Simulated impacts of vertical distributions of black carbon aerosol on meteorology and $PM_{2.5}$ concentrations in Beijing during severe haze events

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Table S1. The values of *hs* for each flight.

Flight date and time	*hs* value
2016/12/11 16:20	N/A
2016/12/12 13:05	0.82
2016/12/12 15:39	0.96
2016/12/16 15:47	0.53
2016/12/17 15:59	0.35
2016/12/18 14:22	0.79
2016/12/19 16:09	0.48

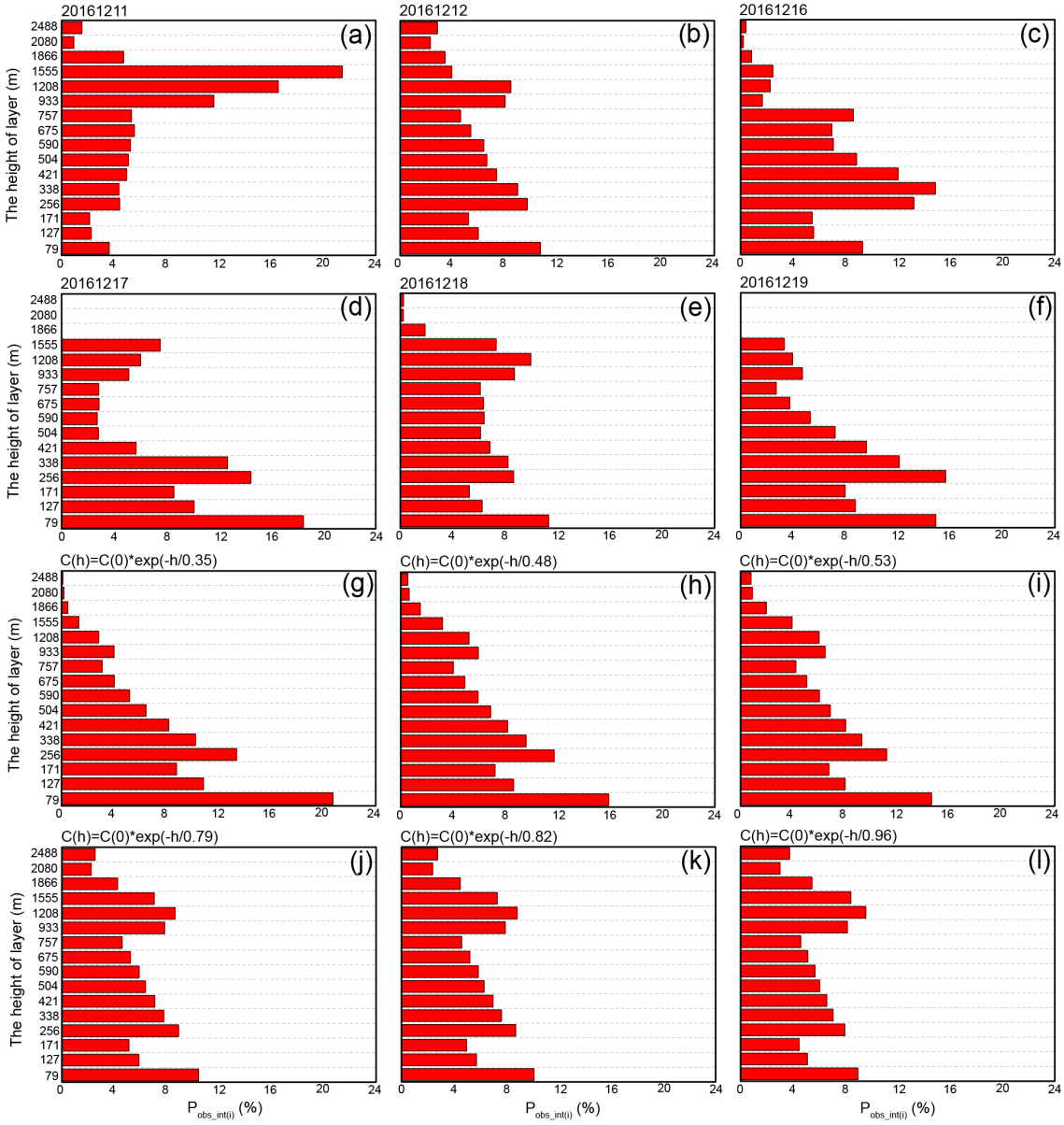


Figure S1. The calculated percentage of BC mass column burden in each layer below 2488 m in the model during the severe haze events by observed BC vertical profiles (a-f) and different exponential decline functions (g-l).

