

**Comments on “The relationship between PM<sub>2.5</sub> and anti-cyclone wave activity during summer over the United States” by Wang et al., 2021**

Based on regression analysis on anticyclone wave activity (AWA) anomalies and PM<sub>2.5</sub> concentrations, the present study attempts to evaluate the possible control of large-scale atmospheric circulation on regional aerosol pollution, which is very important for improving the understanding of air pollution formation and model prediction capability. Since the analysis was conducted on both observations and well-evaluated model simulations under various scenarios, the conclusions drawn from this study are generally reliable and robust. The manuscript is also well organized and prepared. Thus, I recommend it for publication with minor revision. Specific comments are listed as below.

Line 95: How to choose the three sites (i.e., AREN1, SIPS1, and LAVO1) as the representative stations of different part of the country and why? For example, the authors may want to provide more detailed information regarding the representativeness of the three selected stations.

Line 222: It seems that the statement here flipped two simulation terms: it is REFC1SD which is for the reanalysis driven simulations and GCM2000 for the coupled model simulations, right? I also found several other places such as in figure captions show similar typos. Please go through the entire paper and make sure that the case terms are not messed up.

Lines 295-296: why Wise and Comrie (2005) show much lower coefficient of determinations (i.e., 0.1-0.5) than this study (i.e., 0.75)?

Lines 284-286: how about the comparison of PM<sub>2.5</sub> results in this study with that in Porter et al. (2015)? Are they consistent with each other as what is shown in ozone?

Line 150: the full term of AWA should be shown at its first instance (i.e., in Line 59).

Section 2.3: Since the AWA (or LWA) is the key variable in this study, it's better to list the equation(s) used to calculate AWA (or LWA) so that the readers don't need to refer to previous references to understand the detailed calculations related to AWA (or LWA).

Lines 225-226: miss commas after “In addition” and before “suggesting”.

Figures & Table:

Fig. 4: please describe what the contour lines (green and magenta) stand for.

Fig. 6 caption: GCM2100 should be the case with the future climate with current emission while REFC2 is the future climate with current emission. The original description seems wrong based on methodology section.

Fig. 9: Is the panel (a) for the change between GCM2100 and GCM2000 or between GCM2100 and REFC2 simulation? I note that REFC2 is for future climate as denoted in methodology section, right? Similar issue in Fig. 10 caption.

Table 1: The time period information for GCM2000 and GCM2100 do not mean anything, as you just simulated a climatology, not specific years. It should be sufficient to just mention the length of the simulations.