General comments

In this paper, a large-scale device was installed in the open air, ions generation and air transport were measured; A 2-D model was developed which shown that ion concentration is pretty sensitive to wind speeds; Cloud chamber experiment further proved that ions can enhance the growth of droplets, implying a potential application of the device for rain enhancement. On the whole, this work was well designed, a heavy workload was completed, and the results are interesting and convincing. It is definitely in scope for the journal of ACP, and a decent article would be present if more details of the model and the cloud chamber experiment are given. However, frankly speaking, I don't like the writing style of this paper, and the author seems not realize that readers with atmospheric background may not be familiar with the details of plasma science. Overall, I recommend that the paper should be published once the following comments have been addressed.

Specific comments:

About the Introduction :

A paragraph should been added to describe the relevant plasma knowledge: why negative DC rather than positive DC corona discharge is selected ? the effects of the radius and material of wire? the definition of reduced electric field and source density? the species of negative ions (O_2?)? the mechanism of the decay of ions during transport?

About the Field experiment:

Fig. 1(e) may be move into Fig. 3.
What is the relation between the number of corona discharge points and applied voltage? I think the relevant figure should also been shown in Fig. 3.

It seems that the figures in Fig. 4 should be plot in the rank of c-b-a rather than a-b-c.

Change the title of section 3.1 to "Corona discharges and ion generation", and move the context in Line 2-13, Page 7 into section 3.1.

Fig. 6: The inset of "Discharge device" seems to be not necessary, I suggest deleting it.
Clearly plot the applied voltage and wind speed inside the Fig. 6(a)(b)(c) as Fig. 7.

The hydrogen balloon drifts between 20 m and 50 m away from the wire electrode for safety (Page 5, Line 6), how was the ion concentration within 20 m in Fig. 6(a) measured?

The source density in the model locates at the plasma boundary, just 1 cm from the wire, thus the peak in Fig. 6(b)(c) is very close to the wire. However, the peak of ion concentration in Fig. 6(a) is about 10 m ~ 20 m away from the wire, please explain why that happens.

About the 2-D model:

The x(downwind direction), y(wire direction), z(vertical direction) should be clearly defined in the context, which will be frequently used in Fig. 4, 5, 6 ,7.

The expression of coefficients K and λ should be given explicitly, and explain the physical processes, especially for the decay constant.

Line 23 Page 8, the decay constant λ was reduced by 5.533 times from one single discharge point, what is the physical basis?
If the values of λ in Fig. 7 for voltage of -60, -90, -180 kV were all reduced by 5.533 times, in consideration of the number of discharge points will change with increasing voltage?

When multiple discharge points are involved, strictly speaking, the model is no longer two-dimensional, thus more details should be given for the model in this scenario. I doubts if it is valid to build the multiple points discharge model by simply reducing the decay constant in the 2-D single point discharge model.

Will the simulated results in Fig. 7 also work at 4000 m level, considering the low pressure/density there?

About Cloud chamber experiments:

Line 14-15, Page 9, the ion density of $1.2*10^5$ ~$2*10^4$/cm^3 was provided, however, according to Fig. 4(b) and Fig. 5, the ion density at 1 m away for -23 kV should be about $1*10^6$/cm^3 for a single point, why the ion concentration in the chamber is so low?

What is the distribution of charges on varying size of aerosols? Is it possible to provide the average charges on aerosols through dividing the amount of charges by the amount of aerosols?

Fig. 8(d) seems not necessary.
The results will be more interesting if figures like Fig. 8(c) are also obtained at times such as 1 min, 2 min, 10 min, as they will be helpful to illustrate the mechanism through which the charged aerosols enhance the growth of droplets. If possible, show them in Fig. 8, and move Fig. 8(a)(b) to Fig. 2.

The temperature in the chamber should be provided in section 3.3.

According to Fig. 6&7, the ion concentration reduced to ~10^3/cm^3 at 50 m away, will the effect of charges on precipitation still be significant at that low concentration? If possible, provide the minimum and maximum ion concentration that could affect precipitation.

Technical corrections:

Page 5, Line 6: in the downwind -> in the downwind, as shown in Fig. 1(d)
Page 5, Line 2: ∇is -> ∇ is
Page 6, Line 3: during the experiment -> during the experiment (Testo 605-H1)
Page 7, Line 5: the reduced electric field -> the reduced electric field (electric field divided by neutral density, E/N)
Page 7, Line 5: 80 Td -> 80 Td (1 Td = ··· V m^2)
Page 8, Line 10: -40 kV -> -90 kV
Page 8, Line 13-14: “The mutual ··· the wires” has already appeared in section 2.1. Delete it.
Page 9, Line 14-15: the ion density of $1.2*10^5$ ~$2*10^4$/cm^3 -> ???
Page 9, Line 15: 1-20 m -> ??? (20-30m?)
Page 9, Line 17: diameter > 0.7 -> diameter > 0.7 μm? Give a reference for this value.
Page 9, Line 18: contribute -> contributes
Page 9, Line 19: charging.(Jidenko···) -> charging (Jidenko···).
Page 9, Line 26: the charged aerosols -> the small charged aerosols
Page 10, Line 1: on uncharged aerosols -> on large uncharged droplets
Page 10, Line 1: “the consequent electric forces are short range attractive forces” -> the consequent image electric force is short-range attractive force.
Page 10, Line 3: magnitude.(Tan···) -> magnitude (Tan···).
Page 17, 6.75m^3 -> 6.75 m^3
Page 18, Line 6: 1 cm -> 1 cm (blue line) and 1 m (red line).
Page 19, Line 5: error bar -> error bars
Page 20, Line 8: color clines -> color lines.
Page 21, Line 5: the effect of wind on -> the effect of voltage on.

Fig. 1(a)(b)(c): plot “(a), (b), wind, 50 M” in white color; Fig. 1(c): explain the two red lines, and plot the direction chart at the lower left corner and “50 M” at the lower right corner.
Fig. 4(a), explain the meaning of ‘1s’ in the caption.
Fig. 5: plot “-40 kV” inside the figure.
Fig. 6(a): plot “(a)” in white; Fig. 6(a)(b)(c): the legends should be better plot; Fig. 6(d): exchange the position of “y” and “(d)”, move “x” below the arrow.
Fig. 8: move “(a)(b)” to the top left corner.
