Supplementary Information

Iron from a submarine source impacts the productive layer of the Western Tropical South Pacific (WTSP)

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1. Supplementary Figures 1 to 5
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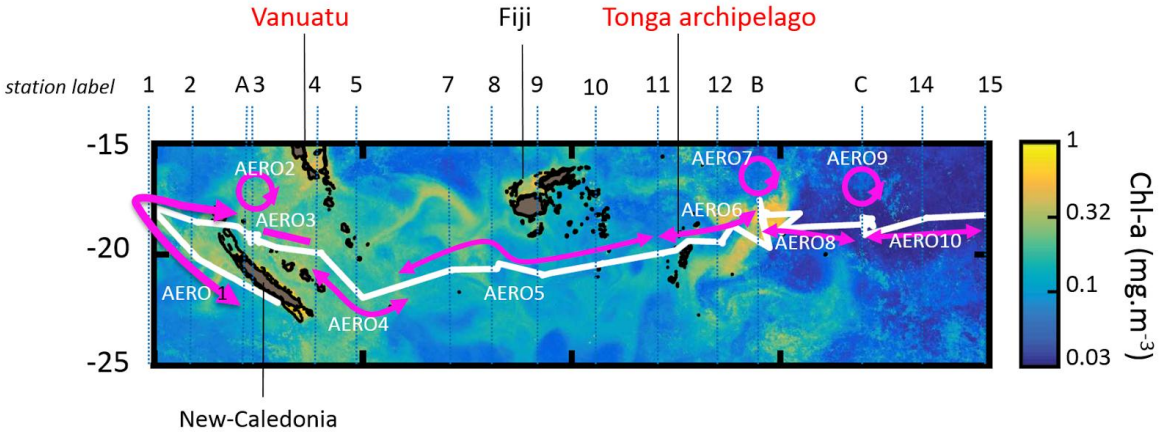
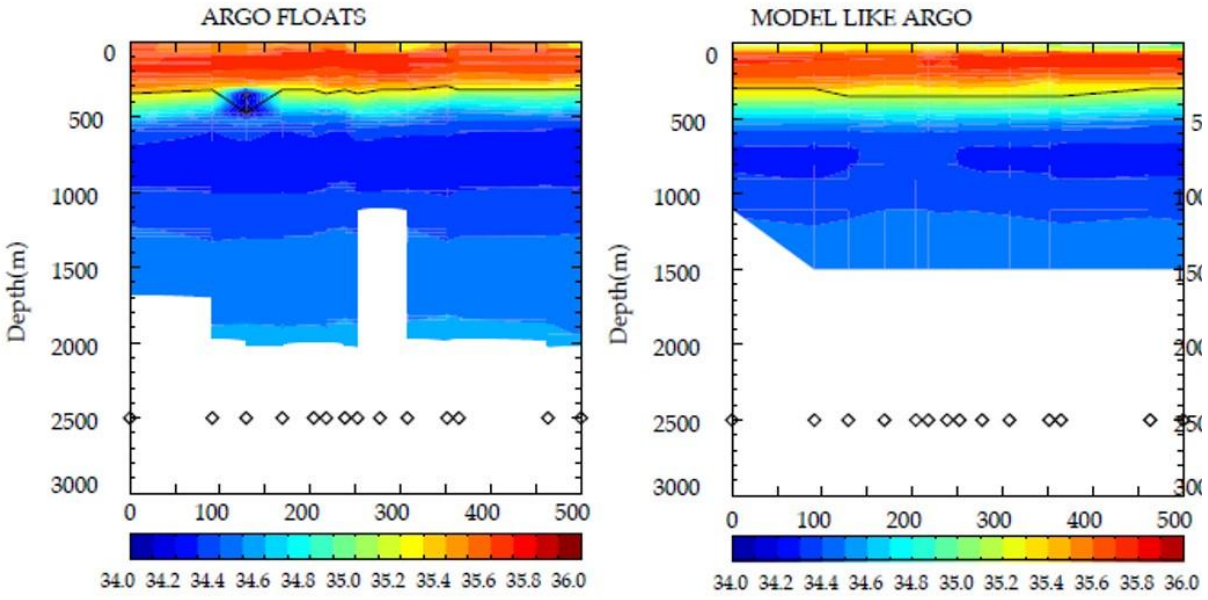
1. **Supplementary Figures 1 to 5**

