Anonymous Reviewer #3

Global Climatology of Equatorial Plasma Bubbles based on GPS Radio Occultation from FormoSat-3/COSMIC by Kepkar et al looks at the seasonal, longitudinal, annual, altitude and local time variations in the occurrence of equatorial plasma bubbles as indicated by the COSMIC S4 index. The authors have failed to highlight the novelty of the work, and as such I cannot recommend it for publication. Their work is very similar to Carter et al 2013, whom they cite in reference to variation with solar activity. However, they have failed to discuss the work in the context of this paper even though Carter et al 2013 looked at the seasonal, longitudinal, annual and local time variations of equatorial plasma bubbles as indicated by the COSMIC S4 index.

- ➔ We like to thank the reviewer for his time in going through paper and providing constructive inputs that will improve the quality of the paper. We agree that occurrence climatology presented in this paper doesn't explain the similarities and dissimilarities in-detail with the previous studies. In order to make this study worthy of publication, we tried to address all the issues raised.

Indeed, Figure 6 of this paper is very similar to Figure 4 of Carter et al 2013. The years of data used are different. However, the differences and similarities between Figure 6 and the results from Carter et al 2013 are not discussed and it is showing how this work provides something new that is currently missing from the manuscript.

- ➔ We are pleased to have authors perspective concern to include differences and similarities shown in the Fig. 6 with previous publication including Carter et al. (2013). One of the main differences from the Carter's et al. (2018) paper, that this study includes seasonal occurrence surrounding the solar max year as pointed out by the reviewer and we intend to explain in more detail the difference in occurrence characteristics. In particular, only one maximum above geomagnetic equator is visible across different seasons and regions with the most EPB occurrence in the African sector during March equinox for solar maximum years (2012-2016). It is also known that different measurement techniques incur different occurrence interpretation and therefore we planned to include comprehensive comparison of EPBs based on previous publication (Burke et al. (2004a, 2004b), Gentile et. al (2006), Su et al. (2006), Stolle et al. (2006), Nishioka et. al (2008), Dao et al. (2011), Carter et al. (2013), Xiong et al. (2013), Liu et al. (2016)).

Taking each sentence from the abstract in turn below it can be seen that no new information is currently being highlighted by the authors "The analysis revealed that the F-region irregularities, associated with plasma bubbles occur mainly post sunset close to Earth's geomagnetic equator."- This has been known and written in many papers, including ones such as Sultan 1996 and others that look at the mechanism and growth rate of post sunset plasma bubbles

- ➔ We would agree with the reviewer's comment, that it has been known that bubbles predominantly occur at the geomagnetic equator. However, we would like to present the maxima of EPB occurrence shifting from the South American sector towards the African sector on a year wise basis, while proceeding the solar maximum year. Subsequently we plan to add this in the manuscript and make changes in the abstract too. In the local time distribution, we already know that plasma bubbles occur post sunset and therefore we showed brief plot and variation according to the solar activity that provides manifestation for GPS-RO as a complementary method for studying the EPBs as also mentioned by Carter et. al (2013) in his paper.

"Dependence on the solar cycle as well as distinctive seasonal variation is observed when analysed for different years." -Bourke et al 2004 looked at the climatology of plasma bubbles for both low and high solar activity, and Carter et al 2013 looked at the climatology of plasma bubbles using COSMIC S4 as a function of year.

- ➔ We are agreeing with the reviewer comment when it comes to the previous work done by different authors. In this paper, the seasonal variation of EPBs agrees well with the results of Burke et al. (2004) and Su et al. (2006) with peak for equinox in the African sector. However, it differs from the observation made by Carter et al. (2013), where he observes peak for equinox in the American region. This could be because of the study period (2007-2011) which covers solar minimum covered by Carter et al. (2013), while Su. et al. (2006) and this paper used datasets surrounding the solar maximum year. We plan to include this and explain in more-detail the occurrence in region wise seasonal dependence of EPBs.

"In contrast to the other ionospheric remote sensing methods, GPS Radio Occultation technique uniquely personifies the activity of the plasma bubbles based on altitude resolution on a global scale." –As mentioned throughout this review, Carter et al 2013 used COSMIC RO data to look at plasma bubbles, so more is needed to make this a new finding.

- ➔ It is very well known that that plasma bubbles vary with the altitude. Since not many techniques providing altitude resolution are globally spread, therefore those studies are restricted to a particular region. The GPS RO provides the advantage of having altitude resolution when it comes to studies related to the F-region scintillation (Liu et al. (2016)). So this paper intends to give information on a year wise basis, starting from solar minimum year, covering the solar maximum year followed by decreasing solar activity. It also highlights the EPBs detected from GPS-RO extending to greater altitudes and shifting its peak from lower latitudes to the higher latitudes as we proceed towards solar maximum. More information and in-detail explanation is planned to be added in the revised manuscript.

Minor comments: In section 2.1.1 Derivation of amplitude scintillation index it is unclear if the authors have used the provided s4max9sec data and are explaining how it is derived, or if they have used raw data and re-analysed it themselves. If it is the later the reasoning also needs to be made clear to the reader.

- ➔ The amplitude scintillation index is calculated using raw 1 Hz SNR measurements from ionPhs data. The same has been already documented in section 2.1 (Data availability). For better understanding, the used dataset will be also mentioned again in section 2.1.1 (Derivation of amplitude scintillation index) in the revised manuscript. The ionPhs data is preferred over the ScnLv1 datasets (which includes 50 Hz measurements recorded at 1 Hz (Syndergaard (2006))), because the ionPhs profiles have increased number of dataset (i.e by factor 5) when compared to ScnLv1 datasets along the F-region altitude. Therefore, to reduce the number of interpolated occurrence number, raw SNR measurements are exploited for this study.

It is unclear why the authors have chosen to use the average S4 rather than some occurrence calculation. Averages can be misleading if the distribution between cells varies, or the number of points vary etc. A justification should be added or another way to demonstrate the data should be used.

- ➔ We are thankful for the reviewer's hint and agree with his suggestion on having some occurrence calculation. Based on his suggestion, we modify the earlier plots showing S4 average with occurrence rate. The occurrence rate is calculated as a ratio of number of profiles having maximum S4 value greater than 0.3 to the total number of profiles in each grid.

In Figures 5 & 6 the captions state that the Figures show the EPB occurrence. In Figure 5 the numbers seem very low for this to be the case and in Figure 6 it is clearly the S4 average again, this is inconsistent, confusing and needs to be fixed.

- ➔ Thank you for pointing this out. As mentioned in the previous reply, we have replaced the S4 average with the occurrence rate. This will further unify the results based on the occurrence calculation in the analyses. As far as the numbers are concerned in the Figure 5, the occurrence rate is calculated as ratio of number of profiles having maximum S4 value greater than 0.3 for a particular time interval [for e.g 20 hr – 21 hr] to the total number of profiles in each grid for the same time interval [for e.g 20 hr – 21 hr]. The low numbers could be probably because of using low sampling rate data and we plan to include this reason while comparing our results with Carter et al. (2013).

In order to make this work worthy of publication the authors need to carefully discuss the results in the context of similar papers that are currently not included in the discussion of the results. Following this they need to assess and highlight what is new and different to determine if the work is novel.

- ➔ Finally, we would like to appreciate the reviewer for giving his comprehensive review on this paper. We will surely add and discuss the results with the previous studies in-detail. We will also incorporate the suggestion and hints provided by reviewer in the revised manuscript and improve the quality of the paper for publication.

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