



Supplement of

Formation, radiative forcing, and climatic effects of severe regional haze

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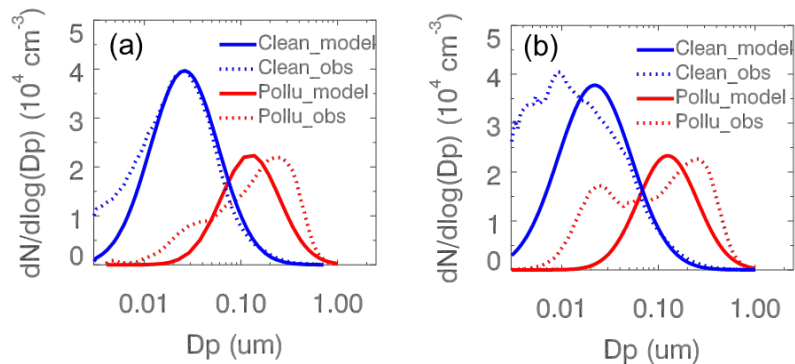


Figure S1. Aerosol size distributions from observations and for modeling inputs. Aerosol size distributions taken from measurements on 25 and 28 September (a) and 2 and 5 October (b), 2013 (blue and red dot lines, respectively) and used as inputs for the simulations of the Clean and the HAZE cases (blue and red solid lines, respectively).

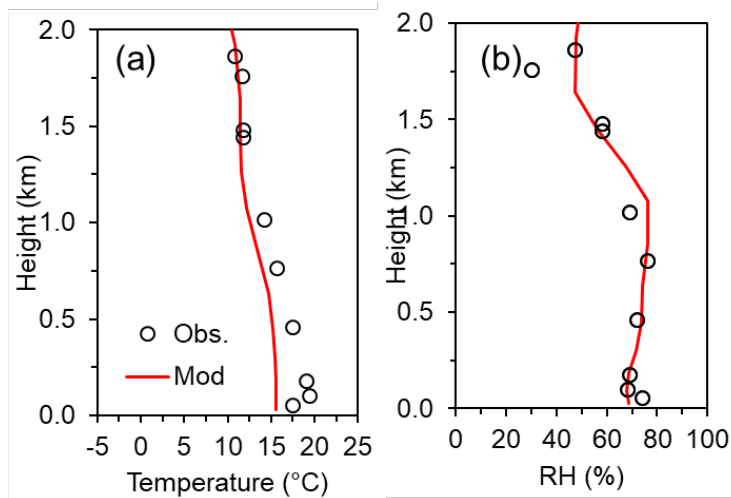


Figure S2. Comparison of model simulations with sounding observations. (a) temperature profile at 12Z 28 September 2013; (b) relative humidity profiles at 12Z 28 September 2013. Black open cycles denote sounding profiles and solid lines denote the simulations. Sounding data are available at <http://weather.uwyo.edu/upperair/sounding.html>.

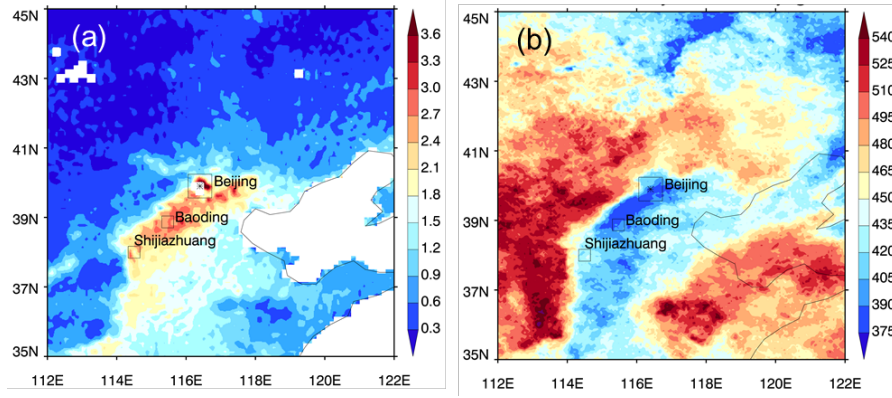


Figure S3. MODIS AOD (a) and surface solar radiation (SSR) (b) averaged over all the hazy days in 2013. The megacities of Beijing (BJ), Baoding (BD) and Shijiazhuang (SJZ) are marked as squares.