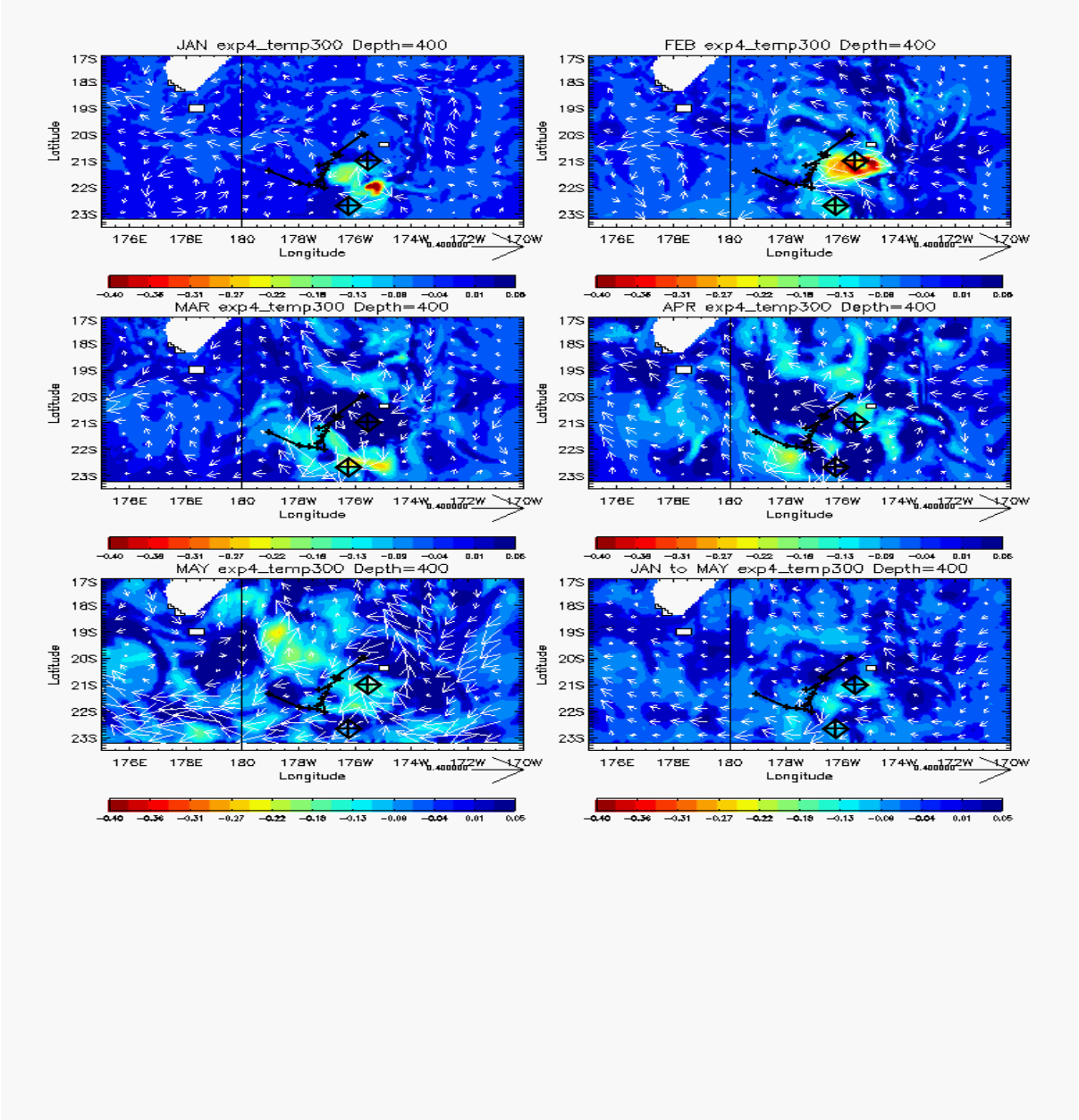


Supplementary Figure 1. Segments of transect corresponding to the different aerosols sampled during the OUTPACE cruise. (The ocean color satellite products are produced by CLS. Figure courtesy of A. De Verneil)

