- DMS Solubility:

In the Dacey et al. (1984) study there appears to be an error when converting the Henry's Law coefficients. As a result, the Bunsen (B) and Henry's Law (H) values and equation are incorrect in the original paper. We recommend using the dimensionless Ostwald solubility coefficient for DMS from Dacey et al. (1984), which was described as a function of temperature (T, °K) in Saltzman et al. (1993):

$$\ln(\alpha) = -10.1794 + 3761.33(1/T) \qquad \textit{Equation S1}$$

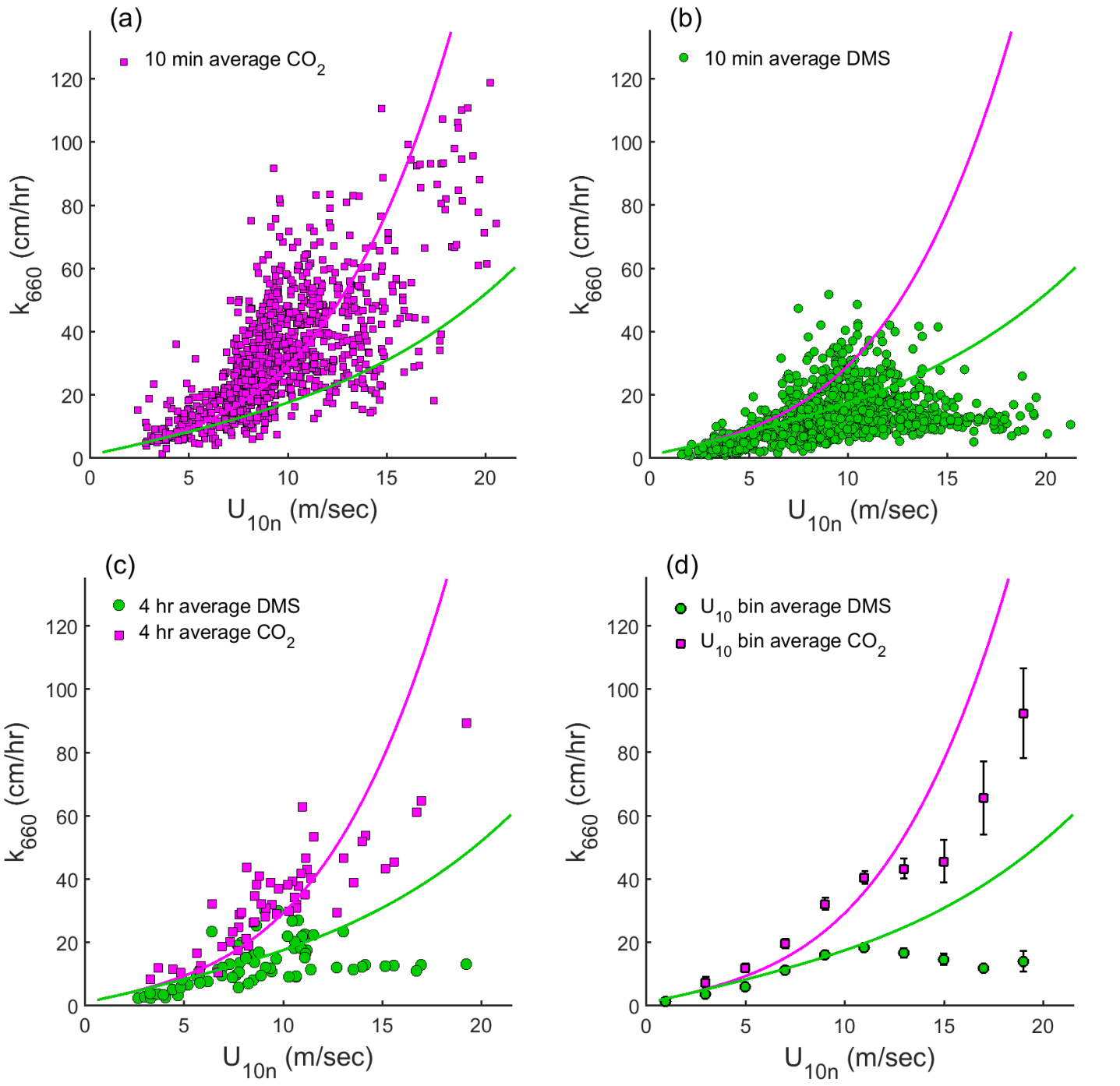

Figure S1 Equivalent to Figure 5 in main manuscript but with gas transfer velocities normalised to *Sc*=660 (k_{660}).

