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The role of anthropogenic forcing on Australia's Tinderbox (2017-19) Drought and its future likelihood

Surendra Rauniyar[1], Scott Power[2,3], Pandora Hope[1,3], and **Ulrike Bende-Michl**[1]
[1]Australian Bureau of Meteorology, Research Program, Science and Innovation Group, Docklands, Australia (surendra.rauniyar@bom.gov.au)
[2]School of Earth, Atmosphere and Environment, Monash University, Melbourne, Australia
[3]ARC Centre of Excellence for Climate Extremes, Australia

During the 2017-2019 period, a large region of the Murray Darling Basin in Australia received the lowest three-year rainfall resulting in an unprecedented drought, known as the Tinderbox Drought. The cool season (Apr-Sep) rainfall declined by more than 54% of the 1901-1960 average. An analysis of the observed rainfall records (1900 – 2020) shows that it was exceptionally unlikely that a decline of this magnitude could occur from internal climate variability alone. In this study, we analysed outputs from CMIP5 and CMIP6 climate models under different forcing conditions (i.e., pre-industrial, historical-all forcings and different future emissions pathways) to estimate the relative contribution of anthropogenic forcing and internal variability to the observed 2017-2019 cool season rainfall reduction and the future likelihood of three-year rainfall change as dry or drier than the Tinderbox Drought under different emission pathways. According to the models, taken at face value, the Tinderbox Drought is an extremely unlikely event, but the likelihood of its occurrence is being increased from virtually impossible to extremely unlikely by the anthropogenic forcing. This suggests that the Tinderbox Drought was largely dominated by internal climate variability, however, it would not have been as dry without the influence of anthropogenic forcing. We found that the likelihood of a three-year drought as dry or drier than the Tinderbox Drought is going to increase by 15% towards the end of the twenty-first century under a high-emission scenario. Even with a marked reduction in emissions, its likelihood will be still around 5 % which is 10 times higher than the pre-industrial climate. Only a few ensemble members simulate a drying as large or larger than the observed 2017-2019 drying. The inability of most models to fully replicate the large drying seen so far leads to two possible conclusions: the rainfall in this region is more sensitive to greenhouse gas concentrations than is currently modelled, or factors other than climate change have coincidentally reduced rainfall during the recent period of anthropogenic climate change.