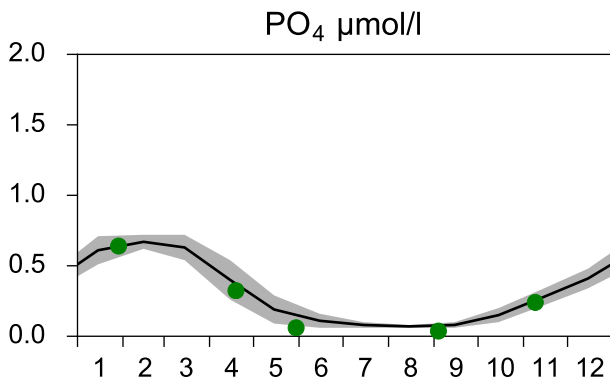
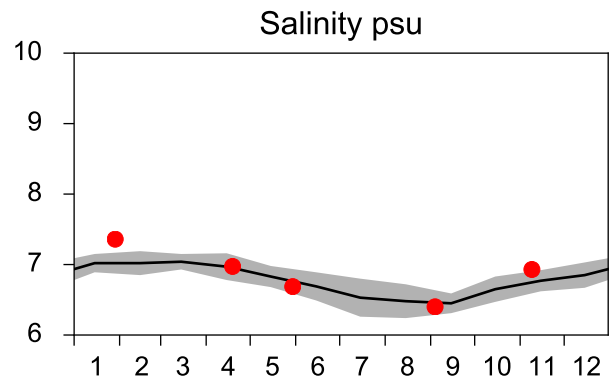
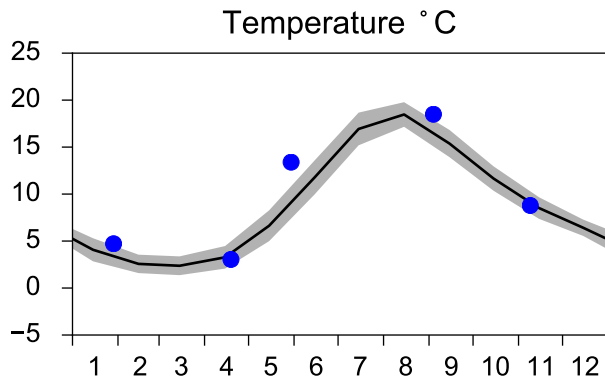
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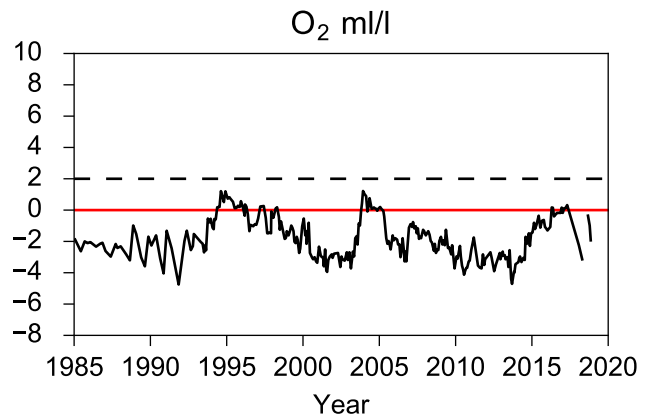
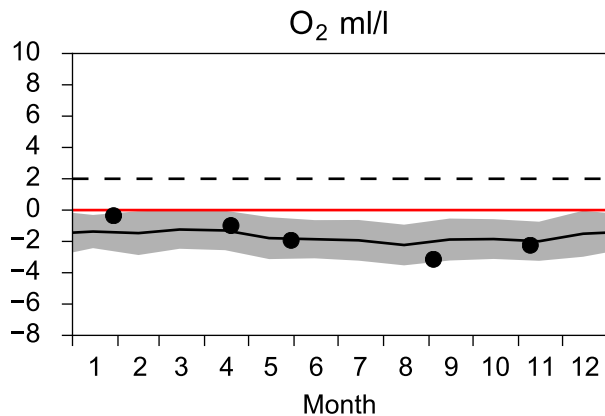
STATION BY20 FÅRÖDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 ■ St.Dev. ● 2018

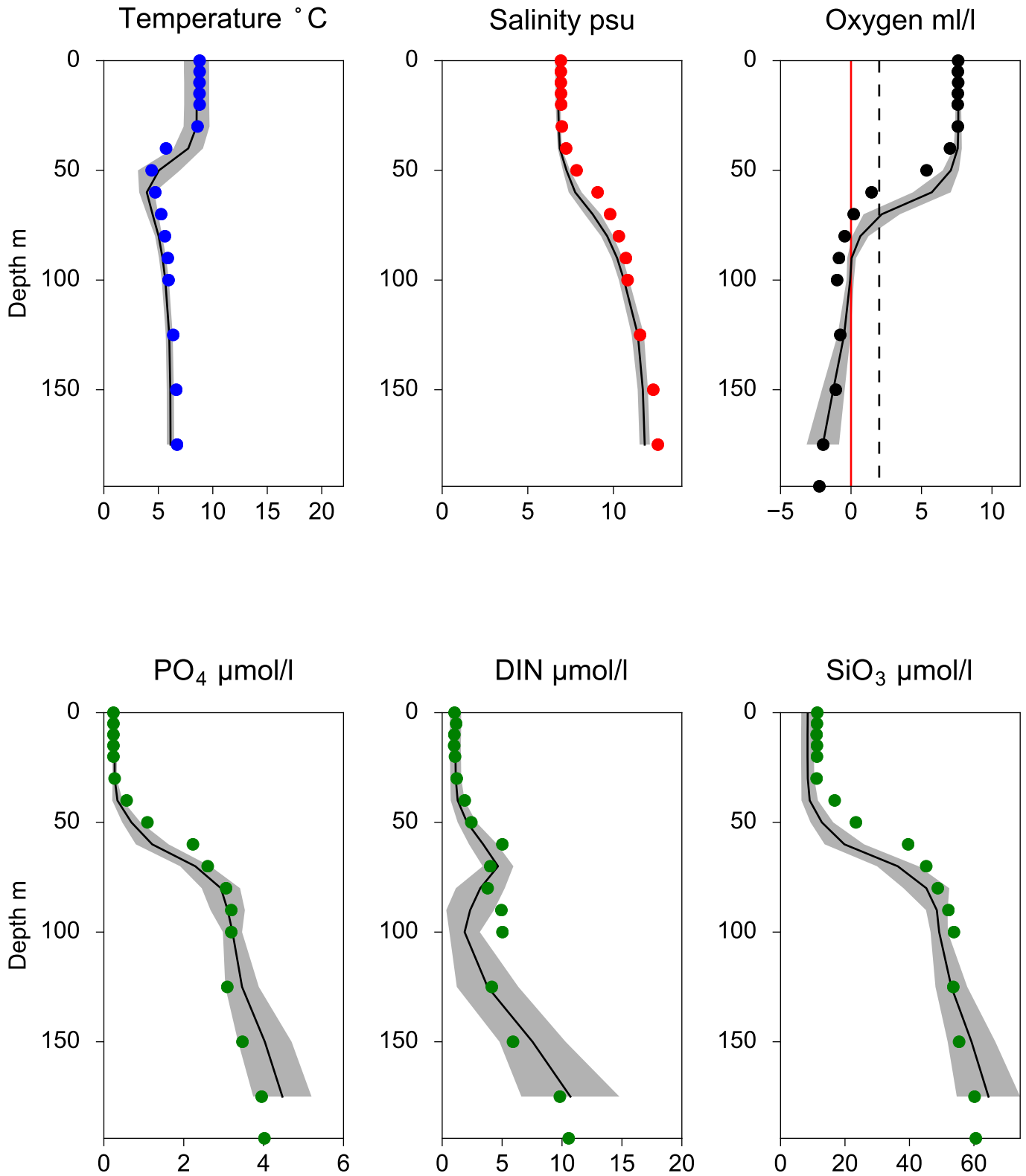


OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY20 FÅRÖDJ November

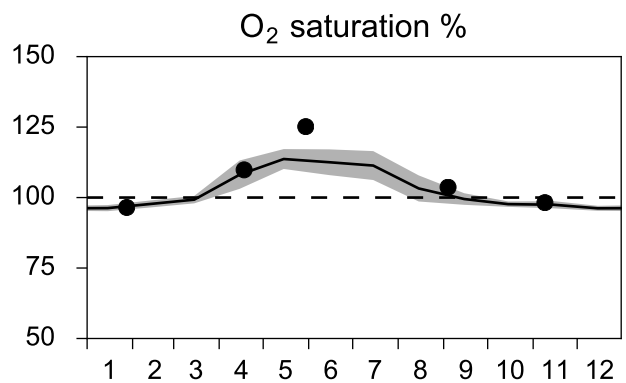
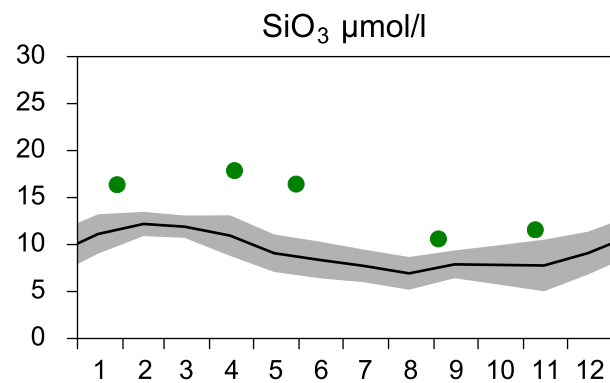
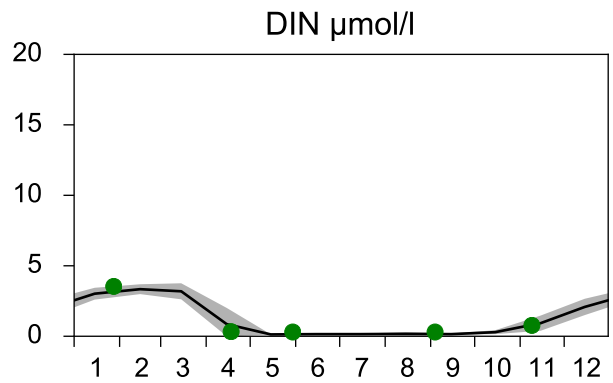
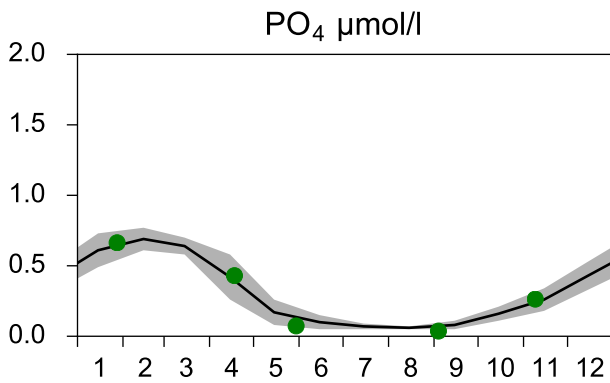
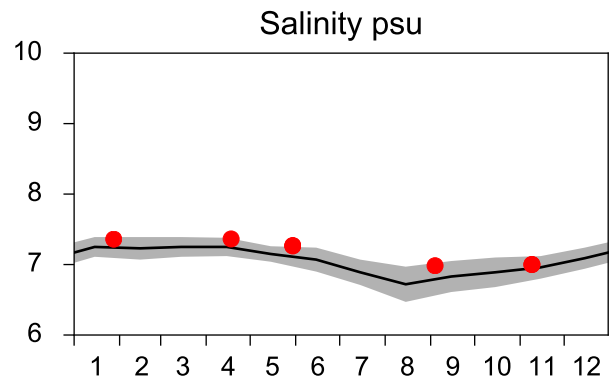
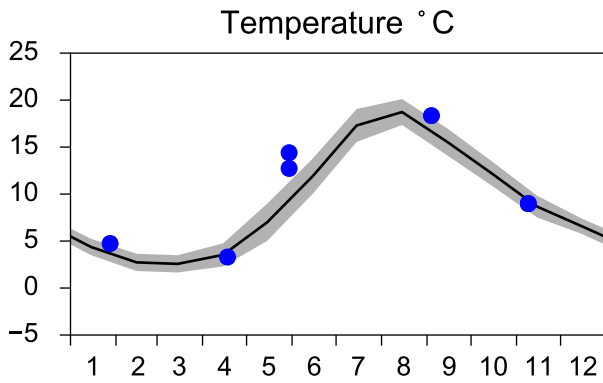
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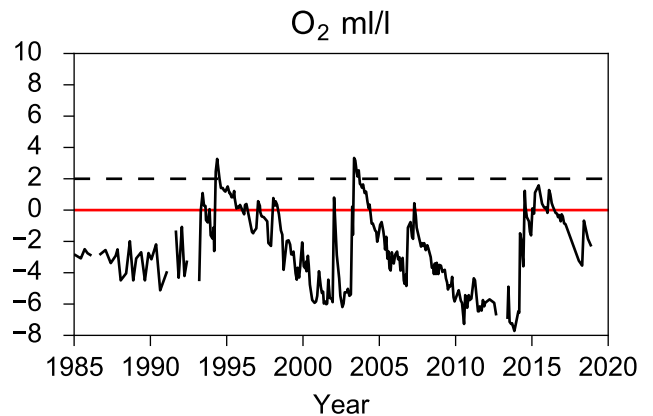
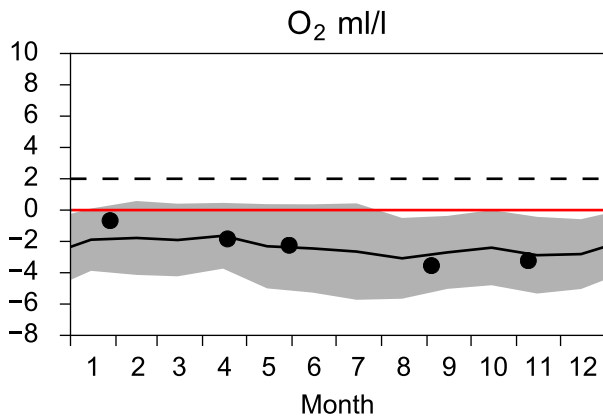
STATION BY15 GOTLANDSDJ SURFACE WATER (0-10 m)

Annual Cycles

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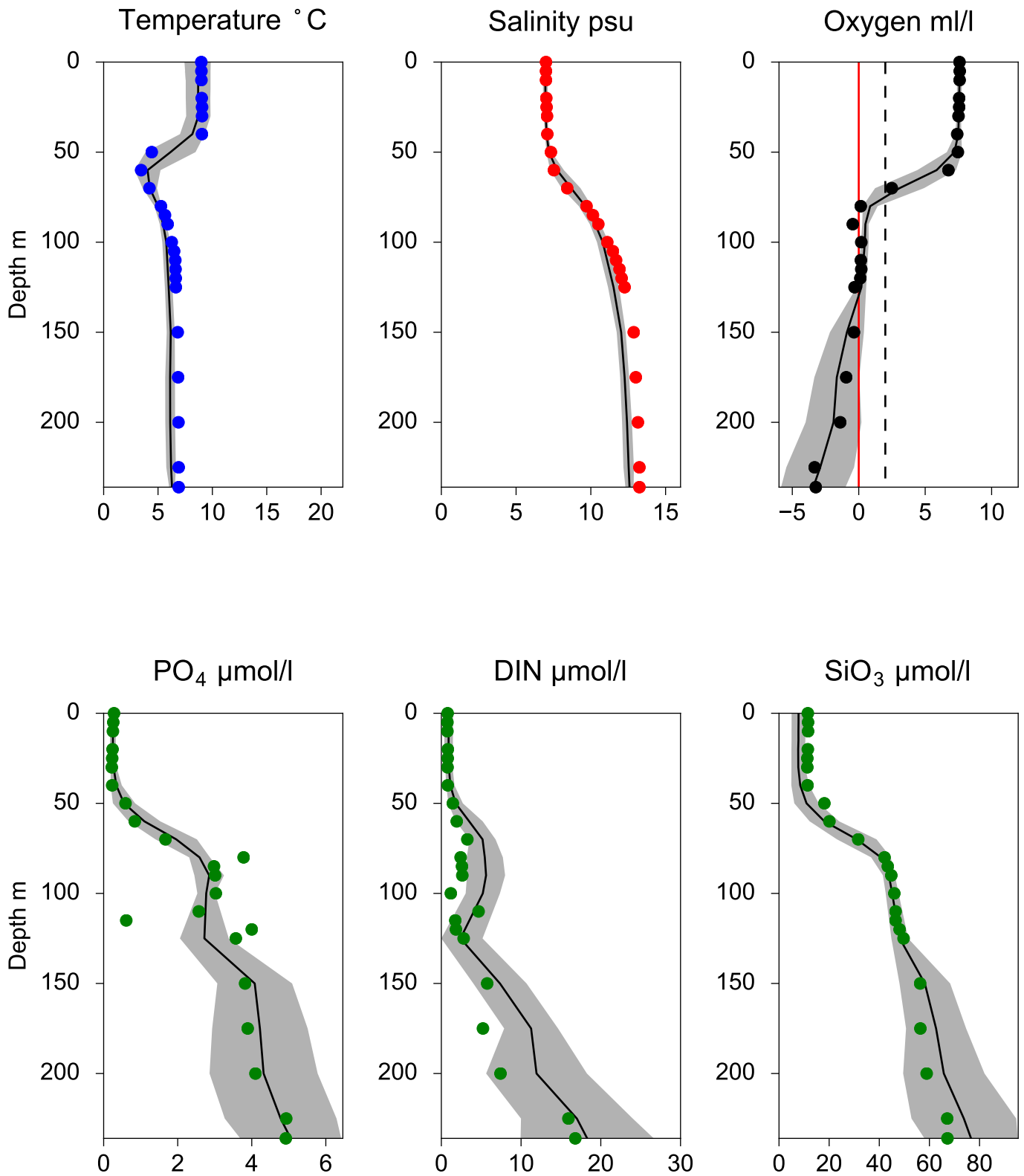


OXYGEN IN BOTTOM WATER (depth >= 225 m)



Vertical profiles BY15 GOTLANDSDJ November

— Mean 2001-2015 ■ St.Dev. ● 2018-11-09



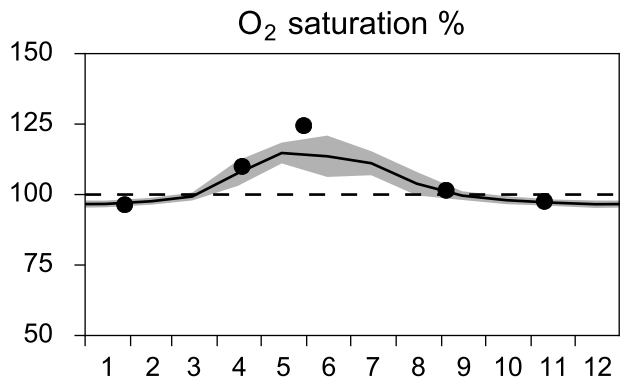
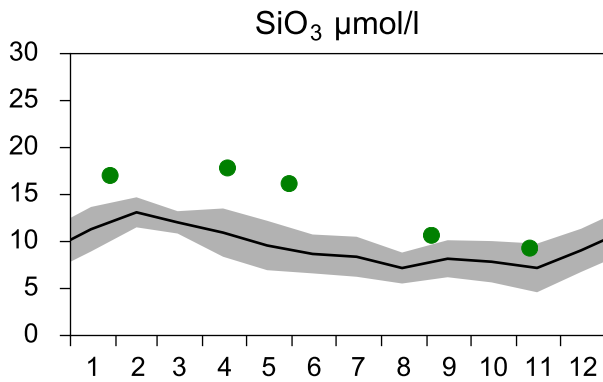
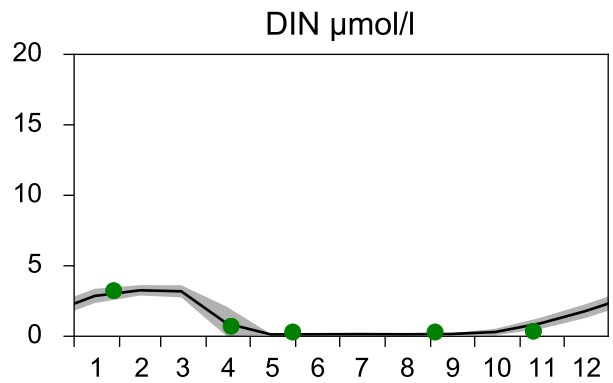
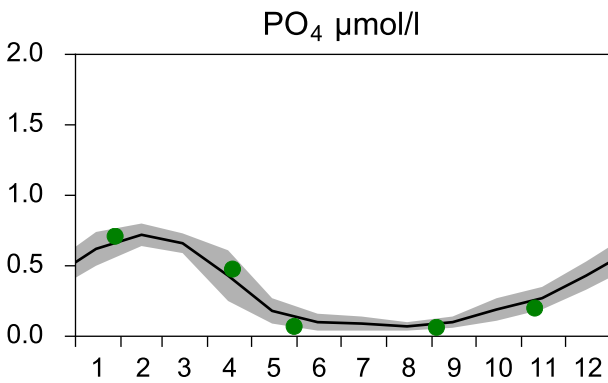
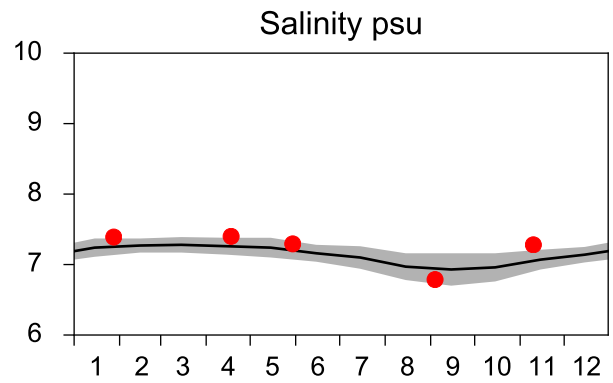
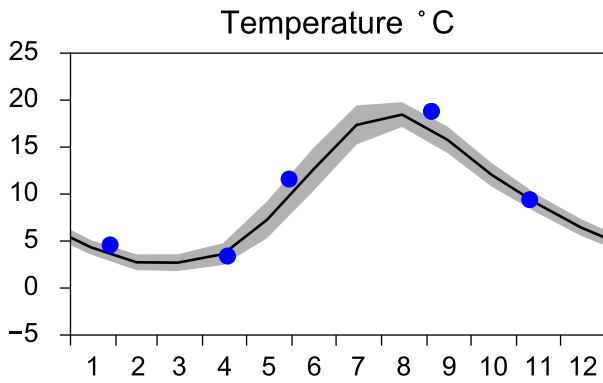
STATION BY10 SURFACE WATER (0-10 m)

Annual Cycles

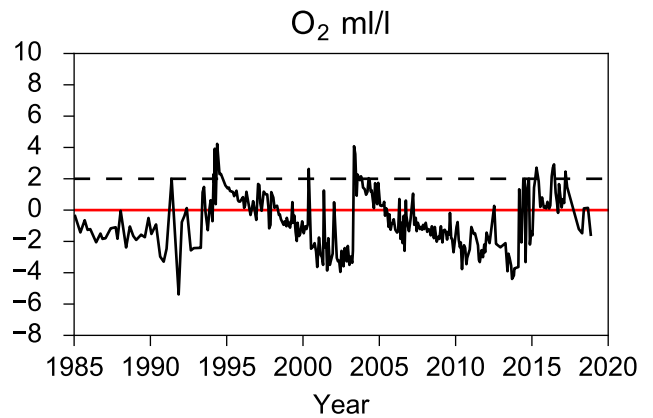
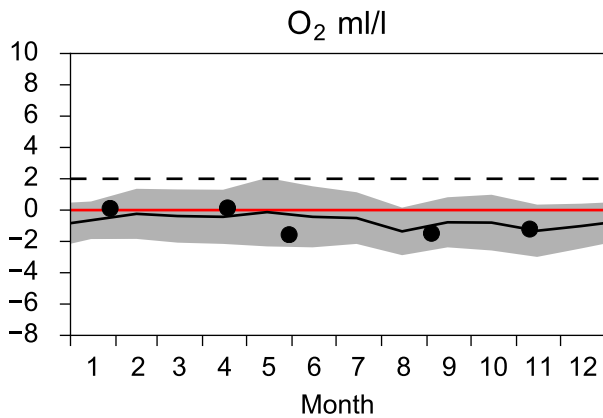
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■ St.Dev.

