We are very grateful for the insightful comments from the reviewer, which have allowed us to clarify and improve the manuscript. We addressed the reviewer's comments with the comments marked in black and our response in blue.

Reviewer comments:

I still have a little concern on the fuel moisture content inferred from either VPD or RH. Comparing the Figure R3 and R4 in the response with Figure 7, the VPD and RH distribution clearly demonstrate a good agreement with the fire AOD, indicating the high correlation between VPD or RH with fire activities.

Aerosols are known to change surrounding water vapor in air when they grow. This is the different pathway with how aerosols affect precipitation through their influence in clouds. Besides, aerosols also affect the downward shortwave fluxes (particularly diffuse light) through the direct effect and hence change the photosynthesis rate and subsequent primary productivity.

The author may want to calculate 1) the correlation between VPD (or RH) and burned dry matter and 2) the correlation between the downward diffuse flux and burned dry matter and include the correlation in the Table 1 and add some discussions of the possible contribution of the aerosol-RH and the aerosol-SW feedback on the variability of fire activities in the interested regions.

We agree with the reviewer that changes of VPD or RH are possibly correlated with fire activities on interannual scales. Following your suggestion, we have calculated the correlations between VPD/RH and burned dry matter and added in Table 1. The correlations of fire-consumed dry matter with VPD and RH are significant (with a value of 0.61 and -0.63, respectively), which are slightly weaker than that with precipitation (-0.69). In fact, the interannual variation of VPD and RH are not independent of temperature or precipitation. In the previous version of manuscript, we have pointed out this in Lines 228-232 "*Other meteorological metrics such as vapor pressure deficit (VPD) and relative humidity (RH) are also frequently used to help understand fire-meteorology interactions. Here we found the interannual variations of regional mean VPD and RH are highly correlated with precipitation (R =-0.8 for VPD and R=0.7 for RH, respectively) and temperature (R = 0.7 for VPD and R = -0.5 for RH, respectively) over the SMCA region.*" As we have investigated the interannual variation of temperature and precipitation in detail, we only briefly discussed the influence of VPD and RH as above. Furthermore, it's worth to note that among all variables including VPD, RH, precipitation and temperature, only regional mean precipitation during the fire seasons show an obvious quasi-biennial variability as indicated by both its time series and spectral analysis. Hence, in this study we focus on the dominant contribution of precipitation to the quasi-biennial variability of fire activities on interannual scales, though other variables could potentially correlate with the interannual variation of fire activities as well.

For the short-term aerosol-RH feedback, we examined the fire aerosol-induced changes in RH based on our model simulations. As shown in figure R1(a), we found that changes in 2m RH between Case_Strong and Case_Weak are relatively small.

We have also followed the reviewer's suggestion to look at the possible fire-SW interaction on both interannual and short-term scales. On the interannual scale, the correlations between the

regional mean fire-consumed dry matter in the fire season and downward diffuse radiative flux (from CERES satellite data) in the month prior to the fire season and during the fire season are both insignificant based on the student's T-test (reach -0.1 and 0.4, respectively). On the short-term scale, our simulations show that more fire aerosols in the atmosphere slightly increases downward diffuse shortwave radiative flux, but signals are generally insignificant statistically (figure. R1(b)). In addition, we have demonstrated in the previous version of manuscript that the biennial variability of fire activities is less influenced by fuel load (indicated by NPP). Hence, we conclude that the contribution of aerosol-SW interaction to the quasi-biennial variability of fire activities by modifying primary productivity are negligible. We have added a brief discussion in the revised version of manuscript.

Line 106-109: . Interannual variations in the shortwave diffuse radiative fluxes at surface, which is closely related to photosynthesis rates and primary productivity are also analyzed using the photosynthetically active radiation from the Earth's Radiant Energy System (CERES) product (Su et al., 2007).

Line 122-124: We also calculated near surface relative humidity and vapor pressure deficit following Chiodi et al. (2021) with the use of 2m temperature and dew point temperature from ERA5 reanalysis data.

Line 216-218: .Correlations between regional GPP and fire-consumed dry matter are even slightly negative. Moreover, correlations between the regional mean diffuse radiative flux and fire-consumed dry matter are also statistically insignificant.

Line 231-235: Correlations in Table 1 indicate that higher VPD facilitates fire activities while higher RH depresses fire activities. Here we found that the interannual variations of regional mean VPD and RH are in fact highly correlated with precipitation (R =-0.8 for VPD and R=0.7 for RH, respectively) and temperature (R = 0.7 for VPD and R = -0.5 for RH, respectively) over the SMCA region.

Line 397-400: Therefore, the model simulations confirm a positive fire-precipitation feedback loop on the short timescale within the fire season. Though variations of relative humidity could influence fire activities on interannual scales, the short-term feedback of fire aerosols on near surface RH are much weaker compared to precipitation (Fig. S5).

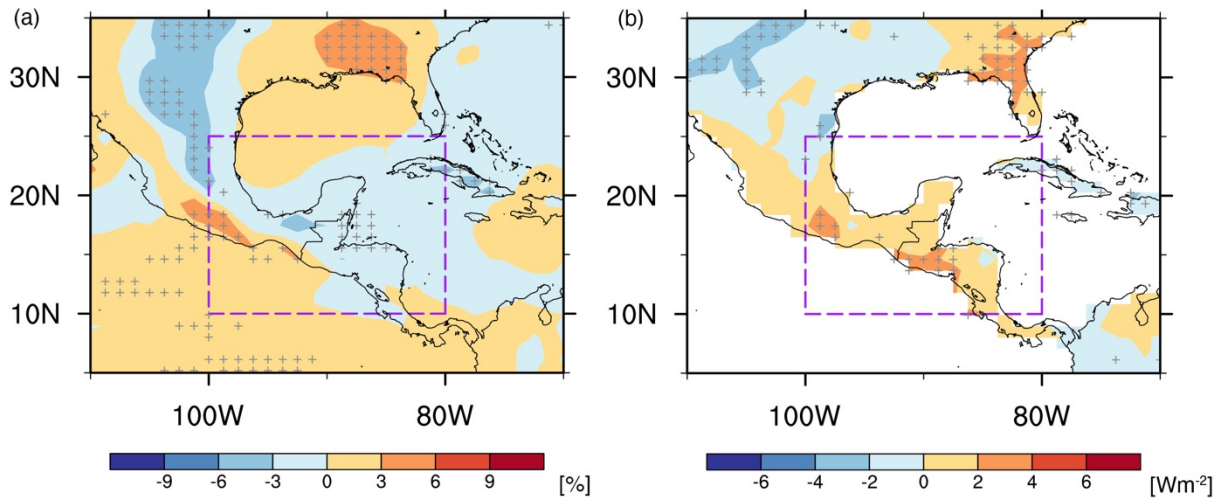

Figure R1. Changes in meteorological variables induced by fire-emitted aerosols. Differences in (a) 2m relative humidity and (b) shortwave diffuse radiative flux at surface over land regions between Case_Strong and Case_Weak. Stippling indicates the differences are statistically significant at the 90% confidence level based on T-test.

We are very grateful for the insightful comments from the reviewer, which have allowed us to clarify and improve the manuscript. We addressed the reviewer's comments with the comments marked in black and our response in blue.

Reviewer comments:

I am satisfied with the revised manuscript and appreciate the additional discussion included by the authors throughout the paper. Overall, I believe the results from this work make a strong case for studying different fire regimes with coupled fire-climate simulations.
One minor correction: the authors should ensure that the author list in the supplementary information is also updated before publication.

We thank the reviewer for pointing this out. This has been corrected accordingly.