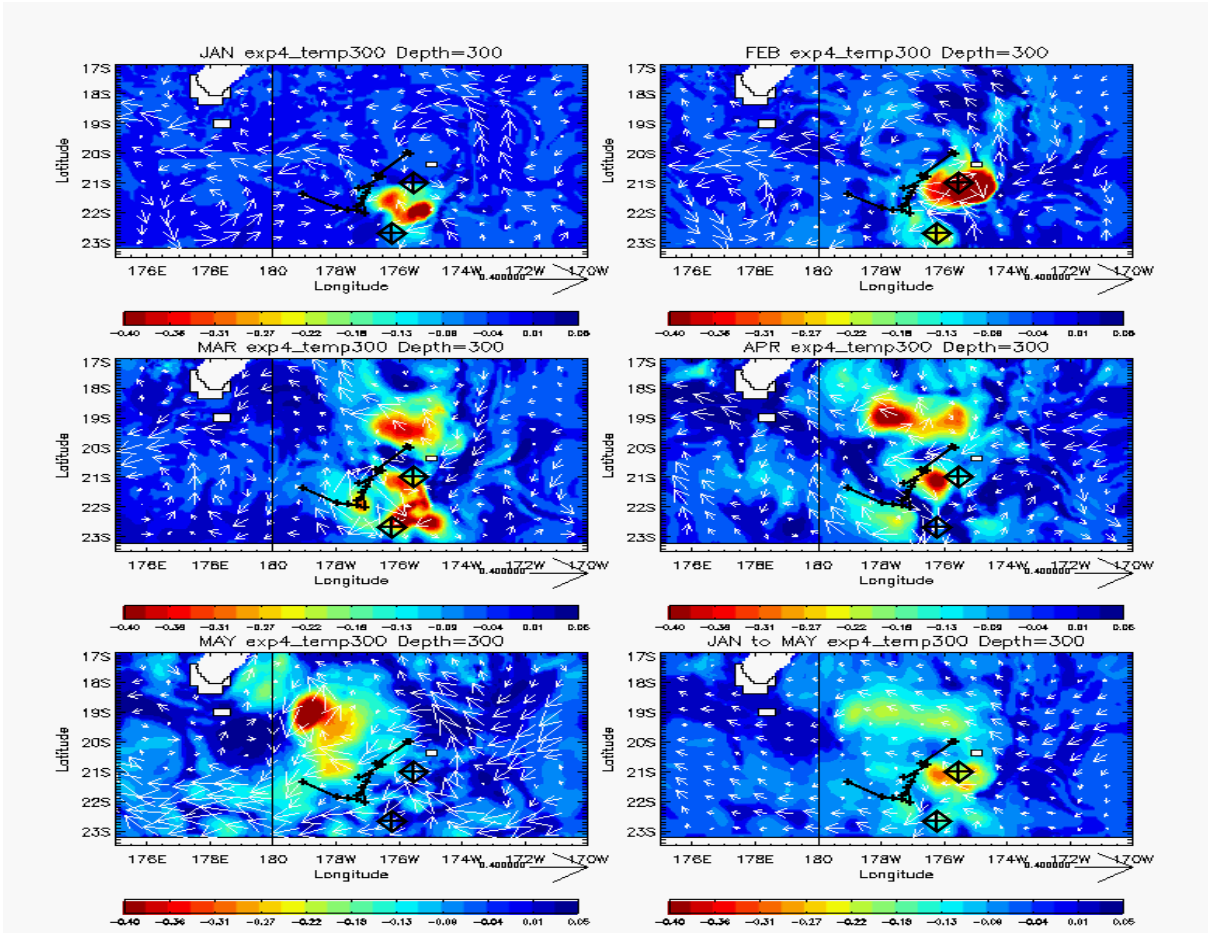


Supplementary Figure 2. Vertical sections of salinity for the ARGO float (along the red segment in Fig. 2A) (left) and reference model outputs averaged for February 2015 to May 2015 (right). Diamonds on the X-axis represent the position of the ARGO profiles along that section; the x-axis being the orthodromic distance in kilometers (0 = profile 57 to 500 = profile 2). The model reproduces the major features and typical range of values observed in that region.

(a)



