

Supplementary material for OS-2014-42

October 19, 2014

1 Cruise track and hydrographic data for the winter cruise

The positions of the CTD stations are shown in figure 1. Figures 2 and 3 show the hydrographic data for the winter cruise. During leg 2, sampling was carried out from the ice edge to Marion Island in a straight line and then around the island in an anti-clockwise direction. The profiles for leg 2 are shown by station number rather than by latitude as the circular nature of the transect gives rise to overlaps in the latitude. The positions of the 15N stations where nitrogen uptake was measured are highlighted.

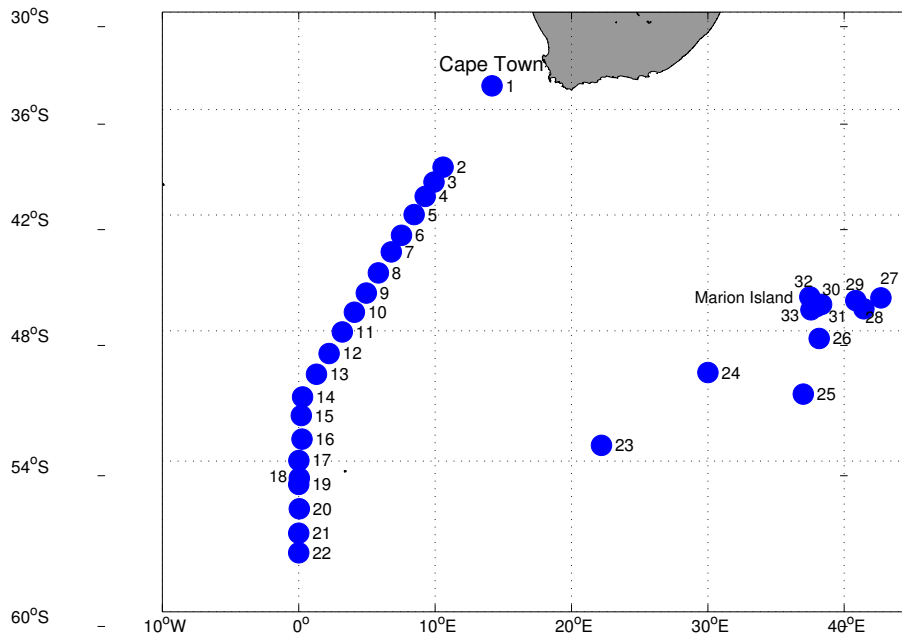
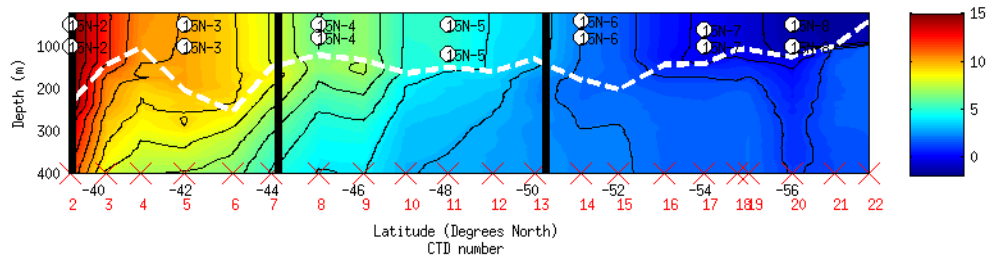
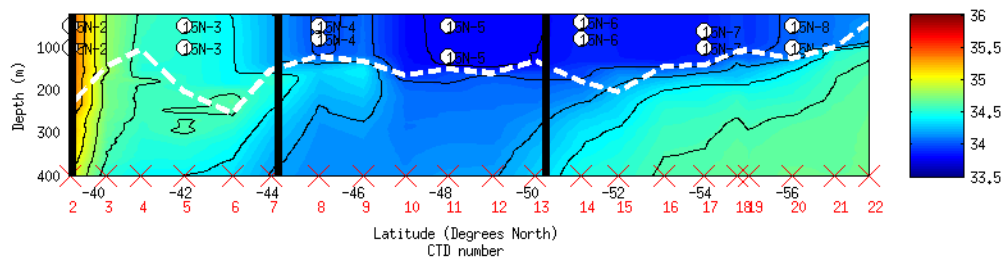


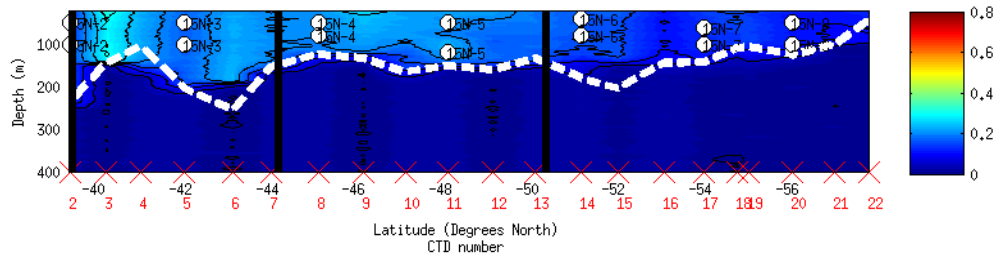
Figure 1: CTD positions for the winter cruise. The numbers represent the cruise CTD number.