● 2018

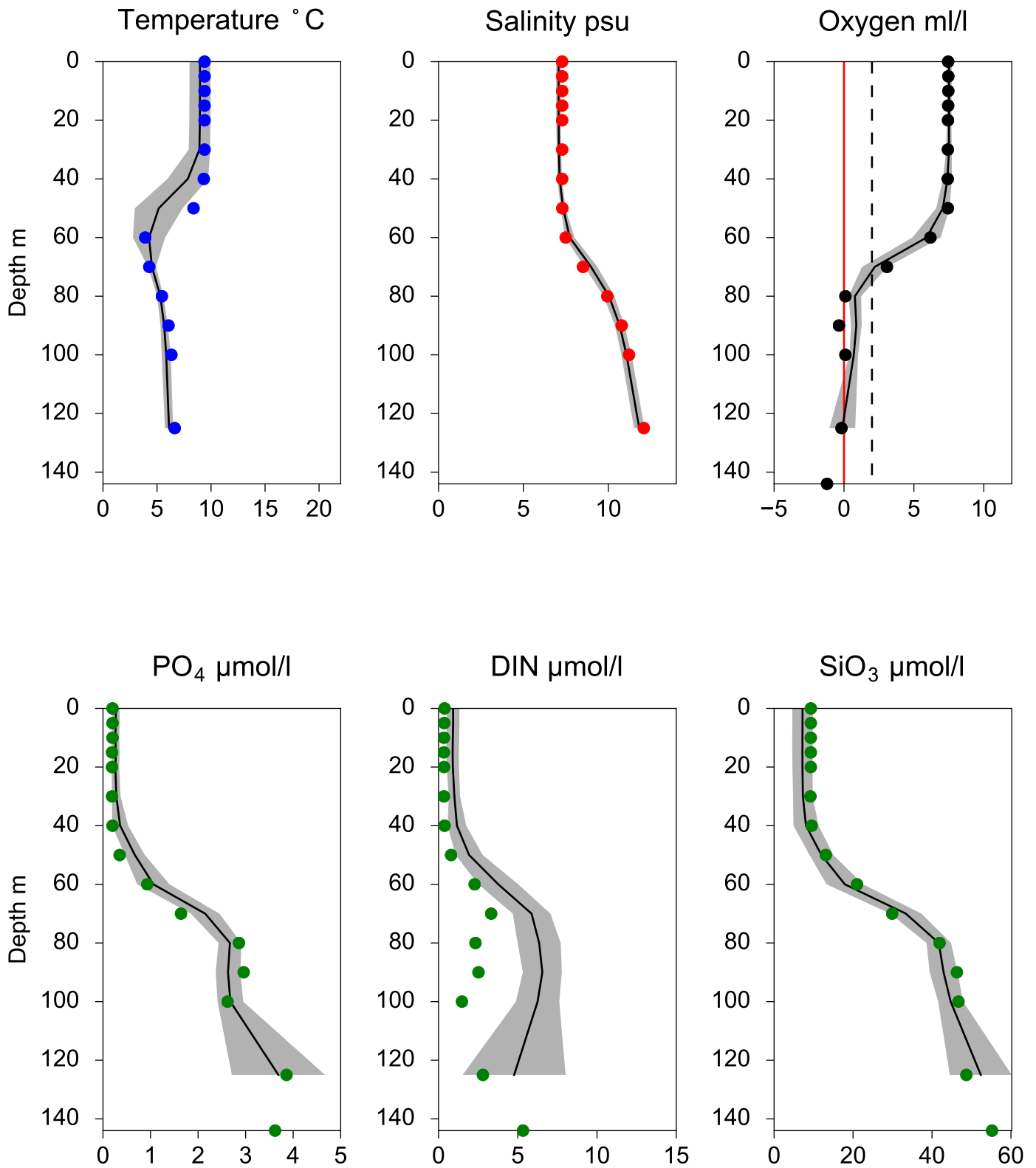


OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles BY10 November

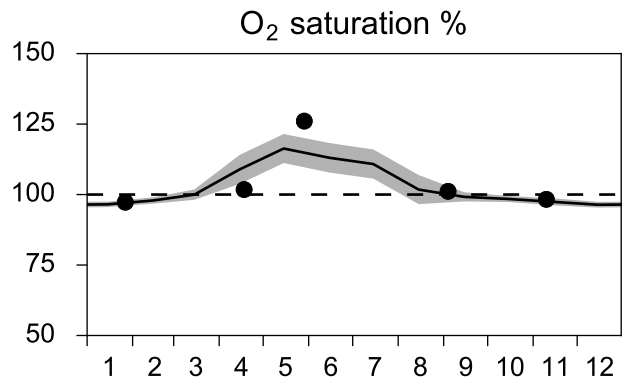
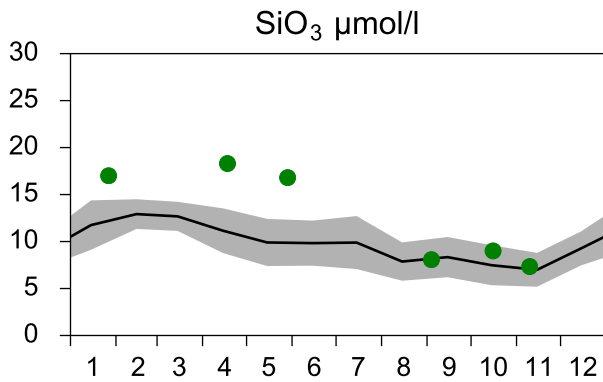
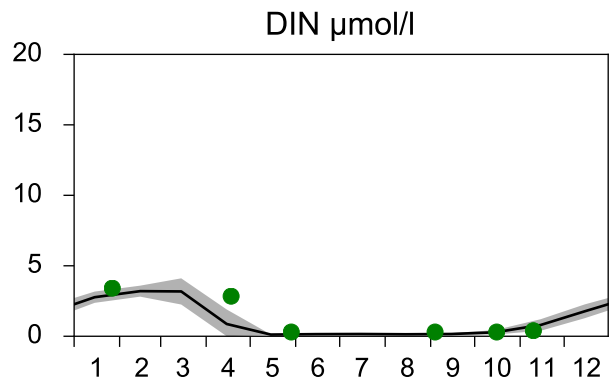
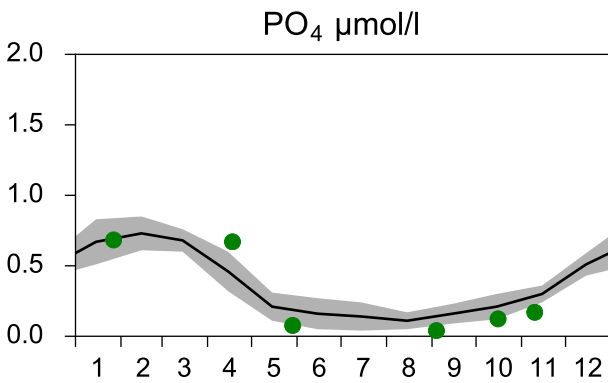
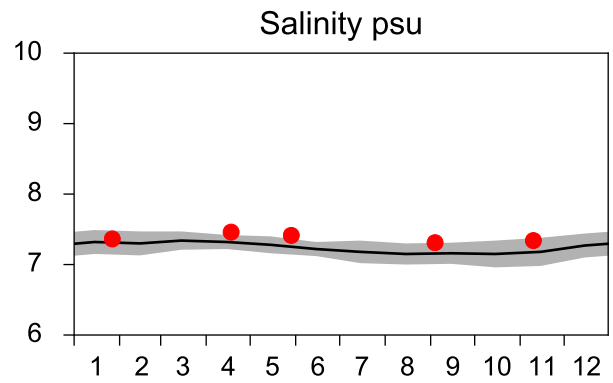
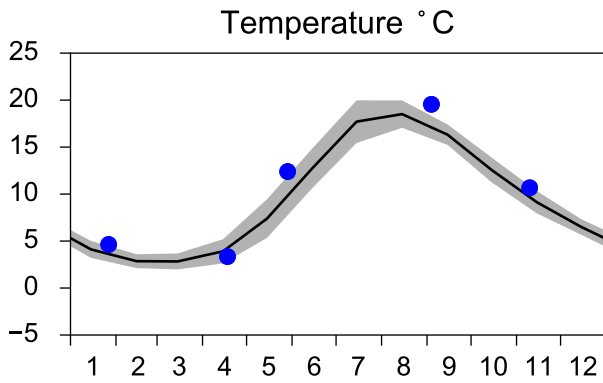
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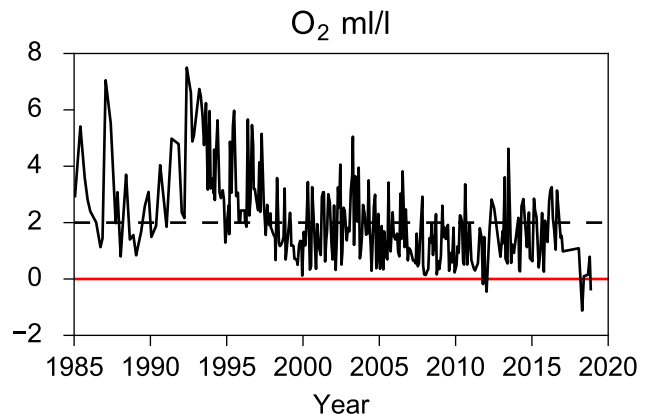
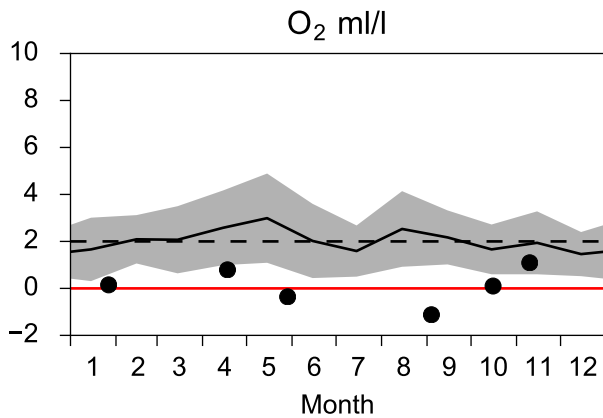
STATION BCS III-10 SURFACE WATER (0-10 m)

Annual Cycles

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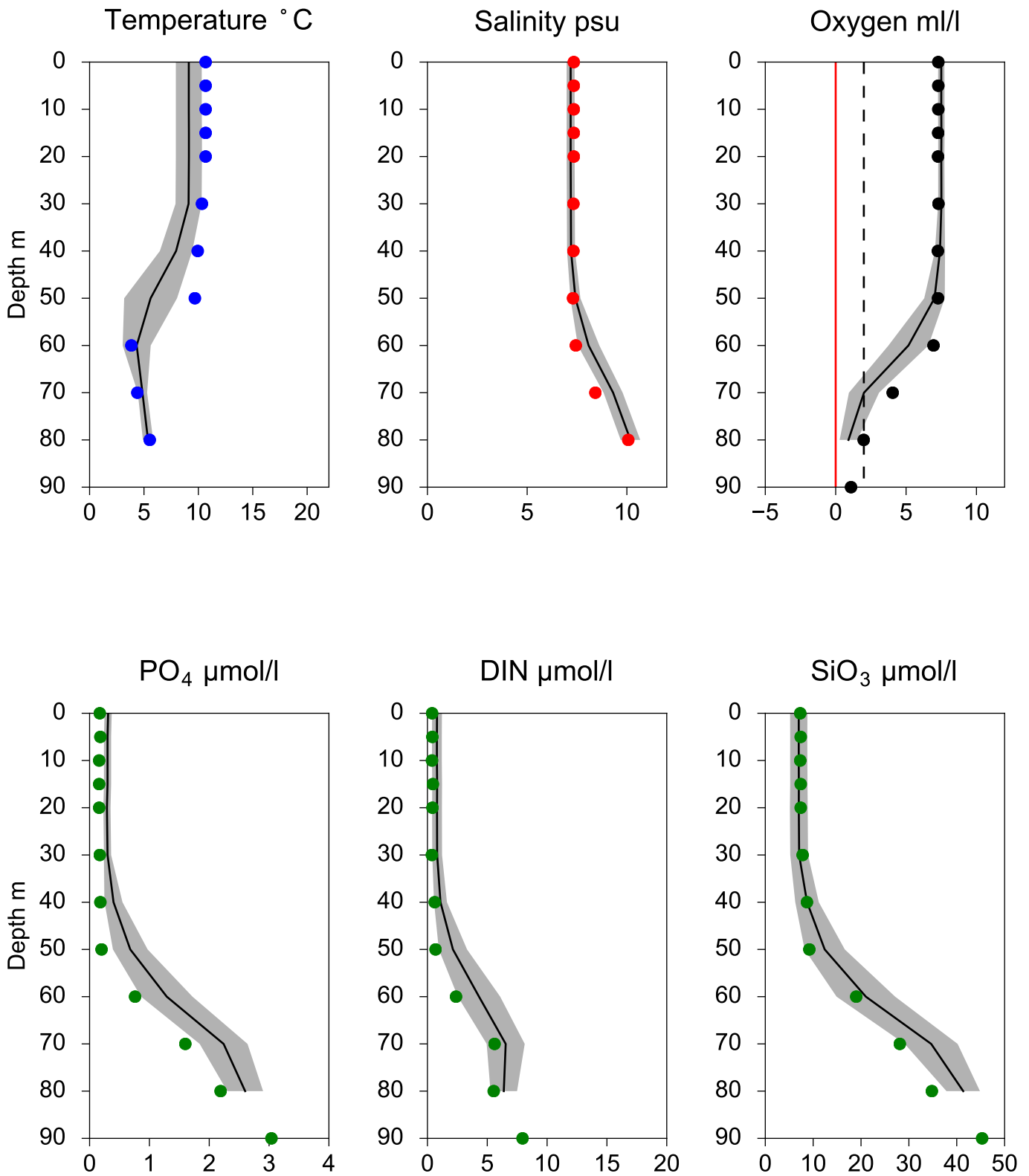


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BCS III-10 November

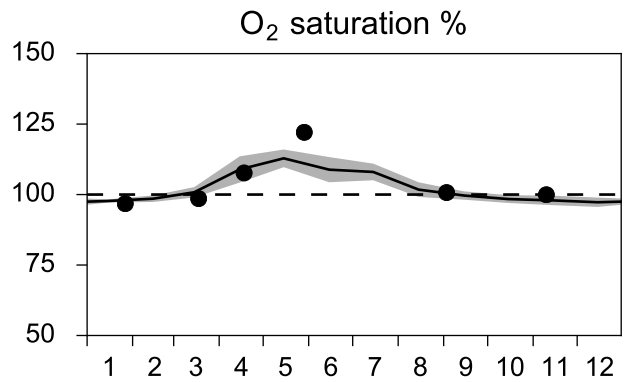
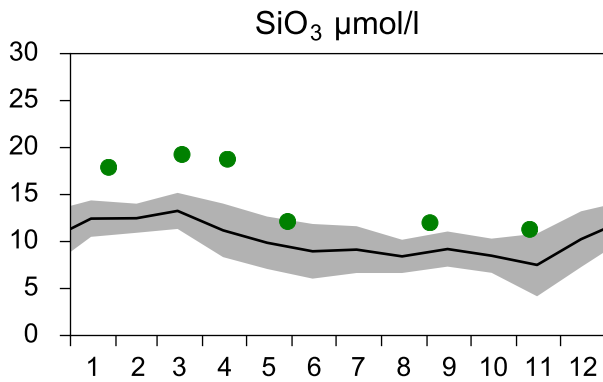
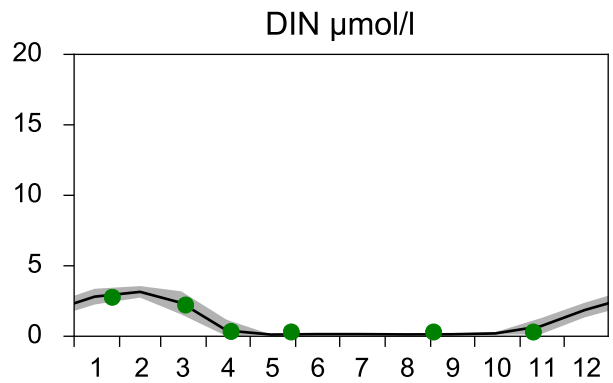
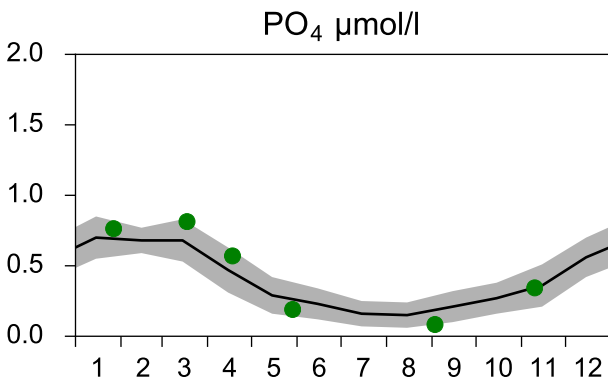
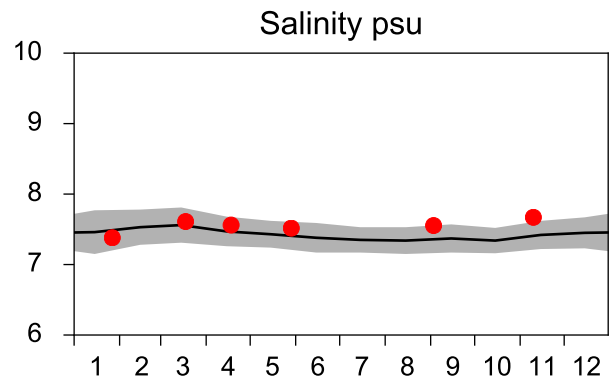
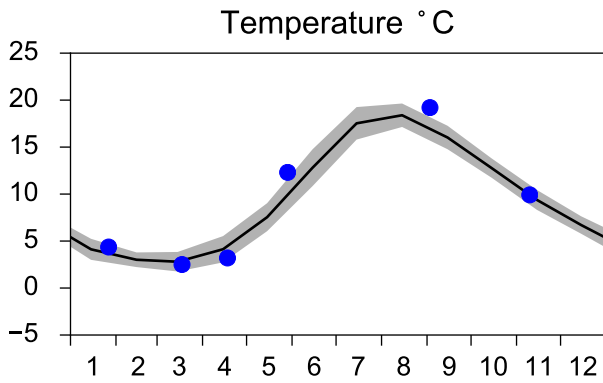
— Mean 2001-2015 ■ St.Dev. ● 2018-11-10



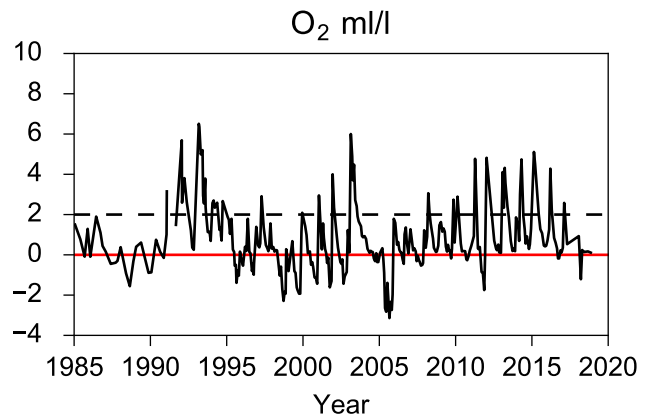
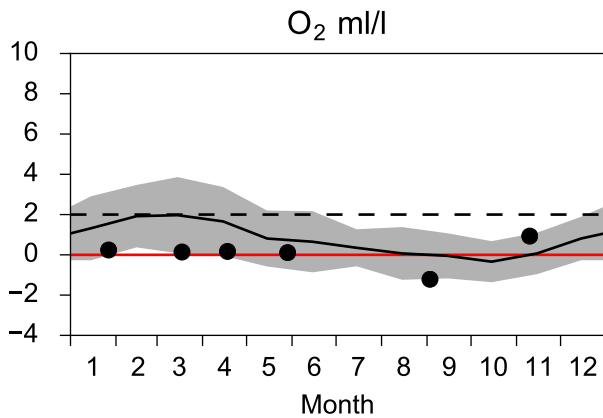
STATION BY5 BORNHOLMSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

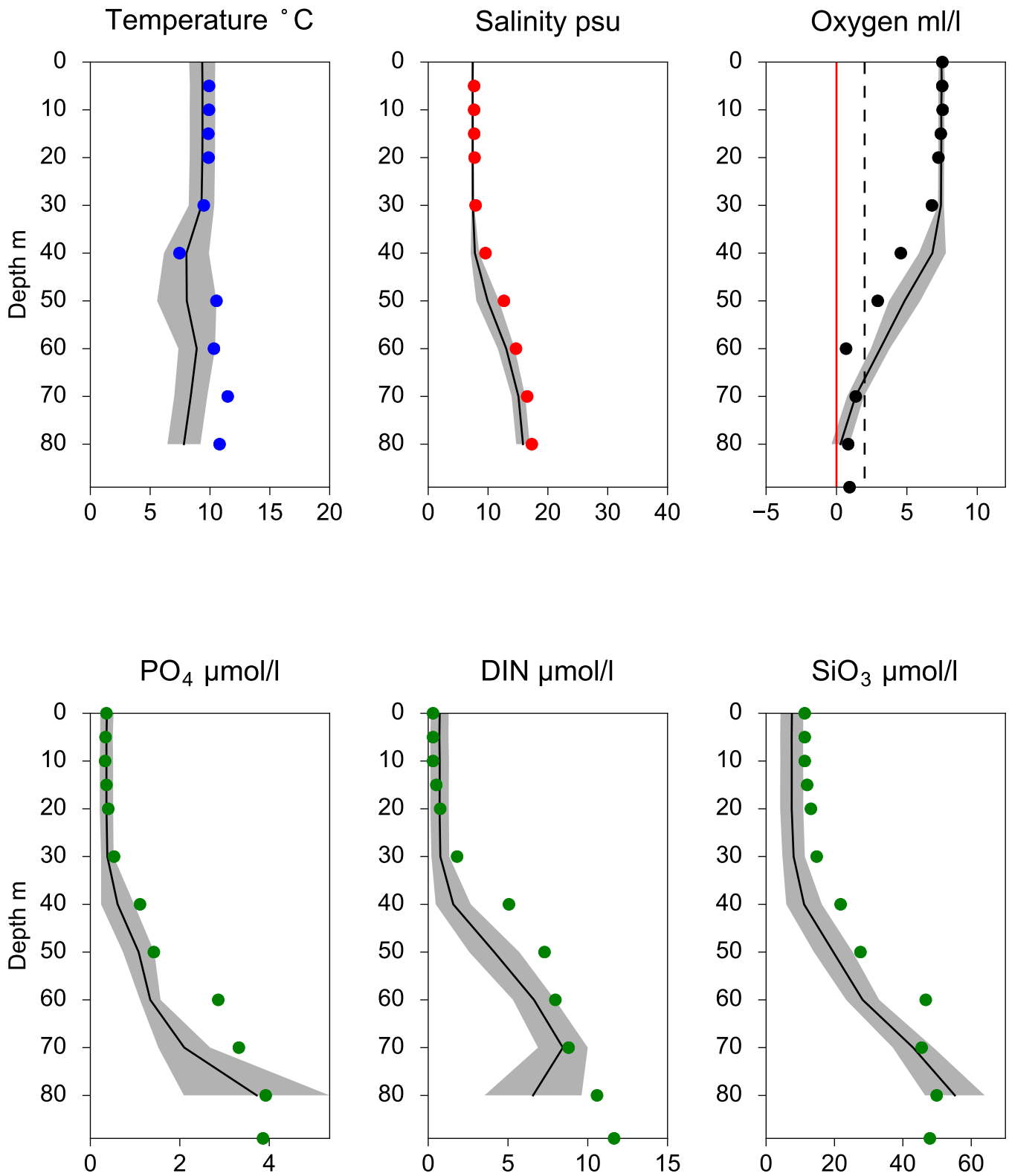


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY5 BORNHOLMSDJ November

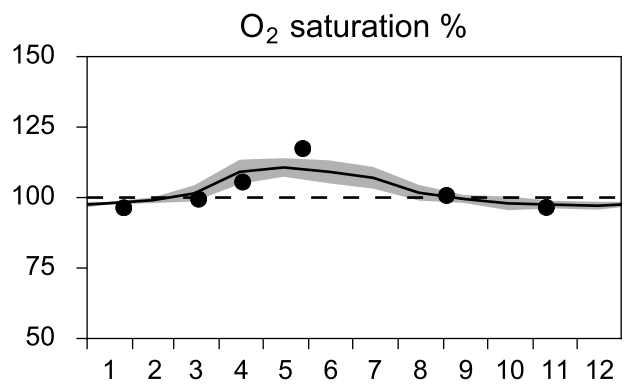
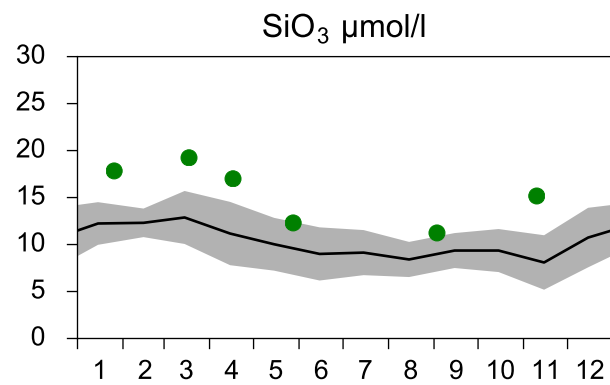
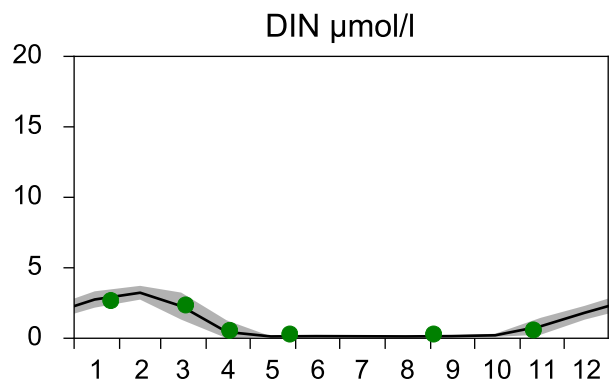
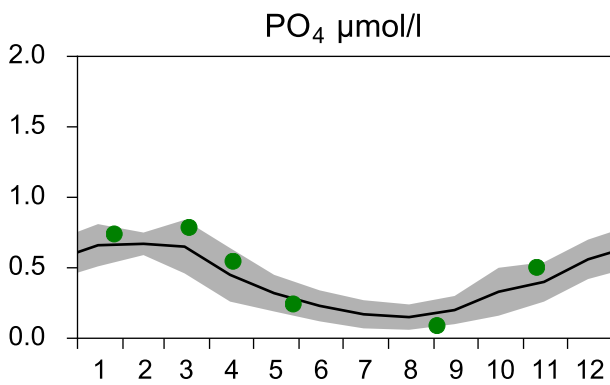
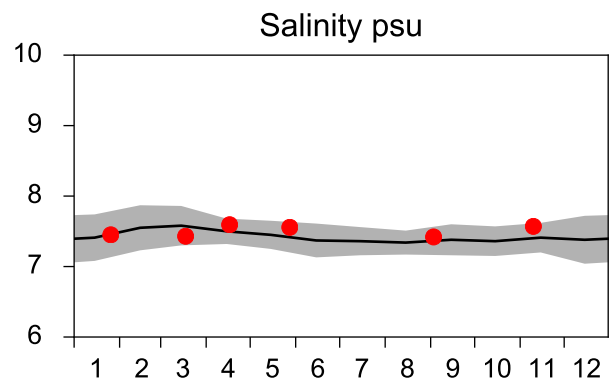
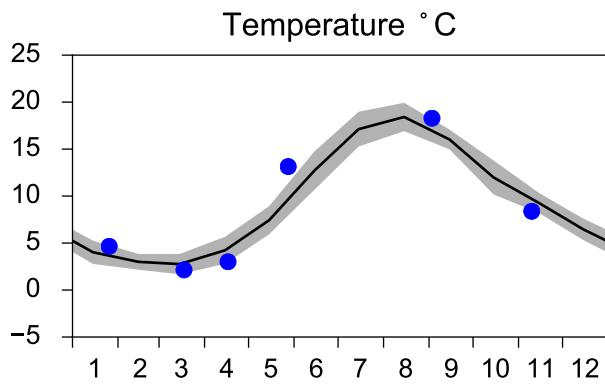
— Mean 2001-2015 ■ St.Dev. ● 2018-11-10



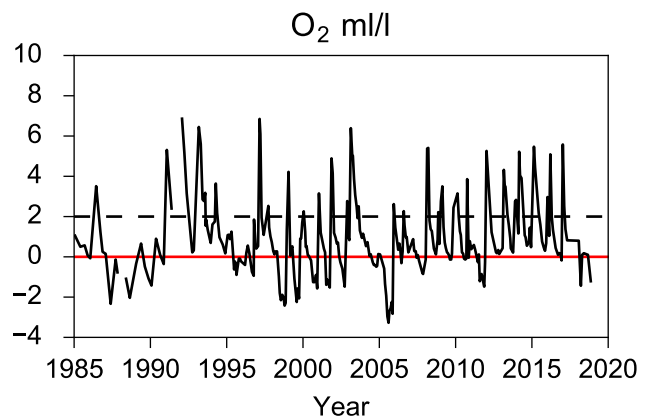
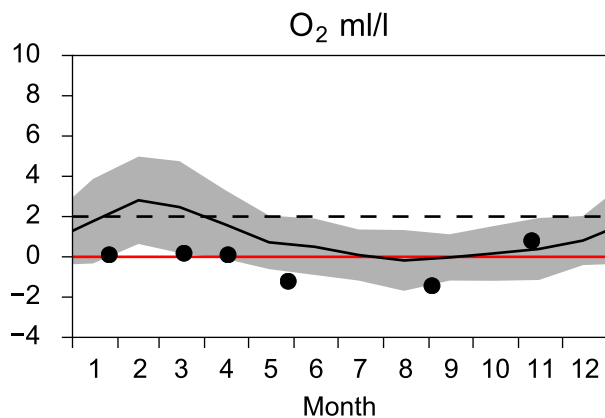
STATION BY4 CHRISTIANSÖ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

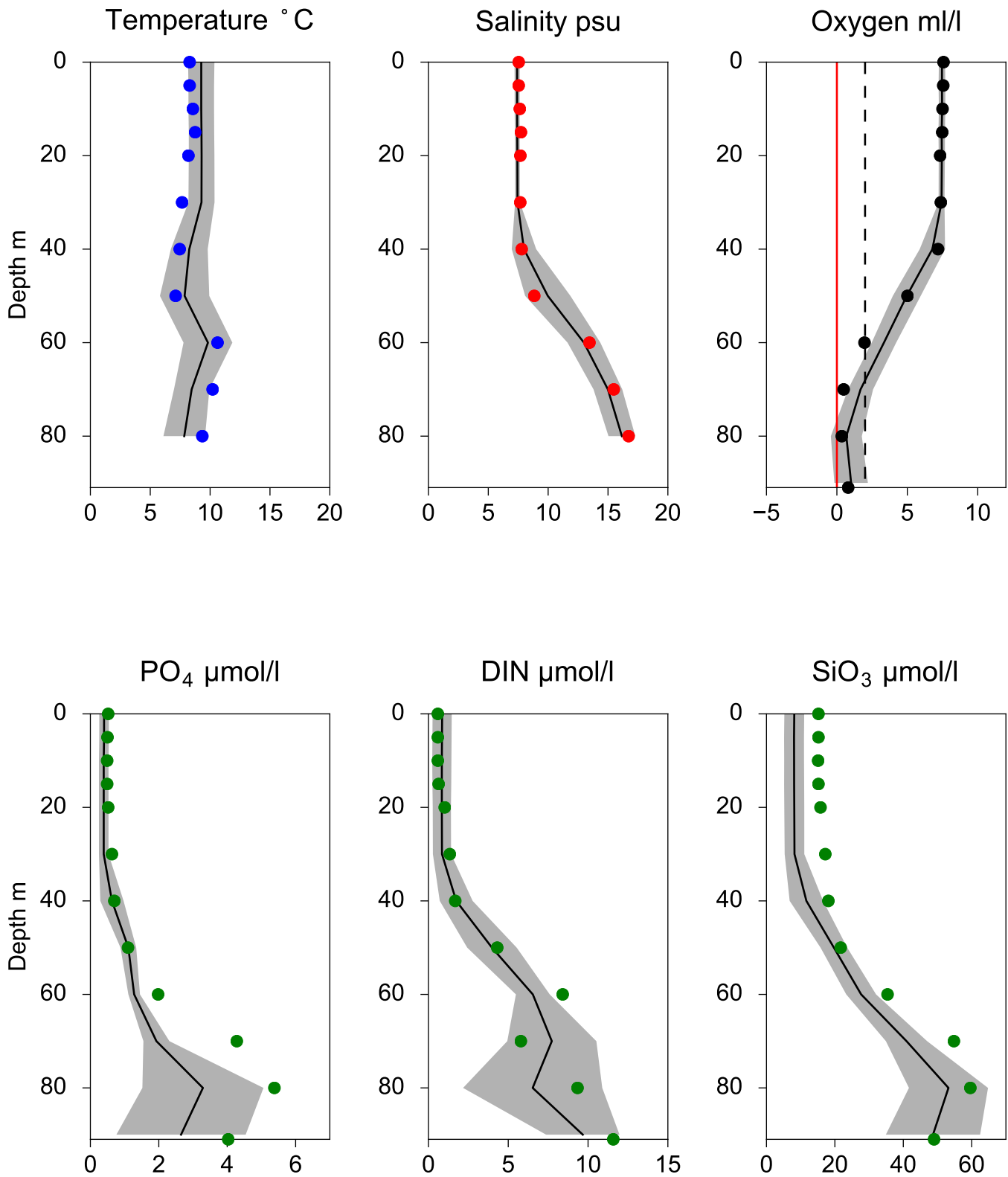


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles BY4 CHRISTIANSÖ November