(b)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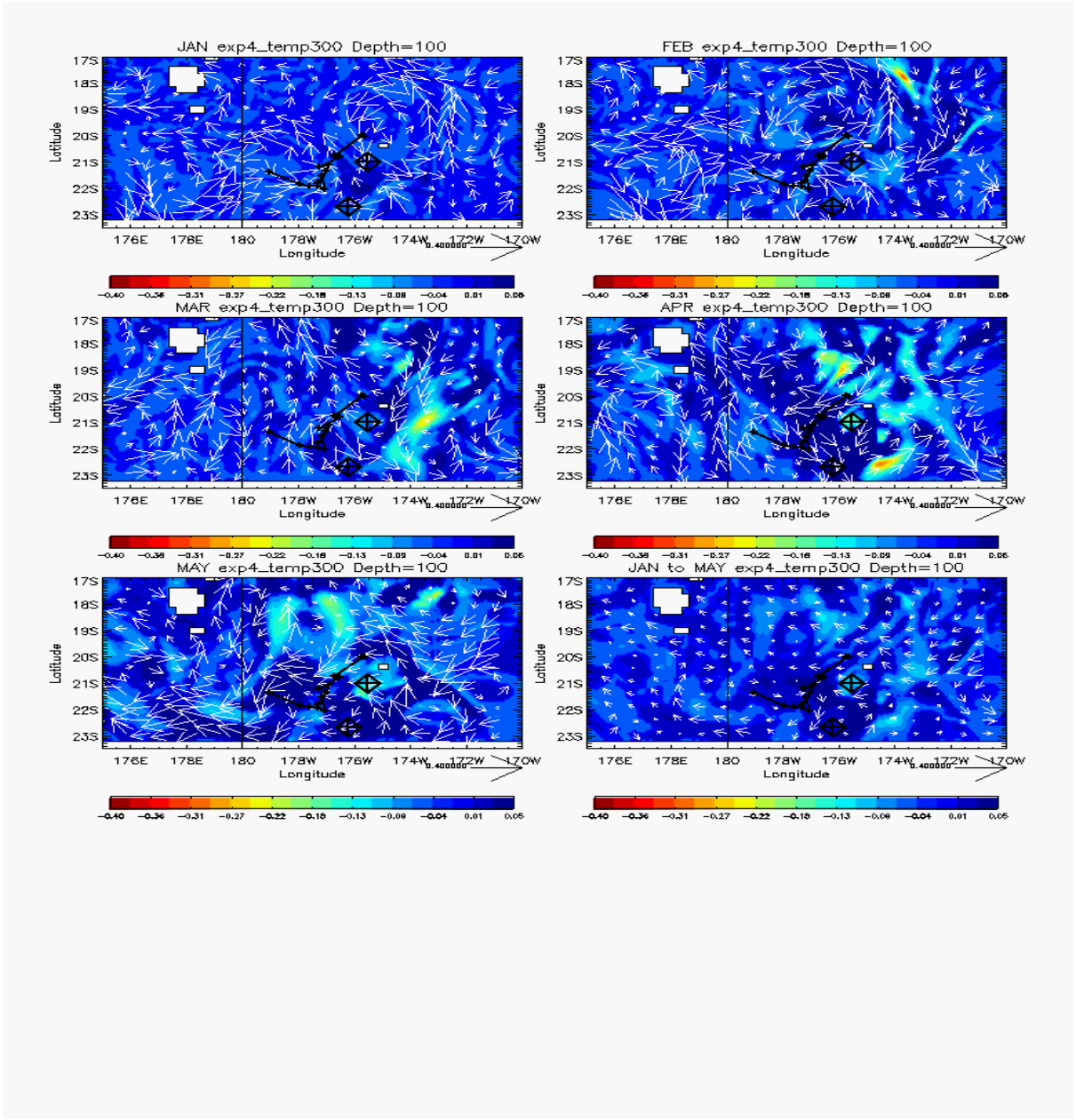
FEB exp4_temp300 Depth=300
MAR exp4_temp300 Depth=300
APR exp4_temp300 Depth=300
MAY exp4_temp300 Depth=300
JAN to MAY exp4_temp300 Depth=300
Latitude
Longitude
17S
18S
19S
20S
21S
22S
23S
176E
178E
180
178W
176W
174W
172W
170W
−0.40
−0.36
−0.31
−0.27
−0.22
−0.18
−0.13
−0.09
−0.04
0.01
0.05

