Table S1. Sampling information of 2015 cruise, including starting and ending sampling time, and location (longitude and latitude).

NO.	Start			End		
	Data	Longitude	Latitude	Data	Longitude	Latitude
1	0330 9:00	120.62 E	36.00 N	0330 18:00	121.23 E	35.03 N
2	0330 18:00	121.23 E	35.03 N	0331 8:00	122.33 E	32.87 N
3	0331 8:00	122.33 E	32.87 N	0331 17:00	123.00 E	31.50 N
4	0331 17:00	123.00 E	31.50 N	0401 3:00	123.50 E	30.80 N
5	0401 10:30	124.00 E	30.00 N	0401 22:00	125.00 E	28.40 N
6	0402 12:00	125.00 E	28.07 N	040312:00	127.28 E	25.65 N
7	0403 12:00	127.28 E	25.65 N	0403 22:30	129.28 E	25.18 N
8	0403 22:30	129.28 E	25.18 N	0404 18:40	132.03 E	25.00 N
9	0404 18:40	132.00 E	25.00 N	0405 13:30	134.08 E	25.18 N
10	0406 14:00	134.08 E	25.18 N	0407 6:00	136.70 E	26.20 N
11	0407 15:00	136.70 E	26.20 N	0408 12:00	140.55 E	27.61 N
12	0408 12:00	140.55 E	27.62 N	0409 12:00	145.20 E	29.33 N
13	0409 12:00	145.20 E	29.33 N	0410 11:30	147.00 E	30.00 N
14	0411 11:50	147.00 E	30.00 N	0411 21:30	147.00 E	31.00 N
15	0412 7:00	147.00 E	31.00 N	0412 21:30	147.00 E	33.00 N
16	0412 21:30	147.00 E	33.00 N	0413 10:30	146.42 E	34.02 N
17	0413 10:30	146.42 E	34.02 N	0414 9:00	145.97 E	32.53 N
18	0414 17:15	145.97 E	32.53 N	0415 7:00	145.12 E	32.12 N
19	0415 17:15	145.12 E	32.12 N	0416 17:00	145.07 E	32.75 N
20	0416 17:00	145.07 E	32.75 N	0417 17:00	144.97 E	34.13 N
21	0417 17:00	144.97 E	34.13 N	0418 12:30	145.13 E	34.58 N
22	0418 12:30	145.13 E	34.58 N	0419 8:40	145.20 E	33.87 N
23	0419 8:40	145.20 E	33.87 N	0419 19:40	146.13 E	34.27 N
24	0419 19:40	146.13 E	34.27 N	0420 18:40	150.87 E	34.02 N
25	0420 18:40	150.87 E	34.02 N	0421 8:10	152.00 E	34.00 N
26	0421 9:10	152.00 E	34.00 N	0422 9:30	152.18 E	32.27 N
27	0422 9:30	152.18 E	32.15 N	0423 5:00	150.00 E	34.00 N
28	0423 15:00	150.00 E	34.00 N	0424 12:00	148.00 E	34.00 N
29	0424 12:00	148.00 E	34.00 N	0425 11:00	147.00 E	38.00 N
30	0426 19:40	147.00 E	38.00 N	0427 18:00	147.00 E	35.00 N
31	0427 21:00	147.00 E	35.00 N	0428 20:00	143.27 E	32.87 N
32	0428 20:00	143.27 E	32.87 N	0429 18:00	139.57 E	31.07 N
33	0429 18:00	139.57 E	31.07 N	0430 9:15	136.63 E	31.00 N
34	0430 9:15	136.63 E	31.00 N	0501 9:00	132.12 E	31.00 N
35	0501 9:00	132.12 E	31.00 N	0501 22:00	129.38 E	30.98 N
36	0501 22:00	129.38 E	31.00 N	0502 10:00	127.08 E	30.52 N
37	0502 10:00	127.08 E	30.52 N	0503 6:30	125.00 E	31.00 N
38	0503 6:30	125.00 E	31.00 N	0503 19:00	124.00 E	32.00 N
39	0503 19:00	124.00 E	32.00 N	050408:20	124.00 E	33.60 N

