

Revision comment on “Agricultural management effects on mean and extreme temperature trends” by Aine M. Gormley-Gallagher et al.

Anonymous Referee #2

Received: 30 October 2021

The authors took time to respond. Thank you.

Reply. The Reviewer’s time and recent recommendation are greatly appreciated. We have addressed the reviewer’s recommendation as detailed below (in blue) and the amended manuscript text is provided in italics.

1. My remaining comment is that they still make this, in my view, poor assumption:

“An underlying premise of this paper is that GCMs remain the primary tool for providing long-term projected changes in the climate system and have been often used for studying land cover and land management effects on climate”.

Unfortunately, landscape heterogeneity, including resulting mesoscale circulation features, on spatial scales that their model cannot resolve are very important. Indeed, unless the models can resolve mesoscale features such as sea breezes, (which is an analog for landscape forced mesoscale circulations) they are going miss significant effects. Here is one example illustrating why higher spatial resolution is essential:

- Marshall, C.H. Jr., R.A. Pielke Sr., L.T. Steyaert, and D.A. Willard, 2004: The impact of anthropogenic land-cover change on the Florida peninsula sea breezes and warm season sensible weather. *Mon. Wea. Rev.*, 132, 28-52.

A second paper, dealing with dispersion over variations in land surface forcing also shows the importance of smaller scale resolution.

- Pielke, R.A. and M. Uliasz, 1993: Influence of landscape variability on atmospheric dispersion. *J. Air Waste Mgt.*, 43, 989-994.

Even on regional scales, they will miss effects due to lack of spatial structure. Their model can only resolve features that are at least 4 horizontal grid increments in each x-y direction. The model set up has:

“The period 1976-2010 was simulated with a horizontal pixel resolution of 0.9° latitude × 1.25° longitude.”

This means they can only resolve, with any fidelity, features 3.6 degrees by 5 degrees; much too coarse to resolve important landscape effects on the local, mesoscale and regional scale. Here is an example of an analysis for aerosols and found a large potential influence on regional circulation features;

- Matsui, T., and R.A. Pielke Sr., 2006: Measurement-based estimation of the spatial gradient of aerosol radiative forcing. *Geophys. Res. Letts.*, 33, L11813, doi:10.1029/2006GL025974.

A similar large effect is expected with landscape management and landscape changes.

I recommend more text be added on this issue. One suggestion for future work is to run higher spatial resolution (both regional; mesoscale) model runs for selected shorter time slices, and compare results to the coarser resolution results they have with the global models.

After the authors and Editor consider this recommendation, I recommend acceptance.

Reply. To the introductory paragraph that focuses on the limitations of GCMs (paragraph 4), we have added:

“Regarding the applicability of the knowledge produced by GCMs, they do not provide the skill required at the spatial scale to offer practical responses at the infrastructure scale (Hossain et al., 2015) or in terms of water resource management (Marshall et al., 2004)”.

The following reference has thus been added to the reference list:

“Marshall, C.H. Jr., Pielke Sr., R. A., Steyaert, L. T. and Willard, D. A. 2004: The impact of anthropogenic land-cover change on the Florida peninsula sea breezes and warm season sensible weather. Monthly Weather Review, 132, 28-52.”

Also, to the conclusion, the following text has been added:

“Furthermore, we encourage the community to compare the coarser resolution results gained in this GCM study with higher spatial resolution models and for seasonal and monthly time periods. This will support decision-making on the incorporation of agricultural management processes in future GCM projects.”

Lastly, the final sentence in the abstract has been adjusted to now read:

“Our results underline that agricultural management has complex and nonnegligible impacts on the local climate and highlight the need to evaluate the representation of land management in global climate models using climate models of higher resolution.”

We thank you for your continued effort on our paper and for ensuring that important information is included. We believe your contribution and our response has greatly helped to improve the value and quality of our paper.