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Interactive comment on "Exploring the First Aerosol Indirect Effect over the Maritime Continent Using a Ten-Year Collocated MODIS, CALIOP, and Model Dataset" *by* Alexa D. Ross et al.

Anonymous Referee #1

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This manuscript combined satellite observations and model reanalysis data (NAAPS) to study the relationship between aerosol and cloud effective radius (re) over Southeast Asia. They used both MODIS, CALIPSO, and model results to present the collocated dataset for analysis of aerosol-cloud relationship, which is critical for this kind of scientific topic. However, there have some fundamental issues need to be addresses carefully. First, they used aerosol information from the model simulations, since MODIS retrieval only provides few retrievals in moderate and high cloudy environment, and CALIPSO is unable to see aerosol below a cloud layer under some conditions, as the authors stated. The model can indeed provide much more aerosol information, including spatial-temporal distribution, size distribution, chemical component, etc., but the

method to collocate aerosol from model and cloud from satellite retrieval are unclear, especially the model results are 6 hourly products, and how to collocate with the time of satellite overpass? the model spatial resolution is much lower than satellite retrieval, how to collocate them in spatial? This need to be clarify. Second, it is unclear that how accurate is the modeled aerosol compared to the satellite retrieval. The authors gave the statistical analysis of the AOD differences between the model and satellite, as well as the vertical profile, but what about the spatial distribution of the model results in comparison to satellite retrievals? Also, only the relationship between aerosol and cloud effective radius is studied, and definition of first aerosol indirect effect (FIRE) on p.15 and use of this definition in the title is inappropriate. The results and conclusions are not quite new. The anti-correlation of aerosol and cloud effective radius over the oceanic regions have been reported extensively.

Specific comments: p.3, bottom line, what aerosol amount? Please clarify.

p.4, line 12-15, the study of Ma et al. (2010) was cited in the text, but not listed in reference.

Section 2.3, p. 6, line 9 15, it is unclear that how to collocate the data, e.g. line 19-10, level 1 or level 2, or both? Also, on the collocation of time. As described in sec. 2.2 (p.5), the model results are 6-hourly product, so how to collocate the model results with the time of satellite overpasses?

p.8, line line 5-9, what is the average of AOD over the region?

Figure. 5, top panel is for above sea level, not surface.

p.12, line 1-2, the definition of aerosol anomaly is difficult to understand. 'when the AOD is greater than an upper threshold, (μAOD $\times$ σAOD). A negative aerosol anomaly, or clean event, is when the AOD is less than a lower threshold, (μAOD Ãů σAOD)', why the polluted and clean condition are defined like this?

Figure. 7: . . .in the lower left", should be lower right.

p.15, top of the page, the definition of FAIE. This definition is only the differences of cloud effective radius between the polluted (clean) conditions and baseline. This is actually not FAIE, so the definition is incorrect and misleading.

p. 17, line 7: aerosol amount, what aerosol properties is used in the analysis, AOD or aerosol number? or something else?

p.17, line 10-11, finding. . ., this is not new.

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