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Interactive comment on "The sensitivity of CO and aerosol transport to the temporal and vertical distribution of North American boreal fire emissions" *by* Y. Chen et al.

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We would like to thank Dr. Andreae for his very constrcutive comments. Indeed, there are quite a few recent studies on the understanding of fire-induced air lofting and the representation of initial injection height of fire plumes in regional or global models. We will acknowledge these studies in the revised manuscript. We note that although these studies may represent more realistic parameterizations of the smoke plume injection height, there are still uncertainties in the physical understanding (e.g., the entrainment profile) as well as obstacles in practical use of these methods (e.g., the availability of accurate ways of relating fire radiant energy measurements to dynamical heat flux).

The focus of the present study is to investigate the effects of different temporal and vertical constraints on biomass burning emissions. We would like to point out that although we did not use a detailed injection model or physically based parameterization, we did use "ALL_IN_PBL" and "uniform" profiles (see text for details) to represent the two extreme ways of treating plume injection height in the model. As part of a parallel effort to this study, a manuscript in preparation by Val Martin et al. involving David Diner, David Nelson, and Ralph Kahn, co-authors on this study, is specifically investigating ways to parameterize plume injection in global models.

The second point raised by Dr. Andreae, i.e., the smoke effect on cloud microphysics and scavenging efficiency of aerosols, is very thoughtful. The aerosol indirect effect has been extensively studied recently. Due to their high concentrations and strong light absorbing ability, smoke aerosols from fire may have their own characteristics in affecting the cloud microphysics and precipitation. We agree that the inclusion of this effect in the study of smoke injection height represents an interesting direction for future work.

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