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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol and precipitation chemistry in a remote site in Central Amazonia: the role of biogenic contribution" *by* T. Pauliquevis et al.

Anonymous Referee #1

Received and published: 9 August 2007

Review for 'Long-term aerosol and precipitation chemistry', Pauliquevis et al.

Summary:

The authors present a the results of a two years of measurements of aerosols and precipitation in the Central Amazon. Aerosols filters (fine and coarse mode) were analyzed for mass, BC and elemental composition. Rainwater was analysed for pH and ionic composition and compared to trends in aerosol composition. Using multivariant analysis, the authors show clear seasonal differences between the wet and dry seasons. During the wet season, coarse mode aerosol ($2.5 < dp < 10$ um diameter) dominates the mass, and biogenic material is the major source for both fine and coarse

modes. There is a small biomass burning component in the fine mode from fires at the edge of the wet season. Soil dust and chlorine make up a small fraction of the fine and course modes, repectively. During the dry season, biomass burning aerosol is a major contributor to fine aerosol mass; fine and coarse modes contribute almost equally to the total aerosol mass. Rainwater chemistry consisted primarily of biogenic emissions identified by weak organic acids. The authors could not discern the presence of biomass burning emissions in rainwater chemistry.

General comments:

The authors present an important long-term dataset of aerosols and rainwater chemistry to enhance our understanding of the region's climatology. In general, the paper is well-written and clearly presents the data; however, the analysis in several sections lack sufficient discussion. The manuscript deserves publication in ACP after addressing several comments outlined below.

1. The authors emphasize in the paper that pristine conditions are still observable as a broad, general statement, yet it's clear that biomass burning (which is primarily anthropogenic) has an influence in both seasons. Thus, I encourage the authors to state the conditions when pristine conditions are observed (i.e., during the wet season when wet deposition removes the input of anthropogenic sources before their transport to Central Amazonia).

2. In the analysis and presentation of the data, the authors define seasons in 6-month averages (wet, Jan-Jun; dry, July-Dec), which are biased by the transition periods. Instead of taking averages for a 6-month period, I suggest reporting 1-month average minimum (wet-season) and maximum (dry-season) values to better separate the signature of both seasons.

3. The analysis and discussion of the rainwater section seemed weak. It is known that biomass burning aerosols can serve as CCN (Roberts, 2002; Andreae, 2004; Rissler, 2006), and previous studies in the Amazon (Forti, 2000; Schkolnik, 2005; Allen,

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2004) have shown the presence of biomass burning in rainwater. The authors neither cited this work nor clearly defined the signatures that identify biomass burning in their manuscript.

4. The authors often use relative terms (i.e., 'very low' or 'high') without a comparison. Report the value from this study (with uncertainties) and compare it to another location (i.e., Amapa) to convey the message. There are many such cases in the text.

Minor comments:

for future papers, use page numbers and/or line numbers to help the reviewer idenify specific locations in the text.

citations with two authors use 'e' instead of 'and'

Abstract:

'Soil dust was responsible _for_ a minor...'

'_Wet_ deposition rates...'

'The results _shown_ here...'

Introduction:

'Minor but important...' replace 'very low concentrations' with quantitative values. Do the same for the rest of the text where appropriate.

Study area:

notation for Units are not consistent throughout the text, use ng m-3.

4.1. Aerosol measurements:

'The observed _yearly average_ aerosol mass....'

Figure 2 shows at least a factor of two increase in PM10 (sum of fine and coarse), which is not a 'slight' increase. I think the authors refer to coarse mode here. The

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first two sentences in the paragraph 'Considering the pristine character...far from the sampling site.' do not contribute to the discussion and can be removed.

Section 4.1.1. discuss possible source for a biogenic chlorine component. This is critical as the analysis later in the manuscript supports the conclusions that the chlorine has a maritime origin.

The authors state that there is 'no influence of biomass burning' in the coarse mode. Yet, in Figure 3, there is a clear cycle to the BC coarse mode that follows the same seasonal trends as the BC fine mode. This needs to be acknowledged and the paragraph 'some important features' needs to be removed.

What do the authors mean by 'statistically compatible'?

Is the decrease in the absolute biogenic component related to the methodology or degradation of the filter samples?

replace 'totally unexpected' with 'unexpected'

4.2.1. 'as one can see by the high concentration of NH4 and Ca _in the Sahelian Savanna site_ in comparison...'

'predomincance of formic over acetic acid, _F:A ratio_ ....'; define variable

The analysis on the F:A ratios in Balbina merits a brief discussion of the sources and sinks of formic and acetic acid for a possible explaination for the smaller F:A ratio compared to other locations.

remove the lines following, 'The altitude difference between Manaus and its estuary....'

4.2.2. In the analysis on rainwater chemistry the authors do not find any evidence for biomass burning, yet it has been shown that biomass burning aerosols act as CCN. A brief discussion is needed here.

The signatures for biomass burning signals in the rainwater are not stated what the

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authors were looking for and references to previous work in the Amazon need to be mentioned.

add the hyphens in Table 2 to be consistent with Table 3

Can Na be included in the principle component analysis to better identify a marine component?

Figure 2: Show 6 month or yearly ticks on the x-axis to make the figure easier to read.

Figure 3: The second and subsequent sentences of the caption are analysis and should be place in the text. While BC trends of the coarse mode are not as strong as the fine mode, there is still a clear visible trend that follows that of the fine mode. The filter units do not have a sharp efficiency curve at 2.5 um diameter (John, 1983).

Figures 6 and 7: Use same colors for each component to help reader.

Figure 8: The labels on the y-axis are not readable. It is impossible to distinguish wet and dry-seasons in any of the figures. Use a color scheme for better readability.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 11465, 2007.