General comment:

In this paper, an analysis of vertical transport of a passive tracer (signifying pollutants) in shallow cumuli is presented using large eddy simulations (LES). The tracer source is uniformly distributed at the surface and in the inversion layer, respectively, to study the upward and downward transport. As convective clouds can enhance vertical mixing of aerosol and gaseous matter, investigating the transport mechanism can improve our understanding on dispersing local pollutants. Thus this subject is worthy to study in detail. However, some major points need to be addressed:

- Resolution: I agree with the first referee's comment that the coarse horizontal resolution (100 m) applied in this study may not be able to adequately resolve the cloud structure. Moreover, the vertical resolution (40 m) may also be insufficient in analyzing the entrainment/detrainment on the top of boundary layer. The boundary layer entrainment is sensitive to the vertical grid spacing (e.g., Lewellen and Lewellen, 1998; vanZanten et al., 1999). Since the main subject in this paper is to understand the vertical transport through boundaries, the finer vertical resolution is needed to properly represent processes at the entrainment interface.

- The interpretation of the results should be revised as it is often not clear and can lead to confusion. See specific comments below.

Specific comment:

P11396, L3-4: Only the condensation scheme is described here. What about other processes? Is sedimentation/precipitation included in the simulation? It is commented in the introduction concerning the difference in dispersion efficiency between non-precipitating and precipitating cumuli. Are the shallow cumuli precipitating in these simulations?

P11396, L15-16: What does the sentence "BOMEX has the practical advantage of a lack of diurnal cycle" really mean? Also, is radiation included in these simulations? If so, are both longwave and shortwave radiation included? As radiation affects the cloud formation, more description is needed for the model setup.

P11397, L23-26; P11398, L12-14: It is stated that "the higher tracer mixing ratio over cloud-free columns results from clouds that were higher and transported tracers upward at previous moments but have evaporated and left tracers in the cloud-free columns at this moment." What is the approximate life time or time scale of each shallow cumulus cloud? It is not clear to readers concerning the evolving of the cloud with time. More details are needed to support these statements.

P11398, L14-18: It is mentioned that the clouds penetrate into the inversion layer, evaporate, and release tracers above the boundary layer. How often does the cloud penetrate the inversion? The variation of cloud top heights with time can help readers understand this matter.

P11399, L6-9: Based on the description "the maximum vertical transport at about 0.2 km at 6 h (Fig. 2) is due to higher tracer mixing ratio in cloudy columns (associated with updrafts) than in cloud-free columns (associated with downdrafts) and intense vertical air motion", it seems the maximum transport at 0.2 km is due to the convective cloud. In that case, why does the dry convection have even stronger vertical transport at 0.2 km at 6 h? The explanation is confusing.

P11401, L21-22: It is mentioned that the great values of vertical transport in the inversion layer (Fig. 5) are induced by oscillating movement of air and high tracer mixing ratio. According to this explanation, why it is not seen in the corresponding dry convection case?

P11403, L7-9: It is stated that shallow cumuli are efficient in venting pollutants from the surface upward to the cloud layer. However, the overall effect (for the whole domain) with and without cumulus convection does not seem to make a big difference according to Fig. 1. It is shown the dry convection has very efficient vertical mixing within the boundary layer as well (though it does not cross the inversion). Doesn't this indicate that without convective cloud the pollutants can still be transported efficiently within the boundary layer?

Typing errors:

P11392, L11: preformed → performed.

P11392, L22: in the boundary.→ in the boundary layer.

Caption in Fig. 2.: The black, red, and blue lines represent ….. cloudy grids, and cloud-free grids. → add ", respectively" in the end.

Reference:

Lewellen, D., and Lewellen, W: Large-eddy boundary layer entrainment. *J. Atmos. Sci.,* **55,** 2645–2665, 1998.
vanZanten, M. C., Duynkerke, P. G., and Cuijpers, J. W. M.: Entrainment parameterization in convective boundary layers derived from large eddy simulations. *J. Atmos. Sci.,* **56,** 813–828, 1999.