Atmospheric
Chemistry
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Discussions

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comment

Interactive comment on "Characterization of the radiative impact of aerosols on CO_2 and energy fluxes in the Amazon deforestation arch using Artificial Neural Networks" *by* Renato Kerches Braghiere et al.

Anonymous Referee #3

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Summary

This paper presents the evaluation of the relation of aerosol optical depth and surface fluxes of mass and energy on three study sites using Artificial Neural Networks and radiative transfer modeling. The impact of atmospheric aerosols on the carbon balance over three sites in South America were investigated, in the deforestation arch of the Amazon forest, making use of a novel approach, combining two different types of modeling techniques.

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Discussion paper

Response overview

The paper was written well and the field and the problems are interesting. The paper seems novel, by utilising a machine learning approach in this field, but first question, is it the only artificial neural networks (ANNs) or machine learning model available there? I haven't found any discussion or references about this in the manuscript.

The title contains artificial neural networks (ANNs), they need to be defined briefly in the introduction because some ACP readers may not be familiar with this type of model.

In line 14-15 (page 4), it stated; "make use of Artificial Neural Networks (ANNs) to build a new modeling framework from scratch relating a number of state variables", what does it mean by "from scratch" in this context?

There are many other statistics and machine learning methods, the authors must mention clearly and briefly why ANNs were chosen with the pro and cons.

After section 3 Models, please explain briefly what do you want to discuss in the section. Why there are two subsections etc. Perhaps you want to state that there are two types of models used here that are radiative transfer model and ANNs that are physics based and statistical based models.

Since there are two subsections in section 3, Section 3.1 subtitle can be "radiative transfer model." libRadtran is just the name of one of the model.

Lines 22-23 (page 9), state and cite, where it said that: "Traditionally, simulation systems, whether physical or statistical, have great difficulty in reproducing complex responses of natural events." Why are they difficult to reproducing complex responses of natural events? Also in fact ANNs can also be considered as a statistical method, as they learn from data too to construct a model.

Lines 21-30 (page 9), there is a brief explanation about ANNs, then the explanation is continued in the page 10 (lines 1-10). Express the formulation of MLP and RBF

mathematically (even briefly is okay), so the readers get insight about these ANN types without checking other articles or sources and understand the key differences between these two. Also state why you chose them since there are still many other classes in ANNs themselves.

Although, this is not main topic in this paper, but the authors need to state why 70

ANNs usage can also be tricky, in addition to the types of ANN (i.e. the structure), there are many other tuned variables and methods need to be selected, including optimisation method, number of hidden layers, activation functions types, number of neurons in each layer, etc. How did the authors optimise these selection?

Lines 1-13 (page 11), MAE and RMSE are good metrics for modelling. Although Pearson correlation coefficients (PCC) can be used for an additional performance metric, but for modelling, coefficient of determination is typically used, symbolised by R^2. It can be obtained simply by taking power two of PCC.

The ANN mathematical expresssions asked to be included in the paper, must match the metrics used here (equations 2-4). For example, line 4 (page 11), explain clearly calculated values and observed values? They are not clear and seem to be picked from a book or somewhere, I mean the definitions are right, but connect them to the models used, etc.

The results of Figure 3 are very good, but it seems too redundant, the subFigures are also not clear because the fonts are too small. Is there any way to compress the Figure results? for instance by making a box plot of these days and compare the real observation and the ANN outputs.

You mentioned some future works in the conclusion, can you elaborate the weaknesses of your method and connect them to your future works please.