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Interactive comment on "Attribution of the Australian bushfire risk to anthropogenic climate change" *by* Geert Jan van Oldenborgh et al.

Tim Palmer

tim.palmer@physics.ox.ac.uk

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In my view, three key questions need to be addressed before we can attribute the bushfire risk to climate change, at least quantitatively.

1. The predominant cause of the bushfires were unquestionably the exceptionally (unprecedented) dry conditions in 2019. These were linked to the IOD (and other remote factors). Did climate change makes such dry conditions more likely? A pre-requisite to answering such questions is that we can simulate extremes of the IOD, the regional heat waves and the teleconnnections between the two. Studying 7-day heat waves does not address this issue adequately. We should be looking at model fidelity on monthly to seasonal timescales, where teleconnection biases are known to be sub-

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stantial. The dry conditions of 2019 persisted into 2020 partly through continuation of the IOD, and partly because of the negative SAM.

2. The Fire Index has a dependency on temperature which presumably relates to the fact that vegetation dries out more at higher temperatures. Of course, in general terms this is entirely reasonable. However, at the beginning of summer 2020, the vegetation was already extremely dry due to the exceptional conditions of 2019. It is not clear to me that under these circumstances additional temperature increased the fire risk much further than the critical value it was already at. In this sense the dependence of the fire index on temperature for these exceptionally dry conditions may not be correct.

3. The one factor where anthropogenic climate change may have been important, but has not been taken into account here, is the CO_2 fertilisation effect, i.e there was simply more vegetation to burn.

Unless we can answer these questions, then I do not think we can, or indeed should, be making quantitative estimates of the impact of anthropogenic climate change on these bushfires.

Instead we must focus effort on developing a next generation of model where the regional dynamical effects of climate change can be simulated with much more confidence than is currently possible (Palmer and Stevens, 2019). Such models are likely to require much greater resolution than we have now - in particular allowing the convective rainfall anomalies associated with the IOD to be represented with the laws of physics rather than with relatively crude parametrisations.

Palmer, T.N. and B. Stevens, 2019: PNAS, 116, 24390-24395.

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