Thank you so much for reviewing our paper! We've copied your review here in blue. We've responded to each part of your review separately, in black. We've also printed our planned revisions in response to your comments here, in black and in italics.

Review 2:

GENERAL COMMENTS:

This paper presents a claimed novel technique for finding collocations between measurements from RO and passive nadir sounders. As the introduction highlights, these types of collocations have proven useful for various applications in the weather/atmospheric science community over the past years, thus this type of work presented is important and valuable to the community. The paper is well structured, clearly written, and has well placed/formatted figures. Results in the paper support their conclusion. I recommend it be accepted with minor revisions. Some of the specific comments below are just suggestions the authors can consider.

SPECIFIC COMMENTS:

Introduction – Is there any other publicly known/available code out there that does these sort of collocations – e.g. between different satellite tracks as referenced in your conclusions? This could be noted in the Introduction.

Yes, a few publicly available tools for finding satellite collocations already exist. As far as we are aware, all existing tools use brute-force methods, and some tools execute brute-force methods in parallel in the cloud in order to speed up collocation-finding.

We have added a line to the introduction noting this.

Original lines 44-45: *"We refer to collocation approaches similar to this as a brute force method."*

Revised lines 44-47: *"We refer to collocation approaches similar to this as a brute force method. Publicly available tools for collocating satellite data generally use brute-force approaches which are not specific to the geometry of collocating GNSS RO and nadir-scanner soundings, and instead use parallelization and cloud computing to speed up collocation-finding (Chung et al., 2022; Smith et al., 2022; Wang et al., 2022)."*

Line 33 – Sentence starting "Intercomparison of RO …". It's not exactly correct to say "for the sake of validating the calibration of the infrared sounders…". It would be more exact to say "for the sake of validating the retrieved temperature products of the infrared sounders". The uncertainties involved with the radiative transfer model used to go between radiance and physical temperature doesn't (yet, from what I've seen) allow the RO to assess the calibration of the IR sounding instruments. If you have a reference for this it could certainly be included.

We appreciate the feedback, but would like to consider that studies exist that derive calibration offsets for microwave sounders. For example, the paper “Use of Radio Occultation to Evaluate Atmospheric Temperature Data from Spaceborne Infrared Sensors” (Yunck et al., 2009) compares AIRS atmospheric profiles to GPSRO profiles from CHAMP, SAC-C, and COSMIC, in order to derive bias offsets for AIRS. We now include a reference to this paper.

Original lines 33-35: *“Inter-comparison of RO and spectral thermal infrared sounders for the sake of validating the calibration of the infrared sounders has also been investigated (Feltz et al., 2017)”*

Revised lines 33-35: “*Inter-comparison of RO and spectral thermal infrared sounders for the sake of validating the calibration of the infrared sounders has also been investigated (Feltz et al., 2017; Yunck et al., 2009)”*

Line 75 (Intro of Section 2/2.1) – delta t and delta d should be more clearly defined, i.e. what time is used to define the “time” of the RO measurement (begin or end time)? What lat/long is defined as the location of the RO profile (perigee point)?

Good point -- we will clarify this. The “time” we use for each RO measurement is the start time, and the lat/long is the projection of the perigee (tangent point) onto Earth’s surface.

Original lines 72-73: *“Collocations are defined as RO soundings that are separated from a passive nadir sounding by at most Δt in time and Δd in distance. First,...”*

Revised lines 80-83: *“Collocations are defined as RO soundings that are separated from a passive nadir sounding by at most Δt in time and Δd in distance. We consider the time corresponding to each RO sounding to be the start time of the RO measurement, and consider the position corresponding to each RO sounding to be the ray perigee (tangent) point projected onto Earth's surface. First,...”*

Table 3 – is a great way to show your results. Very organized and makes it easy to compare results from your collocation methods. You could consider adding the time match criterion in your table caption.

Yes, we’ve added the spatial and temporal criteria for collocation to the caption, for clarity.

