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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Lidar ratios of stratospheric volcanic ash and sulfate aerosols retrieved from CALIOP measurements" *by* Andrew T. Prata et al.

Anonymous Referee #4

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Review of "Lidar ratios of stratospheric volcanic ash and sulfate aerosols retrieved from CALIOP measurements" by Prata et al. (2017).

Volcanic aerosol optical depth from satellites are used in numerical simulations, including those presented in the Intergovernmental Panel on Climate Change reports, to assess the impact of volcanic eruptions in climate and separate natural and anthropogenic climate forcing factors. In order to derive this quantity, native backscatter measurements from CALIOP need to be converted into an extinction coefficient using a lidar ratio. The volcanic layer detection approach of this paper is based upon the combined use of AIRS and CALIOP, providing complementary information on volcanic clouds. They calculated statistical parameters associated with the optical properties

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(lidar ratio, volume depolarization and attenuated color ratio) of three volcanic plumes (Sarychev, Kasatochi and Cordon) based upon the CALIOP level 2 products. They provided a thoughtful assessment of these coefficients associated with a rigorous and clear analysis of the different sources of errors. This is a very well written paper on which I don't have major comments. Thus, I strongly recommend it for publication in ACP.

I have two minor comments:

1) I believe that the proposed threshold (fig 9) to separate volcanic clouds into ash-rich and sulfate-rich categories is optimized for those cases. Indeed, Vernier et al. (2015) has shown that the pdf of the particulate depolarization ratio associated with the Kelud plume observations were indeed between those of Cordon and Sarychev/Kasatochi. Thus, the classification of volcanic cloud based upon their optical properties is challenging since those properties evolve with time depending of the presence of ash and sulfate which can also be mixed. Overall, because volcanic plumes are a mixture of two types of aerosol (external and possibly internally mixed) (sulfate and ash) which evolve with time, it makes them difficult to classify them (e.g. Kelud, Tavurvur). 2) How would you propose to use the lidar ratios calculated in this paper for deriving times series of volcanic aerosol optical depth during the months following those eruption when AIRS is not sensitive enough to detect SO2 or Ash in contrast to the CALIOP lidar measurements ? I think it would be interesting to discuss how your results can be used to derive volcanic aerosol time series.

Very nice paper!

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