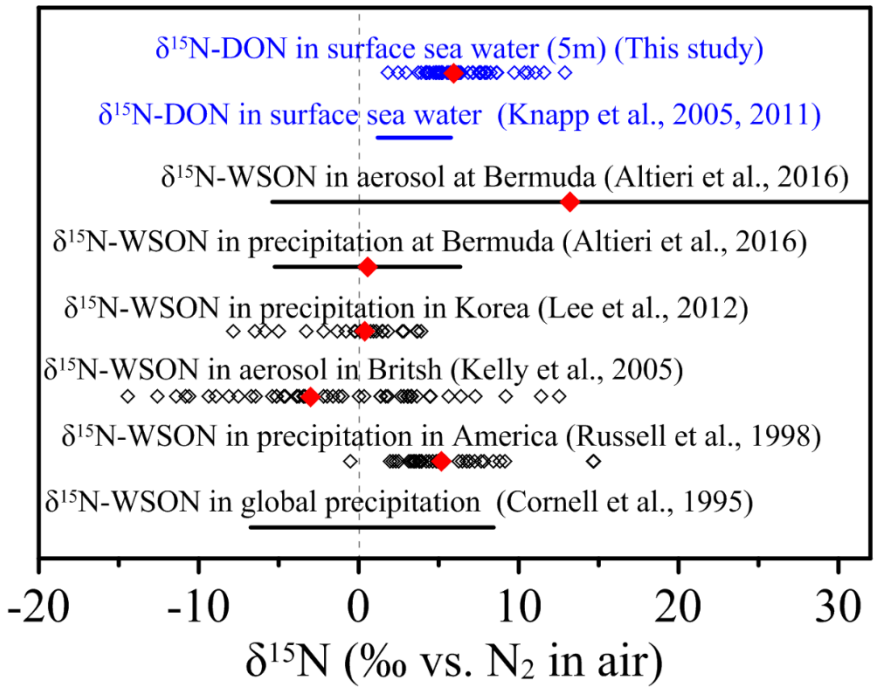

Figure S1: δ^{15}N-WSON in atmospheric precipitation and aerosol, and δ^{15}N-DON in surface sea water. Solid red diamonds stand for the average values of δ^{15}N.

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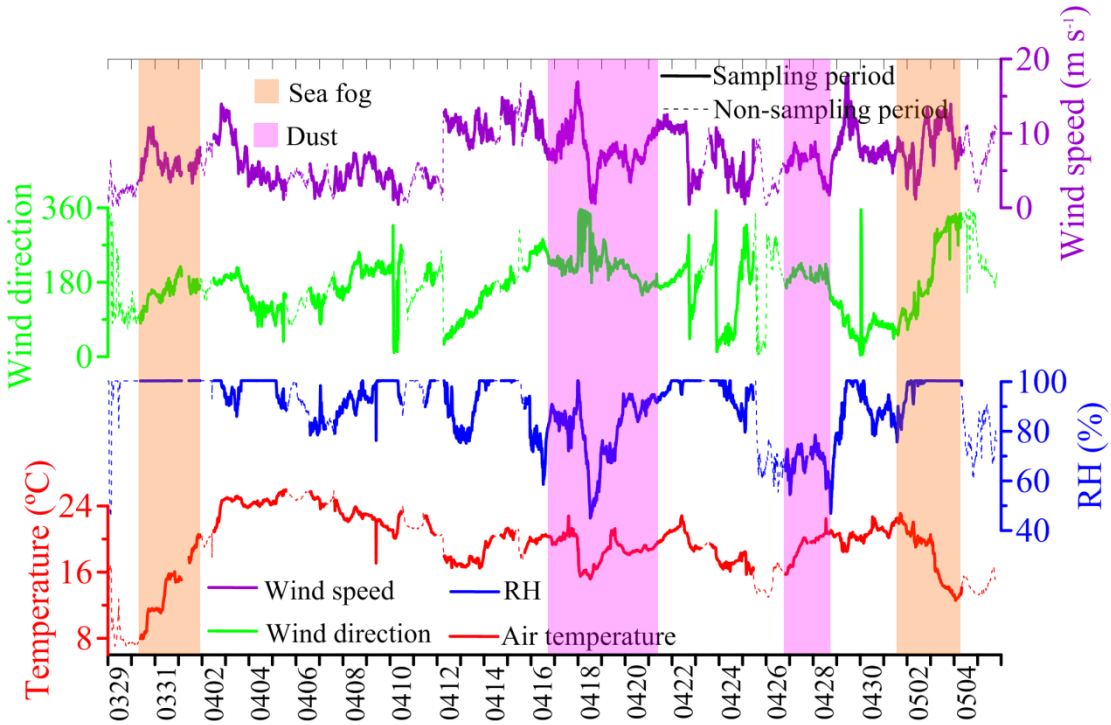

