The manuscript entitled "*Measurement Report: Aircraft-Ground Observation Study of a Spring Snowstorm Event in the North China Plain: Cloud Microphysical Characteristics and Precipitation Vertical Structure*" by Song et al. details the microphysical and remote sensing measurements of a springtime convective system with occasionally intense snowfall and rainfall at the surface. The authors provide a thorough presentation of the results from the available airborne and ground-based instrumentation and attempt to relate the observations to microphysics processes occurring in the mixed-phase clouds. However, work still needs to be done to more clearly contextualize the findings to the figures and to past literature before it meets the standards for publication in the journal *Atmospheric Chemistry and Physics*. As such, I recommend Major Revision to the manuscript.

Major Comments

1. The habit analysis (e.g., Fig. 3 and related text) is incomplete as it does not give enough context to the distribution of particle sizes for each habit. For example, to hexagonal plates dominate for the smaller CIP size bins? As shown, holistic fractional habit contributions for the 3 representative periods aren't very revealing. Further, the authors need to discuss the limitations of the CIP as it relates to (1) the probe resolution (could small particles be misclassified as hexagonal?) and (2) maximum detectable size (if aggregates aren't identified in the Holroyd habit scheme until Dmax > 1.6 mm, how many aggregates in the cloud are actually undetected in this analysis?). Alternatively, the authors may consider analyzing each habit's fractional contribution to the bulk mass (assuming a mass-Dimension relationship) or reflectivity (simply summing the D^(2*bm)*n(D)*dD bin contributions for each habit).
2. More discussion as it relates to past studies is needed. This includes but is not limited to: comparing the bimodal ice PSDs for stages 1–3 to other convective snowstorms in the literature (~L245), relating vertical motions and collision/coalescence to lightning activity (L347), and contextualizing the Z, V, W CFADs (L388–415) as has been done in other winter storm studies (e.g., Rosenow et al. 2014 doi:10.1175/JAS-D-13-0249.1).
3. Discussion of the results are frequently difficult to follow without explicit context from the figures. The authors need to add parenthetical figure references throughout the results section next to where claims are made so that their arguments are clear and with scientific backing. A short list of effected lines follow, but there are many more areas that can use figure citations: L306, L340, L395, L424, …

Minor Comments

1. Several spots throughout the paper do not have a space immediately before parenthetical citations. Please correct this.

2. Discussion of results typically alternated between past and present tense within the same paragraph. The authors should choose one to remain consistent throughout.
3. Many parts of the paper mention “snowstorms with thunderstorm” (e.g., L104) or similar phrasing. This should be rephrased to say “convective snowstorms” as it better describes the dynamical environment being framed for this study and is less redundant of the use of “storm”.
4. Specify time zone or UTC for all times listed throughout the paper.
5. L143: Clarify what you mean by “raw data files with spectral Doppler density data”. Is this raw Doppler spectra or derived moments (skewness, kurtosis, etc.) from the Doppler spectra?
6. L153: Expand on “the dimensions of non–complete particles were corrected”. Does this mean a maximum dimension definition where the diameter of a circumscribing circle was used? If not, how were the particles corrected?
7. L162–165: I thing a sentence or two is needed for the MRR QC process and fuzzy logic algorithm as these are not straightforward and should be succinctly summarized here.
8. L169: Quantify (degrees C) the temperature decrease over this time period.
9. L173: I don’t see this echo base height in the top panel. I looks like precipitation (and echo) reaches the surface. And by “horizontal flight” do you mean “constant altitude”?
10. Fig. 2b: Should the units for the N_CIP y-axis label be L^-1? A number concentration of 10/cc is extremely high for ice. Also, it should be explained upfront why points C and F aren’t mentioned in the analysis of this figure. It’s hard to follow the 4 different stages when some of them skip a letter.
11. L190: Quantify how heavy snowfall was (e.g., snowfall rate).
12. L193: Quantify the number concentration and size range you’re referring to for the large particles.
13. L194: “higher content” is a far stretch for an LWC of < 0.01 g/m3. In fact, I’d hedge to say it’s below the measurement sensitivity of the CDP.
14. L196: State the instrument(s) that observed mixed precipitation and, if applicable, what in the data indicated this
15. L200: Quantify the echo top height reduction
16. L202: Rather than simply state the decrease, quantify it and provide physical context such as why it’s lower in this part of the storm vs stage 2
17. L203: It should be stated the aircraft descended prior to this stage
18. Table 2 should list mean +/- standard deviation in the microphysical properties
19. L209: How can this be? The CIP PSDs for sub-200 micron particles are very similar across the 4 regions and since there are fewer large particles in Stage 4 I’d think the CIP number concentrations (D > 50 μm) should be lower, not higher.

20. L219: These are relative/general terms that need to be quantified. Riming is best defined in particle imagery, so I'd think the visual CIP images would strengthen the argument here.
21. L222: Tiny particles, as defined by the habit algorithm or tiny as in some undefined size threshold?
22. Fig. 3a–c: The y-axis should be relabeled as it's fractional contributions that are plotted rather than percentages. The figure caption should indicate the height of the image strips (units mm).
23. L227: Chain aggregates are commonly comprised of planar crystals, so it's a stretch to say that plates don't contribute to aggregation
24. L231: Be careful when conflating supercooled liquid droplets and the spherical habit category. One can assume liquid if the CIP shows circular particles with a clear diffraction signature, but it's better to pair this discussion with CDP concentrations or LWC as the CDP is better at detecting/differentiating liquid.
25. L234 (or earlier in paper): Discussion of the "tiny" category should be better defined. Holroyd defined tiny as having < 25 pixels shadowed, so this distinction can be related to an area (units mm^2) threshold based on the probe resolution.
26. L233–237: I would tend to believe the high habit fraction of tiny particles observed by the CIP in stage 4, actually. Since we know from the CDP that supercooled droplets are abundant in this period and their concentrations are orders of magnitude greater than ice particles, the CIP is likely being inundated (by number) with these droplets.
27. Figure 5 caption and L261 should indicate these are *mean* vertical profiles. To this end, were the reflectivity profiles (Fig. 5a) averaged using the reflectivity factor in linear units (mm^6 m^-3) for each altitude level? If not, this should be recalculated to ensure the discussion/conclusions don't change.
28. L2274–279: I would think that the drops are getting larger via collision/coalescence and should actually contribute to a greater radar reflectivity given the D^6 dependence. Couldn't attenuation or multiple scattering at this wavelength be causing the signature you're noticing?
29. L292 is difficult to follow. Do you mean that the in-situ measurements only apply to the aircraft altitude?
30. L296: Signify these are ground-based radars and mention they are CAPPI views
31. L355: Do you mean reflectivity echoes?
32. Fig. 8: Similar to Comment 27, ensure the mean profiles were averaged using linear units before converting back to dBZe. Also, the solid black lines should be mentioned in the caption.
33. L412: I suggest you put the ERA-5 vertical velocity in more relatable terms (m/s) to confirm it's in the ballpark of the MRR-estimated vertical motion

34. Table 3: The temperature inversion layer row contains the altitude and temperature ranges, but the temperature range isn't explicitly stated with units (I assume degC?)
35. L520: Again, an LWC of 0.003 g m^-3 is within the detectible threshold of the CDP and may be instrument noise or drift if not calibrated correctly

Technical Corrections

1. L21: Do you mean *oriented* ice crystals?
2. L23–26: Change to past tense to match the surrounding text
3. L61: "were" -> "can be"
4. L63: Define the MRR acronym
5. L72: "habits" -> "habit"
6. L76: "Snow crystal spectrum distribution and"…is there supposed to be another item listed after this phrase?
7. L85: "snowband" -> "snowbands"
8. L88: "base" -> "based"
9. L103: Remove "in"
10. L106: "thunderstorm -> "convection"
11. L112: "observation" -> "observational"
12. L115: Clarify what you mean by "widespread stratiform–convective mixed clouds"
13. L118: Put a space before "(Fig. 1)"
14. L128: Put a space before NY
15. L152: McFarquhar citation should not be parenthetical
16. L154: "following" -> "follow"
17. L157: "observation" -> "observations"
18. L172: The echo top altitude ranges between 6 and 10 km
19. L181–182: The first two sentences need to be past tense for consistency.
20. L184: Remove period before Table 2 reference.
21. L216: What is "ofin"?
22. L306: Remove the period
23. L343: "is" -> "are"
24. L352: Remove "was"
25. L362: Define the ILW and IWV acronyms
26. L383: I'm not sure what you mean by "1, 2, 3"
27. L392: Remove "a showed", "a increasing" -> "an increasing"
28. L388: Explicitly call out the panels being discussed in this paragraph as it's currently hard to follow the discussion
29. References: It's difficult to distinguish from one reference to the next without proper indentation