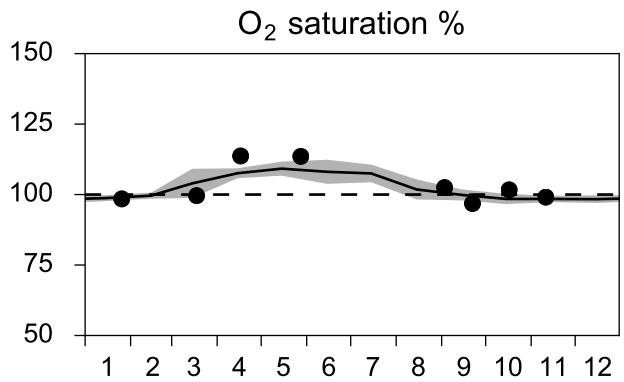
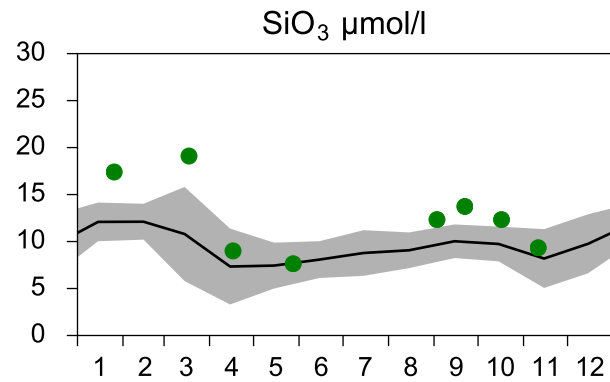
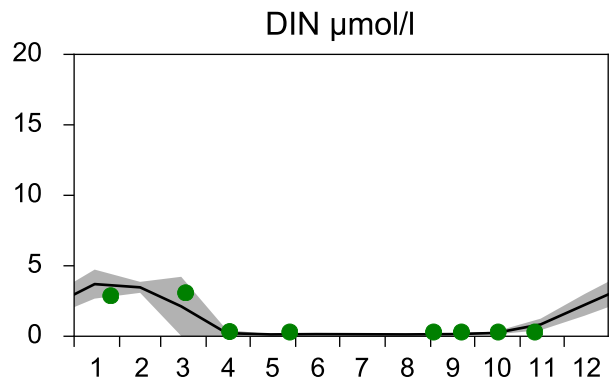
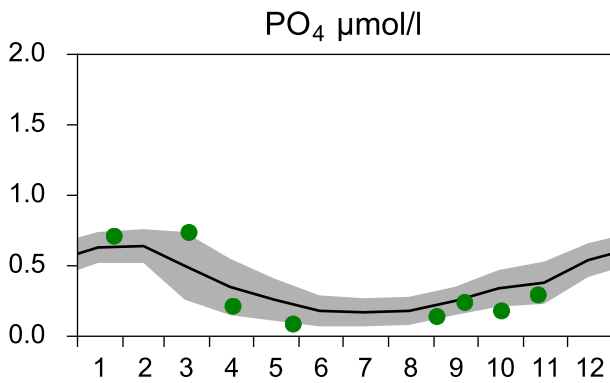
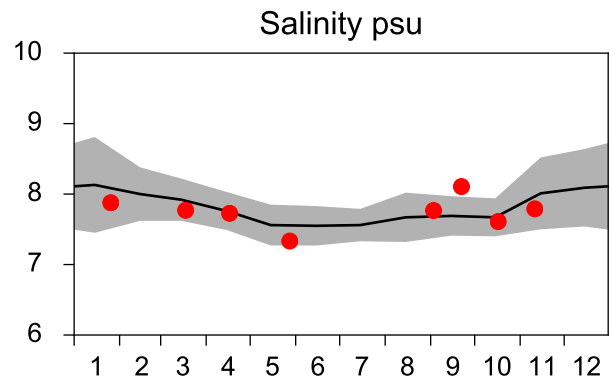
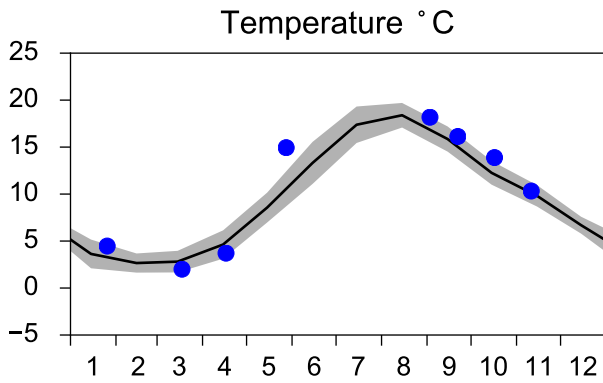
— Mean 2001-2015 ■ St.Dev. ● 2018-11-10



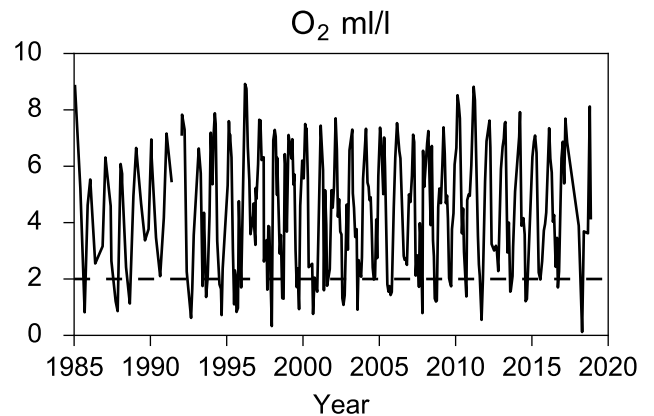
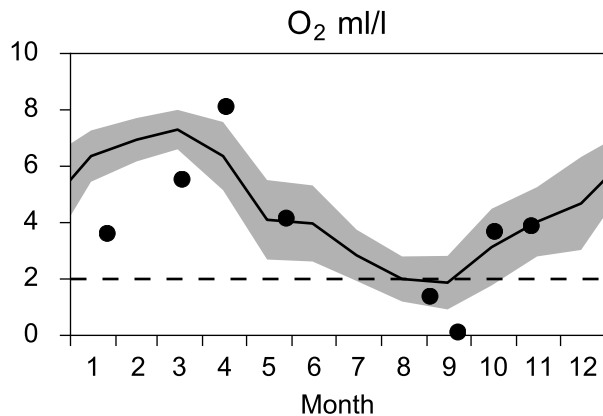
STATION BY2 ARKONA SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

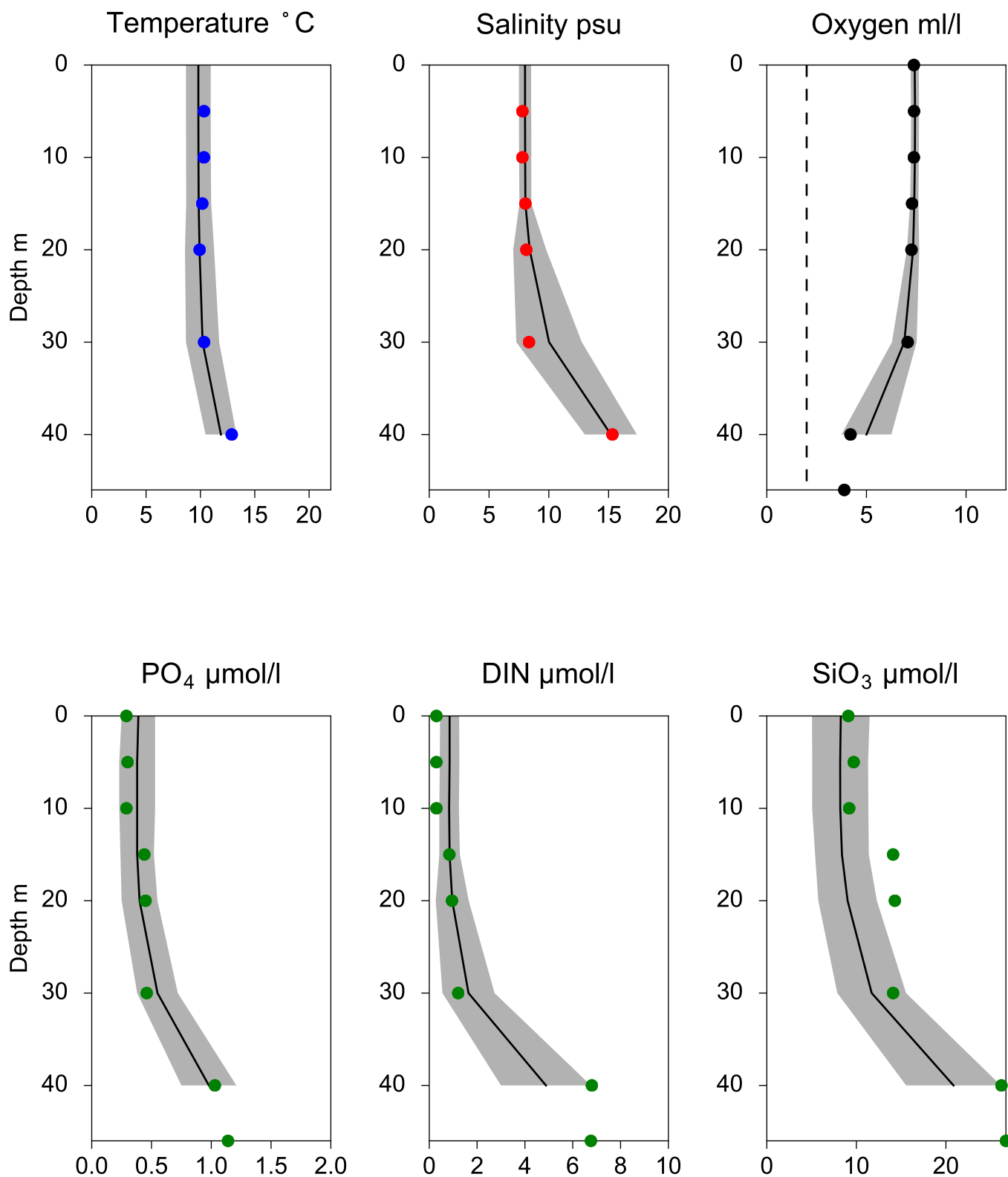


OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY2 ARKONA November

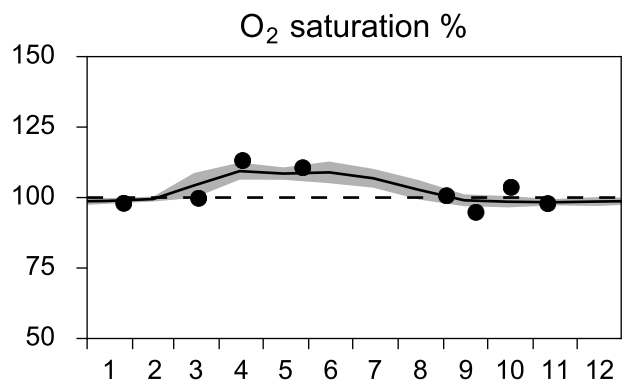
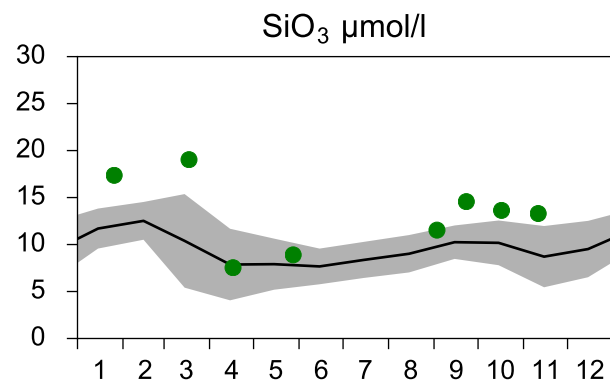
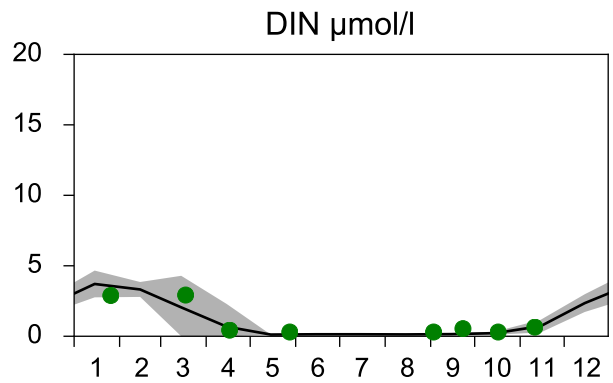
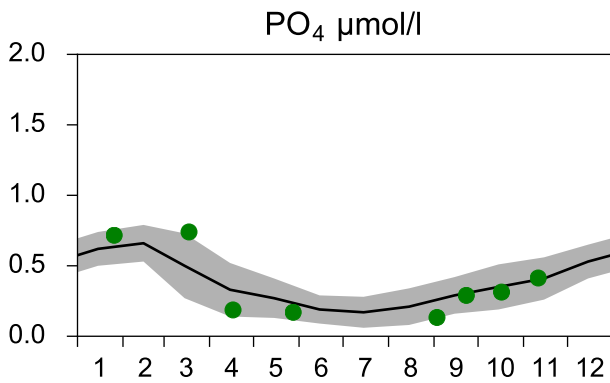
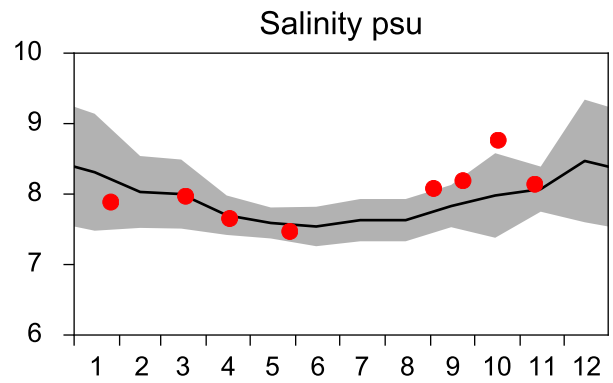
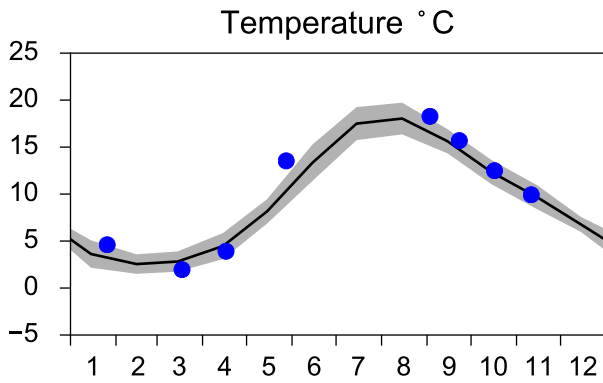
— Mean 2001-2015 ■ St.Dev. ● 2018-11-11



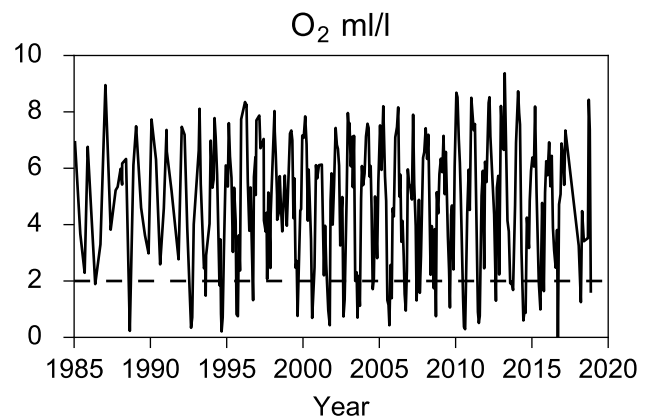
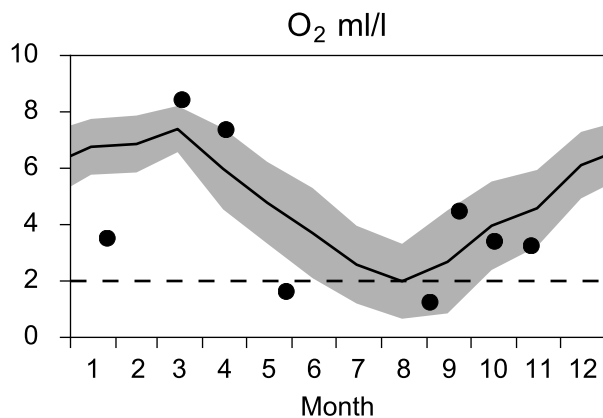
STATION BY1 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

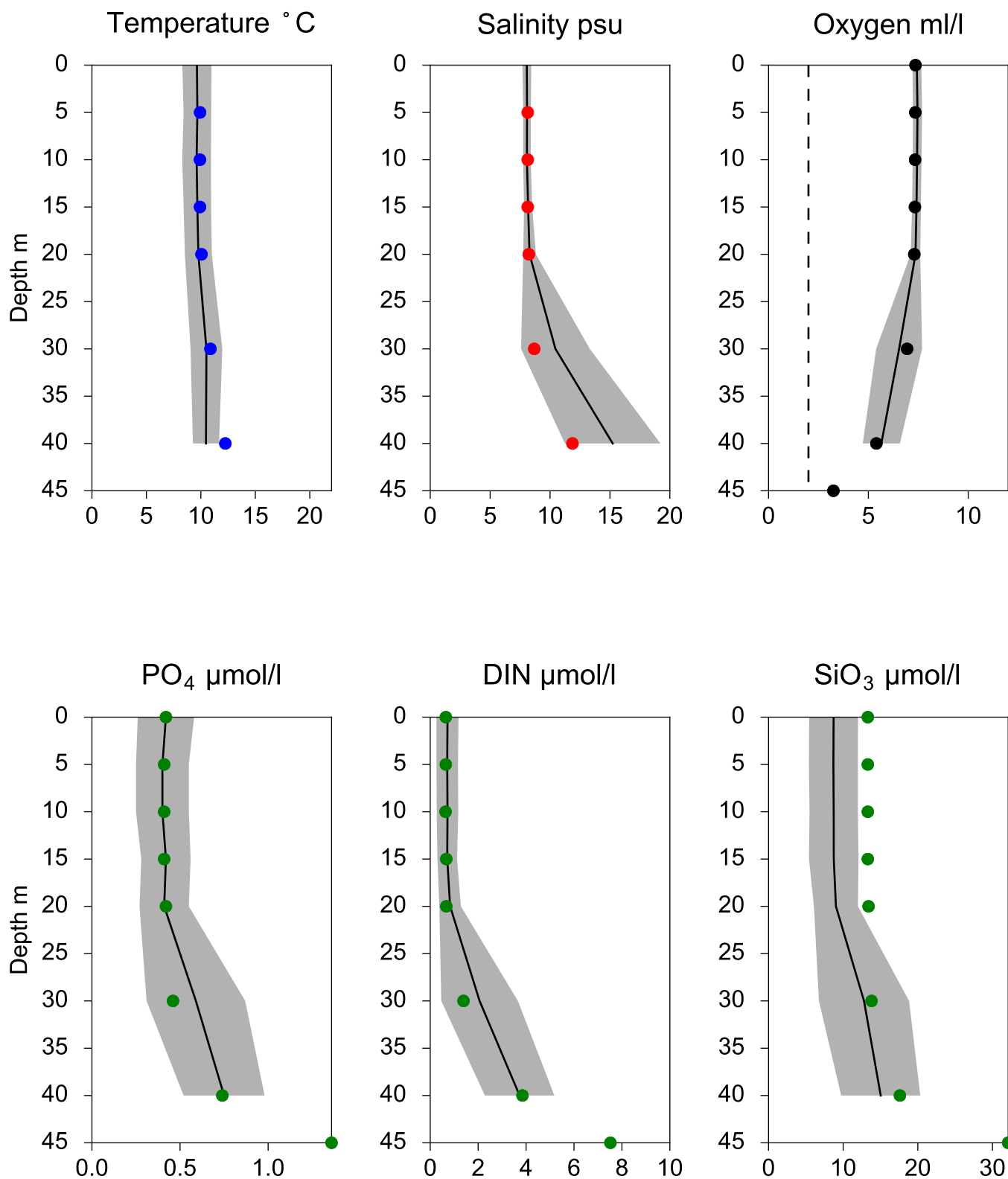


OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles BY1 November

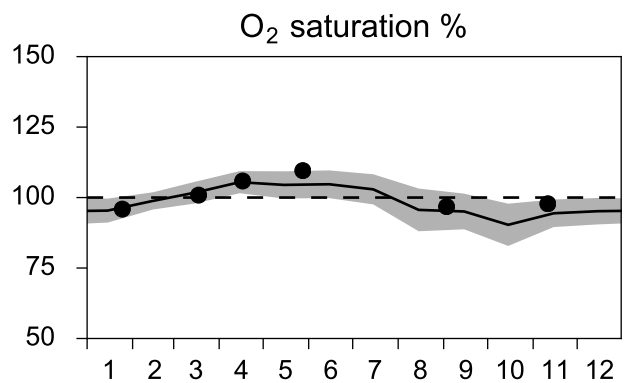
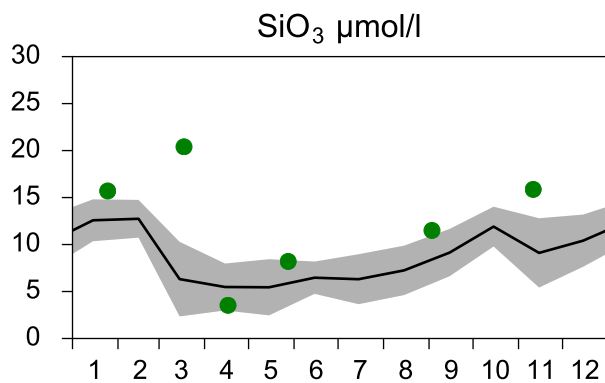
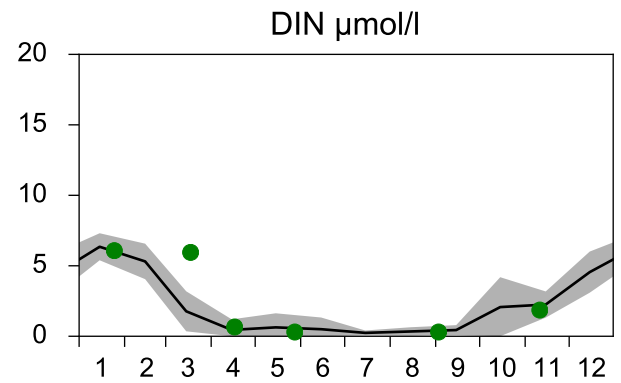
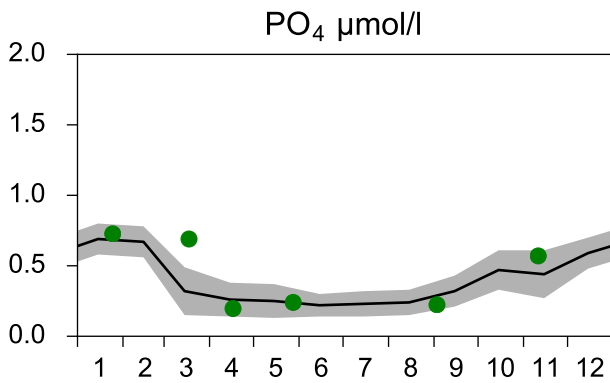
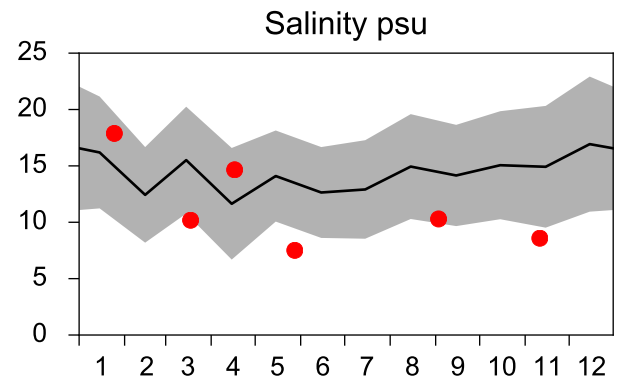
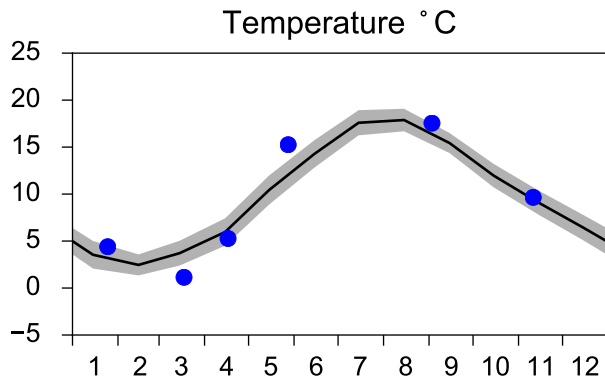
— Mean 2001-2015 ■ St.Dev. ● 2018-11-11



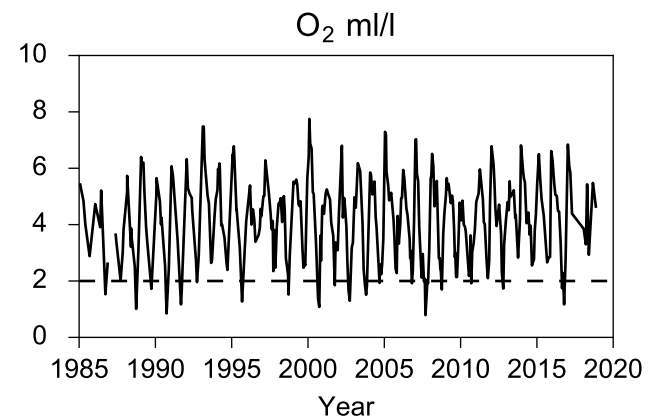
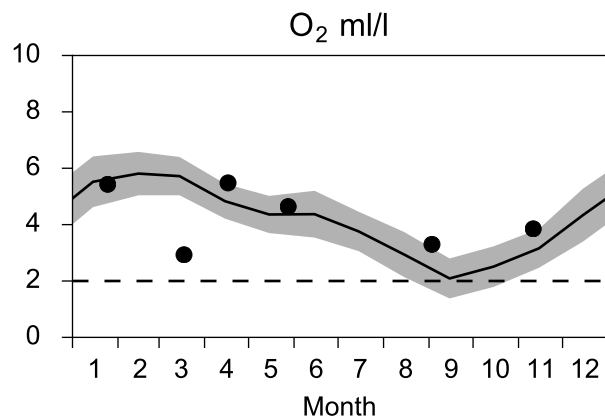
STATION W LANDSKRONA SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 ■ St.Dev. ● 2018

