Editor:

Please clarify the statistical significance of the results, as suggested by the first reviewer. It is also unclear why 95% confidence level is only plotted in Fig. 6. All other maps about differences should report the similar statistical significance.

We have clarified the statistical significance of the results as suggested by first reviewer below. We have also included significance test for all the figures showing wildfire-induced difference in PM2.5, dynamical, and thermodynamical variations (Figure 3-6) in the manuscript now as suggested by editor.

Reviewer#1:

I appreciate the authors' efforts in addressing the concerns raised by both reviewers in the last round. However, after reading the author's response and the revised manuscript, I am even more concerned whether the results are overly interpreted, especially with the single member simulation and 10-year mean monthly output. One fundamental question is how did you do t-test with a sample size of 1? For example, when you test the null hypothesis that at a specific grid 2050ALL-2000ALL is 0, you need the variance of 2050ALL-2000ALL under null hypothesis. But if my understanding is correct, you have only 1 replicate (decadal mean, 1 member) of 2050ALL-2000ALL at a specific grid; there is no way to obtain the variance. Please clarify this statistical testing question.

For the significance test of the differences 2050ALL-2000ALL or [(2050ALL-2050WEF)-(2000ALL-2000WEF)] at a specific grid, the sample size is 10. Each sample of the population represents one of the 10 years in each simulation corresponding to 2000s/2050s.

A statistically significant difference between 2050ALL and 2000ALL means that the average of the 10 samples in 2050ALL is significantly different from the average of the 10 samples in 2000ALL, considering the interannual variability within each period. Thus, the variance for the t-test from the sample size of 10.

It is common in climate modelling to simulate 10 years of historical period as the control run and then repeat the same 10 years under a perturbed forcing such as changes in greenhouse gases, aerosols, and land use and land cover to examine the impact of the forcing. In such studies, the mean differences, variances and statistical significance in the results are calculated using each year as a sample point (similar to our approach). A few references for similar analysis of statistical significance in context of air quality impact studies using climate models are Ford et al., 2018; Nolte et al., 2018; Hong et al., 2019; Zou et al., 2020;

We have also included a revised figure of the wind circulation changes (averaged from surface to boundary layer) which clearly shows that the dynamical effects are substantial.

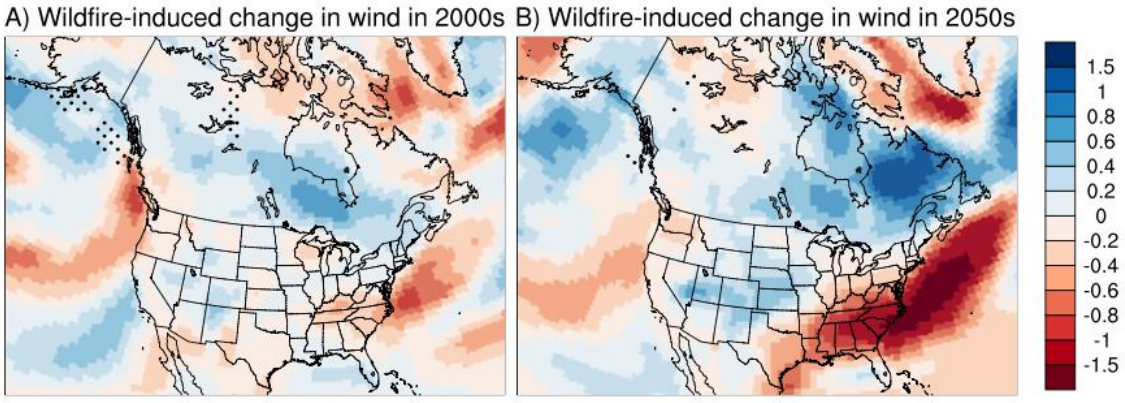

Figure 5a: Spatial distribution of decadal mean summer (June through August; JJA) wildfire-induced future changes [(2050_{ALL}-2050_{WEF}) – (2000_{ALL}-2000_{WEF})]. A) Wind speed below 850 hpa for [(2050_{ALL}- – 2000_{ALL}], B) Wind speed below 850 hpa [(2050_{WEF}) – (2000_{WEF})].

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