(c)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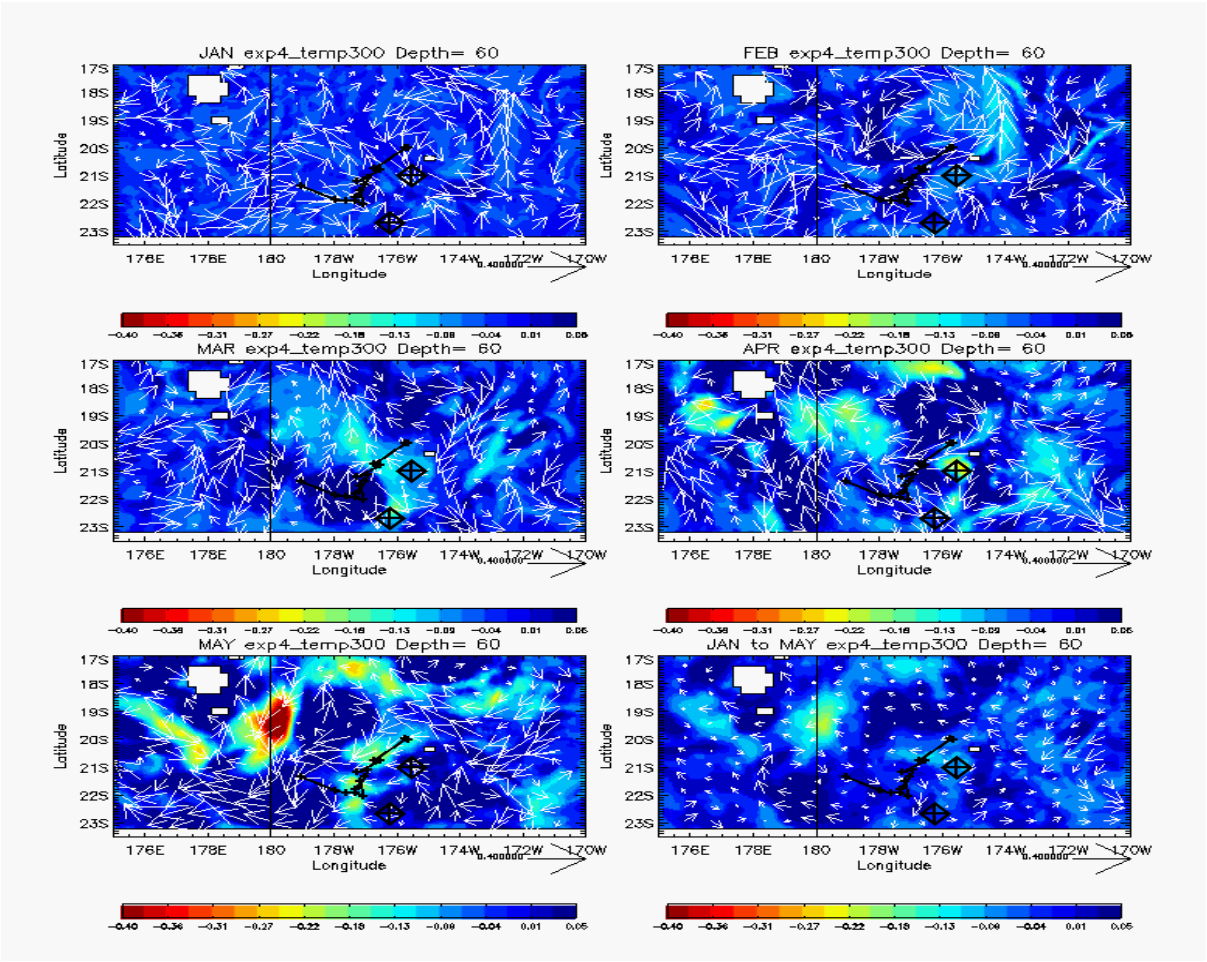
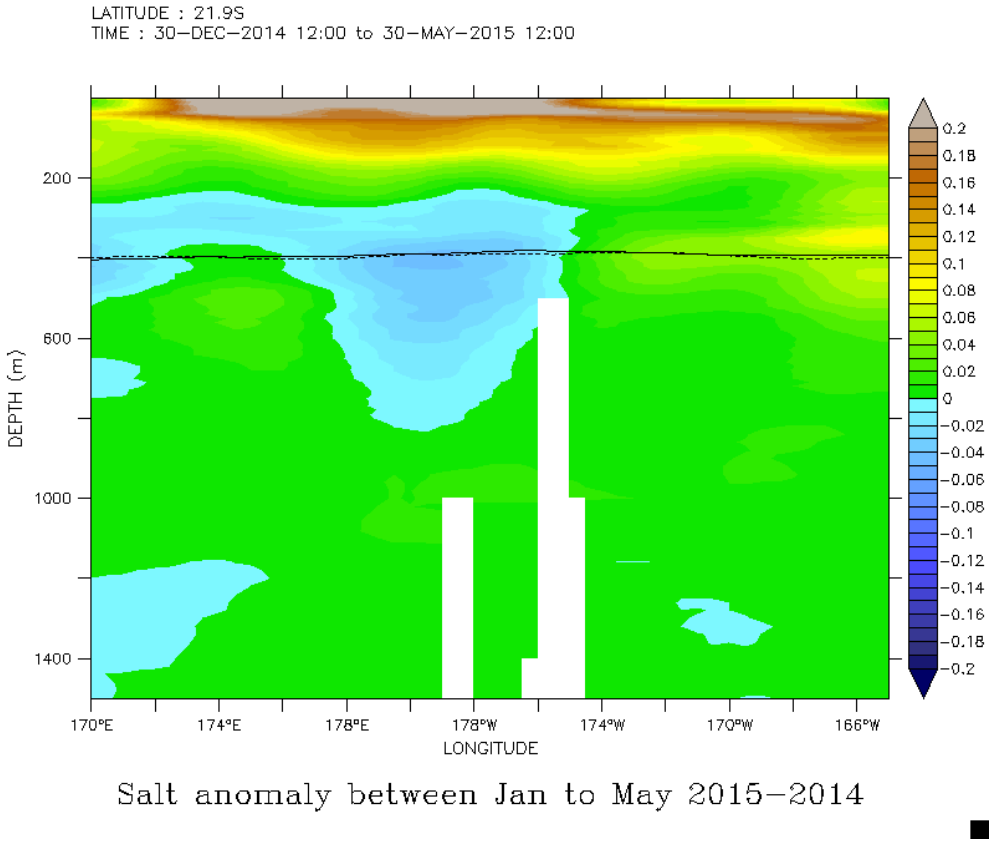
FEB exp4_temp300 Depth=100
MAR exp4_temp300 Depth=100
APR exp4_temp300 Depth=100
MAY exp4_temp300 Depth=100
JAN to MAY exp4_temp300 Depth=100
Latitude
Longitude
17S
18S
19S
20S
21S
22S
23S
176E
178E
180
178W
176W
174W
172W
170W
−0.40
−0.36
−0.31
−0.27
−0.22
−0.18
−0.13
−0.09
−0.04
0.01
0.05

