Review of "In situ detection of electrified aerosols in the UTLS" by Renard, J. –B. et al., 2013 for ACPD, by J. P. Schwarz

The paper addresses on the interesting question of the distribution of electrified aerosols in the UT/LS, with focus on a single balloon flight, and on a single "novel" observation of an altitude range without charged aerosol particles. As new instrumentation is applied, however, the paper needs to more thoroughly present the technique and its validation before the results can be considered seriously. My concerns about the results stem from a specific error in the brief description of the electric precipitator used to obtain the results, and a general wariness of experiments in which common mode errors may not be properly dealt with (expanded on, below). If the results hold, then the observations are certainly worthy of publication.

As is, the manuscript does not provide enough information for the reader to conclude that the measurements are reliable, and I recommend that, if the authors are convinced of their validity, they substantially expand their description of the equipment and the tests they've done on it. Without a firm basis for trust in the experimental results, it is not possible to interpret either the model performance or the relevance of the novel uncharged aerosol layer.

In particular, I suggest addressing the following points:

1) The manuscript states that particles that charged particles up to "a few μm" are removed from air in " a few microseconds" by a grid of dimension 5 mm. However, simply by using the Aerocalc equations, I find that a 3 micron particle with a single charge would need over 2 minutes to cross a 5 mm distance at the stated electric field strength in an ambient pressure of 40 hPa and temperature of 270K, with only fairly weak temperature dependences. Even if the grid spacing is 5 microns, rather than millimeters, the assertion of "microseconds" cannot be correct, calling into question the meaning of the results.
2) Two STAC instruments are run in parallel, with one located behind the electrostatic precipitator, to measure total aerosol and uncharged aerosol concentrations. The comparison of the two measurements is used to calculate the charged particle fraction. However, there is no information about how well the two STAC instruments were cross-calibrated, nor how stable the calibrations could be anticipated to be under the conditions on the balloon (are the instruments temperature controlled?). This is especially important because the detection size range (0.3 – 5.5 μm) is on the "edge" of typical aerosol number size distributions, which peak closer to 0.1 μm. Hence, if one instrument is actually measuring a particles of 0.33 – 0.36 μm, and the other is actually measuring 0.31 – 0.34 μm in the "same" size bin, there could be substantial offsets in their concentrations. If the two instruments drift differently with ambient temperature/pressure, the meaning of the concentration comparison is not clear.

3) More information about the statistical uncertainties associated with the STAC instrument comparison is needed. At the observed concentrations and the time resolution used, what is the statistical uncertainty in the charged particle fraction? Without this information it is hard to assess the significance of the results.

Here are specific comments:

1) Page 7063, line 20-25: how do the previous measurements relate to the current results?
2) Page 7065, line 5 – 10. More details please. How were uncharged aerosols generated? This is a non-trivial task. Are there laboratory results showing that the precipitator works? How were the two instruments calibrated? How stable is the calibration? Temperature/pressure sensitive? What are the instrument conditions on the balloon?
3) Line 15-20: what is the integration time for the altitude bins? How many particles sampled in each bin? Statistical uncertainty in the STAC concentrations?
4) Figure 4: Why are panels b and c included? What should the reader gain from their inclusion? Please highlight the value of these panels.
5) P7068, line 20; Figure 5 does not strongly support the statement that the model /observations are in good agreement below 10km and above 20km. Please revise the discussion. Note that if the precipitator doesn't work well, the more general model/measurement comparison results do not seem unreasonable.
6) P7070, line 4-6. This short paragraph should be removed, as it is not relevant the current work, and has no information about the LOAC.