Original line 351 (table 3 caption): *“Number of collocations by day, by satellite combinations.”*

Revised line 384 (table 3 caption): *“Number of collocations by day, using Δt = 600 seconds as the temporal criterion and Δd = 150 km as the spatial criterion for collocation, by satellite combinations.”*

Section 4.5/Table 4 – what time tolerance was tested to get the numbers for this Table? In hindsight I see it’s the same as previous section, but maybe state again for explicitness.

Yes, we can state this explicitly.

Original line 358 (table 4 caption): *"Core-minutes required for computation by day, by satellite combinations (excluding data-loading)."*

Revised line 391 (table 4 caption): *"Core-minutes required for computation by day, using Δt = 600 seconds as the temporal criterion and Δd = 150 km as the spatial criterion for collocation, by satellite combinations (excluding data-loading)."*

Section 5 – You might consider making a comment about the geographic distribution of the collocations missed by the rotation method – your maps in previous sections illustrate this nicely for given days. However, adding a statement about the random geographic distribution of occultations (if true, which it looks like it is?) could (for some users) significantly strengthen the argument to use the rotation method.

Excellent point. This comment actually helped us correct a bad approximation in the rotation-collocation method! We had previously been using a constant satellite altitude when calculating scan distance, but the orbits of all the MW scanners considered in this paper are slightly eccentric, and so MW scanner altitude was slightly lower over the North Pole and slightly higher over the South Pole than what we had been modeling. As a result, we had a lot of false positives near the North Pole and a lot of false negatives over the South Pole.

We have now updated the rotation-collocation method to use the time-dependent altitude of the microwave satellite when calculating scan distance, and have updated our results. Now, the geographic distribution of misclassifications (all false positives + false negatives) roughly matches the geographic distribution of all collocations, as expected. The only deviation is that the mean latitude of false negatives is around 10 degrees south of the Equator, but the sample size is small, so it's difficult to draw conclusions about these distributions.

We added a figure showing a map of false positives and false negatives, as well as histograms over latitude and longitude for false positives, false negatives, and all collocations. We also added some comments about the distributions in sections 4.3 and 5.

New figure (on next page):

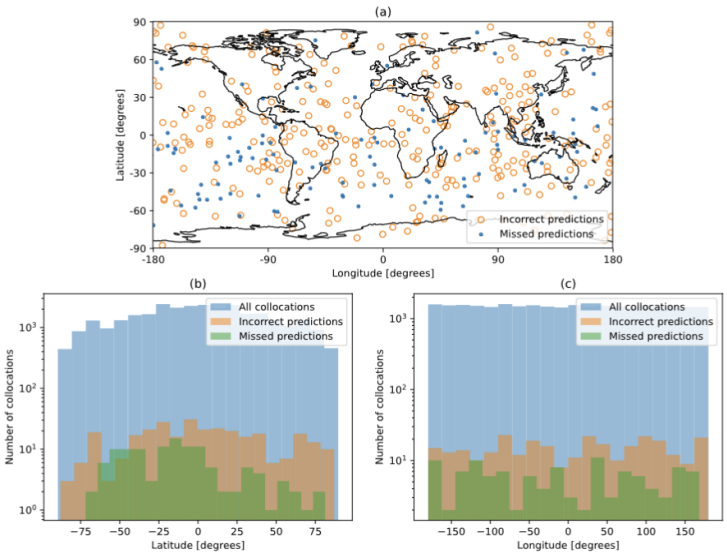

Figure 6. (a) Map of incorrect and missed predictions for all satellite combinations, (b) Histogram of latitude of all collocations, incorrect predictions, and missed predictions for all satellite combinations, (c) Histogram of longitude of all collocations, incorrect predictions, and missed predictions for all satellite combinations.

