Review

[General Comments]

Time Zone: I was confused by time zones throughout the manuscript. When you are talking the results of model simulations, I know they should be based on UTC by default. But when you are talking about observations, it is little tricky because I don't know whether they are using the local time. Also, you may add the local time next to UTC time, otherwise it will be a confusion. For example, L160 mentioned morning time as well as from 0000 to 0400 UTC, the readers have to convert UTC time to local time to understand you are talking about from 0800 to 1200 local time. Also, you may add all local time information for all figures if necessary.

Figure 6: All panels are almost the same and I don't understand the whole paragraph of discussing Figure 6 in section 3.2. For example, when you are trying to explain the nonlinear relationship, you should try to use tables rather than explaining the figure. In addition, in L172-174, you stated "When the AESF increases from 0.125 to 1.0, near-surface [PM2.5] increase by 6.6 times. However, when the AESF increases from 1.0 to 8.0, the enhancement of [PM2.5] is 9.4 times". This is more likely to describe a proportional relationship rather than linear relationship, even though the proportional relationship is a special linear relationship. Also, your assumed relationship is supposed to be explained earlier, i.e. why do you believe near-surface [PM2.5] should be 8 times larger when AESF is 8 times larger. How is that AESF working in the model?

Figure 12 and Figure 13: Given that you want to compare the area and the amount of precipitation, you can try to sum up the total amount of precipitation in the selected domain (total: x mm, south with some definition about the region: y mm) and count the grids number for each color (yellow: x, red: y, …). I tried to compare these two figures back and forth, and found it difficult to get the same results as you mentioned in the manuscript.

[Specific Comments]

L31-32: The sentence is ambiguous. Typically, we don't say cloud intensity, so you shouldn't say "their", but you are supposed to specifically point out which variable you are mentioning. Also, if "intensity" is about precipitation, why do you mention "precipitation amount" in the end?

L106-107: What is "designed with a strech"? Are you sure this is the term we describe the uneven vertical grid spacing? Do you mean that the vertical resolutions are different, i.e. 30 m near surface and 400 m above 2.5 km? You can be more specific by mentioning "vertical resolution" to make it clear if so.

L110: Are you sure this is a 60-h period? Do you have some spin-up time not included, otherwise you made a mistake here?

L121: I am confused here about "benchmark simulation". Is it just the CTRL result? If so, you may just say "control simulation results" or other name about "control" rather than involving a new word "benchmark".

L140: You may mention this is local time if so. Model simulations usually use UTC time, as well as in your manuscript.

L145-148: The maximum CAPE of 5045 J/kg is indeed really high. However, it is not safe to say the CAPE decreased significantly after the rainfall. First, you need to zoom in the CAPE values from the title to the description of the figure, otherwise they are very hard to be found. Second, the CAPE observations occur 2 times per day, whose time resolution much longer than a convective precipitation event. Third, all three CAPE observations are high (4416, 5045 and 2486 J/kg, and please make them larger). You cannot argue that CAPE decreases a lot after the rainfall. How do you know that the decreasing doesn't result from the sunset (UTC 1200 is local time 2000 sunset time, also add the local time information as I state in the general comments)? You can't simply compare 4416 with 2486, unless you have historical observation data showing 4416 is higher than average but 2486 isn't. In short, you can say UTC 1200 CAPE observational value is very high, but you can't specifically guess its trend or changing reason. By the way, Figure S1 and Figure S2 can be added in the main text.

L155: You may add this sentence "IOA describes the relative difference between the model and observation, ranging from 0 to 1, with 1 indicating perfect agreement" from the supplement to the main text, so that the readers can understand the IOA values of 0.88 and 0.96 are really high.

Figure 3: Panel (c) and (d) don't have that high IOAs and do you have a specific reason about them? Maybe you can mention this in the main text.

L165: How do you know starting from 0400 UTC "clouds commence to form and develop"? Do you have observations or your model simulations to support this statement?

