On-Orbit Callibration and Performance Validation of the Yunyao Polarimetric Radio Occultation System

General comments

The manuscript presents the first on-orbit calibration, validation, and performance assessment of the Yunyao Polarimetric Radio Occultation (PRO) system. The study describes the data processing methodology, analyzing over 53000 occultation events collected between March and June 2025, and employs the GPM IMERG precipitation product to establish an empirical relationship between the differential phase shift (ΔΦ) and rain rate. The topic explores the use of GNSS-PRO observations, providing valuable insights for the community and demonstrating the potential of this technique for hydrometeor detection and precipitation monitoring.

The work is generally well structured and results are clearly presented. It should be suitable for publication after minor revisions.

To further improve the manuscript, the following points are suggested:

(1) A short paragraph discussing the motivation for the Yunyao mission in the context of previous PRO missions, such as PAZ and Spire.

(2) Provide a clear and concise definition of the polarimetric observable ΔΦ at the beginning of the manuscript.

(3) Expand the Conclusions section with a brief discussion of the potential applications of PRO measurements within the atmospheric science community.

Specific comments

L40. I think you should rephrase and define the polarimetric observable differential phase shift or at least said what it represents (point (1) of general comments).

Also, I would not say that PRO observable reflects rain rate. The differential phase shift does not reflect a direct measurement on rain rate, it is influenced by the presence of non-spherical raindrops so I would say something more like it reflects the integrated scattering properties of the hydrometeors along the propagation path.

L138. You mention the horizontal and vertical polarizations, but I did not see any mention to PRO employing this kind of polarization, instead of RHCP, before that.
You introduce it at section 2.3 but maybe you could mention it briefly before that. Maybe put Eq 12 at the begining of the article.

L264. Cloud itself is not a hydrometeor category; rather, cloud water is. It was demonstrated the sensitivity of PRO to oblate non-spherical raindrops typically present during heavy precipitation events, as well as to oriented frozen hydrometeors, such as snow aggregates. However, given that PRO operates at L-band frequencies, it is unlikely that the technique is sensitive enough to detect small cloud water droplets.

Figure 10. Specifiy what the solid and dashed lines represent in the caption.

L355. Why the signal decreases near the surface?

Figure 12. Could you explain why the heaviest rain rate profile of Figure 12 (b) (dark red color) is superposed with the second heaviest rain rate profile?

Technical corrections

L12. low-Earth-orbit, while on **L49** it is written as low Earth orbit, without the middle dash.

L67. You wrote co-located but then in caption Figure 4 you said collocated.

L71. You wrote POR instead of PRO.

Figure 2. You missed a markpoint after Figure 2

Figure 5. Missing caption for (c).

Figure 6. Missing markpoint after Figure 6

Table 1. Missing markpoint after Table 1

Table 2. Missing markpoint after Table 2

L200. Geometric optics (GO) was already defined as GO at **L189**

L344. Instead of Fig 11 and Fig 12, you wrote Fig 10 and Fig 11.

Figure 14. Units of IMERG precipitation in the x-axis?