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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Statistical properties of aerosol-cloud-precipitation interactions in South America" *by* T. A. Jones and S. A. Christopher

T. A. Jones and S. A. Christopher

tjones@nsstc.uah.edu

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Response 3:

General Comments: We thank the reviewer for their comments and have made modified the manuscript accordingly to address the concerns brought forth. Most significantly, the PCA section has been beefed up with equations and additional discussion of methods and inherent uncertainties. Other changes include the addition of correlation statistics in the results section as well as some clarification of the physical interpretation of individual PC variables. In order to improve the focus of this manuscript, discussion of higher order PC variables was considerably shortened. Much of the results section was revised to improve clarity, though the level of changes may not reach the "nearly complete revision" threshold suggested by the reviewer since the introductory

sections were not substantially modified from previous versions except where specific comments needed to be addressed.

Major Issues:

Correlations: A new table (Table 2) has been added to show the correlation coefficients between AOT and selected cloud properties. Additional discussion of these values has been added throughout the text. We agree that showing these values is important to the overall conclusions of this work.

Physical interpretations and PCA: The discussion of the physical interpretations of various PC variables has been improved. Furthermore, only PC1-6 are now discussed in detail since the remainder of the PC variables account for only a small portion of the total variance. In tables 1, 3 (now 4), we are not sure what you mean by "supposed to be two values per variable" Each value represents a mean statistic with the $\pm$ value representing the standard deviation. Units are now included with Table 1. Prior to the calculation of the PC variables, the raw data are normalized by subtracting out their mean values. Thus, the resulting weights ranged between $\pm$1.0 and produced PC score values generally between $\pm$4.0. For higher order PC variables, the magnitudes of both the individual weights and the scores decrease. To determine the physical interpretation of individual PC variables, the primary focus lies on the relative sign of certain weights (i.e. cloud properties) to other weights (i.e. aerosol properties) within the same variable. For the most part, we base the physical interpretation what the change in the PC value would be given certain changes in raw parameters. With respect to wind velocities, we added some clarification to the discussion based on your comment. Instead of a "westerly wind" weighting, we now say something along the lines of "the westerly component of the wind". In this example, it is possible that the mean wind vector is from the east, but that an increasing component from the west is a factor in the interpretation of a PC variable.

Uncertainties: The uncertainties inherent in the raw data such as the interrelationships

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between cloud and aerosol properties not associated with AIE are still present within the PC dataset. The thresholds used during the PCA process do aid in the removal of randomly distributed uncertainties associated with individual parameters. It does not remove uncertainties corresponding to interelationships between certain groups of parameters (i.e. aerosol and cloud products). However, these relationships may fall out into higher order PC variables assuming they are not significantly correlated with the more physically significant relationships we hope to find in this research. An example of this occurs in PC9 where the weights assigned to AOT and cloud-thickness parameters (COT, LWP) are of the same sign. Thus, increasing AOT corresponds to thicker cloud cover, which can also mean that AOT increases because of the nearby clouds due to the reasons specified in section 2. We have also included additional discussion of the uncertainties in aerosol retrievals in the vicinity of clouds and how they can affect the interpretation of the results.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 21463, 2009.