Supporting information for:

Controls on nitrite oxidation in the upper Southern Ocean: insights from winter kinetics experiments in the Indian sector

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Contents of this file

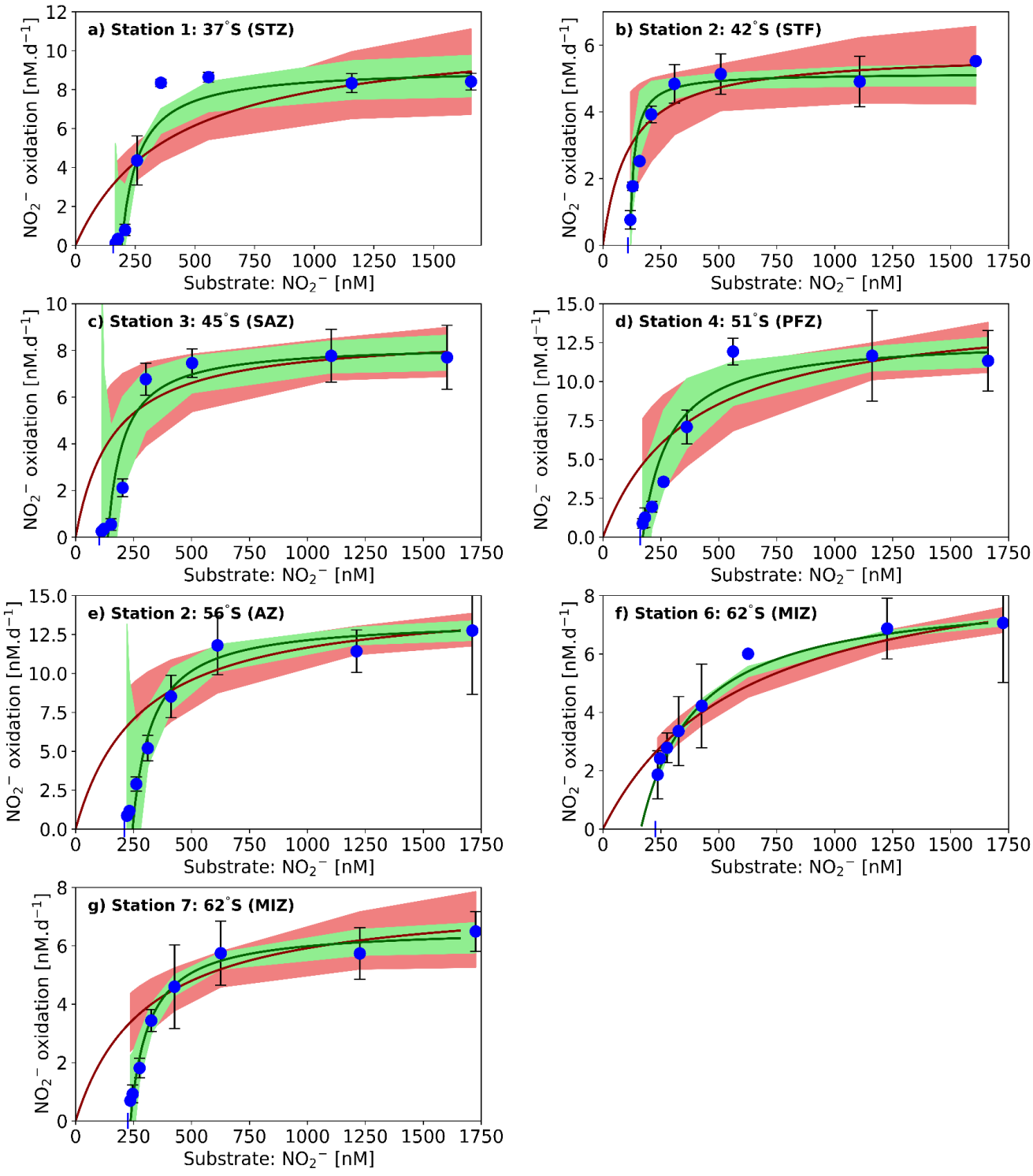

Figure S1: The two kinetics curves fitted using two different kinetics models (see section 2.2.3 of the main text). Panel a) St 01: 37°S (STZ), b) St 02: 42°S (STF), c) St 03: 45°S (SAZ), d) St 04: 51°S (PFZ), e) St 05: 55°S (AZ), f) St 06: 62°S (MIZ), and g) St 07: 62°S (MIZ). The solid lines show the Michaelis-Menten (MM) fits – the red line is the MM curve fit using the traditional model (equation 2) while the blue line is the modified MM curve defined by equation 3. For the derived kinetic parameters associated with both models, see Table S1. Error bars indicate the standard error of replicate experiments, each measured at least twice. Where errors bars are not visible, they are smaller than the data markers. The red and green shaded areas are the 95% confidence intervals associated with the models described by equations 2 and 3, respectively.