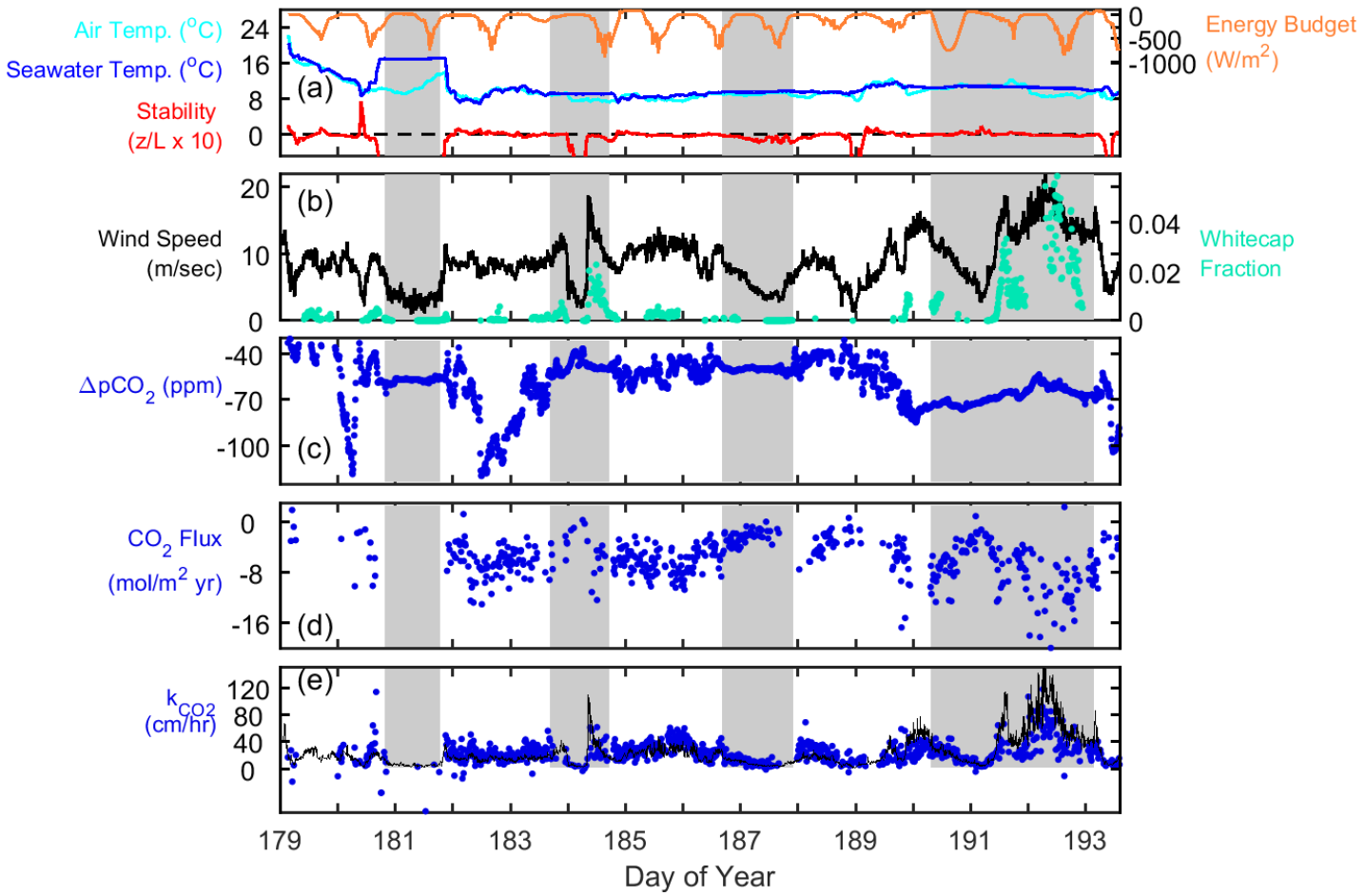

Figure S2 Replication of Figure 1 in the main manuscript. Axes in panel (e) are not restricted so that all data is plotted.

