

I am not an expert in "Economics of climate change" and "discount rates" applied in estimating damages from climate change. Hence, I ask the editor to rely on the opinion of reviewers who are experts in assessing the economic damage from climate change. Here I am providing just a couple of minor comments.

We would like to thank the referee for their comments. For responses comment by comment, see below. All author replies are in red. There is also a summary of new sensitivity analyses that is included at the end of the reply to William Collins.

A recent paper (Modak, A., G. Bala, K. Caldeira, and L. Cao, 2018: Does shortwave absorption by Methane influence its effectiveness? *Climate Dynamics*, <https://doi.org/10.1007/s00382-018-4102-x>) shows that the efficacy of methane forcing is only 80% relative to CO<sub>2</sub> forcing. The lower efficacy affects the estimation of GTP and hence the damages. What is the implication of this result to the conclusion reached in your study? Discuss.

Modak et al. 2018 appears to be a similar paper, though opposite in direction, from Etminan et al. 2016 which was referred to by Referee #2 and in the original paper. We have performed a sensitivity analysis wherein we double the radiative efficiency of methane. In this case, while damage ratios double, the GWP calculated with the updated radiative efficiency also doubles, such that the net effect on calculated timescales is less than 1/10<sup>th</sup> of a percent (see sensitivity analysis in the reply to William Collins).

Modak et al. is slightly different than Etminan, as it occurs after radiative efficiency in the causal chain. However, it seems likely that an updated GWP calculation for methane might take into account forcing efficacy, much the way it takes into account ozone and stratospheric water vapor perturbations. But even if we knew that an updated GWP would not take into account efficacy differences, we would be inclined to treat this effect like we treat the ozone health effects from methane: a potentially important factor in weighing the relative value of methane to CO<sub>2</sub>, but not an influence on implicit timescales.

In the abstract and in the 2nd paragraph of the Introduction section, it is stated that GWP assumes constant future concentrations. I believe this is true only for the baseline state. GWP is estimated for a case where the concentration of the gases decay with time. The integrated radiative forcing is calculated for the time evolving concentrations relative the baseline.

The GWP assumes constant background concentrations, which is what the abstract and 2<sup>nd</sup> paragraph refers to. An additional increment to the concentration at time zero from an emissions pulse is added, and this additional increment decays over time.

Fig. 1c and d: Is the unit for the damages and discounted damages correct? Should it be Billion \$ per year? Same issue for Fig. S1

Correct. We will update the axis titles accordingly.