We thank the two reviewers for their helpful comments. We have provided our responses to the comments below in blue.

REFEREE 1
Second review of Sensitivity of aerosol and cloud properties to coupling strength of marine boundary layer clouds over the northwest Atlantic by Zeider et al. (2024)

The authors overall did a good job addressing the other reviewer's and my comments. The manuscript has improved, and I can recommend it for publication, but suggest that the authors consider the additional comments I have made below. Please note that line numbers are based on the tracked changes manuscript.

1. Regarding my first major comment, it is not entirely clear whether the chosen variation of the thresholds makes sense in terms of measurement uncertainty. The authors might want to consider explicitly mentioning values for the measurement uncertainty. Furthermore, I think sensitivity tests 0.6/0.8 and 1.0/1.2 could be included varying both parameters at the same time. The tests with small variations (0.7/1.0, 0.9/1.0, 0.8/0.9, 0.8/1.1) could be omitted since the tests with larger variations (0.6/1.0, etc.) are also consistent with the main results. At the moment, the analysis the authors provide appears to me to mostly test the robustness of the (somewhat arbitrarily) chosen thresholds but not explicitly account for a known uncertainty of the measurements.

Response: We have explicitly listed measurement uncertainties in Table 2 and made mention of them in the text when discussing the sensitivity tests of Table S1:

"We also note that sensitivity tests were conducted (Table S1) to see how the assignment of MinAlt-BCB pairs to the four coupling categories changed when accounting for measurement uncertainties (shown in Table 2), which could push points across the border of their regime in Fig. 4. Varying Δq_t and $\Delta \theta_\ell$ by absolute values of 0.2 in both directions was investigated to test for sensitivity to measurement uncertainty in this study."

Also, we test the two situations the reviewer mentioned and added them to Table S1 without much change to the story. We didn't feel we needed to omit the old combinations we tested as it doesn't hurt to include them along with the new ones.

	0.8/1.0	0.6/1.0	0.7/1.0	0.9/1.0	1.0/1.0	1.0/1.2	0.8/0.8	0.8/0.9	0.8/1.1	0.8/1.2	0.6/0.8	0.5/0.5
# points												
Strong coupling	293	274	286	302	310	320	287	289	297	303	268	210

Moderate coupling, high $\Delta\theta_\ell$	56	53	56	57	57	47	62	60	52	46	59	92
Moderate coupling, high Δq_t	42	61	49	33	25	27	35	38	42	44	54	63
Weak coupling	20	23	20	19	19	17	27	24	20	18	30	46
Δscat												
Strong coupling	2.2	1.9	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Moderate coupling, high $\Delta\theta_\ell$	3.5	3.5	3.4	3.4	3.4	3.9	3.3	3.3	3.7	3.9	3.4	3.0
Moderate coupling, high Δq_t	2.4	2.5	2.5	2.4	2.7	2.8	2.6	2.5	2.4	2.5	2.6	2.1
Weak coupling	3.5	3.3	3.5	3.5	3.5	3.4	3.0	3.2	3.5	3.4	2.9	3.1
ΔIntV												
Strong coupling	2.5	1.5	2.5	2.5	2.5	2.4	2.5	2.5	2.5	2.5	2.4	2.5
Moderate coupling, high $\Delta\theta_\ell$	2.1	2.1	2.1	2.2	2.2	2.3	2.2	2.2	2.2	2.2	2.2	2.1
Moderate coupling, high Δq_t	1.9	2.5	2.1	1.9	2.3	2.3	1.8	1.8	1.9	1.9	2.6	2.5
Weak coupling	2.8	2.8	2.8	2.6	2.6	2.6	2.6	2.7	2.8	2.9	2.6	2.8
$\Delta N_{a>3\mu m}$												
Strong coupling	0.32	0.20	0.32	0.31	0.31	0.30	0.32	0.32	0.32	0.31	0.33	0.35
Moderate coupling, high $\Delta\theta_\ell$	0.33	0.35	0.33	0.32	0.32	0.37	0.32	0.32	0.34	0.38	0.34	0.29
Moderate coupling, high Δq_t	0.15	0.15	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.22
Weak coupling	0.53	0.45	0.53	0.57	0.57	0.60	0.41	0.46	0.53	0.56	0.36	0.31
N_d												
Strong coupling	344	366	346	344	348	348	345	345	343	343	351	356
Moderate coupling, high $\Delta\theta_\ell$	419	422	421	419	419	439	411	412	432	441	412	376
Moderate coupling, high Δq_t	329	318	334	343	294	285	373	362	345	336	767	371
Weak coupling	275	279	275	270	270	280	263	267	275	286	267	254
MinAlt σ_w												
Strong coupling	0.86	1.17	0.87	0.86	0.86	0.86	0.85	0.85	0.86	0.86	0.86	0.85
Moderate coupling, high $\Delta\theta_\ell$	1.00	1.00	0.99	0.99	0.99	0.97	1.01	1.02	0.96	0.97	1.02	0.97
Moderate coupling, high Δq_t	0.81	0.78	0.77	0.73	0.79	0.79	0.84	0.84	0.81	0.80	0.80	0.86
Weak coupling	0.49	0.58	0.55	0.52	0.52	0.50	0.57	0.53	0.55	0.53	0.60	0.63
BCB σ_w												