L193-194: I can't see the relationship between increased stability and ARI effects on water vapor mixing ratio. I believe that it is more related with Figure 7a: With lower atmosphere gets cooler and upper atmosphere gets warmer, it is likely to be more stable. If so, you could move this sentence forward a bit.

L195: Why does the "warm bubble" effect appear? Is it related with upper atmosphere getting heated, like Figure 7a from 1000 m to 2500 m? If so, please related Figure 7a with Figure 7c.

Figure 8: You mentioned a lot of thresholds of AESF, such as 0.33, 1.6, …, and I hope that you can label these values on the x-axis (same suggestion for all similar figures) so that the readers can find them out quickly. Also, your statements about panel (c) and (d) are so complicated that I can't understand why there are so many intervals. From my point of view, I can only see that the red dots are significantly lower than the blue dots when AESF is more than 1.6. The differences between red and blue dots are too small to be trusted when AESF is less than 1.6, unless you can prove your results are robust.

Figure 9: Similar with Figure 8. There are too many intervals and I can only believe significant differences appear when AESF exceeding 1.6 from panel (a) and (c). Otherwise, when AESF is smaller than 1.6, the differences of updraft velocity only range from -4 % to 4 %, and I am more likely to believe it is caused by

model itself. I am wondering if you can really prove your results are robust when AESF is small.

L245-247: Yes, I can see the strong correlation between CWP and updraft, which makes sense. But I don't understand why you say "However, the variation direction of the two variables is not always consistent." The correlation coefficient of 0.87 is indeed very high, which can explain why the red dots in Figure 9 (a) and (c) have almost the same tendency. The following discussion in this paragraph doesn't disprove this consistency, so you don't need to start with "however".

L247-255: You try to explain the negative correlation between CDNC and updrafts, but it seems to be too complicated and I think you it should be the relationship between CDNC and AESF (or aerosol itself) rather than updrafts. That's why I am confused. I suggest you can start with your Figure 10 and talk about the reverse relationship between aerosol loading (no matter ARI included or not) and Reff. Then you need to prove the relationship between Reff and the conversion efficiency or CDNC.

L268-269: You haven't found that higher aerosol loading resulting in an increasing precipitation and I don't know whether it is related with the scale of the convection. Like you said earlier, the GZB during the event is located near the bottom of a trough at 850 hPa and the center of 200 hPa. Also, according to Figure 5, the precipitation area was too large to be a single convective cell. I am wondering if the precipitation itself is more likely to be determined by dynamics rather than aerosol itself. If so, the convective precipitation amount won't change a lot unless the aerosol loading is too high.

L287: How do you define “heavy and torrential rainfall” or do you have any thresholds? It would be better if you can state specific color(s) in the figures as heavy rainfall, like yellow and red. Also, Figure 12 and Figure 13 should be combined, so that the readers can compare them directly.

L290-294: Even though ARIs can alter the precipitation amount and area, how can you determine the change is caused by the lifting or stabilizing effects? Are they considered as the only effects on convective precipitations and could you please justify this?

L306: Do you want to compare Figure 14 (b) and (d)?

L325-326: How do you consider the effect of ACIs in your simulation? Are you referring to Figure 8? If so, you can be more specific, as ACIs are much more complicated, including the cloud lifetime, the ratio between ice and liquid, etc. You may also revise the abstract by specifying the ACIs.

[Technical Corrections]

General: It would be better if you can put the figures in the main text, so that the readers don’t need to turn the pages back and forth to find out which figure you are talking about.

L99: What is SI of Supplement Information?

L110: The time information is a little bit confused. Could you please revise it to “from UTC 1200 of July 21 to UTC 0000 of

July 25, 2016” if this is not convention? Actually, I was a bit confused when I saw UTC 25 or so. Same for L118. You may keep it if you are sure this is conventional writing style.

Figure 2: There is a strange symbol in the text of Figure 2. Also see Figure 5.

Figure 7: Larger font size is preferred here.

L187: …, the deduction becomes more pronounced with increasing AESF, but is not sensitive to height.