Table S1. Sampling information for the 2015 cruise, including starting and ending sampling dates, times, and locations (longitude and latitude).

No.	Start Data	Longitude	Latitude	End 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

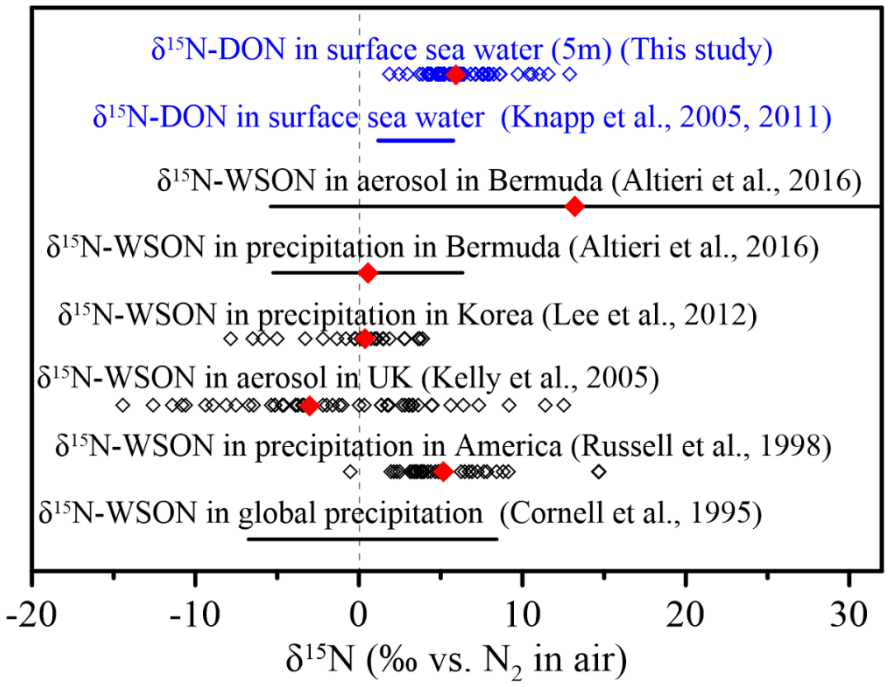

Figure S1. δ^{15}N-WSON in atmospheric precipitation and aerosol, and δ^{15}N-DON in surface sea water. Solid red diamonds denote average δ^{15}N values.

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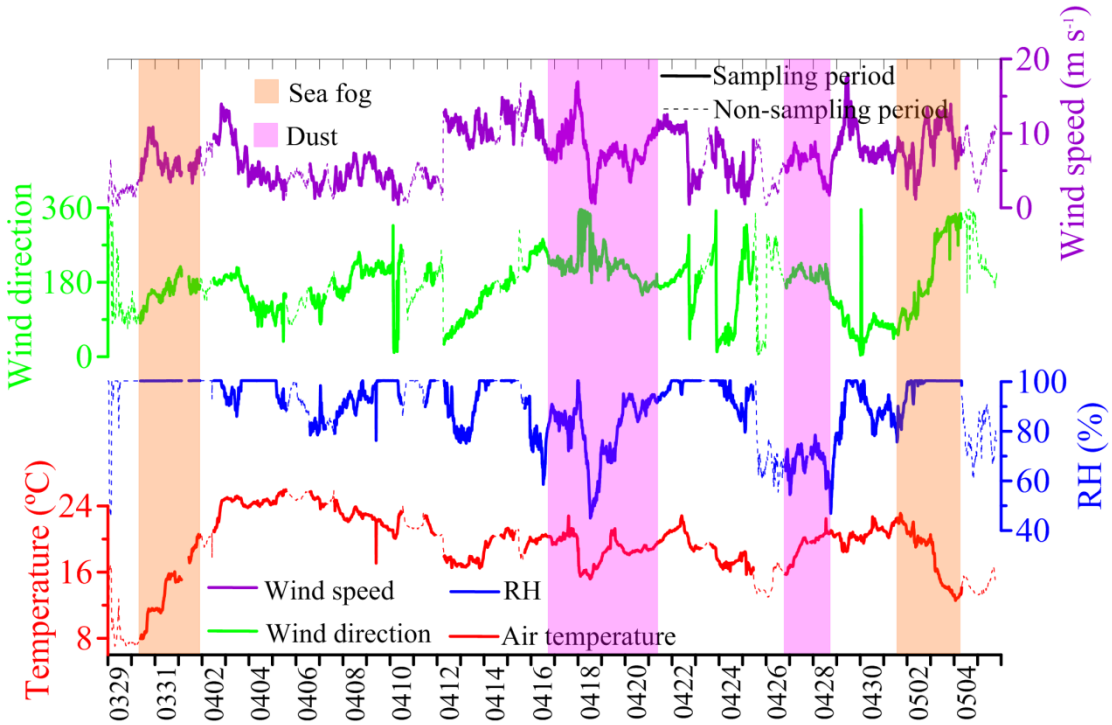

Figure S2. Meteorological parameters recorded during sampling periods (solid lines; non-sampling periods are indicated by dashed lines). Wind speed is in purple, wind direction in green, RH in blue, and temperature in red. Orange shading indicates periods of sea fog contact, and pink shading indicates dust periods.