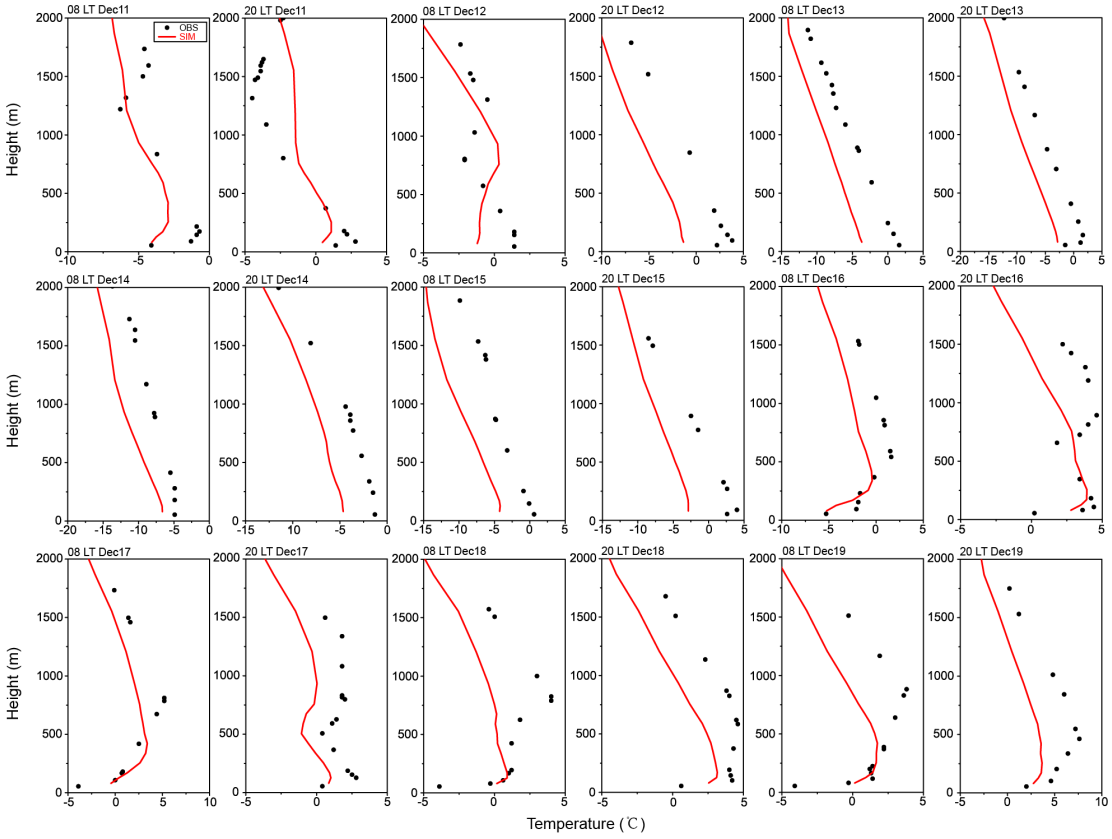


Figure S2. Observed (black dot) and simulated (red line) temperature (°C) profiles in Beijing at 8 am and 8 pm LT during 11-19 December 2016.

