

Interactive
Comment

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

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Metric or measure?

This is a general author comment to respond to some reviewer statements that describe the Specific Forcing Pulse (SFP) as a metric. The word “metric” in the climate policy community has come to mean a quantity that can be used to compare the impacts of different species, usually for trading. (The word may not carry such connotations in other discussions.)

Reviewer 1 states in the clarification: “Finally I don’t really see the usefulness of a metric if it excludes long-lived species from its definition.”

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Reviewer 3 states: “The authors have presented a new metric for quantifying and comparing the climate impact of SLCFs to facilitate their inclusion in a climate mitigation policy.” The reviewer also states: “Since the definition of SFP excludes long-lived GHGs, I find it difficult to assess its usefulness as a metric for including SLCFs in a multi-gas abatement strategy for climate change mitigation.”

McCabe and Sarofim also comment that SFP is presented as a metric.

In this paper, we presented a measure that we believe is useful to estimate the impact of short-lived climate forcers (SLCFs) emitted from one region on (1) immediate radiative forcing and (2) radiative forcing within the region of emission or other affected regions.

We have not stated anywhere that we wish to facilitate inclusion in climate mitigation policy, only that we would like to quantify the impacts of SLCFs. Changes in SLCF emissions will occur regardless of whether they are included in any climate policy, and it is desirable to understand the implications of those changes. For example, integrated assessment models project changes in emissions and use these to infer temperature changes and possibly other impacts. These models currently have no way to quantify impacts when both emitting and forcing regions are important. The SFP provides one. It is our interest to quantify the impacts of SLCF emissions, so that one can explore the benefits of reductions or ramifications of emission changes.

Trading SLCF emissions for greenhouse gas (GHG) emissions may be questionable due to the differences in time and region of impact. We quote from a recent National Academy of Science report (2010):

The effect of mitigation of methane and black carbon is thus to trim the peak warming rather than limit the long-term warming to which the Earth is subjected... Carbon [CO₂] emission control and short term forcing agent control are two separate control knobs that affect entirely distinct aspects

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of the Earth's climate, and should not be viewed as substituting for one another.

If SLCF mitigation and GHGs affect different aspects of the climate, then the value of using the same quantification measure for all mitigation actions is dubious. We understand that many people are looking for tradeable metrics; it must be so if three reviewers read “metric” into the presentation of SFP when that application was never stated. However, we suggest that basic quantification *measures* of physical impact should come first, and that such measures could allow a discussion of the impacts, timing, and location that one might wish to mitigate. Perhaps later, SFP or a variant could be used to communicate value, but we believe such a discussion is premature at this point.

Total forcing integrated over time is one environmental goal worth quantifying, but not the only one. A requirement that quantification measures must allow GHG equivalence is overly limiting and inhibits a broader discussion. Furthermore, it is fallacious to assume that all climate mitigation will be accomplished through current trading mechanisms, which are not presently open to SLCFs anyway. For these reasons, we have not used the word “metric” in this paper to describe SFP, nor have we suggested that SFP should be used in trading.

We did discuss the relationship between SFP, trading metrics such as GWP and AGWP, and another commonly discussed measure, radiative forcing. This is not a recommendation to use SFP for trading. The discussion provided is intended to provide a connection to familiar quantitative measures, and we will make that intention clear in a revised paper.

We see the direct connection between SFP and absolute global warming potential (AGWP) as an advantage, not a shortcoming. SFP communicates the temporal and regional dependence of impact, yet it does so without inventing a completely new concept. Regional SFP must sum to global AGWP, with a modification in units. Therefore,

one can evaluate immediate regional impact and directly connect this to another measure that is common in climate policy discussions.

We now return to the discussion of SFP as a quantification measure. Both in the paper and in our response to Reviewer 1, we discussed reasons for the units, name and calculation of SFP. Although two reviewers suggested that SFP was essentially the same as AGWP, they did not indicate how AGWP could be used for the purpose we demonstrate—that is, as a measure of immediate forcing by emissions from a region, exerted upon the same or another region. We argued that the current calculation of AGWP is awkward if not impossible to use for this purpose, and the argument was not countered. Perhaps a failure of imagination prevents us from discovering how to apply AGWP for the purpose we outlined. However, we are not alone in this fault. To the best of our knowledge, neither the reviewers nor any previous literature have outlined such an application.

We therefore infer that two reviewers' comments about the similarity between SFP and AGWP is due to a desire to produce trading metrics, rather than the need stated in our paper for quantifying and communicating physical impact. Perhaps some of the reviewers thought that our presentation advocated doing away with AGWP and trading global SFP instead. We did not make such a proposal, and we agree that such a change would not add new information to a discussion of trading.

Citation

National Academy of Sciences, *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia*, Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations, S. Solomon, Chair, 2010

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