Figure S2: The meteorological parameters recorded during the sampling period (solid line). Wind speed is in purple, wind direction in green, RH in blue and temperature in red. The orange shadings indicate the period of sea fog contact and pink indicate the dust period. Non-sampling period is shown with dashed curves.

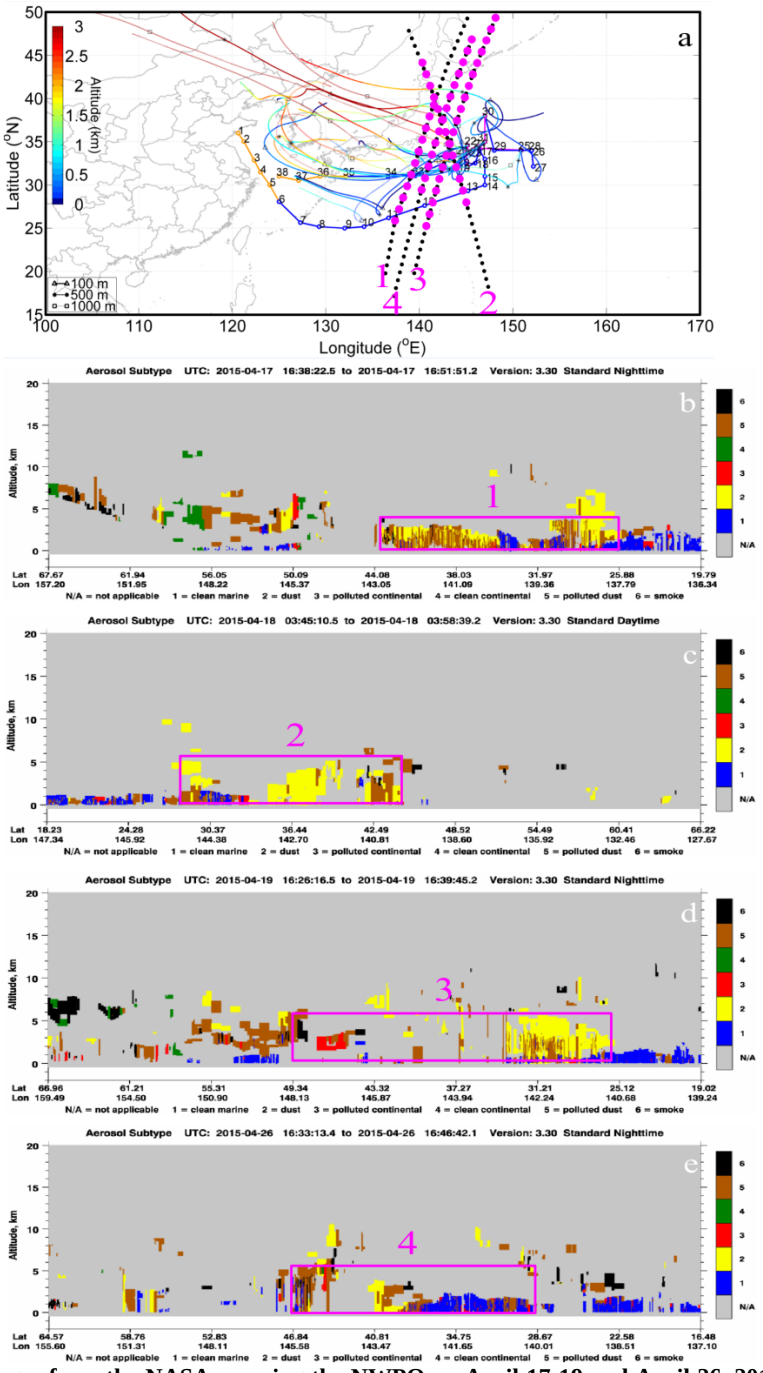

Figure S3: Lidar browse images from the NASA covering the NWPO on April 17-19 and April 26, 2015. Black dashed lines in (a) represent satellite scanning tracks #1, #2, #3 and #4. Enlarged pink dots are for the target areas shown in (b), (c), (d) and (e) along the tracks #1, #2, #3 and #4. The pink box in images (b), (c), (d) and (e) revealed signals of polluted dust and dust mixed with clean marine aerosols. All the dusty zones location near the dust aerosol (small open pink triangles) we collected along the cruise tracks.

