Comment on acp-2022-422

Anonymous Referee #2

Referee comment on "Impacts of reductions in non-methane short-lived climate forcers on future climate extremes and the resulting population exposure risks in eastern and southern Asia" by Yingfang Li et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-422-RC2, 2022

Review of "Impacts of reductions in non-methane short-lived climate forcers on future climate extremes and the resulting population exposure risks in Asia" by Li et al.

This study uses AerChemMIP simulations to examine the effects of improved air quality through pollutant emissions reductions on projected climate extremes and associated population exposure in south and east Asia. A significant accelerated warming effect is found highlighting the importance of these short-lived forcings in policy-making and planning for future extremes.

The study will make a useful contribution to the literature and this is a very important area for analysis. I do have some significant concerns that I would ask the authors to consider.

My first major concern is a technical one. The data are regridded using bilinear interpolation onto a 1-degree grid (L128). This is a much higher resolution than all but one of the models' native resolutions (Table 1). By interpolating to a higher resolution (in effect extrapolating) additional synthetic information is being added unintentionally and this could have a substantial effect on the extremes analysis in particular. My suggestion is to interpolate onto a common grid that is coarser (perhaps 2-degrees) and to use a different interpolation method for precipitation. I would recommend having a look at this webpage for useful discussion: https://climatedataguide.ucar.edu/climate-data-tools-and-analysis/regridding-overview.

My other main concern is that there is no attempt at model evaluation apparent. I understand this may be challenging but given the analysis I would suggest some evaluation of extremes against an observational dataset over the recent period would be useful to benchmark whether the models are performing well enough.

There is other relevant literature on the role of aerosols in influencing the climate of this region (Freychet et al. 2019), including on accelerated warming and associated extremes (King et al. 2018; You et al. 2020).

Section 3.2. Some comparison of the changes in temperature extremes over Asia relative to other parts of the world would also be useful in reinforcing your point about the role of short-lived forcers in affecting local climate extremes.

Table 1: "America" should be the "United States" and "England" should be "United Kingdom".

All map figures: Stippling where 60% of models agree (I'm assuming you mean five out of seven?) is quite a weak threshold for agreement that could be met by chance quite often. It might be more useful to just say the fraction of models and use a higher threshold (e.g. six out of seven).

References

Freychet, N., S. F. B. Tett, M. Bollasina, K. C. Wang, and G. C. Hegerl, 2019: The Local Aerosol Emission Effect on Surface Shortwave Radiation and Temperatures. *J. Adv. Model. Earth Syst.*, **11**, 806–817, https://doi.org/10.1029/2018MS001530.

King, A. D., R. Knutti, P. Uhe, D. M. Mitchell, S. C. Lewis, J. M. Arblaster, and N. Freychet, 2018: On the linearity of local and regional temperature changes from 1.5°C to 2°C of global warming. *J. Clim.*, JCLI-D-17-0649.1, https://doi.org/10.1175/JCLI-D-17-0649.1.

You, Q., F. Wu, L. Shen, N. Pepin, Z. Jiang, and S. Kang, 2020: Tibetan Plateau amplification of climate extremes under global warming of 1.5 °C, 2 °C and 3 °C. *Glob. Planet. Change*, **192**, 103261, https://doi.org/10.1016/J.GLOPLACHA.2020.103261.