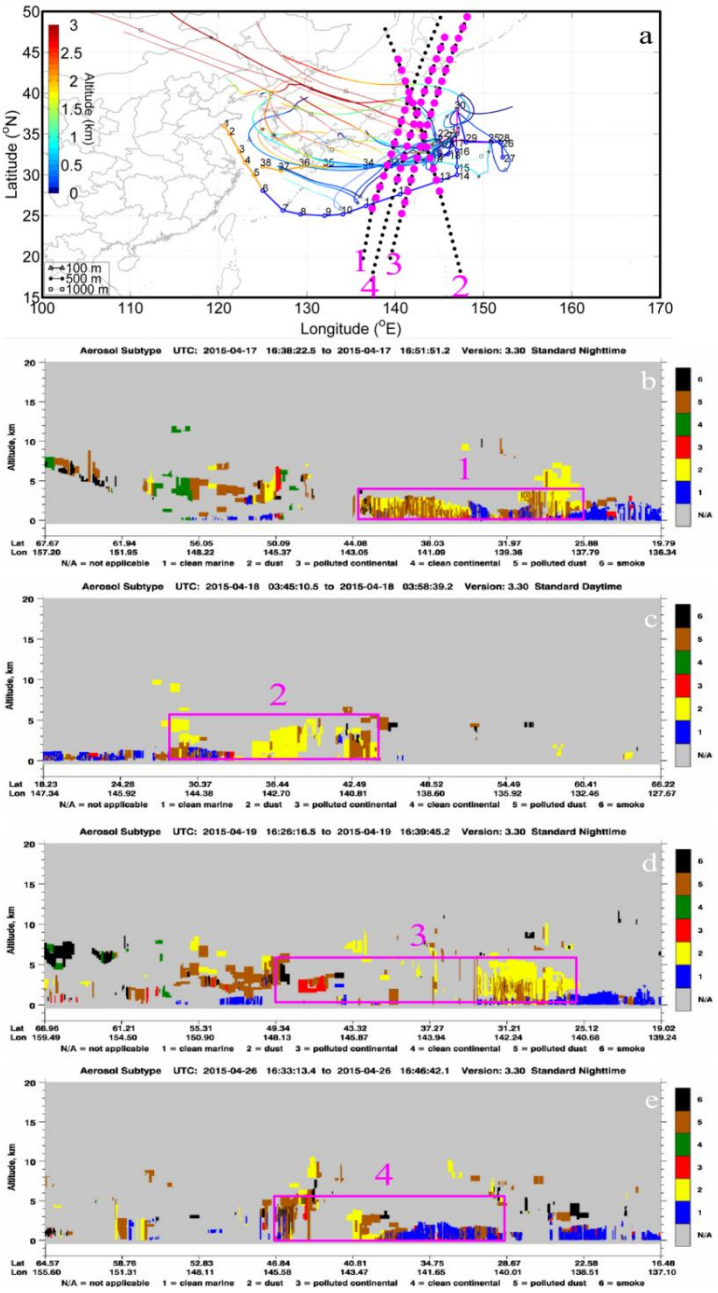

Figure S3. Lidar browse images from NASA covering the NWPO on 17-19 April and 26 April 2015. Black dashed lines in (a) represent satellite scanning tracks #1, #2, #3, and #4. Enlarged pink dots indicate the target areas shown in (b), (c), (d), and (e) along tracks #1, #2, #3, and #4, respectively. The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

