Atmospheric
Chemistry
and Physics

Supplement of

Photochemical age of air pollutants, ozone, and secondary organic aerosol in transboundary air observed on Fukue Island, Nagasaki, Japan

Satoshi Irei et al.

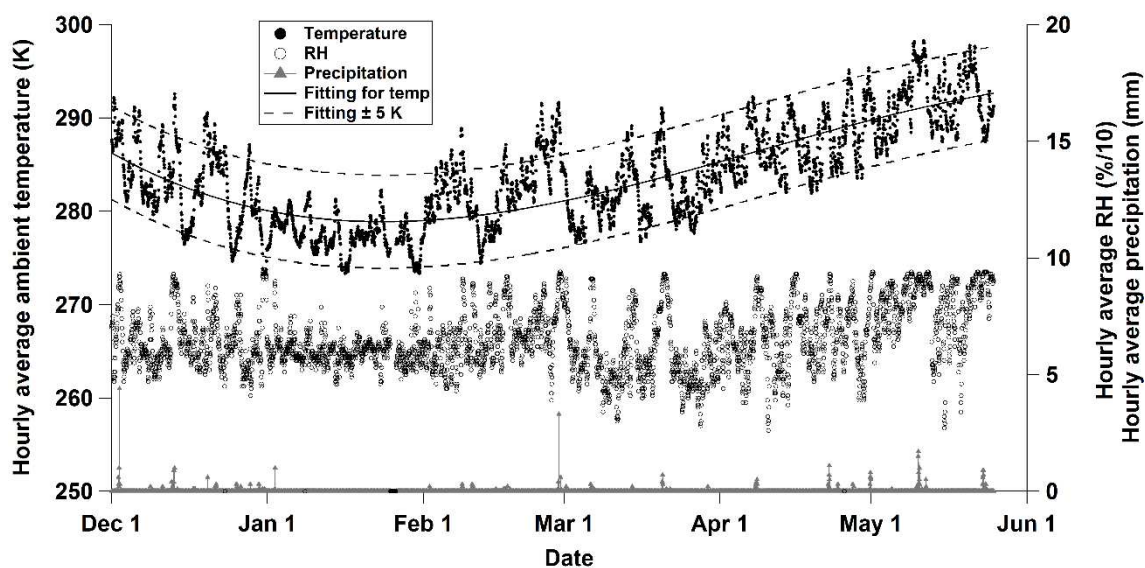*Correspondence to:* Satoshi Irei (satoshi.irei@gmail.com)

Figure S-1. Time-series plots of hourly average ambient temperature, relative humidity (RH), and precipitation during the field study.
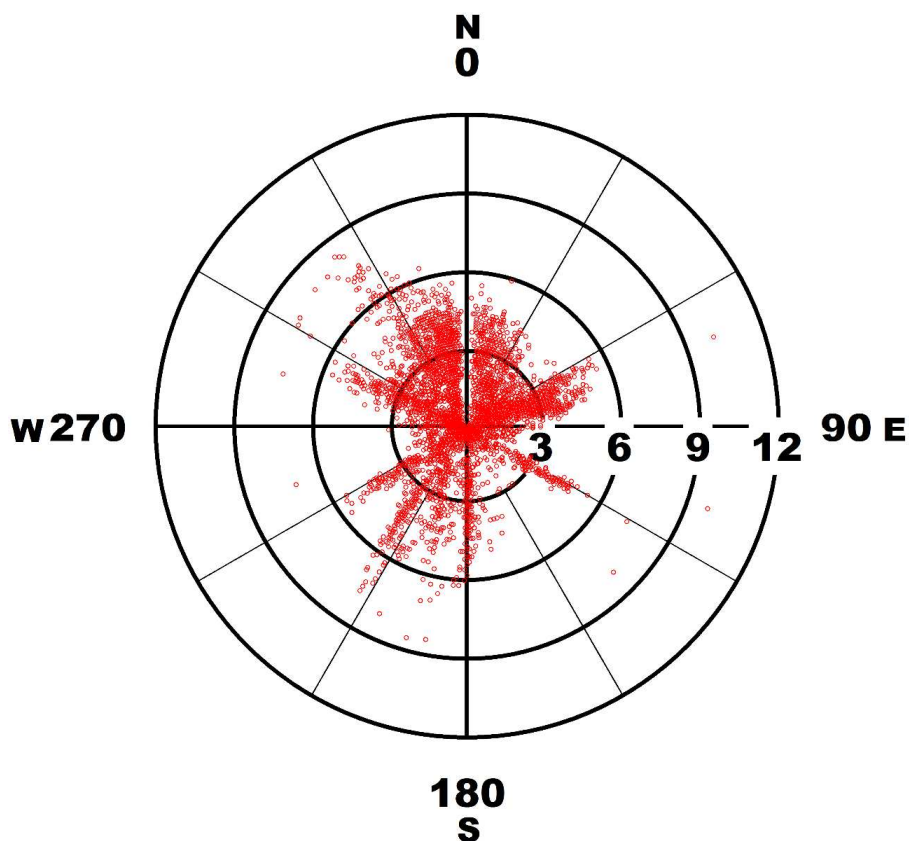

Figure S-2. Polar plot of the dependence of hourly average wind speed (radial axis in m s^{-1}) on wind direction (degrees) observed at the Fukue monitoring station (north = 0 degrees, east = 90 degrees).
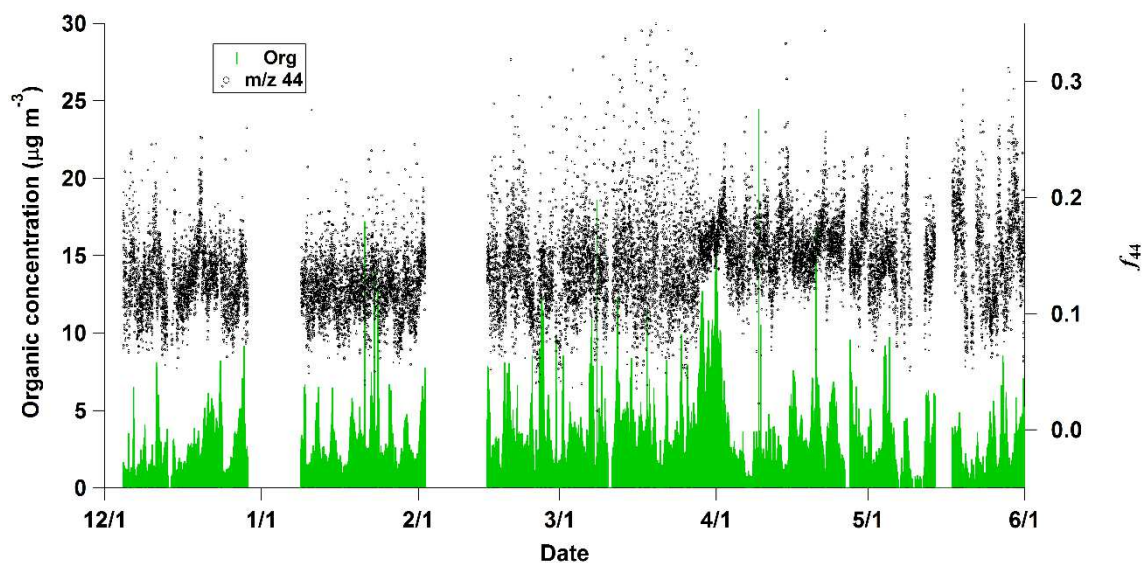
Figure S-3. Temporal variation of concentration of organic species and fraction due to m/z 44, f_{44}, in the mass spectra of organic species measured by quadrupole aerosol mass spectrometry.
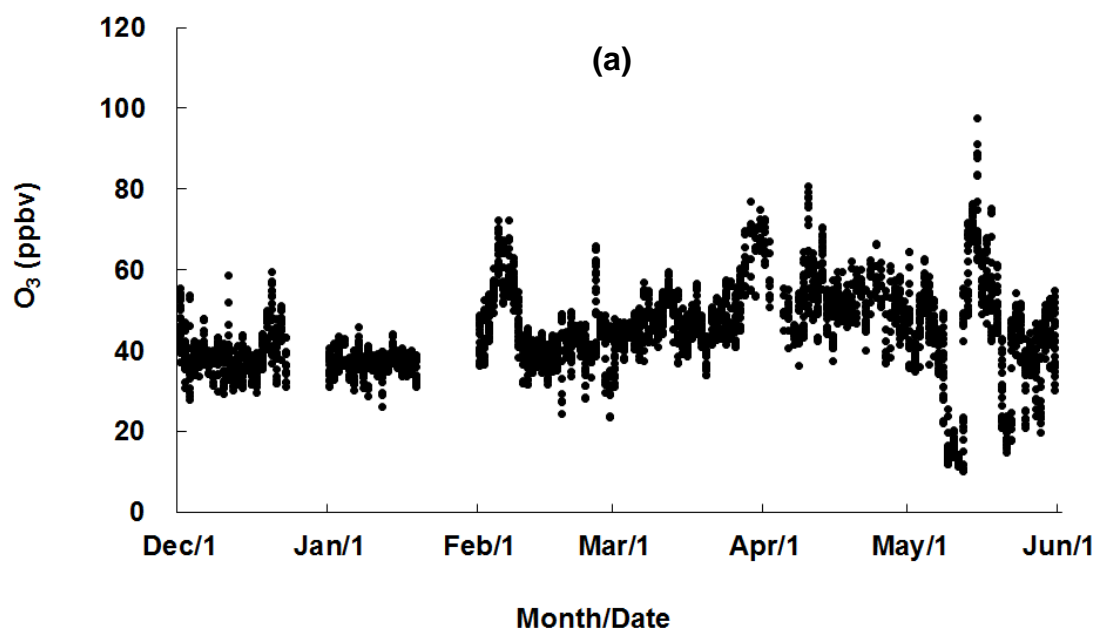

