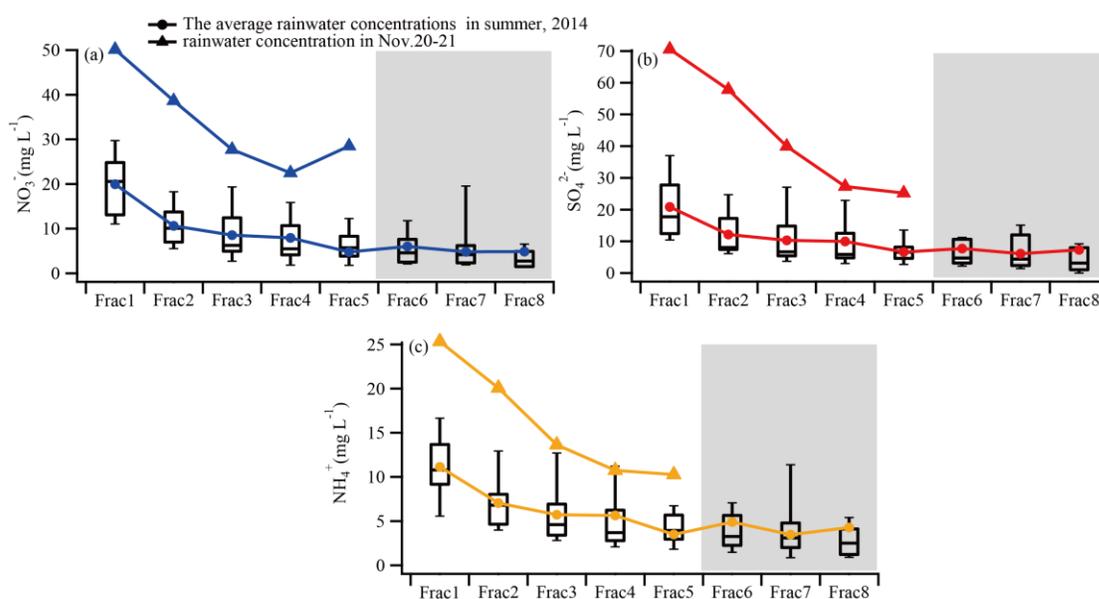




11 The Figure. s2 shows the average concentrations of SNA in summer of 2014 (Box and whisker plot) and this  
 12 rain event in winter of APHH-Beijing campaign. The VWA concentrations are no more than 30, 40 and 15  
 13  $\text{mg L}^{-1}$  for  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$  and  $\text{NH}_4^+$ , respectively, and decreased sharply during the beginning of rainfall and  
 14 remained at low levels during the event. The in-cloud scavenging process is considered as the median value  
 15 of the concentrations after accumulated precipitation exceeds 5 mm. These values were 2.75, 3.33, and 2.51  
 16  $\text{mg L}^{-1}$  for  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$  and  $\text{NH}_4^+$ , respectively, in summer of 2014 (as shown in Figure. s2 marked in grey  
 17 shadow) (Xu et al., 2017).



18  
 19 **Figure s2. Evolution of the (a)  $\text{NO}_3^-$  (blue), (b)  $\text{SO}_4^{2-}$  (red) and (c)  $\text{NH}_4^+$  (orange) of precipitation during**  
 20 **summer 2014 and November 20<sup>th</sup> to 21<sup>st</sup> within different precipitation fractions of several sampled**  
 21 **precipitation events (The data show the lowest, lowest 25 percentiles, median highest quartile, highest**  
 22 **75 percentiles, and highest value, respectively).**

23  
 24  
 25

26 **Table s1. The observation dataset list**

Observation instrument	Abbreviation	Introduction (time resolution and mainly measured material)
Ion Chromatography	IC	anions (SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> and F <sup>-</sup> ) and cations (NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> and Mg <sup>2+</sup> ) in the rainfall samples
Ambient Ion Monitor-Ion Chromatograph	AIM-IC	60 min resolution, PM <sub>2.5</sub> concentrations
Scanning Mobility Particle Sizer	SMPS	5 min resolution, 14-740 nm particle number concentration
Single-particle Aerosol Mass Spectrometer	SPAMS	60 min resolution, 0.2-2.5 μm particle number concentration, mainly focus on NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> and NH <sub>4</sub> <sup>+</sup>
Polarization Optical Particle Counter	POPC	5 min resolution, 0.4-10.35 μm particle number concentration

27  
 28  
 29  
 30  
 31  
 32  
 33  
 34  
 35  
 36  
 37  
 38  
 39

Nomenclature			
$d_p$	aerosol particle diameter	$F$	aerosol flux
$D_p$	raindrop diameter	$D_{ep}$	wet deposition
$N(d_p)$	aerosol particle number concentration	$C_p$	concentration in the precipitation
$N(D_p)$	concentration of raindrops	$C_{a0}$	original aerosol concentration before the rainfall
$K(d_p)$	size-resolved below-cloud scavenging coefficient	$C_a(0)$	aerosol concentration at the surface
$K$	below-cloud scavenging coefficient	$C_a(z)$	aerosol concentration at height $z$
$U_i(D_p)$	falling velocity of raindrops	$C_{p, \text{below}}$	washout concentration
$E(D_p, d_p)$	collision efficiency	$P$	precipitation intensity
$A$	horizontal area of the given box	$h'(z)$	depth of the layers in the vertical direction
$h$	vertical height of the given box or cloud-base height	$f$	vertical distribution of aerosols
$M$	aerosol mass of the given box	$C'_a(0)$	aerosol concentration at the surface and eliminates effects of north and north-west wind
$C_a$	average aerosol concentration	BWSC	below-cloud wet scavenging coefficient
APHH-Beijing	Atmospheric Pollution and Human Health-Beijing	CTMs	Chemical Transport Models

MICS-Asia	Model Inter-Comparison Study for Asia	TF-HTAP	Hemispheric Transport of Atmospheric Pollutants
VWA	volume weighted averaged	NCP	North China Plain
IAP	Institute of Atmospheric Physics	IC	Ion Chromatography
AIM-IC	Ambient Ion Monitor-Ion Chromatograph	SMPS	Scanning Mobility Particle Sizer
SPAMS	Single-particle Aerosol Mass Spectrometer	POPC	Polarization Optical Particle Counter
SNA	$\text{NO}_3^-$ , $\text{SO}_4^{2-}$ and $\text{NH}_4^+$	NAQPMS	the Nested Air Quality Prediction Modeling System
NAAQS	the National Ambient Air Quality Standard	CAMx	Comprehensive Air Quality Model with Extensions
CMAQ	Community Multi-scale Air Quality modeling system	CNEMC	China National Environmental Monitoring Centre