(d)

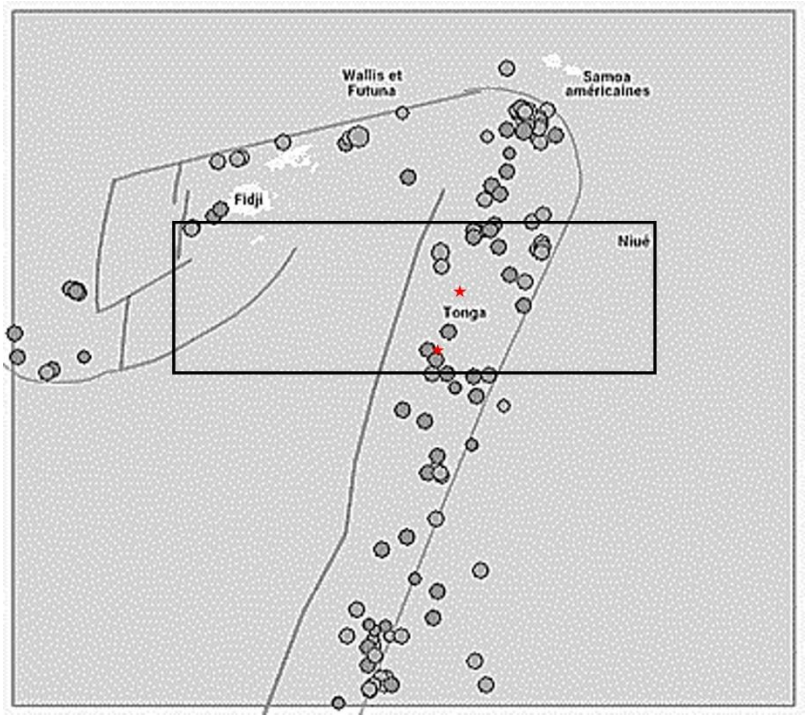


Supplementary Figure 3. Time mean section of the January 2015 to May 2015 simulations to characterize spatial and temporal plume impacts taking Volcano 8 as a source location that emitted throughout December 2014 and January 2015 (same conditions as in Fig. 2C : salinity of the source = 5, temperature = 300°, duration of the emission = 2 months, flux = 10 000 l.s^{-1}). Monthly mean snapshots of the region from January to May 2015 (from left to right and top to bottom), the last panel representing the mean of February to May 2015. On each panel, salinity anomalies (model with volcano 8 plume minus model without) are shaded and horizontal currents are represented as vectors. These snapshots are represented at 400 m (a), 300 m (b), 100 m (c) and 50 m (d). On each panel, the position of the ARGO float section of Fig. 2A is represented by a black line and

the positions of Volcano1 and 8 are noted as crossed diamonds. IDL version 6.4, Mac OSX (Darwin) , (c) 2007 ITT Visual Information Solutions URL link : http://www.harrisgeospatial.com/SoftwareTechnology/IDL.aspx was used to generate the maps.