Figure S-4. Temporal variation of hourly average mixing ratios for (a) O_3, (b) NO_x, (c) NO_y, (d) CO, (e) i-pentane, (f) toluene, and (g) ethyne.
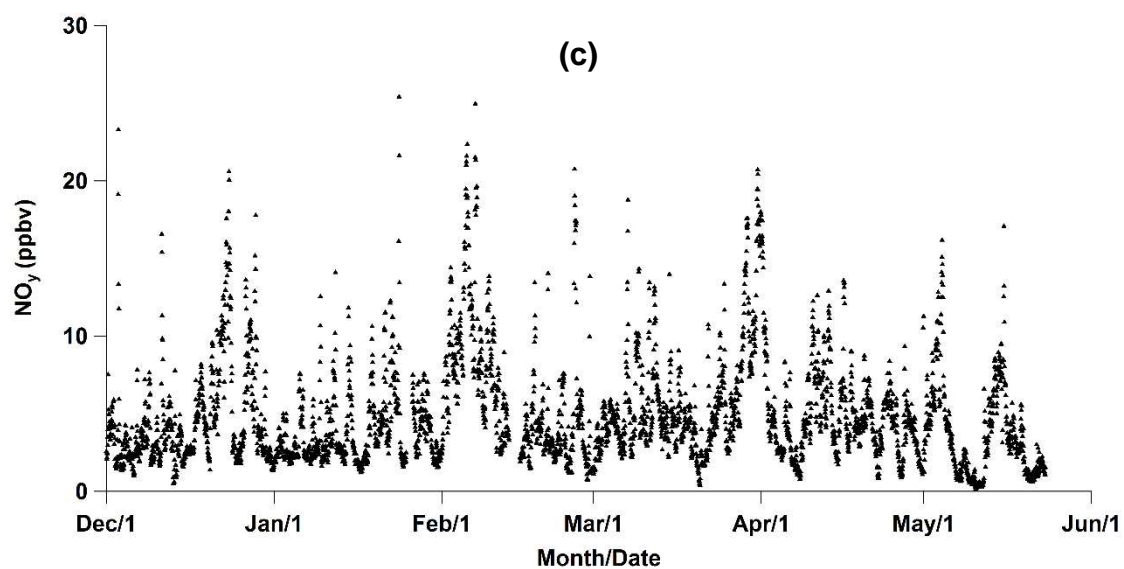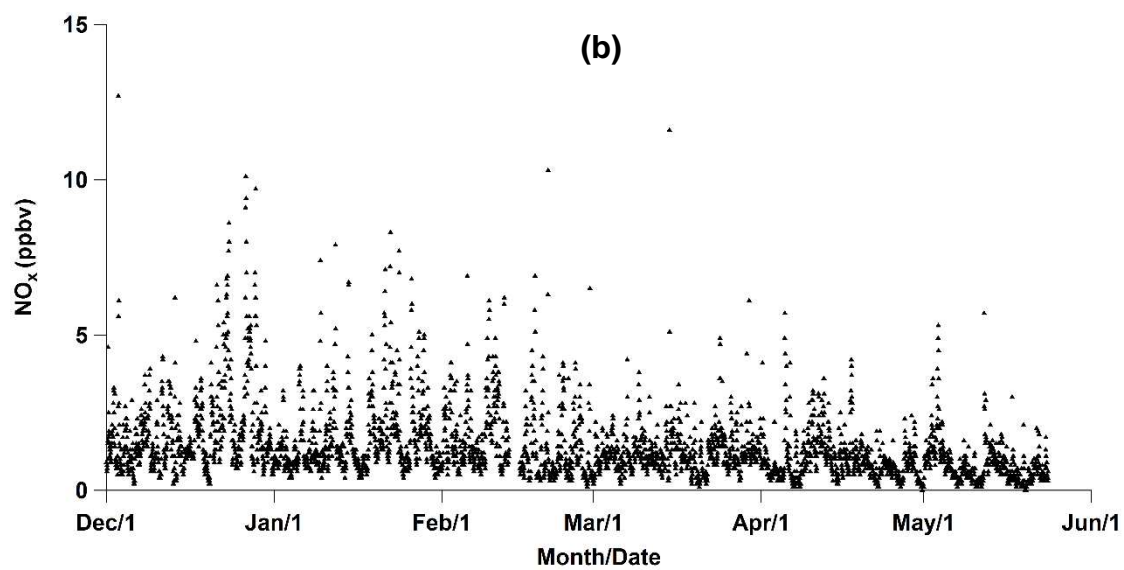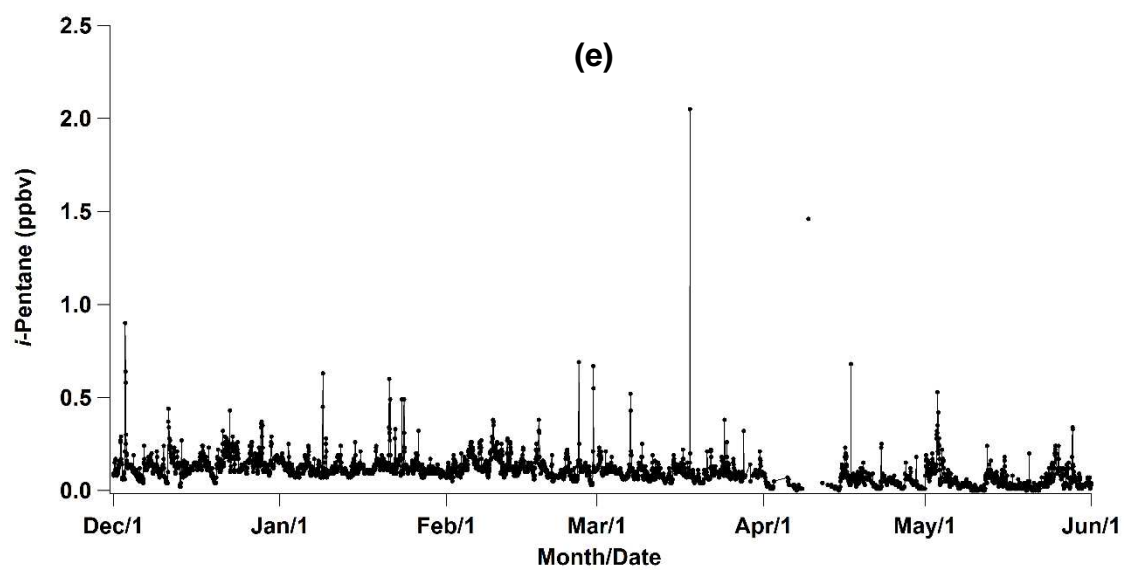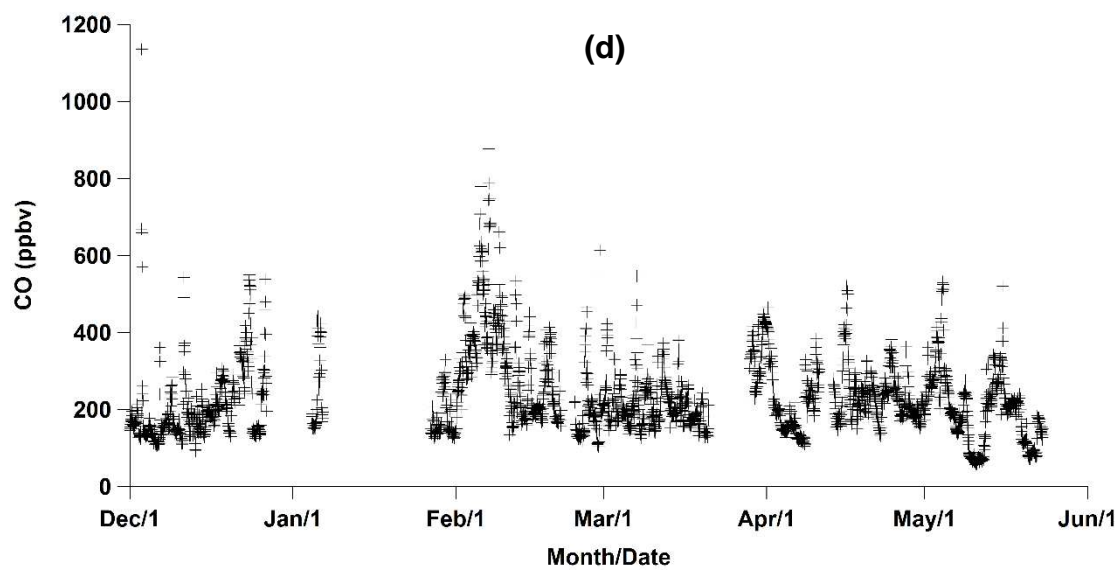
Figure S-4. Continued.
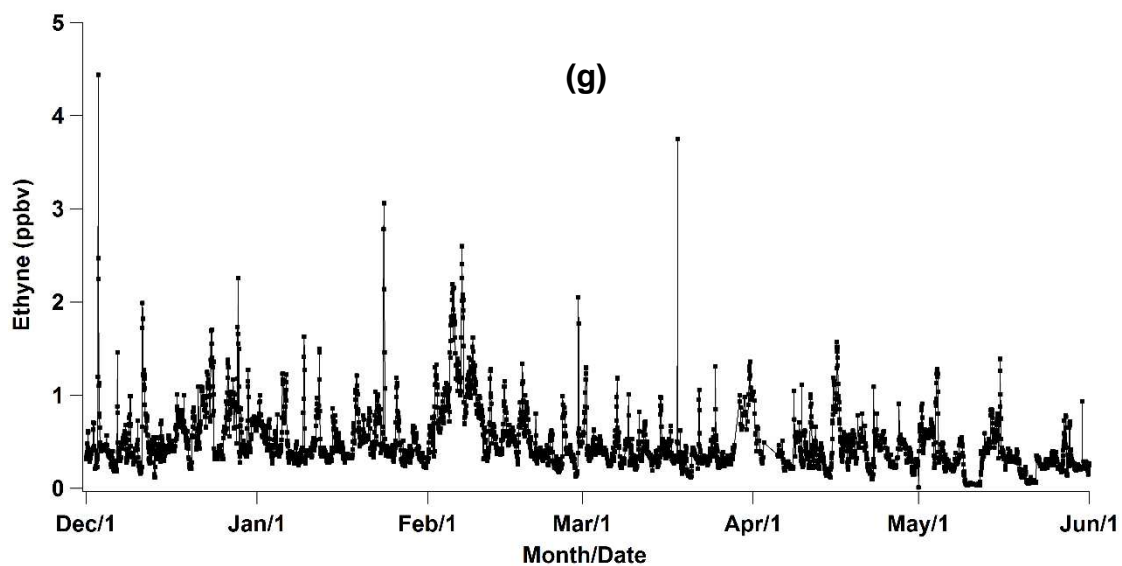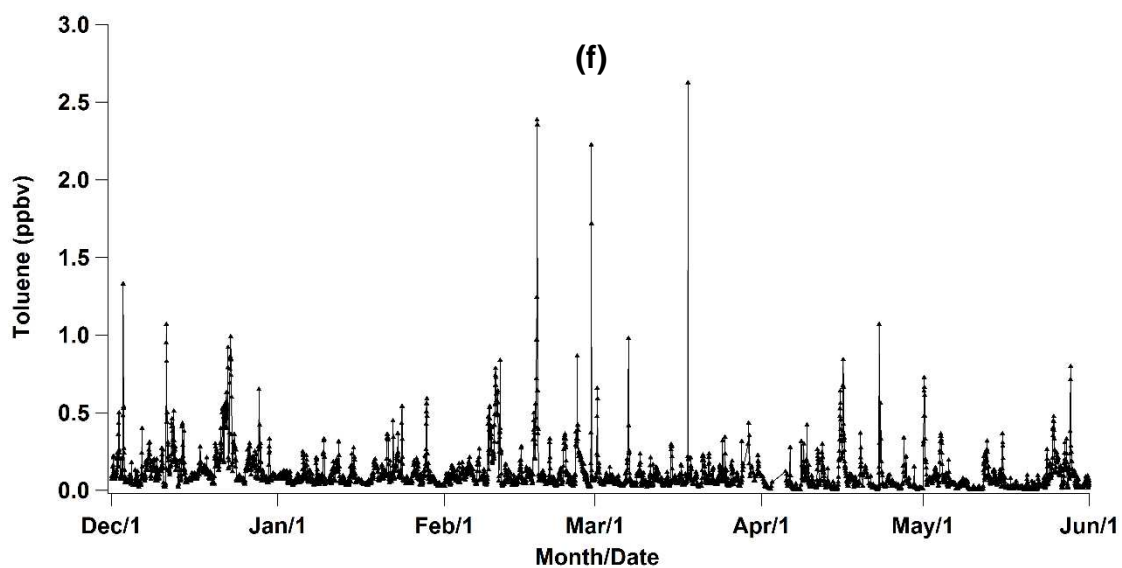
Figure S-4. Continued.