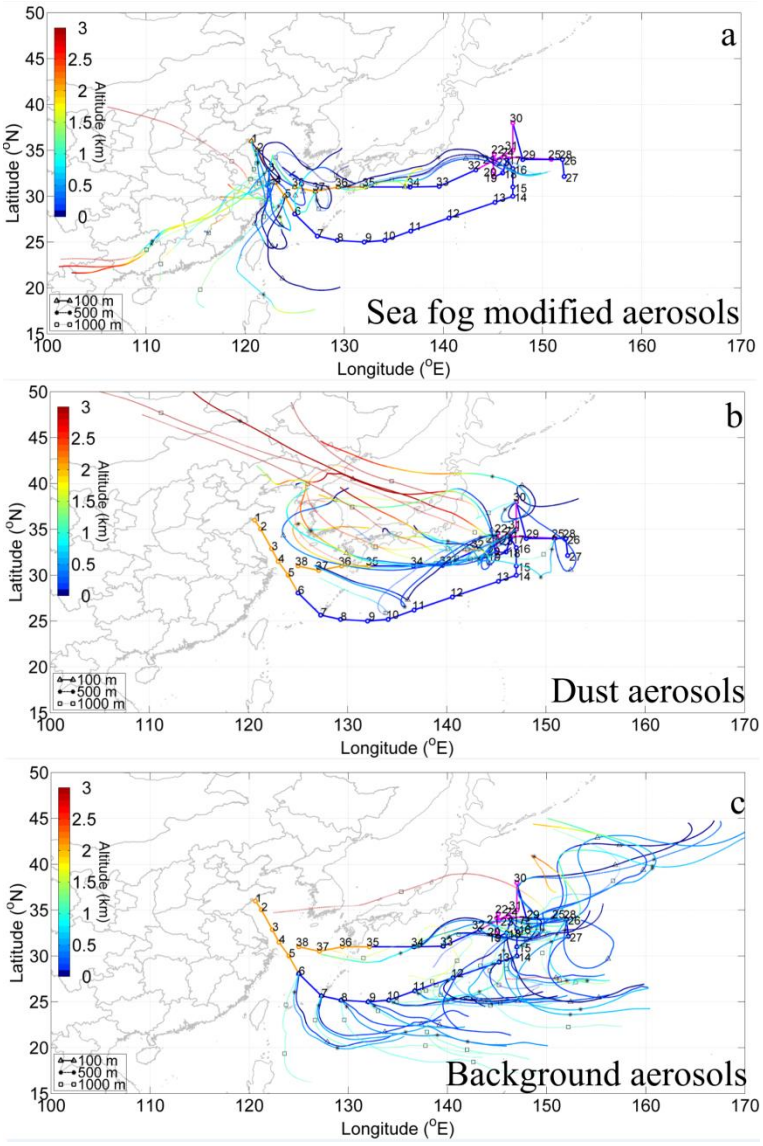

Figure S4: Map and cruise tracks of 2015 superimposed on 3-days air mass backward trajectories corresponding to each sample. Altitudes of 100 ma.s.l. (triangles), 500 m a.s.l. (asterisks) and 1000 m a.s.l. (squares) are above sea level during the collection of (a) sea-fog-modified aerosols in the ECSs, (b) dust aerosols and (c) background aerosols in the NWPO. The color bar represents the altitude (in km).

