Reviewer 1

Thanks to the authors for their clarification and revisions. I have two more comments/questions below.

Thank you for your additional comments and questions on our manuscript. We appreciate the chance to clarify uncertainties in our radiative forcing calculations, put the importance of tundra wildfires into a global perspective, and propose directions for future research. We responded to your specific comments individually below and made changes in blue to the manuscript. Red text denotes changes from the first round of review.

1. As the burned areas of tundra fires are much smaller than those of boreal forest fires, is the global impact of tundra fires supposed to be limited? Can you compare the radiative forcing of tundra-fire emissions to that due to boreal forest fires?

RESPONSE: While to our knowledge there has only been limited study quantifying the net global radiative forcing of boreal fires (Oris et al., 2014), these questions raise an important point regarding the net effect of wildfires, including both gaseous emissions and ecosystem changes. On lines 578-580 we show that our estimate of the radiative forcing of gaseous emissions from tundra wildfires is within the range of previously estimated radiative forcings for the gaseous emissions from boreal wildfires. However, boreal wildfires have a negative radiative forcing from post-fire changes in surface albedo that has the potential to partially or completely counterbalance the warming effect of gaseous emissions. Without overstory vegetation, tundra ecosystems lack this cooling post-fire albedo effect to balance the warming effect of their gaseous emissions and other post-fire ecosystem changes. These competing dynamics are discussed between lines 580 and 596**.** We add text on lines 600-602 to suggest that future work synthesizes the net radiative forcing of boreal and tundra wildfires across their global domains. It could be the case that despite the smaller size and lower magnitude of gaseous emissions, tundra wildfires have a comparable or greater global impact compared to boreal fires per unit area when accounting for their additional warming post-fire ecosystem changes and lack of a cooling albedo effect (lines 602-605). Furthermore, even though tundra wildfires currently burn less area than boreal wildfires in both Alaskan (lines 596-597**)** and pan-Arctic (lines 597-599) regions, the projected increase in tundra fire frequency (e.g., lines 531-534) may also contribute to a higher net radiative forcing from tundra than boreal wildfires in the future (lines 602-605).

Reference:

Oris, F., Asselin, H., Ali, A. A., Finsinger, W., and Bergeron, Y.: Effect of increased fire activity on global warming in the boreal forest, Environmental Reviews, 22, 206–219, https://doi.org/10.1139/er-2013-0062, 2014.

2. Emission factors are crucial for the radiative forcing estimates in this paper. However, the authors did not measure the emission factors of tundra emissions. Instead, they used the emission factors of boreal forest fires. While the greenhouse gases are long-lived and well-mixed in the atmosphere, the aerosols are short-lived and quite heterogeneous. So the authors should at least discuss the limitation and the uncertainty of the radiative forcing calculations.

RESPONSE: We agree that our use of boreal emissions factors and estimation of the effect of SCLFs inject uncertainty into our radiative forcing calculations. We made textual changes in the paragraph of our discussion section that enumerates uncertainties in our radiative forcing model to reflect these caveats. On lines 651-652 we added text describing how the use of boreal emissions factors may misrepresent the specific mass of gaseous emissions from tundra biomass burning. We also suggest that future studies directly measure emissions factors from tundra biomass burning (lines 654-655). On lines 655-658, we describe how our radiative forcing calculations are done with and without taking SCLFs into account, because their effect when emitted from the Arctic remains uncertain in current literature. We suggest that future research examine how emission location, abbreviated atmospheric lifetime, and regional atmospheric patterns govern the behavior of SCLFs to constrain estimates of radiative forcing.