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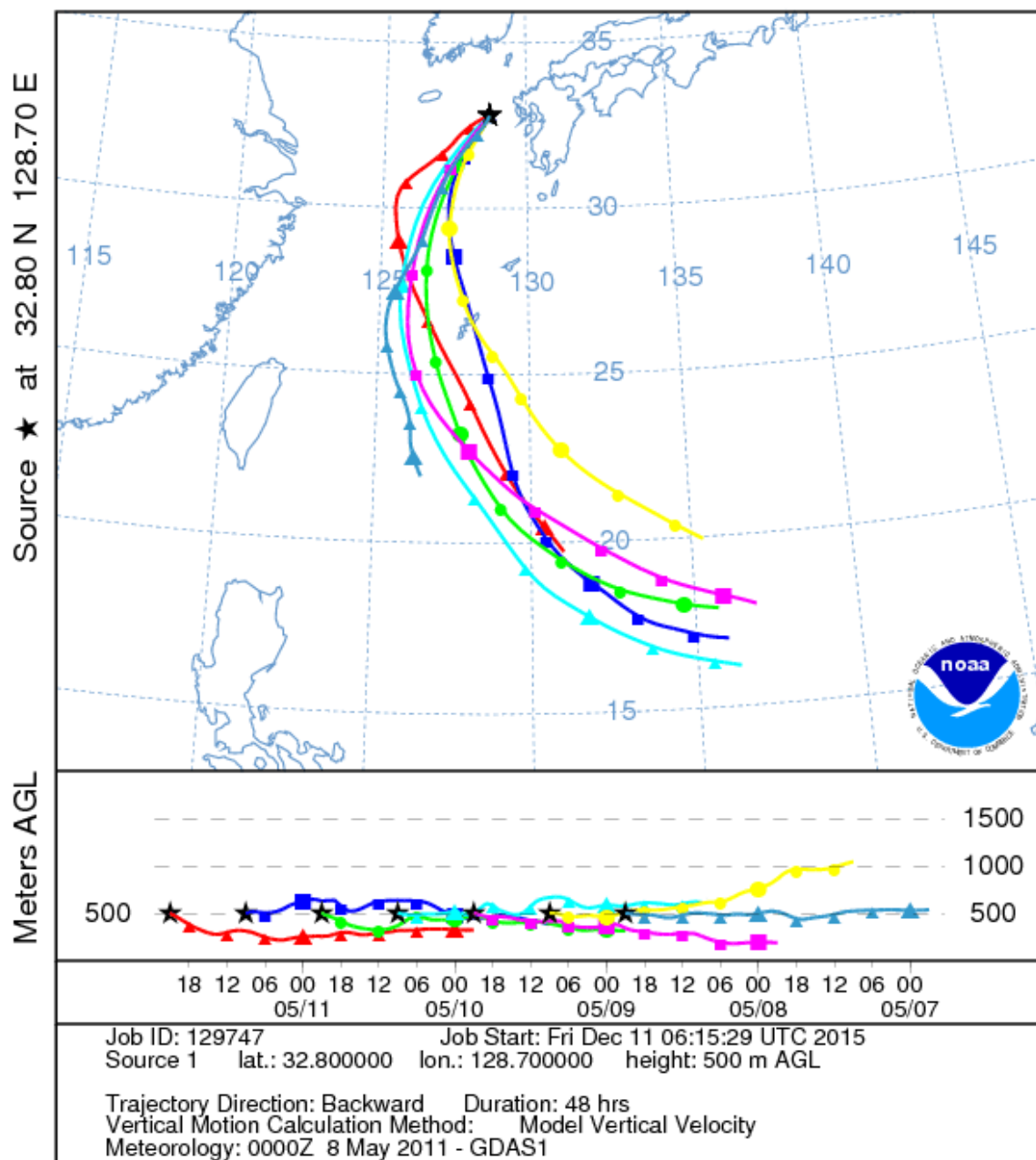Figure S-5. Back trajectories of air masses arriving at Fukue during the low mixing ratio episode of ozone (May 9 to 11).
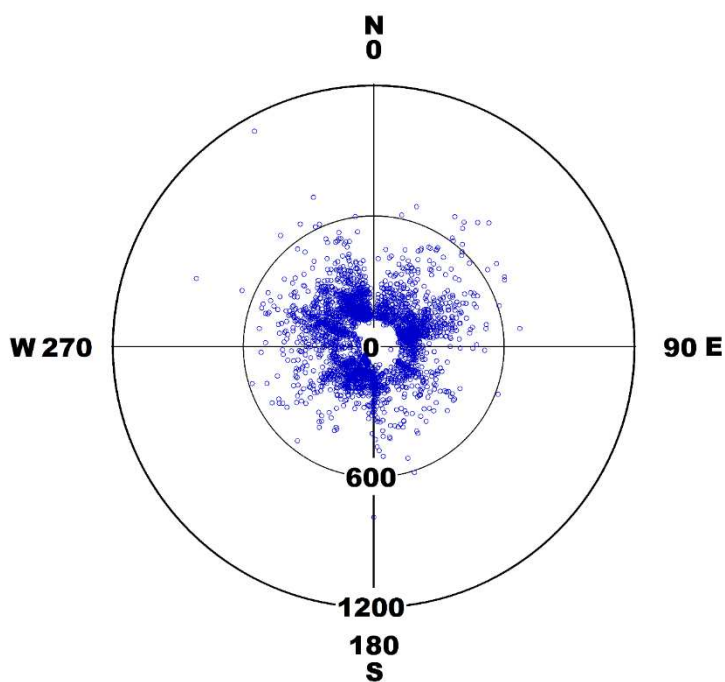
Figure S-6. Wind-sector dependence (north = 0 degrees, east = 90 degrees) of CO mixing ratio (the radial axis in ppbv).

