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Interactive comment on "Satellite observations of aerosols and clouds over southern China from 2006 to 2015: analysis of changes and possible interaction mechanisms" *by* N. Benas et al.

Anonymous Referee #2

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This paper synthesizes monthly-averaged satellite aerosol data from MODIS and CALIPSO, biomass burning emissions data from GFED, and cloud data from MODIS and CLARA-A2 to examine annual and seasonal trends for the South China region over the past decades. The purported goal of the study is two-fold (as stated on Pg. 2, Lines 9-13): 1) to analyze aerosol and cloud characteristics and changes, and 2) to investigate the possibilities and limitations of the synergistic use of this multitude of data for assessing aerosol and cloud interaction mechanisms. Only three aerosol types are investigated from the CALIPSO dataset: Dust, Smoke, and Polluted Dust. This substantially limits the conclusions that can be drawn with regard to aerosol source attribution; although, the manuscript forges ahead and attributes changes in the decadal

C1

timeseries of aerosol optical depth large to changes in biomass burning, particularly residential energy sources (Pg. 5, Lines 14 and 18). The authors then average the decadal cloud microphysical data by month to look at seasonal trends, and find no clear seasonal trend in aerosol optical depth even as there are pronounced increases in liquid water path, cloud fraction, cloud optical thickness, and effective radius during the November-December time period. From these relationships, they conclude that the observed seasonal trends are inconsistent with the first and second aerosol-cloud indirect effects, but possibly consistent with the semi-direct effect (Section 3.3.2).

Such strong conclusions are not supported by the underlying data, which are themselves highly averaged in both space and time. The highly-averaged nature of the data makes it hard to draw conclusions other than to say that the seasonal trend of one variable appears to correlate with the trend of another variable or that one or more variables trend up/down slightly over time – such apparent correlations are neither causal nor attributive. No statistical tests are presented to quantify the robustness or strength of such correlations. Indeed, I find all of the authors' conclusions regarding the attribution of aerosol sources to biomass burning and their effects on clouds to be highly speculative. To quote the authors (Pg. 9, Lines 19-21): "These results do not constitute evidence of any cause and effect mechanism, which cannot be proved based on observations only. They rather represent a contribution to the observational approaches in aerosol-cloud-radiation interaction studies, highlighting both the possibilities and limitations of these approaches." From reading this paper, I don't know what approaches are being referred to here. The approach employed seems to have been to take a bunch of Level 3 temporally-averaged and gridded satellite data products, plot them up, and draw strong, unsupported conclusions about aerosol-cloud interactions based on perceived annual or seasonal trends.

In my opinion, this paper does not represent a substantial contribution to scientific progress, which is the minimum criterion for the ACP scientific significance review criteria. As I do not see a path forward by which this manuscript could be revised to be a

significant contribution, I recommend to the editor that this manuscript be rejected.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-982, 2018.

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