Strong coupling	0.70	0.86	0.71	0.70	0.69	0.70	0.71	0.71	0.70	0.71	0.72	0.71
Moderate coupling, high $\Delta\theta_\ell$	0.64	0.68	0.64	0.65	0.65	0.62	0.64	0.64	0.64	0.61	0.67	0.67
Moderate coupling, high Δq_t	0.81	0.72	0.75	0.83	0.99	0.97	0.79	0.82	0.81	0.81	0.70	0.67
Weak coupling	0.49	0.44	0.49	0.48	0.48	0.45	0.60	0.54	0.49	0.47	0.55	0.72
BCB - MinAlt σ_w												
Strong coupling	-0.15	-0.31	-0.15	-0.16	-0.16	-0.17	-0.15	-0.14	-0.16	-0.16	-0.14	-0.15
Moderate coupling, high $\Delta\theta_\ell$	-0.34	-0.32	-0.35	-0.34	-0.34	-0.36	-0.37	-0.38	-0.33	-0.36	-0.35	-0.30
Moderate coupling, high Δq_t	0.01	-0.06	-0.02	0.10	0.20	0.19	-0.04	-0.03	0.01	0.01	-0.10	-0.19
Weak coupling	-0.05	-0.14	-0.05	-0.05	-0.05	-0.05	0.03	0.01	-0.05	-0.06	-0.05	0.09

2. The authors could include indications of the coupling regime in Figures 5 and S2 directly in the respective figure not just in the caption (i.e. a legend for the colors and/or x-axis labels).

