Review of manuscript titled "Linear relationship between effective radius and precipitation water content near the top of convective clouds" by Ramon Campos Braga et al. submitted to EGU's *Atmospheric Chemistry and Physics by Anonymous Referee #1*

This work provides, unique aircraft measurements in clean and polluted conditions over the Amazon Basin and the western tropical Atlantic in September 2014 to come up with a threshold value of effective radius of droplets and ice particles (r_e) for warm rain initiation in convective clouds. This finding is consistent with previous modeling studies which indicated precipitation initiated when r_e near cloud top is around 12–14 μm, as the manuscript also states in the introduction. Authors found a statistically significant linear relationship between r_e and precipitation water content (PWC) with high correlation , i.e. nearly 0.94.

However, the scope of this study is limited to the 2014 dry season (September) in Amazon rain forest as stated in the manuscript. However, authors need to point towards the future research need to expand to say a wet season with different meteorological conditions and thermodynamics as well, to understand – if this linear relationship between r_e and precipitation water content (PWC) holds true 'temporally' as well. If possible: add few sentences in discussion, in relation to possibility in disturbances to in-situ precipitation formation processes (See last comment #14). Also, possibility of validating in-situ measured vs satellite retrieved r_e should be explored (See comment #13), if possible in reasonable time-frame for revised version of this manuscript.

The manuscript is well written with findings presented well through descriptive statistics (with various sensitivities pertaining to cloud property, size properties and pollution types) and visualizations. The findings are critical for a wider regional- and global- scale modeling community interested in correcting biases pertaining to precipitation amount in widely accepted meteorological models like WRF in WRF-Chem. I will encourage this manuscript for publication, once authors address the following edits/comments:

1) Lines 25-26 (consider rephrasing the following lines and explaining 'precipitation-forming processes' in terms of connecting them better with subsequent sentences):
"In the Amazon Basin, the formation and development of precipitation-forming processes of convective clouds occur at different levels of atmospheric pollution". (Also see Comment #7)

2) Lines 31-32: Suggest defining the time-period of *'wet', 'dry' and 'dry-to-wet transition'* seasons of Amazon region, on their first use.

3) Lines 42-43: '*Amazonian dry season in September 2014*' (refer to comment #2, define time-period of different seasons at first use)

4) Lines 47-52: Please provide appropriate citations in these statements if possible:

"Here, the relationship between cloud particle sizes and PWC is investigated by calculating retaking into account the concentration of particles with precipitating sizes (1.5μm< r ≤480μm) ***(citation needed)****. The size range of the PWC calculation includes particles with drizzle (25μm≤ r ≤125μm) and raindrop (125μm< r ≤480μm) sizes* ***(citation needed)****. This size range is selected because it includes particles with terminal fall50speeds large enough (>~0.5 m* s^{-1}*) to survive evaporative dissipation over a distance of the order of several hundred meters* ***(citation needed)****. Droplets smaller than drizzle particles fall slowly enough from most clouds that they evaporate before reaching the ground* ***(citation needed)****."*

5) Lines 53-54: Possibly would be better to rephrase *'……which increases with the* 5^{th} *power of* r_{ec}*'* with something on the lines of:
'…..Coalescence rate increases in direct proportion to r_{ec}^5'?

6) Lines 57-58: Please add citation if possible: *'For raindrops, this value is close to unity, and is several times larger than that for small drops (r< 10μm).'* OR
Better to combine following 2 sentences if they are from same citation:
'The collision efficiency of drops increases as a function of their sizes (Khain and Pinsky, 2018). For raindrops, this value is close to unity, and is several times larger than that for small drops (r< 10μm).'

7) Line 59: Why 'graupel' form of ice drops are mentioned specifically? Are other types such as hail or sleet uncommon? If so why? Also, would be helpful to briefly mention at first instance of use of what 'graupel' ice form means physically or size-wise (and its difference with 'frozen' form), if possible. I notice some features of graupel ice drops is mentioned in Line 134, but introduction early on is more apt.

8) Lines 62-63: *'…..These* ***precipitation-forming processes*** *result in a broadening of the particle size distribution and thus* r_e*.'* (See comment #1, where *'precipitation-forming processes'* are mentioned first in Lines 25-26 but explained much later here). Some rearrangement of text would be better to have these parts next to each other sequentially.

9) General comment for Abstract and Introduction:

How the term 'Amazon Basin and over the western tropical Atlantic' is mentioned in both "Abstract" and "Introduction" sections might confuse readers who are not very familiar with HALO or ACRIDICON-CHUVA flight campaign, as though the manuscript will present data for 2 separate flight campaigns one over Amazon and other over Atlantic. Would be better to clarify that the HALO flights cover this entire region as a single campaign, at the first instance of use in introduction/abstract. (It is clear in Figure 1 of course)

10) Figure 1 and Lines 77-80: As the Flights are color-coded as per pollution level classification in Figure 1, might help to add that in Figure 1 caption text and in the following preceding text as well for ease of readers:
'Convective clouds formed in clean air masses were found above the Atlantic Ocean during flight AC19 **(in blue, Fig. 1)***. Flights AC09 and AC18 took place in lightly polluted conditions* **(in green, Fig. 1)** *over the tropical rain forest. Clouds forming in deforested regions in very polluted (biomass burning) environments were measured during flights AC07 and AC13* **(in red, Fig. 1)***.'* (Like it's done in Figure 2 caption text)

11) Line 84: Full forms of CDP and CIPgs in 'CCP-**CDP** and CCP–**CIPgs**' if possible should be defined – since it is first use of these abbreviations

12) Lines 87-89: Can you back up the following criteria for cloud pass with a suitable citation or elaborate on it further? :

'In this study, a cloud pass is assumed when the total water content (TWC) exceeds 0.05 g m^{-3} *and the number concentration of drops (*N_d*) exceeds 20* cm^{-3}*. This is performed to avoid cloud passes well mixed with environment air.'*

13) Lines 2019-217: Is comparison of co-located r_e from MODIS satellite retrievals with r_e presented as part of the measurements in this manuscript, more of a future research step or plausible to be included to validate this linear relationship between r_e and PWC better?

14) Lines 228-230: Since the author mentioned themselves: *'These remarkable results were found because at the cloud tops, no precipitation from higher cloud regions disturbed the in situ precipitation-forming processes.'*

Can authors clarify further, If its mostly because their study was in dry season and this issue of higher cloud regions with more significant rain disturbing the in-situ precipitation formation processes would perturb the smooth linear relationship between r_e and PWC (or CMR, PMR as in Fig. 5), that we observe in this manuscript?