Review of manuscript egusphere-2024-2984
Revision Round 2

Title: Shallow cloud variability in Houston, Texas during the ESCAPE and TRACER field experiments

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Summary:

The authors have made substantial improvements to the manuscript and the revised version is shaping up nicely into to a final product. I have a few suggestions to address minor gaps that can be resolved quickly. I recommend a minor revision. Red text indicates deletions, and blue text indicates additions. The line numbers in my comments below follow the numbering indicated in the author's tracked changes pdf file.

Major comments:

1. **Section 2.4 HRRR data:** Unlike other parts of Section 2, this subsection currently lacks the detailed discussion on the relevance and application of the dataset chosen. Please provide additional context and explanation for choosing HRRR data over observed measurements (or a best-estimate product such as the ARM INTERPSONDE) for this analysis. Specifically, the text should clearly articulate the unique value of HRRR data such as its high-resolution sounding profiles and comprehensive meteorological fields that goes beyond what AMF1 observations offer. Furthermore, because the analysis relies on HRRR model soundings rather than direct observations, it is important to address whether a comparison has been made between HRRR profiles and AMF1 observations. In doing so, please clarify:
   (i) Which thermodynamic or kinematic features are well represented by the HRRR model.
   (ii) Which features exhibit significant biases.
   (iii) Whether these biases in the simulated meteorological variables might affect the accuracy of the results.

2. Please be consistent in usage of 'Figs' or 'Figures' throughout the manuscript.

Minor comments:

1. **Line 149-150:** …provide a large statistical sample of precipitating and nonprecipitating clouds ~~and precipitation (both shallow and deep)~~ over the Houston area…

2. **Line 151:** Daily statistics are used to infer the different spatiotemporal patterns of both shallow and deep convective clouds…

3. **Line 152:** surface properties may not be the most accurate descriptor here. Suggesting replacing with 'surface type' instead.

4. **Line 154-155:** Four main diurnal characteristics ~~properties~~ of shallow ~~cloudiness~~ clouds will be evaluated over land and water: domain fraction, frequency of occurrence, cloud top height, and cloud to-precipitation ratio.

5. Suggest replacing 'domain fraction' with 'diurnal cloud fraction over land and water' and 'cloud-to-precipitation ratio' with 'precipitation fraction.'

6. **Line 166:** The ARM handbook cited here (Bartholomew, 2020) may be less relevant and perhaps outdated. The latest version of the Laser Disdrometer (LDIS) instrument handbook is likely more useful as a reference. If the authors agree with this assessment, I recommend citing Wand and Bartholomew (2023) instead.

   References:
   Wang, D, and MJ Bartholomew. 2023. Laser Disdrometer (LDIS) Instrument Handbook. U.S. Department of Energy, Atmospheric Radiation Measurement user facility, Richland, Washington. DOE/SCARM-TR-137.

   Handbook available at https://www.arm.gov/capabilities/instruments/ldis

7. **Line 166:** Did you mean to say (warm and cold cloud phase) instead of (warm and cold season)?

8. **Line 167:** …were performed at the AMF1 site.

9. **Line 168:** …followed a ~~radiosonde launch~~ schedule of four radiosonde launches per day at six-hour intervals…

10. **Line 200:** …resolution of ~~30m~~ 30 m and a …

11. **Line 250:** and ~~has~~ a temporal resolution of 5 minutes

12. **Line 252:** and ~~has~~ a temporal resolution of 5 minutes

13. **Line 269:** …Herbie ~~(Blaylock, 2024)~~ Python library (Blaylock, 2024), ...

14. **Line 270:** …wind direction from model analysis (forecast hour 0) here.

15. **Lines 385-386:** The methodology in line 304 states that the KHGX analysis was confined to the region within the 112.5 km radial range (or 225 km diameter). How is the farthest range ~ 176 km then?

16. **Line 402-403:** highest echo-top height corresponding to what reflectivity threshold (0, 10, 20, 30, 40-dBZ)?

17. **Line 767:** Please specify the 'high spatial resolution' explicitly.

18. **Line 768:** Suggest replacing 'forecast hour zero' by 'analysis.'

19. **Lines 777-779:** The description of the temperature gradient orientation is inaccurate. The 850 hPa isotherms in Clusters 1 and 4 are parallel to the coast, thereby making the gradient perpendicular to the coast. Conversely, clusters 2 and 3 have isotherms perpendicular to the coast and thereby the temperature gradient is parallel to the coast. This description also makes logical sense since the sea breeze is expected under a land-ocean temperature contrast forcing perpendicular to the coast (not parallel as suggested in the text). Please revise the text accordingly.

20. **Line 842:** Aided by the onshore flow ~~we showed~~ shown in Figure 12, we hypothesize…

21. **Lines 851-853:** The first sentence claims that higher shallow cloudiness at 15 LT is found east of HGB area, while the second sentence states the exact opposite. Please clarify and/or rephrase the second sentence.

22. **Line 906-907:** ~~(< 0.1 mmhr^{-1})~~ (< 0.1 mm hr^{-1})

23. **Line 909:** …we identify shallow and deep clouds, and associated precipitation ~~and deep clouds and associated precipitation~~

24. **Lines 955-956:** The meteorological set-up we showed in the HRRR composite maps suggest~~s~~ environmental conditions favorable for sea breeze ~~conditions~~ formation, though to confirm the passage of sea breeze frontal boundaries over the AMF1 site, low-level thermodynamics would be needed

25. **Line 1121:** Suggest either replacing 'data' with 'dataset' or 'is' with 'are'

Figures:

Comment on Figure 4: The reflectivity data in panel plots (f) and (g) shows some convective cells along the coast which should have been masked out for analysis (marked in red below). Can the authors clarify what's going on here?