Response: Changes made as shown here (Figures 5 then S2, respectively):
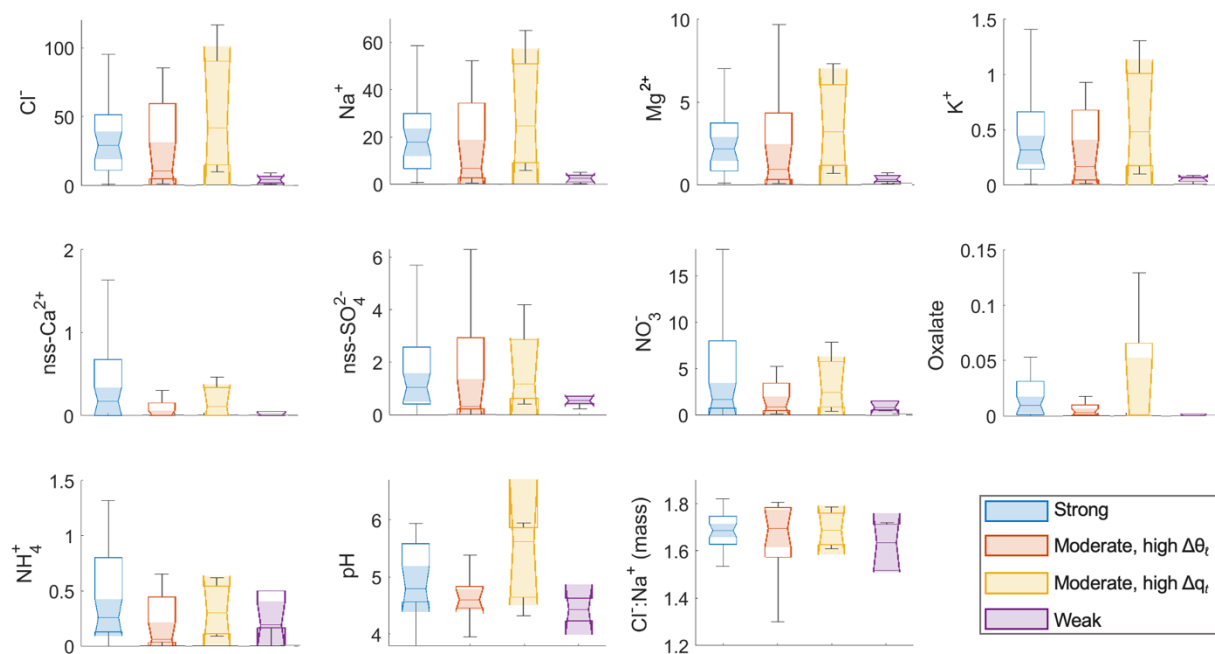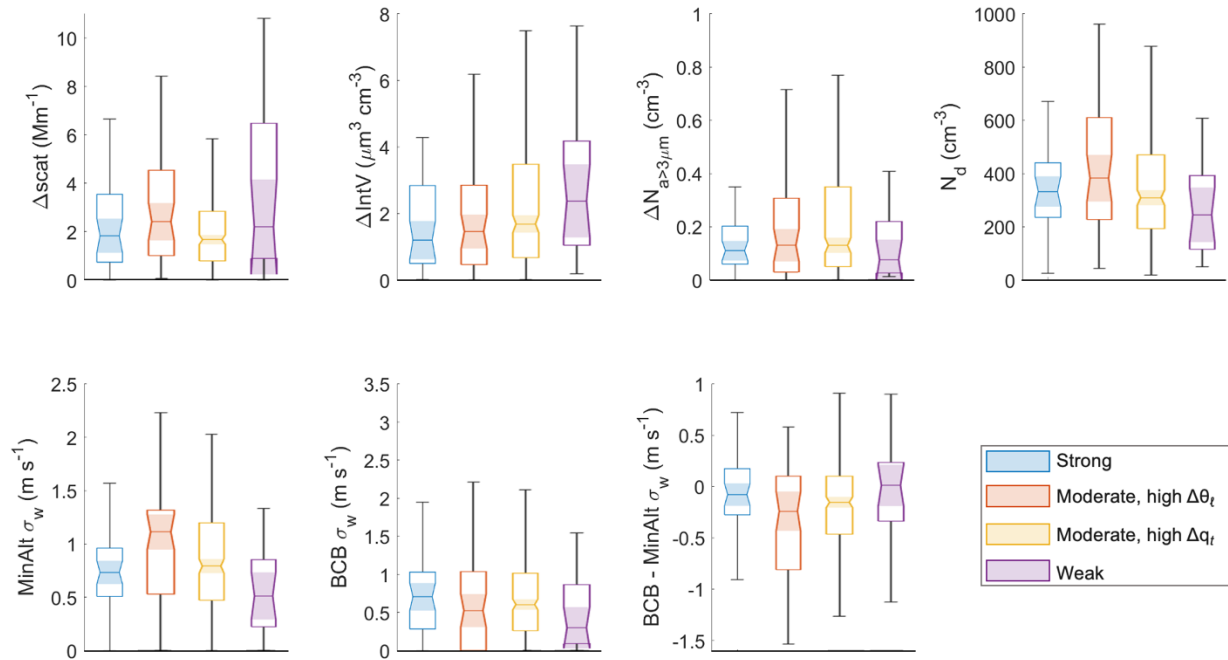
3. I feel some of the figure captions are overly long. The authors could consider limiting the captions to be purely descriptive of the figure, any analysis or description of methodology should be in the main text.

