

A review on: "Microphysical, macrophysical and radiative signatures of volcanic aerosols in trade wind cumulus observed by the A-Train"

By Yuan, Remer and Yu

This paper deals nicely with one of the most critical problems of cloud-aerosol analysis, namely the separation between the true aerosol effects and coincidental correlations driven by meteorology.

When showing correlations between aerosols and clouds properties one has to separate associations from cause-and-effect. Theoretically, associations between aerosols to clouds can be driven by meteorological states that favor clouds and aerosols with particular properties with no real interaction-driven-effects.

Here, by analyzing clouds inside and out of the volcanic aerosol plume the authors solved much of the decoupling issue. It is fair to say that away from the island the meteorological conditions are expected to be similar. Moreover, the authors make sure that the wake effect is not included in the results.

I think that this paper should be published and have few minor comments:

- 1) I think that the EOF analysis reduces the clarity of the paper. Without it the paper is clear and the analysis is straightforward. The EOF uses linear mixture of variables (similar to PCA) that does not necessary make a physical sense. I think that the arguments are quite convincing without it.
- 2) I miss discussion on invigoration. The authors show here clear invigoration of warm clouds. The polluted clouds are taller and thicker. This was shown in Koren et al, (2005) as the warm part of all convective clouds and since then there is a debate if warm clouds are invigorated or actually shrinks due to enhanced evaporation. I see it as a key result of the paper analysis and think it should be discussed and even highlighted. (see for enhanced evaporation: Small, J. D., P. Y. Chuang, G. Feingold, and H. Jiang (2009), Can aerosol decrease cloud lifetime?, *Geophys. Res. Lett.*, 36, L16806, doi:10.1029/2009GL038888).
- 3) Why Aerosol Index (AI)? Andreae (2009) showed that AOD is a good measure to CCN and for low levels of AOD fine fraction measurements are significantly less accurate. (Ref: Correlation between cloud condensation nuclei concentration and aerosol optical thickness in remote and polluted regions. *Atmospheric Chemistry and Physics* 9, 543-556 (2009)).