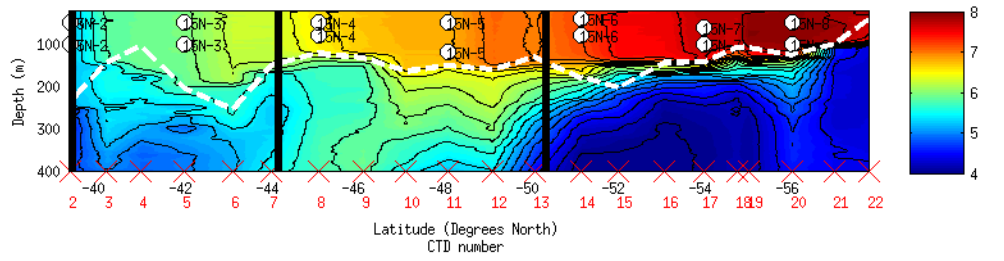
(a) Temperature ($^{\circ}\text{C}$)



(b) Salinity



(c) Chlorophyll



(d) Dissolved oxygen

Figure 2: CTD data for leg 1 of the winter cruise: (a)Temperature ($^{\circ}\text{C}$) (b)Salinity (psu) (c) Chlorophyll ($\text{mg} \cdot \text{m}^{-3}$) (d)Oxygen ($\text{mL} \cdot \text{L}^{-1}$). The red crosses and numbers represent all the CTD stations during this leg. The white circles are for stations where ^{15}N tracer experiments were run. The black lines from left to right show the STF, SAF and the PF and the white dotted line shows the mixed layer depths.