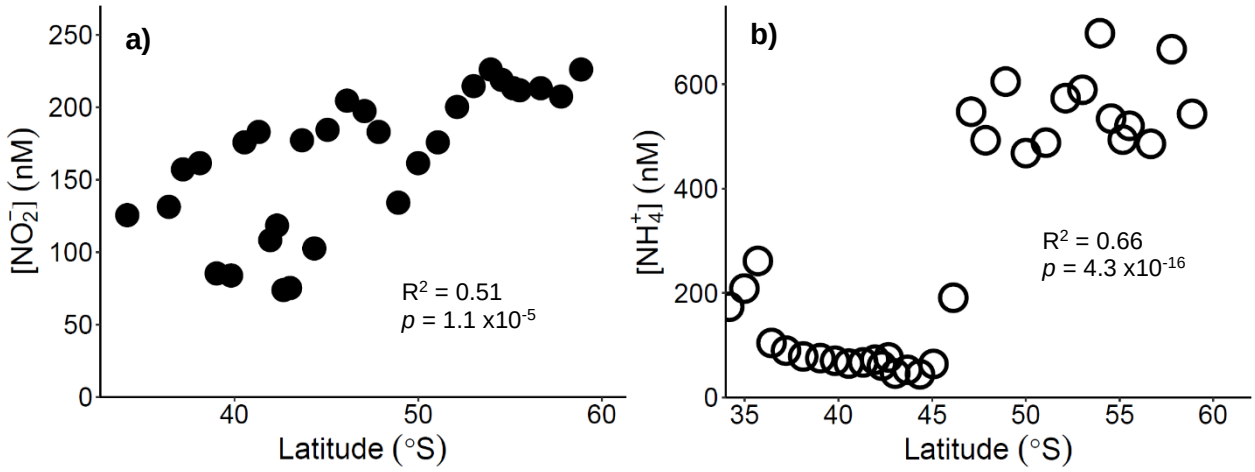

Figure S2: a) Ambient surface nitrite concentrations ($[NO_2^-]_{amb}$), b) Ambient surface ammonium concentration ($[NH_4^+]_{amb}$) measured every four hours across the transect (Leg 1) between 34°S and 59°S.

