1st review of "Processing Multiple GNSS RO Data Using FSI and ROPP: Results from the ROMEX" by Chen et al.

This manuscript evaluates the performance of the STAR RFSI processing system in deriving atmospheric profiles from level-1b data across multiple GNSS RO missions collected during the ROMEX project. By comparing the results against ROPP (using the CT2 method) and EUMETSAT-processed datasets, the authors further discuss the structural uncertainties inherent in RO retrievals. While the study presents noteworthy results, certain areas remain ambiguous (listed below) and would benefit from further clarification.

General comments:

1. The FSI method was introduced two decades ago and is recognized as a powerful WO method for resolving fine-scale structures and multipath effects. However, its requirement for specific geometric conditions (e.g. circular orbits) meant that it required significant/complicated correction (as described in Line 363-374) before it could be reliably used in operational RO data processing. In addition, the FSI method is highly sensitive to noise, as acknowledged by the authors. In the lower troposphere, where SNR is often low, FSI performance can degrade significantly. These limitations have likely contributed to the fact that FSI has not been widely adopted in operational RO processing centers. Given these considerations, the manuscript would benefit from a clearer explanation of the scientific or practical motivation for reprocessing data using FSI. Beyond generating an additional version of RO products, what specific advantages does the FSI offer compared to existing operational algorithms?

2. The authors devote a substantial portion of Section 3 to describing the methodology. It would be helpful if they could first clearly summarize the core methodological differences between the approach presented here and that described in Adhikari et al. [2021]. Such clarification would allow readers to better understand the novelty and specific contributions of the current work.

3. The title of Section 3, "Full Spectrum Inversion Algorithm", appears somewhat misleading. Based on the content, the section describes the STAR FSI-based processing framework as a whole, including the full processing chain for retrieval Level 2 data products from Level1b data. This scope extends well beyond the pure FSI algorithm itself, which is fundamentally a WO method for resolving multipath effects in the troposphere. The title could therefore be reconsidered to better reflect the broader processing steps being presented.

4. The manuscript also introduces several technical terms and abbreviations that are not sufficiently explained or referenced, making it difficult for readers to follow. For example: what're the differences between STAR RFSI and STAR ROPP? Is it correct to simply understand the STAR RFSI uses the FSI algorithm, whereas STAR ROPP applies the CT2 algorithm? What is the core difference between STAR ROPP and the well-known ROM SAF ROPP processing system? Is the STAR ROPP considered the "community standard" ROPP referred to in Lines 19-20 and in the title?

5. Does EUMETSAT use ROM SAF ROPP operationally to process RO data? If not, what kind of WO method is used in their processing? CT2?

6. Regarding QC (Section 3.4), the authors use ERA5 forecasts as reference for QC checks, and ERA5 reanalysis as a reference for evaluating RO retrievals. Could the authors assess the impact of using ERA5 as a QC reference on the resulting dataset? For example, how sensitive are the retained profiles to the choice of ERA5-based thresholds?

7. In Section 4, global RO retrievals from different ROMEX missions processed by different systems are compared. This raises concerns of the impact of significant sampling differences on the statistics shown in Fig. 5-10. In particular, C2, as the only low-inclination mission, with observations concentrated in mid- or low latitudes, can give significantly different statistical results. In addition, it would be very informative if the authors could include penetration depth statistics for different missions and processing systems in Fig. 5-10. Such information would help readers better interpret differences in lower-tropospheric performance and assess the practical impact of the different algorithms.

8: I found the results presented in Fig. 16b particularly interesting, as they show strong agreement between the STAR RFSI-processed C2, Spire and PlanetiQ datasets. This consistency is noteworthy given the findings in Anthes et al. (2025) (*https://doi.org/10.5194/amt-18-6997-2025*), which discuss the bending angle biases associated with the sideways sliding of the tangent point. That research suggests such sliding can introduce a slightly positive BA bias in C2 and typically negative biases in other high-inclination missions. I would appreciate the authors' interpretation of why the RFSI framework yields such high agreement across different missions.

Specific comments:

1. L57-58: Can the authors be more specific about the "particular strength" of FSI, compared to other WO methods in resolving fine-scale structures?

2. L97: "ROEMX" → "ROMEX"

3. L113-114: As far as I know, C2, Spire and PlanetiQ are all using OL tracking, instead of the combination of OL and CL tracking. Can the authors recheck the fact and may readdress the statement?

4. L170: "GNS" → "GNSS"

5. L171-172: "STAR RFSI algorithm has been integrated into ROPP version 10.0": Do you mean the STAR RFSI algorithm has been included in the ROMSAF ROPP package? If not, please rephrase the sentence. It's misleading.

6. L214-217: Grammatical error. Rephase it.

7. Section 3.2.1: I had thought that the navigation data modulation had been removed in the provided Level1b data, isn't it true?

8. The current presentation of Fig. 4 is somewhat confusing, as different months are represented by colors that appear identical.

9. L465-466: So the RO data may be flagged as "bad" solely because "the model simulation data are unavailable"? This doesn't sound like a good QC criterion.

10. L743-745: could the authors elaborate on the statement regarding "degraded L2 signals and reduced GNSS SNR above ~20 km"?