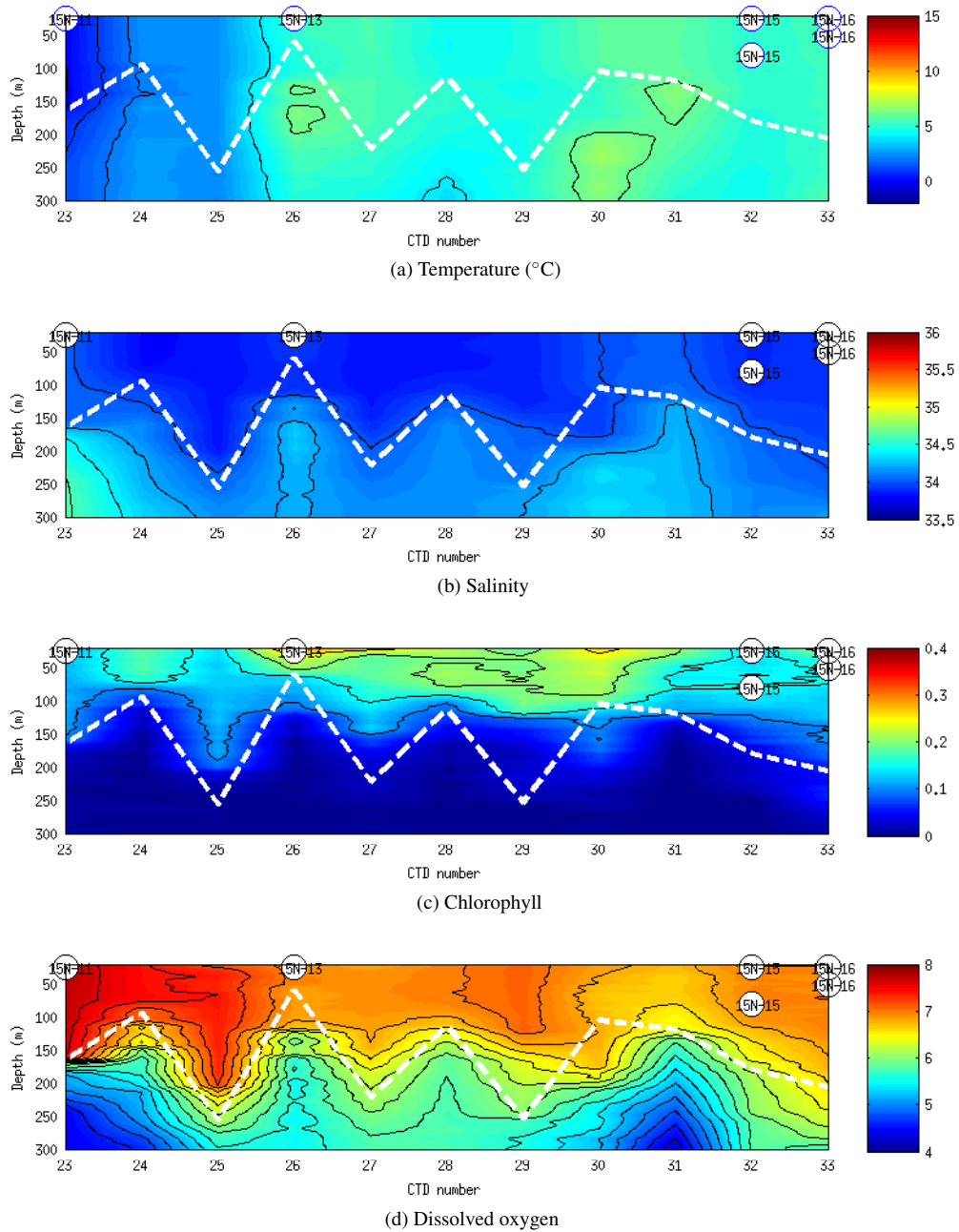


Figure 3: CTD data for leg 2 of the winter cruise: (a)Temperature (°C) (b)Salinity (psu) (c) Chlorophyll ($\text{mg} \cdot \text{m}^{-3}$) (d)Oxygen ($\text{mL} \cdot \text{L}^{-1}$). The stations here are labelled based on the CTD numbers rather than latitude. The white line represents the mixed layer depths and the white circles the primary productivity stations.

2 Ammonium uptake rates

The concentration effects of ammonium on ammonium uptake were investigated by plotting the ammonium uptake rates against Atom Enrichment percent (AE%) in order to determine whether the addition of the ammonium tracer affected the uptake rates (figure 4)

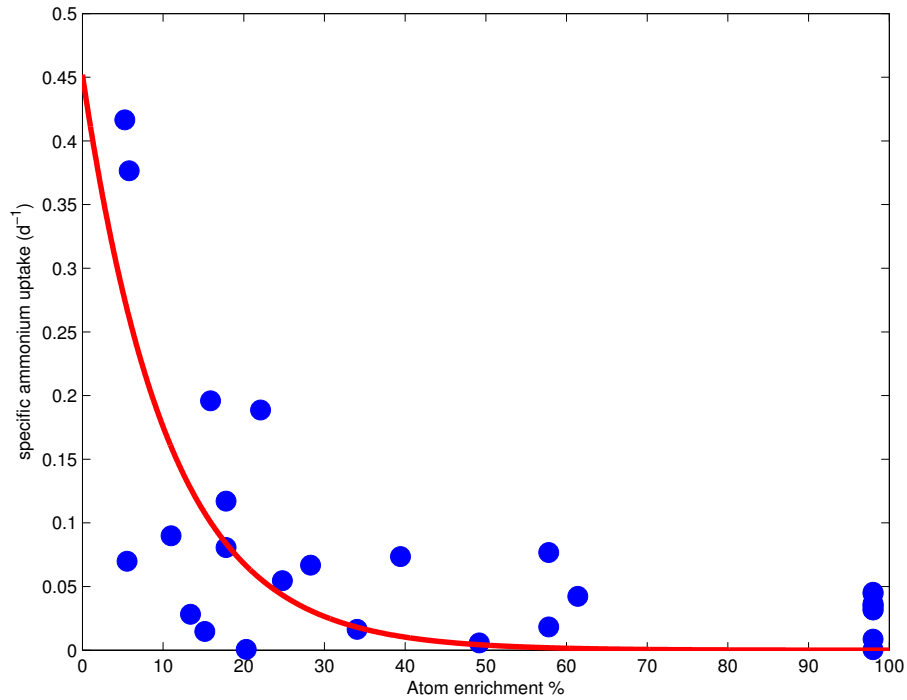


Figure 4: Plot of ammonium uptake vs Atom Enrichment % of ammonium.

3 Comparison of integrated nitrogen uptake rates

Table 1: Overview and comparison of integrated nitrogen uptake rates, ρ_{NO_3} and ρ_{NH_4} ($\text{mmol N m}^{-2}\text{d}^{-1}$). Average rates and the range are presented here

Integrated ρ_{NO_3}		Integrated ρ_{NH_4}		Month	Reference
mean	range	mean	range		
0.34	0.16–0.65	5.605	1.4–11	February – March	this study
1.14	0.16–5.2	6.7	0.6–33	July	this study
3.01	1.8–6.6	1.1	0.55–2.2	March	Nelson and Smith (1990)
1.47	0.29–2.5	3.01	0.66–9.7	April–May	Cota et al (1992)
3.33	0.79–8.6	14	2.7–39.2	April	Thomalla (2011)
1.49	0.80–2.5	3.6	0.35–11	February	Sambrotto and Mace (2000)
4.37	1.3–8.9	2.3	1.6–2.9	October	Savoye (2004)
5.25	1.9–9.3	4.6	1.5–10	November	Nelson and Smith (1990)
10.43	0.90–35	12.6	2.8–23	November	Waldron (1995)
6.10	1.90–13	5.7	3.3–8.8	December	Sambrotto and Mace (2000)
1.50	0.30–4.1	1.1	0.80–1.6	December–April	Gandhi (2012)
4.07	(3.6–4.6)	1.4	(1.0–1.9)	December	Savoye (2004)