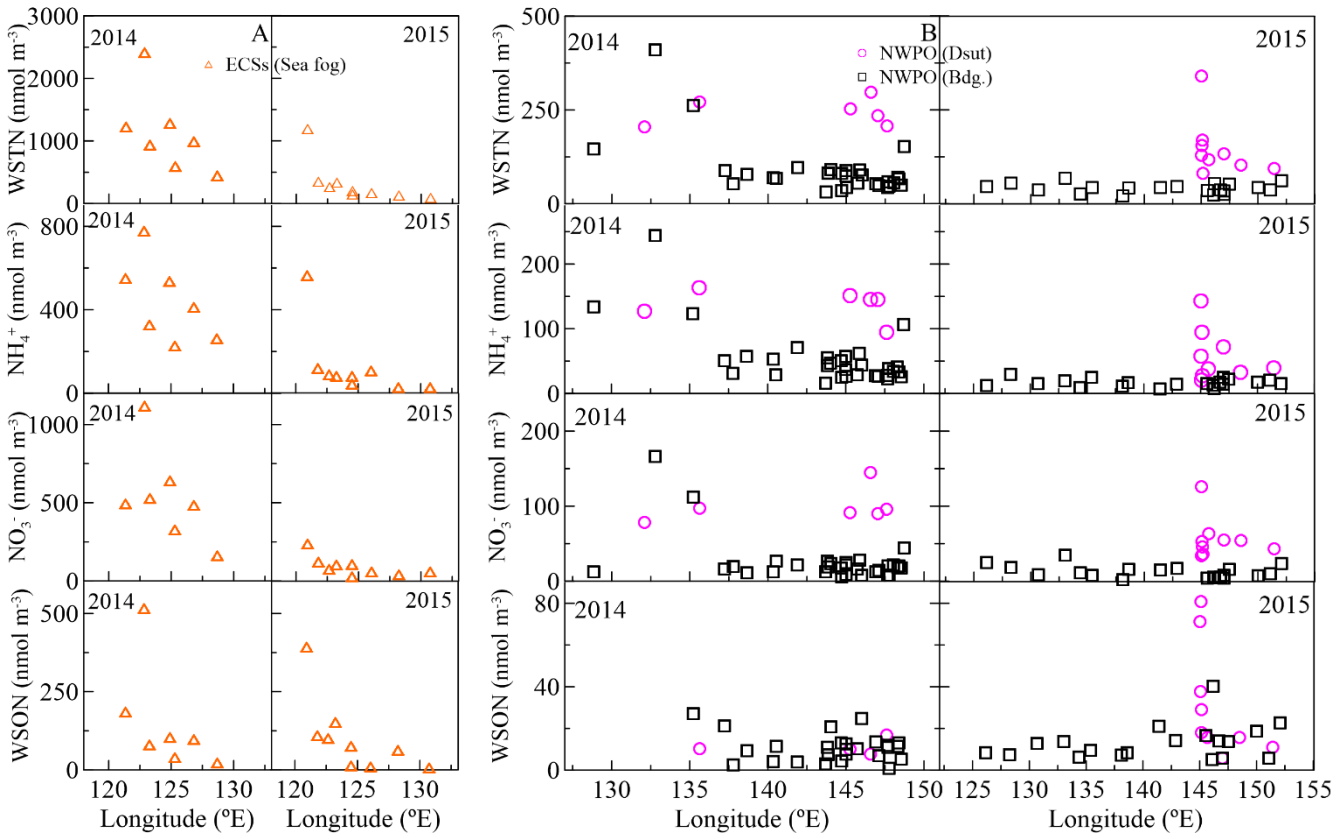

Figure S4. Concentrations of aerosol WSTN, NH_4^+, NO_3^-, and WSON with longitude during the 2014 and 2015 cruises in the ECSs (A) and NWPO (B), where orange open triangles denote sea-fog modified aerosol, pink open circles denote dust aerosol and black open squares denote background aerosol.

