Earth Syst. Dynam. Discuss.,
https://doi.org/10.5194/esd-2018-6-RC2, 2018

Earth System Dynamics
Discussions

Interactive comment on "A quantitative approach to evaluating the GWP timescale through implicit discount rates" *by* Marcus C. Sarofim and Michael R. Giordano

Anonymous Referee #2

Received and published: 9 March 2018

The paper provides an interesting analysis on the connection between GWP timescale and discounting rates. However, I think that before publication, some major issues need to be addressed.

First, while the paper acknowledges a lot of recent articles that discuss GWP, it does not adequately discuss recent articles that look at climate metrics in an economic framework (such as Tol et al. 2012 and Mallapragada and Mignone 2017). There needs to be more incorporation of these types of studies to show how this study builds on the existing literature.

Second, the authors seem to misunderstand the messages of several recent studies,

such as Shindell et al. 2017 and Ocko et al. 2017. These studies are not advocating for a shorter time horizon for GWP, as this paper implies in both the main text and the supplemental information. Rather, they are advocating for using BOTH short AND long-term time horizons to capture the full scope of climate impacts over all timescales – a key distinction that is not depicted in the text. The paper in its current forms criticizes these studies for something that they are not doing. Further, the authors frame their motivation around the fact that studies are advocating GWP20 to then show that GWP100 fits better with discount rates, but because these studies are not simply advocating GWP20, it makes the authors appear naïve to the existing literature. Further, there is a strong reason behind why other timescales are not promoted which needs to be acknowledged (it is not simply a lack of quantification in research efforts) – that just as it is difficult to move the policy community away from the comfortable GWP, it is reasonable to believe that it will be equally as difficult to move the community away from 20 and 100 year timescales of which they are also most familiar with.

Third, it would be great if the damages function description went into more details about what is included in "damages." For example, I believe the authors make it clear later on that health or agriculture impacts from methane were not included. So what is included? Those damages are part of what makes near-term impacts so important to reduce, which justifies the use of a shorter time horizon.

Finally, I wonder about the argument that we should select a time horizon based off of appropriate discount rates. What if the GWP timescale tells us which discount rates are more appropriate? Why is it necessarily the other way around? The literature on appropriate discount rates is vast and its value is debated as much as GWP timescale selection. The paper makes it seem like there is solid agreement on appropriate discount rates but not GWP timescales, but both are subject to similar challenges and debates.

Minor comments:

1.26: Key criticisms also include the reliance of GWP value on a specified time horizon (that is a value judgement) (e.g. Ocko et al. 2017) and that emissions are not continuous (Alvarez et al. 2012). Would also include citations for each point of criticism that you mention. http://www.pnas.org/content/109/17/6435

2.1: Definitely one of the reasons, stronger than "likely."

2.3: Please explain upfront *why* you assess the choice of time horizon – as it wasn't even listed in your list of criticisms other than in reference to discounting (and it is problematic aside from discounting as well).

2.3: 100 year was also selected as middle ground from IPCC FAR as values for 20, 100, and 500 years were given.

2.8: Not sure why the word "therefore" is here. A description of why 100 year was selected does not in itself provide justification for why scientists are promoting 20 years. It is because 100 years does not adequately capture near-term impacts as it masks the importance of short-lived climate pollutants in the near-term. There needs to be a better transition from the 100 year discussion to the 20 year discussion.

2.10: Papers such as Ocko et al. 2017 are not pushing for shortened time horizon, they are pushing for a two-valued GWP metric that includes BOTH 20 and 100 year time horizons. Very important distinction that needs to be clarified, as there are efforts (some livestock groups) that push for short time horizon only.

2.13: Part of the reason that other timescales are not suggested is because of the climate policy community's familiarity with 20 and 100 years. Just as they don't want to adopt a whole new metric, it is very plausible that they will reject a new time horizon. Since 20 and 100 years are adequate for near- and long-term, pushing for say 30 and 200 year time horizons may be counter-productive.

2:20: There are more recent papers that need to be cited that look at the intersection of climate metrics and economics (Tol et al. 2012; Mallapragada and

Mignone 2017). http://iopscience.iop.org/article/10.1088/1748-9326/7/4/044006/meta http://iopscience.iop.org/article/10.1088/1748-9326/aa7397

2.31: Why CO2 and CH4 only? Justification needed, such as represent the largest long-lived and short-lived climate pollutant contributor's to today's radiative forcing.

3.5: Why is a pulse of 28.3 Mt of CH4 used, just bc of 10ppb? Why not today's annual emissions of methane from human activities (around 300-400 Mt)?

3.12: What radiative efficiencies are used? Should specify this since you go into so much detail of other parameter values. I'm assuming radiative efficiencies are from IPCC AR5 but as you cite in your references, there are more recent calculations in Etminan et al. 2016.

3:28: What damages are included by using this function?

3:30: Please include citations for the first alternative.

4.2: Suggest mentioning how these results fit in with scientific literature that has looked at these tradeoffs for decades.

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