The paper by Baek et al. analyzes AGCM simulations from two climate models with different convective parameterizations. They show improvements of simulated Arctic cloudiness in SAM0, which they suggest is due to increased moisture transport into the Arctic compared to CAM5. The paper is well written, however, some arguments need to be strengthened and improved. I hope to see the following issues being addressed by the authors.

Major issues:

1) Improvements of simulated Arctic clouds: according to Figure 1, although SAM0 cloud fraction is closer to observations, significant biases still persist, especially in winter. The improvement in PR90 is marginal. I suggest the authors to also compare the liquid and ice water path to the observations (e.g. Lenaerts et al. 2017), because they are also important for cloud radiative effects. For example, does the decrease in cloud ice mass (Figure 2c) make it closer to observations?
2) Relationship between meridional fluxes and increased cloud liquid:
    a) Is vertical advection included in the meridional transport? Heat and moisture transport into the Arctic doesn't just happen in the horizontal plane. In fact, eddies transport moisture along (moist) isentropes.
    b) Even though increased moisture flux and Arctic liquid cloud are correlated, it doesn't provide causation.
3) The results shown here are from atmospheric only GCMs. Since the results depend on the atmospheric heat transport, ocean coupling could potentially alter the results. Have the authors looked at whether the changes in heat and moisture fluxes are still robust in coupled SMA0?

I also agree with Reviewer #2's major issues, some of which are in line with my concerns regarding the causal arguments.

Minor issues:

Please hatch the maps to show their significance level, instead of saying "most shaded areas exceed a 95% significance level". Since not all areas are significant, it is useful to know where it is not significant.

Line-by-line comments:

P3 L7: What microphysics scheme does SAM0 use? Is it the same for CAM5? If not, it can introduce additional sensitivity.

P3 L23: Are different periods from 1979 to 2015 selected to compare with the corresponding observations (CALIPSO and CERES)? If so, it should be specified, since

the simulation period is much longer than what the observations cover. If not, are the results sensitive to the mismatch in periods?

P4 L14-15: The TCA bias also varies seasonally. SAM0's improvement is the most significant in summer, but less so in winter. Have the authors investigated the seasonal and spatial variability in poleward moisture transport? The seasonal cycle combined with spatial maps could shed light on why clouds are underestimated in the Arctic.

P6 Figure 3: Are these budgets closed? Net tendency profiles for liquid and ice from each model can be added to these figures.

P8 Figure 4: According to the moisture and heat flux convergence, we expect increased liquid condensation thus more liquid clouds at around 70N. Is this the case? For example, in winter the total cloud increase is quite spatially uniform over the Arctic Ocean (Fig 7b).

P8 L22-P9 L2: We all know that correlation does not mean causation. By just showing correlation, the causality is not proven. For example, it is also possible that both changes are caused by a third factor that is not in the analysis.

P8 L13: LCA was never spelled out in the paper.

P9 L14: What makes these two models the outliers? Are there any physical reasoning to say so? One should not just pick and choose the models or discard the end members because they do not agree with your hypothesis.

P10 Figure 6: Are the widths of black lines in (a) and (b) represent the spread of observed poleward moisture transport? If not, these lines are very misleading and unnecessary.

P10 L7: Upward LW at TOA includes both clear sky and cloud effects. Have the authors look at the cloud radiative effect differences between the two models? The negative bias in upward LW at TOA in the Atlantic sector seems to get worse in SAM0. Is it because in this region, SAM0 is producing too much clouds comparing to the observations?

P10 L11: Figure 7 shows TCA, but the argument the authors give here involves LCA. Is the LCA change the same as TCA?

P11 L7: Remove “a” before “summertime biases”

P13 Figure 8: Does panel d) suggest that CAM5 SW cloud forcing is too weak at the surface? This would lead to a warm bias over the Arctic ocean. But g) shows a cold bias, which means that the LW cloud forcing bias (not enough warming at surface) dominates the net forcing. It would be helpful to see both LWCF and SWCF to get a fuller picture. I suggest the authors to plot LWCF and SWCF for both TOA and surface, at least to include them in the supplementary material.

P14 L11: The wording “SAM0 remedies these problems” is too strong, given that significant cloud biases still persist.

Reference:

Lenaerts et al. (2017) Polar clouds and radiation in satellite observations, reanalyses, and climate models. GRL.