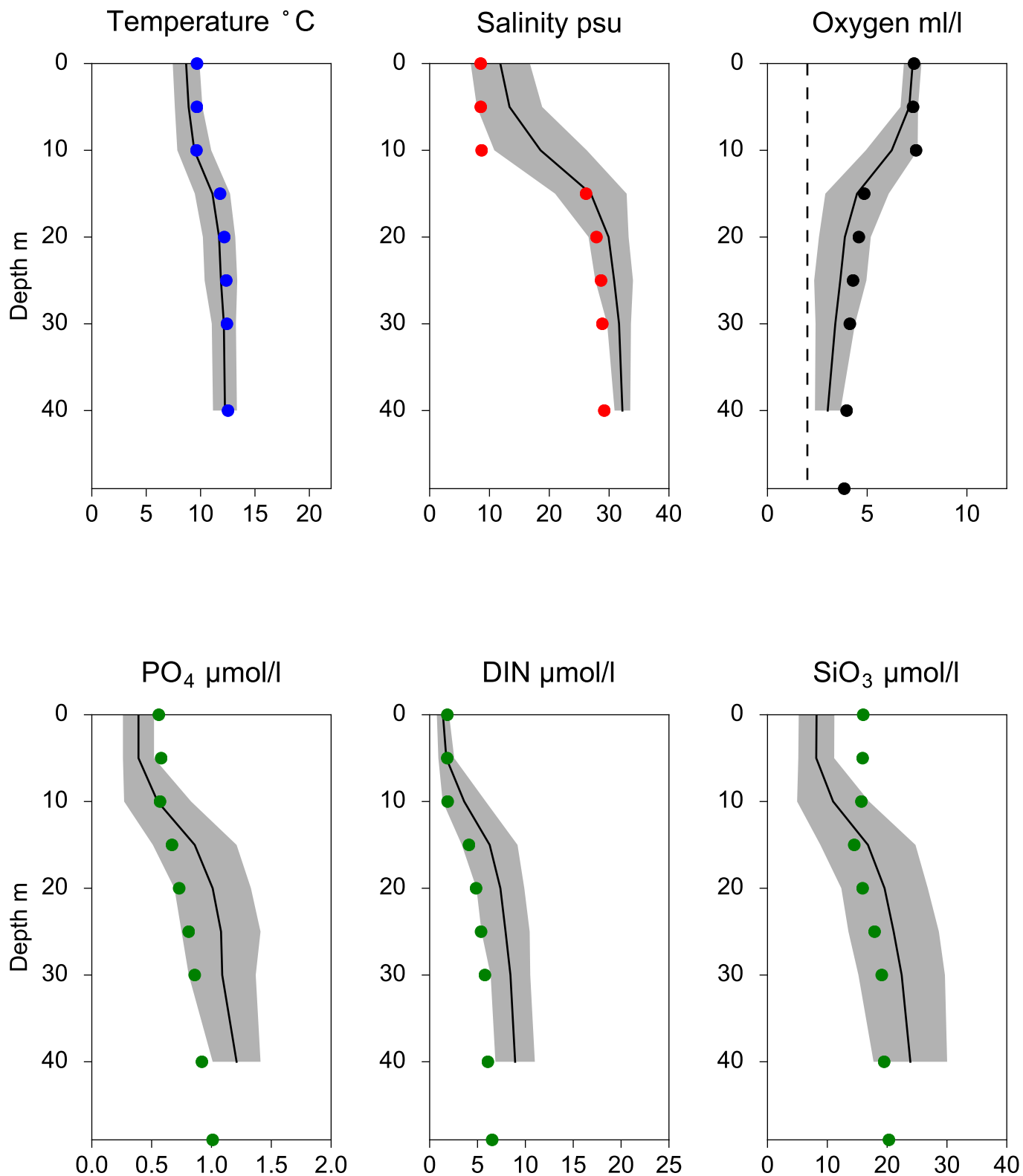


OXYGEN IN BOTTOM WATER (depth >= 40 m)



Vertical profiles W LANDSKRONA November

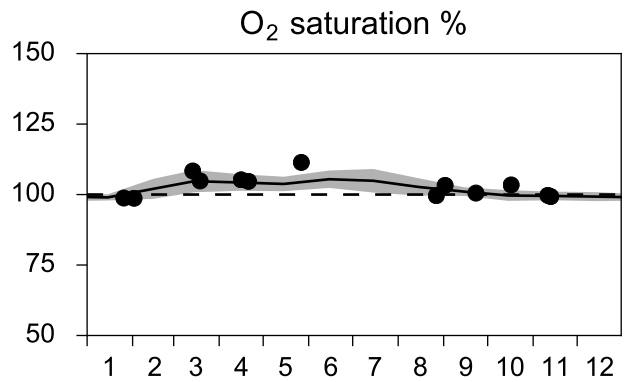
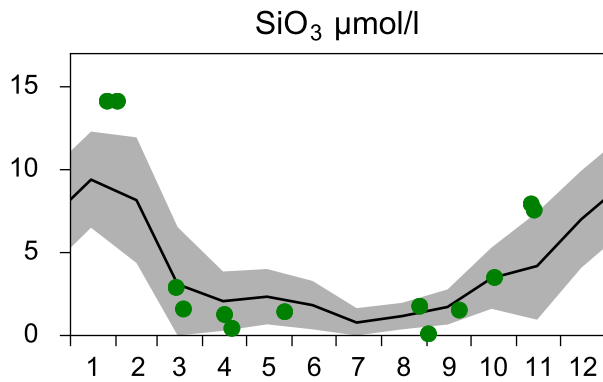
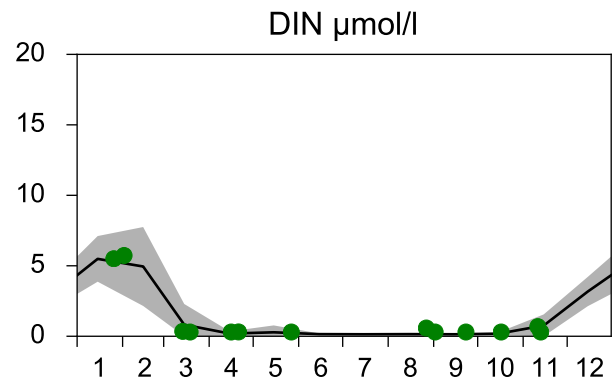
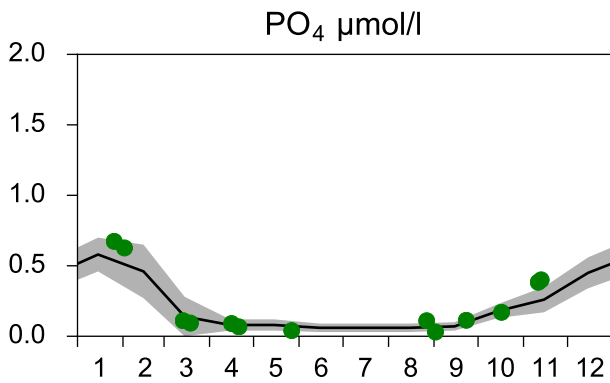
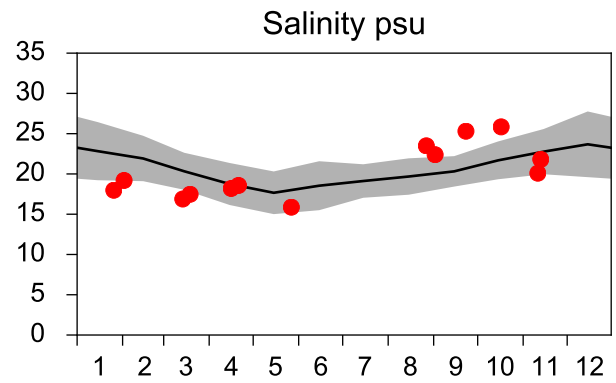
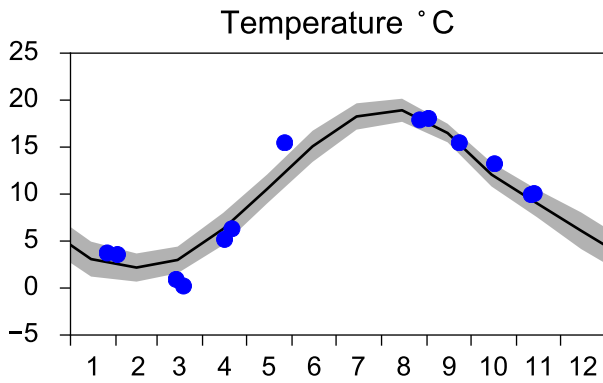
Mean 2001-2015
 St.Dev.
 2018-11-11



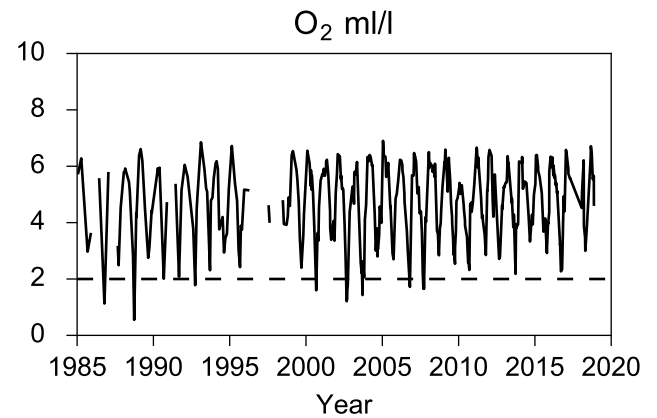
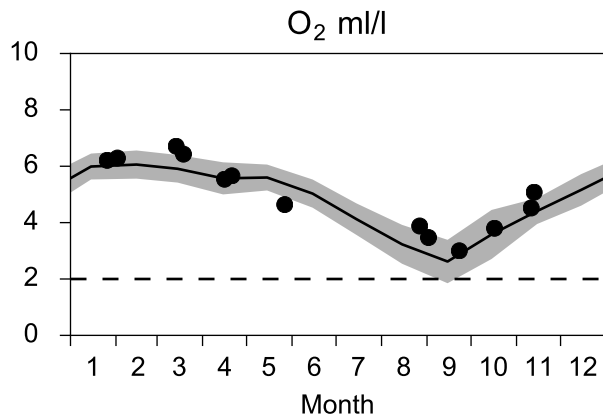
STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

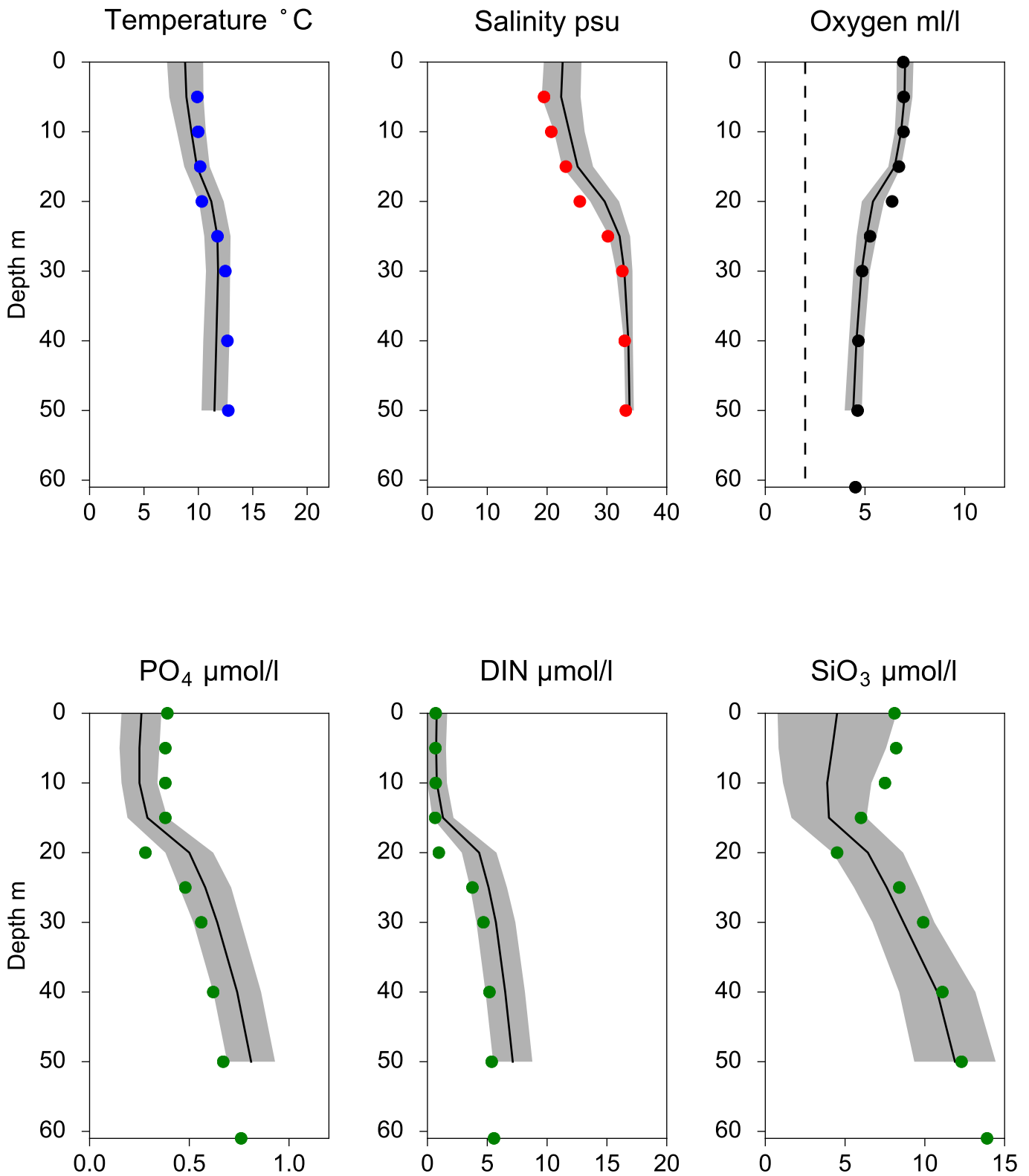


OXYGEN IN BOTTOM WATER (depth >= 52 m)



Vertical profiles ANHOLT E November

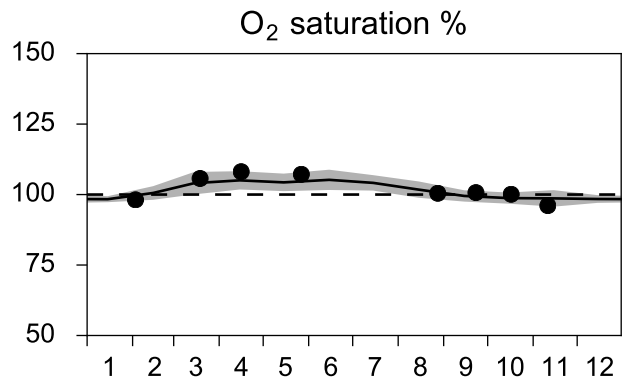
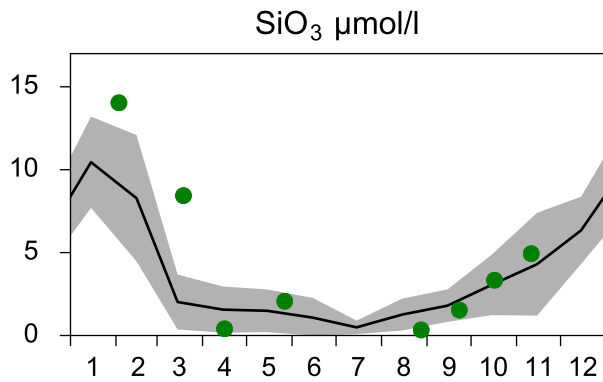
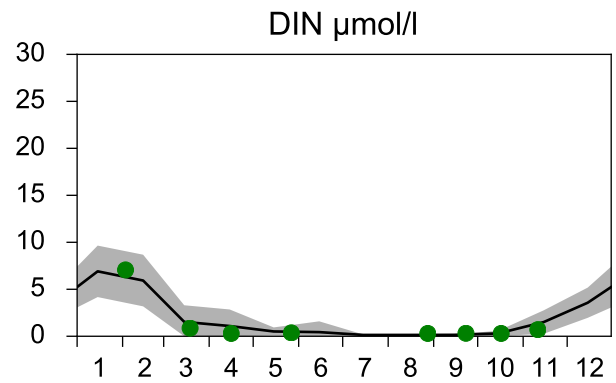
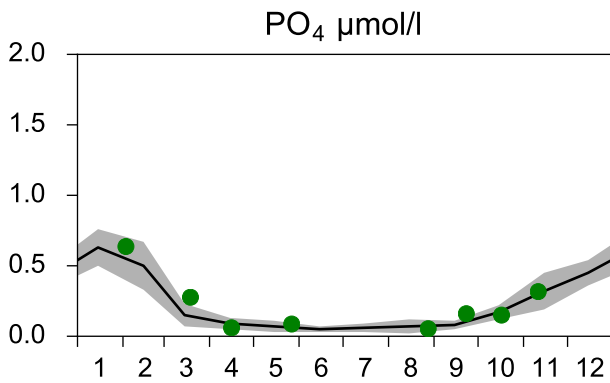
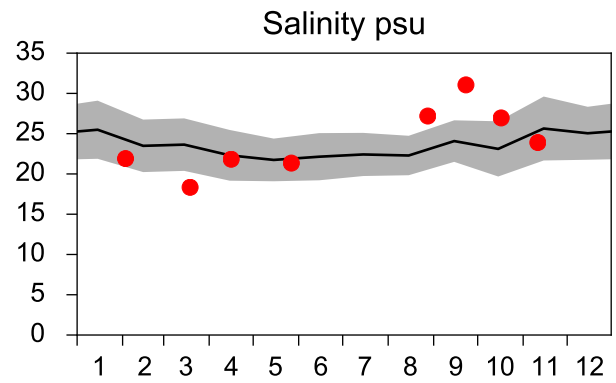
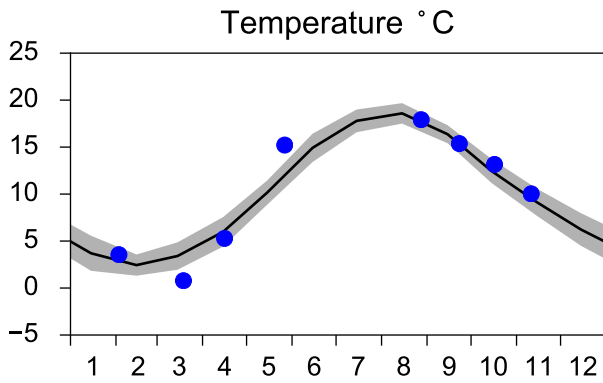
— Mean 2001-2015 ■ St.Dev. ● 2018-11-11



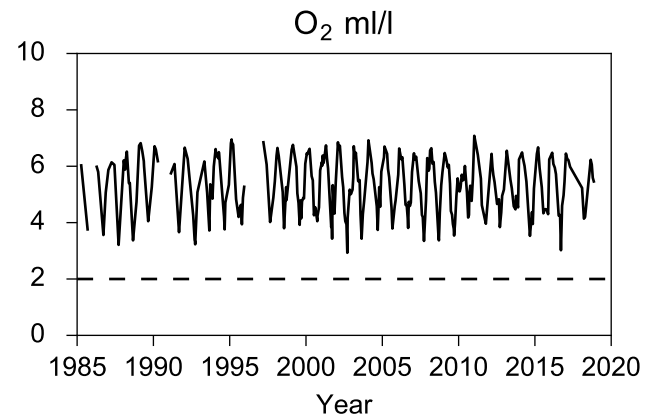
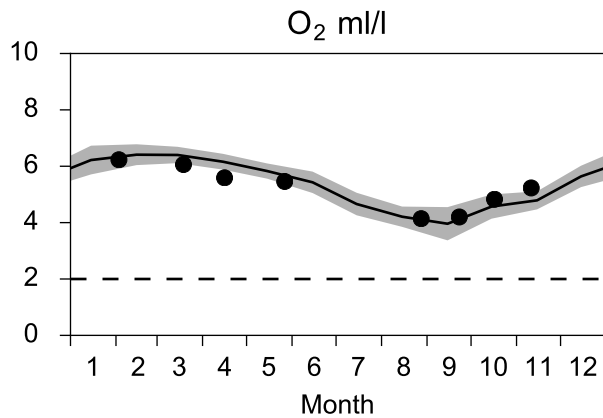
STATION FLADEN SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

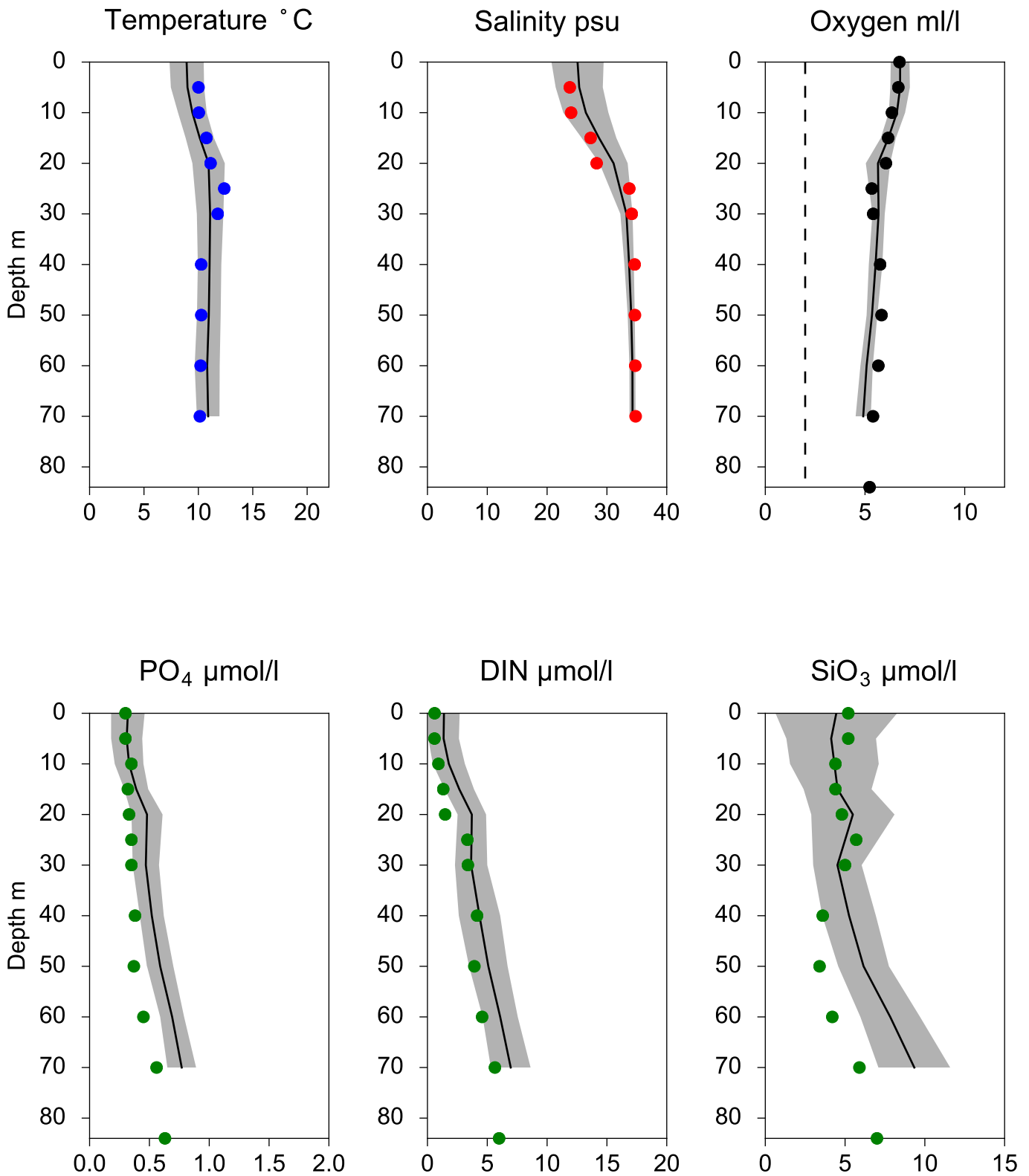


OXYGEN IN BOTTOM WATER (depth >= 74 m)



Vertical profiles FLADEN November

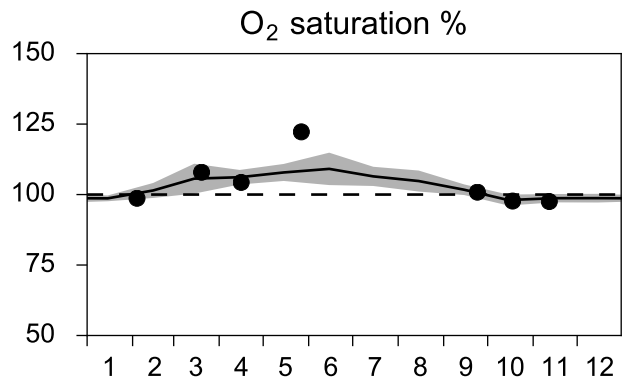
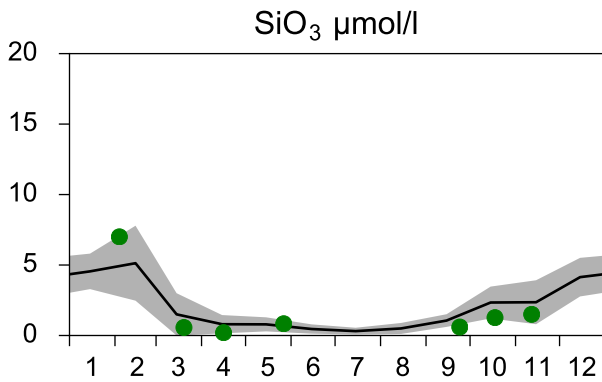
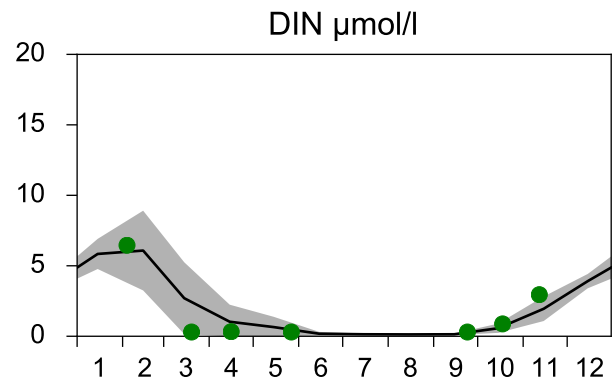
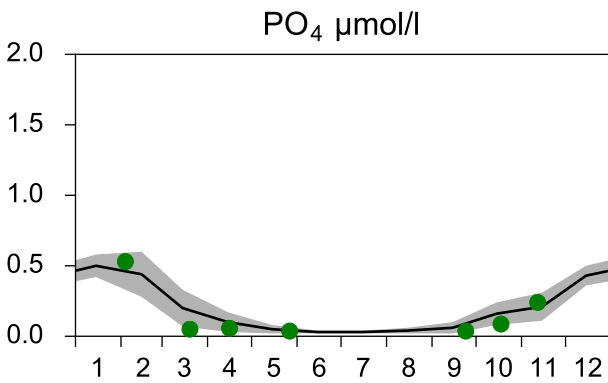
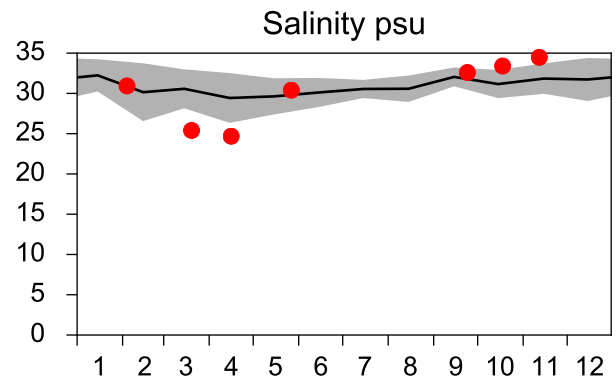
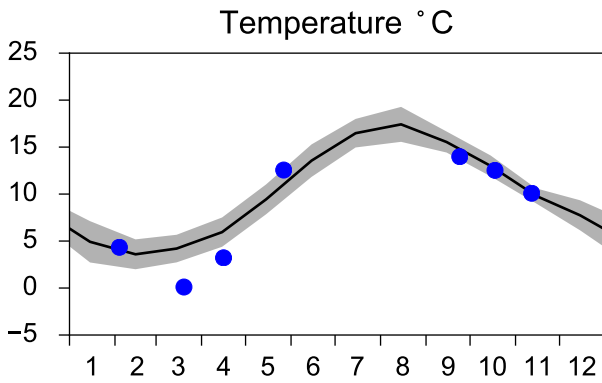
— Mean 2001-2015 ■ St.Dev. ● 2018-11-11



