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Interactive comment on “LOAC: a small aerosol optical counter/sizer for ground-based and balloon measurements of the size distribution and nature of atmospheric particles – Part 1: Principle of measurements and instrument evaluation” by J.-B. Renard et al.

T. J. Roberts

TjardaRoberts@gmail.com

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In “LOAC: a small aerosol optical counter/sizer for ground-based and balloon measurements of the size distribution and nature of atmospheric particles – Part 1: Principle of measurements and instrument evaluation” Renard et al. present a new optical particle/sizer counter called LOAC (Light Optical Aerosol Counter) which uses light scattering at small angle (12 degrees) to quantify the aerosol number and size distribution

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across 19 size-bins for a size range from 0.2 to several tens of micrometers particle diameter. The instrument also provides insights into particle nature by comparing the small angle signal to that obtained at a larger angle.

To validate the instrument, Renard et al. show some examples of agreement between LOAC and other aerosol instruments co-deployed in a number of field campaigns. However, the data also show cases of disagreement, as commented on by Reviewer #1, who asks for further evaluation of the global instrument uncertainty for measurements under real atmospheric conditions.

In collaboration with the LOAC developers, I have undertaken a field campaign to deploy the LOAC in a volcano plume. My comment here discusses performance of the LOAC instrument to measure volcanic aerosol number and size-distributions, expands on my insights already communicated by internal mini-reports.

As a summary, my detailed data analysis of the field observations provides evidence of LOAC success to measure volcanic aerosol (which is in itself a real challenge), but also shows signs of non-linearities in the volcanic plume environment. I propose these are most easily attributed to measurement errors and biases rather than plume aerosol processes. I propose that these biases may result from measurement complications due to detection of scattering signals from multiple particles at the same time. Through sampling of both concentrated and more dilute plume conditions, and in-situ co-measurement of SO₂ as a plume tracer, as well as preliminary instrument modelling, I believe this study can provide a valuable basis for a systematic assessment of measurement uncertainties and biases under volcanic plume conditions.

Importantly, I believe the insights gained from this volcanic aerosol study can also be highly valuable for understanding LOAC observations in other high aerosol environments specifically where there are many larger particles, and addressing some of the key questions posed by Reviewer 1.

I upload this comment in order to contribute my provisional research findings to the

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discussion of Renard et al., although I am still in the process of fully interpreting and modelling the data, towards finalising the study for future peer-review. I gratefully acknowledge the LOAC developers and INGV Italian volcano observatory scientists for their contributions in providing the instrument and undertaking the volcanic field-work alongside me, but emphasize that the analysis and interpretation of the results presented in this comment is my own.

Please see the uploaded comments and figures given as a Supplement pdf.

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/8/C4046/2015/amtd-8-C4046-2015-supplement.pdf>

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