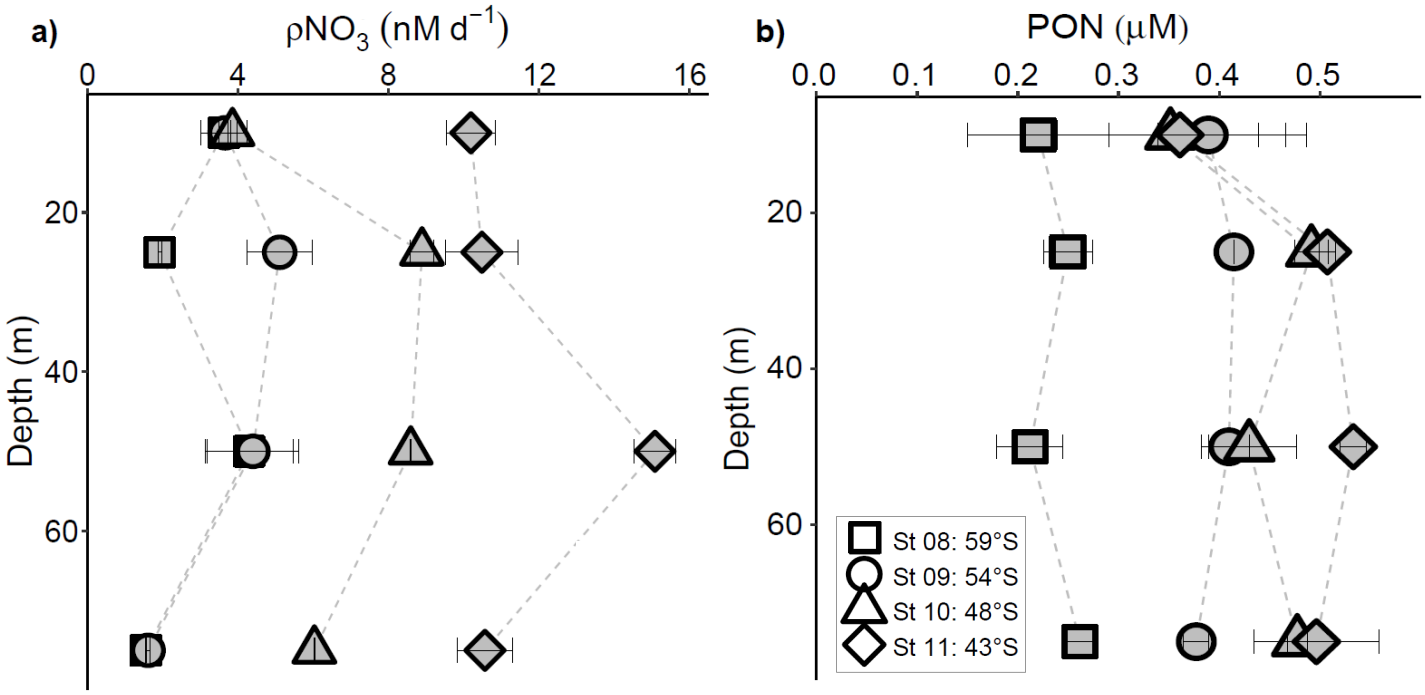

Figure S3: Upper 75 m- a) rates of NO_3^- uptake (ρNO_3^-) and b) concentrations of particulate organic nitrogen (PON) for samples collected at the depth-profile stations (St 08 to St 11; Leg 2). Error bars indicate the standard error of replicate experiments/collections, each measured at least twice. Where errors bars are not visible, they are smaller than the data markers. The dashed lines connecting the data points are included only to guide the eye and should not be taken to indicate interpolation with depth.

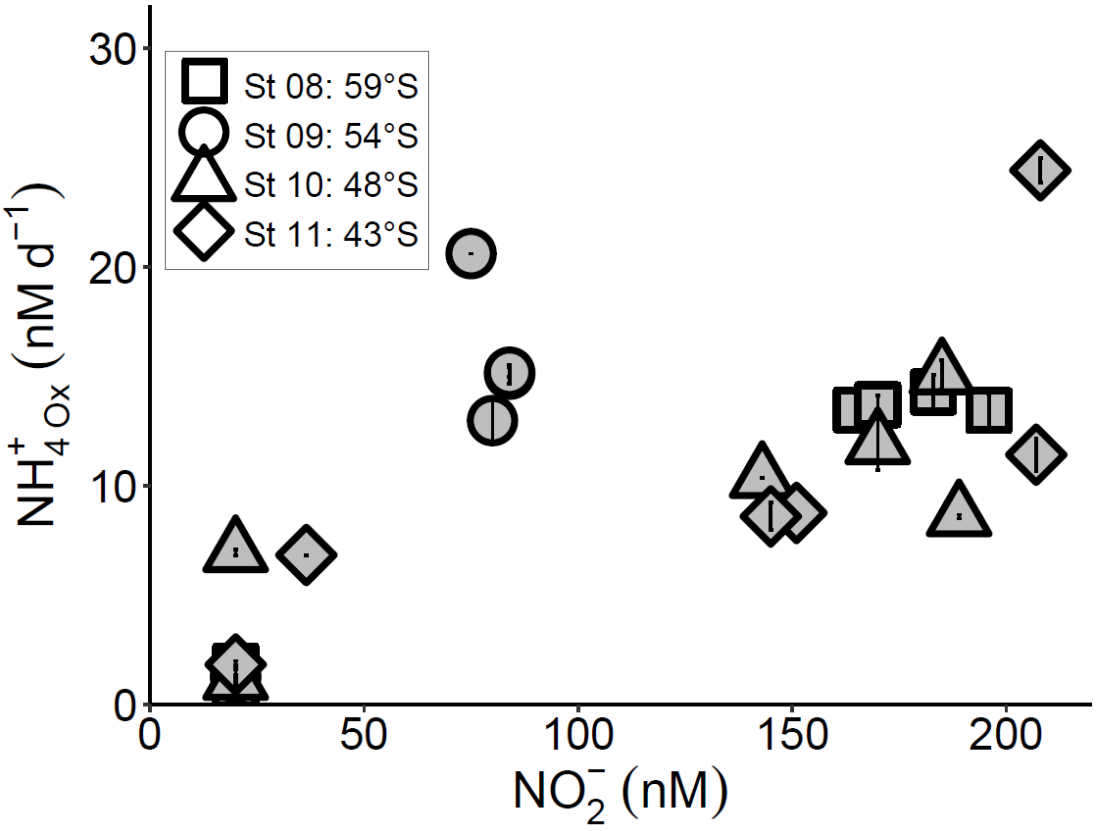

Figure S4: Depth profile (0-500 m) rates (St 08 to St 11) of NH_4^+ oxidation (nM d^{-1}) plotted against coincident measurements of the ambient NO_2^- concentration (nM). Error bars show the standard error of replicate experiments or collections, each measured at least twice

Table S1: Kinetic parameters calculated for each NO_2^- oxidation kinetics experiment using two different models. The values shaded in grey were computed using the traditional Michaelis-Menten (MM) model (equation 2 in the main text), while the values on a white background were derived using a modified form of the MM model (equation 3 in the main text). The numbers in red are the values used throughout the main text.

