The authors incorporate the impact of microphysical processes on the wet depositon of black carbon in the CAM5 global climate model. With this parameterization, they carry out a systematic evaluation of the importance of various microphysical processes on the distribution and radiative forcing of black carbon. Global distributions of black carbon remain highly uncertain, and this study provides a novel and substantial contribution towards the understanding a key piece of this complex problem. The paper is well-structured and the presentation is clear. I recommend minor revisions.

I have two main comments on how the conclusions can be better supported:

- Figure 2: authors have two full years of usable simulation data (2009-2010) and one partial year (2011). Do convection scavenging, aerosol activation, ice nucleation, evaporation, and below cloud scavenging dominate when the other years are considered?
- Figure 5: The colorbar saturates too quickly, making it hard to compare between simulations. In particular, it appears that convective scavenging (a) and cloud activation (b) are on par in the mid-latitudes, rather than the claim that the former dominates. Also, it is difficult to tell the changes in vertical profile, which is relevant for the section on radiative forcing.

I encourage the authors to frame their discussion on the direct radiative forcing (DRF) in the context of the major factors known to affect the direct radiative effect (e.g. in Equation 6.1 of Bond et al. (2013)): emissions, lifetime, absorption cross-section, and absorption efficiency. In particular, recent work suggests that there has been both an underestimate in emissions (e.g. Cohen and Wang (2014)) and overestimate in lifetime, and that the two factors act to cancel each other (Hodnebrog, Myhre, and Samset 2014). I agree that wet deposition is an important piece of constraining DRF; my concern is that a reader may walk away thinking that it is the only factor.

In the introduction, the authors may want to comment on the relative roles of transport vs removal, as in the introduction of Q. Wang et al. (2014).

Specific comments

- p1, line 26: I don't see significance tests, perhaps rephrase as 'largest impact'
- p1, line 29: do you mean "convection scavenging mainly increases the fraction of column BC below 5 km"?
- NO BERGERON and NO PRECIP EVAP are misspelt as NO BEGERON and NO PERCIP EVAP in some cases (eg p19 line 7, p21 line 21, Figure 7)
- p6, line 6: 'more accurately simulates' -> as compared to?

- p9, line 17: ‘we turn off the impact of each cloud process on BC’ -> I assume you mean that the changes in cloud processes do not affect the climate. Would be good to make clear.
- p14, line 6: do you mean 1.9 kg/s?
- please be consistent in use of abbreviations (e.g. fig in p15 vs Fig in p16, figure in p18 line 24 vs Figure in p18 line 1)

References

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Hodnebrog, Øivind, Gunnar Myhre, and Bjørn H Samset. 2014. “How Shorter Black Carbon Lifetime Alters Its Climate Effect.” *Nature Communications* 5. Nature Publishing Group: 5065.

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