Addition to section 4.3 (lines 367-375): "*Figure 6(a) shows the geographic distribution of incorrect predictions and missed predictions. Figures 6(b) and 6(c) display the distribution of latitude and longitude, respectively, for incorrect predictions, missed predictions, and all collocations. The set of all collocations is roughly centered at the equator and prime meridian, with a mean latitude of 0.49◦, mean longitude of −1.69◦, standard deviation of latitude of 42.2◦, and standard deviation of longitude of 104.1◦. The distribution of incorrect predictions is similar, with a mean latitude of 2.82◦, mean longitude of 4.52◦, standard deviation of latitude of 42.2◦, and standard deviation of longitude of 103.4◦. The distribution of missed predictions, however, is centered slightly south of the equator; it has a mean latitude of −12.58◦, mean longitude of −10.5◦, standard deviation of latitude of 34.1◦, and standard deviation of longitude of 105.4◦. The sample size (n = 116) of missed predictions is small, however, which makes it difficult to evaluate the significance of this small shift in geographic distribution.*"

Addition to section 5 (lines 467-468): "*Currently, the geographic distribution of the soundings misclassified by the rotation-collocation algorithm roughly matches the geographic distribution of collocated soundings, as shown in Figure 6*."

Addition to section 5.1 (lines 492-3): "The authors also plan to further investigate the geographic distribution of collocations missed by the rotation-collocation method."

TECHNICAL COMMENTS/CORRECTIONS:

Line 68 – "define" should be "defines"

Good catch.

Original lines 67-68: *"Section 3 describes the data sets that will be used in the study and define the experimental setup."*

Revised lines 75-76: *"Section 3 describes the data sets that will be used in the study and defines the experimental setup."*

Line 95 – should Section 2.1 be 2.1.1?

Yes, it should.

Original line 95: *"This approach is similar to that of the brute-force method discussed in §2.1 but with narrowed windowing in time."*

Revised line 104: *"This approach is similar to that of the brute-force method discussed in §2.1.1 but with narrowed windowing in time."*

Line 146 – define ECI acronym

Yes -- we should define the ECI acronym before using it.

Original lines 143-144: *"...the coordinates $x_{ECI}(t)$, $y_{ECI}(t)$, $z_{ECI}(t)$ are Cartesian coordinates of a location in an Earth-centered inertial coordinate system."*

Revised lines 152-153: *"...the coordinates $x_{ECI}(t)$, $y_{ECI}(t)$, $z_{ECI}(t)$ are Cartesian coordinates of a location in an Earth-centered inertial (ECI) coordinate system"*

Line 252 – "four collocation-finding methods" – only 3 lines shown in Fig 2(a)

Both brute-force methods find the same collocations, and are represented by the same line in Figure 2(a). We will make this explicit.

Original lines 251-254: *"In Figure 2(a), we show the collocations between COSMIC-2 and NOAA-20 by day found by each of our four collocation-finding methods. The rotation-collocation algorithm with sub-occultations (orange) and the linearized rotation-collocation algorithm (light green) find slightly more collocations on each day than the brute-force algorithm (blue)…"*

Revised lines 267-271: *"In Figure 2(a), we show the collocations between COSMIC-2 and NOAA-20 by day found by each of our four collocation-finding methods. Both brute-force methods yield identical results, and so both methods are represented in Figure 2(a) by the same blue line. The rotation-collocation algorithm with sub-occultations (orange) and the linearized rotation-collocation algorithm (light green) find slightly more collocations on each day than the brute-force algorithms (blue)…"*

Line 347 – "non" to "none"?

Yes, “non” was a typo.

Original lines 346-347: *“There are no collocations between Metop-B-AMSU and Metop-C-GRAS, and non between Metop-C-AMSU and Metop-B-GRAS.”*

Revised lines 380-381: *“There are no collocations between Metop-B-AMSU and Metop-C-GRAS, and none between Metop-C-AMSU and Metop-B-GRAS.”*

Line 433 – get rid of “that”?

Yes.

Original lines 433-434: *“Cohosted instruments on Metop-B and Metop-C greatly increase the percentage of soundings that are collocated, and that cohosting MW and RO instruments is a powerful tool for increasing the number of collocations.”*

Revised lines 477-478: *“Cohosted instruments on Metop-B and Metop-C greatly increase the percentage of soundings that are collocated, and cohosting MW and RO instruments is a powerful tool for increasing the number of collocations.”*