

Supplementary Materials for

Characterizing the diurnal evolution of the wintertime boundary layer in urban Beijing, China: Insights from integrated observations from Doppler lidar and a 325-m meteorological tower

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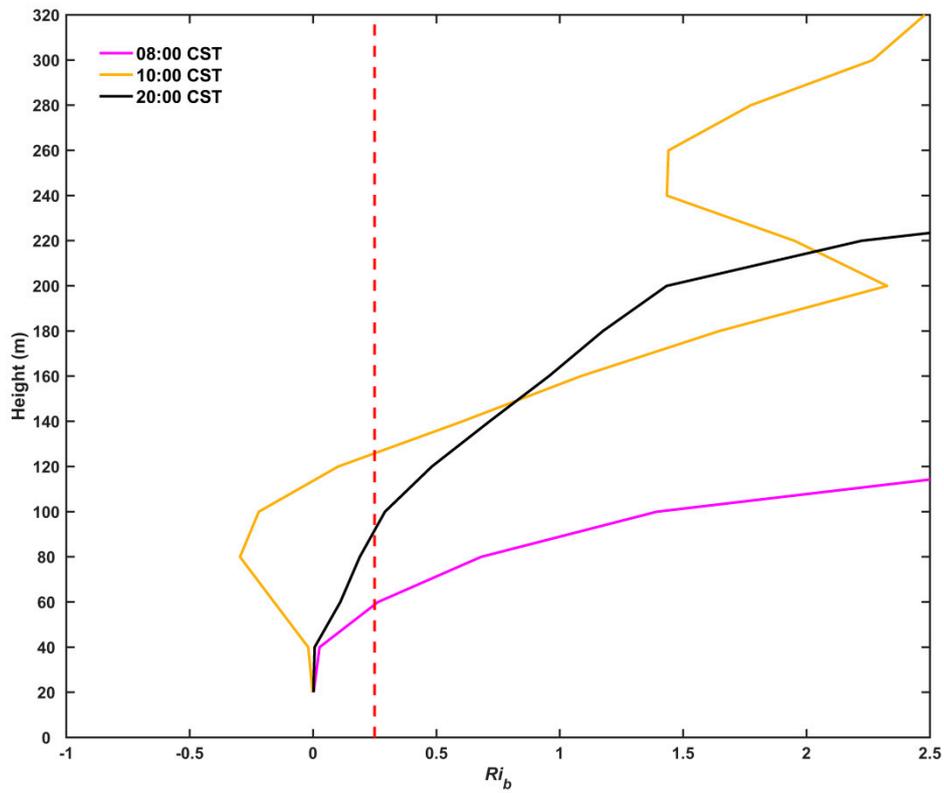


Figure S1. Height dependence of Ri_b (calculated by Eq.1 with $b=100$) at 08:00CST (purple line), 10:00CST (orange line), and 20:00CST (black line) on 19 December, 2016.

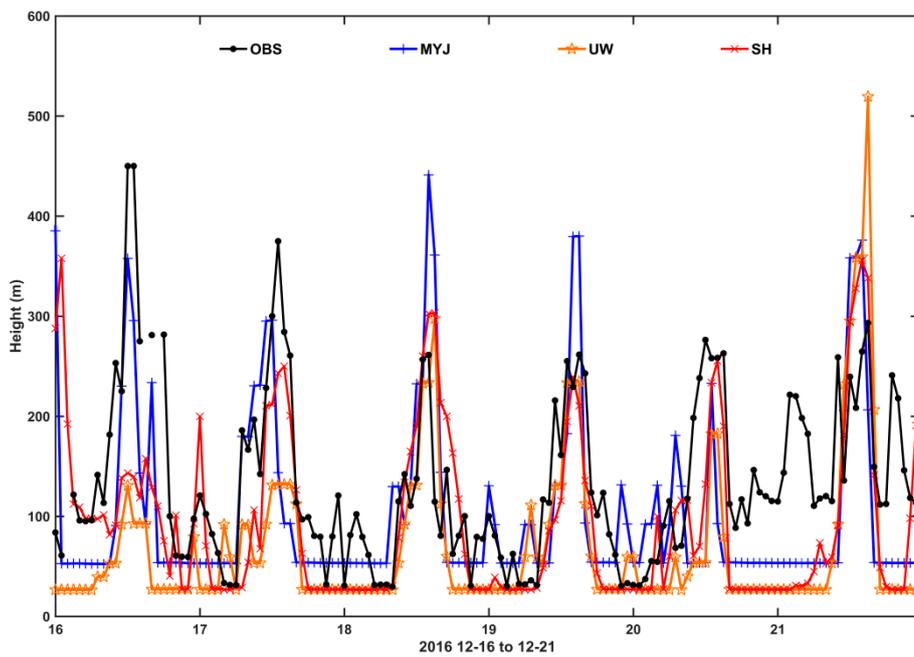


Figure S2. Hourly variation of simulated PBLH derived by three different PBL parameterization schemes (detail as followings) in Weather Research and Forecast (WRF) model during 16–21, December 2016.

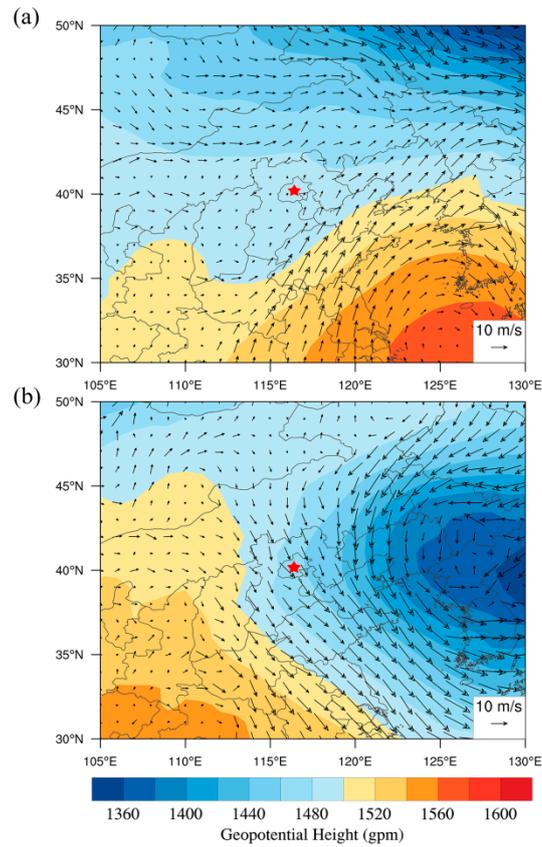


Figure S3. Synoptic weather patterns at 850hPa geopotential height (Data source: NCEP FNL) at 14:00 CST on (a) December 17, 2016 and (b) December 17, 2016. The shadings, blue vectors, and red star indicate the geopotential heights, winds, and Beijing location, respectively. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Table S1 Properties of the three different boundary layer parameterization schemes.

Scheme	Surface layer scheme	Closure order and localization	PBLH definition
Local Mellor-Yamada-Janjic (MYJ) scheme	Monin-Obukhov (Janjic Eta)	1.5 local	$TKE = 0.1 m^2/s^2$
the University of Washington moist turbulence (UW) scheme	Revised MM5 Monin-Obukhov	1.5 (1.0) local	$Ri_g = 0.19$ (stable), ~ 0.0 (unstable)

SH	Revised MM5 Monin– Obukhov	1.0 non-local	$Ri_b = 0.25$ (stable), 0.0 (unstable)
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Abbreviations: bulk Richardson number (Ri_b), gradient Richardson number (Ri_g), and turbulent kinetic energy (TKE).