Supplementary Figure 4. Differences of the average salinity section over the Jan-May period between 2015 and 2014 along 22°S from the ISAS13 Argo atlas. The quite similar depth of the 26.5 kg/m3 isopycnal surface for 2015 (thin line) and 2014 (dash line) indicates that this salt anomaly is compensated by a cold anomaly of (0.2°C) during the same period.



Supplementary Figure 5. Earthquakes (magnitude > 4 and above 100 km) recorded during the period 01/12/2014 to 01/06/2015, in our study area (black box; red stars: volcano 1 and 8). (this map was generated using https://earthquake.usgs.gov/).

2. Supplementary Tables 1 to 2

Supplementary Table 1. Aerosols results: total iron concentrations and fluxes; soluble iron concentrations and fluxes. The segments where aerosols were sampled are indicated Supplementary Figure 1.

Aerosol samples labels	Fe concentrations	Total Fe flux	DFe concentrations	DFe fluxes	DFe fluxes
	nM.m-3	nM.m-2.d-1	nM.m-3	nM. m-2. d-1	mg.m-2.yr-1
AERO 1	1.375	*1663*	nd		
AERO 2	0.041	*49*	nd		
AERO 3	0.013	*15*	nd		

AERO 4	0.064	*78*	0.0012	*1.42*	*0.029*
AERO 5	nd		nd		
AERO 6	0.162	*196*	0.0027	*3.25*	*0.066*
AERO 7	nd		0.0020	*2.46*	*0.050*
AERO 8	0.085	*102*	0.0402	*48.7*	*0.992*
AERO 9	nd		0.0007	*0.85*	*0.017*
AERO 10	1.96	*2371*	0.0104	*12.6*	*0.256*

Supplementary Table 2. Dissolved iron, nM measured between 0-500m during the OUTPACE cruise.

Latitude	Longitude	Station	Depth (m)	DFe nM
-18	159.9	1	500	0.85
-18	159.9	1	400	0.60
-18	159.9	1	350	0.88
-18	159.9	1	300	0.59
-18	159.9	1	250	0.60
-18	159.9	1	200	0.62
-18	159.9	1	150	0.53
-18	159.9	1	90	0.42
-18	159.9	1	80	0.31
-18	159.9	1	50	0.50
-18	159.9	1	30	0.92
-18	159.9	1	10	0.67
-18.6	162.1	2	500	0.42
-18.6	162.1	2	400	0.36
-18.6	162.1	2	350	0.37
-18.6	162.1	2	300	0.39
-18.6	162.1	2	250	0.56
-18.6	162.1	2	200	0.36
-18.6	162.1	2	150	0.37
-18.6	162.1	2	100	0.26
-18.6	162.1	2	70	0.24

-18.6	162.1	2	50	0.99
-18.6	162.1	2	30	0.41
-18.6	162.1	2	10	0.36
-19.2	164.7	LD_A	500	0.50
-19.2	164.7	LD_A	450	
-19.2	164.7	LD_A	350	0.50
-19.2	164.7	LD_A	300	0.48
-19.2	164.7	LD_A	250	0.49
-19.2	164.7	LD_A	200	0.51
-19.2	164.7	LD_A	80	0.52
-19.2	164.7	LD_A	50	0.50
-19.2	164.7	LD_A	30	0.85
-19	165	3	500	0.43
-19	165	3	400	0.31
-19	165	3	350	0.58
-19	165	3	300	0.44
-19	165	3	250	0.42
-19	165	3	200	0.62
-19	165	3	150	0.21
-19	165	3	100	0.85
-19	165	3	70	0.37
-19	165	3	50	0.48
-19	165	3	30	0.32
-19	165	3	10	0.38
-20	168	4	500	0.60
-20	168	4	400	0.85
-20	168	4	350	0.67
-20	168	4	300	0.82
-20	168	4	250	0.63
-20	168	4	200	0.56
-20	168	4	150	0.78
-20	168	4	100	0.41
-20	168	4	70	0.54
-20	168	4	50	1.16
-20	168	4	30	0.55

