Reviewer #2:

Overall Comment:

The manuscript attempts to highlight the results of an important feasibility study on reconstruction of atmospheric rivers (ARs), known to be a chief source of bulk of atmospheric water vapour transport from tropics to mid-latitude regions. The study resorts to use of both space-based as well as ground-based GNSS observations within the framework of machine learning NN architectures. The subject of the study is quite significant and the use of ML based exploratory nature of the work is relevant given the surge in the use of ML techniques in recent times. The study is meticulously planned, thoroughly detailed and thoughtfully implemented, even if for a localized region of study with a signature of AR. The craftsmanship with NN architectures is well appreciated, though study with some of the advanced ML approaches, e.g. ensemble learning etc. would have been comparative. Authors are admonished to think of it as future scope of the work. Nevertheless, the study highlights the potential effectiveness of GNSS RO data when used additionally with ground based networks. The manuscript is well-written, organized nicely and representations are clear. The manuscript is recommended for publication after a few suggested modifications as illustrated in "Detailed major comments" and "other minor comments" in the attached pdf.

Dear reviewer, thank you very much for taking the time to review our work. We really appreciate your comments and your positivity towards our work.

Before answering to each specific comment, I wanted to point out that our results are an output of an ensemble of 10 different NNs (each with slightly different results due to random initialization of model parameters, stochastic optimization algorithms that randomly sample the data points or possible GPU precision and optimization implementation). This has not been strongly highlighted in the manuscript, only mentioned in lines 296-299. To further emphasize this, the following sentence has been added in the conclusions:

'We point out that the ML results in this study are an average of an ensemble of 10 trained NNs.'

Below, you can find our answers to all your points in an extended version.

Detailed major comments:

1. In figure 1, what is the grid resolution of the ECMWF 12 h forecast? It must be mentioned in the text. A similar structure with a long streak is seen in red below the rectangle. What objective basis is used by the authors to identify the AR in figure 1? Justification required. Sub-section 2.1 needs to be strengthened with substantive basis and characterization of AR scenarios in terms of parameters to distinguish them from other features of similar nature.

Thank you for pointing this out. The ECMWF data that we have used in this work are at 0.1° resolution. This is mentioned later in the text in section 3.1.2 and at the conclusions section. As suggested, I also added this in the Figure caption as follows:
'*AR scenario visualized using 12-h forecast ECMWF data, with a resolution of 0.1°.*'.

Regarding the AR identification, we do not identify it ourselves but rather use an AR that has been identified/reported by NOAA:
https://www.weather.gov/mtr/AtmosphericRiver_10_24-25_2021#:~:text=Atmospheric%20River%20October%2024%2D25%2C%202021&text=Higher%20elevations%20of%20the%20North,the%20risk%20of%20fire%20season.

To further specify this, we have changed the following sentence in section 2.1:
'*Figure 1* depicts the AR scenario that we have identified on the website of US National Weather Service, (NOAA, 2021).'. into '*Figure 1* depicts the AR scenario reported on the website of US National Weather Service, (NOAA, 2021).'

We would like to clarify that the red structure represents very dry area where the refractivity values are the lowest (dark red in the colorbar), and the AR is the area with highest moisture, i.e. highest refractivity values (dark blue).

In the introduction, we have mentioned the main characteristics of AR as follows:
'*ARs are narrow maritime atmospheric low-level jets that transport large amounts of moisture from the Tropics into the mid- and high latitudes, often impinging on the continents (Newell, et al., 1992), (Zhu & Newell, 1994), (Newell & Zhu, 1994). ARs can release massive amounts of moisture in the form of precipitation (NOAA, 2023). Depending on the size and intensity of the AR, it might lead to extreme precipitation …*'
and
'*AR widths are typically 1000 km, and their lengths 2000 km or longer (Zhu & Newell, 1998). The total precipitable (column-integrated) water vapor is at least 20 mm (20 kg m-2) (Ralph, et al., 2004). While they cover only 10% of Earth's circumference, ARs are still responsible for 90% of the total meridional moisture transport (Zhu & Newell, 1998).*'

To further distinguish the AR, we refer to our supplementary material, where videos of ECMWF data are also reported (in *Video_IWV_maps.mp4* and *Video_Refractivity_maps.mp4*). The AR is a more persistent structure on the 24th and 25th of October that fits the AR characteristics mentioned in the introduction.

We have also added the following sentence:
'The evolution of the selected AR can be seen in the supplementary material where videos of ECMWF refractivity and IWV fields are included.'

2. In sub sub-section 3.1.1, authors highlight the results for 65o inclination but the same are not shown in either figures 2 (shows 70o , 80o , 90o and 100o inclinations) or figure 3 (85o inclination). Authors to re-draw the figures 2 and 3 to incorporate the results for 65o inclination also.