Response: We have trimmed several figure captions, notably for Figures 1, 3, 5. Please see the revised captions below; the trimmed text was placed back into the main text as suggested by the reviewer.

"**Figure 1:** Cloudy ensemble flight strategy of the HU-25 Falcon during the ACTIVATE flights, where the grey box represents a typical cloud layer. The red star indicates where the BCB level would be marked and the data that would be utilized for this particular flight pattern. Otherwise, MinAlt-BCB pairs that are used include when a MinAlt level leg was immediately preceded or succeeded by a BCB level leg. The green line illustrates the data that would be used to investigate the vertical structure of the layer, starting with the last timestamp from the pseudo-BCB leg and ending with the first timestamp in the MinAlt leg."

"**Figure 3**: Locations of the BCB segments of the MinAlt-BCB pairs (blue circles), broken up into the four different degrees of coupling. The locations of the cloud water samples (white triangles) are overlaid on the BCB segment locations. The black star indicates the location of NASA Langley Research Center, the red diamond indicates Bermuda, and the orange dashed line indicates 37.5°N, which is referenced in the discussion about this figure. The total number of MinAlt-BCB pairs for each category are also included for each coupling regime."

"**Figure 5**: Notched box plots of species concentrations (μg m-3), Cl-:Na+ mass ratio, and pH from cloud water samples collected during periods coinciding with MinAlt-BCB pairs."

4. A few comments regarding your response to my comment 10. If these cases are uncommon or in other words less representative, why were they specifically chosen to be shown in Figure 2 instead of cases that are more representative? A follow-up question I have is, even if coupling regimes were not impacted, is it not possible that other measurements (Δscat, etc.) could have changed significantly if taken closer to cloud base? I guess this question cannot be answered since there is no level leg closer to cloud base for these cases. Given the uncertainty arising from this and these cases being uncommon, would it not make sense to remove them from the analysis since it would have little impact on the results (few cases), making the results more robust (removing cases with larger uncertainty)?

Response: The choice of the original profiles was based on having chosen these very early on and we just stuck to them. We certainly are happy to change them out and agree now that this will assist for readers. We kept all the cases as these are the ones that reflect the ACTIVATE dataset, which we will be used by others in the future in the context of comparing BCB legs to in-cloud legs. Rather than cherry-pick the "good ones" where BCB is much closer to ACB, we felt better to use all of our cases even if BCB was farther below ACB than is typically desirable. These larger gaps for some of the cases reflect the challenge of airborne ACI science in the northwest Atlantic which is challenging, and even probably more challenging than typical stratocumulus cloud decks off the eastern coasts of subtropical continental areas. So we keep the original cases but still revise Figure 2 to address the 2nd reviewers comment; we feel this choice of modifications is the best compromise to improve the study.

5. The lack of statistical significance for most variables in Figure S2 might concern some readers. The authors might want to consider including some further discussion on this, e.g., in the context of the sample sizes.

Response: The following text was added:

"Although there is a lack of statistically significant differences between the four coupling regimes for the investigated atmospheric properties, it is important to note that the sample sizes for each regime vary greatly. Therefore, there is more variability within the weak coupling regime with only 20 data points compared to the strong coupling regime with over 200 data points. As this study utilized all of the data at its disposal and there were more strong coupling cases than any other coupling regime, the lack of statistical significance across coupling regimes did not impact the general conclusions of the study."

Typographical

6. 444: 0.2 instead of 0.02

Response: Thanks for catching this. Change made.

REFEREE 2
Both reviewers note the large gaps between BCB and cloud base height in Figures 2a and 2d. The authors claim the two cases are not common, so why not change the cases to the ones that are more representative, especially considering Figure 2 to be illustrative of the four categories?

Response: Change made and here is the updated version of Figure 2: