Review on “Observing atmospheric rivers using GNSS radio occultation data”, by Bahareh Rahimi and Ulrich Foelsche

General comments.

In this paper, the authors analyze specific humidity profiles and IWV values from RO data measurements for the study of atmosperic rivers (ARs), focusing on their vertical structure. They consider data obtained at CDAAC and at WEGC, concluding that GNSS-RO data provide indeed additional vertically-resolved information, which was not already contained in the background or in operational analyses. IWV values from CDAAC and WEGC tend to underestimate the SSMI/S data, since GNSS-RO profiles not always reach the lowermost part of the atmosphere. The authors suggest that is promising to combine the GNSS-RO data (high vertical resolution) with SSMI/S data (high horizontal resolution) to get a more compete view of the 3D structure of ARs.

This is an interesting intercomparison between different techniques with data processed at different centres. Some recommendations are made, mainly for obtaining specific humidity profiles in the lower troposphere and in relation to the different calculations of tangent point trajectories and reference points. The authors conclude that their results contribute to the understanding of atmospheric moisture profiles and set a direction for future research. It is not clear to me what that specific direction is for a more accurate and complete understanding of ARs.

In an AR the moisture is transported along narrow corridors, often driven by large-scale weather patterns like cyclones. The process typically starts when warm ocean waters evaporate and the resulting moisture is lifted into the atmosphere. When these rivers encounter land or mountains, the moisture condenses, leading to heavy rainfall or snowfall. Therefore, it would be very illustrative to indicate the synoptic conditions corresponding to each case study.

On the other hand, we know that mesoscale models, like WRF, have been instrumental in advancing our understanding of ARs, particularly with regard to their dynamics. There are numerous studies on ARs using mesoscale models. These are capable of simulating meteorological phenomena on scales ranging from a few km to hundreds of km and are particularly valuable for understanding the detailed structure and dynamics of ARs. In particular, they are able to resolve important features of ARs, such as their interaction with topography, the development of precipitation bands and the processes leading to extreme precipitation and flooding. I would then suggest that the authors indicate to what extent the results presented in these case studies help to understand, through the combination of GNSS-RO data with SSMI/S, data, the structure and dynamics of ARs and the processes leading to extreme rainfall and flooding.

The results obtained in this paper seem to be useful in a more general context and not particularly pertinent to RAs. In summary, what can be concluded about the generation and evolution of RAs from RO data in addition to satellite data that cannot be inferred or forecasted from mesoscale models?

Scientific significance: Good. Scientific quality: Good. Presentation quality: Good.

The paper address relevant scientific questions within the scope of AMT. It presents novel concepts. Additional conclusions could have been reached, specifically to the knowledge of the dynamics of the atmospheric rivers. The scientific methods and assumptions are clearly outlined. The description of experiments and calculations are sufficiently complete and precise to allow their reproduction. The authors give proper credit to related work and clearly indicate their own contribution. Perhaps the seminar paper by Bevis et al (JGR, 1992) could have been included too. The title should include both complement techniques, not only RO data. The abstract provide a concise

summary. The overall presentation is well structured. I am not native so I cannot comment about the English language. The mathematical formulae, symbols, abbreviations, and units are correctly defined and used. The references are appropriate.

Line 314 > Figure 3(d).