

Interactive comment on “Dome effect of black carbon and its key influencing factors: A one-dimensional modelling study” by Zilin Wang et al.

Anonymous Referee #2

Received and published: 15 November 2017

This study investigated the black carbon “dome effect” and its key influencing factors, namely the vertical distribution and aging processes of BC, and the underlying land surface. The “dome effect” can play an important role in haze evolutions, which makes this study an interesting topic. Also, the manuscript is well organized and clearly presented, and is worth publishing. However, several concerns need to be addressed before the final publication.

Major comment:

(1) One major concern of this study is the lacking of information on actual scenarios. While low-level BC can enhance PBL height while upper-level would suppress that,

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what is the approximate threshold of low-level BC to upper-level BC concentration ratios, at which these two effects can offset each other? Is this threshold easily reached during haze events? That is, how often and how universal is the “dome effect” present? In actual scenarios, the BC are more likely to be composed of both a low-level freshly emitted peak, and an upper-level transported peak. Their different ratios may lead to different overall effect. Since observation on vertical BC profile is scarce, a relatively long-term simulation covering a larger domain (e.g., northern and eastern China) with actual configurations like the one shown in Fig. 1 might be helpful, or at least this issue should be discussed in more detail.

(2) Although the simulation results are well explained, the conclusion about chimneys and domestic stoves seems somewhat abrupt. What is the typical height of chimneys? Can that compare to the height of the inversion layer? It was more confusing on the conclusions about domestic stoves at rural areas. In the context of this manuscript, the depression of PBL at rural areas should be caused mainly by the long-range transported upper-level BC, not the local emitted ones. On the contrary, the freshly emitted BC would serve as the low-level BC and tend to enhance the PBL. Thus the fact that rural areas are more sensitive to “dome effect” would lead to the conclusion that reducing long-range transported upper-level BC is more important. The casual relationship should be better described.

Minor comments:

Page 2 Line 1: “developed regions like...”: change into “the more developed regions like...”

Page 2 Line 6: is the “680 ug/m³” daily average? Later the hourly maximum of ~900 ug/m³ is mentioned, so here need some clarification.

Page 2 Line 17-L18: consider change the expression of “concentration of BC... far more than...”; “more concentration” seems strange.

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