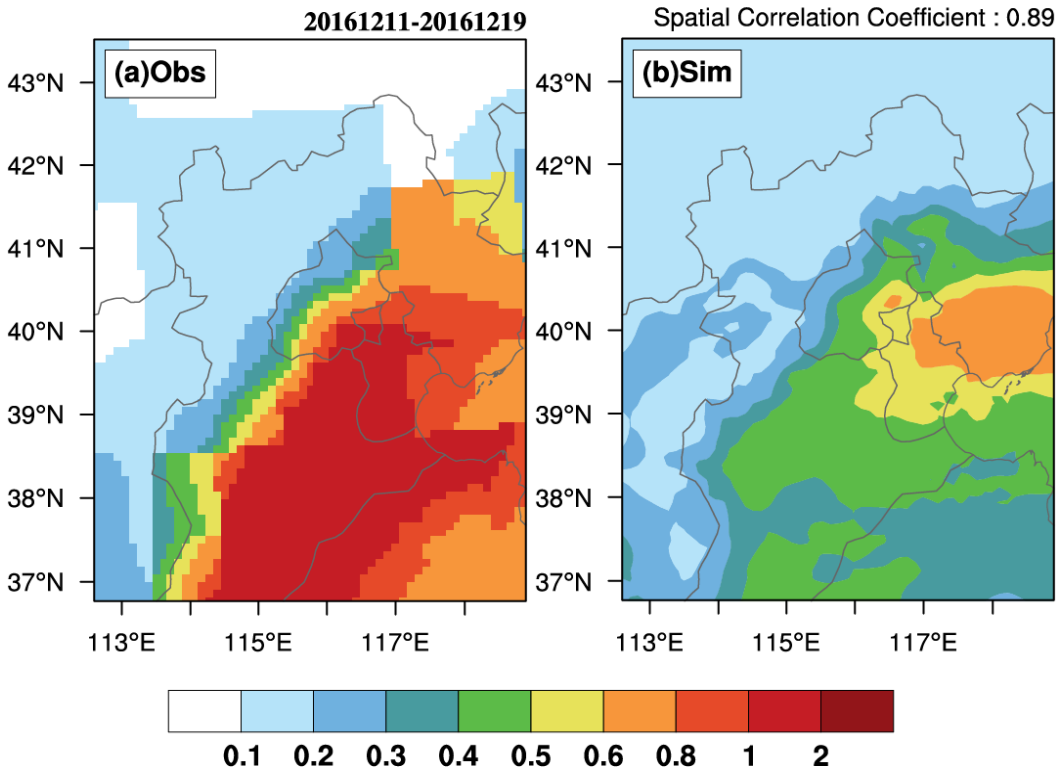
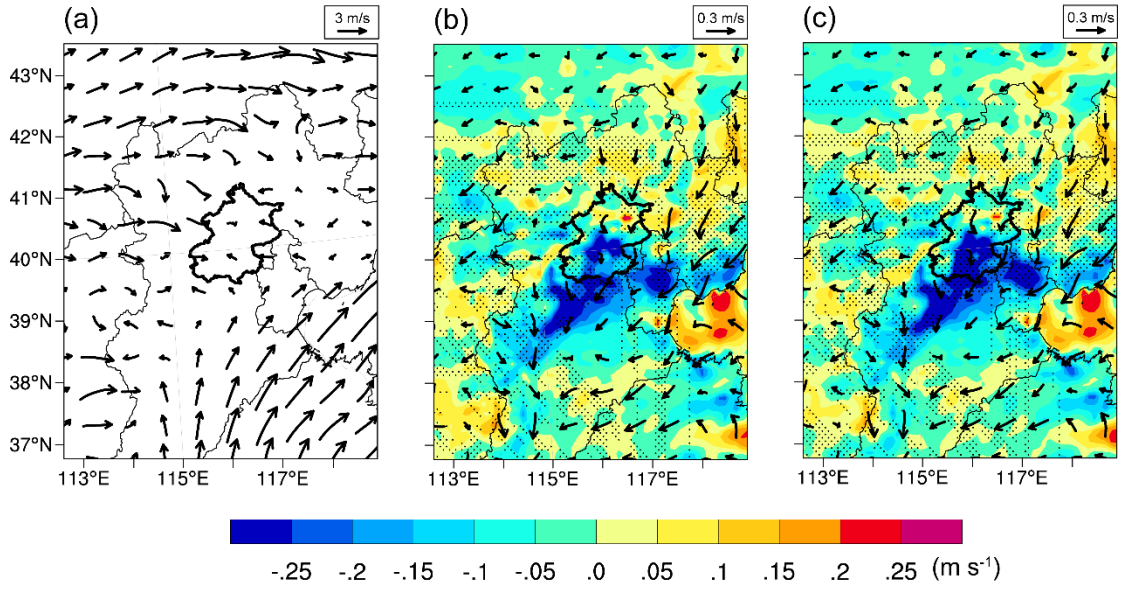


