

Review of “Air pollution and associated human mortality ...” By Fang et al.

This paper discusses the simulated (using a single chemistry-climate model) changes from pre-industrial (1860) to present in mortality, looking at the specific roles of climate, emissions and methane. This paper is one in just a handful of papers dealing with estimating mortality changes using global chemistry-climate models. As such, there is considerable value in seeing it published. There are however a certain number of questions and loose ends that need to be addressed before publication.

General comments

- It seems that only present-day population maps are being used to assess the mortality. Maybe this is not the case and it needs to be made more explicit. If it is the case, then it should be justified. Population maps (regardless of their quality) are available for 1860 and should be used (<http://themasites.pbl.nl/tridion/en/themasites/hyde/download/index-2.html>).
- The discussion on OH and H₂O₂ is of very little use in this paper. While there is a coupling to PM_{2.5}, this is not discussed specifically enough to justify the space used by this discussion. I would strongly suggest removing it altogether (page 22725, second paragraph, page 22727 lines 16-28 and section 4.3.3).
- Figures 3 and 5 are too small to be useful.

Specific comments

- Page 22714, Line 4: write “pre-industrial”
- Page 22714, Line 6: change “go beyond” to “extend”
- Page 22714, Line 21: mention explicitly that this is a global number
- Page 22715, Line 12: this 3-4 increase is not true for BC (see Lamarque et al., 2010 page 7033)
- Page 22715, Line 18: change “apply” to “use”
- Page 22716, Line 10: it is Anenberg, not Annenberg
- Page 22716, Line 25: reference Shindell et al., Science, 2009.
- Section 2.2: no spinup?
- Page 22722, line 16: change 10 ppbv to 15 ppbv, which by the way is not that small!
- Page 22724, line 8: what is the methane lifetime and how does it compare to Prather et al. (2012)?
- Page 22728, line 3: is that direct+indirect forcing?
- Page 22728, lines 5-9: sentence does not belong to this section, if at all in a paper.
- Page 22728, line 25: this is not completely clear once the potential CO₂ compensation is taken into account. Rephrase.

- Page 22729, line 5: correlated with what?
- Page 22733, line 9: does “anthropogenic” refer to all the changes or simply the changes in anthropogenic emissions. There is also a potential change in natural emissions and impact of methane on its lifetime, so “anthropogenic” might be a misnomer.
- Page 22733, line 11: why can’t the same measure be used instead of simply a “consistent” statement?
- Page 22738, line 29: there is really no discussion of cost prior to this? More information should be used to make this useful.