Table S1. Yearly average VWA concentration of major ions in precipitation from 1995 to 2017 in Beijing. Unit: ions (μeq/L) and rainfall (mm)

Year	NO_3^-	NH_4^+	SO_4^{2-}	Ca^{2+}	Rainfall	References
1995-1998	54.5	135.1	359.0	464.0	609	Yang et al. (2012)
2001-2005	105.9	236.0	314.1	209.0	441	Yang et al. (2012)
2007-2010	111.1	237.3	234.9		572	Pan et al. (2012; 2013)
2010	142.5	339.9	246.3		438	Pan et al. (2012; 2013)
2014	102.2	262.9	173.7	72.3	460	This study
2015	84.4	220.4	132.2	74.8	452	This study
2016	90.0	215.4	127.4	82.6	670	This study
2017	89.9	198.3	105.9	47.2	569	This study

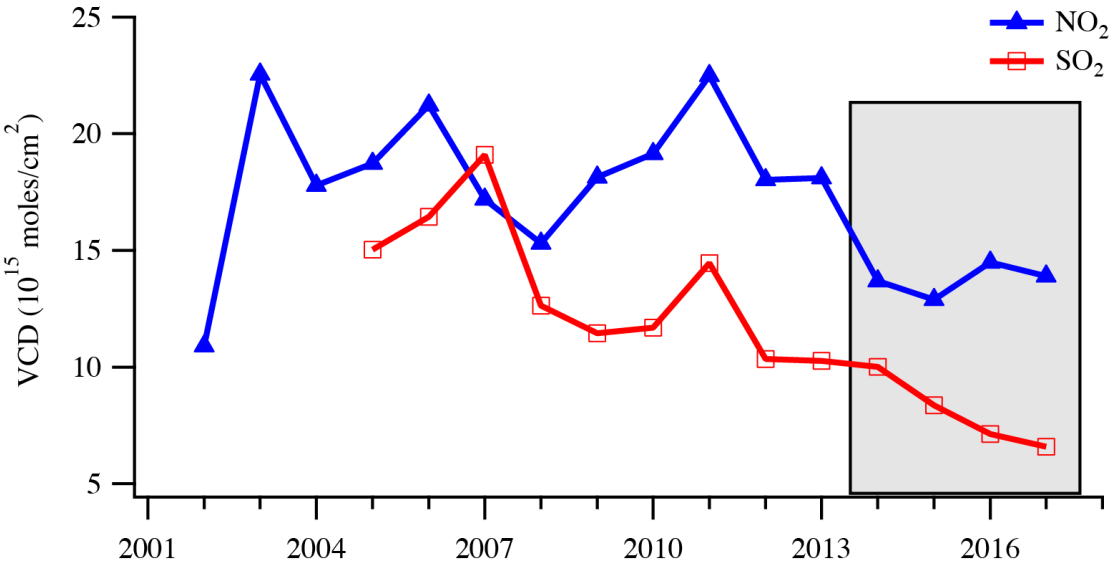

Figure S1. Long-term trend of the SO_2 and NO_2 VCD in Beijing from satellite observation, the shaded box area is the measurement period of fractional sampling in this study.

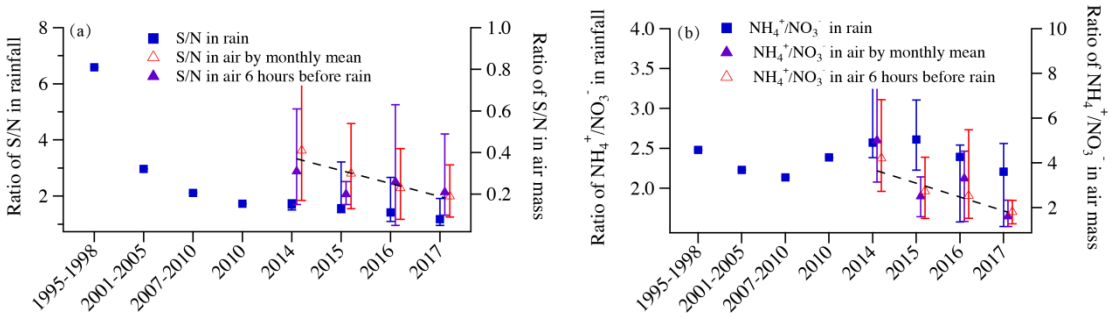

Figure S2. Annual variations in the ratio of sulfate to nitrate (a) and ammonium to nitrate (b) in aerosols and in precipitation. The ratios for aerosols are annual averaged concentration ± σ/3 in the 6 hours before rainfall events.