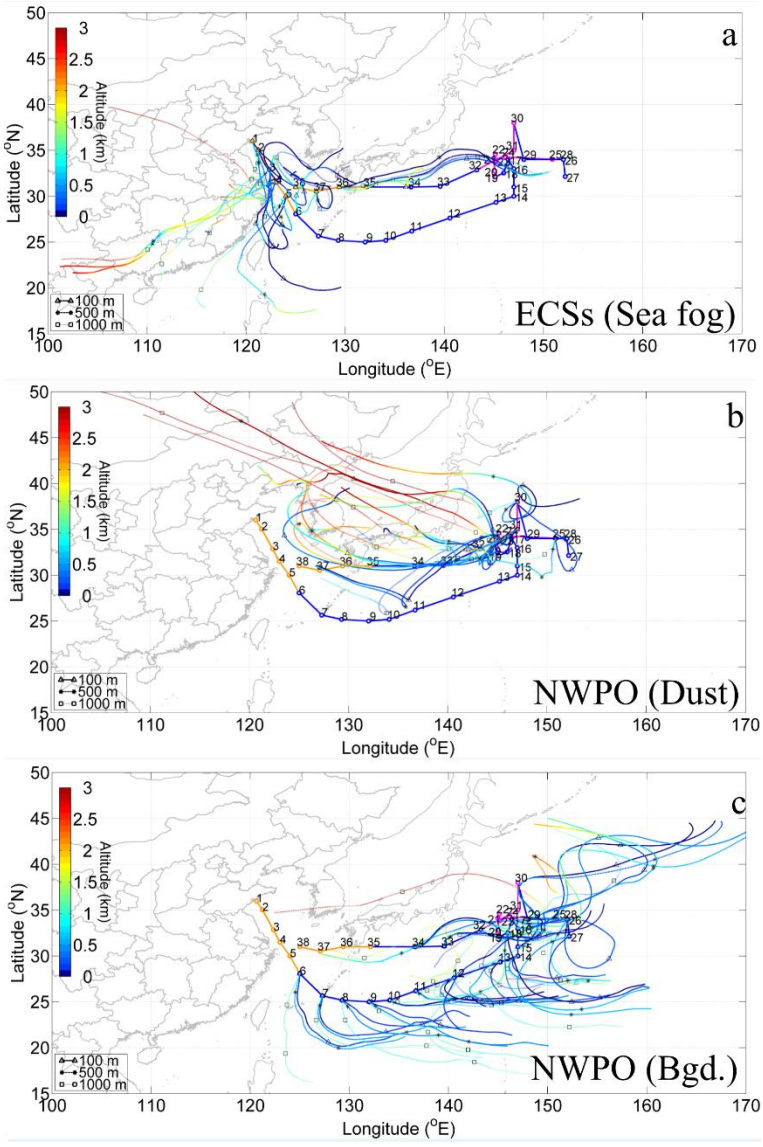

Figure S5. Map and cruise tracks for 2015 superimposed by 3-day air mass backward trajectories at 100 m (triangles), 500 m (asterisks), and 1000 m (squares) above sea level corresponding to each sample during the collection of (a) sea-fog-modified aerosols in the ECSs, (b) dust aerosols, and (c) background aerosols in the NWPO. The colour bar represents altitude (in km).

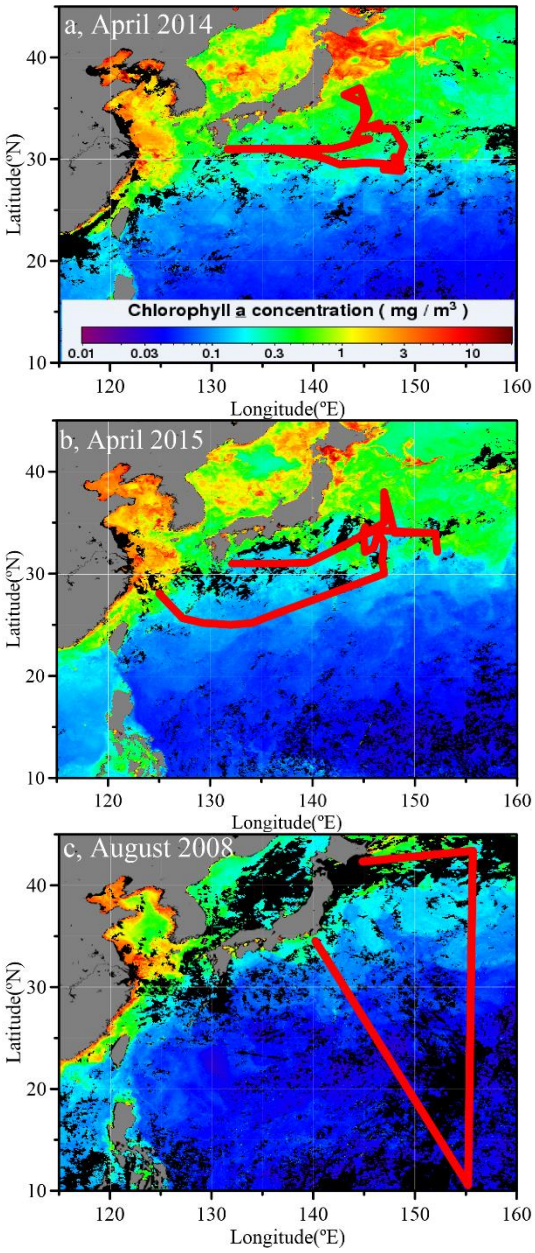

Figure S6. Cruise tracks (red lines) covering the Northwest Pacific (a) from 21 March to 20 April 2014 (this study), (b) from 2 April to 1 May 2015 (this study), and (c) 24 August and 13 September 2008 (Miyazaki et al., 2011). The monthly averaged chlorophyll-*a* concentrations corresponding to the sampling periods were derived from http://oceancolor.gsfc.nasa.gov/cgi/l3. The black regions indicate missing satellite data at a corresponding grid.

