The paper "Spatio-temporal variation characteristics of global wildfires and their emissions" presents a very detailed analysis of fire burned area, fire fraction, fire radiative power, and fire count in different regions and different seasons using satellite remote sensing data, emission data, and meteorological data. The study found that while the burned area of wildfires has decreased slightly over the past 20 years, there are pronounced regional and seasonal variations in the burned fraction, fire count, and fire radiative power of wildfires. The study also found that emissions from wildfires decreased in some regions (such as Northern Canada, Alaska, and Northeast China) while increasing in others (such as Siberia) and that the intensity of wildfire development is primarily affected by the abundance of vegetation, while weather conditions can also indirectly influence wildfire incidence. The study concludes by suggesting that this research can provide support for the control of wildfire activity across regions and seasons.

The paper is well-structured, the research question is well-defined, and the methods used are appropriate for the research question. The study findings are well presented and the conclusion is well drawn.

General comments:

1. Introduction: it would be better to include more papers from previous studies in your paper, particularly those focused on burned area trends, fire intensity trends, global patterns of wildfires, variations in fire season, and the impact of weather on wildfires. These studies would provide a more comprehensive understanding of the topic.

2. This paper found a decrease in burned areas in the western US, however, other studies have found an increase in burned areas in the same region. For example:

   M. Burke, A. Driscoll, S. Heft-Neal, J. Xue, J. Burney, M. Wara, The changing risk and burden of wildfire in the United States. Proc. Natl. Acad. Sci. U.S.A. 118, e2011048118 (2021).

   Y. Zhuang, R. Fu, B. D. Santer, R. E. Dickinson, A. Hall, Quantifying contributions of natural variability and anthropogenic forcings on increased fire weather risk over the western United States. Proc. Natl. Acad. Sci. U.S.A. 118, e2111875118 (2021).

   This discrepancy in findings is noteworthy and deserves further investigation. I would recommend considering comparing the findings in your paper with previous studies and discussing the differences.

3. This study utilized GFAS emission data, however, it has been shown in the paper by Li et al. (2020) that GFAS data is much lower than other widely used emission data products. This difference in the data sets could have a significant impact on the results of your study. I recommend comparing GFAS with other emission data products (e.g., QFED, FEER, GFED, etc.) to make your results more robust and reliable.
   Li, Y., Tong, D. Q., Ngan, F., Cohen, M. D., Stein, A. F., Kondragunta, S., et al. (2020). Ensemble PM2.5 forecasting during the 2018 Camp Fire event using the HYSPLIT transport and dispersion model. Journal of Geophysical Research: Atmospheres, 125, e2020JD032768. https://doi.org/10.1029/2020JD032768

Specific comments:

1. Line 59: Please add more references for wildfire impact on human health. Below are some examples:
   Reid, C.E., Brauer, M., Johnston, F.H., Jerrett, M., Balmes, J.R., Elliott, C.T.: Critical review of health impacts of wildfire smoke exposure. Environ. Health Perspect. 124, 1334–1343, 2016.

   Cascio WE.: Wildland fire smoke and human health. Sci Total Environ. doi: 10.1016/j.scitotenv.2017.12.086, 2018.

   O'Neill, S. M., Diao, M., Raffuse, S., Al-Hamdan, M., Barik, M., Jia, Y., Reid, S., et al.: A multi-analysis approach for estimating regional health impacts from the 2017 Northern California wildfires, Journal of the Air & Waste Management Association, 71:7, 791-814, DOI: 10.1080/10962247.2021.1891994, 2021.

   Liu, Y., Austin, E., Xiang, J., Gould, T., Larson, T., & Seto, E.: Health impact assessment of the 2020 Washington State wildfire smoke episode: Excess health burden attributable to increased PM2.5 exposures and potential exposure reductions. GeoHealth, 5, e2020GH000359. https://doi. org/10.1029/2020GH000359, 2021.

   Li, Y., Tong, D., Ma, S., Zhang, X., Kondragunta, S., Li, F., & Saylor, R.: Dominance of wildfires impact on air quality exceedances during the 2020 record-breaking wildfire season in the United States. Geophysical Research Letters, 48, e2021GL094908. https://doi.org/10.1029/2021GL094908, 2021.

2. Introduction: Please include more papers on burned area trends, fire intensity trends, global patterns of wildfires, variations in fire season, and the impact of weather on wildfires.

3. Line 109: Please provide the full name for MODIS. Make sure you have provided the full name of any abbreviation before using it for the first time in your paper. Please check throughout the paper.

4. Line 110: full names for MCD, MCD64CMQ, and MCD14DL are missing.

5. Line 117: full names for MOD, and MYD are missing.

6. Line 117: Please add the reference for the FIRMS product here.

7. Line 123: full name for FireCCI is missing.

8. Section 2.2.2: Compare GFAS with other widely used fire emission products. (See general comments)

9. Line 134: full names for ERA, ERA-Interim, and ERA5 are missing.

10. Line 153: any reference for the definition of the fire month? Why do you use 80% rather than 70% or another percentage?

11. Figure 1: It would be better to show the trend of burned areas in the 12 different regions defined in table 1.

12. Figure 1: Please explain the difference in the results of MODIS and FireCCI.

13. Figure 2: Please add the time period in the figure 2 caption.

14. Line 199: It's interesting to see how land use affects the fire trend. It'd be better to add one figure and some discussion about the BA, BF, BC, and FRP trends in different land use type regions.

15. Line 254: According to Sofiev et al. (2012), plume injection height is related to FRP. It'd be better to show the scatter plot of FRP and APT.

    Sofiev, M., Ermakova, T., & Vankevich, R.: Evaluation of the smoke-injection height from wild-land fires using remote-sensing data. Atmospheric Chemistry and Physics, 12(4), 1995–2006. https://doi.org/10.5194/acp-12-1995-2012, 2012.

16. Line 264: The relative changes of FRP of NAU is not the highest. NCA, SI, and WUS is higher than NAU.

17. Line 274-303: This paragraph is very long. Consider separating it into two paragraphs.

18. Figure 5: Can you explain why there is no data for SI in the Jan and Feb (2003-2011)?

19. Line 295: The increase in SI is only after May. There is a decrease from Jan-April.

20. Figure 6: Please provide the time period in the caption.

21. Line 388: why use 2001-2009 instead of 20 years (2001-2019)?