-20	168	4	10	0.69
-22	170	5	500	0.44
-22	170	5	400	0.62
-22	170	5	350	0.35
-22	170	5	300	1.17
-22	170	5	250	1.25
-22	170	5	200	0.26
-22	170	5	150	0.24
-22	170	5	100	1.01
-22	170	5	70	0.50
-22	170	5	50	0.53
-22	170	5	30	0.61
-22	170	5	10	0.44
-20.73	174.27	7	500	0.32
-20.73	174.27	7	400	0.44
-20.73	174.27	7	350	0.44
-20.73	174.27	7	300	0.43
-20.73	174.27	7	250	0.44
-20.73	174.27	7	200	0.46
-20.73	174.27	7	150	0.39
-20.73	174.27	7	100	0.21
-20.73	174.27	7	70	2.88
-20.73	174.27	7	50	0.25
-20.73	174.27	7	30	1.22
-20.73	174.27	7	10	0.21
-20.7	176.4	8	500	0.47
-20.7	176.4	8	400	0.41
-20.7	176.4	8	350	0.42
-20.7	176.4	8	300	1.38
-20.7	176.4	8	250	0.42
-20.7	176.4	8	200	0.33
-20.7	176.4	8	150	0.26
-20.7	176.4	8	120	0.31
-20.7	176.4	8	70	0.22
-20.7	176.4	8	50	0.45

-20.7	176.4	8	30	1.35
-20.7	176.4	8	10	0.38
-21	178.6	9	500	0.39
-21	178.6	9	398	1.90
-21	178.6	9	350	0.42
-21	178.6	9	300	1.60
-21	178.6	9	250	5.50
-21	178.6	9	200	66.20
-21	178.6	9	150	12.10
-21	178.6	9	100	63.00
-21	178.6	9	70	0.76
-21	178.6	9	50	0.25
-21	178.6	9	30	0.22
-21	178.6	9	10	0.22
-20.5	181.5	10	500	2.15
-20.5	181.5	10	400	1.55
-20.5	181.5	10	350	7.80
-20.5	181.5	10	300	0.87
-20.5	181.5	10	250	4.80
-20.5	181.5	10	200	1.17
-20.5	181.5	10	150	0.16
-20.5	181.5	10	120	5.17
-20.5	181.5	10	70	11.32
-20.5	181.5	10	50	0.94
-20.5	181.5	10	30	0.43
-20.5	181.5	10	10	0.97
-19.98	184.33	11	500	0.42
-19.98	184.33	11	400	0.47
-19.98	184.33	11	350	0.51
-19.98	184.33	11	300	1.08
-19.98	184.33	11	250	0.63
-19.98	184.33	11	200	0.59
-19.98	184.33	11	150	0.64
-19.98	184.33	11	100	0.72
-19.98	184.33	11	70	0.65

-19.98	184.33	11	45	0.54
-19.98	184.33	11	30	0.84
-19.98	184.33	11	10	1.16
-19.5	187.2	12	500	0.66
-19.5	187.2	12	300	0.47
-19.5	187.2	12	250	1.10
-19.5	187.2	12	200	0.33
-19.5	187.2	12	150	0.36
-19.5	187.2	12	100	0.48
-19.5	187.2	12	70	0.45
-19.5	187.2	12	50	0.50
-19.5	187.2	12	30	0.94
-18.2	189.1	LD_B	500	0.34
-18.2	189.1	LD_B	450	0.23
-18.2	189.1	LD_B	400	0.41
-18.2	189.1	LD_B	350	0.28
-18.2	189.1	LD_B	300	0.43
-18.2	189.1	LD_B	200	0.30
-18.2	189.1	LD_B	150	0.38
-18.2	189.1	LD_B	100	0.71
-18.2	189.1	LD_B	80	0.39
-18.2	189.1	LD_B	50	0.30
-18.2	189.1	LD_B	30	0.52
-18.2	189.1	LD_B	10	0.59
-18.2	189.1	LD_B	5	0.71
-18.4	194.1	LD_C	500	0.29
-18.4	194.1	LD_C	450	0.29
-18.4	194.1	LD_C	400	
-18.4	194.1	LD_C	350	0.25
-18.4	194.1	LD_C	300	
-18.4	194.1	LD_C	250	0.16
-18.4	194.1	LD_C	200	0.35
-18.4	194.1	LD_C	150	0.24
-18.4	194.1	LD_C	100	0.17
-18.4	194.1	LD_C	50	0.16

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-18.42	197	14	250	0.49
-18.42	197	14	200	0.27
-18.42	197	14	150	0.31
-18.42	197	14	100	0.32
-18.42	197	14	80	0.31
-18.42	197	14	30	0.21
-18.42	197	14	5	0.46
-18.27	200	15	500	0.48
-18.27	200	15	450	0.40
-18.27	200	15	400	0.26
-18.27	200	15	250	0.25
-18.27	200	15	200	0.40
-18.27	200	15	150	0.47
-18.27	200	15	100	0.28
-18.27	200	15	80	0.37
-18.27	200	15	50	0.34
-18.27	200	15	30	0.20
-18.27	200	15	10	0.31
-18.27	200	15	5	0.31