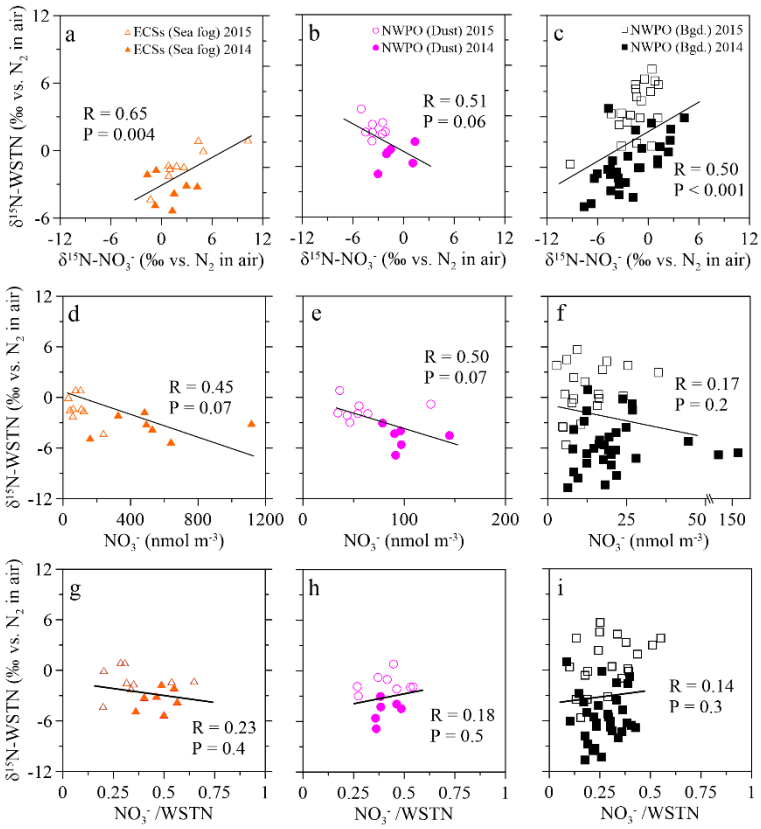

Figure S7. Scatter plots of δ^{15}N-WSTN against δ^{15}N-NO_3^-, NO_3^- and NO_3^-/WSTN, respectively, in aerosol sampled in the ECSs (a, d, g), and dust aerosol (b, e, h) and background aerosol (c, f, i) collected in the NWPO. The solid and open symbols indicate aerosols sampled in 2014 and 2015, respectively.

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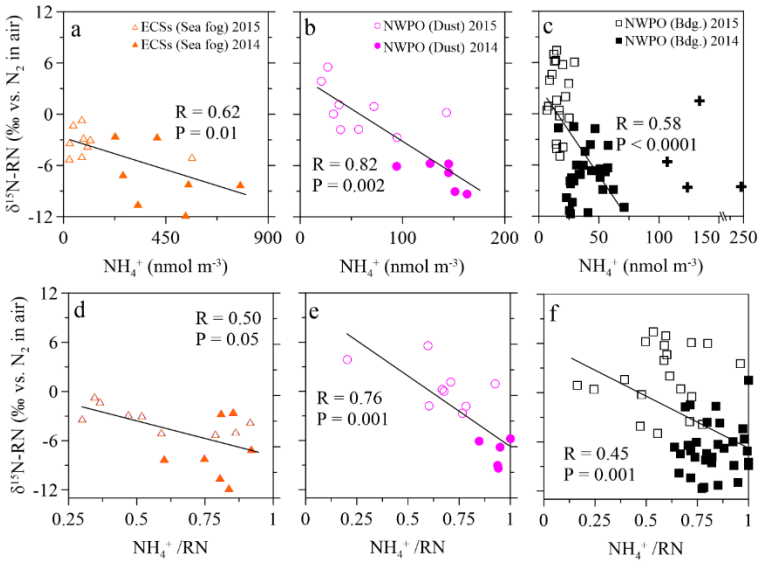

Figure S8. Scatter plots of δ^{15}N-RN against NH_4^+ and NH_4^+/RN, respectively, in sea-fog modified aerosols sampled in the ECSs (a, d), dust aerosol (b, e) and background aerosol (c, f) collected in the NWPO. The solid and open symbols indicate aerosols sampled in 2014 and 2015, respectively.