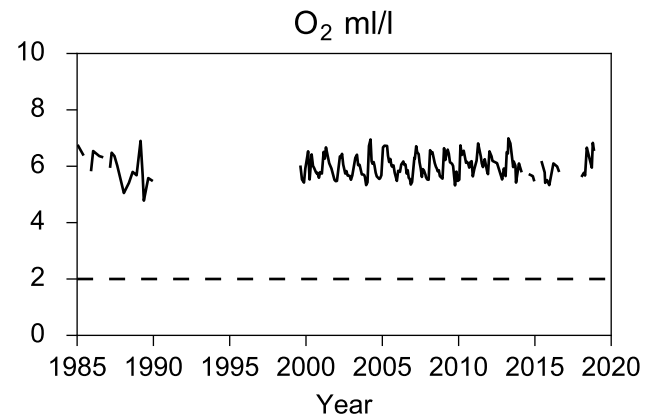
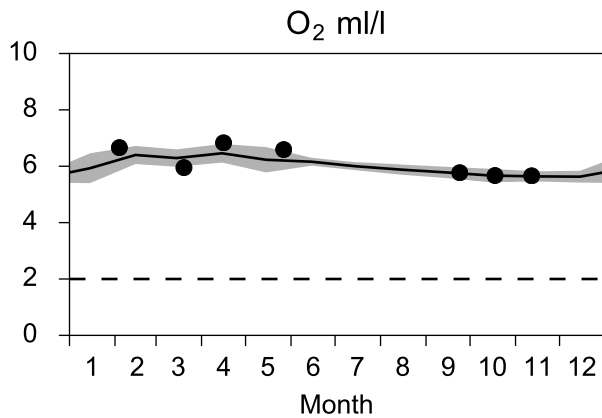
STATION Å17 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

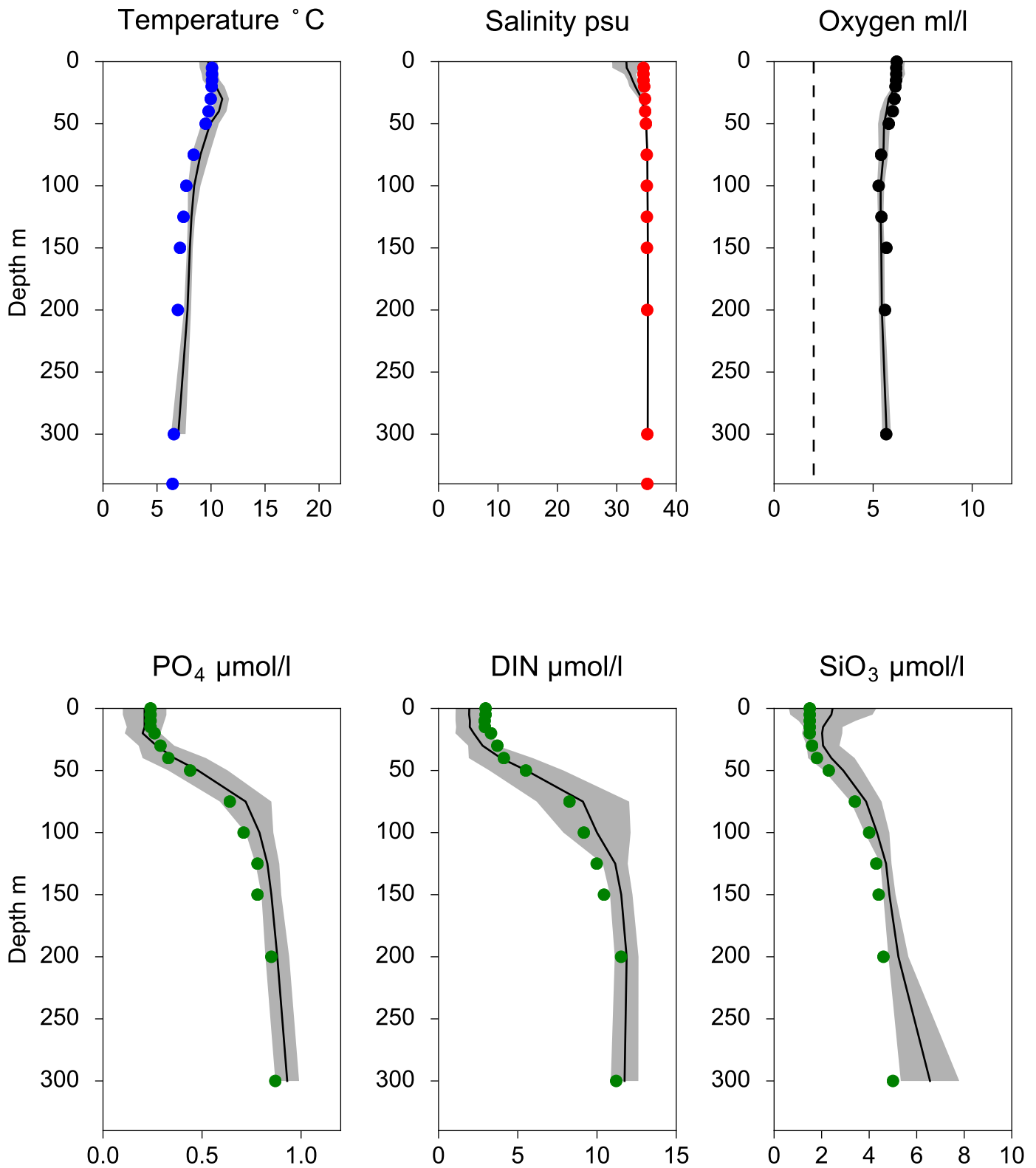


OXYGEN IN BOTTOM WATER (depth >= 300 m)



Vertical profiles Å17 November

— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



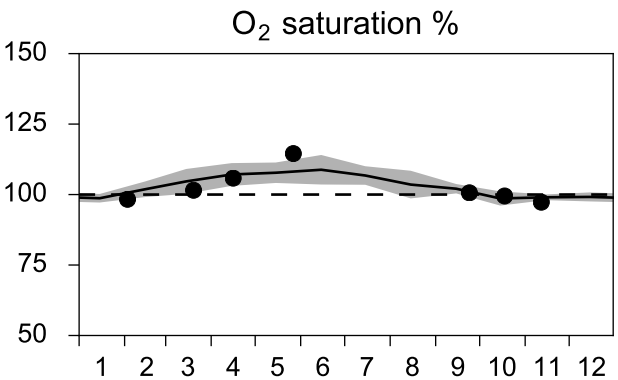
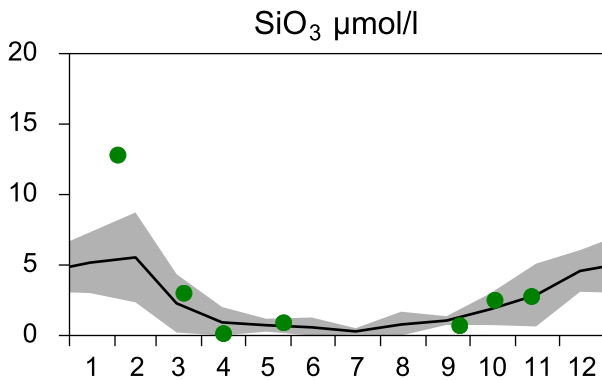
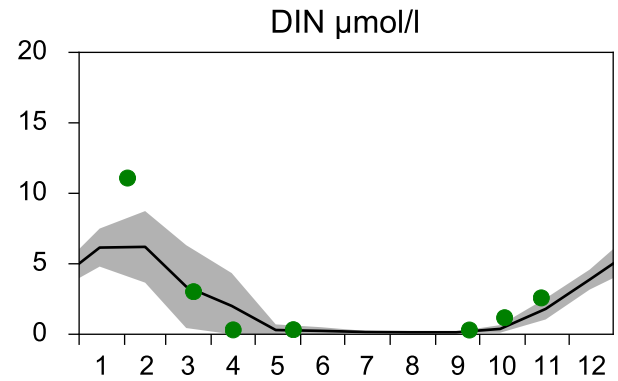
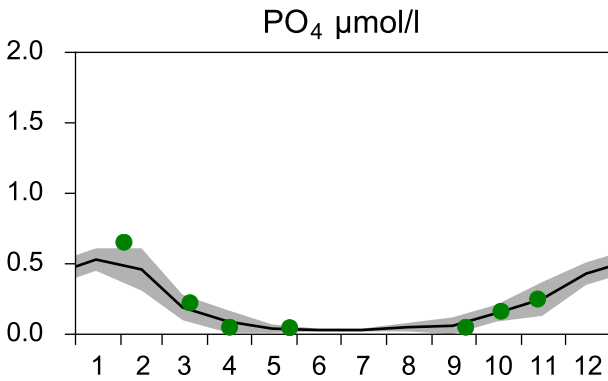
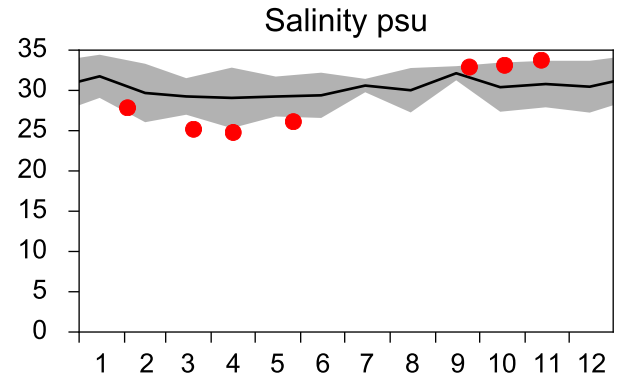
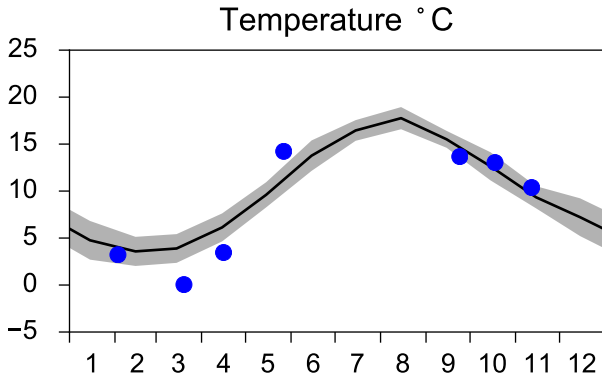
STATION Å15 SURFACE WATER (0-10 m)

Annual Cycles

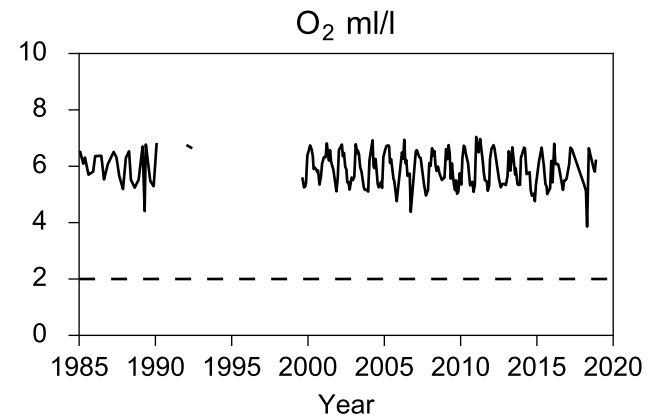
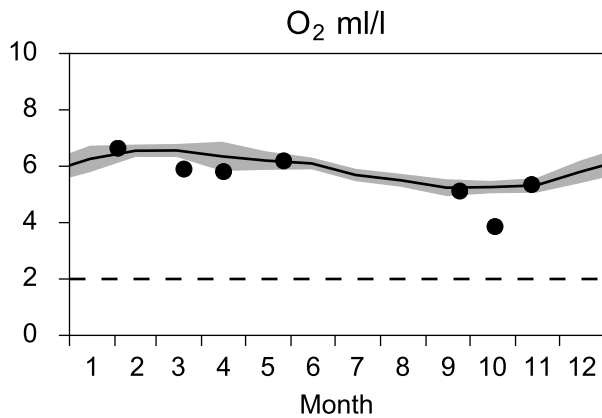
— Mean 2001-2015

■ St.Dev.

● 2018

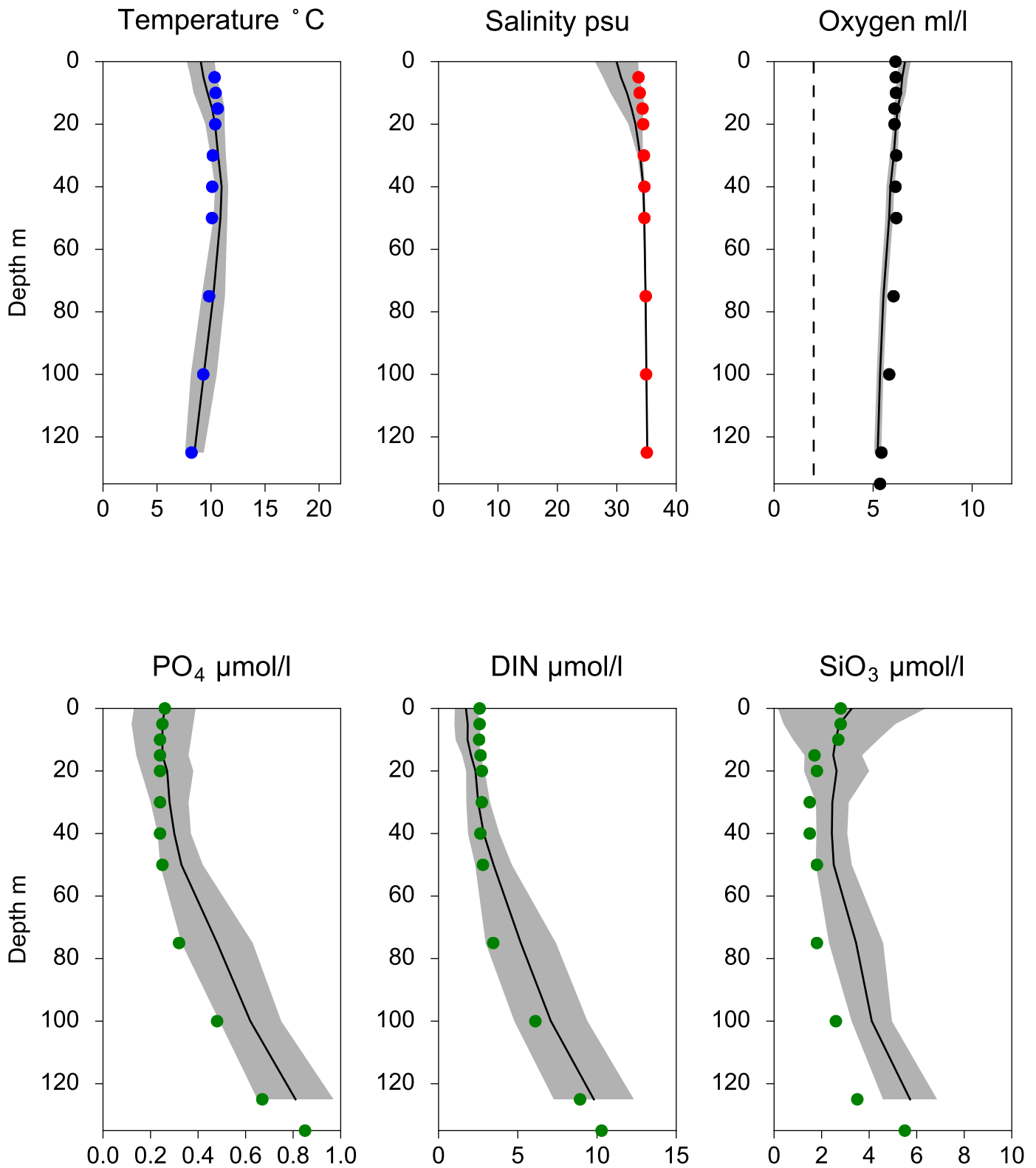


OXYGEN IN BOTTOM WATER (depth >= 125 m)



Vertical profiles Å15 November

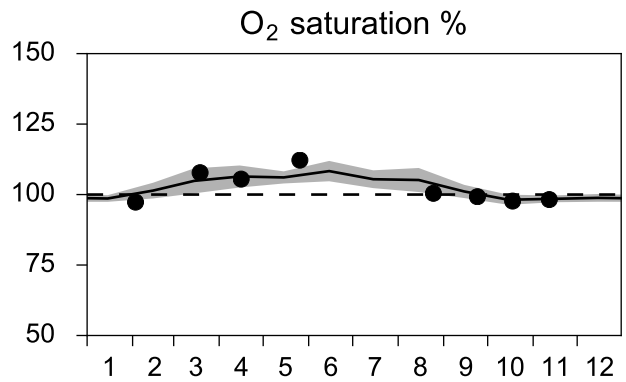
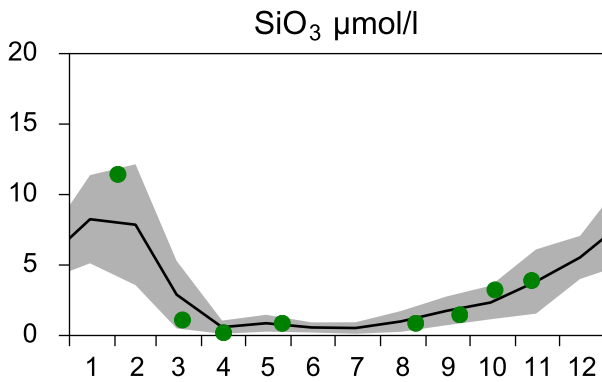
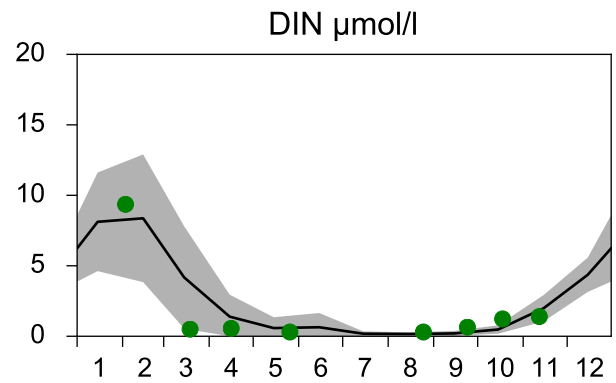
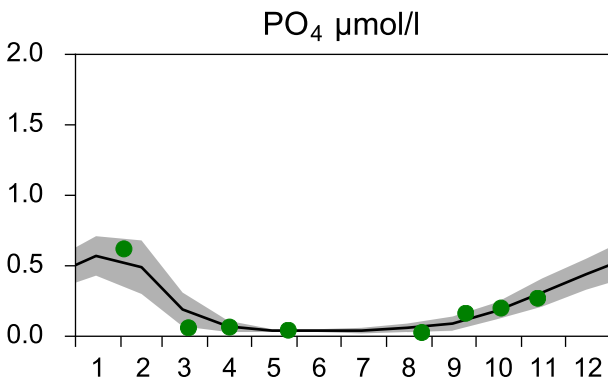
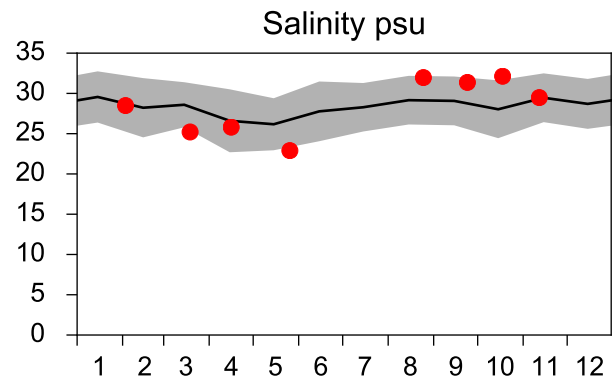
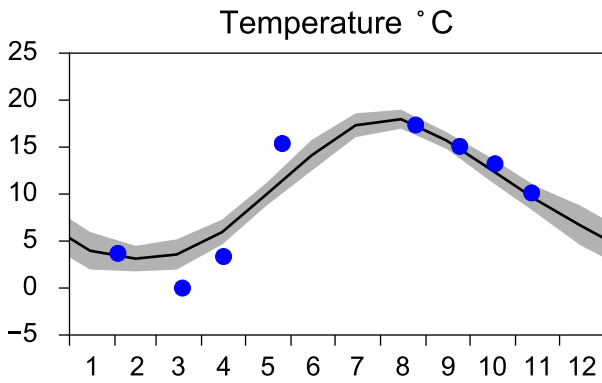
— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



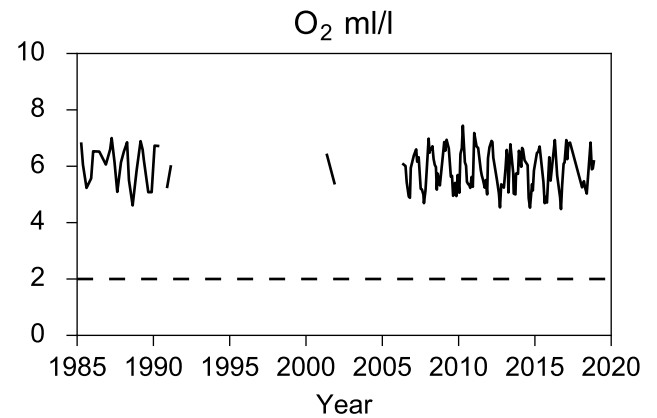
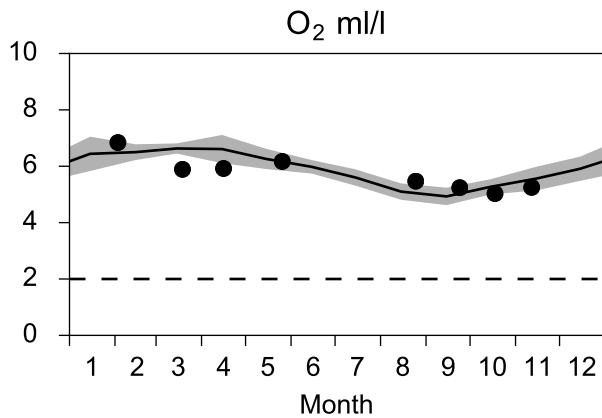
STATION Å13 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

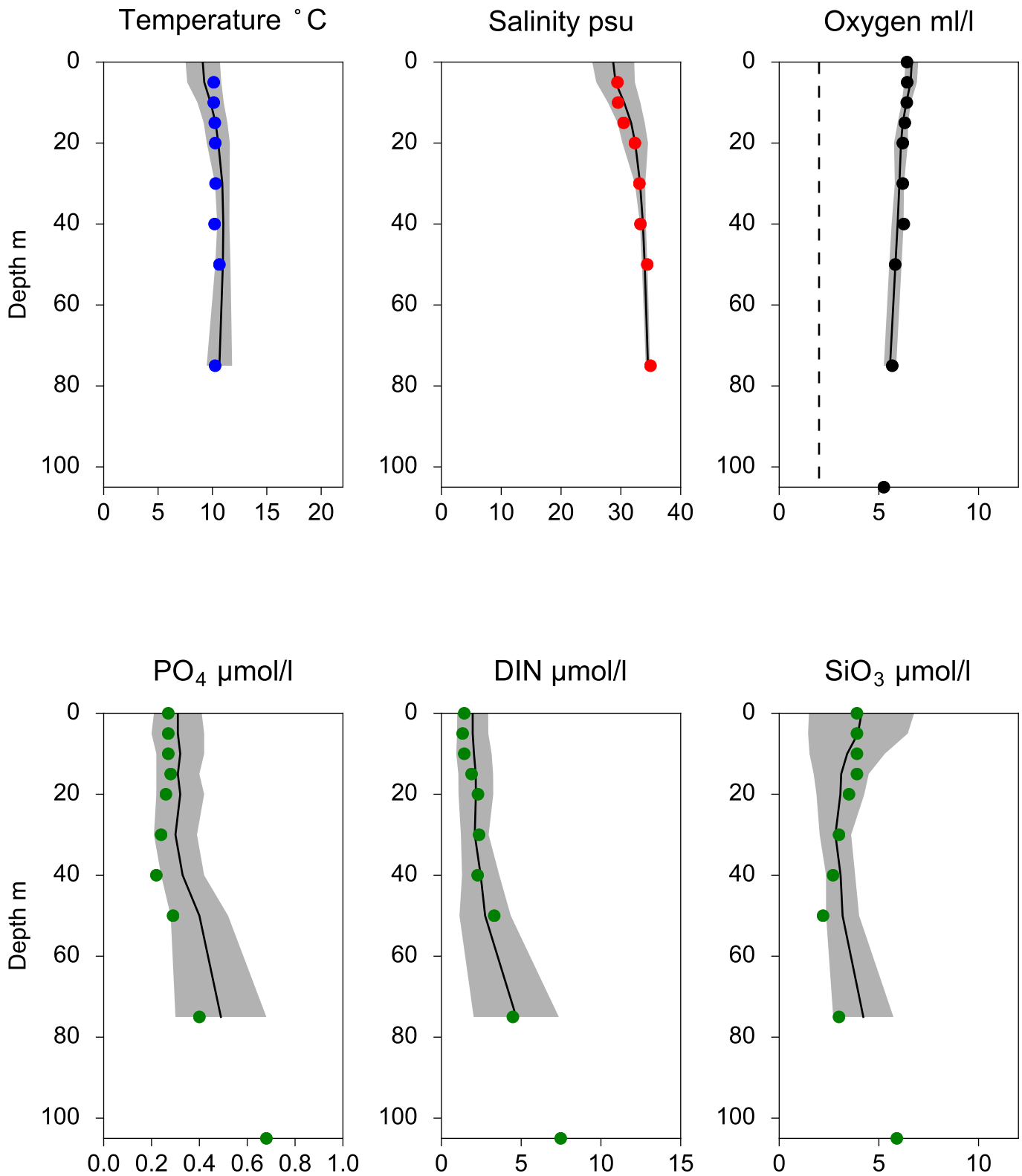


OXYGEN IN BOTTOM WATER (depth >= 80 m)



Vertical profiles Å13 November

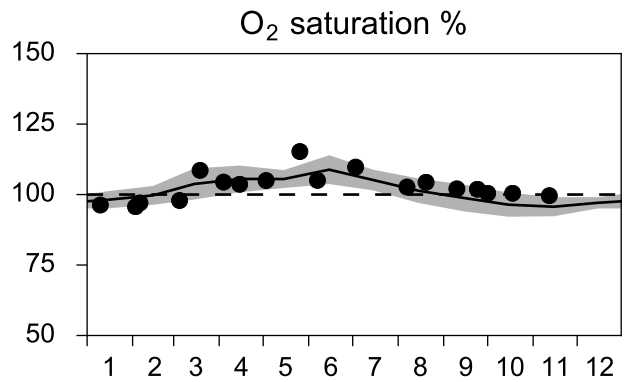
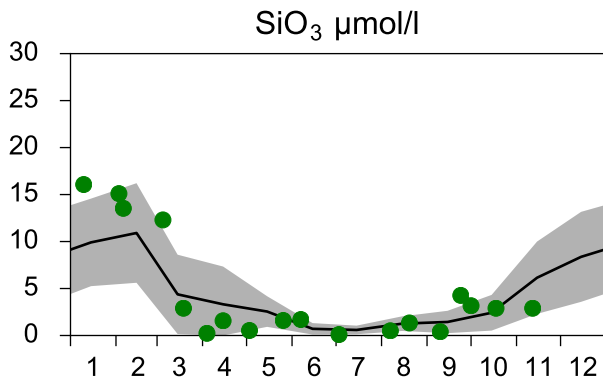
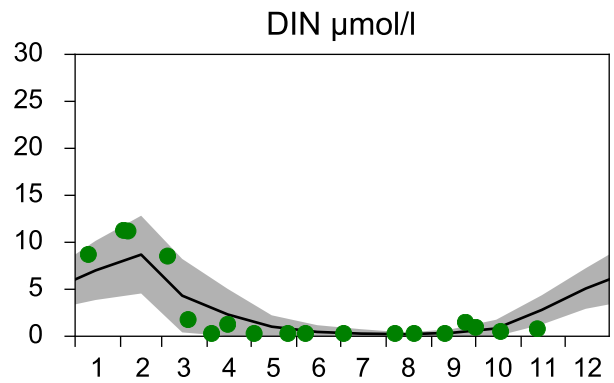
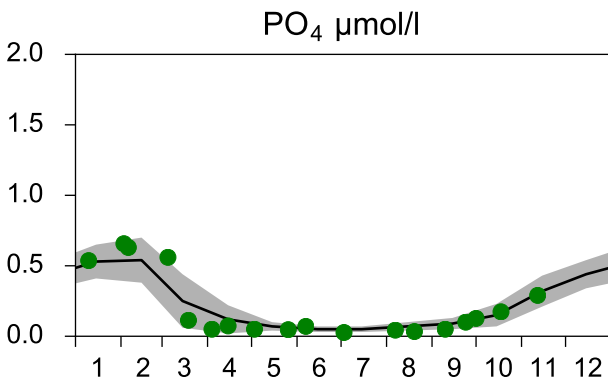
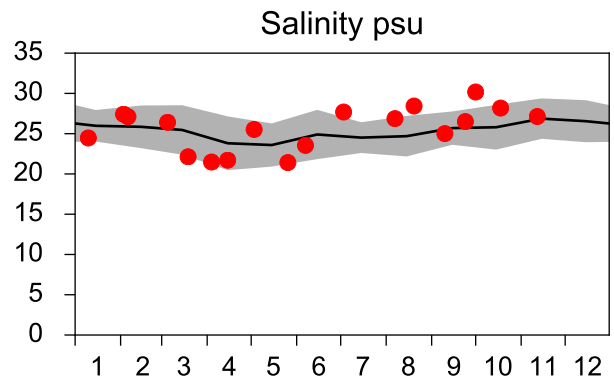
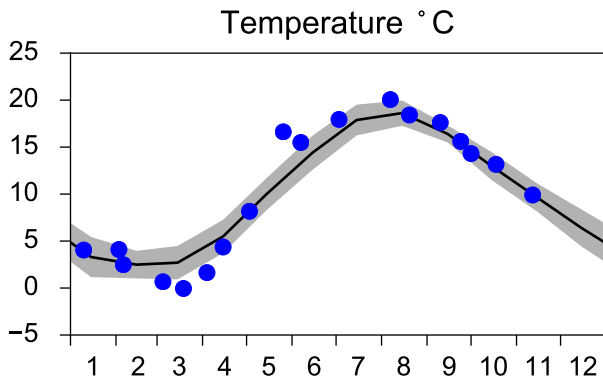
— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



