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Interactive comment on "Tropical cyclones vertical structure from GNSS radio occultation: an archive covering the period 2001–2018" *by* Elżbieta Lasota et al.

Anonymous Referee #2

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Recommendation – acceptance subject to revision and clarification.

Ratings: Significance of the data set

Uniqueness - Low rating (1) As discussed in section 4 of the paper, the atmospheric RO profiles are available online, seemingly at two online locations. The Tropical cyclone best tracks data are also available online at the NOAA IbTrACS website. Hence many researchers may wish to extract the two data sets and match them themselves.

Usefulness. A reserved high rating (4). I believe there are many research issues and studies of tropical cyclone thermal and moisture structure that could be addressed with these data set. The reservation as to the usefulness is set out in comments below on

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Discussion paper

presentation quality

Completeness: High rating (4)

Data Quality. High rating (4). There is an extensive literature on the two primary data sets – the RO profiles and the ibTrACS cyclone tracks.

Presentation quality.

In my opinions, the utility of the data set for studying thermal and moisture structure of tropical cyclone is not well explained.

Lines 34 to 40 give references on the assimilation of the refractivity profiles (not the temperature and moisture profiles) in numerical weather prediction of tropical cyclones. Lines 40 to 69 give examples of research studies on tropical cyclones using RO profiles. However, these studies are almost exclusively related to detection of cloud height, to tropopause structure and to gravity wave generation in the upper atmosphere by tropical cyclones. The one paper referenced as examining of the vertical structure of cyclones is Biondi et all 2011a. That paper also has upper troposphere and lower stratosphere in the title, and its main findings arer on the bending angle of the radio occultation signal between 14 and 18 km. The paper does show temperature and moisture profiles for two cyclones through the depth of the troposphere. The paper makes the comment that the " water vapour anomalies from COSMIC agree largely with those of ECMWF, which can be explained by the fact that the ECMWF model is used in the derivation of the water vapour profiles"

Thus, so far from the literature review, there is no evidence concerning the quality of the thermal profiles and moisture profiles through the major structure of a tropical cyclone, which is in the troposphere. Line 70 of the paper states: "A comprehensive review on the use of RO observations to study TCs is given by Bonafoni et al. (2019)" The discussion in that paper is an expanded version of the discussion in lines 34 to 69 of the current paper.

There are two figures in the Review paper by Anthes et al 2011 showing RO profiles of moisture and temperature overlaid on dropsonde profiles, in typhoon Toraji and typhoon Jangmi. Both profiles are very impressive. However, whether the same methodology as that used in the current data set for obtaining moisture and temperature profiles from the RO refractivity profiles is unknown to this referee.

According to line 206, Detailed information on the retrieval and on data quality is given by Angerer et al. (2017). Referring to that paper, we learn that the calculation of physical variables (wet-temperature and specific humidity) requires a priori knowledge of the state of the atmosphere, for which ECMWF short-range forecasts are used. This immediately raises the issue as to how independent the resultant RO humidity profiles are from the ECMWF forecast profiles, the same issue that arises from the results in the Biondi et al 2011a paper. As opposed to that the paper by Kursinski et al JGR 1997 implies in section 2.3.3 that the derivation of the lower tropospheric water vapour profile requires only a background estimate of temperature from an independent source.

If I sound confused, I am. The main point is that all of this should be clarified for the tropical cyclones scientists who presumably are the potential users of the data set being documented. What is the quality of the RO temperature and moisture profiles in a tropical cyclone environment between about 100 hPa and the surface? How independent are the profiles from the ECMWF short-term forecast nearest profiles used in their derivation?

Given the wide-spread use of RO profiles in the last decade and the high profile of the program, I expect the issue is not with the data, rather it is with the level of explanation in the current write-up. Hence my recommendation of acceptance, subject to this issue being adequately resolved.

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