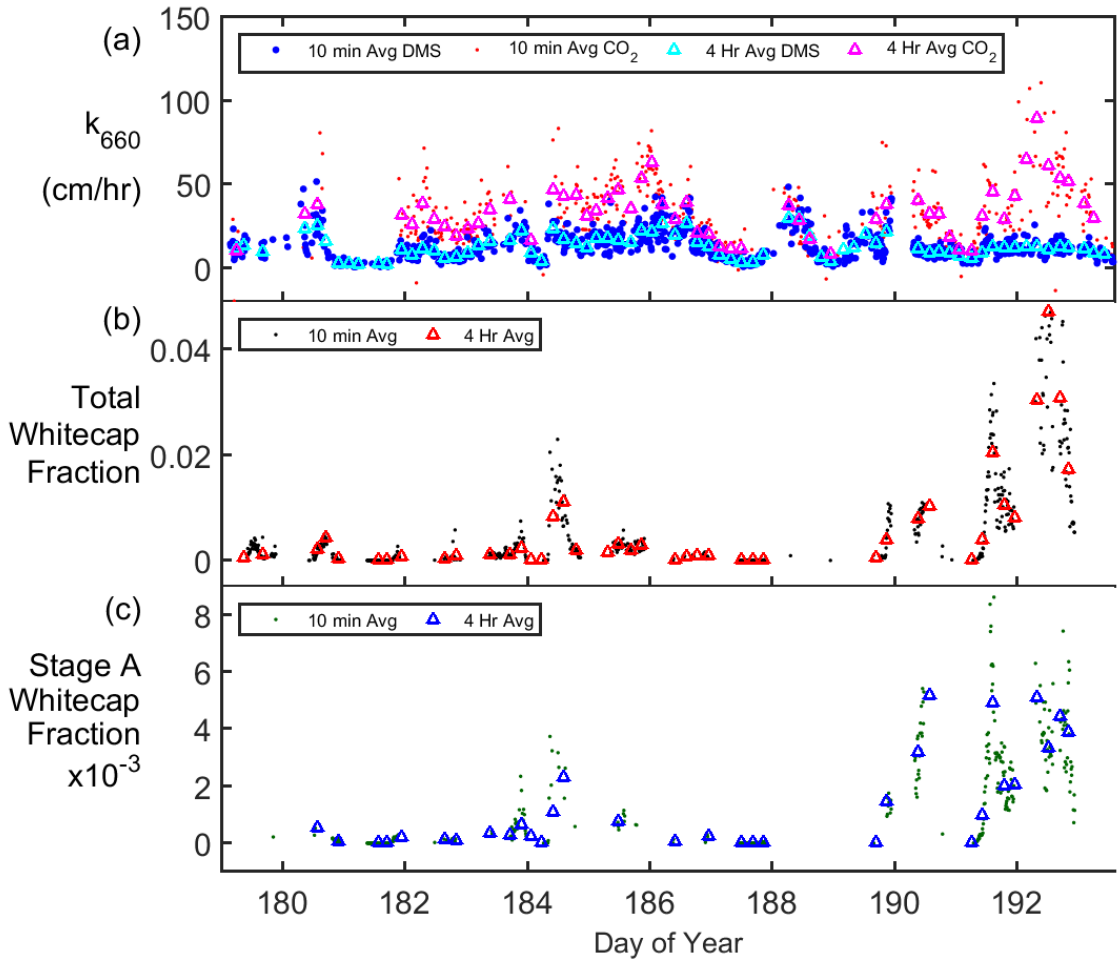

Figure S3 Timeseries examples of relationship between 10 minute average and 4 hour average data: gas transfer velocities for DMS and CO2 (upper panel); total whitecap fraction (middle panel); and Stage A whitecap fraction (lower panel).