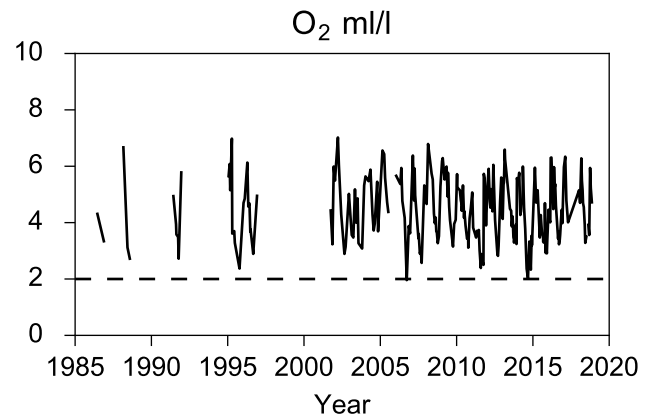
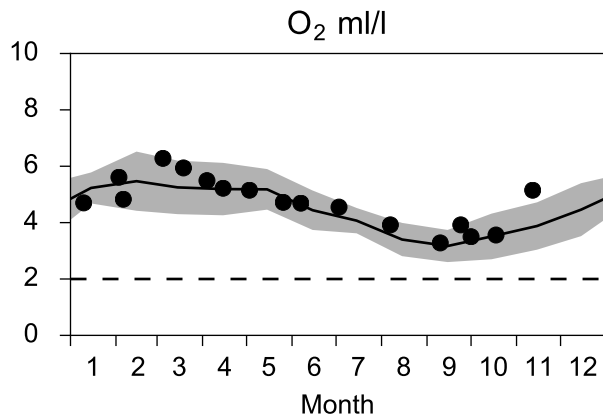
STATION SLÄGGÖ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

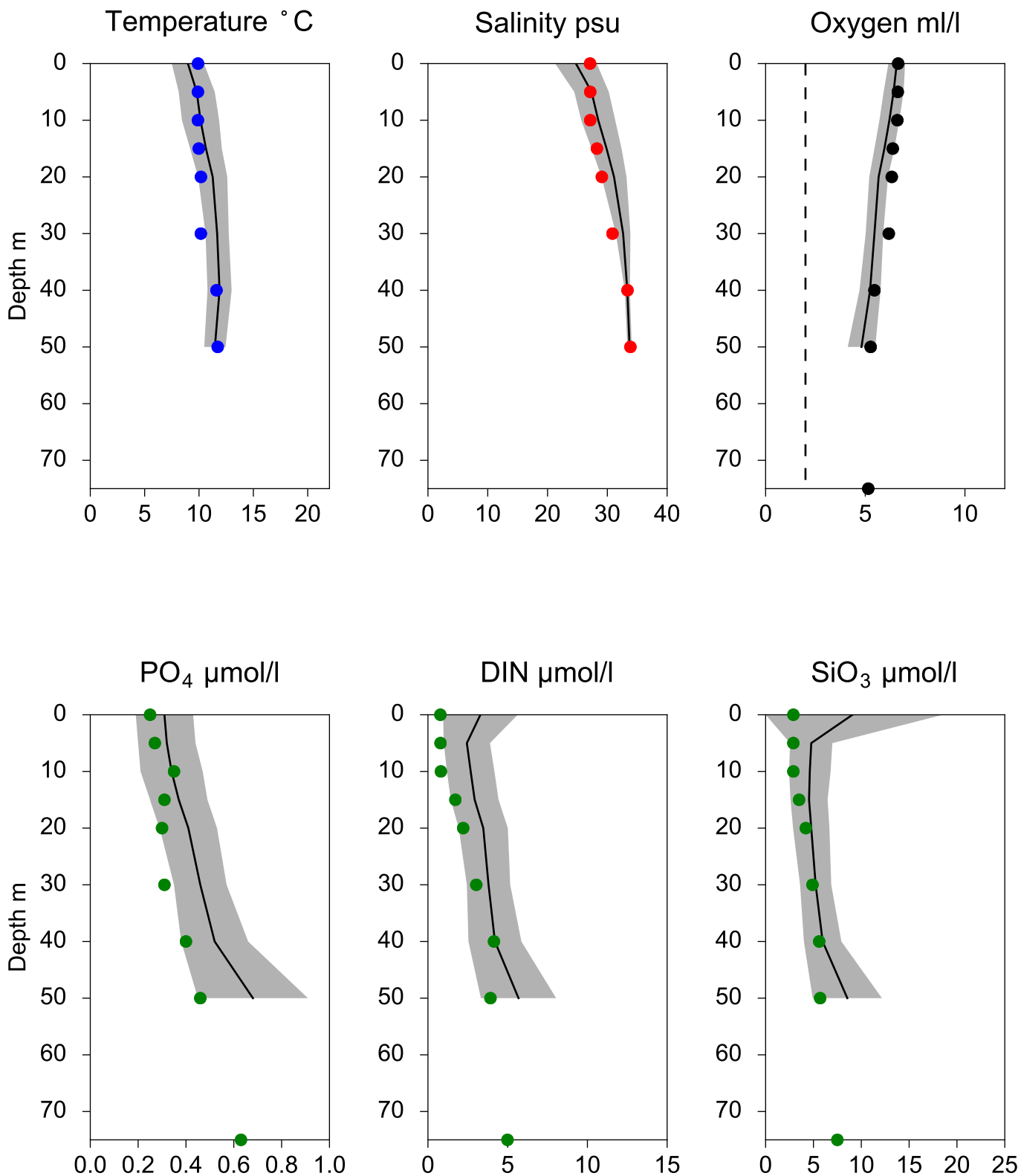


OXYGEN IN BOTTOM WATER (depth >= 64 m)



Vertical profiles SLÄGGÖ November

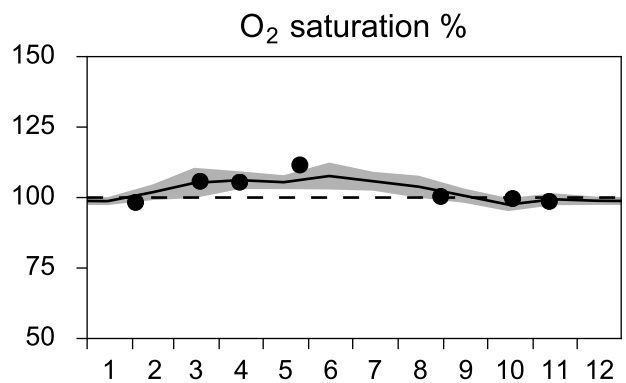
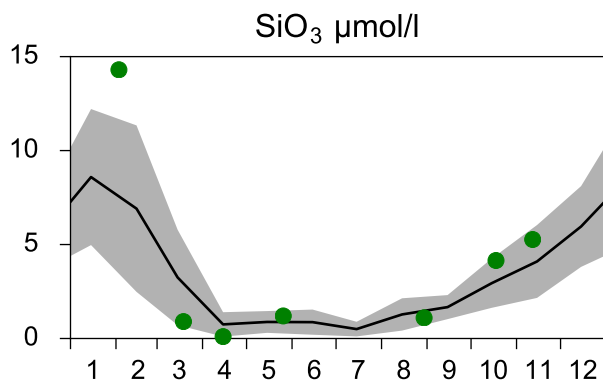
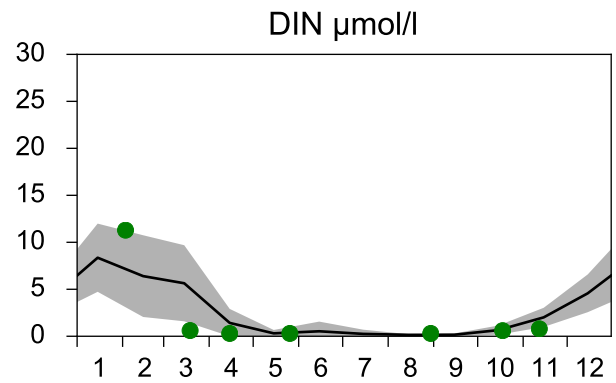
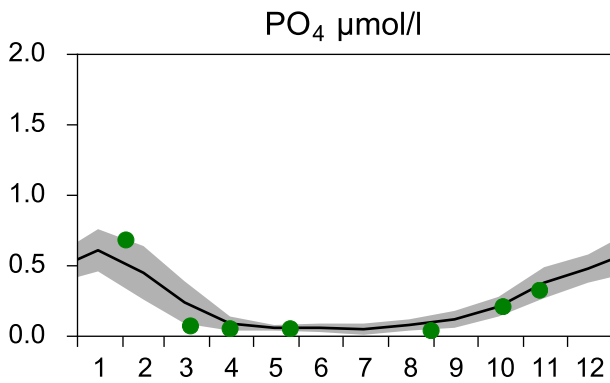
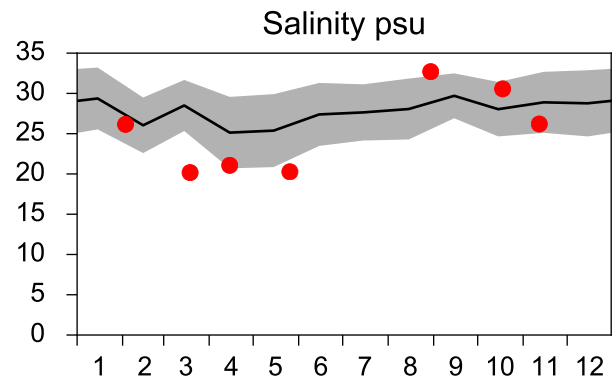
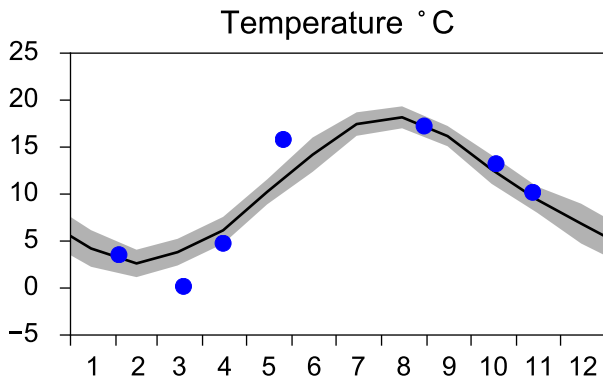
— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



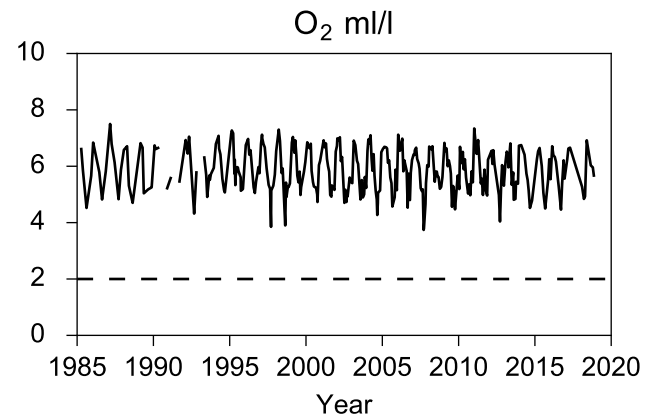
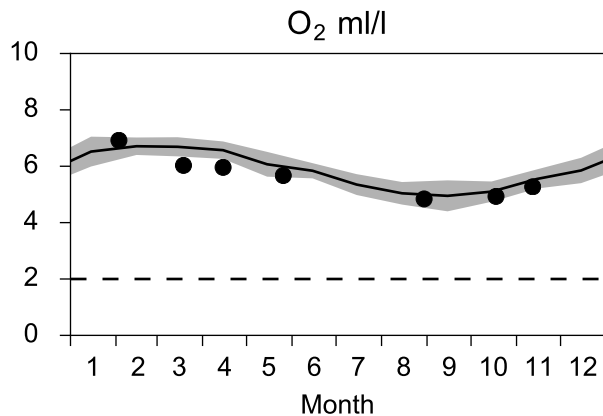
STATION P2 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

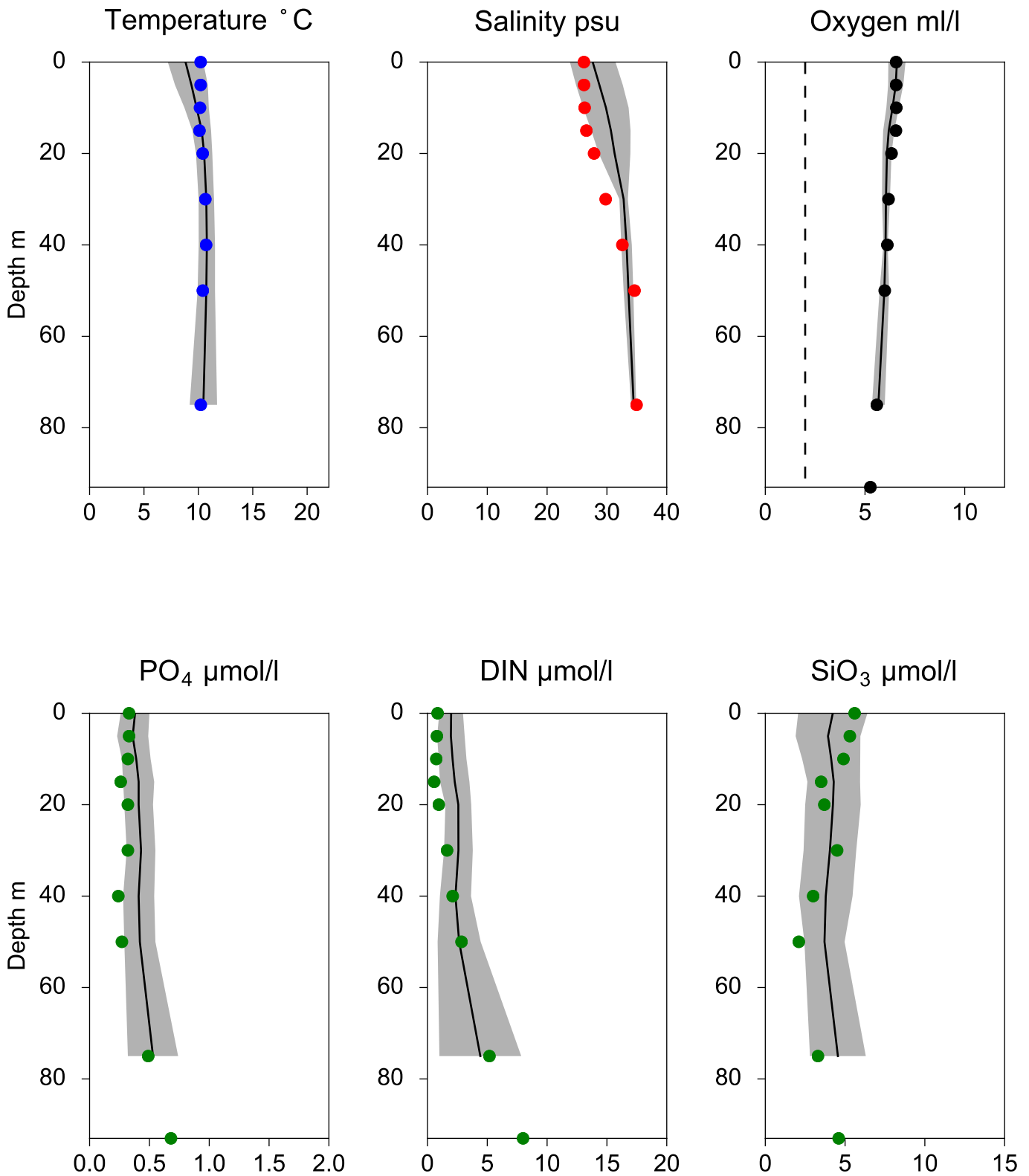


OXYGEN IN BOTTOM WATER (depth >= 75 m)



Vertical profiles P2 November

— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



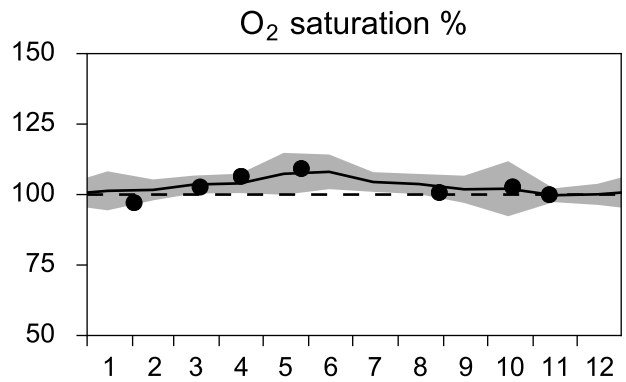
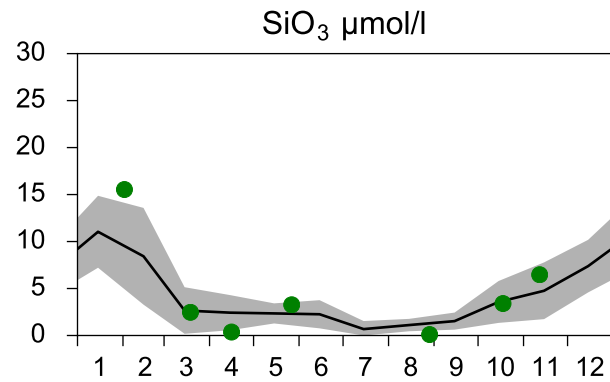
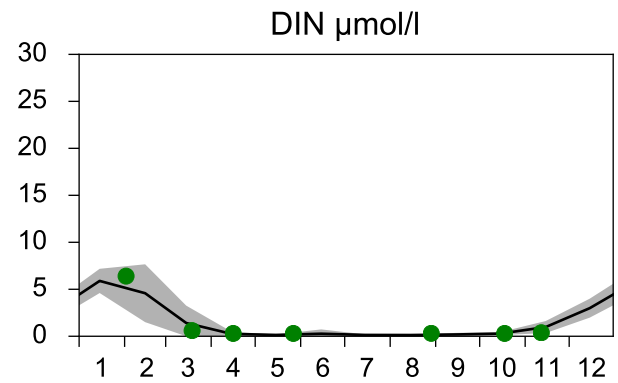
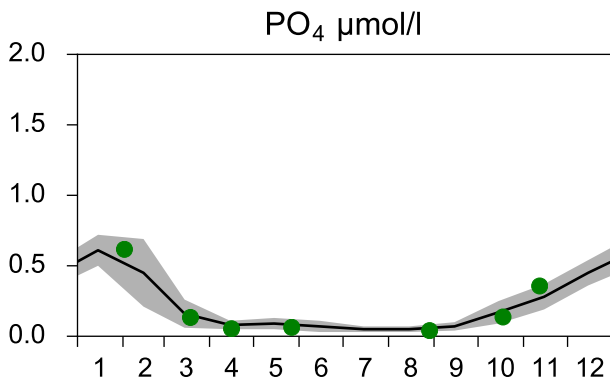
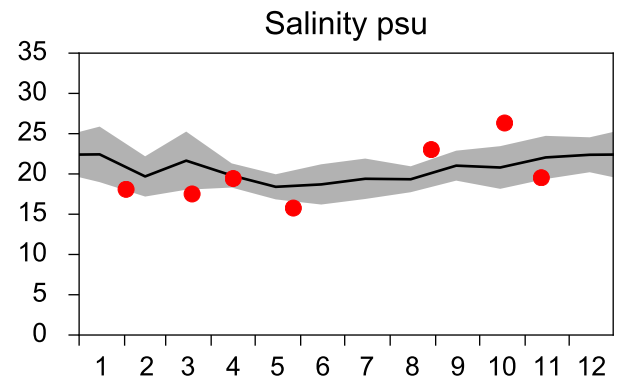
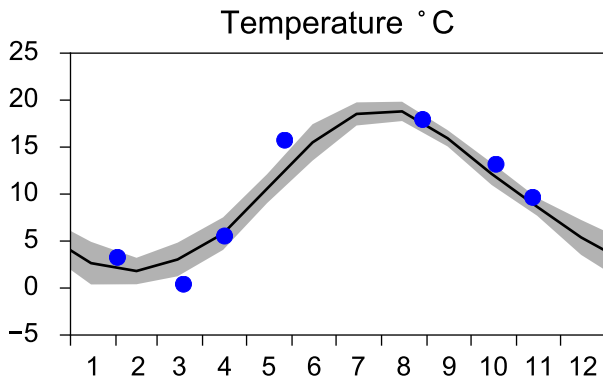
STATION N14 FALKENBERG SURFACE WATER (0-10 m)

Annual Cycles

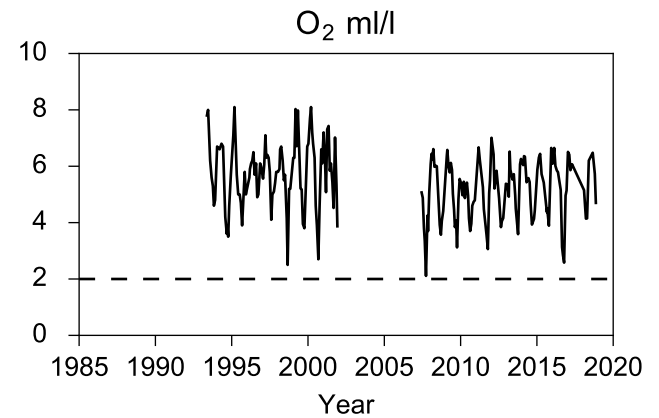
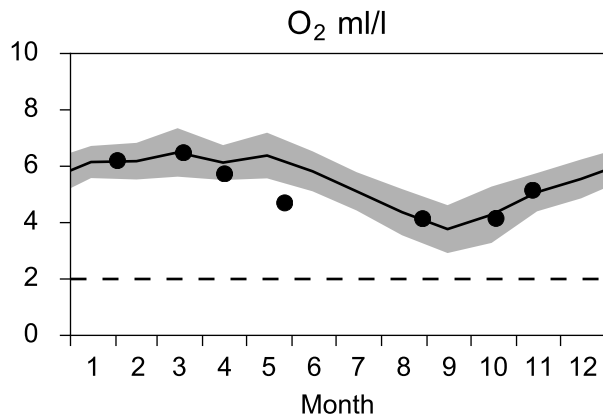
— Mean 2001-2015

■ St.Dev.

● 2018

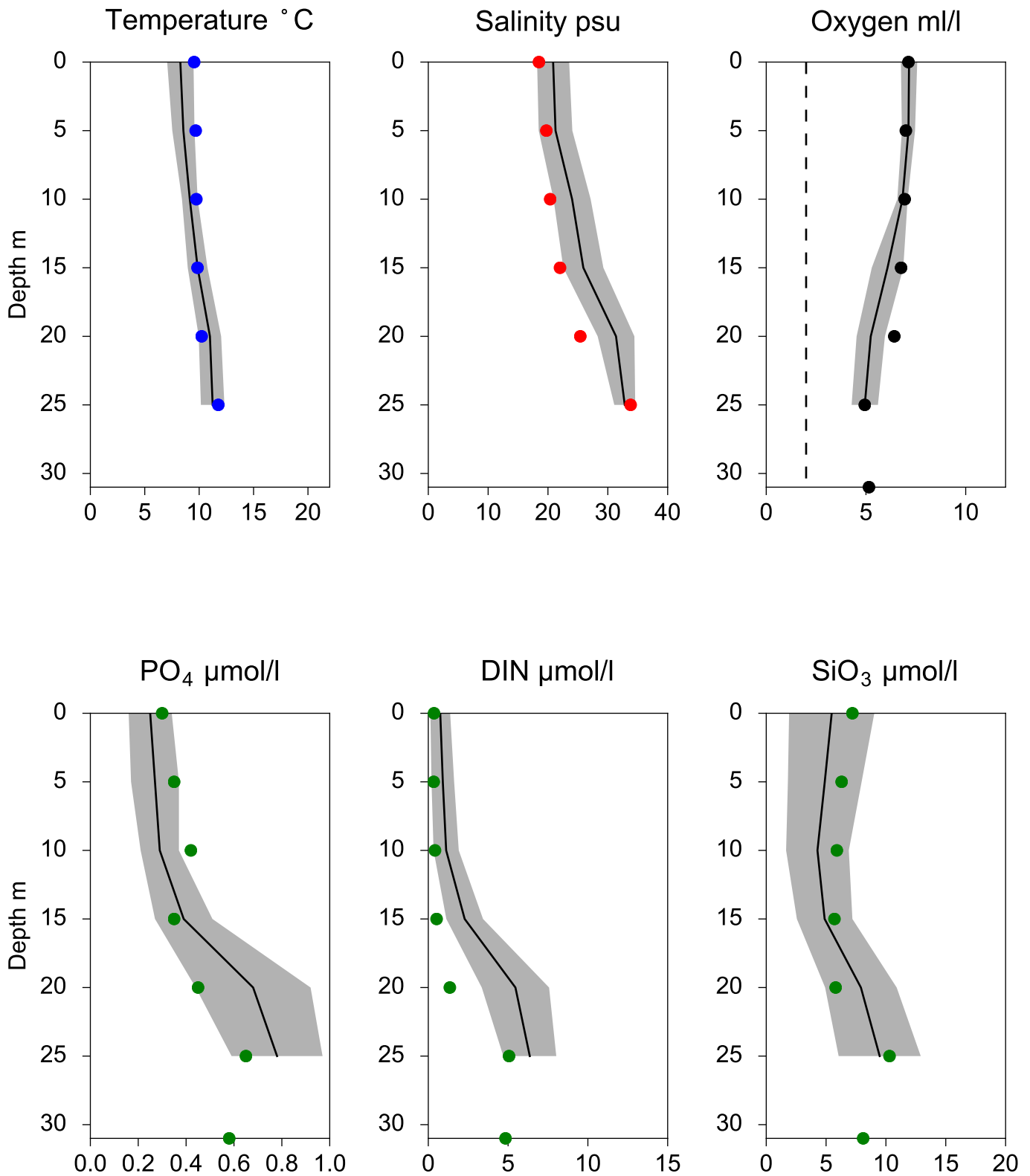


OXYGEN IN BOTTOM WATER (depth >= 25 m)



