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Interactive comment on "The biomass burning aerosol influence on precipitation over the Central Amazon: an observational study" *by* W. A. Gonçalves et al.

Anonymous Referee #1

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In this work the authors used combination of S-band radar, BC ground measurements and radiosonde data to improve the understanding of the effects of biomass burning aerosol on precipitation over the Amazon basin. They used radiosonde data in order to estimate CAPE values and separate the atmospheric conditions according to the stability. Their results show a redaction in rain as a result of increase in BC concentration during the wet season both in unstable and stable conditions. During the dry season, under stable conditions, addition of BC results in lower rain fraction while under unstable conditions addition of BC results in higher rain fraction. The decrease in rain fraction under stable conditions was explained by warm rain suppuration by aerosols (it

was claimed that under those conditions it is unlikely that cold rain will be developed). The increase in rain fraction under unstable conditions was explained by the invigoration mechanism. During the dry season they show an increase in the rain cell size with increase in the BC concentration only for large rain cells. For small rain cells and during the wet season no effect was found. The positive connection that was observed between the BC concentrations and the rain cell size only in large cells was explained by the inverse relation between the cell size and the entrainment strength.

In general I think that the issue addressed in this article is of a high interest. The combination of different observational tools done here can provide a new pespective on the link between biomass burning aerosol ad precipitation. The examination of the effect of aerosol on precipitation under different stability conditions gives insight on the possible physical effects involves.

I have two basic problems with the analysis that might be critical to the presented results and the interpretation:

1) the effect of earosol absorption should be considered seriously as an important player. They briefly mention references considering the aerosol absorption effct in the data analysis part and never discuss it more. Aerosol absorption was shown in many studies to play an important role during the dry season. It can explain many of the results by simply suggest that when the conditions are more stable and cloud fraction is relatively low, the interaction of the smoke with EM radiation is larger and herefore warming by absorption can further stabilize the atmosphere. They can find many references for such process. The fact that there is a competiton between microphysical and radiative effects is very important in the amazon. It'll change the papers interpretation.

2) The aoutors use the Manaus sounding measurments as a key part of the data. Therefore all results are gathered within +/- 2hrs around the measurments. This is a magor problem of the analysis in my opinion. Manaus is 4 hrs after GMT. It means that all measurments are around 8am or 8pm. These times are probably the worst to study

convection in the Amazon. I suspect that whatever is studied here might be the tail of the distribution. The Amazonian convection develops slowly from the morning and peaks in the afternoon. After the afternoon strong rain the whole atmosphere is getting more stable.

I don't see how the paper can be valid without addressing the two points above. I predict that the aouthors will find that the atmophere is much more unstable and that radiation plays a critical role if they will study convection on the right times.

More General remarks

3) In this article the statistic is based on observations of one El NINO year. Although it is based on a large number of rain observations the conclusions made about the difference between the wet and dry season are weak. In EL-NINO year we expect the rain characteristics in that arae to be significantly different than the average. This again suggest that the study is on a very spcific subset of the whole data.

4) The introduction is sparse. The authors do not use the known terminology for the earosol effects and cite the wrong papers for the discussed effects. This is true for the entire paper. Parts that should be in the introduction apear in other places in a partial form. The paper should be reedtited.

Specific comments:

* Abstract – there are many good reasons for understanding aerosol cloud interactions not only deforastation fires.

* Specify better the months of the wet and dry season troughout the paper. I think that the use of the word "semester" here is strage.

* P 5 L 20-26: I didn't understand why the explanation of the Z-R relation is important? The results afterwards are only based on Z and not R.

* P 8 L 1: It is not clear what the described process is in this case. It could sound like

the intensity of the rain increase due to the decrease in the RF. If so, why is it true?