**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Quantifying immediate radiative forcing by black carbon and organic matter with the Specific Forcing Pulse" *by* T. C. Bond et al.

Anonymous Referee #4

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This manuscript introduces a new metric for quantifying and comparing the climate impact of short-lived climate forcers (SLFCs) called specific forcing pulse (SFP). I think this a very useful matrix, but the manuscript has many issues. As already noted by three reviewers, the manuscript is very difficult to understand. I also agree with reviewer #1 that the manuscript is over-stating the differences of SFP over AGWP. Some of the specific comments listed below will be redundant with comments already made by the other reviewers and commenters; however, I hope my comments will be helpful for the authors as they revise the manuscript and I would like to see the work published eventually.

I agree with reviewer #1 that the manuscript is overstating the difference between SFP and AGWP, i.e., that some of the "alleged advantages of the SFP over the AGWP are because SFP is restricted to short-lived species, rather than an intrinsic property of the SFP." The main advantage of SFP I see is that SFP can refer to forcing within a specific region, but the difference in time horizon is the nature of the short-lived species, not SFP. I think Section 2 would be easier to understand if the manuscript introduces AGWP first, and then introduce the definition of SFP as a refinement of AGWP that is applicable for short-lived species only.

I disagree with setting the minimum value of one year for the time horizon. Precisely because there are seasonal variations in forcing, SFP should also be subdivided into seasons or months. To achieve a policy goal of a certain reduction in forcing, we need to know not only how much emissions reduction is needed from where, but also when (seasons or months).

Equation (4) assumes that climate response is linear. This is not a trivial assumption as many studies have indicated that climate response is non-linear.

Starting from Equation (4), I simply do not understand Section 4 "Ensemble-adjusted models". (Sloppy section title: models are not ensemble-adjusted; forcing estimates are ensemble-adjusted.) In Equation (4), is SFP_{full} from baseline model results or "enhanced" model results? Does the index i indicate processes or models? Is E_{proc} based on the median or average of the ensemble?

There are many incidents of sloppy writing throughout the manuscript. Any single incident of sloppiness by itself is unfortunate but does not necessarily make the material difficult to understand; however, frequent occurrences of sloppiness not only makes manuscript difficult to digest, it also makes the reasons for some of the errors unclear: is it sloppiness in writing or is it a true error by the authors?

Section 2 "Impact Measures" is very difficult to understand. Reviewers #1, #2, and #3 all have listed a few examples of sloppy sentence constructions. There are more

examples.

In Section 2 the symbol τ sometimes refers to lifetime of a species in the atmosphere while other times the symbol τ refers to the time horizon. This is another example of the sloppy writing that makes comprehending the manuscript more difficult than necessary for the reader.

Equation (1) is more than a bit sloppy. The use of symbols A and a implies all regions with the same physical area (as in meter^2) have the same SFPs; further, it implies that forcing in a given region is impacted only by emissions in the same region. f_s and SPF both should depend on the region in which forcing is manifested and the region of emissions.

Equation (4) is also sloppy. First, the term ϵ should not be there because the climate response matrix R includes forcing efficacy/efficiency impact. Second, the indexing of columns and rows are not consistent: the statement "I and e are vectors in which the n-th element..." should be "I and e are vectors in which the m-th element"

I agree with reviewer #1 that the use of "rejected" is sloppy language. Instead of 'rejected" or "rejection", I think "reflected back to space" is a better phrasing.

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