Figure S3. Horizontal distribution of observed and simulated AOD at 550 nm averaged 11-19 December 2016.



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36 **Figure S4.** (a) The spatial distribution of wind at 10 m in NoBCrad case averaged two
37 haze events. (b-c) The spatial distributions of changes in wind at 10 m due to BC DRE
38 with original and modified vertical profiles, respectively. The dotted areas are
39 statistically significant at the 95% level, as determined by a two-sample Student's t test.

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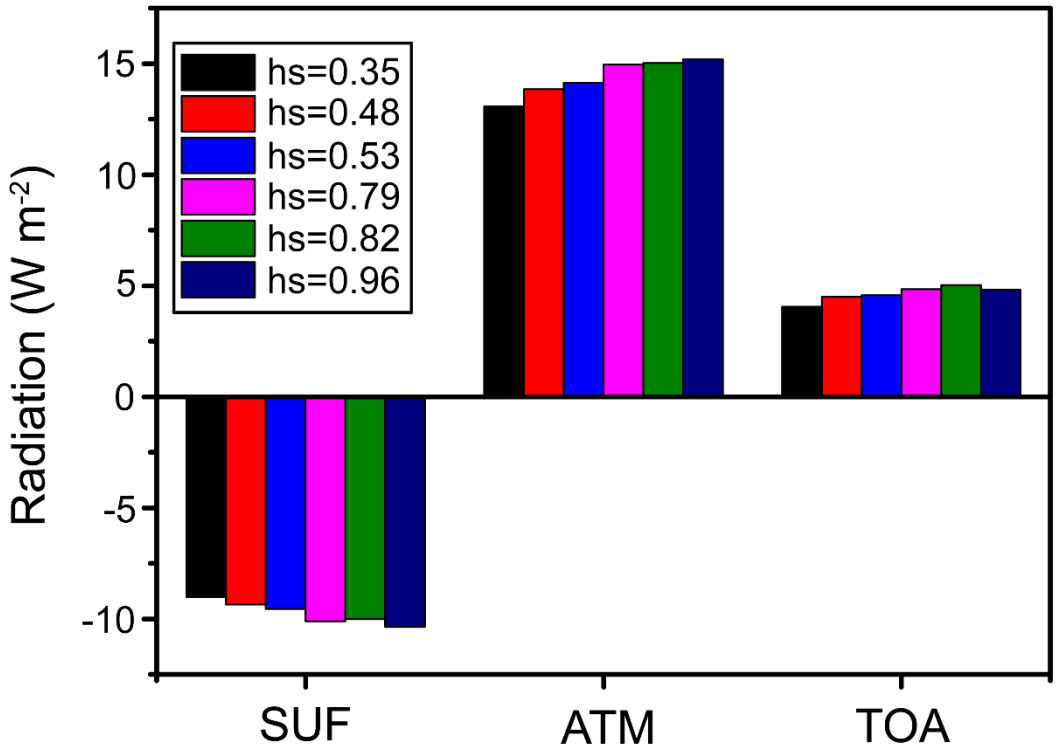

Figure S5. Direct radiations of BC at the surface (SUF), in the atmosphere (ATM) and at the top of atmosphere (TOA) in Beijing averaged 12 and 16-19 December in six sensitivity experiments (VerBC_hs1-6).