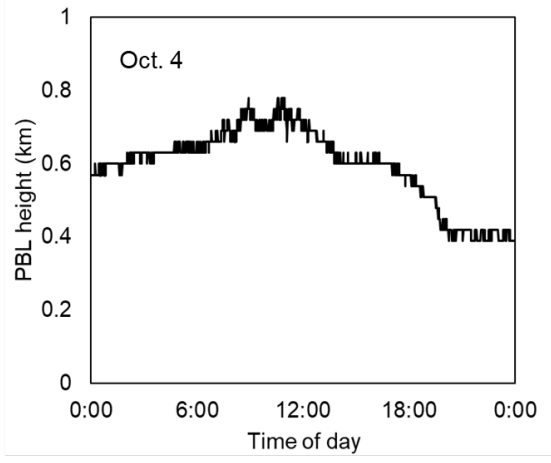
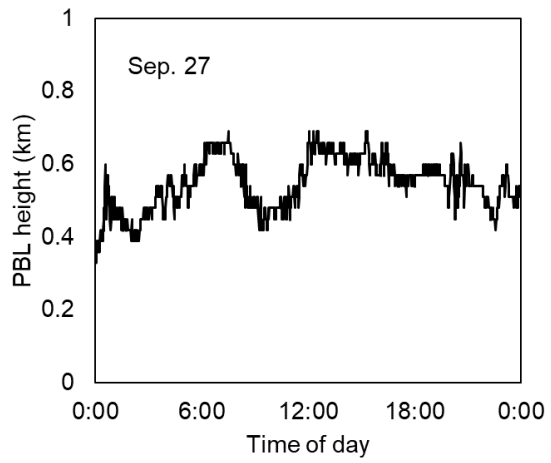


Figure S4. PBL heights retrieved from ceilometer measurements on the two transition days.

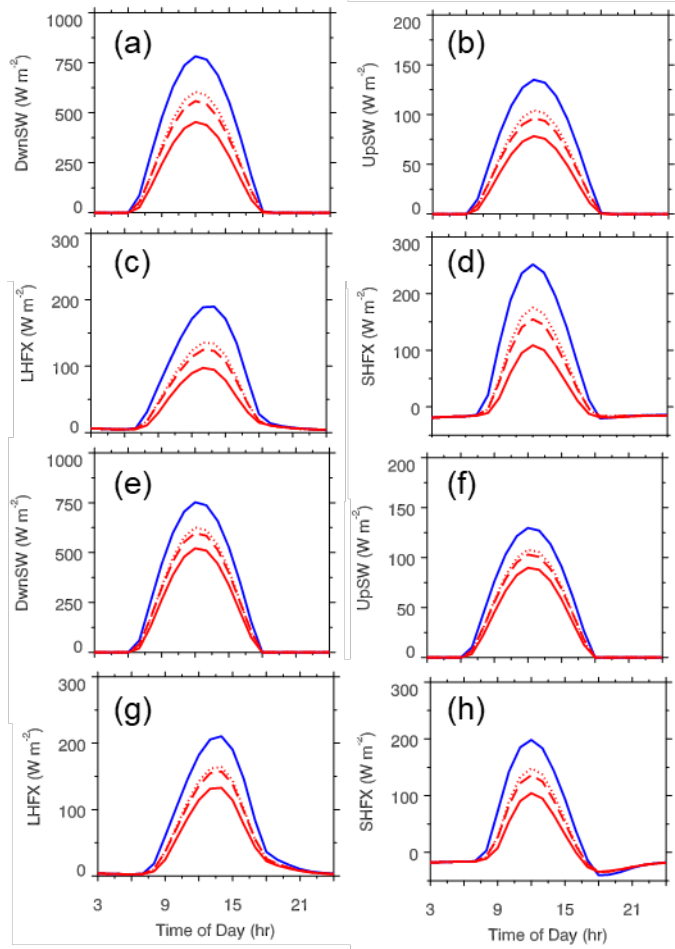


Figure S5. Temporal evolutions of downward (a and e) and upward (b and f) shortwave radiation, and latent (c and g) and sensible (d and h) heat fluxes under different aerosol pollution conditions. Panels (a-d) are for EP1 and (e-h) for EP2. Blue solid lines represent CLEAN case, red dot lines represent non-BC case, red dash lines represent “fresh” BC case, and red solid lines represent the HAZE case (or “aged” BC).

Table S1. Comparisons of aerosol forcing and BC forcing between this study and other studies.

Aerosol forcing at TOA (W/m²)						
Source	Q2003	R2007	L2009	W2009	D2016	This study
Method	Model+Obs.	Model	Obs.	Model+Obs	Model	Model
Region	China	Beijing	Xianghe	Beijing	China	Beijing
AOD	0.5~0.8	0.65	>0.2	1.78	-	3.1
Forcing	-1~-14	-20.7	2.4	-21	2.4	-5.6~-5.9
BC forcing at TOA (W/m²)						
Source	B2013	P2016	G2016	D2016		This study
Method	Model	Model	Model+Obs	Model		Model
Region	China	Beijing	Xianghe	Beijing		Beijing
Forcing	0.71	0.77	0.2~1	35.8		20.1~31.2

Q2003: Qian et al. (2003)
R2007: Ramanathan et al. (2007).
L2009: Li et al. (2007).
W2009: Wang et al. (2009).
D2016: Ding et al. (2016).
B2013: Bond et al. (2013).
P2016: Peng et al. (2016).
G2016: Gustafsson and Ramanathan (2016).