

Interactive comment on “Variations in the physicochemical and optical properties of natural aerosols in Puerto Rico – Implications for climate” by Héctor Rivera et al.

Anonymous Referee #1

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This manuscript uses a combination of observations to classify aerosol air masses over the Cape San Juan Atmospheric Observatory in Puerto Rico. The authors determine the surface and columnar optical properties of the aerosol associated with each of these air masses and do a rough estimate of how these air masses impact the direct radiative forcing.

The overall science in the paper seems sound. I am supportive of this manuscript's publication in ACP once my concerns below have been addressed.

General issues

- 1) I recommend that the paper be thoroughly proofread for English and general readability.
C1

ability. I found a number of sentences that while not technically incorrect were awkward and that took me a while to fully understand. For example, the second sentence of the abstract, “Hundreds of teragrams and the absorbing properties of aerosols such as African dust and volcanic ash affect radiative balance changing atmospheric temperature and thus, climate.” took me a long time to parse and fully understand. Further, “hundreds of teragrams” of what? I assume aerosol, but what more specifically? In the global atmosphere? In the column above Puerto Rico? Emitted globally each year? Emitted near Puerto Rico each year? Also, I found a bunch of typos throughout.

- 2) I'm confused as to why fine-mode aerosol associated with a volcanic aerosol is being called “ash”. Ash particles are the primary particles associated with volcanoes and they are overwhelmingly coarse mode (e.g. http://www.nature.com/nature/journal/v528/n7583/fig_tab/nature16153_SF1.html?foxtrotcallt but please search beyond this for “volcanic ash size distribution”). Even accounting for settling before Puerto Rico, these particles should be mostly supermicron. I would guess that most of the fine mode associated with the volcanic plume is actually secondary sulfate associated with the volcano, not ash. Hence, I think it would be better to change the definition of “VA” in the paper to Volcanic Aerosol.

- 3) What is the relative frequency of each air mass type, and how much does each air-mass type contribute to the radiative forcing over Puerto Rico when accounting for their frequencies?

Specific comments

Abstract: Instruments, such as AERONET, HYSPLIT, and MODIS (sort of), are capitalized as if spelling out the acronym, but then the acronym is not defined in the abstract, which seems strange.

P2 L10: Is the Caribbean different from other regions of the same latitude as acting as a conduit? Is there a citation for this?

P3 L17: Should specify *direct* climate-forcing properties since CCN properties weren't addressed.

P5 L7: "greater the angstrom exponent, the smaller is the size..." This is not strictly true since the angstrom exp oscillates between small positive and negative numbers in the Mie regime.

P6 L6: What are "SAL" images? This is not defined but the "SAL" acronym is used throughout the paper.

P9 L26: "VA enhanced both the scattering the optical depth twice." What does this mean?

Section 3.3.2. I find it somewhat incorrect to refer to the "sizes of absorbing particles" here. It could be that both fine and coarse mode particles are both absorbing, but rather the particles in one mode may be more absorbing than the other. Hence, it would be better to simply saying "there is more absorption from particles in the coarse/fine mode".

P12 L23: Can you explain why the single-scattering albedo doesn't affect the rad forcing efficiency? Is this simply because there isn't enough variability in the single-scattering albedo?

P14 L15: "greater radiative cooling" at the top of the atmosphere or at the surface?

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