			Confidence interval						
Station	**Equation#**	**Kinetic parameter**	**99.73%**	**95.45%**	**68.27%**	**Best fit**	**68.27%**	**95.45%**	**99.73%**
1	2	V_{max}	5.0	7.6	9.4	11.1	13.1	16.5	28.6
1	2	K_m	11	156	277	400	564	890	2335
1	3	V_{max}	6.7	***7.9***	8.6	**9.1**	9.6	***10.4***	infinity
1	3	C	-829	***144***	182	**193**	199	***206***	214
1	3	K_{m*}	31	48	59	70	88	145	infinity
1	3	K_m	-798	***192***	241	**263**	287	***350***	infinity
2	2	V_{max}	3.5	4.5	5.2	5.8	6.5	7.8	12.1
2	2	K_m	-43	6	56	112	191	353	1052
2	3	V_{max}	4.5	***4.8***	5.0	**5.2**	5.3	***5.5***	6.0
2	3	C	72	***105***	112	**115**	117	***119***	124
2	3	K_{m*}	0	4	11	18	28	43	87
2	3	K_m	72	***109***	123	**134**	145	***163***	212
3	2	V_{max}	6.0	7.2	8.0	8.7	9.6	11.2	18.3
3	2	K_m	-47	21	88	162	269	500	1706
3	3	V_{max}	6.5	***7.4***	7.9	***8.3***	8.7	***9.3***	infinity
3	3	C	neg infinity	***-11***	117	***139***	152	***169***	180
3	3	K_{m*}	neg infinity	26	47	67	96	204	infinity
3	3	K_m	0	***15***	164	**206**	248	***373***	infinity
4	2	V_{max}	9.7	11.7	13.3	14.9	17.4	23.3	100.9
4	2	K_m	-15	99	223	374	619	1263	10118
4	3	V_{max}	10.2	***11.4***	12.2	**12.8**	13.6	***15.2***	infinity
4	3	C	-1646	***68***	148	**172**	186	***204***	243
4	3	K_{m*}	6	36	75	117	176	335	infinity
4	3	K_m	-1640	***104***	223	**288**	363	***538***	infinity
5	2	V_{max}	11.1	12.7	13.9	14.9	16.1	18.2	25.0
5	2	K_m	-15	93	185	279	401	631	1441
5	3	V_{max}	11.8	***12.6***	13.1	**13.5**	13.9	***14.6***	infinity
5	3	C	neg infinity	***138***	221	**245**	259	***272***	292
5	3	K_{m*}	20	45	64	84	112	186	infinity
5	3	K_m	20	***183***	285	**329**	371	***458***	infinity
6	2	V_{max}	7.7	8.5	9.2	9.7	10.3	11.3	13.5
6	2	K_m	294	421	519	609	718	897	1359
6	3	V_{max}	7.6	***7.9***	8.1	**8.2**	8.3	***8.6***	9.2
6	3	C	70	***129***	151	**163**	174	***187***	204
6	3	K_{m*}	154	191	217	239	266	312	448
6	3	K_m	224	***320***	368	**403**	440	***499***	652
7	2	V_{max}	4.3	5.7	6.8	7.7	8.9	10.9	16.8
7	2	K_m	-50	79	191	304	450	722	1636
7	3	V_{max}	5.4	***6.0***	6.3	**6.6**	6.9	***7.4***	8.6
7	3	C	-47	***190***	223	**237**	246	***255***	269
7	3	K_{m*}	19	45	64	80	101	140	396
7	3	K_m	-28	***234***	287	**317**	346	***395***	664

[#]Note: the equation number corresponds to the numbering in the methods section of the main text.

Table S2: Upper 75 m- average particulate organic N (PON) concentrations, integrated rates of NO_3^- uptake and NO_2^- oxidation, and the ratio of NO_2^- oxidation to NO_3^- uptake. The numbers in parentheses are the propagated standard errors.

Station name	Avg PON (µM)	$NO_2^-{}_{Ox}$ (mmol m^{-2} d^{-1})	ρNO_3^- (mmol m^{-2} d^{-1})	$NO_2^-{}_{Ox}/\rho NO_3^-$
St 08: 59°S	0.27 (0.08)	0.61 (0.00)	0.26 (0.03)	2.37 (0.24)
St 09: 54°S	0.38 (0.04)	0.19 (0.00)	0.30 (0.05)	0.63 (0.11)
St 10: 48°S	0.47 (0.09)	0.52 (0.04)	0.71 (0.01)	0.73 (0.07)
St 11: 43°S	0.44 (0.09)	1.65 (0.61)	1.44 (0.06)	1.15 (0.48)