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Interactive comment on “Cloud invigoration and suppression by aerosols over the tropical region based on satellite observations” by F. Niu and Z. Li

Anonymous Referee #3

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The authors try to estimate the aerosol effects on warm and mix phase clouds by using aerosol information from MODIS and cloud properties from CloudSat and CALIPSO. They show clear invigoration for mix phase clouds with warm bases and no effect (or opposite in case of rain) for warm clouds. While appreciating the scientific question, I see two major problems in this work: 1) I see no real efforts to separate meteorological from aerosol effects and 2) scale mismatch between the MODIS and CloudSat / CALIPSO data.

1) I see no real effort to reduce the meteorological effects. It is well known that the local thermodynamic conditions play a key role in determine the cloud properties. The authors cluster clouds only by their base and top height (or temperature) mixing many tropical and sub tropical profiles aiming to show that the two meteorological parame-

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ters: lower tropospheric static stability (ltss) and column water vapor can not explain the observed trend. Such statement is far from being enough to make the point that the observed effects are due to aerosols. 2) The analysis is done on one degree grid resolution (MODIS level 3) by scaling the CloudSat and CALIPSO curtains to the grid box. It is not clear why the analysis is done in such way. What portion of the grid-box the CloudSat and CALIPSO cross-sections represents? To the best of my knowledge these instruments have narrow swath that cover very little surface area in the middle of the MODIS (AQUA) larger swath. Why not working with level 2 and comparing aerosol data that is relevant to the CloudSat and CALIPSO footprint? More in this direction: it is not clear what resolution of the ECMWF-AUX they used. Is it for the 1 degree grid box or only along the CloudSat and CALIPSO path?

More comments: 3) The classification between aerosol invigoration and microphysical effects is confusing. Both effects starts from the microphysical (or the droplet evolution) scale and both affect cloud dynamics. Aerosol invigoration is balanced by early warm rain suppression and by enhanced evaporation which is not discussed in this paper and can be important. 4) Why AI? Andreae (2009) suggests that AOD by itself is a good measure. Do the authors see better correlations when using AI? (Andreae, M. O.: Correlation between cloud condensation nuclei concentration and aerosol optical thickness in remote and polluted regions. Atmospheric Chemistry and Physics 9, 543-556 2009).

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