Vertical profiles N14 FALKENBERG November

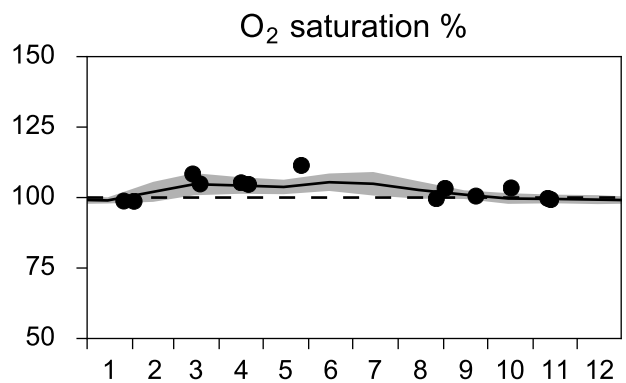
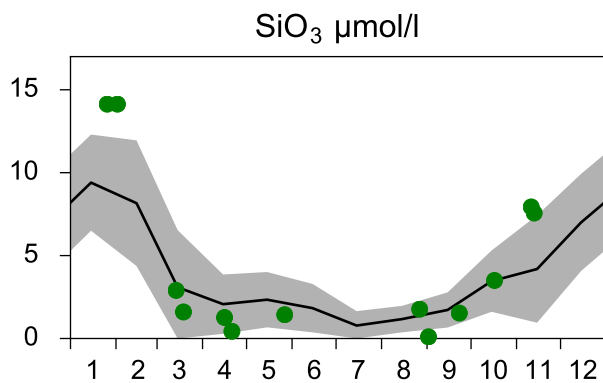
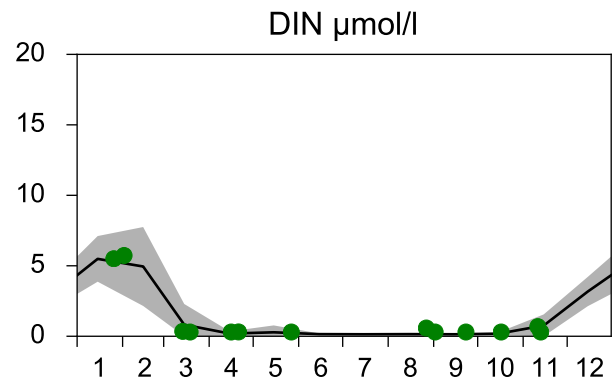
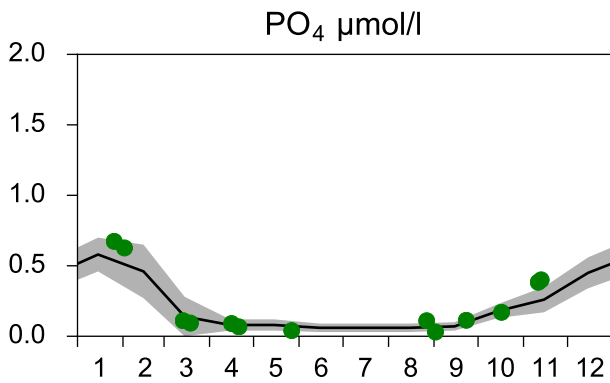
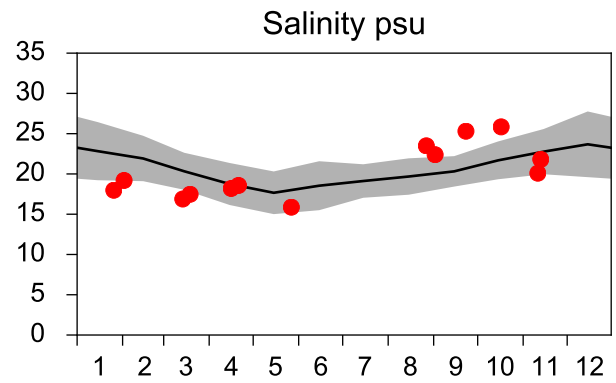
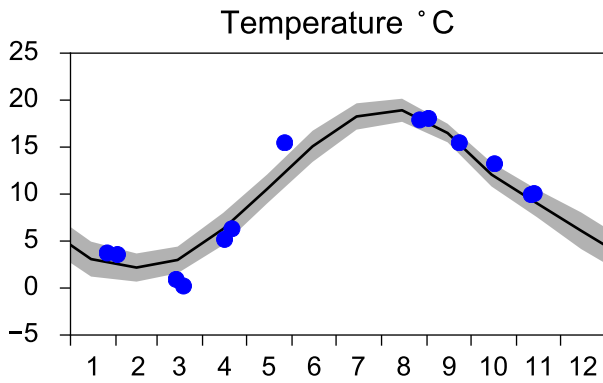
— Mean 2001-2015 ■ St.Dev. ● 2018-11-12



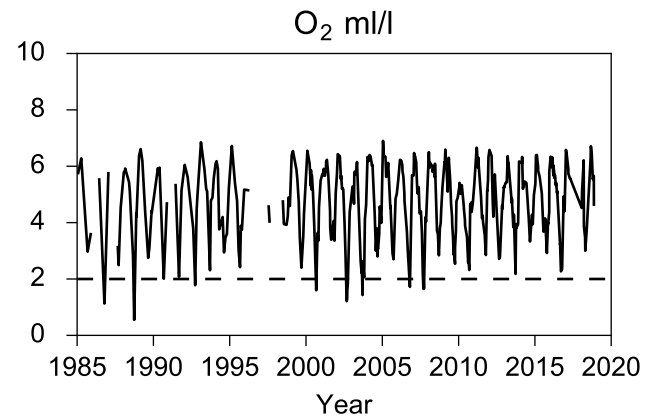
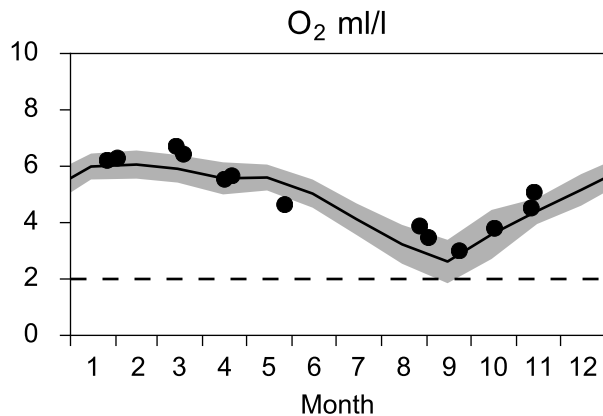
STATION ANHOLT E SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

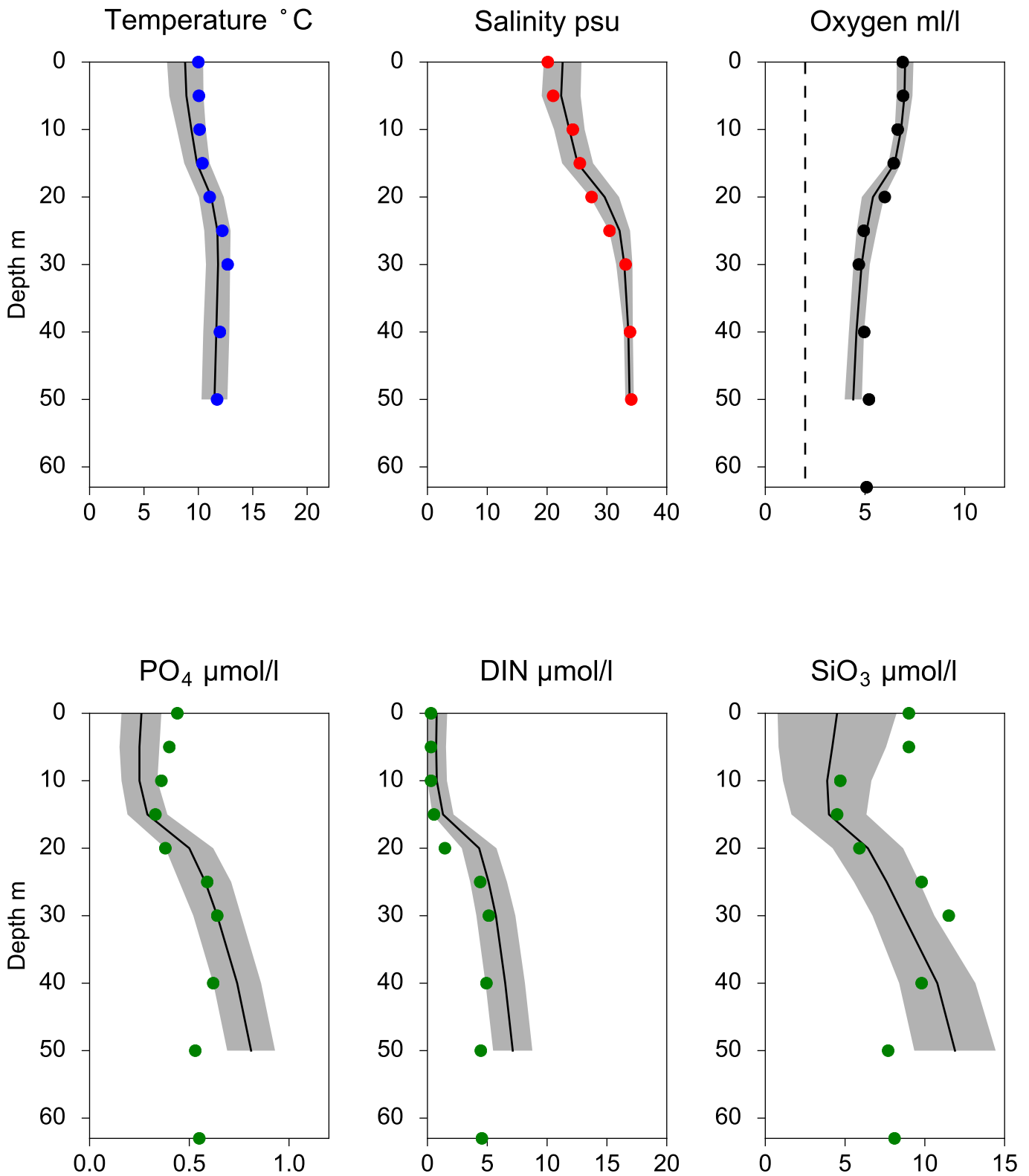


OXYGEN IN BOTTOM WATER (depth >= 52 m)



Vertical profiles ANHOLT E November

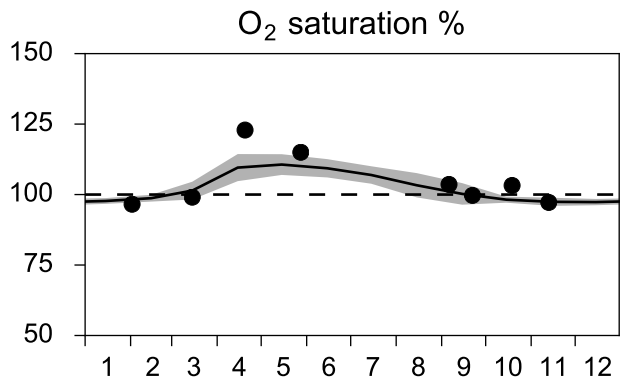
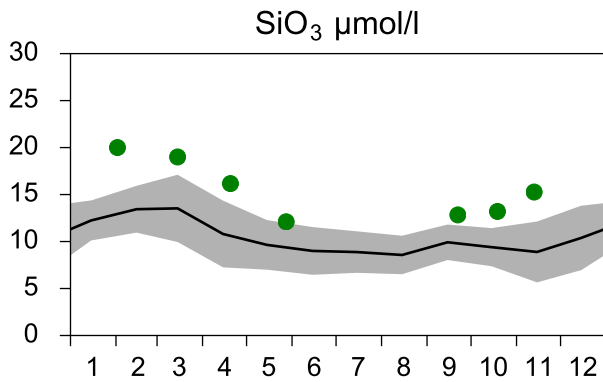
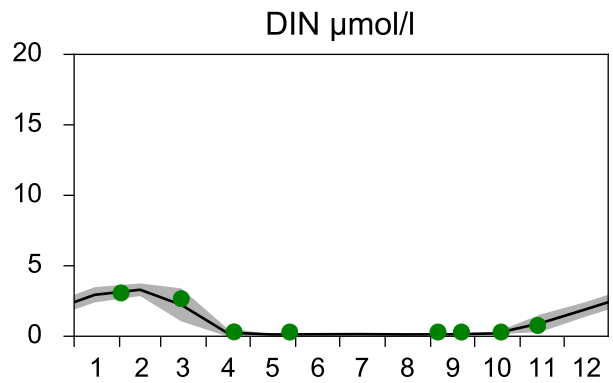
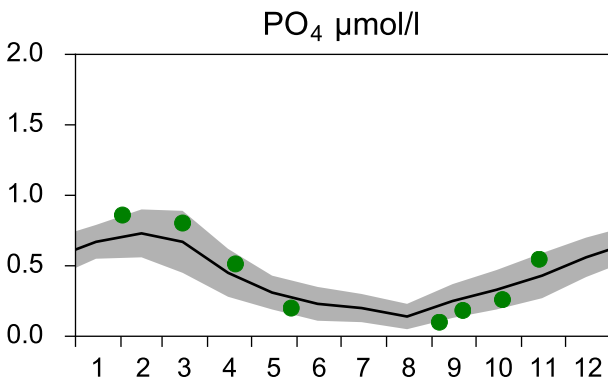
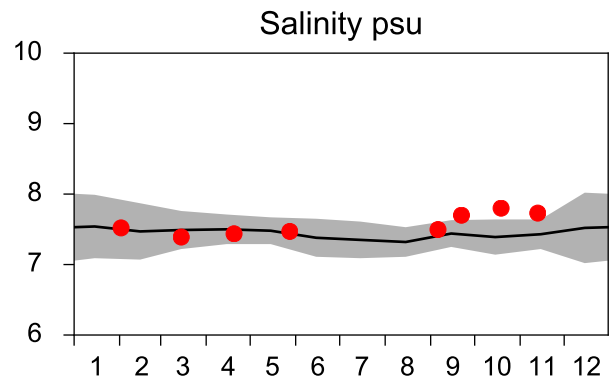
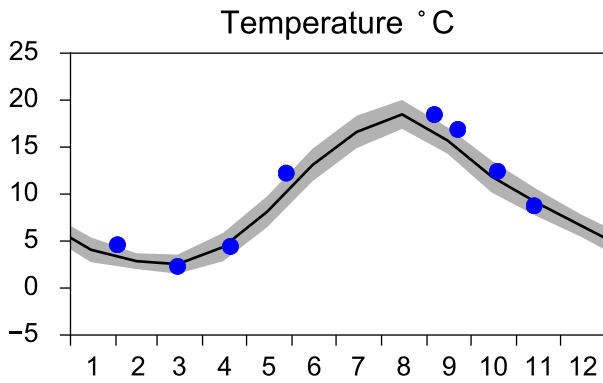
— Mean 2001-2015 ■ St.Dev. ● 2018-11-13



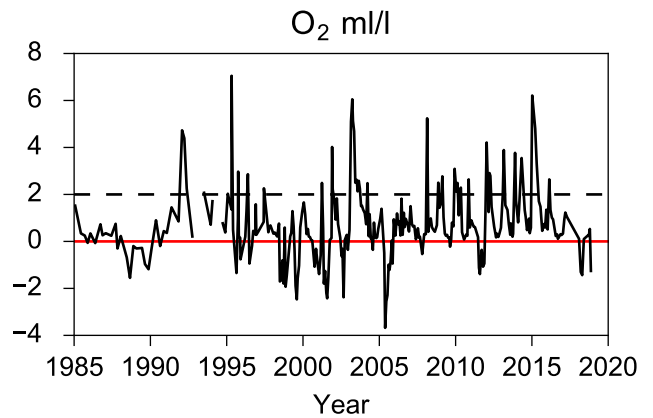
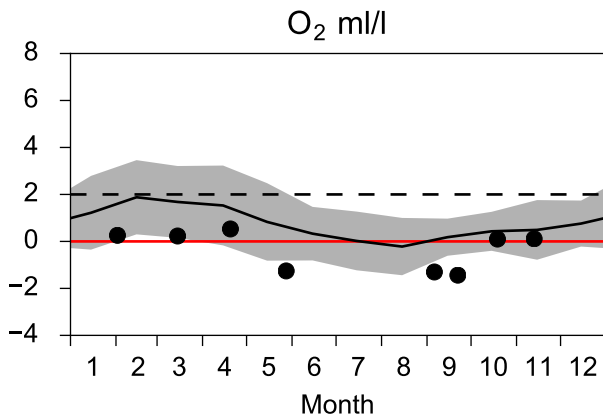
STATION HANÖBUKTEN SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

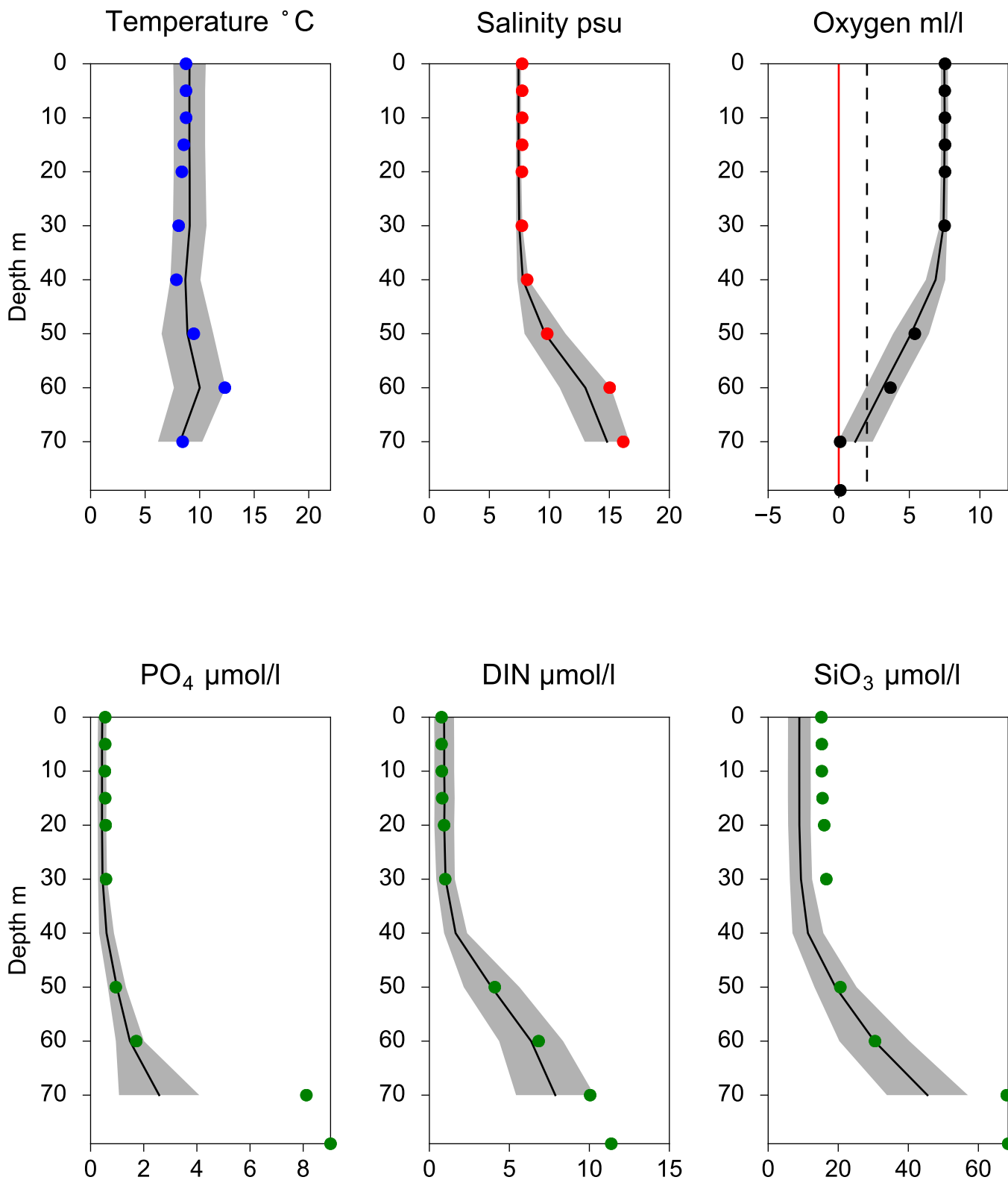


OXYGEN IN BOTTOM WATER (depth >= 70 m)



Vertical profiles HANÖBUKTEN November

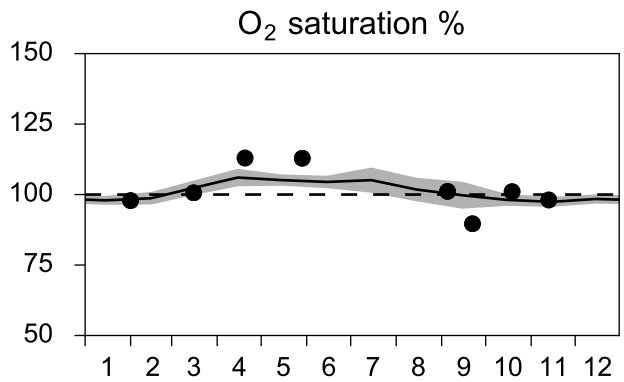
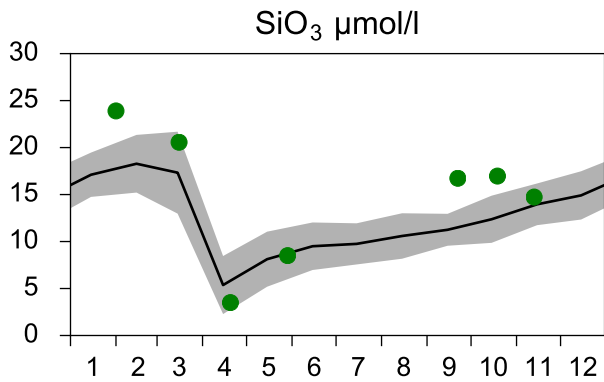
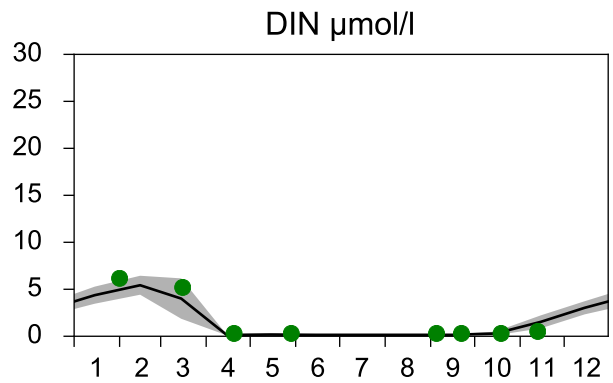
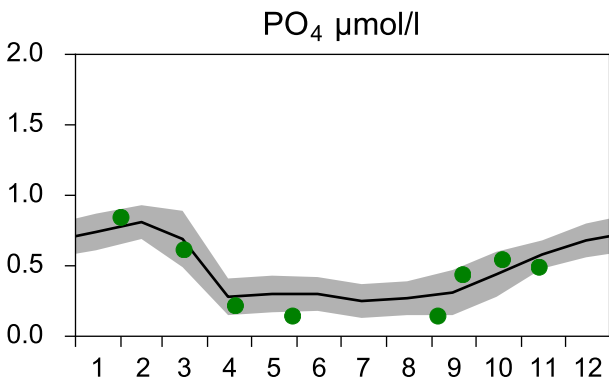
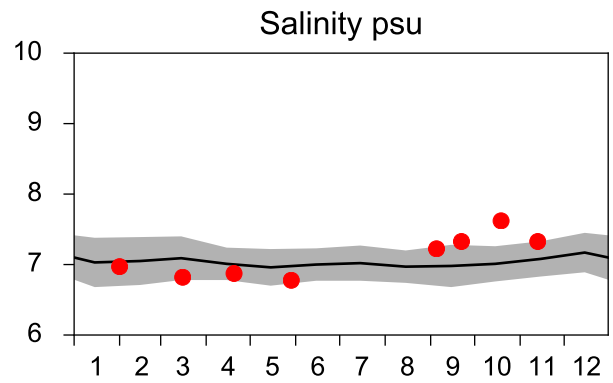
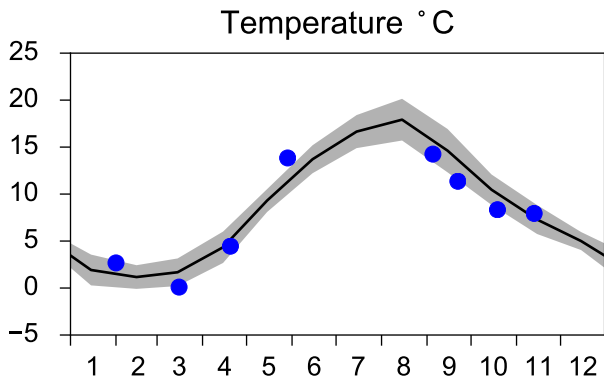
— Mean 2001-2015 ■ St.Dev. ● 2018-11-13



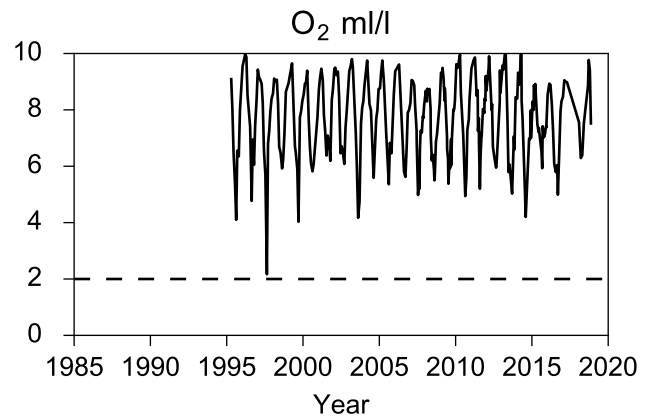
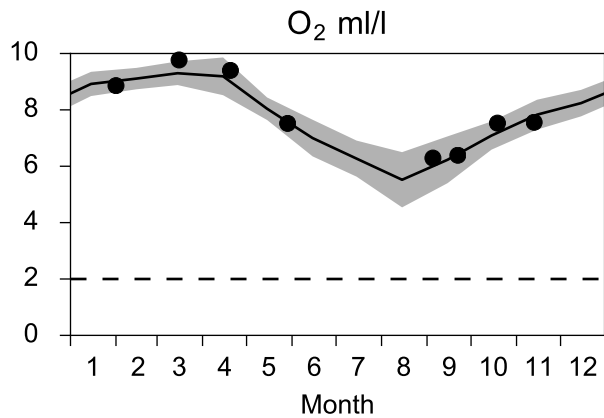
STATION REF M1V1 SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

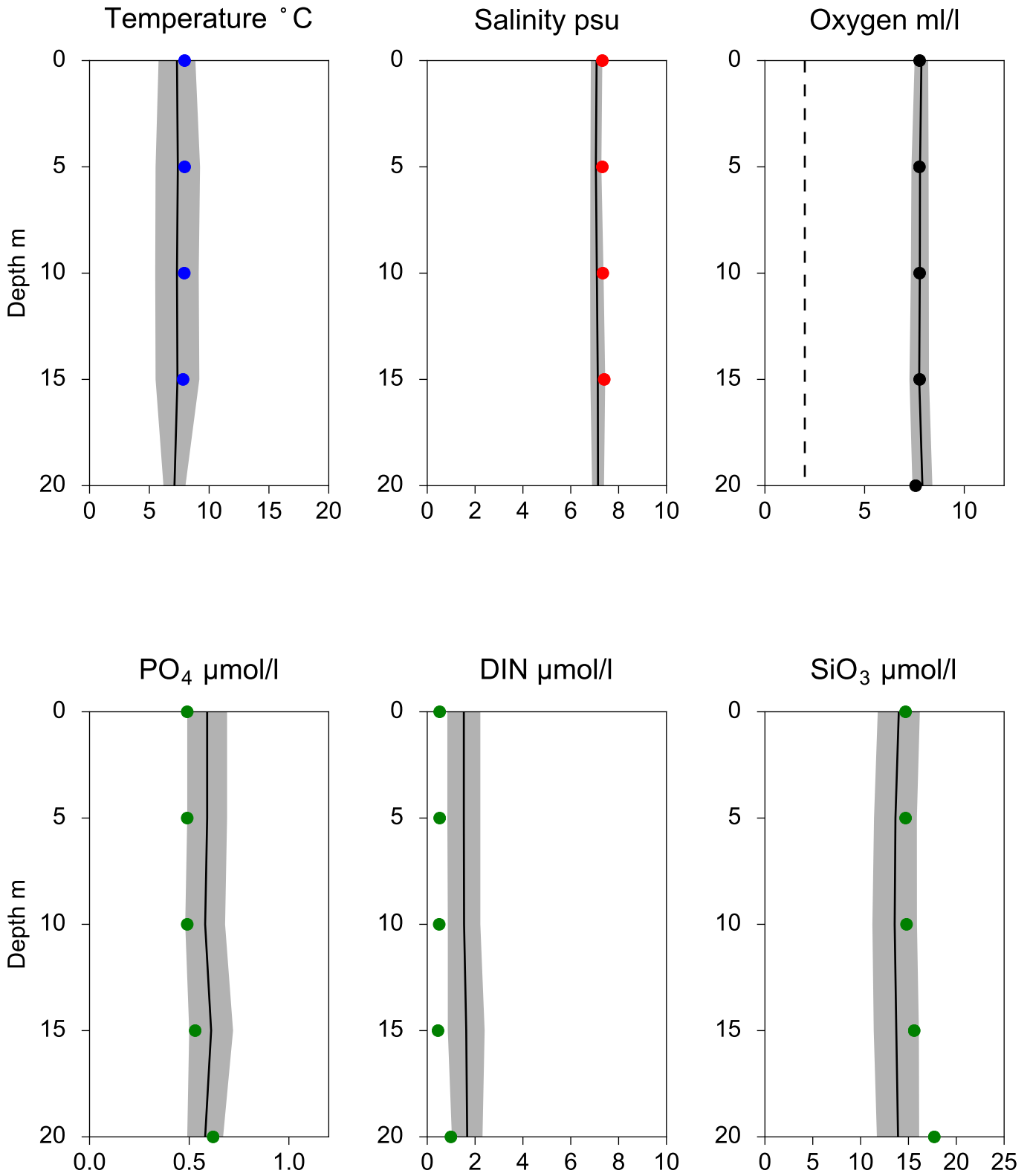


OXYGEN IN BOTTOM WATER (depth >= 17 m)