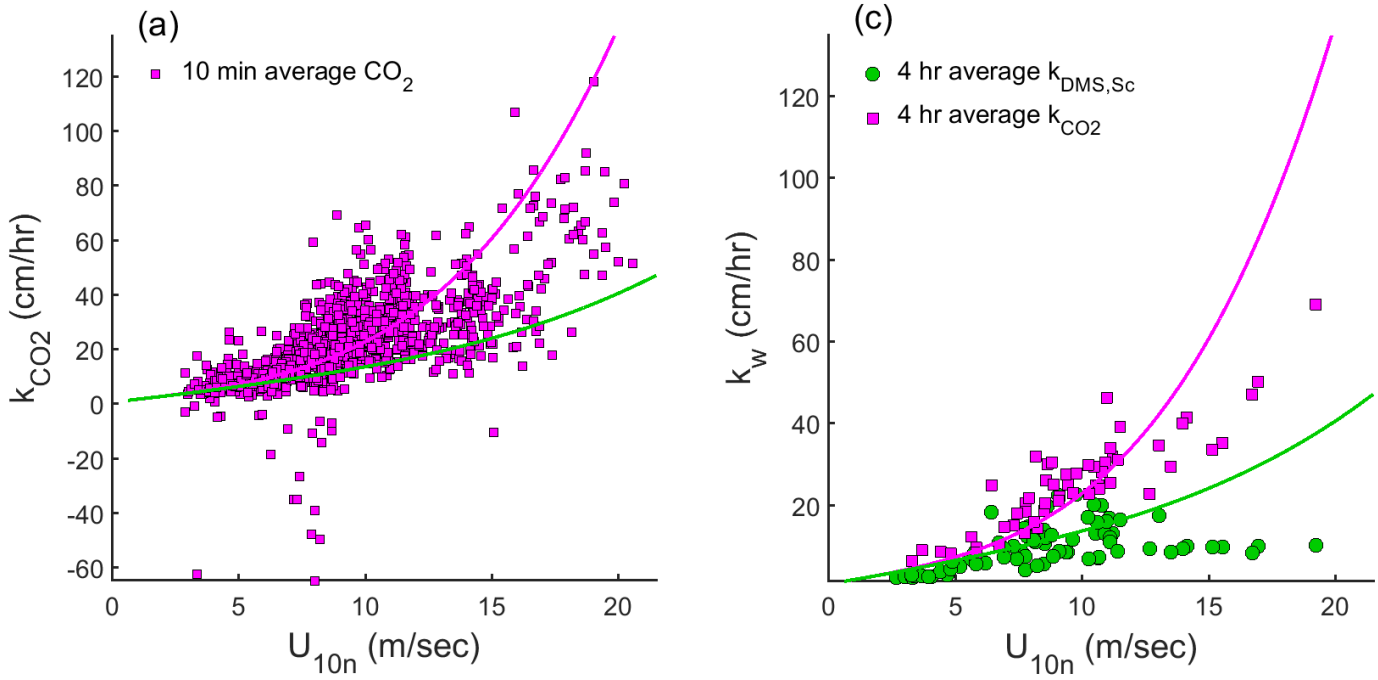

Figure S4 Replication of Figure 5a and 5c in the main manuscript. Axes are unrestricted so that all data is plotted.

- k_{bub} models:

Asher et al. (2002) model (A02):

$$k_{bub} = W_C\left(\frac{-37}{\alpha} + 10440\alpha^{-0.41}Sc^{-0.24}\right)$$

Woolf (1997) model (W97):

$$k_{bub} = \frac{2450W_C}{\alpha\left(1+\left(14\alpha Sc^{-0.5}\right)^{-1/1.2}\right)^{1.2}}$$

Using $f = \frac{k_{bub,DMS}}{k_{bub,CO_2}}$ we calculate f = 0.14 (A02) and f = 0.27 (W97). Using these estimates of f with Eqn. 6 (see main text), we use Δk_w to estimate k_{bub,CO_2}. We also use the same k_{bub} models to produce normalisation factors (i.e. F_n = $\text{Model}_{20°C}$ / $\text{Model}_{\text{InSituTemp}}$) to convert the k_{bub,CO_2} at in situ temperature (9.8°C) to a standard temperature, 20°C ($k_{bub,CO_2,20°C}$). $F_{n,A02}$ = 1.2754 and $F_{n,W97}$ = 1.3142.

Table S1: Knorr_11 cruise data (4 hour averaged). Minimum number of 10 minute average data points per 4 hour data interval = 3. k_{bub,CO_2} is derived from Δk_w using f and Eqn. 6 (main text). $k_{bub,CO_2,20°C}$ is calculated from k_{bub,CO_2} using F_n (see above).

