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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of interannual variations in aerosol particle sources on orographic precipitation over California's Central Sierra Nevada" *by* J. M. Creamean et al.

Anonymous Referee #2

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Recommendation: I recommend the publication of "Impact of interannual variations in aerosol particle sources on orographic precipitation over California's Central Sierra Nevada" with some moderate revisions.

Comments: "Impact of interannual variations in aerosol particle sources on orographic precipitation over California's Central Sierra Nevada" used extensive data to analyze possible influences of different sources of insoluble aerosol on orographic precipitation. It is very impressive that the aerosolized particles from precipitation samples can provide clues to the category and amount of precipitation over mountain area even though more field and lab studies would be required to better support the hypothesis. The

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manuscript tried to incorporate the impact of aerosol sources on orographic precipitation by both serving as ice nuclei and cloud condensation nuclei. The study employed a wide array of techniques to delve into the hypothesis, such as ATOFMS and S-PROF. The study contains multiyear data to support the proposition of the manuscript.

However, there are still some questions to be answered for the paper to be publishable: 1. The study is only about the impact of insoluble particles on precipitation, by serving as either CCN or IN, or both. Nevertheless, the title of the manuscript doesn't specify that. The title looks like a comprehensive discussion of all aerosol sources. But the soluble aerosol species is not the purpose of this study and would be a totally different story. It won't undermine the significance of the study by specifying that. Similarly, all the discussions about the aerosol sources need to be defined more accurately as insoluble aerosol sources since the soluble part is not measured and discussed in this manuscript. 2. Random coincidence could play a large role in correlation when the sample size is small. The reliability of aerosolization method needs to be better supported. The authors admitted the composition change during the aerosolization process. Then the authors will need to prove that the change is minor or the change has a small effect on the way aerosol influences cloud seeding. 3. The pronounced effect of insoluble particles on precipitation over California's Central Sierra Nevada area, presuming the significance is supported by this study and other related studies, could also be important for some other regions. The paper could simply discuss the global significance of insoluble particles in terms of precipitation and the climate.

Detailed suggestions: 1. In the abstract, there is one sentence: "The correlation between the source of aerosols within clouds and precipitation type and quantity will be further probed in models to understand the mechanisms by which local emissions vs. long-range transported dust and biological aerosols play roles in impacting regional precipitation processes". The model study is described neither in this manuscript nor in a companion paper of this manuscript. It might be an integral part of the funded project. But this sentence doesn't seem to belong to this paper, especially not the

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abstract.

2. The first paragraph of the introduction part tries to discuss the impact of CCN and IN on precipitation comprehensively. Again this paper discusses about the insoluble fraction of aerosol. It needs to be emphasized in the introduction as well.

3. The last paragraph of the introduction tried to outline the purpose of the manuscript, but the order of the two goals seems to be reversible. It makes better sense to me to first identify the temporal variation of sources and then find the linkage between source variation and precipitation.

4. In the second paragraph of the discussion part, there is one statement: "A modeling study of aircraft measurements from 2011 presented by Martin et al. (2014) show the presence of organic carbon residues at lower cloud levels during prefrontal storm conditions in the Sierra Nevada". It would be a poor citation to support the presence of a chemical species using a model study, especially in a paper discussed about measurement results. It would be great to infer the significance of a measurement study by a model study though.

5. Conclusion part could be more concise and better organized. The last paragraph seems like a future study plan for a bigger project, not an indispensible part of this paper. The whole paragraph could be replaced by one sentence indicating the significance of this study in future modeling studies. The detailed discussion of how the result could be used in model studies seems to belong to the discussion session rather than the conclusion session.

6. Please check grammar inaccuracies in the manuscript. There are a few.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 931, 2015.