# Responses to comments from Reviewer #1

We thank you for the helpful comments.

> *L55 (Table 1): What is the horizontal length scale used to define these weights? Is it something like a ~100 km box surrounding the SGP?*

Following Bogenschutz et al. (2020), the E3SM SCM used in this study is configured with ne4np4 grid. The horizontal length scale for the grid cell is ~ 800 km. This detail has been added into the context now in L62.

> *L89: How big of an impact do you think using a homogeneous u* could have? Please comment on this if possible*

The control run HOM is using a homogeneous u*, computed on the basis of grid-cell mean momentum. The impact generally can be considered as the differences arising from the HOM and HET runs as discussed in Section 3.

> *L115: Is the near-surface atmospheric state used for each patch the same? i.e. is the atmosphere treated as homogeneous?*

The near-surface atmospheric states for each patch are different. E3SM land model has subgrid-scale treatment for patches. Though the atmospheric states passed from atmosphere to land are treated as homogeneous (grid-cell mean), E3SM land model applies Monin-Obukhov similarity theory to determine the atmospheric states for individual patches according to their unique characteristics. We have clarified this now in L122.

> *L130: You mention in figure 2 and in the conclusion that the fluxes are computed offline. Could you define/explain that in more detail here?*

Done. We clarified it starting from L136 now as "In the HET configuration, we used the atmospheric state variables and surface fluxes for each patch in ELM saved at every model time step from the HOM configuration to compute the spatially heterogeneous characteristics (i.e., surface variances and covariance of potential temperature and specific water content) following Eqs. (7-9) in Section 2.2. These surface heterogeneous characteristics were then provided to CLUBB as the lower boundary condition." We also clarified "offline" in the caption of Fig. 2 as "The heterogeneous surface moments are computed offline by our implementation of the HET approach (white boxes on the right)."