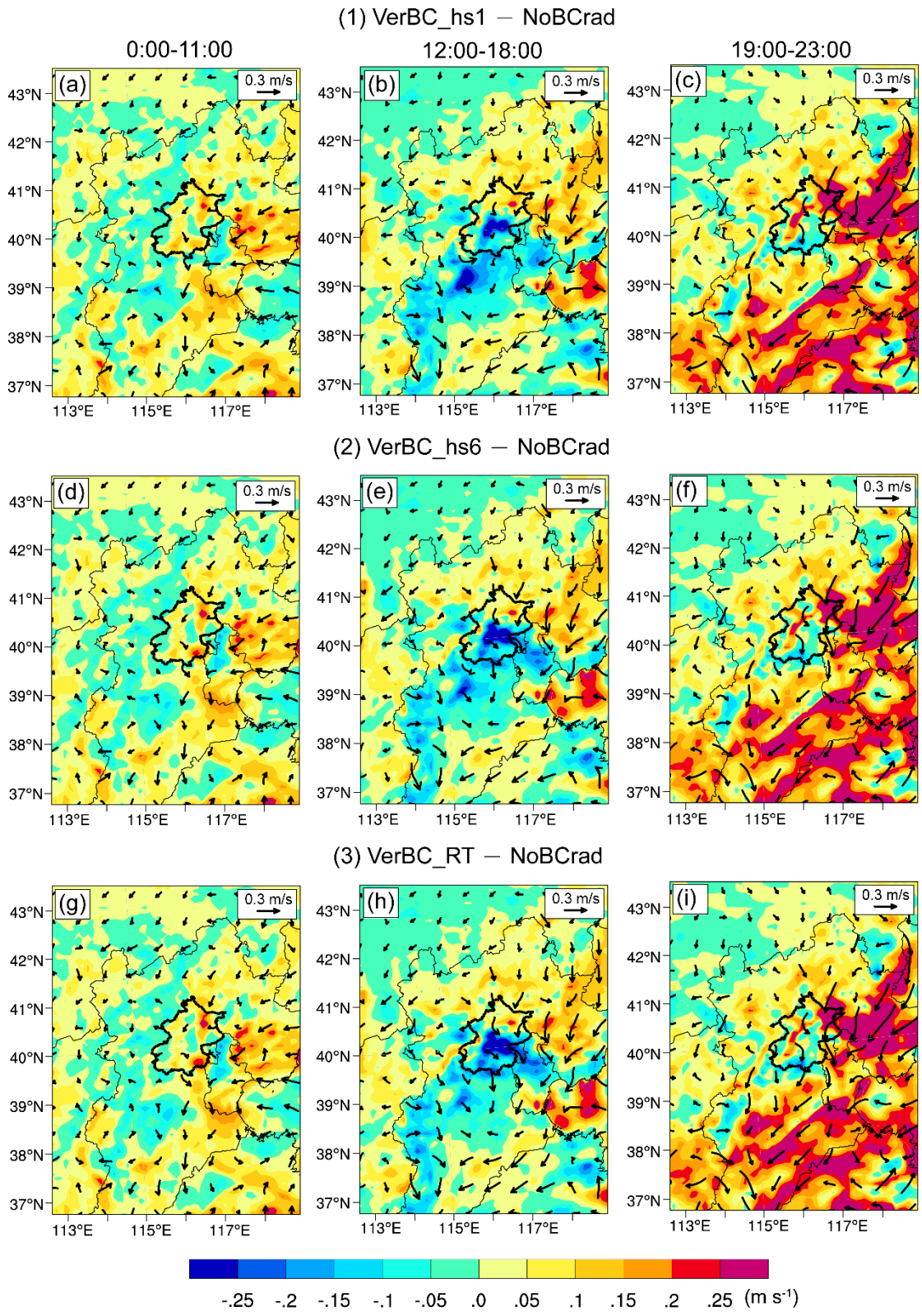

Figure S6. The spatial distributions of changes in wind at 10 m due to BC DRE with two exponential functions (VerBC_hs1,6 minus NoBCrad) and one observed transport vertical profile (VerBC_RT minus NoBCrad) average 0:00-11:00 LT (a, d, g), 12:00-18:00 LT (b, e, h), and 19:00-23:00 LT (c, f, i).