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Interactive comment on "Characterising Brazilian biomass burning emissions using WRF-Chem with MOSAIC sectional aerosol" *by* S. Archer-Nicholls et al.

Anonymous Referee #5

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Archer-Nicholls et al. present a well-structured and complete study of a joint regional modelling-field observation campaign above Amazonia. They try to reproduce the evolution of the aerosol particles emitted by biomass burning during the 2012 fire season by modelling with WRF-Chem, and evaluate the model results by comparison with observations from ground/airborne/satellite measurements in the framework of the SAMBBA campaign. Overall, this work is thorough and well presented. I would recommand publication on ACP after a few minor comments.

As most of the comments have already been stated by previous referees, I only have a few remarks/questions with a special focus on the aerosol modelling methods and results.

1/ My main concern is the fact that the authors seem to state that the MOZAIC module is the only way in WRF-Chem able to reproduce complex processes (P6068L20-23:"Of these, only MOSAIC (Zaveri et al., 2008) uses the more rigorous sectional representation of aerosol size distribution, enabling detailed aerosol interactions with radiation and clouds (Chapman et al., 2009)."). While I don't question the ablity of MOZAIC to have good performance, I believe the authors should put some perspectives on their choice in regard on other available aerosol modules present in WRF-Chem. Moreover, I think it would be very helpful if the authors could justify the reason why they use a sectional model and not a lognormal model to represent the aerosol dynamics.

2/ P6069L27-30: The authors enumerate the different mixing rules present in WRF-Chem to compute the aerosol optical properties. They also rule out the volume-averaging rule. However in the rest of the manuscript they only consider the Maxwell-Garnett mixing rule, except in the conclusions where they say the shell-core rule should be tested. For more constitency, i think it would be better to state from the beginning that you chose the Maxwell-Garnett mixing rule (and justify it), or to test the results of the 2 other mixing rules and show some results (as it is only an easy chosable option in WRF-chem).

3/ While I understand it is a very complex aspect, it would be very interseting to have a more detailed information about the aerosol composition, especially with the large set of accurate instruments presented by the authors. For example, I think it would be a great challenge to present more detailed results of the cToF-AMS as the secondary organic component and the secondary inorganic ions, and compare them with the model results. It is so helpful and rare to have such a various set of equipment at disposal that the potential of a more detailed analysis based on in-situ measurements and not only satellite observations as it is usually the case should be at least mentionned for further studies.

4/ Finally, again it would have been great to present time series of comparisons of aerosol modelled (composition and concentration) and observed along the flight path.

GMDD

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Indeed, while most studies rely on AOD data and often have to boost their aerosol emission to match the AOD observations, you have the opportunity to bring new perspectives on aerosol emissions from fires by having a complete set of in situ observational data. A comparison between aerosol concentration/composition observed and modelled with the original and modified emissions would have been very helpful for the community .

Interactive comment on Geosci. Model Dev. Discuss., 7, 6061, 2014.