Table S-1. Observations of chemical species concentration rise during the seven primary emission episodes indicated by CO mixing ratio[a]

	episode 1	episode 2	episode 3	episode 4	episode 5	episode 6	episode 7
beginning[b]	12/21 18:00	2/1 1:00	3/28 20:00	4/15 5:00	4/24 6:00	5/1 4:00	5/12 9:00
end[b]	12/24 7:00	2/11 10:00	4/2 13:00	4/17 1:00	4/25 16:00	5/6 4:00	5/19 17:00
particulate SO_4		n/a[c]	✓	✓		✓	✓
particulate Org		n/a[c]	✓	✓		✓	
particulate NO_3	✓	n/a[c]	✓			✓	
particulate NH_4	✓	n/a[c]	✓			✓	✓
NO_x	✓					✓	✓
NO_y	✓	✓	✓	✓		✓	✓
O_3	✓	✓	✓			✓[d]	✓
ethylene	✓	✓	✓	✓		✓	✓
benzene	✓	✓	✓	✓	✓	✓	✓
toluene	✓		✓	✓	✓	✓	✓

[a]A check mark indicates confirmation of concentration rises. [b]Time is in local time. [c]n/a indicates no data available during the episode. [d]Diurnal variation was observed.
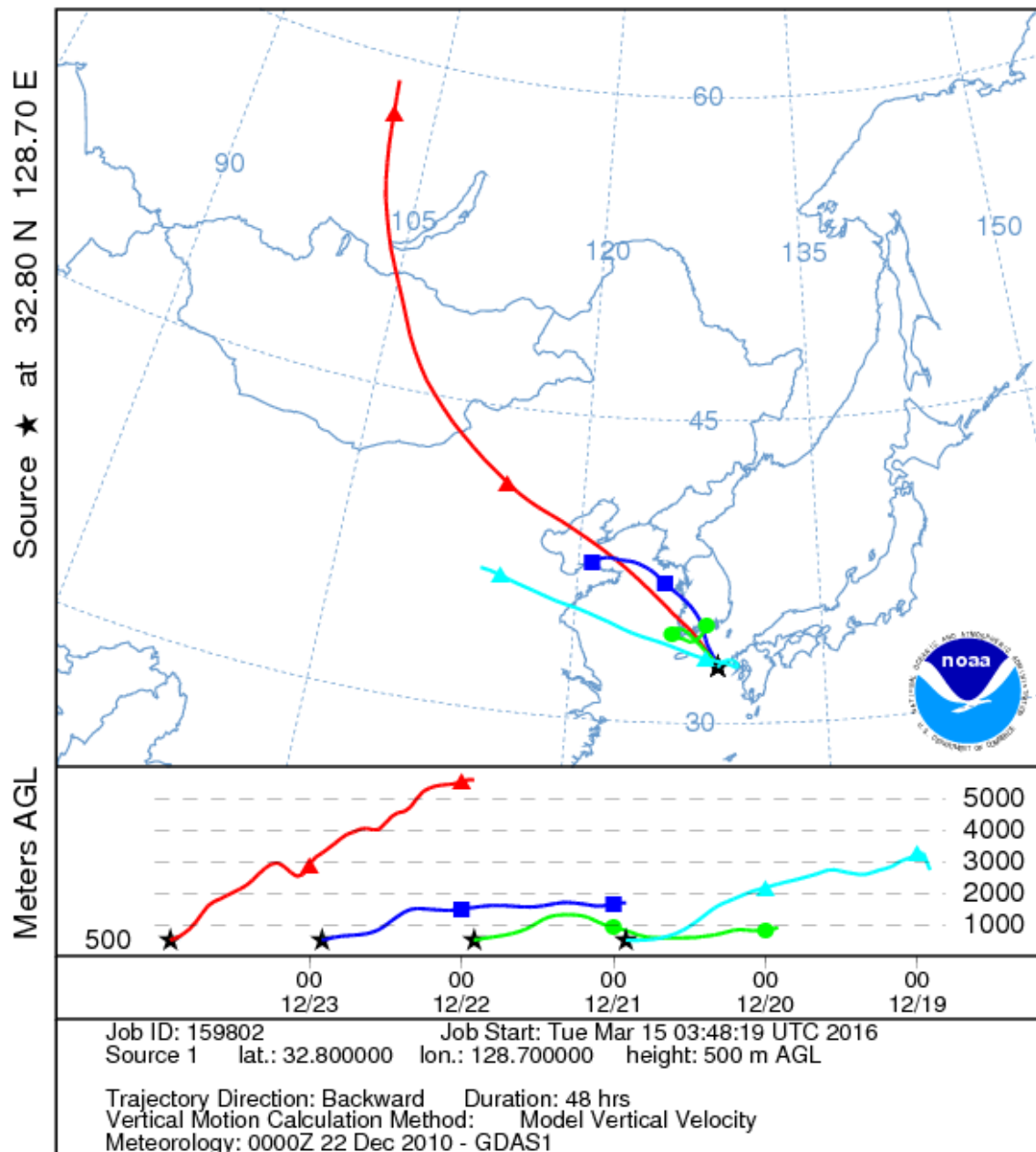
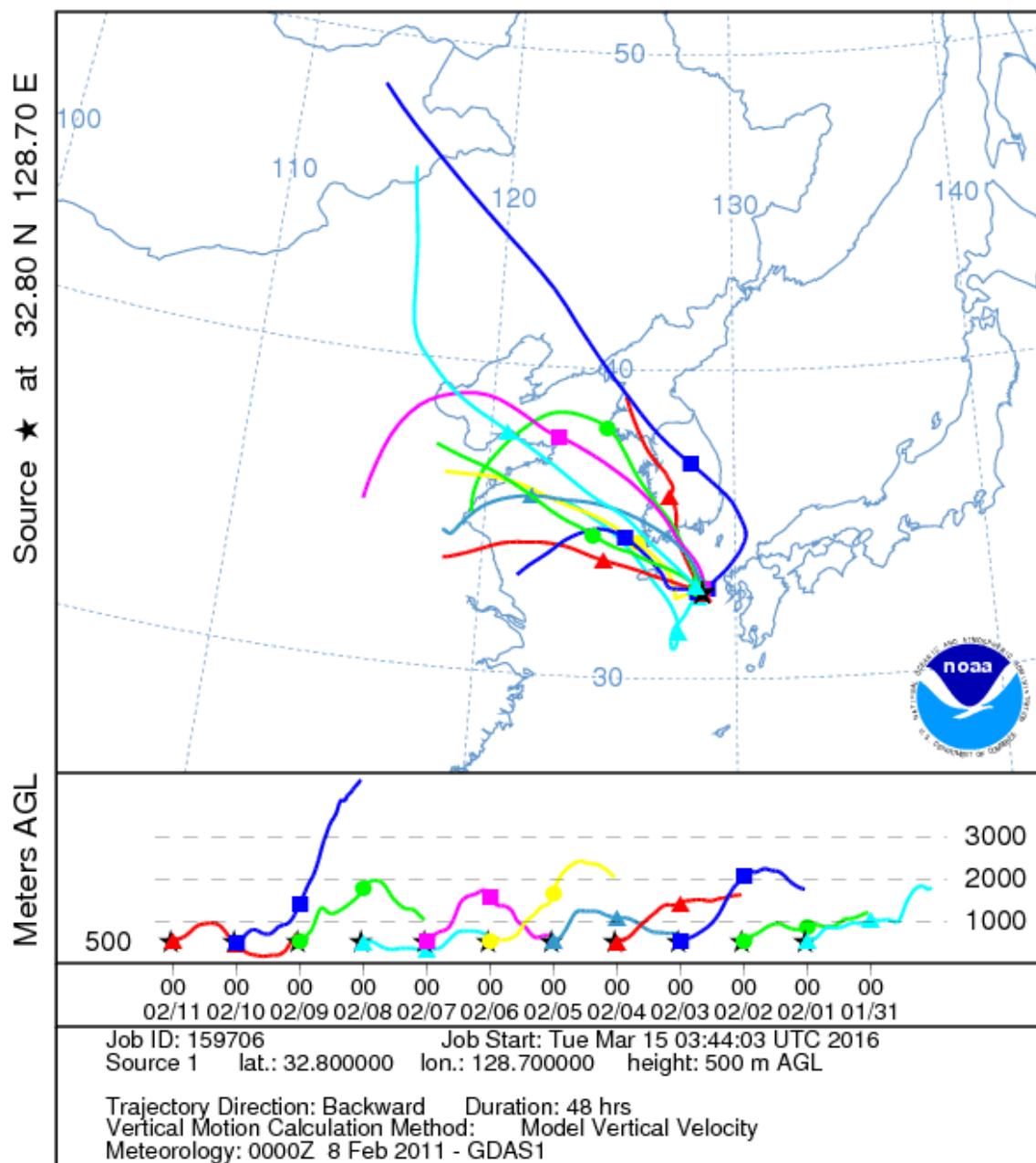Figure S-7. 48h back trajectories of air masses during the episode 1. See Table S-1 for the detail of episode period.

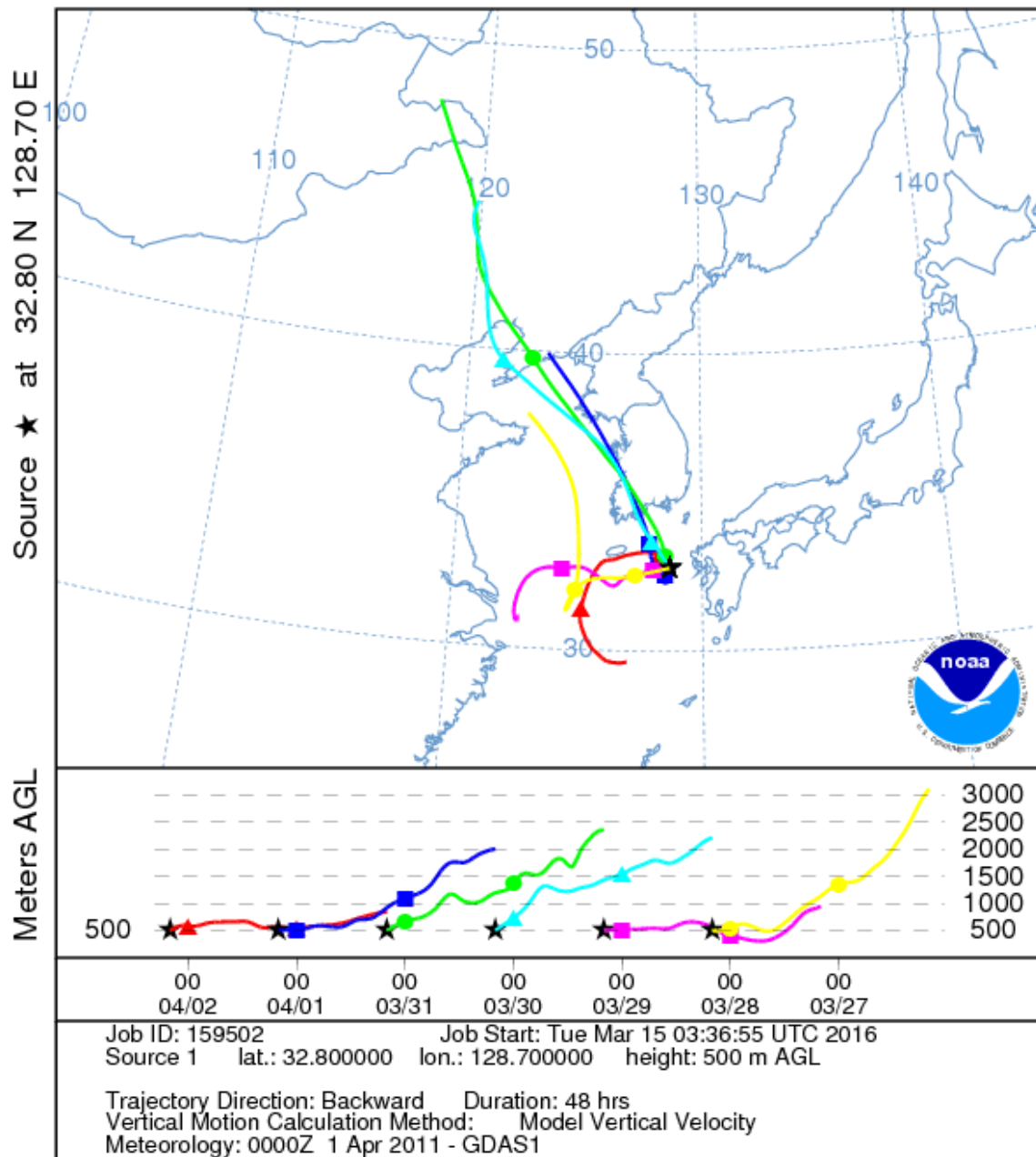Figure S-8. 48h back trajectories of air masses during the episode 2. See Table S-1 for the detail of episode period.

