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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of buildings on surface solar radiation over urban Beijing" *by* B. Zhao et al.

Anonymous Referee #2

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This study systematically examines the impact of buildings on downward surface solar fluxes over Beijing by using a 3-D radiation parameterization that accounts for 3-D building structures versus the conventional plane-parallel scheme. Results show that the downward surface solar flux deviations between the two schemes are ±1–10 W m-2 at 800-m grid resolution. However, flux deviations are much smaller at 4-km resolution because the pairs of positive-negative flux deviations on different sides of buildings offset each other. Diurnal variations of flux deviations and contribution of individual flux components (e.g. direct flux, diffuse flux, etc.) are also analyzed. Further sensitivity experiments show that atmospheric aerosols can evidently reduce the magnitude of flux deviations while the surface albedo generally has a rather moderate impact. The results imply that the building effect on downward surface solar fluxes can play a crucial role in fine-resolution atmospheric models with grid spacing of 1 m – 1 km.

The subject is interesting, the paper is well written and the results are useful for urban-scale and meso-scale modeling applications. In fact I have two minor comments only:

1. The authors mainly compare the surface downward solar fluxes simulated by 3-D radiation parameterization and plane-parallel schemes. What about the difference between those simulated by 3-D radiation parameterization and by single- or multiple-layer urban canopy scheme? Some discussion about this would be helpful given that urban canopy schemes are widely used in urban climate applications.

2. In the 3-D radiation parameterization scheme, solar radiative fluxes can be categorized into five components (i.e. direct flux, diffuse flux, and so on) according to photon path. I am wondering whether it is possible to partition the total flux into individual components at roof, wall, and road, which are variables that can be used to calculate the canopy temperature and overall energy exchange between urban surface and atmosphere.

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