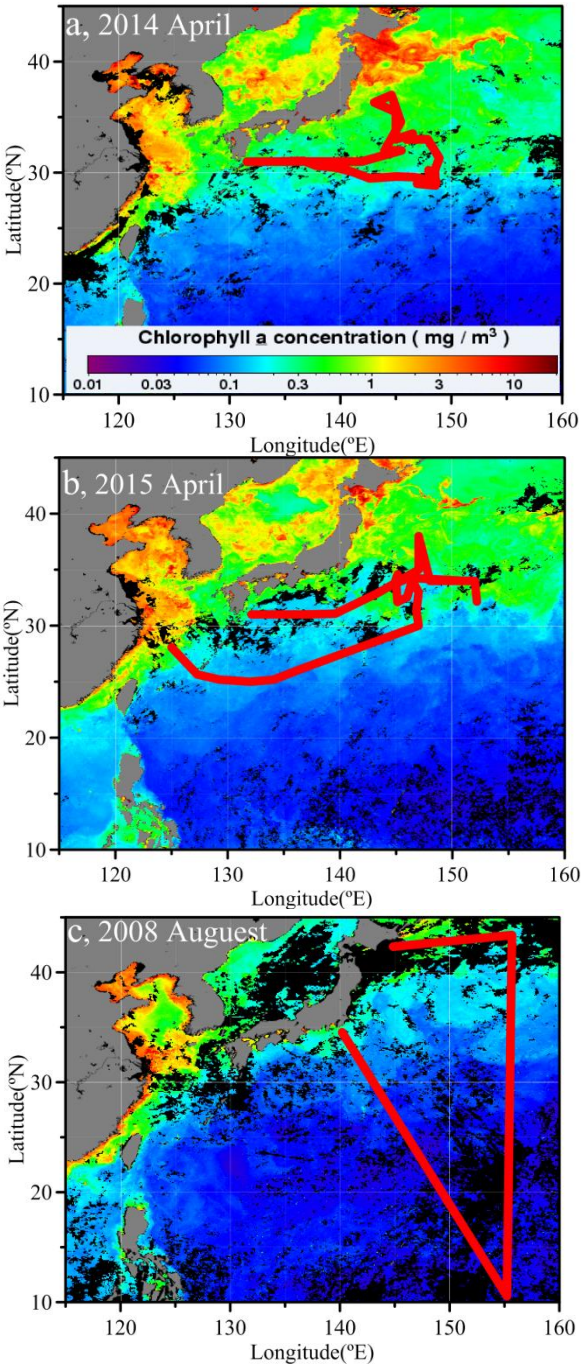

Figure S5: Cruise tracks (red line) cover the Northwest Pacific (a, from 21 March to 20 April 2014 (this study); b, from 2 April to 1 May 2015 (this study) and c, 24 August and 13 September 2008 (Miyazaki et al., 2011). The monthly averaged chlorophyll-*a* concentration corresponding to the sampling periods derived from http://oceancolor.gsfc.nasa.gov/cgi/l3. The black region indicates that the satellite data is missing at a corresponding grid.