

The author develops a simple and realistic aerosol emission approach. Using the Common Community Physics Package (CCPP), they embedded sea-salt, dust, and biomass burning emission modules as well as anthropogenic aerosol emissions into the Unified Forecast System (UFS) to provide realistic aerosol emissions for these two variables. This approach provides realistic aerosol emissions without the need for additional tracer variables, resulting in minimal additional computing cost.

The manuscript is well-written and easy to follow. The new aerosol emission approach demonstrates good realism in the runs with online emissions, as evidenced by comparisons with analyzed fields for the Aerosol Optical Depth (AOD). Additionally, the cloud cover, radiation, and precipitation in the runs also exhibit realistic representations. This simple and realistic aerosol emission approach is highly suitable for operational Numerical Weather Prediction (NWP) due to its affordability.

The reviewer recommends a minor revision for the manuscript. Below are the main comments of the reviewer.

Specific comments:

1. Please ensure consistency in the citation format of the references mentioned in the paper. For example, Line 36: "Conrck et al. 2021" should be "Conrck et al. (2021)"; Line 44: "Zhao et al. 2021" should be "Zhao et al. (2021)"; Line 49: "Mulcahy et al. 2014" should be "Mulcahy et al. (2014)" .
2. In the main text, the full name should be provided for the first occurrence of an abbreviation. Please check this. For example, "UFS" should be expanded to its full name at Line 61, rather than at Line 69.
3. Will the UFS Weather Model (<https://github.com/NOAAGSL/ufs-weather-model/releases/tag/global-24Feb2022>) in this study be made publicly available? Currently, it seems that the provided link is not accessible.
4. Please provide a detailed explanation of the $fact_{wra_ss}$, $fact_{wra_oc}$, $fact_{ifa}$ in the formula section.
5. The author should provide an accurate description of the experimental results. e.g., in Figure 3, the EXP experiment overestimated AOD in central Africa while underestimating it in South Asia.
6. To provide a more intuitive comparison between CTL and EXP, it would be helpful to include the EXP minus CERES results in Figure 5 and Figure 6. Additionally, in Figure 5b, the title "New-CTL" should be changed to "EXP-CTL" to maintain consistency with the other figures. Similarly, in Figure 10a, "NEW" should be changed to "EXP" for consistency.
7. Just like in Figures 5 and 6, it would be beneficial to include the results of EXP minus Obs in Figure 9. Comparing CTL minus Obs and EXP minus Obs would provide a more comprehensive assessment of the improvement and differences between EXP and CTL.
8. Lines 152-154: Is there any difference in the calculation of the averages for WFA, IFA, AOD, temperature, hydrometeors, cloud cover, radiation, and precipitation, are they all averaged over a 120-hour forecast period? Does "The forecast is integrated for 120 h" mean that the forecast has a time resolution of 120 hours?
9. Lines 192-194: "The global mean SFCDWSW from the averaged CERES observations compared to the CTL and EXP runs are 192.5 W m^{-2} , 194.7 W m^{-2} and 193.7 W m^{-2} , respectively" means the

global mean SFCDSW from the averaged CERES observations, the CTL, the EXP are 192.5 W m^{-2} , 194.7 W m^{-2} and 193.7 W m^{-2} , respectively? What does "comparison" mean here? in the same way What does "compare" mean in 199-201? Please provide a clear description.

10. Line 194 and Line 200, " W m^{-2} " should be " W m^{-2} ."

11. The validity of the liquid water path (LWP) obtained from the CTL and EXP runs can be assessed by comparing it with other LWP products or by calculating LWP using ERA-Interim/CFSR (Climate Forecast System Reanalysis) data. Additionally, the results of the CTL and EXP runs for the 120-h averaged high cloud, mid cloud, and low cloud cover fractions can also be compared with satellite products such as CloudSat/CALIPSO.

12. Some figures are not very clear, such as Figure 4. It is recommended to replace them with clearer versions for better readability by the readers.