Atmos. Chem. Phys. Discuss., 13, C10733–C10735, 2014
www.atmos-chem-phys-discuss.net/13/C10733/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the link between the Amazonian forest properties and shallow cumulus cloud fields" *by* R. H. Heiblum et al.

Anonymous Referee #3

Received and published: 8 January 2014

The paper presents a possible connection between the presence of shallow cumulus clouds and a measure of forest density. However, the paper lacks much discussion of the relevant physics at work, and that leads to some ambiguity in how the argument supporting the observation is presented. As it stands, the paper presents a correlation between two variables with little discussion of why we should expect them to be correlated or any supporting evidence to show that the physical connection is plausible. With some further attention to the actual physics at work relating surface fluxes to cloud formation, the paper may be suitable for publication.

The term "meteorology" is used vaguely throughout this paper, and frankly throughout most aerosol/cloud interactions literature. Presumably "decoupling meteorology from higher-order effects on clouds" (e.g. P.30024, l.12-13) means separating geopotential

height and humidity from higher-order effects (presumably the EVI). But perhaps a more specific description of the analysis presented in fig. 4 and section 3.1 is an understanding of the regional distribution of shallow cumulus based on the regional distribution of humidity and geopotential height, rather than a full "decoupling".

Furthermore, if the higher-order EVI effect is real, then there must be some residual correlation between temperature, relative humidity, and EVI. If increasing EVI influences clouds because it is a proxy for an increase in the latent heat flux, then presumably the difference in heat flux corresponds to a difference in the low-level profiles of temperature and humidity, and that is why there is greater abundance of shallow cumulus. In the manuscript there is much more attention paid to the physics of mesoscale organization of cumulus clouds above the underlying land surface type patterns than there is the basic physics that would explain how increasing EVI should lead to more cumulus clouds. I think more attention to this underlying physics is warranted. Are there relationships between the EVI and the meteorology observations that can be presented that support the causal link between EVI and clouds?

Is the correlation between cumulus clouds and EVI an expression of colocated spatial gradients in the two quantities, or mainly an expression of temporal variability in the two at specific locations? This can be addressed in two ways: (1) the authors could show the spatial pattern of EVI, just as they have done for geopotential height and relative humidity; (2) the authors could subdivide their region into smaller boxes and include more years for statistical robustness as suggested by another reviewer.

Is it possible that there is an artifact whereby the retrieval of EVI may be impacted by variations in AOD? Since the two are purported to impact clouds, this potential should be dismissed.

Regarding the decrease in cumulus cloud frequency with increasing EVI at high EVI values in non-forested cases: Are we to presume that the decrease in cumulus cloud occurrence corresponds to an increase in the frequency of cloud-free conditions? Or

could it be that the cumulus are giving way to deeper clouds that do not match your cumulus criteria?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 30013, 2013.