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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The invigoration of deep convective clouds over the Atlantic: aerosol effect, meteorology or retrieval artifact?" *by* I. Koren et al.

Anonymous Referee #2

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I am afraid that I cannot agree with the enthusiasm of the other reviewer. While I think Koren et al are looking at an interesting part of the world, and it is indeed an interesting subject, I find the paper has many major shortcomings which I believe require an entire rework. After doing so I think they will have a stronger paper worthy of citation.

The paper starts strong with a reasonable (if optimistic) survey of satellite-aerosol-cloud findings and methods. However, the paper quickly degenerates into a multi-regression fishing expedition with no meteorological context and even less statistical strength. They examine a mere 2 months of data (July and August 2007) for a ten degree box along the equator (0-10 N; 20-30 W). They do not explain why this area and time period was chosen. It is just south of the typical easterly wave/SAL track, as well as the ITCZ. Looking at TRMM satellite products online, looks like the area of

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precip is very thin and at the very north of this area. Given this is hurricane season, this precip is mostly modulated by easterly waves. How does all of this fit into the meteorological picture?

Based on their area of interest, they can observe periodic dust outbreaks as well as pollution/biofuel/smoke from central Africa. This yields the variability in fine mode fraction observed in Figure 2. But each of their AOD regimes (very clean <0.06, moderate (0.11), and heavy (0.23)) likely has a very specific transport pathway and corresponding meteorological pattern. The authors very quickly say aerosol particles are not associated with other meteorological features associated with cloud development. Well certainly, if one has a background marine airmass, RH will be very high, whereas a SAL intrusion will be dry. Also, area of active precipitation scavenge particle. But they are then dismissive of any other meteorological transport features. Indeed, any discussion of meteorology is very minimal. For each of your regimes, is there a corresponding EOF? How about periods of high AOD and high and low fine mode fraction? Is it smoke coming from central Africa or Saharan dust? What do model soundings look like for these cases?

The next issue I have is on the cloud definitions. How are the authors differentiating cirrus tops associated with high pressure with cirrus on anvil tops from individual storms? For low AOD (clean marine), the normalized histogram shows no high clouds, whereas the moderate to higher AOD do show clouds at 200 mb. How do we know the nature of these clouds? From the paper, I can't tell if they have convective origins. Also, using an "average cloud top pressure" is a very misleading statistic in a three modal system.

Speaking of statistics, the authors here again fail to make a compelling case. It is a limited areas of only a few months and is really a multivariate "pour in data and stir" method. They do not even list how many cases they have in each of their AOD categories. A histogram like figure 3 for AOD would be good. A three dimensional plot of cloud to pressure and regional average AOD would be best and would likely go a long way to explaining what is going on. Without physics and meteorological analyses

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to back studies like this up, the statistical conclusions are at best ambiguous, at worst downright dangerous.

The use of GOCART in this study is a bit odd. Given the narrowness of the impact between middle and high AOD, I am not sure the free running GOCART model can be of that much help. They should prove for this period of time that GOCART is generating adequate analyses that make sense.

Bottom line, is that this is a good idea but quickly and carelessly executed. If real meteorology and statistical rigor were folded in, it would be suitable for publication. This will take some time to put in.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3893, 2010.