Reviewer 2 (Anonymous)

The paper presents results from wind-tunnel and aircraft testing of a new CVI inlet. The authors use previously established wind-tunnel test procedure to characterize the CVI performance for conditions consistent with Twin Otter operation. The sampling performance determined from laboratory experiments is validated from analysis of aircraft-based measurements of cloud size distributions and total concentration downstream of the CVI. The
paper is reasonably well written and the experiments and analysis are quite thorough. I have a few minor comments that are listed below, which I hope the authors can address.

We thank the anonymous reviewer for helpful comments that have greatly assisted us in producing an improved version of the manuscript. Detailed responses to each comment are provided below.

Comments:

1) Page 1518: lines 24-25: "The pores allow the add-flow to enter the particle stream … " maybe better to rephrase as: "The pores allow the add-flow to enter into the inner sample-stream …"

Response: This change has been made.

2) Page 1520: Line 8: How were the glass beads dispersed and introduced into the wind tunnel?

Response: We have addressed this comment in the text:

"Beads were introduced by dropping a small quantity into a tube located above the inlet orifice at a distance of approximately 12 cm, well longer than the stopping distance of a 20 μm particle at 50 m s^{-1} of 5 cm."

3) Page 1520: Line 8: Figure 2 seems to suggest that the wind-tunnel experiments were conducted with the test particles injected close to the inlet, but no distance is mentioned. Could the large relaxation time of the test particles (esp particles larger than 15 μm) have resulted in their velocities at the CVI inlet be different from that in the freestream?

Response: We have addressed this comment in the text:

"Beads were introduced by dropping a small quantity into a tube located above the inlet orifice at a distance of approximately 12 cm, well longer than the stopping distance of a 20 μm particle at 50 m s^{-1} of 5 cm."

4) Page 1520: Line 26: I'm a little uncomfortable with the normalization scheme to compare the APS size distributions with and without the CVI. The idea behind the normalization, I believe, is to consider any changes in total concentrations that may occur between tests. My concern is the stability of size distributions. Were any lab studies conducted to confirm that the size distributions of the test beads generated were temporally consistent? Of particular concern would be the consistency of the concentrations of particles in the reference size range (17-20

μm)? Also, similar to Anderson (1993), it might be helpful to list the results (cut-size, slope) for both cases of with and without normalization.

Response: In response to the reviewer's comments, the following text has been added:

"Stability of the number-size distribution was evaluated by examining the variations between batch averages of the isokinetically sampled distribution. Standard deviations of the batch averages were 9 to 11% of the normalized concentration or 10to 23% of the non-normalized concentration."

5) 1521: line 10: The argument for changing the sampling curve sharpness definition from that used in Anderson (1993) is not clear.

Response: The range over which the cut sharpness calculation was determined was shortened to stay consistent with the meaning of the term for data containing a higher minimum transmission efficiency below the cut size. This was clarified in the text:

"Previous work has defined cut sharpness as $(D_{p,84}/D_{p,16})^{1/2}$, (± 1 σ about $D_{p,50}$) with values ranging between 1.08 – 1.13 for at least one other CVI design (Anderson et al., 1993). Here we define cut sharpness as $(D_{p,69}/D_{p,31})^{1/2}$, (± 0.5 σ about $D_{p,50}$)to stay consistent with the higher minimum transmission efficiency below the cut size obtained in the experiments. Further work will examine this minimum transmission efficiency."

6) 1522: Line 25: Were any experiments conducted with liquid droplets? Large liquid droplets may have lower transmission efficiency than correspondingly sized solid particles. From the field measurements, did the authors determine any decreased efficency

Response: No controlled experiments were conducted using liquid droplets.

7) 1525: line 20: I'm not entirely clear about the procedure used for comparison of the CPC data and the cloud probe data. It is my understanding that the net size-dependent enhancement factor of the CVI is the product of the EF, transmission efficiency (Figure 3), and transmission efficiency (Figure 4). Is that correct? It seems like the transmission efficiency (Figure 3) is ignored in the comparison analysis, with a sharp cut-size assumed for the CVI. This assumption will likely result in an error in the calculation of the expected cut-size, biasing the results to either smaller or larger sizes, depending on the shape of the cloud droplet size distribution.

Response: We believe the reviewer may have misunderstood our treatment of the EF and transmission efficiency with regard to how we corrected data.
(quantity 1) CPC downstream CVI: we took this data and applied the enhancement factor
(quantity 2) Cloud probe drop concentration data: we obtained total concentration above the expected cut size of 11 μm (Fig. 3) and then applied the size-dependent transmission efficiency correction from Fig. 4.

Then we compared the two quantities above in Figure 6.

Since we feel this was explained already we do not address this comment with additional text.

8) The use of label “transmission efficiency for both figures 3 and 4 is confusing.

Response: The caption in Figure 4 has been rephrased to indicate there is no counter-flow present and that the decrease in transmission efficiency is due to particle losses during sampling.