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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observational analysis of the daily cycle of the planetary boundary layer in the central amazon during a typical year and under the influence of the ENSO (GoAmazon project 2014/5)" *by* Rayonil G. Carneiro and Gilberto Fisch

Anonymous Referee #2

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Observational analysis of the daily cycle of the planetary boundary layer in the central amazon during a typical year and under the influence of the ENSO (GoAmazon project 2014/5)

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This study presents results from an intensive field campaign in Amazon (GO-Amazon project). It focuses on the detection and evolution of the Planetary Boundary Layer height (PBLH) during a non-El Nino (2014), and El Nino (2015) years. To estimate the

PBLH, this work used several remote sensing instrumentations (Vaisala wind profiler - WP, Scintec SODAR, Vaisala Ceilometer, Radiometrics micro-wave radiometer - MWR, and Halo wind-lidar - Lidar), and radiosondes (RS). Surface measurements, such as sensible (H) and latent heat (LE) fluxes from an eddy covariance system (EC), net radiation (Rn), and soil heat flux were also analyzed. This work is within the scope of the journal, since the realization of the importance of the PBLH in atmospheric chemistry. Unfortunately, I believe there are several concerns that the authors must address before publication.

Major Concerns:

1. I wonder what the meaning of a "typical year" is in the title. If ENSO correlates well with Amazon rainfall, then it is not an anomaly. I believe, the authors mean non-El Nino year (instead of typical year), and El Nino year (instead of ENSO).

2. The methods are incomplete:

a. Some instruments do not have the maker and/or model (SODAR, Lidar, EC, solar and terrestrial, soil heat flux).

b. How high are the radiation and flux measurements? What is the landscape of the study area, and what is the landscape composition of the flux and radiation footprint?

c. Is there any data filtering or all data were considered (clear, cloudy/rainy days)? What are the data sample size in figures 3 to 6?

d. Radiosonde PBL estimation, it only shows for the procedure for the convective boundary layer (CBL), what are the criteria for the nocturnal boundary layer (NBL)?

e. For the other remote sensing instrumentation, but SODAR. It seems that only the CBL detection are being shown. Do these methods also apply to the NBL?

f. Also, I believe that PBLH from MWR should be explained in more detail. Is this a novel method or is it based on previous studies? I wonder, because, from my expe-

rience, temperature profiles from the MWR do not show sharp gradients at the top of the CBL. Also, I am not sure how this interpolation works during the transition periods (mornings, and early night).

g. NBL detection from SODAR: The use of the maximum of the wind profile is associated with the lower level jet. Have the authors consistently observed LLJ at the study site? If so, this should be written.

h. Why not use the temperature profile from WP to estimate the NBL?

3. Results, discussion, conclusion: there are some parts that needs some work and/or clarification.

a. There are several comparisons among several parameter (precipitation, H, LE, PBLH) for wet/dry season or El Nino/non-El Nino years. However, averages are presented without any uncertainties, so the authors cannot affirm that those averages are different.

b. I do not understand the PBLH time series for the ceilometer. According to the methods, the PBLH is the cloud base, not the aerosol mixing layer estimated from the aerosol backscatter profile. Thus, are the black lines shown in figures 4 and 6 the cloud base diurnal variation? I do not believe that there will be boundary layer clouds during nighttime at such lower height (maybe fog – but not the cloud base). Also, there is a sharp drop during the afternoon, are the PBL clouds descending?

c. Are the CBL or residual layer (RL) shrinking for all remote sensing PBLHs during the afternoon? I wonder about this because H is still positive till about 16:30-17:00LT.

d. Lines 205-206: The authors claim that there is no ground water at the root level. Is it a shallow root or deep root vegetation? Depending of the type of vegetation, this might not be the reason for lower evapotranspiration.

e. Lines 208-211: Ground water stress are not be the only reason for low evapotranspiration.

f. Lines 223-230: So, how mechanical turbulence will affect the NBL for some instruments, and not for others? I believe a more in-depth analysis should be performed. If there is a presence of LLJ, then more likely there will not be too much turbulent mixing, and the NBL is going to grow due to radiative cooling. Also, usually the local maxima of the LLJ is not co-located with the bottom of the residual layer, so using the level of maxima wind speed will underestimate the NBL. Last, but not least, if there is rain, then most likely the remote sensing instruments do not work properly, and they will be unable to detect any mixing height.

g. The “erosion” of NBL discussion seems confusing and does not make any sense to me. Looking at figures 4 and 6, if the PBL is growing above 250m after 6am, then it means that there is no more a stable layer. If not, then how the PBL is growing? I guess the authors can check that looking at the SODAR RASS data. . .

h. Lines 254-255, 300-302: H by itself does not contributes for the PBLH growth, or the rate of change of temperature.

i. Lines 255-257: Not sure about that a small H will decrease the PBLH. According to the theory, if there is negative flux-divergence, the PBLH will increase. Also, how the entrainment at the top was calculated?

j. Lines 310-312: If one connects the red dots in figures 4,6, he/she can see a diurnal pattern in the RS PBLH time series.

Some Minor Concerns:

Lines 81-82: Wind Profiler, ceilometer, SODAR, MWP, and Lidar are not remote sensing estimation methods, but the instruments that probe the lower troposphere.

Table 1: Ceilometer vertical resolution is missing. I believe some of the instrumentation measure more than reported in row 3.

Figure 1: What is the location of the site? There are 2 red squares and red dots, are they the instrument location of Manacapuru site? If so, where are the location of the

instrumentation? If now, what are they?

Figures 3 and 5: What are the error bars for the measurements?

Figures 4 and 6: What is the shaded area? The errors? If so, how the errors are estimated? Why RS points do not have error bars?

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