Vertical profiles REF M1V1 November

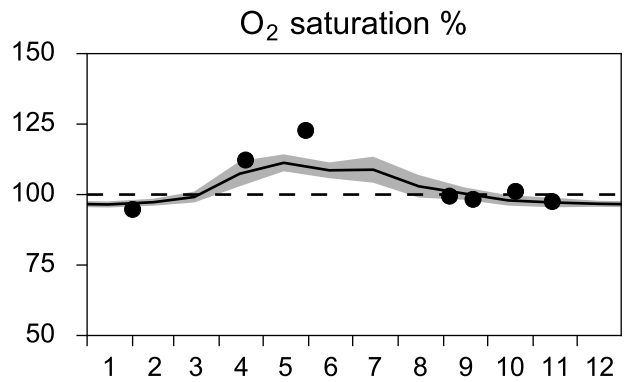
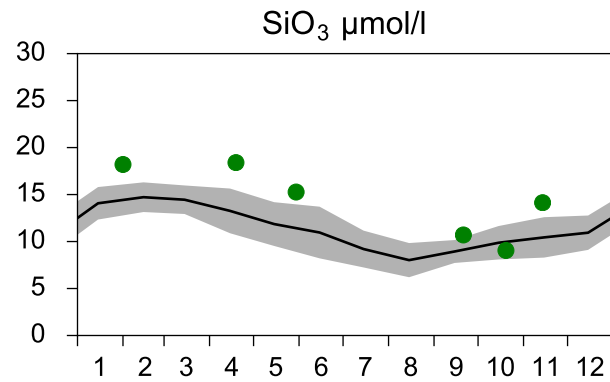
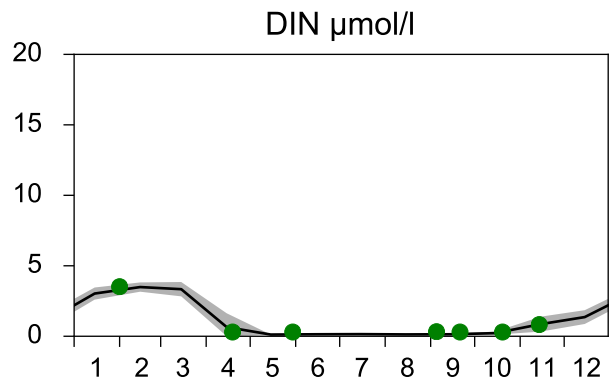
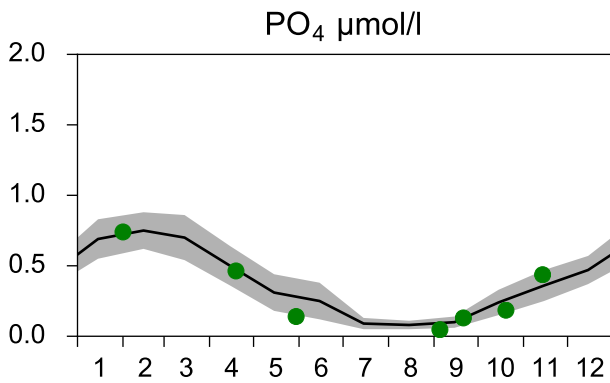
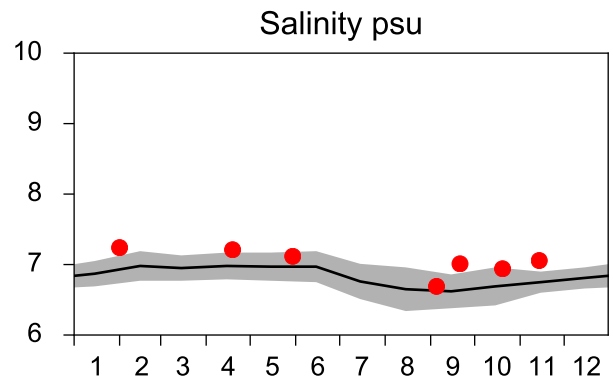
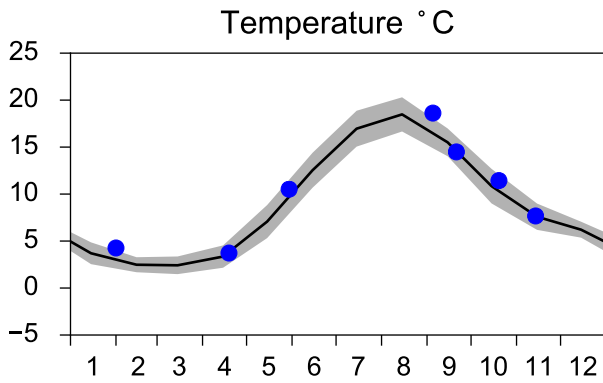
— Mean 2001-2015 ■ St.Dev. ● 2018-11-13



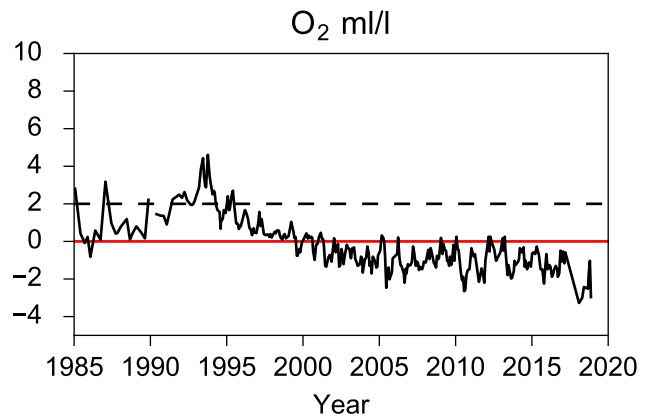
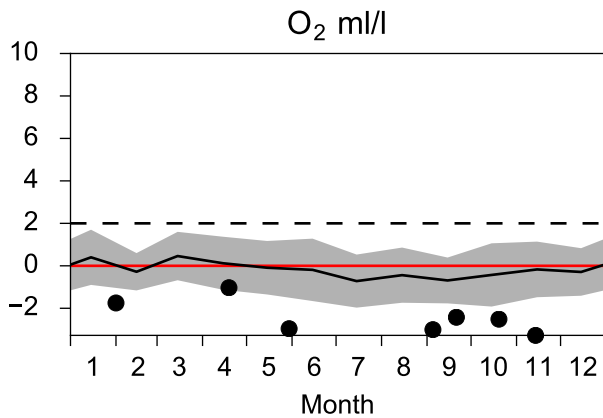
STATION BY38 KARLSÖDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

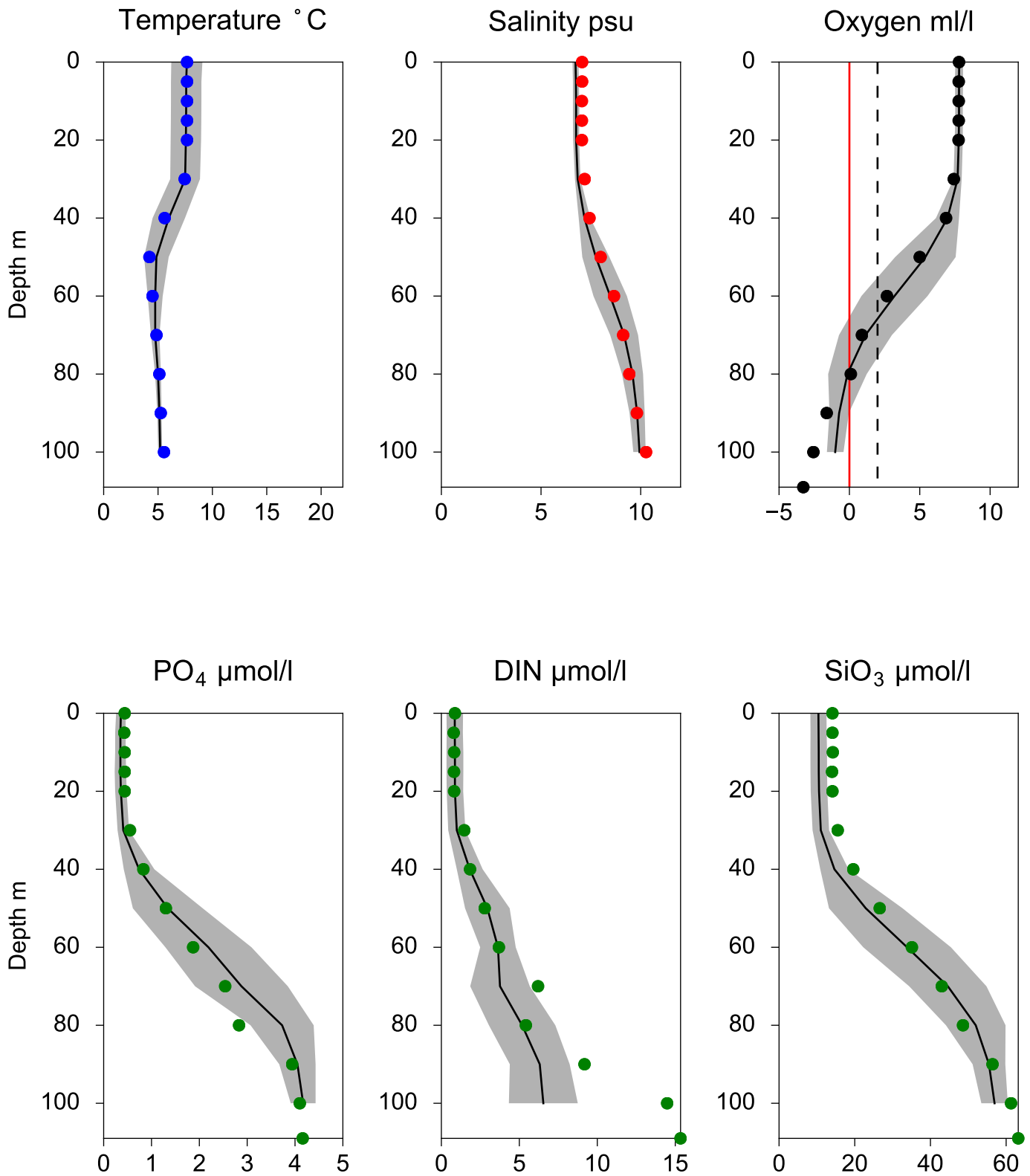


OXYGEN IN BOTTOM WATER (depth >= 100 m)



Vertical profiles BY38 KARLSÖDJ November

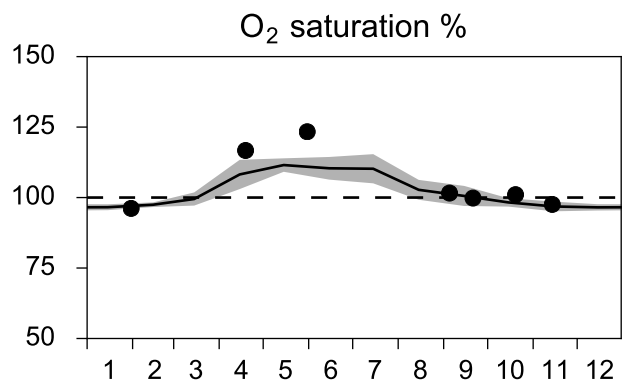
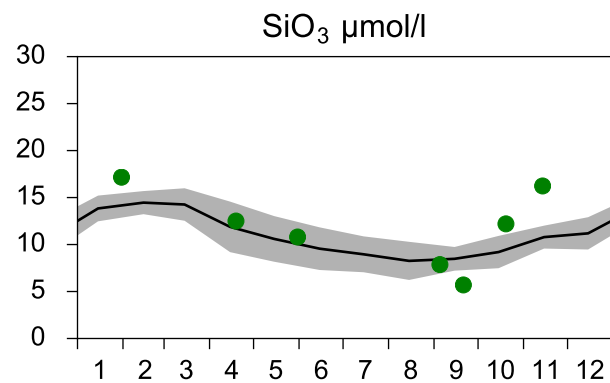
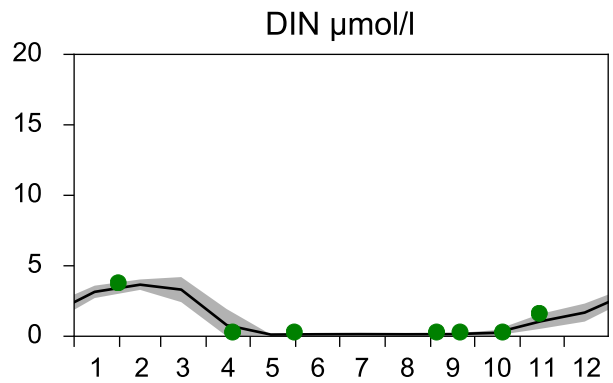
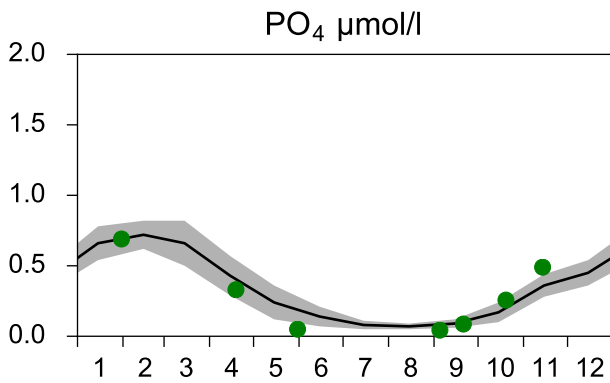
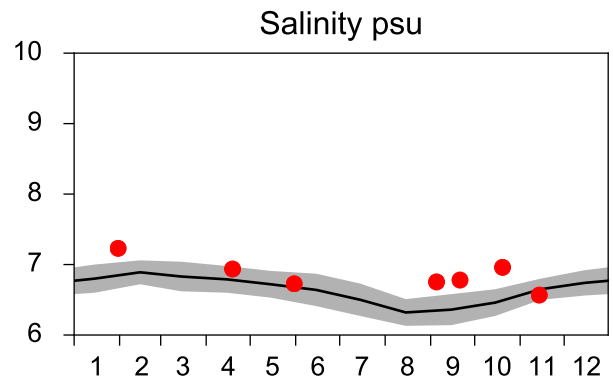
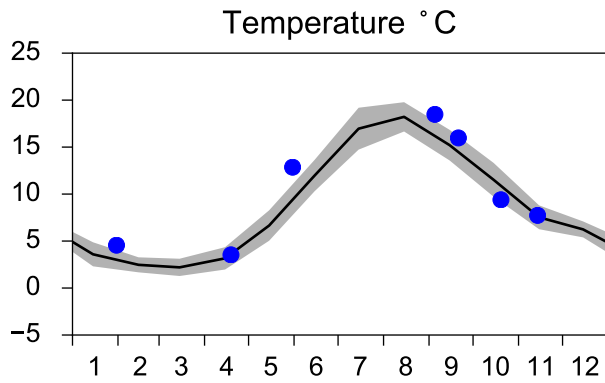
— Mean 2001-2015 ■ St.Dev. ● 2018-11-14



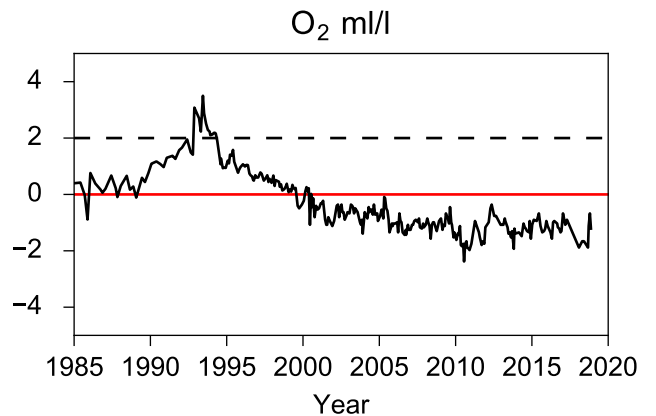
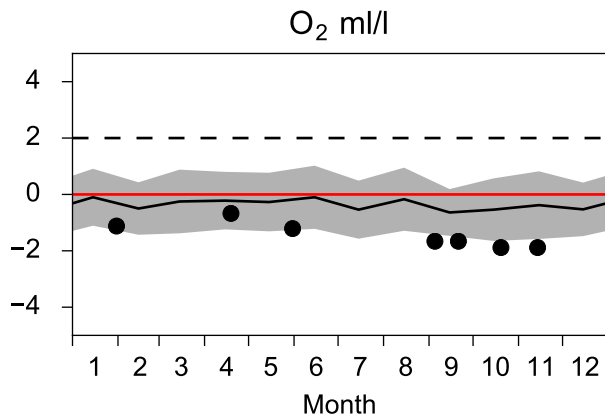
STATION BY32 NORRKÖPINGSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 St.Dev. ● 2018

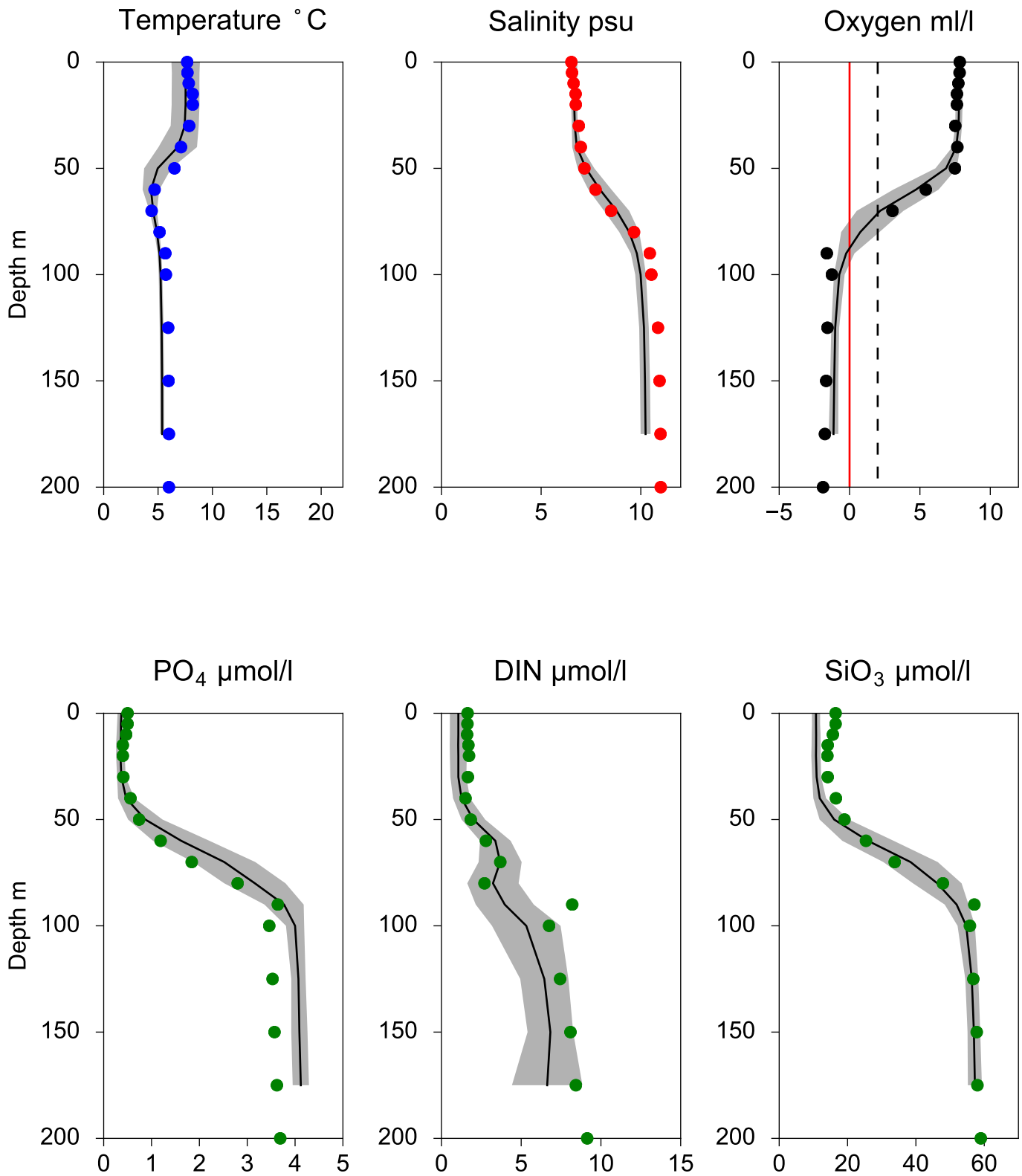


OXYGEN IN BOTTOM WATER (depth >= 175 m)



Vertical profiles BY32 NORRKÖPINGSDJ November

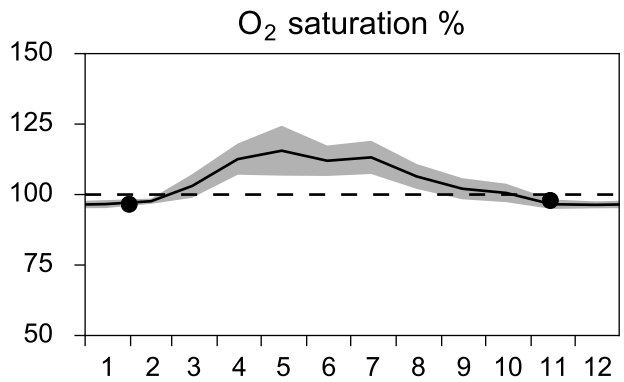
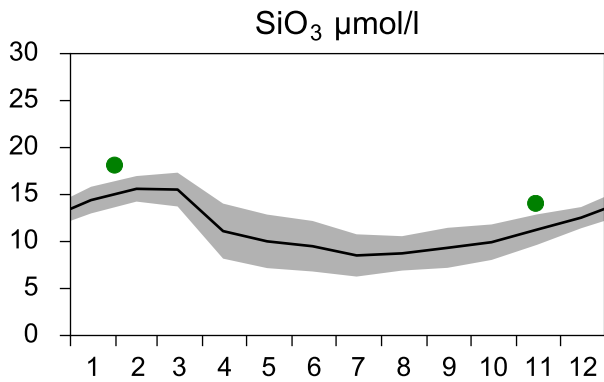
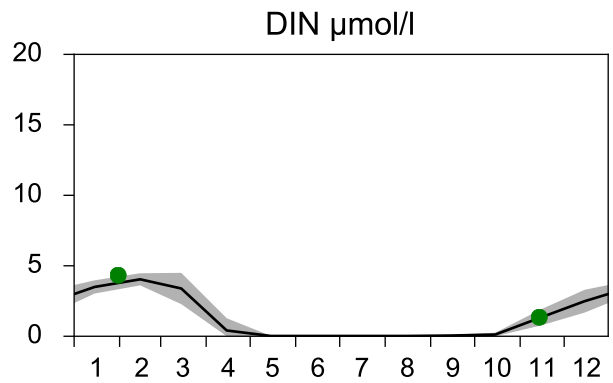
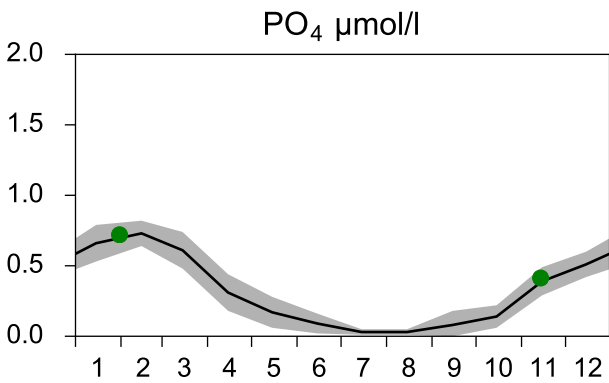
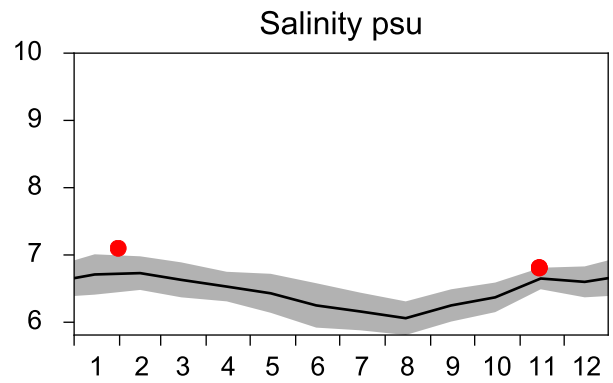
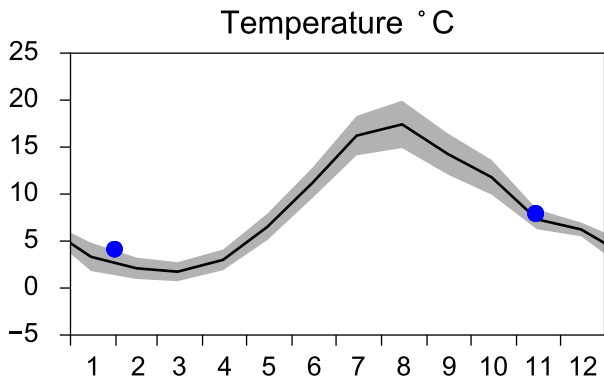
— Mean 2001-2015 ■ St.Dev. ● 2018-11-14



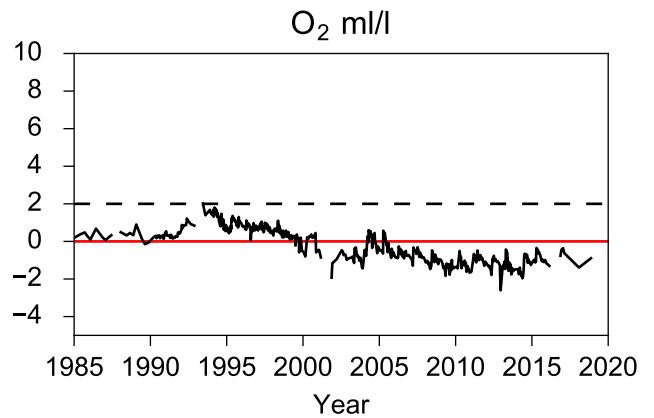
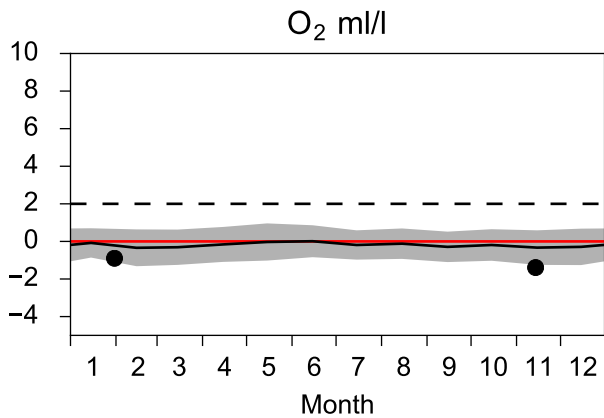
STATION BY31 LANDSORTSDJ SURFACE WATER (0-10 m)

Annual Cycles

— Mean 2001-2015 ■ St.Dev. ● 2018



OXYGEN IN BOTTOM WATER (depth >= 425 m)



Vertical profiles BY31 LANDSORTSDJ November

— Mean 2001-2015 ■ St.Dev. ● 2018-11-14

