

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-195

Anonymous Referee #2

Referee comment on "AttentionFire_v1.0: interpretable machine learning fire model for burned-area predictions over tropics" by Fa Li et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-195-RC2>, 2022

Li et al. presents in this work an attention-augmented LSTM machine learning model framework used to predict burned area over tropics. Attention-augmented models aim to provide interpretability to LSTM models and improve driver selection by adaptively assigning weights to inputs. The authors use this capability to explicitly capture controlling factors of fire predictions with various time-lags (e.g., climate wetness).

I would also like to appreciate the authors' preparation of the source code to include data preparation scripts and a brief tutorial python script to get users started with the model with examples.

The manuscript is generally well written and the AttentionFire model could be useful for burned area predictions. However, there are some sections which need substantial revisions for clarity and for more details. I will be happy to further consider this manuscript for publication after my concerns are addressed.

Major comments:

1. The authors compare against other models (in Section 2.2), i.e., RF, DT, GBDT, ANN, and naïve LSTM. While Table S1 discusses the hyperparameter configuration of these models, it would be more helpful for model users to read here about the specific strengths and shortcomings of the models chosen – e.g., have these been used for burned area predictions before? Why were these particular models chosen for comparison? Not all models here lack interpretability (DT, RF, ...), do they give the same important features as AttentionFire (shown in Fig. 3)? How much more computational cost (memory/data, training time) is incurred with training this more complex, attention-augmented LSTM model, compared to others?

Overall, the comparison needs to have more context (for readers who are interested in fire

models but not necessarily well-versed in machine learning), and more detail (justifying that the model presented is better and its potential shortcomings). A table similar to Table S1 with a summary of all the models would be helpful in the main text.

2. Section 3.3 regarding oceanic dynamics introduces four oceanic indexes into the model, but they are not defined (except in the legend of Fig. 5) nor introduced. There needs to be more context in this set of experiments: what are these oceanic indexes, why are they important or potentially affecting burned area, how much weight was assigned to these OIs by the model – how much relative importance are they compared to the other predictors, and source of data.

3. Section 3.4 mentions “considering land use changes, population growth, and projected climate under the SSP585”. Is AttentionFire using outputs from a fully coupled CESM simulation? More details about the simulation setup (compsets, any customization to the namelists, input data, etc.) need to be provided (supplement). I understand that the choice for 2016-2055 was due to the model being trained under the historically available data; but I would also suggest testing the AttentionFire model under a different SSP for more complete projections. As it stands section 3.4 heavily leans on the SSP585 CESM model output data for predictions, and the prediction results must be presented carefully, especially when some results are not statistically significant.

4. Finally, the manuscript focuses on predicting ASA wildfires using AttentionFire. Can the AttentionFire model be readily applied for interpretable burned area predictions to other regions with wildfires as well?

Specific comments and technical corrections:

1. Line 110: define LSTM acronym here as its used directly in below text.

2. Line 206: “T62 resolution: 94x192”. I suggest noting the approximate resolution (at equator) here, ~210km, for the spectral resolution.

3. Fig. 2: Are these observations from GFED? It is briefly mentioned in the introduction, but I suggest indicating such within the section 3.1.

4. Fig. 3: Please label the three regions in the figure.

5. Section 3.3: Please avoid defining acronyms in the figure 5 legend, bring them into the main text of section 3.3.

6. Line 426: “will dampened” -> “will be dampened”