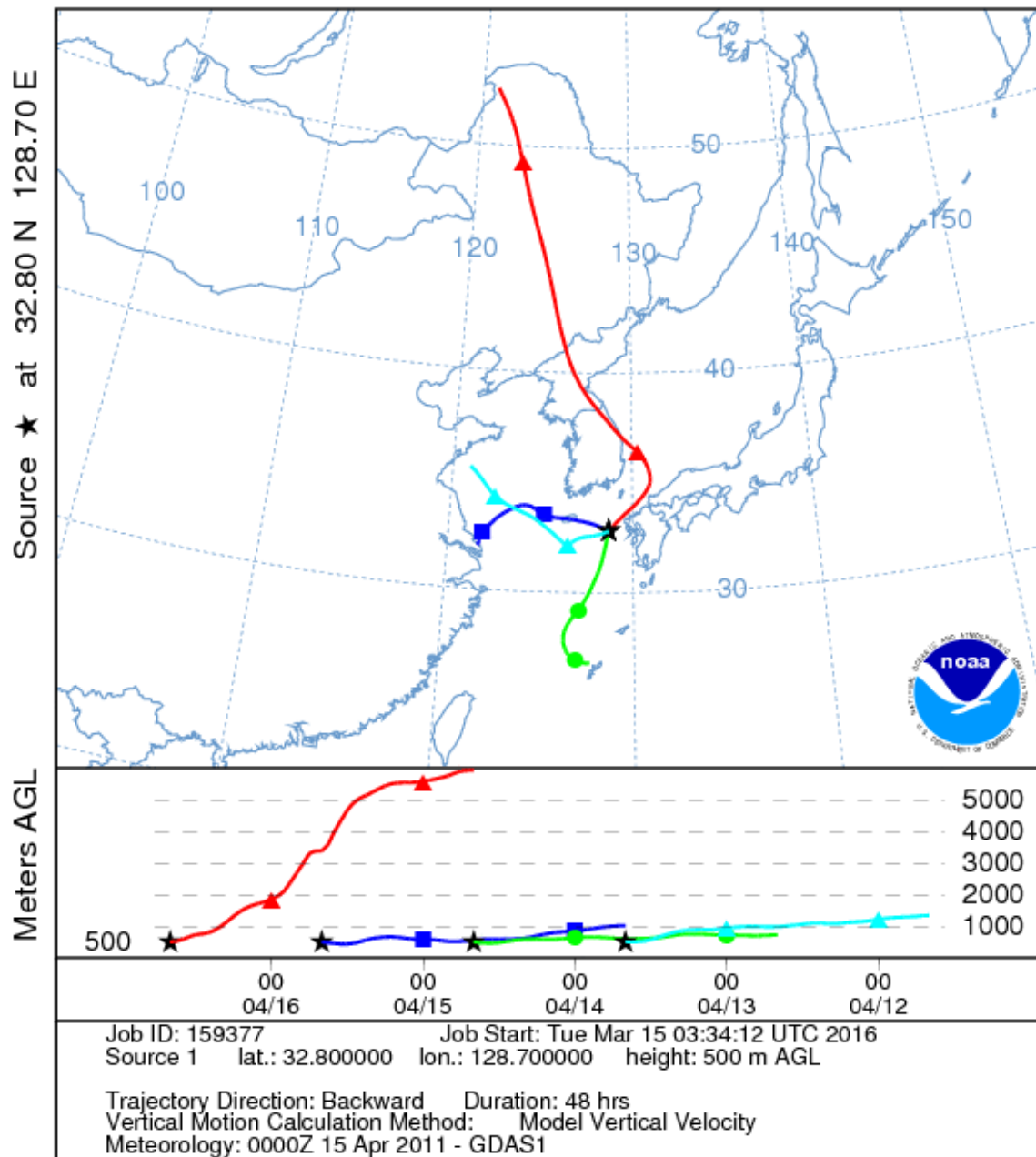Figure S-9. 48h back trajectories of air masses during the episode 3. See Table S-1 for the detail of episode period.

Figure S-10. 48h back trajectories of air masses during the episode 4. See Table S-1 for the detail of episode period.

Figure S-11. 48h back trajectories of air masses during the episode 5. See Table S-1 for the detail of episode period.