Thank you for pointing this out. In the following figure we show the results for all evaluated inclinations:

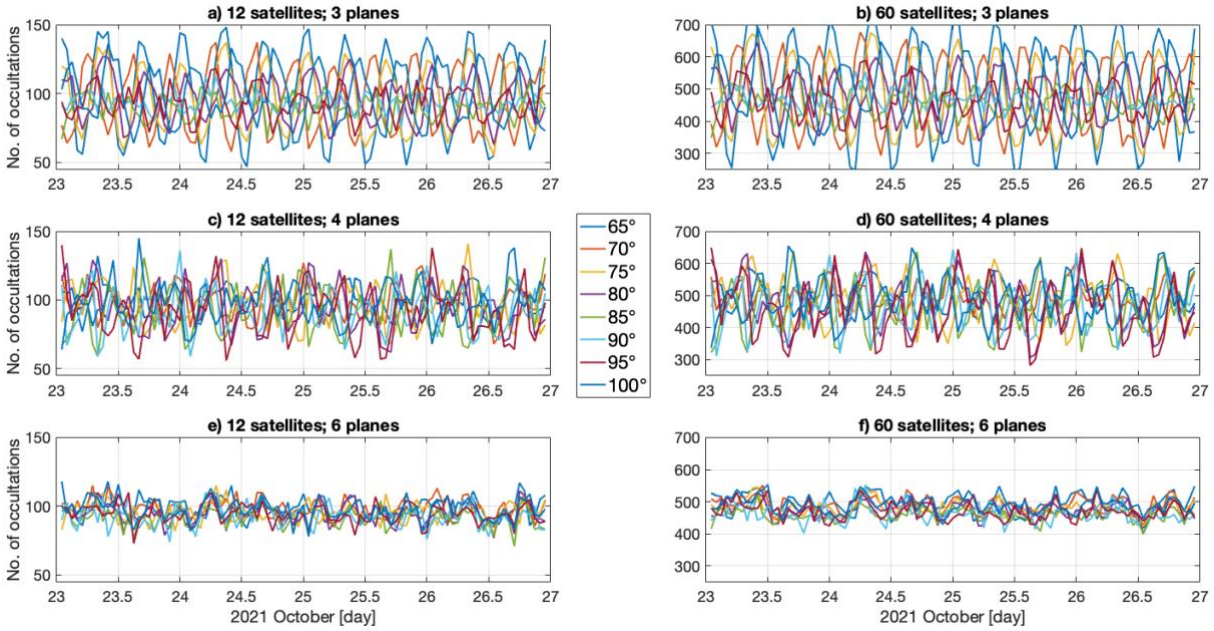

Fig: Hourly number of RO counts for Walker constellations of RO receivers in orbit planes with inclinations of 65°, 80°, 90°, and 100° in the AR region. On the left are displayed the cases for 12-satellite constellations and on the right the cases for 60-satellite constellations. The top, middle and bottom panels represent the cases of 3, 4 and 6 orbital planes.

Since in this figure it is very difficult to distinguish the different curves, we opted to show the results of only some of the inclinations and decided 70, 80, 90 and 100 to keep a similar step. The detailed statistics are then reported for each inclination in Table 1.

We have changed Figure 2 so that the results for 65° inclination are included. To keep the figure as clear as possible, we are showing the results of 65° instead of the results of 70° inclination:

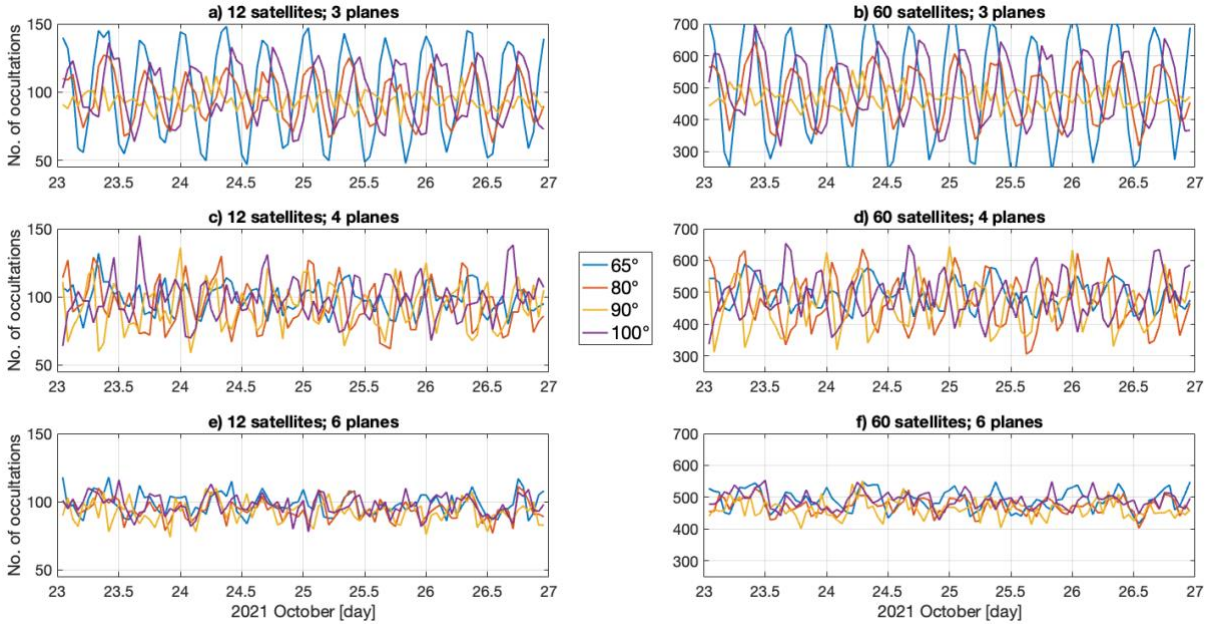

Figure 2: Hourly number of RO counts for Walker constellations of RO receivers in orbit planes with inclinations of 65°, 80°, 90°, and 100° in the AR region. On the left are displayed the cases for 12-satellite constellations and on the right the cases for 60-satellite constellations. The top, middle and bottom panels represent the cases of 3, 4 and 6 orbital planes.

The following figure is the equivalent of Figure 3 for 65° inclination:

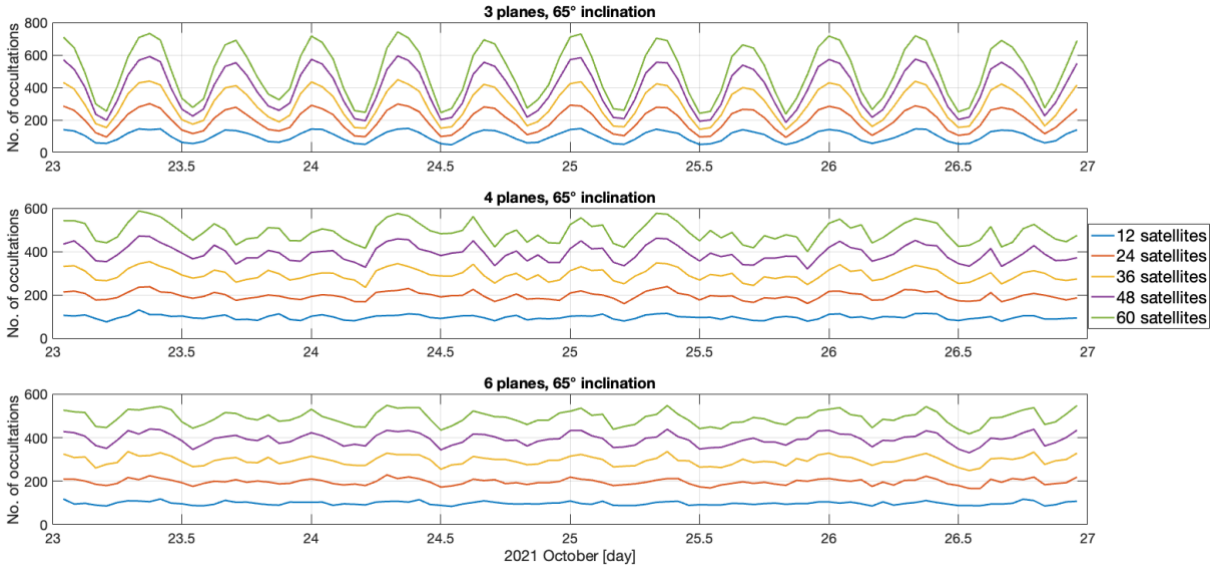

Fig: Hourly number of RO counts for 65°-inclination orbit planes, in the AR region, for 12, 24, 36, 48, and 60 satellites. The top, middle and bottom panels represent the cases of 3, 4 and 6 orbital planes.

We would appreciate the understanding of the reviewer to not add this figure in the manuscript because the manuscript is already very long (~30 pages). The results for 12 and 60 satellites are reported in Table 1 and the readers will be able to see this figure in the discussion section of the manuscript.

Other minor comments:

1. Line 12: Expand the acronym "GNSS" as it ought to be when used for first time. In Line 39: correct practice is to put the acronym in parenthesis and expanded form outside and not the vice versa.

2. Line 46: remove comma after the word “power”.

3. Line 48: Put an apostrophe after “GNSS constellations”.

4. Line 49: Remove comma after “coverage”.

5. Line 50: remove “and”.

6. Line 65: Mention the time period used to compute the “average flow…” from the source NOAA, 2023. Remove comma after “river”.

7. Line 91: Correct “Similarly” to “Similar”.

8. Line 118: Same as suggested in minor comment (1) but for ECMWF.

9. Line 159, 160: Correct the sentence. Put apostrophe after the word “constellations”.

10. Line 166: Once defined, use the acronym “AR” everywhere.

11. Line 196: AR region longitude range to be corrected in conformity with figure 1.

12. Line 197, 198: remove comma after “85° ” and after “planes”.

13. Line 297: correct the syntactic error in the sentence “This makes … related caused ...”. Also remove the comma after “implementation”.

14. Line 329: add the clause “in the given order” after “5 constellations”.

Dear reviewer, thank you very much for reading in detail the manuscript and providing all these corrections. They have been implemented accordingly in the new version of the manuscript.