We appreciate the additional comments from both reviewers. We carefully addressed them, with comments provided here and modifications made in the manuscript.

In the following sections, the reviewer's original comments are in black, our comments are in blue, and the corresponding revisions are in red.

Reviewer #2 mentioned the issues in line 288.

We adjust the sentence to emphasize how one profile is formed. The "flight level" and "surface" are not representative; they are replaced with "upward" and "downward" to describe the motion direction of the ray path.

One complete profile is formed when the signal ray paths connecting the satellite transmitter and the aircraft receiver traverse the atmosphere downward (upward) during a setting (rising) occultation.

Reviewer #1:

Second Round of Review of Manuscript AMT-2024-119 Submitted to Atmospheric Measurement Technology Manuscript Title: Observing Atmospheric Rivers using Multi-GNSS Airborne Radio Occultation: System Description and Data Evaluation

Corresponding Author: Jennifer Haase (jhaase@ucsd.edu)

Study Summary:

This manuscript describes the use of airborne GNSS radio occultation for observing atmospheric river (AR) events that impact the west coast of the United States. These airborne radio occultation (ARO) observations are shown to be successful in observing AR events due to the inherent ability of ARO profiles to ignore clouds and precipitation, resulting in data that can observe the thermodynamics of ARs where other remote sensing methods fail due to low vertical resolution or signal attenuation. A ARO full observation and retrieval system is described, and retrieved results were compared to ERA5 model reanalysis output as well as in-situ dropsonde observations. Mean refractivity differences between ARO profiles and ERA5/dropsonde profiles was found to be less than 0.5% magnitude above 3 km with varying standard deviation that is higher at lower altitudes, indicating the high quality of the observations and their potential usefulness in numerical weather prediction of AR events.

General Comments:

This manuscript has improved after all reviewers' comments and the authors' modifications, and I appreciate the authors' thorough responses to my comments. I would encourage the authors to add some of the information in their responses as text to the manuscript where relevant. The manuscript is still extremely valuable for its unique dataset and the information obtained from it. I think the decision to move the ARO processing description to a set of appendices was a good choice. I would also encourage additional read throughs to find any additional grammatical issues prior to publication. Given the state of the manuscript, I have only minor comments. I recommend publishing this paper after the below comments are sufficiently addressed. Please see my line-by-line comments for more specific details.

Line-by-Line Comments:

L011: I suggest removing the parentheticals surrounding the flight hours and using something like: "… obtained from 39 flights over approximately 260 flight hours by tracking multiple GNSS constellations." Not required, but I think it might help the sentence read better.

Corrected.

L027: Remove "but" from the "but prolonged heavy rainfall…" sentence, it doesn't make sense there.

'but' removed.

L035: I recommend ending this sentence with "… dense horizontal sampling." And creating a new sentence with "However, …" here.

The long sentence is broken into two sentences. The added new sentence is below:

However, these observations often have poor vertical resolution.

L086: I am not sure if you want to specify COSMIC as COSMIC-1 or not in the manuscript. You may also provide the full name for the mission and a citation of Anthes et al., (2008) here since it is the first mention of the mission in the manuscript.

In the manuscript, we use COSMIC, rather than COSMIC-1, to match how it is called in the cited references, where detailed descriptions can be found. We added some clarifications to avoid the possible confusion about COSMIC-1 and COSMIC.

The most notable SRO mission, COSMIC, also known as COSMIC-1, was launched in 2006 and provided many RO observations \citep{Anthes2008}.

L105-106: I would encourage the authors to at least provide a citation for COSMIC-2 here, such as Schreiner et al., (2020).

Recommended reference is added.

Figure 3 Caption: "… and Galileo constellations, respectively."

Added.

L395: Here the authors use "COSMIC-1" but in other places the authors use "COSMIC". Please make sure the references to COSMIC-1 are consistent in the manuscript. Personally, because COSMIC-2 has launched, I would advocate for "COSMIC-1"

We choose to keep COSMIC, as it is named in the cited references. To avoid confusion, we added a one-sentence description at the beginning:

The most notable SRO mission, COSMIC, also known as COSMIC-1, was launched in 2006 and provided many RO observations \citep{Anthes2008}.

Reviewer References:

Anthes, R. A., Bernhardt, P. A., Chen, Y., Cucurull, L., Dymond, K. F., Ector, D., Healy, S. B., Ho, S. P., Hunt, D. C., Kuo, Y. H., Liu, H., Manning, K., McCormick, C., Meehan, T. K., Randel, W. J., Rocken, C., Schreiner, W. S., Sokolovskiy, S. V., Syndergaard, S., Thompson, D. C., Trenberth, K. E., Wee, T. K., Yen, N. L., and Zeng, Z.: The COSMIC/FORMOSAT-3 Mission: Early Results, Bulletin of the American Meteorological Society, 89, 313–334, https://doi.org/10.1175/bams-89-3-313, 2008.

Schreiner, W. S., Weiss, J. P., Anthes, R. A., Braun, J., Chu, V., Fong, J., Hunt, D., Kuo, Y.-H., Meehan, T., Serafino, W., Sjoberg, J., Sokolovskiy, S., Talaat, E., Wee, T. K., and Zeng, Z.: COSMIC-2 Radio Occultation Constellation: First Results, Geophysical Research Letters, 47, https://doi.org/10.1029/2019gl086841, 2020.