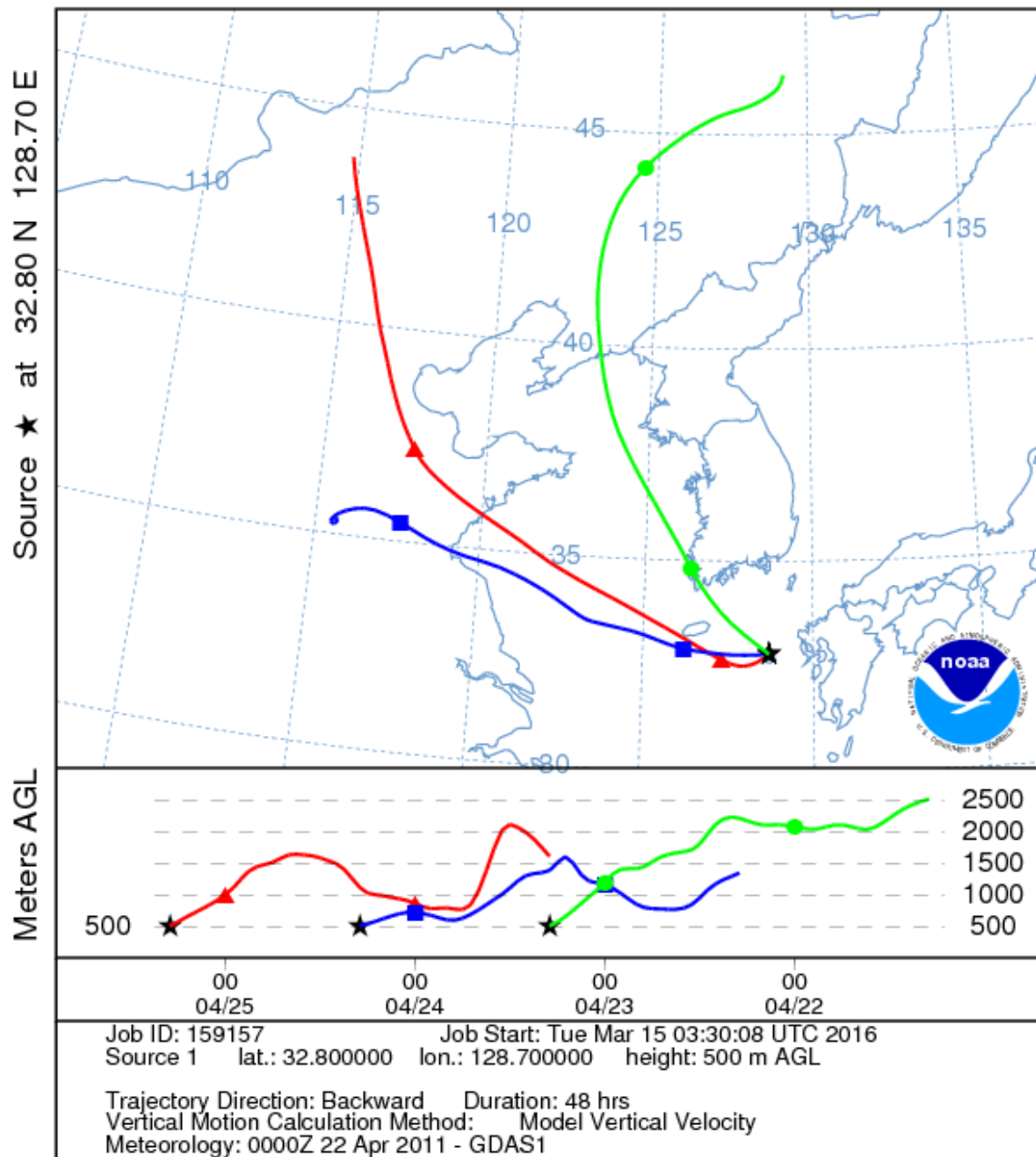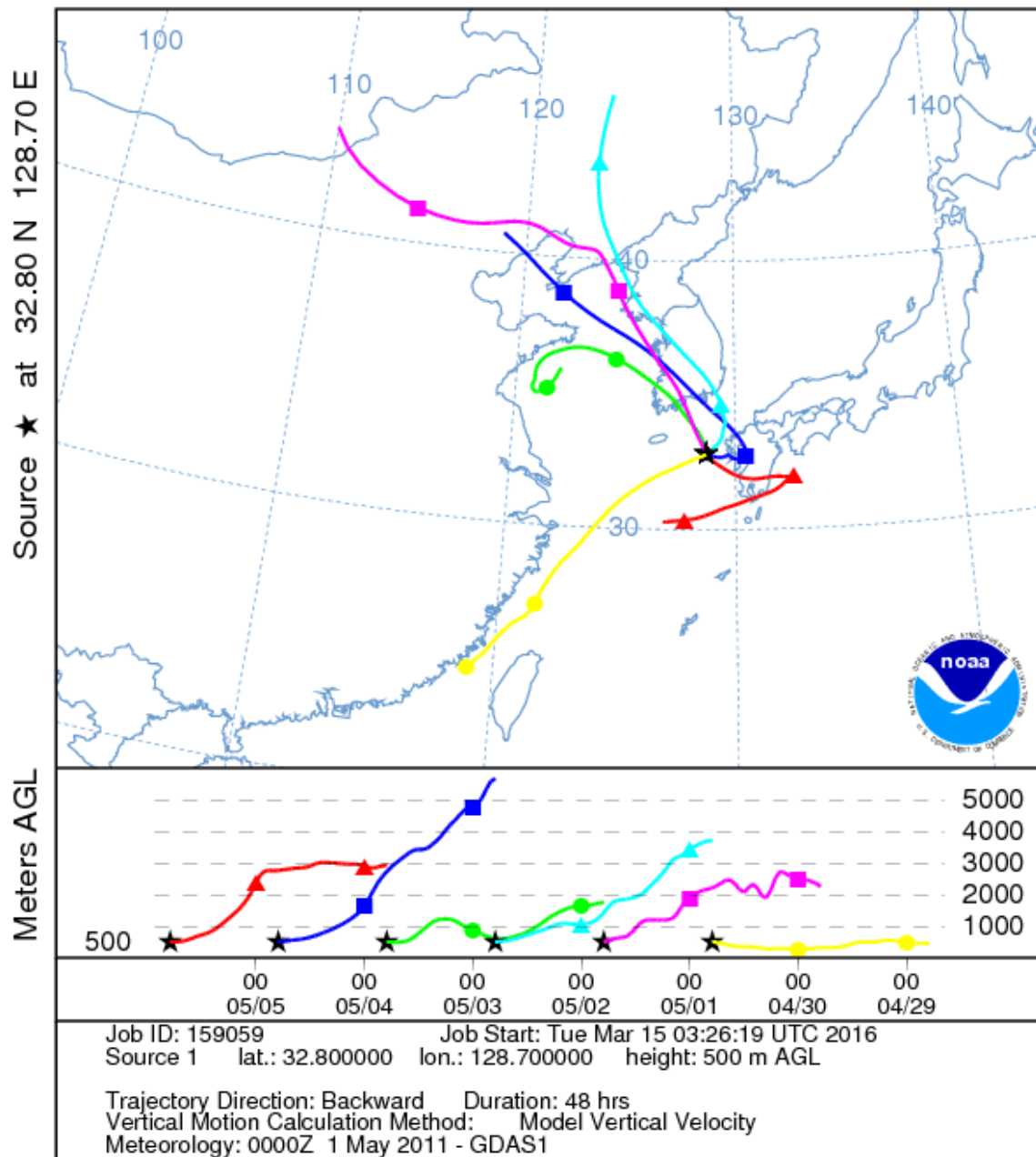Figure S-12. 48h back trajectories of air masses during the episode 6. See Table S-1 for the detail of episode period.
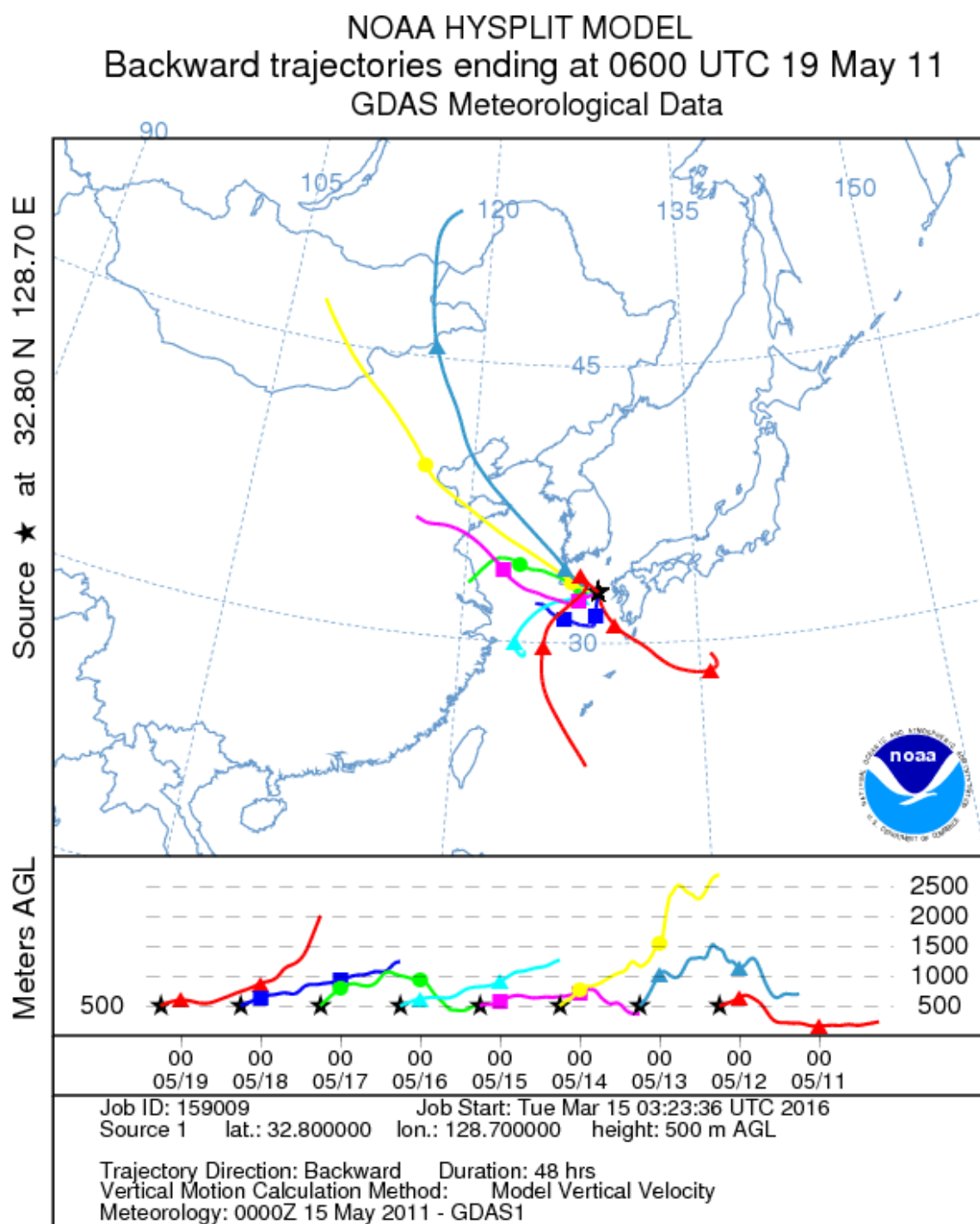
Figure S-13. 48h back trajectories of air masses during the episode 7. See Table S-1 for the detail of episode period.
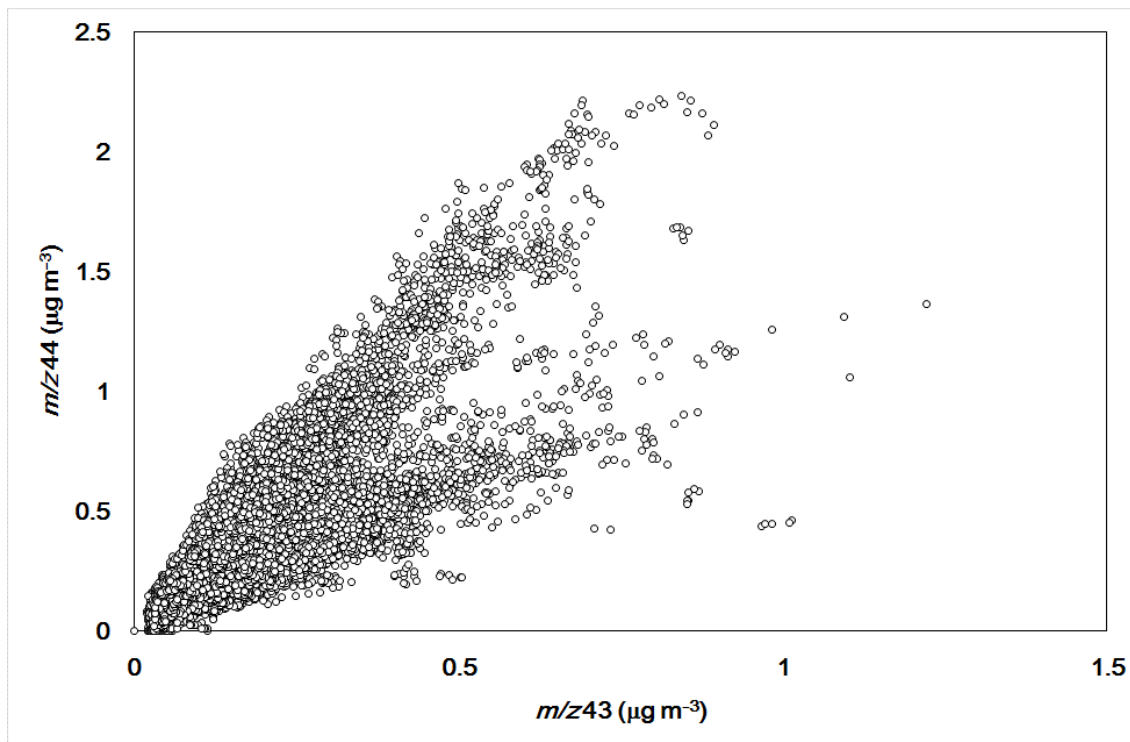
Figure S-14. Scatter plot of hourly averaged *m/z* 44 concentrations of organics as function of hourly averaged *m/z* 43 concentrations of organics.
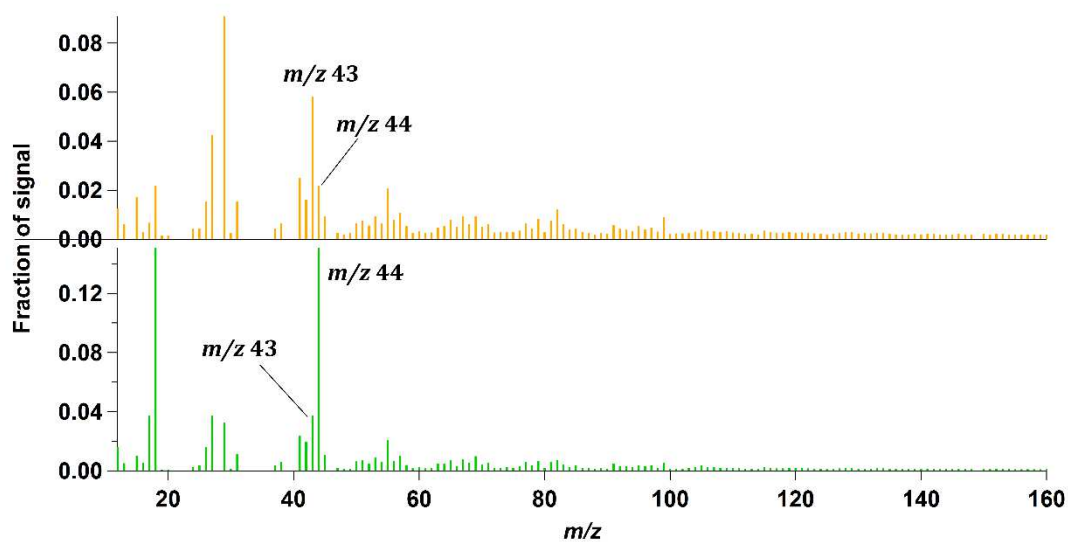

