

Supporting Information for Extreme South Pacific Phytoplankton Blooms Induced by Tropical Cyclones

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1. Highest Potential Chl-a measurement

To understand whether the Chl-a recorded in the Oma bloom could come from vertical mixing of this deep Chl-a maximum, we compute the average Chl-a value, $\overline{C}(D)$ for a profile $C(z)$ perfectly mixed by a storm to a depth D ,

$$\overline{C}(D) = \frac{\int_0^D C(z) dz}{D}. \quad (1)$$

For the Bio-ARGO data obtained in the WVR (Fig. S2) the maximum value of Chl-a is $\overline{C}_{max} = 0.13 \text{ mg/m}^3$ at $D = -125\text{m}$. Color satellites measurements sense Chl-a approximately over the first optical depth, $Z_{90} = 1/\kappa_{490}$, where κ_{490} is the diffuse attenuation coefficient of light at 490nm. We compute κ_{490} by fitting the average downwelling 490nm curve to an exponential function, obtaining $Z_{90} = 37\text{m}$ for this region of the South Pa-

cific. Assuming that vertical mixing homogenizes the maximum amount of deep Chl-a per meter, and that all of this deep Chl-a is mixed into observable depths, we obtain the highest mixing-sourced Chl-a C_{mix} as,

$$C_{mix} = \bar{C}_{max} \frac{D}{Z_{49}} \approx 0.47 \text{ mg/m}^3. \quad (2)$$

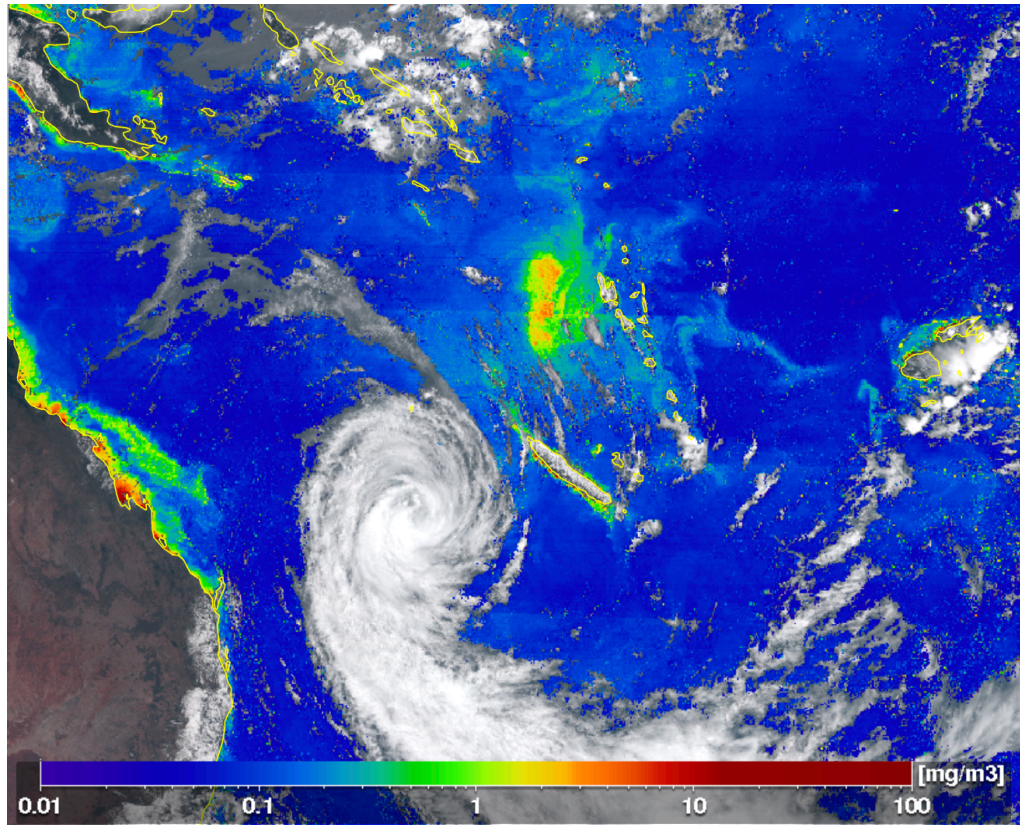


Figure S1. Massive phytoplankton bloom induced by Tropical Cyclone Oma, 21 February 2019, UTC 0.00-0.59. Visible is the TC-PB West of Vanuatu and Cyclone Oma, West of New Caledonia. The Australian East Coast (2000km) provides scale. Chlorophyll model product image (produced from Himawari-8) supplied by the P-Tree System, Japan Aerospace Exploration Agency (JAXA).

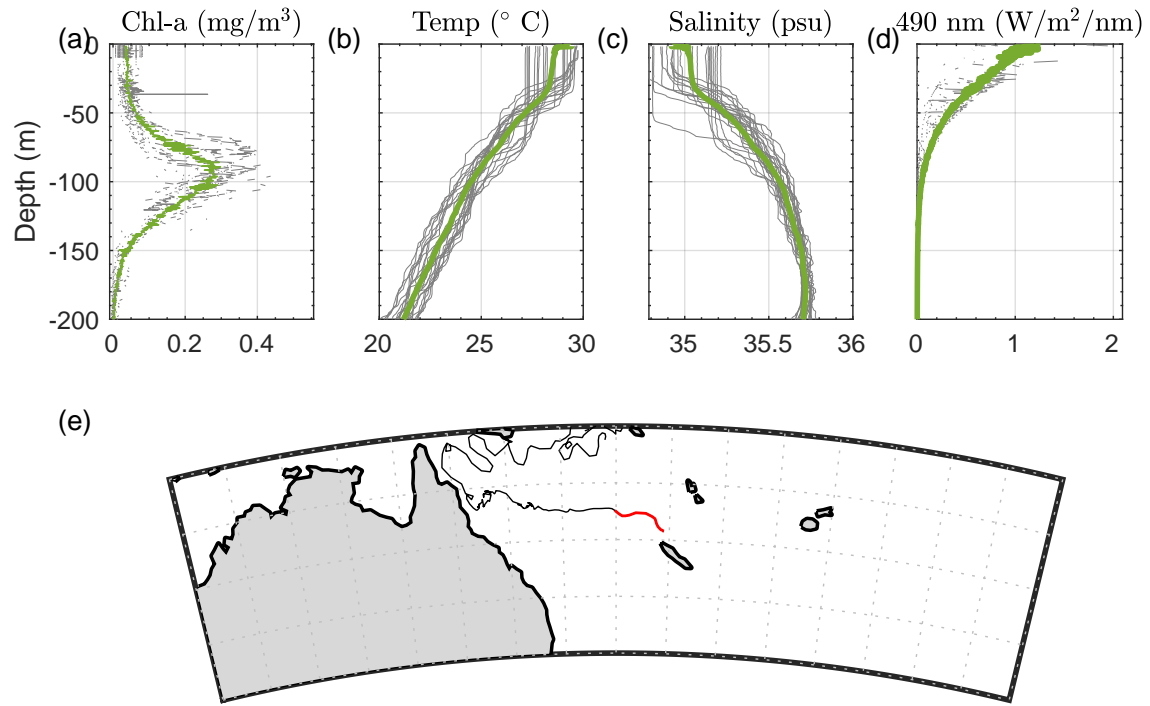


Figure S2. Bio-ARGO float data in the South Pacific. (a) Adjusted Chl-a (mg/m^3) measurements as a function of depth for the first 25 dives (red plot in (e)). Average shown in green. (b,c,d) Same as (a), for temperature, salinity, and 490 nm downwelling irradiance. (e) Location of bio-ARGO float 6901656 over time. Red is the samples used to make (a-d).

Table S1. TC-PB Hover and Chl-a data. Storm name with centre position (lon,lat) of TC-PB, JTWC fix numbers included in hover calculation, hover (H) in hrs^2/km , mean Chl-a $\geq 0.5\text{mg}/\text{m}^3$, number of Chl-a 4km grids in mean, date of Chl-a observation with (number of days after significant ΔSST).

Storm	Lon	Lat	Fixes	H (hrs^2/km)	Chl-a ($\geq 0.5\text{mg}/\text{m}^3$)	Count	Date (days after ΔSST)
Niran	147.64	-14.37	11-20	16.26	1.10	364	9-Mar-21 (3)
Harold	165.45	-15.18	15-21	7.32	0.84	40	9-Apr-20 (4)
Oma	164.85	-14.86	5-28	31.08	1.43	2820	21-Feb-19 (3)
Hola	164.4	-17.41	14-20	7.35	0.65	7	12-Mar-18 (4)
Donna	164.18	-13.72	14-19	9.67	1.05	894	11-May-17 (5)
Winston	172.63	-18.16	47-53	4.92	0.55	28	28-Feb-16 (6)
Pam	169.96	-12.14	5-14	11.53	0.69	208	17-Mar-15 (3)
Sandra	161.47	-16.98	18-25	4.95	0.59	215	15-Mar-13 (3)
Uliu	157.94	-13.50	18-34	21.08	1.10	102	23-Mar-10 (6)
Thomas	-178.46	-14.68	15-19	2.40	0.50	1	18-Mar-10 (4)
Wati	153.21	-18.10	15-19	6.05	0.61	4	27-Mar-06 (3)
Kerry	158.57	-18.30	18-28	16.10	0.67	54	14-Jan-05 (4)
Beni	161.16	-12.84	4-14	10.02	0.58	66	31-Jan-03 (4)
Zoe	169.06	-12.28	13-19	6.63	0.65	59	3-Jan-03 (4)
Katrina	164.67	-15.78	28-36	10.43	0.60	9	15-Jan-98 (7)

Table S1. Dataset details

Storm	JTWC ID	Chl-a dataset	Grid (E E S S)	Date	Δ SST dataset	Grid (E E S S)	Date
Niran	bsb232021	MODIS	146.48 149.98 -12.98 -15.98	9-Mar-21	MUR	146 150 -13 -16	6-Mar-21
Harold	bsb252020	MODIS	163.98 165.69 -13.98 -16.98	9-Apr-20	MUR	164.0 166.5 -14.0 -17.0	5-Apr-20
Oma	bsb152019	MODIS	161.98 166.48 -12.98 -17.98	21-Feb-19	MUR	160 168 -11 -20	18-Feb-19
Hola	bsb122018	MODIS	162 166 -16 -19	12-Mar-18	MUR	164 168 -15 -20	8-Mar-18
Donna	bsb182017	MODIS	161.98 166.48 -11.98 -16.98	11-May-17	MUR	162.0 166.5 -12.0 -16.0	6-May-17
Winston	bsb112016	MODIS	169.98 173.98 -15.98 -19.98	28-Feb-16	MUR	170 176 -16 -20	22-Feb-16
Pam	bsb172015	MODIS	167.98 173.98 -7.98 -14.98	17-Mar-15	MUR	168 174 -8 -17	14-Mar-15
Sandra	bsb192013	MODIS	157.98 163.98 -13.98 -17.98	15-Mar-13	MUR	158 164 -12 -19	12-Mar-13
Uliu	bsb202010	MODIS	153.98 163.98 -11.98 -16.98	23-Mar-10	MUR	154 164 -9 -17	17-Mar-10
Thomas	bsb192010	MODIS	-179.5 -177 -14 -15.9	18-Mar-10	MUR	-180 -176 -10 -18	15-Mar-10
Wati	bsb182006	MODIS	149.98 157.98 -14.98 -19.98	27-Mar-06	MUR	150 160 -15 -20	24-Mar-06
Kerry	bsb082005	MODIS	155.98 163.982 -14.98 -19.98	14-Jan-05	MUR	156 164 -15 -22	10-Jan-05
Beni	bsb122003	MODIS	157.98 163.98 -11.98 -13.98	31-Jan-03	MUR	156 164 -9 -16	27-Jan-03
Zoe	bsb062003	MODIS	165.98 171.98 -8.98 -14.98	2-Jan-03	MUR	166 172 -9 -15	30-Dec-02
Katrina	bsb121998	SEAWIFS	161.96 165.96 -14.96 -17.96	15-Jan-98	AVHRR	163.0 166.0 -14.5 -17.0	14-Jan-98