

**Anonymous Referee #4**

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For clarity and easy visual distinction, the referee comments are copied here in black and the authors' responses are offset in blue below each referee statement. Page and line numbers refer to online ACPD version.

**General comments**

This manuscript by J. A. Huffman et al. provides an overview over some measurements and findings during the BEACHON-ROMBAS campaign. Time series of fluorescent biological aerosol particle (FBAP) concentrations, ice nuclei (IN) concentrations measured by different methods, and precipitation are shown. The main finding is a strong increase of FBAP and IN after precipitation. It is further more demonstrated that the IN in wet conditions mainly consist of biological particles. Two previously unknown species of ice nucleation active fungi are identified.

As this paper has already received a number of comments, I will keep my review short. I find this article very interesting and certainly worth being published in ACP. However, in my opinion the current format does not match this journal. The paper is unnecessarily short, and the description of the methods and the discussion of the results should be expanded. All the figures and tables which are currently in the supplement should be moved to the main text.

We thank the referee for his/her constructive comments. Based on the referee's comment we have moved most of the materials and methods section from the SOM into the main text. Additionally, parts of this section have been expanded in response to specific comments by the other referees. Approximately 200 lines of text, in addition to both figures, were moved from the SOM to the main text in response to this comment.

Some of the results presented here have already been reported in the recent GRL paper by Prenni et al. (doi:10.1029/2012GL053953), so the authors should carefully distinguish and explain what is shown here in addition to or with a different focus than in the other paper.

Indeed, Prenni et al. (2013) discussed the impact of rain on IN during the same BEACHON study. However, the work presented here greatly expands on the observations presented by Prenni et al. with respect to the PBAP measurements and size-resolved IN. As such we are confident that our manuscript contributes uniquely in combination with the observations presented by Prenni et al.

My main question about the findings presented here is the following: Why has this increase after precipitation not been observed in previous publications (some by the same authors) on FBAP time series? Could it be that this effect is something specific to this ecosystem? If this could be the case, then the last paragraph of the conclusions should be reformulated to much less general and more careful statements.

The lack of previous observations of similar FBAP increases with precipitation is indeed curious. At least one publication (Huffman et al., 2012) specifically mentioned that no relationship between FBAP concentration and precipitation was observed. One aspect of the answer is simply that we did not directly look for this effect previously, but while re-analyzing some previous data this trend was observable (Schumacher et al., 2013). Within the context of the study presented here we cannot go into the possible scope of this effect in terms of what types of locations or ecosystems this effect

might be predicted. The work will motivate other experiments and observations in the future, however.

#### Detailed comments

- Abstract: In my opinion, the abstract should contain more quantitative information. I find the word “dramatic” inappropriate for a scientific paper.

To address the referee’s comment we have replaced the word “dramatically” with “significantly” in the abstract.

- What does BEACHON-ROMBAS stand for?

The acronym stands for: Bio-hydro-atmosphere interactions of Energy, Aerosols, Carbon, H<sub>2</sub>O, Organics, and Nitrogen – Rocky Mountain Biogenic Aerosol Study. This information was moved from the SOM to the second paragraph of the introduction to address the referee’s comment.

- SOM should be spelled out.

In reviewing the ACPD version of the paper we realize that the editorial staff changed several instances of “SOM” to “Supplement” and thus removed the first instance where we define the acronym. We will carefully check this issue before final publication, thanks to the referee’s observation.

- Fig. 1: Why is the precipitation data discontinuous? Is it only shown when above a certain threshold?

The rain data are shown for non-zero values. This point has been clarified in the figure caption.

- Fig. 2: Please add the temperature at which IN were measured into the axis labels.

Temperatures at which IN were measured are now listed on appropriate axes of Figure 2.

- Fig. 5: I agree with one of the other referees that this figure does not contain much useful information. It could be improved by adding more details, e.g. the suggested emission mechanism and the nucleation/impaction scavenging.

Figure 5 has been moved to the Supplement (now Fig. S1) in response to the referee’s suggestion.

#### **References:**

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