Wind Speed (U_{10n})	Seawater Temperature (SST, °C)	k_{DMS} (cm hr^{-1})	k_{CO_2} (cm hr^{-1})	Δk_w (cm hr^{-1})	k_{bub,CO_2} (A02, cm hr^{-1})	k_{bub,CO_2} (W97, cm hr^{-1})	$k_{bub,CO_2,20°C}$ (A02, cm hr^{-1})	$k_{bub,CO_2,20°C}$ (W97, cm hr^{-1})
6.72	18.12	8.75	9.87	-0.39	-0.54	-0.46	-0.69	-0.59
6.42	10.83	13.42	25.00	9.36	12.76	10.92	16.28	13.93
8.66	11.11	15.24	30.15	12.39	16.89	14.45	21.54	18.43
9.43	11.42	7.09	25.16	16.89	23.03	19.70	29.37	25.13
8.50	7.81	4.74	18.83	13.34	18.19	15.57	23.20	19.85
9.36	7.68	6.97	27.68	19.61	26.73	22.88	34.10	29.18
7.78	7.62	6.15	20.61	13.50	18.40	15.74	23.46	20.08
7.77	9.33	3.57	18.59	14.44	19.68	16.84	25.10	21.48
8.25	9.85	4.37	14.50	9.42	12.85	10.99	16.39	14.02
7.44	10.29	5.58	18.06	11.57	15.77	13.49	20.11	17.21
8.54	10.54	8.58	20.61	10.62	14.48	12.39	18.47	15.80
8.57	9.73	9.66	26.33	15.10	20.59	17.61	26.25	22.47
8.81	9.24	10.05	30.69	19.02	25.92	22.18	33.06	28.29
5.63	9.12	5.55	12.39	5.94	8.10	6.93	10.33	8.84
13.05	9.13	14.15	34.81	18.37	25.04	21.43	31.94	27.33
11.22	9.10	10.62	32.06	19.72	26.88	23.00	34.29	29.34
8.16	8.68	8.80	32.08	21.87	29.81	25.51	38.03	32.54
9.13	8.05	7.15	22.38	14.09	19.21	16.44	24.50	20.97
10.56	8.53	10.65	25.09	12.74	17.36	14.86	22.15	18.95
10.91	8.37	10.70	30.51	18.10	24.68	21.12	31.48	26.93

11.13	8.48	9.84	34.04	22.64	30.86	26.40	39.36	33.68
11.10	8.28	9.10	25.58	15.04	20.50	17.54	26.14	22.37
11.53	8.78	13.25	39.39	24.02	32.74	28.02	41.76	35.73
10.97	8.87	12.89	46.43	31.47	42.90	36.71	54.71	46.82
10.77	9.11	15.72	28.24	9.99	13.62	11.65	17.37	14.86
7.89	9.08	11.41	21.92	8.67	11.83	10.12	15.08	12.91
10.48	9.42	15.71	29.61	11.35	15.47	13.24	19.73	16.89
8.12	9.54	9.11	16.05	5.47	7.45	6.38	9.51	8.14
7.31	9.53	7.91	15.23	6.04	8.24	7.05	10.51	8.99
5.85	9.51	4.91	9.61	3.90	5.32	4.56	6.79	5.81
4.43	9.48	3.13	8.62	4.98	6.79	5.81	8.66	7.41
3.69	9.57	2.28	8.91	6.27	8.55	7.31	10.90	9.33
9.77	9.65	17.32	27.97	7.84	10.69	9.14	13.63	11.66
9.09	9.45	16.93	21.25	1.58	2.16	1.84	2.75	2.35
7.73	9.55	11.14	13.25	0.30	0.41	0.35	0.53	0.45
3.31	9.45	2.36	6.25	3.51	4.78	4.09	6.10	5.22
9.65	11.57	9.54	23.18	12.06	16.43	14.06	20.96	17.94
10.24	10.81	13.57	29.90	14.10	19.22	16.45	24.51	20.98
11.41	10.46	7.36	31.24	22.67	30.91	26.45	39.42	33.73
10.66	10.61	5.91	24.94	18.06	24.62	21.06	31.40	26.87
8.89	10.81	6.16	25.18	18.00	24.54	21.00	31.30	26.78
6.93	10.86	5.98	14.73	7.76	10.59	9.06	13.50	11.55
5.82	10.84	4.59	8.47	3.12	4.25	3.64	5.42	4.64
4.84	10.81	3.65	8.12	3.86	5.27	4.51	6.72	5.75
10.67	10.82	6.09	24.19	17.09	23.30	19.94	29.72	25.43
15.58	10.76	8.26	35.45	25.83	35.22	30.14	44.92	38.44
12.70	10.68	7.76	22.94	13.90	18.95	16.22	24.18	20.69
15.16	10.65	8.15	33.65	24.15	32.93	28.17	41.99	35.93
16.96	10.59	8.36	50.35	40.61	55.37	47.38	70.61	60.42
19.25	10.48	8.63	69.16	59.12	80.59	68.96	102.78	87.95
16.74	10.40	7.14	47.24	38.93	53.07	45.41	67.69	57.92
14.14	10.41	8.36	41.64	31.91	43.50	37.22	55.48	47.48
13.98	10.34	7.91	40.09	30.88	42.10	36.02	53.69	45.94
13.54	9.91	7.23	29.58	21.17	28.86	24.69	36.80	31.49
10.30	10.16	5.82	22.94	16.18	22.05	18.87	28.12	24.07

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