Figure S-15. Extracted mass spectra from two-factorial PMF analysis on organic aerosol mass spectra obtained from January 8 to February 2, 2011: top (orange), mass spectra identified as semi-volatile oxygenated organic aerosol (SV-OOA); bottom (green), mass spectra identified as low-volatile oxygenated organic aerosol (LV-OOA).
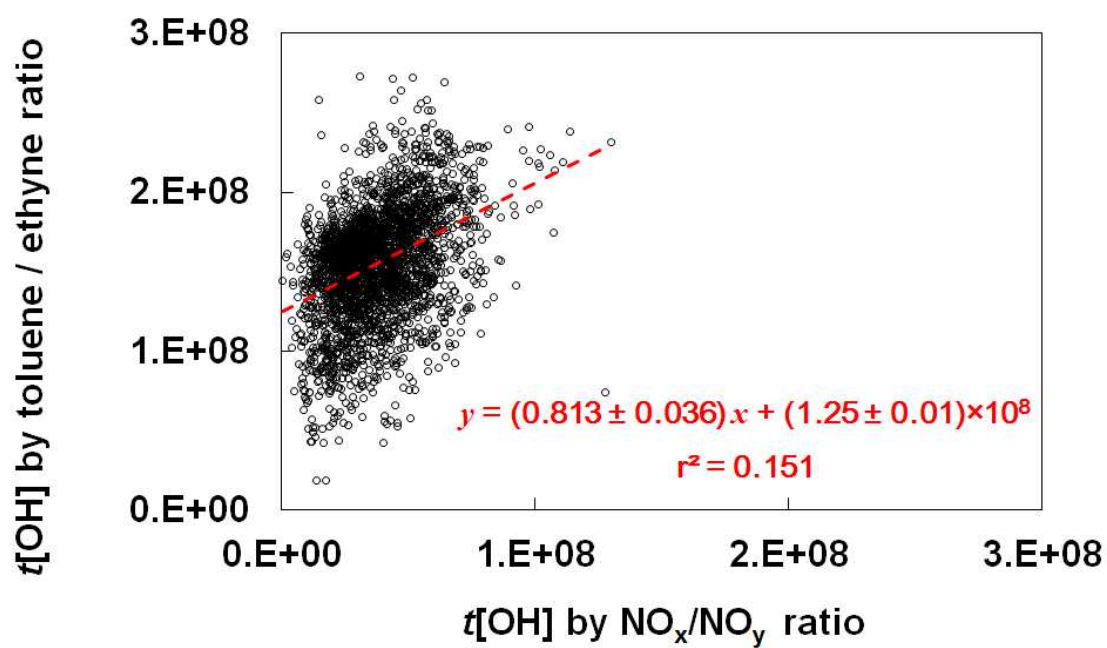
Figure S-16. Scatter plot of t[OH] estimated by NO_x/NO_y clock and toluene/ethyne clock.

The plot shows axes labeled t[OH] by toluene / ethyne ratio (vertical) and t[OH] by NO_x/NO_y ratio (horizontal), with fit equation $y = (0.813 \pm 0.036)x + (1.25 \pm 0.01)\times10^8$ and $r^2 = 0.151$.