

On the whole this is a useful paper that recognizes that climate change mitigation has costs and the optimal temperature target for how much we allow the world to warm depends on not just the damages of climate change but also the costs of mitigation. This is not a new insight but the paper represents a substantial advance over many of the IAMs that have been used in the past by incorporating a much more up-to-date approach to estimating the damage associated with a given temperature rise. On the mitigation side the paper includes a more robust estimation of how the costs of dealing with climate change will change with temperature and, it appears, a great deal more detail on how that will evolve with changes in technology.

I think that this paper usefully fills a gap in the existing literature by updating our understanding of the trade-off between mitigation costs and damages based on new science. However, there are several details of the implementation that concern me.

First, I share the concern pointed out by the first reviewer that the estimates from Burke et al. may not represent permanent declines in growth rates but rather represent a levels effect. Further, assuming these effects remain constant to the end of century, without accounting for adaptation, is problematic. Burke et al. suggest they see no evidence of changes in the relationship since the 1960s and take that as evidence of there being little adaptation but knowledge of climate change has changed a great deal since the last 40 years of the 20th century and it seems unlikely there will not be adaptation going forward. That also suggests a specification that does not treat damages as permanent declines in growth rates.

Second, I also would like more information about the REMIND model. It is a model of mitigation costs that is unfamiliar to me and the information included in the paper makes it difficult to assess whether it is appropriate.

Third, in the mitigation scenarios the authors assume “harmonized greenhouse gas emissions pricing as of 2020.” That seems extremely unlikely to happen at this point. Similarly, while it is not clear when CCS is assumed to be widespread, any assumption that CCS is widespread in the very near future seems equally unrealistic. At the very least I’d like to see how the estimates change if these assumptions are relaxed and the time at which harmonized emissions pricing moves out into the future. I would expect that this increases the mitigation costs and so results in a higher temperature target but there may be offsetting effects (another reason to clarify the details of the REMIND model).

Fourth, I found the aggregation of costs and damages confusing. It seems that it would be better to estimate both costs and damages in the same framework rather than estimating them separately and then trying to aggregate. As the other reviewer points out, using the REMIND temperature pathways in the damage estimation seems the obvious way forward.

Fifth and finally, using a hard threshold to delineate between rich and poor seems fine but this should both be subject to robustness checks – what happens when the threshold is more or less strict? And countries should be allowed to move across the threshold overtime. As the author’s point out, accounting for India’s growth in the last few decades substantially increases the damage estimates in Burke et al. Despite climate change countries will continue to grow and as they grow richer they may become more adept at dealing with climate change. The estimates should allow for that.

Minor points:

- There were a number of typos throughout the manuscript. A quick read through should clean most of those up.
- I thought the figures 1 and 2 were clear and helpful but figure 3 may not have been necessary.

